

ARTIFICIAL INTELLIGENCE-DRIVEN INNOVATIONS IN HEALTH TOURISM AND HOSPITALITY: A REVIEW OF BENEFITS AND CHALLENGES

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Abstract: *AI technology is changing the practice of providing healthcare services to travelers or patients by making it personalized and easier to manage information. This paper seeks to sum up the importance of AI in the medical tourism and hospitality industry in a more detailed way. In particular, we seek to find out how AI approaches can improve health tourism and hospitality in the fields of patient care and management, marketing and personalization of medical services, customer service, appointment scheduling, and the administration of business operations. We focus on the most important AI technologies often used in the tourism and hotel industry: ChatGPT, robots, and systems for facial recognition. We outline the ethical issues of using AI technology in health tourism, including privacy issues concerning data, as well as bias algorithms. At the end of the paper, we examine the interdependence of AI and ethical issues and how they will shape the development of health tourism and the hospitality business in the future. We point out to the need for the balance between business, consumers, trust, safety, and regulation of technology to realize the social and economic benefits of the industry.*

Keywords: *artificial intelligence, health tourism, hospitality, ethical considerations*

INTRODUCTION

Health tourism encounters numerous challenges, including a scarcity of skilled healthcare professionals; this situation can result in the prolonged wait times and diminished care quality. Furthermore, a lack of coordination often exists among international healthcare providers, which complicates patients' efforts to access seamless and integrated services. The high costs associated with health tourism also limit access for many potential patients.

Artificial intelligence (hereinafter: AI) has emerged as a reshaping power in the tourism and hospitality sectors, completely changing how services are delivered and enhancing customer experiences. Integrating AI technologies in these industries can significantly improve operational efficiency, personalized customer service, marketing and personalization, and patient care in health tourism.

Defined broadly, AI refers to the “simulation of human intelligence processes by machines, particularly computer systems, which encompass learning, reasoning, and self-correction capabilities” (Çolak, 2023). The development of AI began in the mid-20th century when scientists first began to investigate how machines could simulate human thinking. One of the pioneers of AI was Alan Turing, who laid the foundation for the idea that computers can solve complex problems using algorithms. Today, we can categorize AI into several types:

- Weak or narrow, which is the most common form of AI today. It is specialized for performing specific tasks, such as image recognition, data analysis, or playing chess. It cannot function outside its specific area. Examples include Siri, Alexa, and Cortana, self-driving cars, facial recognition, spam filters, and more (Putera et al., 2022).
- Generative AI – it is AI that can create new content based on data with which it was trained, such as writing text, creating images, or composing music. Tools like ChatGPT or DALL-E are examples of generative AI, which uses machine learning to “generate” content.

- General AI - refers to the concept that machines can reach the level of human intelligence and use it to solve a wide range of problems, just like humans. This level of intelligence has not yet been reached and much research and development are still needed to achieve it.

The fundamental technologies that support AI in tourism are: machine learning (ML), natural language processing (NLP), and robotics. Machine learning facilitates tools to learn from data and enhance their progress over time. This capability is particularly beneficial for analyzing what are customers' behaviors and propensity (Jabeen et al., 2022). For example, ML algorithms can (in real-time) automatically modify room or airfare prices based on fluctuations in demand, thereby optimizing revenue. NLP enables the creation of AI-based tools such as chatbots and virtual assistants that can “talk” to customers in real-time, delivering information and support (Pillai & Sivathanu, 2020; Tuo et al., 2021).

In the tourism industry, AI is mainly used for recommendation systems, customer service chatbots, and predictive analytics for demand forecasting (Fileri et al., 2021; Kong et al., 2021).

Robotics is also being applied in a variety of contexts: from service robots in hotels to automated check-in systems at airports, these innovations enhance operational efficiency and customer satisfaction (Rafiq et al., 2022). AI-equipped applications and devices can recognize objects and understand and respond to human language. They learn from new data and provide detailed recommendations to users and health workers.

Although these technologies streamline processes, they also foster new alternatives for businesses to engage with patients or customers in innovative manners (Cain et al., 2019). Integrating such advanced technologies into the health tourism industry raises concerns about privacy and data security. The balance of benefits and challenges highlights just how complex it is to bring AI into of health tourism area.

Our motivation for this research was the expectation that AI will affect growth in the tourism and hospitality industries significantly. Current research emphasizes that industry stakeholders must change to meet these changes, embrace AI technologies, and plan with strategies combining technical efficiency and concern for employee welfare (Ryzik & Kissoon, 2022; Zimik & Barman, 2024). The future of health tourism will likely embody a hybrid approach in which AI complements human skills rather than fully replacing them; that model enables a synergistic environment that enhances the overall travel experience (Alyasiri et al., 2024; Ernst et al., 2019). However, challenges still exist, as all stakeholders may not be ready to accept these changes.

