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Article

Research on AI-Driven Whole-Process Service Mode in Cross-Border Medical Tourism

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Abstract: With rapid advances in global medical technology and significant improvements in people's health awareness, international medical tourism has gradually emerged as an increasingly important mode of healthcare service delivery worldwide. The primary purpose of this paper is to comprehensively discuss the application of artificial intelligence (AI) throughout the entire service process of international medical tourism. Furthermore, it aims to construct an innovative, AI-based operating model by systematically analyzing patients' diverse needs, the optimal allocation of global medical resources, and continuous service quality improvement. Studying the integration of AI technology helps to effectively consolidate and optimize healthcare resources, significantly improve patients' personalized service experiences, and substantially reduce the inherent risks caused by information asymmetry between providers and patients. To achieve this overarching goal, this paper proposes a robust, data-driven decision-support system tailored for the healthcare sector. The proposed system can analyze complex market dynamics in real time and dynamically optimize international medical services to meet evolving demands. Comprehensive data analysis based on rigorous empirical research verifies the remarkable effectiveness of the AI-driven service model in improving both the operational efficiency of international medical tourism and overall patient satisfaction. Ultimately, this study provides solid theoretical support and valuable practical guidance for the sustainable development and digital transformation of related fields in the global healthcare industry.

Keywords: artificial intelligence; medical tourism; international healthcare; operating model; data-driven

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1. Introduction

1.1. Research Background

In recent years, the global medical tourism industry has experienced rapid growth, with patients seeking advanced medical technology and higher-quality services in other countries. In regions where health resources are limited or medical expenses are high, seeking medical treatment internationally provides patients with diverse options and highlights the globalization of healthcare services. However, as international medical tourism gains popularity, patients face challenges in obtaining reliable information, evaluating medical quality, and coordinating services across different regions, which can result in inconsistent experiences. The application of AI technology is particularly significant in enhancing the service capabilities of international medical tourism, as it enables personalized medical solutions through big data analysis and intelligent decision-making. This not only reduces service response times but also optimizes resource allocation and improves overall patient satisfaction. With continuous advancements in

technology, AI has become widely utilized in the medical field, offering new opportunities and insights for the development of international medical tourism [1]. This paper aims to provide theoretical support and practical guidance for improving the experiences and services associated with international medical tourism.

1.2. Research Significance

This study holds significant theoretical and practical value. From a theoretical perspective, it advances the understanding of medical tourism and artificial intelligence, fosters interdisciplinary integration, and offers a novel framework for future academic exploration. By examining the role of AI in medical tourism, it contributes to the enrichment of medical service theories and provides insights into patient needs and behaviors. On a practical level, the research delivers data-driven decision-making support for international medical institutions, enabling optimized resource allocation and service processes, reduced operational costs, enhanced service quality and efficiency, and improved market competitiveness [2]. Furthermore, the findings serve as a reference for policy formulation, facilitating the efficient flow of global medical resources, elevating healthcare standards, and promoting sustainable development in medical services. By investigating AI-driven service models, the study outlines potential pathways for the future evolution of international medical tourism.

2. The Current Situation of AI-Driven Service for Cross-Border Medical Tourism

2.1. The Principle of AI Technology and Its Application in Cross-Border Medical Tourism

The core principles of AI technology primarily include machine learning, natural language processing, and data mining. Technical personnel extract valuable information by analyzing and processing large datasets, enabling intelligent decision-making and prediction. The integration of multinational medical resources and the provision of personalized services are key characteristics of international medical tourism, requiring AI to adapt to diverse medical standards and cultural differences across regions. Using natural language processing, AI facilitates real-time multilingual translation, enabling effective communication between patients and healthcare providers while minimizing misunderstandings caused by language barriers [1, 3]. Machine learning algorithms analyze patients' preferences and historical behavior to predict their potential needs, thereby offering tailored medical plans and services for each individual. Data mining assists medical institutions in identifying and optimizing service processes, enhancing resource utilization efficiency. In the context of international medical tourism, the application of AI technology improves service efficiency and quality, enhances patient safety and satisfaction, and provides robust support for the effective operation of global medical services.

