Sağlık ve Sosyal Refah Araştırmaları Dergisi

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DERLEME MAKALE / REVIEW ARTICLE

DITALIZATION IN HEALTH TOURISM: AN EVALUATION OF TURKIYE'S CURRENT SITUATION AND FUTURE PERSPECTIVE

SAĞLIK TURİZMİNDE DİJİTALLEŞME: TÜRKİYE'NİN MEVCUT DURUM VE GELECEK PERSPEKTİFİ ÜZERİNE BİR DEĞERLENDİRME

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ABSTRACT

Health tourism refers to the practice of traveling to a different region or country to benefit from healthcare services, and it is an essential part of the globalization of healthcare services. In recent years, digitalization has transformed health tourism, with technologies such as artificial intelligence, virtual reality, augmented reality, telemedicine, and blockchain playing a crucial role. These technologies have made health tourism processes more accessible, faster, and personalized, improving the experiences of both patients and healthcare providers. Especially, Türkiye holds a significant position in the health tourism market due to its advanced technological infrastructure and cost-effective advantages. The impact of digitalization on health tourism in Türkiye has resulted in positive outcomes, such as increased patient satisfaction, improved health outcomes, and reduced operational costs. Since the 2010s, health tourism in Türkiye has shown significant development, with a notable increase in market share. Additionally, the growing interest in digital technologies in recent years has further enhanced the potential for growth in this sector. In this context, the role and adaptation of digital technologies in health tourism are becoming critical factors for Türkiye's future growth. Innovative technologies like artificial intelligence, virtual and augmented reality, telemedicine, and blockchain are making health tourism processes faster and more efficient, allowing patients easier access to healthcare services, more accurate diagnoses, and more personalized treatment experiences. Türkiye's investments in digital health technologies and its ongoing digital transformation in the healthcare sector will accelerate developments in this area and strengthen the country's competitive position in the health tourism market. This study aims to evaluate the current state and future perspectives of Türkiye's healthcare sector regarding the use and adaptation of these technologies in health tourism, by first addressing the role of digitalization in the field.

Keywords: Digital transformation, Innovative Technologies, Health Tourism, Türkiye

JEL Classification Codes: I15, H51, F63, L83

ÖZ

Sağlık turizmi, insanların sağlık hizmetlerinden faydalanma amacıyla bulundukları bölgeden farklı bir bölgeye veya ülkeye seyahat etmelerini ifade eden, küreselleşen sağlık hizmetlerinin önemli bir parçasıdır. Son yıllarda, dijitalleşme sağlık turizmini dönüştürmüş ve bu süreçte yapay zekâ, sanal gerçeklik, artırılmış gerçeklik, teletıp ve blockchain gibi dijital teknolojiler önemli bir rol oynamıştır. Bu teknolojiler, sağlık turizmi süreçlerini daha erişilebilir, hızlı ve kişiselleştirilmiş hale getirerek hem hastaların hem de sağlık hizmeti sağlayıcılarının deneyimlerini iyileştirmiştir. Özellikle Türkiye, yüksek teknoloji altyapısı ve uygun maliyet avantajları ile sağlık turizmi pazarında önemli bir konumda yer almaktadır. Türkiye'de dijitalleşmenin sağlık turizmine etkisi, hasta memnuniyetini artırmak, sağlık sonuçlarını iyileştirmek ve operasyonel maliyetleri düşürmek gibi olumlu sonuçlar doğurmuştur. Türkiye'de sağlık turizmi 2010'lu yıllardan itibaren önemli bir gelişim göstermiş ve pazar payında önemli artışlar yaşanmıştır. Ayrıca son yıllarda dijital teknolojilere duyulan ilgi, bu alandaki gelişim potansiyelini arttırmaktadır. Bu bağlamda dijital teknolojilerin sağlık turizmindeki rolü ve adaptasyonu, Türkiye'nin gelecekteki büyümesinde kritik bir faktör olma yolunda ilerlemektedir. Yapay zekâ, sanal ve artırılmış gerçeklik, teletıp ve blockchain gibi yenilikçi teknolojiler, sağlık turizmi süreçlerini daha hızlı ve verimli hale getirerek, hastaların sağlık hizmetlerine daha kolay erişmesini, daha doğru teşhisler almasını ve tedavi süreçlerini kişiselleştirilmiş bir şekilde deneyimlemesini mümkün kılmaktadır. Türkiye'nin dijital sağlık teknolojilerine yaptığı yatırımlar ve sağlık sektöründeki dijital dönüşüm, bu alandaki gelişmeleri hızlandıracak ve ülkenin sağlık turizmi pazarındaki rekabet gücünü daha da pekiştirecektir. Bu çalışmada, öncelikle dijitalleşmenin sağlık turizmi alanında kullanımına değinilerek, sağlık turizmi alanında bu teknolojilerin kullanımı ve adaptasyonunda Türkiye sağlık sektörünün mevcut durumu ve gelecek perspektifinin değerlendirilmesi amaçlanmıştır.

Anahtar Kelimeler: Dijital dönüşüm, Yenilikçi Teknolojiler, Sağlık Turizmi, Türkiye

JEL Sınıflandırma Kodları: I15, H51, F63, L83

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GENİŞLETİLMİŞ ÖZET

Amaç ve Kapsam:

Bu çalışma, dijitalleşmenin sağlık turizmi üzerindeki etkilerini inceleyerek, Türkiye'nin bu alandaki potansiyelini ve karşılaştığı zorlukları analiz etmeyi amaçlamaktadır. Özellikle yapay zekâ, artırılmış ve sanal gerçeklik, teletıp ve blokzincir gibi yenilikçi teknolojilerin sağlık turizmi süreçlerine entegrasyonu değerlendirilmiştir. Türkiye'nin dijital sağlık altyapısı, rekabetçi maliyet avantajları ve uluslararası hasta akışındaki artış, bu çalışmanın temel odak noktaları arasında yer almaktadır. Bu kapsamda, dijital dönüşümün sağlık hizmetlerinin erişilebilirliği, verimliliği ve hasta memnuniyeti üzerindeki etkileri incelenmiştir.