This paper discusses and introduces the transformative potential of AI technologies in the health tourism and hospitality sector, concerning customer experience, operational efficiency, as well as the management of patient care and service delivery. It also highlights the need for further research to gain better insights into the complexities associated with AI in tourism.

The main objectives of this paper are:

- Examining the transformative potential of AI technologies in enhancing customer experiences in the tourism and hospitality sectors, with an eye on health tourism.
- Analyzing the impact of AI on operational efficiency and service delivery within these industries.
- Highlighting the ethical considerations, challenges and future development.

THE TECHNOLOGIES OF AI IN HEALTH TOURISM AND HOSPITALITY

AI is transforming the travel and hospitality industry by enhancing customer experience, simplifying operations, and increasing efficiency. AI-based tools--chatbots, virtual assistants, and recommendation engines--deliver tailored services to travelers, answering their questions at instantly upon receiving requests, providing customized travel itineraries, and delivering location-based recommendations. This technology can provide 24/7 support for the business, so it can consequently enhance customer satisfaction and customer engagement.

Additionally, AI can process vast amounts of data to predict travelers' preferences, optimize pricing strategies, and manage bookings, which leads to better predictions of the customer demand and more effective management of revenue.

This application of ChatGPT in health tourism and hospitality is a transformative customer-service and communication solution (Rather, 2024). Thanks to deep neural-linguistic processing, ChatGPT can be used as a virtual assistant that can respond instantly to customer queries, book, and make recommendations (Štilić et al., 2025). Hotels and travel agencies can use ChatGPT to manage routine activities such as answering frequently asked questions, managing reservations, and offering local trips, local food specialties, or travel itineraries, available 24/7. Not only does this AI-powered service help improve the customer experience by responding fast and accurately, but it also frees up human resources to work on other, more sophisticated, high-value interactions. Furthermore, ChatGPT supports multi-lingual communication between customers and businesses removing the barrier between languages and providing more access to international travelers which is extremely useful in a globalized tourism and hospitality sector (Cheng et al., 2022; Rather, 2024). With AI robotics and automation, the health tourism and hotel industries are revolutionizing business operations and improving the guest experience. AI-enabled robots perform room service, cleaning, and luggage management services in hotels, all in an automated and contactless manner. For instance, AI-driven robots can also roam hotel floors to deliver supplies or food in an efficient and timely manner (Rai, 2017). Automated check-in kiosks and baggage-drop stations at airports streamline the process and shorten wait times. Moreover, artificially intelligent robots can assist customers at reception desks, respond to queries, and convey local information in various languages – giving an individual experience without requiring human employees to perform repetitive tasks (Kumar et al., 2021). Interesting and useful are robot suitcases (Figure 1) that drive independently next to passengers or patients with some kind of disabilities or medical problems, controlled by Bluetooth and mobile devices. This greatly facilitates movement around the airport. Integration of AI robotics not only boosts operational efficiency and cost-effectiveness but also helps businesses maintain high service standards while adapting to rising guest expectations in a fast-paced, technology-driven world.



Figure 1: The Travelmate, robot suitcase (Cuskelly, 2016)

Facial recognition systems are transforming the tourism and hospitality industry by improving both operational efficiency and customer experience. In hotels, for example, these systems allow for seamless check-ins (Xu et al., 2021), where guests can bypass traditional reception desks and gain access to their rooms simply by scanning their faces (Gupta et al., 2023). This not only accelerates the check-in process but also enhances security, as it ensures that only authorized individuals access guest services. Airports and airlines are also utilizing facial recognition technology to streamline boarding processes, reduce wait times, and enhance overall passenger flow (Doğan & Niyet, 2024). Hotels and resorts can use the technology to recognize returning guests and anticipate their preferences, allowing staff to provide customized services such as room upgrades or specific amenities without prompting.

Theme parks and other attractions are adopting facial verification for ticketing, fast-passes, and cashless payments to simplify and make the guest experience more pleasant. Although there are obvious advantages to facial recognition, data privacy and safety need to be sorted out to make it widely acceptable in tourism and hospitality.

Wearable devices, powered by AI, are transforming the health tourism sector through tailored and instant solutions. These devices track vital signs, such as heart rate, blood pressure, and sleep patterns, providing valuable data that can be used to improve patient care and wellness experiences. In health tourism, AI helps analyze this data to develop health programs that enhance the overall customer experience for individuals looking for care or health services overseas.

AI technologies are being integrated into various facets of health tourism, providing significant benefits to both providers and patients. The following pages discuss the various effects of AI in health tourism, focusing on its applications in patient care management, appointment scheduling, marketing strategies, telemedicine, and ethical considerations.

a. AI IN PATIENT CARE AND MANAGEMENT

AI-powered tools make it easier to coordinate healthcare services smoothly, from remote consultations to follow-up care after treatment. These solutions help patients connect with doctors and specialists, no matter where they are, breaking down geographical and language barriers (Tripathi & Shalki, 2023).