2.2. Application Scenes

2.2.1. Intelligent Health Assessment and Precision Medical Matching

Through the use of big data analysis and machine learning, this system integrates patients' health records, medical history, genetic predispositions, and lifestyle factors to provide comprehensive evaluations and identify potential disease risks and health needs. It enables patients to gain a better understanding of their health status and offers professional medical advice. During the precision medical matching phase, AI assists in pairing patients with the most suitable medical institution experts based on assessment results [4, 5]. This ensures optimal medical service experiences and enhances the efficiency of the treatment process while minimizing risks associated with information asymmetry. The system continuously updates patients' health data in real time and dynamically adjusts treatment plans based on therapeutic feedback, ensuring adaptability. In summary, the effective integration of intelligent health assessment and precision medical matching plays a crucial role in enhancing service quality and patient satisfaction within the context of international medical tourism.

2.2.2. Personalized Itinerary Planning and Intelligent Service Recommendation

By conducting a thorough analysis of an individual's health condition, medical requirements, and personal preferences, the system creates tailored itineraries that encompass medical appointments, accommodation arrangements, and leisure activities. Utilizing AI, the system evaluates feedback and user preferences to dynamically refine the itinerary, ensuring an optimal integration of medical services and recreational experiences. Intelligent services are incorporated into the itinerary planning process to suggest appropriate medical facilities, specialized practitioners, rehabilitation options, and local health management resources, offering a seamless coordination of services. These personalized approaches significantly improve patient satisfaction within international medical tourism and enhance the competitive edge of healthcare providers. Automated and intelligent service mechanisms enable efficient resource allocation, alleviate patient challenges in decision-making and itinerary organization, and contribute to the sustainable advancement of international medical tourism [6, 7].

2.2.3. Whole-Process Health Management and Follow-Up Tracking

Advanced AI enables real-time analysis of patient health data to create personalized health profiles and monitor recovery progress, potential complications, and other health indicators [8]. Whole-process health management emphasizes evaluating treatment outcomes, tracking overall health status, and offering tailored rehabilitation advice and health guidance to patients. In follow-up tracking, applications assist patients by providing timely reminders for appointments, examinations, and rehabilitation activities, while also collecting feedback to inform future medical decisions. This integrated management approach enhances the continuity and consistency of medical services, alleviating concerns associated with international medical travel. By accumulating and analyzing data, medical institutions can refine service strategies, enhance patient satisfaction, improve healthcare quality, and support the sustainable development of international medical services.

3. Challenges Faced by AI-Driven Cross-Border Medical Tourism Services

3.1. Technical Challenges

3.1.1. Medical Data Island and Integration Difficulties

Data silos present significant obstacles for AI-driven international medical tourism services due to the absence of unified standards and interoperability in data management and storage across medical institutions in various countries and regions. This lack of standardization hinders effective information sharing and circulation. Patient medical records, test results, and treatment plans are often confined to isolated platforms, making it challenging to integrate data efficiently across international medical services. Patients frequently need to repeatedly provide personal information to different medical institutions, which consumes considerable time and effort, ultimately reducing satisfaction with the services provided. Additionally, variations in national laws and policies regarding privacy protection and data management introduce compliance risks when medical information is used internationally, further complicating data integration. Addressing these challenges requires the establishment of standardized data formats, open interfaces, and international agreements to enable seamless information exchange [9]. Resolving these issues is essential to enhancing the efficiency of AI applications in international medical tourism, thereby ensuring the delivery of high-quality medical services.

3.1.2. The Diagnosis Algorithm's Insufficient Accuracy and Generalization Ability

In the medical field, various machine learning models have proven effective in diagnosing specific diseases. However, achieving consistent accuracy remains a significant challenge due to the complex and diverse individual variations among patients. This issue primarily arises from the limitations of existing training datasets, which are often derived from specific regions or demographic groups. As a result, these algorithms frequently struggle to generalize effectively to individuals from different cultural or

geographical backgrounds. Such limitations can lead to diagnostic biases or errors, adversely affecting patient treatment plans and clinical decisions. To address this, it is essential to continuously update and optimize these algorithms as medical datasets expand and evolve.

3.2. Challenges of Cross-Border Business

3.2.1. Multiple User Needs and Complex Service Scenarios

Patients exhibit significant differences in healthcare needs and service expectations due to factors such as disease types, cultural backgrounds, and economic status. This diversity necessitates personalized medical solutions rather than standardized approaches. While some patients prioritize advanced medical technology, others value effective communication with physicians and high-quality nursing care. Additionally, language barriers and cultural differences influence patient choices and experiences [10]. Service scenarios in international medical tourism extend beyond healthcare to include transportation, accommodation, food, and tourism, making the creation of a cohesive and efficient service system particularly challenging. In addressing these complexities, AI demonstrates adaptability and flexibility by analyzing and responding to user needs in real time, integrating diverse resources, delivering tailored services, and enhancing the overall user experience.