Yöntem:

Bu çalışma, nitel bir literatür taraması yöntemiyle gerçekleştirilmiştir. Türkiye'deki sağlık turizmi uygulamaları, dijital sağlık teknolojilerine entegrasyon süreci ve uluslararası karşılaştırmalar, akademik yayınlar, sektör raporları, sağlık turizmi değerlendirme raporları ve istatistikleri ile resmi veriler ışığında değerlendirmeler yapılmıştır. Teletıp, yapay zekâ, artırılmış-sanal gerçeklik ve blokzincir teknolojileri gibi temel dijital araçların sağlık turizmindeki kullanımına yönelik örnek uygulamalar incelenmiştir. Ayrıca, COVID-19 pandemisi döneminde dijital sağlık çözümlerinin hızlı gelişimi ve yaygınlaşması, değerlendirmeye dâhil edilmiştir.

Bulgular:

Türkiye'nin sağlık turizmi alanında güçlü teknolojik altyapısı ve uygun maliyetli hizmet sunumu sayesinde küresel ölçekte rekabet avantajı sağlamaktadır. Estetik cerrahi, diş tedavisi, tüp bebek ve onkoloji gibi alanlarda Türkiye, yüksek kaliteli hizmetleri uygun fiyatlarla sunarak uluslararası hastalar için cazip bir destinasyon haline gelmiştir. Dijital sağlık teknolojilerinin, özellikle teletıp uygulamalarının yaygınlaşması, hizmet erişimini hızlandırmakta ve coğrafi engelleri ortadan kaldırmaktadır. COVID-19 döneminde teletıpta %600'lük küresel artış, bu teknolojinin potansiyelini ortaya koymuştur. Yapay zekâ ve büyük veri analitiği, bireyselleştirilmiş tedavi planlarının oluşturulmasına katkı sağlamakta, hasta memnuniyetini artırmaktadır. Artırılmış ve sanal gerçeklik teknolojileri, hem hastaların hizmetler hakkında bilgi edinmesini sağlamakta hem de sağlık personelinin eğitim ve operasyonel süreçlerini desteklemektedir. Blokzincir teknolojisi ise hasta verilerinin güvenliği, şeffaflığı ve işlem süreçlerinin otomasyonu açısından önemli katkılar sunmaktadır. Türkiye'de dijital sağlık uygulamalarına yapılan yatırımlar, 5G teknolojisinin yaygınlaşması ve bazı hastanelerin HIMSS EMRAM 7 seviyesine ulaşması, bu alandaki dijital dönüşümün somut göstergelerindendir. Ancak dijitalleşme sürecinin önünde bazı engeller de tespit edilmiştir. Veri güvenliği, yasal düzenlemelerdeki eksiklikler, uluslararası standartların olmaması ve dijital sağlık hizmetlerinin maliyetleri, bu sürecin yaygınlaştırılmasını zorlaştırmaktadır. Ayrıca gelişmekte olan ülkelerde altyapı eksiklikleri, ileri teknolojilerin benimsenmesini sınırlamaktadır.

Sonuç ve Tartışma:

Elde edilen bulgular, dijitalleşmenin sağlık turizmi alanında köklü bir dönüşüm potansiyeli taşıdığını ortaya koymaktadır. Türkiye, dijital sağlık teknolojilerini sağlık turizmine entegre ederek hem ulusal hem uluslararası hastalar için cazip bir destinasyon haline gelme yolunda ilerlemektedir. Dijital çözümler sayesinde hasta deneyimi iyileşmekte, sağlık hizmetleri daha erişilebilir ve kişiselleştirilmiş hale gelmekte, süreçler ise daha verimli yürütülmektedir. Ancak bu gelişimin sürdürülebilir kılınması için bazı stratejik adımların atılması gerekmektedir. Öncelikle, veri güvenliği ve hasta mahremiyeti konularında uluslararası iş birliklerinin artırılması, sağlık turizminde dijital hizmetlerin sınır ötesi uygulanabilirliğini kolaylaştıracaktır. Altyapı yatırımlarının hızlandırılması, özellikle gelişmekte olan bölgelerde dijital sağlık hizmetlerine erişimi artıracaktır. Sağlık çalışanları ve hastalar için dijital okuryazarlığın artırılması, teknolojinin daha etkin kullanılmasını sağlayacaktır. Son olarak, yenilikçi teknolojilerin maliyetlerinin azaltılması ve devlet desteklerinin artırılması, dijitalleşmenin yaygınlaşmasına katkı sağlayacaktır. Sonuç olarak, Türkiye'nin dijital sağlık teknolojilerine yönelik stratejik yatırımları, sağlık turizmi alanındaki küresel liderlik hedeflerine ulaşmasında kritik rol oynamaktadır. Dijitalleşmenin sunduğu fırsatlar, sağlık hizmetlerinin kalitesini artırmakla kalmayıp aynı zamanda Türkiye'nin uluslararası sağlık turizmi pazarındaki rekabetçiliğini de güçlendirecektir.

1. INTRODUCTION

The healthcare sector has undergone a significant transformation through the process of digitalization. With the introduction of computers in the 1960s, many processes became digitalized, and by the 1980s, this transformation began to show its effects in clinical applications. The first step in this process was the digitalization of documents. Over time, with the increase in computer processor speeds, the development of mobile technologies, and the widespread use of cloud-based computing services, portable digital devices became more accessible, accelerating digitalization in business practices.

Health tourism is growing rapidly as part of the globalization of healthcare services. Influenced by technology, people's tendency to travel to other countries for medical treatment has diversified, and digital transformation has reshaped the health tourism industry with technologies like artificial intelligence (AI), big data, virtual reality (VR), and augmented reality (AR). These innovations enhance the capabilities of businesses, contributing to the growth of the sector. The widespread adoption of digitalization in healthcare is also facilitated by the expansion of 5G technology, making telemedicine services more accessible and enabling more effective use of AI, VR, and AR technologies. Consequently, this situation increases the impact of digitalization on health tourism.

