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The Key Role of Logistics in Healthcare Tourism: Challenges and Opportunities

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Abstract


Healthcare tourism is one of the emerging and thriving branches of the tourism industry that has experienced significant growth in recent years. This type of tourism involves people traveling to other countries to receive medical, healthcare, and treatment services. Healthcare tourism is considered a combination of the tourism industry and healthcare services, which brings considerable economic benefits to countries. Among the factors influencing the growth of this type of tourism are the high treatment costs in developed countries, limited access to adequate healthcare services in some countries, the high quality of medical services provided in destination countries, and extensive advertising by governments and related organizations. These factors have caused many people, even from developed countries, to choose other countries for specialized treatments, surgeries, cosmetic services, and medical check-ups. The healthcare tourism supply chain includes a network of businesses, organizations, and entities that provide services and goods related to this type of tourism. This network includes manufacturers of medical equipment, pharmaceutical distributors, hospitals, transportation companies, travel agencies, and tourists. In the present study, we examine the field of healthcare tourism with a focus on logistics and the supply chain, and analyze the strengths and weaknesses related to this area.

Keywords: Medical tourism, Healthcare tourism, Tourism logistics, Sustainable tourism, Supply chain.

1 | Introduction

The definition presented in academic articles describes healthcare tourism as activities in which tourists travel to a medical destination for at least one night to receive medical services [1]. This type of tourism has experienced remarkable growth in recent years due to increasing demand for higher-quality or more affordable healthcare services in different countries. The background of this subject has a long history. In the past, people traveled to benefit from the healing properties of natural remedies. For example, in ancient Rome, public baths and hot springs were introduced as centers for relaxation and health. In Eastern civilizations,

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traditional treatment methods such as acupuncture in China and naturopathy in India significantly attracted people from other regions. These journeys, often undertaken for medical and religious reasons, sometimes formed a combination of healthcare tourism and spirituality. During the Middle Ages, traveling to sacred places to treat physical and mental illnesses became popular. Places such as churches and monasteries were known as healing centers, and people from distant regions would visit these locations in search of cures. Such journeys reflected the connection between religious beliefs and faith in divine healing.

In the twentieth century, with significant advances in transportation and medical science, healthcare tourism took on an international form. Europe became one of the leading centers of this type of tourism due to its advanced technologies and modern surgical practices. However, after the World Wars, many medical infrastructures in war-affected countries were destroyed, and residents of these regions traveled to neighboring countries to receive healthcare services. Healthcare tourism became an important factor in the reconstruction and improvement of people's quality of life after the wars.

For many years, the United States and Canada were recognized for their medical innovations and specialized treatments for complex diseases and surgeries. Countries like Germany and Switzerland were considered top healthcare tourism destinations in Europe due to their advanced hospitals and expertise in treating complex and cosmetic conditions. However, in the 21st century, the focus of healthcare tourism significantly shifted to Asian countries. Nations such as India, Thailand, Malaysia, China, and South Korea became prominent centers in this industry due to economic reasons and the provision of quality healthcare services. These countries, by offering lower treatment costs, advanced infrastructure, and a combination of modern services with traditional medicine, have attracted many health tourists from other nations, including developed countries.

Healthcare tourism in Iran officially began in the early 2000s, aiming to attract patients from neighboring countries such as Iraq, Afghanistan, Azerbaijan, and the Persian Gulf states. This movement was shaped by focusing on developing healthcare infrastructure, improving the quality of medical services, and extensive international advertising. Lower treatment costs compared to Western countries and even some regional states, access to experienced and specialized doctors, and the provision of services such as cosmetic surgery, infertility treatments, organ transplants, and orthopedic surgeries have given Iran a special position. Furthermore, medical centers with international standards, the use of modern medical technologies, and natural capacities (such as hot springs and salt therapy) have supported this position. Iran's cultural and religious proximity to neighboring countries is another key factor in attracting foreign patients and expanding healthcare tourism. *Fig. 1* shows the names of the world's top 10 medical tourism destinations based on value (in million USD) in 2017.



Fig. 1. Top 10 countries by the medical tourism industry market value [2].