AI-powered apps make it possible for healthcare professionals to provide better care to patients, while also increasing the satisfaction level for all patients. As an illustration, AI-based diagnostic applications can analyze a large scope of information containing medical data to recognize trends that may be used to forecast health states, therefore increasing the knowledge of health professionals.

Such potential comes in handy in medical tourism because the treatment options that the patients are looking for are often provided in developed countries hence the need for pre-travel evaluations and post-treatment evaluations (Esmailzadeh et al., 2021; Matheny et al., 2020).

Moreover, AI technologies enable personalized patient care by individual treatment plans based on patient-specific data. For instance, AI-powered systems can analyze data from wearable sensors that monitor patients' vital signs in real time and provide immediate action in case of an emergency. This is particularly relevant in medical tourism, where patients may have unique health needs that require careful management during their travels (Sajan & Ann John, 2023).

AI is also used in the field of personalized medicine, where therapeutic protocols are personalized according to individual genetic profiles. AI models can process huge genomic databases and find the optimal therapies for individual genetic variants, thus offering personalized care to international patients seeking cutting-edge treatments for chronic or rare diseases.

Moreover, AI can enhance the interaction between patients and health professionals through virtual care applications, providing patients with relevant and timely information and assistance regardless of geographic location. These tools improve patient involvement and are also excellent methods to build trust, a key factor in patients traveling for medical procedures (Gama et al., 2022).

The use of AI in health care and health management is not without challenges. Questions regarding data privacy and the ethical usage of AI technologies must be addressed to ensure that patients feel secure in sharing their personal health information. Further, healthcare professionals have to be properly prepared and

trained to work with AI systems, ensuring that human supervision remains critical to patient care (Carroll, 2021; Esmaeilzadeh et al., 2021).

b. AI IN CUSTOMER SERVICE

AI is emerging as a crucial technology in the transformation of tourism and hospitality. Its implementation and adoption can provide numerous benefits like increased efficiency and customer experience.

AI-powered technologies such as chatbots and virtual health assistants allow patients to obtain useful data and assistance without delay, transforming the daunting task of seeking out healthcare alternatives. These technological advancements acted as mediators in the interaction between the patients and the health professionals or the staff of the hospitality, allowing patients to receive necessary treatment recommendations and care from a distance (Wong & Sa'aid Hazley, 2020). This can raise the level of user satisfaction because they are provided exactly those services that match their needs and expectations (Stroumpoulis et al., 2022). There is no doubt that the future of customer service will rely on AI for businesses to improve the customer experience and strengthen customer loyalty (O'Brien, 2023).

c. APPOINTMENT SCHEDULING AND ADMINISTRATIVE EFFICIENCY

Apart from improving the user experience, AI also significantly helps in optimizing business operations. Predictive analytics tools allow companies to more accurately predict fluctuations in demand and seasonal trends, thereby optimizing resources such as staffing, inventory, and pricing.

As an illustration, machine learning algorithms can automatically adjust room or airfare prices in real time based on changes in demand, thus maximizing revenue. Besides, AI enables the automation of numerous operational tasks, such as reservation management and check-in processes, reducing the need for manual work and freeing up resources for more complex tasks that require human interaction (Avula et al., 2024).

Prominent hotel chains around the globe are increasingly integrating AI technology into their operations (Štilić et al., 2023); moreover, research suggests that Serbian hoteliers are also prepared to embrace these innovations (Gajić et al., 2024).

AI tools can provide significant advantages to the health tourism sector, particularly in predicting patient no-shows, which, in turn, can result in considerable cost savings. By examining historical data, patient behaviors, appointment schedules, and various other pertinent factors, AI algorithms can effectively estimate the probability of a patient failing to attend their appointment. This capability enables healthcare providers to proactively organize their schedules and adjust resources as needed (for example, overbooking); thus, it mitigates the financial repercussions associated with missed appointments. Research shows that patient no-shows impose a cost exceeding \$150 billion on the healthcare industry annually. Consequently, by reducing these incidents through AI, health tourism establishments can enhance operational efficiency and minimize unnecessary costs (Rajković et al., 2024).

d. AI IN MARKETING AND PERSONALIZATION

AI plays a crucial role in the marketing of health tourism services since it allows highly personalized and targeted communication with prospective patients. By analyzing large datasets (e.g., online activity, search patterns (Sahar & Dar, 2024), social media activity, and demographic data), AI algorithms can accurately identify individuals who are likely to be interested in specific health services (Ekka et al., 2023).