Türkiye has effectively embraced digitalization in the field of health tourism, positioning itself as one of the leading countries in the international market. It is actively working to maintain and enhance its current position. In this context, Türkiye is leveraging technologies such as AI and telemedicine types (such as teleconsultation and teleradiology). Undoubtedly, the use and widespread adoption of these technologies could contribute to Türkiye gaining a larger market share in health tourism and improving its competitive position. This study focuses on the use of digitalization in the field of health tourism; it evaluates the current state of Türkiye's healthcare sector along with the use of digital technologies in health tourism and the process of adapting to these technologies. In addition, the study analyzes Türkiye's digitalization perspective in health tourism and potential future developments in this field.

2. DIGITAL TRANSFORMATION IN HEALTH AND HEALTH TOURISM

Health tourism refers to individuals traveling to other countries for treatment or healthy living purposes. Digital transformation is a process aimed at increasing efficiency in the healthcare sector to provide higher quality services. With the help of AI and big data analytics, patients' health data is analyzed, and personalized treatment plans are created. Mobile health applications allow individuals to manage their treatment processes more effectively, while telemedicine technologies increase access to healthcare services for individuals living in remote areas. The integration of these technologies into the field of health tourism significantly improves the quality and accessibility of services (Topol, 2022; Peek et al., 2023). With the development of technology, health tourists can more easily access affordable, high-quality, and fast services (Carrera and Bridges, 2006; Heung et al., 2011). When examining the historical dimensions of health tourism, high costs and long waiting times have led patients to travel to other countries in search of more affordable and higher-quality services (Dinçer et al., 2016; Kozak et al., 2013). The provision of high-quality services in areas such as aesthetic surgery, dental treatment, and organ transplants in medical tourism is directly related to technological advancements (Carrera and Bridges, 2006; Dinçer et al., 2016).

New health tourism trends heavily rely on technologies for competition, and these technologies attract health tourists by enhancing the services and competitiveness of health tourism centers. AI has expanded the use of digital technologies, provided access to big data sources, and influenced tourist preferences. Ease of use has become one of the most important expectations of tourists and has directly impacted their preferences. In this context, one of the AI technologies, facial recognition, is widely used in the medical sector to improve medical outcomes. On the other hand, virtual reality applications are commonly used in health tourism. Virtual treatment tours, presented in three-dimensional videos, allow tourists to view the hospital environment and services in real time (Rady et al., 2024). These types of technologies directly affect health tourists' decision-making processes, shaping their preferences. Thanks to digitalization, access to healthcare services has become easier through online platforms; tourists now have the ability to compare services that fit their budgets. In this process, affordability, accessibility, and fast service delivery are among the main motivational factors for health tourists. Telemedicine, mobile health applications, and big data analytics are digital health technologies that optimize patients' treatment processes. Particularly, telemedicine applications allow patients to manage their pre- and post-treatment processes remotely. During the COVID-19 pandemic, telemedicine services increased by 600% globally (Indugu et al., 2020).

Countries like Türkiye have transitioned to using telemedicine services by remotely monitoring pre- and post-surgery processes.

Digitalization is considered a significant source of efficiency in the health tourism sector. Particularly in areas such as aesthetic surgery, dental treatment, organ transplants, and cancer treatment, digitalization enables patients to access faster and higher-quality healthcare services. Türkiye is one of the leading countries in the digital transformation process in this field. Health tourism in the country allows health tourists to make more informed decisions thanks to digital platforms. Additionally, digital solutions such as telemedicine and mobile health applications enable patients to manage their treatment processes remotely (AlBasri et al., 2024). Türkiye's digital health infrastructure accelerates the growth of the health tourism sector. Digitalization not only improves the quality of healthcare services but also makes it easier for patients to access personalized treatment plans. Health tourists can access high-quality healthcare services at lower costs thanks to digital technologies (USHAŞ, 2024). With its healthcare services and geographical advantages, Türkiye is progressing towards becoming a global leader in health tourism.

3. USE OF DIGITAL TECHNOLOGIES IN HEALTH TOURISM

Digital transformation in the healthcare sector refers to the integration of technological innovations that make the delivery of healthcare services more efficient, accessible, and patient-centered. This transformation presents significant opportunities, especially in the field of health tourism. Health tourism refers to an individual crossing borders to access healthcare services, and the use of digital health technologies offers numerous advantages in this area. Below, the digital transformation technologies in healthcare and their use in health tourism are discussed.

Telemedicine

Digital health services, particularly telemedicine, are creating a significant transformation in the field of health tourism. Initially used to increase access to healthcare services in rural areas, telemedicine is now widely used in global sectors such as health tourism. This technology enables the remote delivery of healthcare services through video conferencing, smartphones, and other digital tools. Türkiye has integrated digital health services, including mobile health applications and telemedicine solutions, to offer high-quality and accessible services to health tourists. Through telemedicine, patients' treatment processes in areas such as aesthetic surgery and dental care are monitored remotely, which enhances service quality and reduces costs. With the widespread adoption of telemedicine services, access to high-quality healthcare at affordable costs is now possible. The integration of telemedicine into health tourism provides many benefits (Medical Tourism Magazine, 2023):

- **Accessibility**: Patients in rural areas or with mobility limitations can communicate with specialists worldwide.
- **Cost-effectiveness**: Virtual consultations are more affordable than in-person meetings and eliminate travel expenses.
- **Time-saving**: Patients can receive services at their convenience, without long waiting times or the need to travel.
- **Continuous care**: Telemedicine provides continuous communication and follow-up between patients and doctors, improving the treatment process.
- **Privacy and security**: Virtual platforms protect patient confidentiality, especially when seeking advice on sensitive health issues.

Despite the widespread adoption of telemedicine services, there are also some challenges (Medical Tourism Magazine, 2023):

- **Legal and Regulatory Barriers**: The lack of a unified legal framework between countries can create issues such as data privacy and licensing concerns.
- **Technological Issues**: Internet access, outdated software, and inadequate hardware can hinder the smooth delivery of services.