2| Logistics

Logistics refers to planning, executing, and controlling the flow of goods, services, and information from the point of origin to the final destination. This process includes procurement, warehousing, transportation, distribution, and inventory management. Its dimensions include inbound logistics (related to the supply of raw materials), internal logistics (management of warehousing and production), and outbound logistics (distribution of final products) [3]. In the supply chain, logistics management is vital in connecting all stages, from supplying raw materials to delivering the final product to the customer. The main goal of logistics management is to reduce costs and increase efficiency throughout the supply chain.

3| Logistics in Healthcare Tourism

Logistics in healthcare tourism is one of the key factors in the development of this industry, involving the management and coordination of all processes related to transportation, accommodation, and provision of medical services to health tourists [4]. This concept encompasses a wide range of activities, from travel planning and the transfer of international patients to the timely delivery of temperature-sensitive medicines and medical equipment (cold supply chain). Due to the specific needs of this type of tourism, logistics in healthcare tourism require very high accuracy, speed, and coordination.

3.1| Importance of Logistics in Healthcare Tourism

Logistics in healthcare tourism is vital to the safe and comfortable transfer of patients, medical equipment, and medicines. Patients are usually in sensitive physical conditions and require special transportation services such as air or ground ambulances. Additionally, medical equipment and medicines that need to be stored at specific temperatures, such as vaccines, plasma, or blood units, must be transported and stored precisely according to health standards. In this type of logistics, the cold chain is especially important to prevent even the most minor errors and ensure patient health is not endangered.

In healthcare tourism, logistical services must also ensure coordination between hospitals and accommodation centers for patients from different countries. Rapid and efficient transfer of patients from the origin country to the treatment destination, especially in emergencies, improves treatment quality. Advanced transportation networks and precise scheduling management enable faster and easier access to medical centers. This factor enhances patient experience, reduces delays, and increases their satisfaction. Ultimately, strong logistical infrastructure makes countries providing healthcare tourism services more competitive in the global market and attracts a larger share of tourists.

3.2| Services in Healthcare Tourism

Healthcare tourism includes a wide range of services that may include cosmetic surgeries such as liposuction, hair transplantation, and plastic surgery; dental treatments including implant placement, orthodontics, or root canal therapy; infertility treatments like IVF; and even natural and traditional therapies such as acupuncture, massage therapy, or mineral baths. *Fig. 2* shows the increasing demand for healthcare tourism services until 2032. As is evident, cancer treatment services, orthopedics, and cosmetic services have the highest demand.

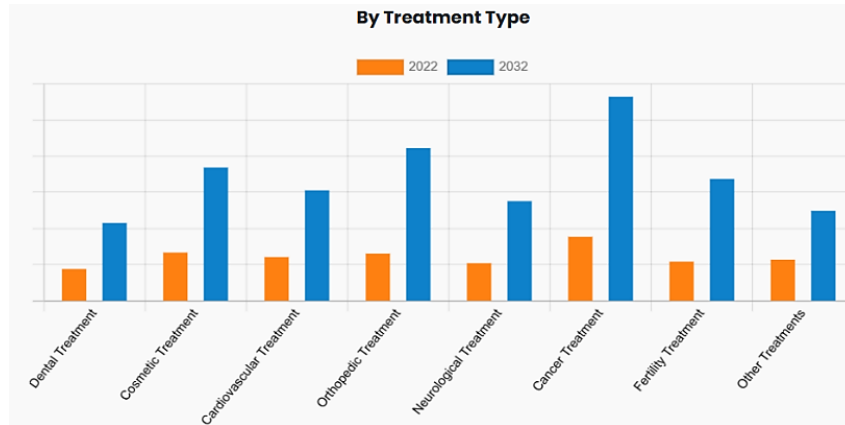


Fig. 2. Increasing demand for medical tourism services [5].

Staying at healthcare tourism destinations may be for recovery and rehabilitation after surgeries or to complete specific treatment courses. In this regard, healthcare tourism includes modern medical services and alternative and complementary services, which are sometimes based on traditional medicine and local experiences. For example, Asian countries such as India, China, and Thailand have become popular destinations for health tourists due to the combination of traditional medicine and modern medical care [6].