3.2.2. Difficulties in Service Effect Evaluation and Value Quantification

Cross-border medical tourism involves numerous complex factors, such as medical quality, patient satisfaction, cultural adaptability, and economic benefits. Single-dimensional evaluation indicators are insufficient to fully capture the actual effectiveness of these services. Traditional methods for evaluating medical outcomes often emphasize treatment results while lacking a systematic analysis of patients' experiences and perceptions throughout the medical process. Additionally, these methods fail to account for the varying medical standards and cultural contexts of different countries. Establishing unified and comparable evaluation indicators presents significant challenges. For patients, medical services encompass not only the treatment process and outcomes but also psychological factors, trust, and convenience, making it difficult to comprehensively represent these aspects through quantitative measures. With ongoing technological advancements, the value of services provided by AI systems must also be reassessed to ensure their role in enhancing medical efficiency and patient experiences. Developing a multidimensional, data-driven evaluation system that integrates both quantitative and qualitative criteria is essential for the effective supervision and improvement of medical tourism services.

3.3. Ethical and Legal Dilemmas

3.3.1. Patient Privacy Protection and Cross-Border Data Security

In international medical services, sensitive information, such as patient health records and personal data, is shared with various medical institutions and platforms, involving data transmission and storage. Different regions have varying laws and policies regarding data privacy protection. Ensuring the security and compliance of patient information during such processes has become a significant challenge. Many regions have implemented stringent data protection measures; for instance, certain frameworks require enterprises to obtain explicit informed consent when processing personal data and to adopt appropriate technical measures to safeguard information. Furthermore, risks such as unauthorized access, improper use, and cybersecurity vulnerabilities pose challenges to the industry, potentially affecting patient trust and the reputations of medical institutions.

3.3.2. Risks Related to Algorithm Bias and Medical Fairness

AI systems often depend on historical medical data for training purposes. If this data contains biases or is incomplete, it can result in algorithms introducing bias, which negatively impacts the fairness of diagnoses and treatments. For instance, when training

data is predominantly derived from specific populations or regions, the algorithm's ability to accurately assess health risks and needs in other populations is hindered, leading to disparities in medical services [11]. The opaque nature of algorithmic decision-making further complicates the ability of medical providers to deliver reliable diagnostic and treatment recommendations. Additionally, patients may struggle to evaluate the accuracy and relevance of these algorithms, potentially undermining trust in AI-driven medical solutions. Such challenges can exacerbate the unequal distribution of medical resources. In international medical tourism, patients from various regions receiving identical technological treatments may experience differing outcomes due to algorithmic bias.

4. AI-Driven Optimization Strategies for Cross-Border Medical Tourism Services

4.1. Technical Optimization Paths

4.1.1. Build a Cross-Border Medical Data Middle Platform and Governance System

The integrated medical data platform facilitates the consolidation of healthcare information from various regions, ensuring standardized management and promoting seamless information sharing. This platform should possess robust data processing capabilities, accommodate diverse data sources and formats, and maintain data integrity and accuracy. Establishing a comprehensive data management framework is essential, encompassing data collection, storage, utilization, and sharing, while adhering to relevant legal and privacy requirements. By implementing clear policies for data access control, security risk evaluation, and compliance monitoring, potential risks associated with data handling can be minimized. Regular assessments and updates to the governance framework are necessary to align with evolving market dynamics and technological advancements, ensuring the long-term growth of international healthcare services. Effective execution of these measures will foster patient confidence, improve service quality, and optimize outcomes for all stakeholders.

4.1.2. Deepen the Application of Deep Learning and Knowledge Graph Model

Deep learning techniques, utilizing multi-layer neural networks, enable the automatic extraction of features from medical data to enhance disease prediction, medical image analysis, and the generation of personalized treatment plans. These technologies contribute to improved diagnostic accuracy, facilitate dynamic adjustments and optimizations based on patient historical records and health conditions, and enhance the intelligence of medical decision-making processes. A knowledge graph, as a structured representation of medical information, connects medical knowledge, patient data, and treatment workflows, providing rich contextual information for AI systems and fostering the sharing of medical expertise [12]. The integration of deep learning with knowledge graphs enables precise intelligent question-answering and case analysis. Additionally, personalized medical services across different domains are continuously refined and updated, enhancing the system's ability to incorporate new medical knowledge. This approach ensures sustained technological advancement and efficiency in the rapidly evolving healthcare sector, ultimately delivering high-quality and safe medical services to patients.