- **Language and Cultural Differences**: Language and cultural differences can lead to misunderstandings during virtual consultations.
- **Ethical Issues**: Ethical practices must be prioritized to protect patient rights.

Telemedicine applications, in the integration of health tourism and remote healthcare services, facilitate patient follow-up and increase service accessibility, especially through the flexibility provided by synchronous and asynchronous methods. Telemedicine offers effective solutions for individuals who cannot access healthcare services due to geographic distances in international health tourism. Through synchronous methods (e.g., live video conferences), patients can benefit from immediate consultations and diagnostic services, while asynchronous methods (e.g., medical record and image sharing) optimize healthcare delivery by reducing operational costs. Telemedicine not only facilitates access to healthcare services but also creates a competitive advantage in the health tourism sector (Doğramacı, 2020). Among the factors that enhance Türkiye's competitiveness in the health tourism sector, high-quality service delivery, affordable costs, and the integration of telemedicine technologies play a significant role. In health tourism, telemedicine increases patient satisfaction, particularly by remotely managing pre- and post-treatment processes, strengthening Türkiye's capacity to attract international patients. Telemedicine applications in Türkiye make significant contributions to the development of health tourism. Access to quality service and cost advantages for international patients support Türkiye's competitive power in health tourism (Tontuş, 2019). According to Gökçe Kutsal and Aslan, 33% of physicians communicated with their patients via phone, while 21% utilized video consultations, indicating an increase in telemedicine applications during the pandemic (27). However, research points out that general problems related to telemedicine were particularly prevalent during the COVID-19 pandemic (Gökçe Kutsal and Aslan, 2021). With the impact of digitalization, the integration of telemedicine and health tourism is rapidly developing. The widespread adoption of 5G technology will make services such as high-quality video consultations and remote surgical interventions more accessible. AI and big data analytics enable the analysis of patients' symptoms and the creation of personalized treatment plans. The 600% increase in telemedicine applications during the pandemic clearly demonstrates the potential in this field (Indugu et al., 2020). In the context of health tourism, these innovations create a more sustainable and efficient model in the sector while improving the patient experience.

Artificial Intelligence (AI)

AI is emerging as a tool that enhances operational efficiency and service quality in the health tourism sector. Specifically, clinical decision support systems play a significant role in improving patient care processes and reducing errors. AI-based algorithms assist healthcare professionals in making more accurate and faster decisions, contribute to the development of innovative strategies in healthcare services, and can offer solutions tailored to patients' needs, improving patient satisfaction levels and enhancing the competitive advantages of healthcare centers. Furthermore, the development of applications aimed at preventing medical errors and technologies that reduce the workload of healthcare professionals enable more effective organization of health tourism (Akalın and Veranyurt, 2020; Yılmaz et al., 2021). Digital transformation and AI have significant potential in improving patient experience and enhancing service quality in the healthcare sector. AI has various applications, including processing medical records, creating treatment plans, solving public health challenges, and identifying at-risk populations through big data analysis. Particularly regarded as an important tool for increasing access to healthcare services in rural areas, AI optimizes processes in the health tourism sector, enhancing patient satisfaction. This technology, combined with the digitalization of healthcare systems, is used in areas such as personalizing treatment processes, disease prediction, and resource management. Digital solutions like the Central Physician Appointment System (MHRS) and e-Nabız in Türkiye enable more effective delivery of healthcare services. MHRS is an integrated digital platform developed to facilitate individuals' access to healthcare institutions in Türkiye, including hospitals, Oral and Dental Health Centers, and Family Health Centers. Accessible via the internet, mobile applications, and the Alo 182 call center, the system aims to reduce inequalities in access to healthcare, eliminate fragmentation in appointment systems, and prevent overcrowding in healthcare facilities. In recent years, with the advancement of digital health infrastructure, MHRS has been integrated with e-Nabız (the national personal health record system) and the e-Government platform. Furthermore, artificial intelligence-supported planning and decision-support algorithms have enabled more effective, data-driven practices in appointment density analysis, resource allocation, and patient referrals. In this context, MHRS has evolved beyond a mere appointment platform to become one of the key components of Türkiye's digital health transformation (Akalın and Veranyurt, 2020).

AI, with methods such as natural language processing and imaging technologies, improves diagnostic processes and provides cost savings in resource usage. For example, in the United States, natural language processing technologies analyze patient data, generating significant cost savings (Akalın and Veranyurt, 2020). The advantages of AI in the healthcare sector include (Rady et al., 2024):

- Digital storage of health data and enabling machine learning applications,
- Development of a clinical decision support system that assists healthcare professionals in solving clinical problems,
- Supporting the healthcare service diagnostic process in areas such as pathology, genetics, and radiology.

Another area where AI enhances the patient experience is real-time monitoring systems and decision support applications. These technologies allow for the optimization of treatment processes and the execution of more cost-effective operations. Additionally, they increase access to healthcare services in rural or developing areas, strengthening the health tourism potential in these regions (Gretzel et al., 2015). AI-based solutions are effective in increasing the accessibility and efficiency of services within the scope of health tourism. According to Gretzel et al. (2015), smart tourism applications use big data analytics to improve customer satisfaction and better understand consumer behavior. Ivanov and Webster (2019) emphasize that AI particularly supports strategic decision-making processes and provides efficiency and cost optimization. Furthermore, Mar and Soyer (2018) state that AI improves diagnostic accuracy, thereby enhancing the patient experience.