3.3 | Benefits of Healthcare Tourism

Healthcare tourism has numerous significant benefits for both patients and destination countries. The most crucial advantage for patients is cost reduction because, in many tourist countries, high-quality medical services are offered at much lower prices than in their home countries [1]. Additionally, healthcare tourism facilitates access to advanced medical services and experienced specialists, especially for patients who do not have access to modern technologies in their own countries. Reducing waiting time is another essential benefit, as the waiting period for surgery or treatment is long in countries with crowded healthcare systems. In contrast, in healthcare tourism destinations, this time is shorter. Also, combining treatment with travel and recreation helps patients achieve not only physical improvement but also mental relaxation.

For destination countries, healthcare tourism is an essential foreign currency income source contributing to economic growth. This industry strengthens the healthcare sector by attracting foreign patients, improving the quality of medical services, and developing medical infrastructure. Moreover, healthcare tourism helps create jobs in medicine, hospitality, transportation, and ancillary services. On the other hand, this industry can strengthen international relations culturally, economically, and politically, introducing the destination country as a significant medical and healthcare hub on the global stage.

4 | Literature Review

In this section, a literature review based on various articles in the field of healthcare tourism logistics is presented, with a summary of these articles provided in *Table 1*. All these articles are from reputable Q1 journals.

Table 1. Reviewed articles in the field of healthcare tourism.

Authors	Year	Mathematical Model	Solution Approach
Heung et al. [7]	2010	-	Qualitative interview
Fetscherin and Stephano [8]	2015	-	Missing value analysis of SPSS22 and multiple imputation
Rezaeiahari and Khasawneh [9]	2017	Non-sequential hybrid flow scheduling problem	Particle swarm optimization algorithm combined with local search and heuristic mining algorithm

Table 1. Continued.

Authors	Year	Mathematical Model	Solution Approach
Jaapar et al. [1]	2017	-	SPSS version 20 and Cronbach's α coefficient
Nilashi et al. [10]	2019	IMCGP	Branch and bound and LINGO17
Ahmadimanesh et al. [11]	2019	multi-objective problem	CPLEX in GAMS
Cham et al. [12]	2020	Structural Equation Modeling (SEM)	Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and AMOS and SPSS programs
Hassan and Salem [13]	2021	-	Social sciences version 26.0 and AMOS v26
Motevalli and Paydar [14]	2021	Multi-Criteria Decision Making (MCDM)	TOPSIS and DEMETAL
Kouaissah and Hocine [15]	2023	XOR-best worst method	lingo program
Zhou et al. [6]	2023	-	multinomial logistic regression model
Tănase et al. [16]	2023	-	direct logistic regression
Gajić et al. [17]	2023	-	logistic regression
Ekonomou [18]	2023	-	Conjoint analysis and contingent valuation
Li and Wen [19]	2023	-	logistic regression
Srisawat et al. [4]	2023	-	SEM, CFA, and Estimating the maximum likelihood
Babaei et al. [20]	2024	weighted GP and fuzzy robust stochastic programming	DEMATEL-AN hybrid fuzzy approach
Charati [21]	2024	multi-objective problem	Improved objective programming
Lin et al. [22]	2025	Mixed-Integer Linear Programming (MILP)	Q-learning-based Adaptive Large Neighborhood Search (QALNS)

Preliminary studies in medical tourism indicate that environmental and media factors play a significant role in tourists' decision-making. Heung et al. [7] examined the impact of negative environmental news in the media on the selection of medical tourism destinations. They found that tourists prefer destinations with higher levels of safety and security when faced with such news. This study, considering uncertainties, aims to optimize the profitability and sustainability of the supply chain. Subsequently, Fetscherin and Stephano [8] addressed the influence of global crises such as pandemics on tourism decisions, emphasizing the importance of tourism potential and logistical efficiency in these decisions.

Rezaeiahari and Khasawneh [9] focused on treatment planning for medical tourism patients and used a hybrid optimization algorithm to reduce patient waiting times. Jaapar et al. [1] studied dental tourism in Malaysia. They identified two groups of dental tourists: those who travel specifically for dental treatments and migrants who return home for holidays and include dental care in their trip. The primary motivating factors include dental care quality, access to information, and cost savings.