4.2. Strategies to Improve Operations

4.2.1. Achieving Full-Cycle Interaction

Developing an AI-driven multi-channel communication platform enhances the efficiency of information exchange and communication for patients throughout the medical tourism process. This platform incorporates a website and a mobile application, integrating instant messaging tools to address users' communication needs. In the initial stages of the journey, the system provides essential medical information, hospital options, and cost estimates, enabling patients to make well-informed decisions. During appointment scheduling, medical arrangements, and follow-ups, AI applications such as chatbots facilitate real-time interaction, respond to patient inquiries, and offer personalized recommendations [10]. Furthermore, user feedback is regularly collected to

analyze data, refine the user experience, and deliver precise services. Comprehensive intelligent interaction ensures that patients receive high-quality service throughout their medical tourism experience, improving satisfaction and loyalty while supporting the sustainable growth of international medical tourism.

4.2.2. Constructing a Dynamic Service Strategy Matrix

This section addresses multiple dimensions, including service types, patient needs, market dynamics, and resource allocation. By evaluating all relevant factors, appropriate service strategies can be developed. Regarding service types, differentiated service processes should be established for various medical projects and patient groups to accommodate diverse medical needs. Concerning patient needs, the system should dynamically monitor patient feedback and health status, making real-time adjustments to ensure services are targeted and personalized. In terms of market dynamics, it is essential to continuously analyze industry trends, competitor activities, and changes in policies and regulations to adapt effectively to external shifts. Resource allocation optimization must be integrated into the matrix formulation, ensuring the rational distribution of medical resources, technical expertise, and equipment to meet changing demands and enhance operational efficiency. Implementing a dynamic service strategy matrix can effectively mitigate uncertainties in international medical tourism services, enhance service quality and patient experience, and support sustainable development.

4.3. Ethics and Legal Protection

4.3.1. Improving Patient Data Authorization and Cross-Border Privacy Protection Mechanisms

In the context of data authorization, it is essential to establish clear and transparent procedures to ensure that individuals fully comprehend the circumstances under which their personal data is collected, utilized, and shared prior to receiving medical services. Medical institutions should develop comprehensive privacy policies that clearly define the objectives and scope of data usage, employing accessible language and formats. Individuals must be granted the ability to decide whether to consent to or decline such data usage. Regarding mechanisms for safeguarding privacy during international data exchanges, medical service providers should strictly comply with globally recognized data protection standards and implement necessary measures and technologies to secure sensitive information during transfers between different regions [3, 12]. This approach facilitates the creation of a collaborative framework for data sharing among medical institutions across various locations. Additionally, it is crucial to prevent the misuse of data. These measures collectively contribute to enhancing trust in data handling and privacy protection, thereby establishing a robust foundation for advancing international medical tourism.

4.3.2. Establishing Norms for Algorithm Transparency and Medical Ethics Reviews

The decision-making process of machine learning models is often complex, and the perceptions of patients and medical personnel directly influence their effectiveness. Medical institutions should ensure transparency in the AI algorithms they adopt by providing patients and relevant parties with basic information about the model, its training data sources, and its functions. This approach enhances the understandability of the decision-making process, thereby reducing psychological barriers and distrust among patients. Establishing norms for medical ethics reviews is crucial to addressing ethical concerns associated with AI applications in healthcare. Comprehensive reviews and evaluations are necessary to ensure that algorithmic decisions do not infringe on patients' fundamental rights and interests, while also preventing bias and unfair outcomes [4]. Ethics Review Committees should regularly assess the applicability of new technologies and set ethical standards for AI applications to uphold the credibility of the medical industry and safeguard patients' rights and interests. By promoting algorithmic transparency and implementing rigorous ethical oversight, the healthy development of

AI technology in medical tourism can be ensured, leading to improved service quality and greater patient satisfaction.

5. Conclusion

Research on the whole-process service model for AI-driven international medical tourism presents both substantial potential and significant challenges. The introduction of advanced AI technologies can markedly improve the efficiency and quality of medical services, enabling more personalized and intelligent care. Through data integration and intelligent analysis, this approach can better address diverse patient needs, optimize resource allocation, and support the improvement and innovation of international medical services. In practice, close attention should be given to data privacy, algorithmic transparency, and ethical standards to ensure effective protection of patient rights. The establishment of a sound legal, regulatory, and ethical review framework provides essential safeguards for international medical tourism and supports the healthy development of the sector. With continued technological progress, international medical tourism is expected to show broad development prospects, offering patients safer, more efficient, and higher-quality medical care. Further advances in AI research and medical service innovation will remain important drivers of industry development.

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