AI is leading to significant changes in the health tourism sector through decision support systems, personalized treatment plans, and problem-solving capabilities. AI-based technologies allow for the analysis of patients' genetic data and medical histories to determine the most appropriate treatment options. This is a major advantage, especially for patients with chronic conditions (Esteva et al., 2021). In this context, the analysis of radiology images by AI enables the rapid and accurate detection of tumors (Topol, 2022). AI-supported telemedicine and robotic surgery applications have great potential to enhance service quality and ensure patient satisfaction in the health tourism sector. Telemedicine platforms allow patients to have online consultations with their doctors during pre-treatment processes. Additionally, virtual assistants and AI-based chatbots can provide support at various stages, from helping patients choose healthcare providers to organizing their travel plans. These innovations, particularly in facilitating international patient traffic, optimize treatment processes (Bhandari et al., 2020). Robotic surgery stands out as one of the most striking applications of AI in the healthcare sector. Robots that perform precise surgical procedures safely and effectively can encourage international patients to travel to different countries for complex surgical procedures. For example, robotic systems like CyberKnife enable radiosurgery in sensitive areas of the brain, providing minimally invasive solutions and increasing patient safety (Murphy et al., 2003; Tzafetas et al., 2020). With digital transformation, AI is considered one of the most important technologies shaping the health tourism sector. The widespread adoption of 5G technology will make AI more accessible and allow for more efficient implementation (Indugu et al., 2020). The integration of big data analytics with AI algorithms enables early disease detection, improvement of treatment processes, and the widespread use of personalized services in health tourism. The rapid increase in AI applications in healthcare during the pandemic has revealed the potential in this field. In the context of health tourism, AI-supported innovations enhance patient satisfaction, creating a more efficient and sustainable business model in the sector.

Virtual Reality (VR) and Augmented Reality (AR)

AR and VR initially emerged as innovative technologies used in the entertainment and gaming sectors. However, today these technologies are creating revolutionary transformations in many fields such as healthcare, education, tourism, and architecture. Health tourism is one of the areas where AR and VR technologies stand out, with the potential to improve patient experience, facilitate treatment processes, and enhance interaction between healthcare professionals and patients. AR technology provides users with an enriched visual experience by integrating digital information and visuals into the real world (Azuma, 1997). In this context, AR can help explain anatomical structures, surgical procedures, or treatment processes to patients with three-dimensional visuals. This helps patients better understand their treatment processes and increases their trust in healthcare services. Similarly, VR surrounds users with a fully digital environment, creating simulations and interactive experiences. In the context of health tourism, VR is used in areas such as pre-surgical simulations, virtual rehabilitation programs, and stress management (Chirico et al., 2020). AR and VR are also effective alternatives in pain management and have the

potential to reduce anxiety, especially in cancer patients. AR helps clarify patients' expectations about their treatment process by visualizing post-operative results in areas like dental aesthetics and plastic surgery. Additionally, AR enables virtual tours of healthcare facilities and interactive presentations of treatment plans, providing a personalized experience, particularly in the context of health tourism. In education, medical students can use AR technology to examine complex surgical operations in advance and practice. VR, on the other hand, is heavily used in rehabilitation and surgical simulations. For example, with VR technologies, students and doctors can experience surgical procedures through risk-free simulations. Moreover, social skill training programs using VR help individuals with autism improve their daily living skills. In rehabilitation processes, VR environments can help patients affected by brain damage regain cognitive and motor skills. Another benefit of these technologies is enabling patients to make informed decisions during or prior to treatment in virtual environments (Mallari et al., 2019).

Health tourism is a rapidly growing sector where international patients travel to receive healthcare services. In this context, AR and VR technologies play a crucial role in the transformation of health tourism. These technologies allow patients to virtually explore healthcare facilities, better understand pre-surgical processes, and interact with specialist doctors (Giglioli et al., 2018). VR technology enables potential health tourists to take virtual tours of healthcare facilities and experience the services offered, while AR technology helps visualize the treatment process, assisting patients in making informed decisions (Azuma, 1997). Such applications particularly enhance the accessibility and transparency of health tourism services for international patients (Chirico et al., 2020). Additionally, the integration of these technologies ensures the more effective delivery of patient-centered healthcare services. For example, AR and VR-based simulations provide visual and interactive guidance for patients to better understand their treatment processes, while also facilitating education and operational planning for healthcare professionals (Mallari et al., 2019). These innovations enhance both the quality and competitiveness of health tourism services. The widespread use of these technologies in health tourism requires an interdisciplinary approach and continuous technological adaptation. In terms of improving patient experiences and supporting healthcare professionals, AR and VR can play an important role in the future of health tourism.

AR and VR technologies offer many innovations in health tourism and digital health services, while also presenting challenges such as cost, access, and data security. High costs, particularly in low-income regions, limit access to these technologies and hinder the widespread adoption of digital health applications (Kıraç, 2024; Yao et al., 2022). Even in developed countries, significant investments are required for the integration of these technologies into the healthcare system. Additionally, AR and VR applications collect large amounts of personal health data, raising concerns about the security and privacy of this data. In digital health environments, data management has a direct impact on patient satisfaction. Security vulnerabilities can undermine user trust in these innovative solutions and may necessitate the establishment of new standards by regulatory bodies (Tu et al., 2020; Kıraç, 2024). However, for these technologies to be fully adopted, costs need to be reduced, access to the technologies should be increased, and concerns about data security must be addressed (Yao et al., 2022).

Blockchain

Blockchain technology is a digital, distributed ledger used to securely record and verify transactions without the need for a central authority. This technology ensures that transactions are stored in an immutable and transparent manner. Key features of blockchain include decentralization, immutability, transparency, and high security. In complex systems such as health tourism, which involves many different stakeholders, these features offer significant opportunities to make processes more secure, efficient, and transparent. Blockchain provides effective solutions in critical areas such as data security, patient privacy, medical data sharing, and payments in the context of health tourism. Especially in cross-border healthcare services, securely storing and sharing patient data is of utmost importance. Blockchain technology offers an effective solution to this need through its encryption and decentralized structure (Esteva et al., 2021).