In sustainability, Ahmadimanesh et al. [11] designed a sustainable supply chain for dental tourism. Their research identified key factors affecting dental tourists' satisfaction, such as accurate information access, dental service quality, and reasonable costs. Nilashi et al. [10] studied the impact of awareness and social trust

on healthcare tourism intention based on forest tourism, highlighting that awareness about health preservation and social trust are influential factors. Forest-based healthcare tourism refers to travel to forests and natural areas to benefit from the health and therapeutic advantages of natural environments, often including activities like forest walks, stays in natural accommodations, and nature-based health services aimed at improving physical and mental health, reducing stress, and enhancing quality of life.

With the emergence of COVID-19, research focus shifted towards analyzing the impacts of the pandemic on supply chains and tourism decision-making. Cham et al. [12] explored travel motivations and barriers in the post-COVID era, identifying push factors like stress and pull factors like improved hygiene as influential in tourist decisions. Hassan and Salem [13] developed a mathematical model for the dental tourism supply chain, demonstrating that optimizing the capacity of accommodation and treatment centers increases profits. Motevalli and Paydar [14] investigated the impact of safety measures at Sharm El-Sheikh airport on tourists' decisions, highlighting the importance of security considerations in the post-pandemic period.

Recent studies have analyzed the structures and indicators of medical tourism. Tănase et al. [16] examined Generation Z's preferences for rural tourism destinations, finding authenticity, cultural heritage, and nature as key attraction factors. Gajić et al. [17] studied factors affecting acceptance of medical tourism in Malaysia, identifying significant human, technological, and organizational aspects. Ekonomou et al. [18] designed a crisis management model for tourism during COVID-19, recognizing tourist entry control as a key factor in disease management.

Moreover, Li and Wen [19] developed a comprehensive index to evaluate countries' attractiveness for medical tourism, covering treatment services, quality, safety, infrastructure, and patient experience, useful for comparing countries at various levels. Srisawat et al. [4] investigated social and national factors influencing Malaysia's image as a medical tourism destination, finding most factors significant except the impact of country-generated social media news. Zhou et al. [6] studied word-of-mouth communication among tourists in shaping urban tourism destination reputation in China. Their research analyzed factors influencing consistency in tourists' reputation judgments and word-of-mouth, emphasizing attention to local food, the natural environment, and the social atmosphere. Results showed these factors significantly affect consistency in positive and negative reputation judgments.

From an economic perspective, Kouaissah and Hocine [15] introduced the XOR-BWM method to assess COVID-19 impacts, revealing that tourism, industry, and health sectors in Italy suffered the most. Babaei et al. [20] proposed a two-stage framework: first, suppliers are evaluated for sustainability using weighted ideal programming, fuzzy, and robust stochastic methods; second, an outsourcing strategy is designed by combining ANP-DEMATEL methods. Their model, applied in Tehran, demonstrated a 40% increase in supply chain profitability.

Charati et al. [21] studied sustainable supply chain design for dental tourism, considering waste treatment. They determined optimal locations, numbers, and capacities of dental clinics and accommodations, addressing economic, social, and environmental sustainability. Results suggest governments should increase subsidies to individual dentists to improve waste treatment facilities and transportation.

Finally, Lin et al. [22] studied the task allocation and routing problem for a heterogeneous fleet of uncrewed aerial vehicles (drones) in the context of emergency health services. This research aims to maximize the total profit obtained from performing a set of delivery and pickup tasks involving critical medical supplies and laboratory samples under emergency conditions. To this end, the problem was modeled as a Mixed-Integer Linear Programming (MILP) formulation, incorporating constraints such as time windows, payload capacity, drone altitude, and flight range. The primary decision variable is the optimal selection of the combination of drone, task, and center for each mission. To solve this NP-hard problem, a hybrid Q-learning-based Adaptive Large Neighborhood Search (QALNS) algorithm based on adaptive large neighborhood search and Q-learning reinforcement learning was developed. By employing the learning mechanism, this method showed

significant improvements in convergence speed and solution quality compared to Gurobi and classic ALNS, providing, on average, 5.49% and 6.86% better performance in numerical tests, respectively.

5 | Research Findings

5.1 | Challenges and Barriers in Healthcare Tourism Logistics

Despite significant advancements in healthcare tourism, critical gaps that need future research attention remain. One key gap is insufficient focus on the environmental dimensions of healthcare tourism. Comprehensive evaluations of sustainability and environmental impacts in this industry are lacking, highlighting the urgent need to develop sustainable models that reduce environmental damage.