AI-driven systems can recommend travel destinations, travel itineraries, and even hotel rooms for patients based on their preferences. Personalized recommendations help the planning process and therefore encourage customer loyalty to specific brands or service offerings. This allows healthcare providers and medical tourism agencies to design and implement specific marketing campaigns aimed at the interests of prospective patients. For example, AI-driven recommendation systems analyze patients' past booking data and browsing behavior creating personalized travel packages, accommodations, and attractions, tailored to the customer's

interests. Such a level of customization can strengthen customer satisfaction and foster brand loyalty, as travelers feel understood and valued (Grandinetti, 2020).

AI-driven systems can also segment audiences according to health conditions, travel preferences, and even budget; this ensures that the appropriate message reaches the right individuals at the most effective time (Sharma et al., 2023). Furthermore, AI-driven analytics can provide valuable insights into patient outcomes and satisfaction levels, enabling healthcare providers to continuously refine their services and address any areas of concern (Matheny et al., 2020).

AI technologies, including chatbots and virtual assistants, are changing customer interactions in real time. Such tools can give an immediate answer to any question, help with booking, and generate customized suggestions based on user input. For instance, a hotel's chatbot might engage a potential guest by asking about their preferences—room type, amenities, food preferences, allergies, or local attractions—thereby creating a more engaging and personalized booking experience.

However, a travel agency might also use AI to analyze seasonal trends and customer demographics, optimizing their advertising spend by focusing on the most promising market segments during peak travel times (Lichtenthaler, 2019).

e. AI IN TELEMEDICINE AND VIRTUAL CONSULTATIONS

With the help of AI, telemedicine services have been enhanced, letting the patients meet the healthcare professionals at different distance locations. This is especially useful for the people traveling for medical purposes who may want to have the first appointment or follow-up care without the need to travel (Shaw et al., 2019). Another aspect of AI in this regard is the use of chatbots or virtual assistants which can provide prompt feedback to patients and make them feel more comfortable when looking for help.

ETHICAL CONSIDERATIONS AND FUTURE DEVELOPMENT

AI is indeed transforming how businesses operate and how everyday life is organized. No company wants to be at the center of attention for using AI tools that are not protected or not in compliance with legal regulations, such as the EU's General Data Protection Regulation (GDPR) or other relevant data privacy laws. The legal framework of AI implementation in health tourism and hospitality is still evolving. The implementation of AI should follow existing legal regulations. At the same time, new legal challenges in terms of data privacy and consumer protection should be anticipated and developed and the implementation of AI tools should be aligned with them.

Besides the many advantages that make chatbots, robots, and personalized recommendation systems, their rapid adoption leads to ethical issues, notably the privacy of data and the risk of algorithmic bias. Personalization enabled by AI does raise some ethical issues, particularly around data privacy. Consumers are asked to share personal information for an AI system, leading to a delicate balance between personalization and privacy concerns (Cunha et al., 2024). The main threat of using robots in the hotel sector are privacy and cyber security as almost all robots require internet access. Hence, these systems must be protected from cybercriminals (Kumar et al., 2021).

One of the key ethical issues in the application of AI in the health tourism sector is bias, which can manifest itself through gender discrimination based on gender, race, ethnicity, or other social factors. This bias can arise because of insufficient sample data or inadequate training of AI models. That can lead to unequal treatment outcomes for international patients from different cultural and ethnic backgrounds. Accordingly, we must adhere to ethical standards that ensure correctness and transparency when developing and implementing AI solutions.

Social isolation is another critical concern linked to the increasing reliance on AI in health tourism and hospitality. The use of AI-driven tools in service delivery can lead to the reduced human interaction. That may negatively impact the customer experience and contribute to loneliness among patients.

Concern for being unemployed through AI automation is a major ethical concern in the tourism and hospitality industry. Research points to the high risk of automation of many positions, especially in

hospitality (e.g., hotel), with the highest probability of job displacement estimated at 94% for hotel desk clerks (Chau et al., 2019).

The management of health data in AI applications in health or medical tourism settings poses ethical challenges related to privacy and consent. The ability of AI to analyze vast amounts of health data can improve service delivery and enhance customer experiences; however, it also raises concerns about data security and the potential for misuse (Gulumbe et al., 2023). There may be a loss of confidentiality between the doctor and the patient, so it is necessary to protect the data and enable its confidential and safe use.

Based on the abovementioned findings, we can conclude that AI is transforming patient care and management in health or medical tourism and hospitality by enhancing diagnostic accuracy, personalizing treatment plans, and optimizing operational efficiencies. Healthcare professionals face a significant challenge between implementing innovative solutions that will bring numerous benefits and the ethical considerations crucial to implementation. Besides, the education of future professionals in health tourism and hospitality about AI is significant and must not be underestimated (Aydin & Sirkeci, 2024).

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