Blockchain technology offers innovative solutions for ensuring data security and patient privacy in health tourism processes. This technology encrypts data and stores and shares it securely. The distributed ledger structure of blockchain ensures that medical records are accessible securely and quickly worldwide, while also preventing data manipulation and unauthorized access. Blockchain-based smart contracts automate financial transactions in health tourism, providing transparency and security in payment processes. For example, automatic payment systems reduce the risk of fraud and expedite processes once treatment is completed. Furthermore, this technology reduces costs by eliminating intermediaries. To ensure continuity of healthcare services, blockchain's immutable record

structure prevents data inconsistencies and enhances reliability. However, the implementation of blockchain technology faces challenges such as the lack of international standards and legal regulations. Despite this, the advantages it offers in enhancing patient data privacy and security make it an effective tool in the health tourism sector (Fonsêca et al., 2024; Swan, 2015). Blockchain-based digital health identities securely store patient information such as vaccination status, medical history, and test results. These blockchain-supported passports enable the rapid verification of health conditions at border crossings during international travel, facilitating faster processes and enhancing security. Blockchain technology also facilitates the use of anonymized patient data in medical research. In the context of health tourism, this application could make a significant contribution to the development of new treatment methods. When a transaction is requested, it is converted into a cryptographic block containing information about the date/time, sender, receiver, asset type, and amount, and is stored to be added to the ledger. It is then connected to a network of nodes for block validation. After validation, the block is added to the blockchain. Due to its unique features, blockchain technology has the potential to revolutionize many industries. The main advantages of blockchain technology include (Tyan et al., 2021):

- **Elimination of intermediaries**: Blockchain's peer-to-peer structure eliminates the need for a central authority.
- **Data integrity**: Any data added to the blockchain is immutable and cannot be deleted, ultimately providing a very high level of security.
- **Traceability**: All data can be traced to verify its origins and paths.
- **Security**: Block encryption in the chain and the provision of a unique identity for each user of the blockchain guarantee a high security range.
- **Faster processing**: Compared to the traditional banking process, which usually takes three days, blockchain technology significantly reduces transaction times, with the process taking only a few minutes or seconds.
- **Lower costs**: Costs can be reduced due to the elimination of intermediaries.
- **Trust**: All users of the blockchain can trust one another and transact directly with each other.

However, there are some challenges in applying blockchain to health tourism, which are discussed below (Tyan et al., 2021):

- **High energy consumption**: The energy intensity of blockchain networks raises environmental concerns.
- **High operational costs**: The implementation and maintenance of the technology can be costly.
- **Regulatory gaps**: The international regulation and compliance processes for blockchain technology may take time.

In conclusion, blockchain technology offers significant benefits to the health tourism sector by improving data security, patient privacy, and transaction speed. However, overcoming cost and regulatory challenges is necessary for the widespread adoption of this technology.

4. THE ROLE OF DIGITAL TRANSFORMATION IN HEALTH TOURISM AND THE CHALLENGES FACED

Digital transformation is a significant process that enhances efficiency by optimizing processes and improving services through technology in the healthcare sector. In the health tourism sector, digitalization offers advantages such as improving patient experience, reducing costs, and increasing service quality. Innovative technologies like AI, telemedicine, big data analytics, mobile health applications, and blockchain facilitate cross-border access to healthcare services and contribute to personalized service delivery (Topol, 2022). These technologies offer a wide range of impacts in the health tourism sector, from fast and efficient treatment processes to cost advantages, while also presenting various challenges such as infrastructure gaps, data security, and legal regulations. The contributions of digital technologies to health tourism are discussed below:

- **Fast and Efficient Treatment Processes**: Telemedicine applications speed up remote diagnosis and treatment processes, providing both time and cost savings (Ryu, 2012).
- **Broad Access and Easy Communication**: Mobile health applications and telemedicine services facilitate access to cross-border healthcare, providing significant ease in the health tourism sector (Phuong et al., 2023).
- **Personalized Service and Patient Satisfaction**: AI and big data analytics help deliver personalized healthcare services, enhancing patient satisfaction and contributing to the sector (Kaur, 2024).
- **Cost Reduction**: Remote healthcare services offer more economical solutions to health tourists by reducing costs such as travel and accommodation (Phuong et al., 2023).
- **Data Security and Patient Privacy**: Blockchain technologies ensure the security of patient data and enhance privacy (Kaur, 2024).

However, there are certain challenges brought about by digital transformation in health tourism, as discussed below (Kaur, 2024):

- **Lack of Digital Infrastructure**: The lack of digital infrastructure, especially in developing countries, hinders the digitalization of healthcare services and slows the global development of health tourism. Strengthening infrastructure is crucial for the widespread adoption of advanced technologies.
- **Data Security and Privacy Issues**: While the protection of digital health data is a critical requirement for health tourism, the lack of data security standards and insufficient legal regulations create significant security vulnerabilities in this area.
- **Legal Regulations**: Different legal regulations between countries limit the international applicability of digital health services. This situation makes it difficult for health tourism to reach a broader audience. The lack of international standards, especially regarding data sharing and patient privacy, negatively impacts this process.

Digital transformation improves service quality in the health tourism sector, enhances patient experiences, reduces costs, and ensures services reach a wider audience. However, challenges related to infrastructure gaps, data security, and legal regulations must be addressed for the sustainable growth of the sector.

5. EVALUATION OF TURKIYE'S CURRENT STATUS AND POTENTIAL IN DIGITAL HEALTH APPLICATIONS IN TERMS OF HEALTH TOURISM

Digitalization has emerged as one of the key factors supporting the growth of the health tourism sector. Today, digital technologies not only make it easier for individuals to access healthcare services but also enhance the global competitive edge of countries in the field of health tourism. In this context, Türkiye holds a significant advantage, modernizing its healthcare services through digitalization and developing notable practices in the medical tourism sector.

Telemedicine, used as an innovative approach in the Turkish healthcare sector, has become an integral part of the healthcare system, allowing patients to access remote health services, particularly gaining momentum during the COVID-19 pandemic (Bak and Çobanoğlu, 2024). The COVID-19 pandemic has clearly highlighted the importance of digital health technologies in crisis management. During the pandemic, big data analytics was effectively used to track disease spread and develop prevention strategies. During this period, telehealth applications quickly became widespread in response to social distancing requirements and played a critical role in ensuring the continuity of healthcare services. The use of 5G technology has enhanced the speed and quality of remote healthcare services, strengthening communication between healthcare providers and patients. This process demonstrated that digital health technologies can play a critical role not only during crisis periods but also in long-term healthcare systems (Samancı, 2024). Through telemedicine, healthcare services can reach wider audiences by overcoming geographic and economic barriers (Bak and Çobanoğlu, 2024; Yapar and Demirköse, 2024). Health tourism, costs, and telemedicine applications mean that patients no longer need to physically travel to receive

certain healthcare services. Studies have shown that healthcare services provided via telemedicine reduce costs and increase patient satisfaction. These developments are also changing the dynamics of health tourism and expanding its boundaries (Sevim et al., 2024).