Therefore, designing solutions for resource management, waste reduction, and environmental balance preservation in healthcare tourism supply chains is a priority. Moreover, the social aspects of healthcare tourism have not been fully explored. Supply chain design must address economic needs, social welfare, and local community participation. Another identified gap is the lack of research on risk management, especially in crises like pandemics. Addressing uncertainties, system complexities, and data limitations requires more focus. Transportation challenges, including flight delays, absence of direct routes, and high patient and equipment transfer costs, are serious barriers. Medical equipment supply and maintenance, requiring exceptional standards and timely distribution, are also critical. Poor coordination among hospitals, transportation companies, and accommodations disrupts integrated service delivery. Differences in treatment standards between countries and concerns about service quality and safety reduce patient trust. Variations in laws and legal issues related to treatment liability, processes, and visa issuance complicate matters. Additionally, many international insurance policies do not fully cover medical expenses, imposing extra financial burdens on patients.

5.2 | Logistics Improvement Strategies in Healthcare Tourism

Modern technologies play a vital role in enhancing logistics efficiency in healthcare tourism. GPS-based tracking systems, blockchain for supply chain transparency, and the Internet of Things (IoT) for monitoring the conditions of medicines and equipment during transit can significantly increase reliability and efficiency. Advanced technologies such as artificial intelligence and machine learning are essential for demand forecasting, reducing patient waiting times, and optimizing medical equipment transport routes.

Employing multi-objective and robust mathematical models to manage uncertainty and improve the medical tourism supply chain efficiency can also be effective. These models enhance collaboration between primary suppliers and medical and welfare service providers, boosting customer satisfaction and profitability. Circular economy approaches, including material recycling and resource optimization, can reduce environmental impacts and increase supply chain durability. Developing sustainable transport infrastructure, reducing carbon emissions through route management, and prioritizing public transport are helpful measures. Other effective strategies include government subsidies to medical service providers to improve transport and waste management systems.

6 | Future of Healthcare Tourism

Healthcare tourism is moving toward digitalization and the adoption of technologies such as telemedicine and artificial intelligence, which will facilitate easier access and management of treatments. Demand for specialized treatments such as robotic surgeries and genetic therapies is increasing, and countries with advanced infrastructure are expected to become the main healthcare tourism hubs.

Personalized services will enhance patient experience. Sustainability, adherence to environmental and ethical standards, and focus on patient welfare will be key success factors in this industry.

Word-of-mouth advertising is crucial in healthcare tourism because it directly affects the destination's reputation. High-quality medical and accommodation services, information transparency, and cultural and natural attractions strengthen this advertising. Positive patient experiences quickly spread through social networks, influencing others' decisions. Utilizing digital tools for word-of-mouth can increase trust and attract international patients. Transparent sharing of treatment processes and outcomes also improves the destination's reputation.

7 | Conclusion and Suggestions for Future Studies

Healthcare tourism involves traveling to other countries or regions for medical, health, and therapeutic services. Motivations include lower treatment costs, high quality and variety of medical services, and access to advanced technologies. Benefits for travelers include affordable treatments, advanced surgeries, and internationally standard medical services. Many countries offer a blend of modern and traditional medicine, which attracts certain patient groups. For host countries, healthcare tourism boosts the economy, creates employment, and improves healthcare industries. Patients benefit from combining treatment with tourism experiences.

Despite significant progress, challenges and gaps remain, notably inadequate attention to environmental aspects. Reducing environmental harm, resource management, and sustainable supply chain models must be prioritized. Proposed research areas include designing reverse logistics for medical waste management and facilitating foreign patient transfers. Using circular economy models to minimize waste and developing integrated systems for better coordination among tourism and health sectors (such as patient discharge and transfer to medical hotels) are critical. Optimizing medical transport routes through hub and network models to better manage crises and health conditions can improve services.

Lastly, developing new objective functions that ensure fairness in-service distribution and adequate coverage for tourists is an important future research priority, especially for countries relying on healthcare tourism as an economic growth pillar. It can significantly improve tourist satisfaction and system efficiency.

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