Given Türkiye 's geographical structure and rural-urban population distribution, telemedicine presents innovative opportunities as an alternative healthcare delivery model for both national and international health tourists. Digital platforms such as e-Pulse, developed under the leadership of the Ministry of Health in Türkiye, enable the secure storage of patient data and provide easy access to this data from anywhere, offering significant convenience for health tourism patients. This platform is evolving into a model for international patients, known as the "e-Pulse International" system (Yıldırım, 2021). These systems have ensured continuity in healthcare services by offering remote video consultations and consultations to patients. Telemedicine has also become a crucial solution for individuals living in rural areas or those who are unable to access healthcare centers due to physical disabilities (Ulutan and Ünal, 2024). When we look chronologically at remote healthcare services in Türkiye, we see that telemedicine and telehealth applications, which directly cover remote healthcare services, are relatively new and span only a few years. Like most parts of the world, one of the first implementations in Türkiye was in the field of tele-radiology. The infrastructure for tele-radiology services was established when the first version of the "Tele-Radiology System" was developed by the Ministry of Health's General Directorate of Health Information Systems' Projects Coordination Department on 05.12.2014, and it began to be actively used. The tele-radiology system was updated and improved on 31.05.2022. The health services provided through the tele-radiology system offer four different service modules. The goals of these services are defined as follows: The first module, Radiological Reporting, aims to balance the workload distribution of radiologists between hospitals, thereby enabling faster radiological reports for patients. The second module, Quality Control, involves the continuous monitoring and inspection of all radiological images and reports across the country to improve the quality of radiology services. The third module, Tele-Consultation, allows radiologists to consult with specialists in other fields, enabling a more accurate diagnosis. Finally, e-Pulse Integration allows citizens to access their own radiological images registered in the Tele-Radiology System via e-Pulse. In 2021, the Ministry of Health's SBSGM launched the "Dr. E-Pulse System," which is a telehealth project. The Dr. E-Pulse System is an integrated and comprehensive telehealth application that enables information sharing with the MHRS and e-Pulse systems, using information technology and telecommunications technologies through smart devices and mobile applications. During the COVID-19 pandemic, this project was implemented to provide online video consultations for patients who were in quarantine due to being coronavirus-positive or in contact with infected individuals, through internet connections and smart mobile devices. Appointments for online video consultations can be made through the Ministry of Health's Central Physician Appointment System (MHRS) (Gerçeker and Erdemi, 2024). However, outside of tele-radiology, other telemedicine applications (such as tele-clinic, tele-radiology) in Türkiye are relatively limited. Issues such as technological infrastructure deficiencies, low digital literacy levels, and data security concerns are the main barriers to the widespread adoption of these applications (Yapar and Demirköse, 2024; Bak and Çobanoğlu, 2024). Therefore, enhancing the digital skills of users and strengthening technological infrastructure could facilitate the development of Turkey's national and international health tourism market.

Turkey offers healthcare services at 50–70% lower costs compared to Europe and the United States, positioning itself as one of the most preferred global destinations, particularly in fields such as hair transplantation, dental treatments, and aesthetic surgery. Artificial intelligence and other digital health applications not only support this cost advantage but also significantly contribute to the expansion of Turkey's market share in healthcare services (Tiryaki, 2025). In Turkey, AI-supported healthcare projects have gained momentum in recent times, with digitalization efforts, particularly those supported by the Ministry of Health, drawing attention. The Corona Prevention Application, developed by the Ministry of Health during the COVID-19 period and made available to all citizens, is an AI application designed to provide a preliminary assessment based on COVID-19 symptoms and recommend that citizens visit a healthcare facility based on this assessment. Similarly, the "Neyim Var" Application, developed by the Ministry of Health, is another AI application launched in September 2021 to prevent patients from seeking treatment in the wrong departments and to provide effective treatment to patients as quickly as possible. This application aims to prevent users from applying to the wrong department for healthcare services. Another example of AI in the Turkish healthcare sector is the mammography CAD (Computer-Aided Diagnosis) application, which is currently under development by the Ministry of Health. This application, expected to play a significant role in the analysis and diagnosis of radiological images, can help increase the accuracy rates of detecting diseases such as lung and breast cancer (Tarcan et al., 2024).

The integration of Hospital Information Management Systems (HIMS) with IT technologies and applications has enabled progress in the healthcare sector, improving the reliability of patient data, ensuring compliance with JCI standards, and enhancing service quality. This has facilitated the development of personal health record (PHR) systems directly connected to HIMS. Moreover, the expansion of access to personal health records (PHR), now also available through mobile devices, offers more pathways for patients to engage more actively in their own care. However, in the context of the digitalization of healthcare services, it may be more beneficial to provide access to health data via the personal health record system instead of printing the health data from HIMS and handing it to health tourism patients (Yıldırım, 2022).

Turkey, in the midst of its digital transformation in the healthcare sector, has made significant strides in enhancing the accessibility of healthcare services through the development of digital health platforms such as e-Nabız and the increasing adoption of telemedicine applications. These digital tools have allowed for greater convenience and efficiency in healthcare delivery, especially during the COVID-19 pandemic, which saw a rapid surge in the use of remote consultations and digital health services. However, despite these advancements, blockchain technology remains relatively underutilized in Turkey's healthcare transformation. Blockchain, known for its ability to provide secure, transparent, and tamper-proof systems, has the potential to revolutionize various aspects of healthcare. In Turkey, its adoption in the healthcare sector has been slow, but there is increasing awareness of its potential benefits, particularly in areas such as data security, patient privacy, and the efficient management of medical records. Blockchain's decentralized structure could significantly reduce the risk of data breaches, ensuring that sensitive patient information remains secure and accessible only to authorized individuals. Furthermore, blockchain technology could streamline healthcare operations by enabling more efficient tracking of medical supplies, simplifying billing processes, and ensuring the authenticity of pharmaceuticals. As Turkey's healthcare sector continues to modernize and embrace digitalization, there is growing interest in exploring the integration of blockchain technology to address challenges related to data management, trust, and transparency. Additionally, the country's increasing focus on healthcare tourism has accelerated the need for more reliable and secure systems that can handle cross-border patient data exchanges. Blockchain's ability to facilitate secure international collaborations, while ensuring compliance with privacy regulations, makes it a valuable tool for the growth of health tourism in Turkey. While blockchain technology is still in its early stages in Turkey's healthcare sector, it holds immense potential to enhance security, improve patient care, and optimize healthcare services. As global healthcare trends continue to evolve, and with the increasing integration of digital platforms, blockchain is expected to play a pivotal role in shaping the future of both the healthcare sector and health tourism industry in Turkey.

In connection with Industry 4.0, the Health 4.0 framework has emerged, where technologies such as virtual reality (VR) and the Internet of Things (IoT) are making healthcare services more efficient, and disease diagnosis processes are accelerated through AI-supported systems. In the Turkish healthcare sector, there are applications related to the use of virtual reality technologies. For instance, in 2022, Ankara University İbni Sina Hospital began performing brain surgeries using 'metaverse' technology, a practice now being applied in only a few centers globally (Medimagazin, 2024). As of 2022, Romatem Bursa Physical Therapy Hospital and Bursa City Hospital, with approval from the Ministry of Health, conducted an important study using "VR (augmented/virtual reality) technology" for the rehabilitation of Parkinson's patients with walking disorders (DHA, 2025). This technology helps make treatment processes more effective by visualizing three-dimensional hospital environments, surgical procedures, and treatment methods in virtual settings. Therefore, in the field of health tourism, the use of such technologies could play a significant role in patients' and health tourists' choices of hospitals and doctors. The detailed and engaging presentation of healthcare services in digital environments can assist in making more informed decisions and increasing trust in the treatment processes. While the number of such applications is currently limited and still developing, Turkey's investments in digital health solutions are expected to increase the number of international patients, contribute to the country's economy through health tourism, and strengthen Turkey's competitive position in the health tourism market.

6. CONCLUSION AND RECOMMENDATIONS

Digitalization has significant transformative potential in the health tourism sector. Digital technologies, which enable healthcare services to be delivered more quickly, accessibly, and securely, also offer the opportunity to reduce process costs and reach a broader audience. However, the full adoption of these technologies requires the evaluation of certain opportunities and overcoming challenges. In this context, telemedicine is one of the greatest

advantages that digitalization offers in the field of health tourism. This technology, which enables remote diagnosis and treatment processes, not only increases access to healthcare services but also reduces travel and logistics costs (Indugu et al., 2020). Countries like Turkey are gaining a competitive advantage in the global market by integrating telemedicine infrastructure into their health tourism strategies. However, the regulation of telemedicine services at the international level and the protection of patient privacy are critical to enhancing the effectiveness of this technology.

Another digital application used in the healthcare sector, AI, has the potential to make processes more efficient in the health tourism sector and provide personalized solutions to patients' individual needs. For example, AI-based applications can analyze patients' past medical data and offer personalized treatment recommendations. However, the use of AI is limited by high costs, data security concerns, and regulatory shortcomings. Overcoming these challenges will enable the sector to fully benefit from AI technologies. Furthermore, AR and VR offer new opportunities for both patients and healthcare professionals in health tourism. These technologies are particularly effective in rehabilitation and surgical training processes. AR and VR, enable treatment processes to be applied in a more efficient and personalized manner. Through virtual environments, patients can visualize three-dimensional hospital settings and surgical procedures, allowing them to engage more actively in the treatment process. Moreover, the potential of VR technology in the context of health tourism is also considerable. Today, health tourism not only focuses on medical success but also on the digital experiences that play a significant role in patients' choices of hospitals and doctors. Innovative technologies like virtual reality can effectively present aspects of healthcare that could not be experienced before, allowing both local and international patients to make more informed decisions. For instance, patients can observe how treatment processes will unfold and how these processes will be visualized in virtual environments, thereby increasing their trust in the treatment process. These developments can significantly improve the quality of healthcare not only in terms of the efficiency of treatment processes but also in terms of patient satisfaction and trust. Through digital platforms, healthcare institutions can promote themselves more effectively, meet potential patients' expectations, and gain a competitive advantage in the health tourism market. Digital solutions that can influence health tourists' decision-making processes in selecting hospitals and doctors may become a key element shaping the future of the healthcare sector.

Blockchain technology provides a revolutionary solution in health tourism in terms of data security, patient privacy, and process transparency. Blockchain-based systems ensure that medical data is stored and shared securely, protecting patients' privacy. However, challenges such as high energy consumption and regulatory uncertainties need to be addressed for the widespread adoption of this technology (Kaur, 2024). On the other hand, Turkey, in the process of digital transformation in the healthcare sector, has made healthcare services more accessible through digital health platforms such as e-Nabız and telemedicine applications, while blockchain technology is not yet widespread in this transformation. However, due to the global transformation in the healthcare sector and the influence of the healthcare tourism perspective turning towards this area, blockchain technologies are expected to gain significant importance in both the healthcare sector and the health tourism industry.

In conclusion, digitalization has the potential to make the health tourism sector more efficient, accessible, and personalized. Innovative technologies such as telemedicine, AI, augmented reality, and blockchain are leading to profound changes in the sector. However, the key challenges of strengthening digital infrastructure, ensuring data security, and developing an international legal framework must be overcome in this process. In recent years, as part of the government's policies in the healthcare sector and health tourism, digitalization has gained significant importance in Turkey. Efforts to expand telemedicine and the use of AI in the healthcare sector are expected to further enhance Turkey's competitive advantage in the field of health tourism.

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