



A Blockchain Enabled Medical Tourism Ecosystem

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Abstract. Medical tourism is considered as a potential field for high growth. There are several problems, including the possible ability of patient tourists to monitor critical elements of healthcare quality and professionals. In addition, patient-doctor confidence, process, openness of risks, privacy of the medical record and other threats associated with health in specific treatments come from queries. We study the possible benefits of Blockchain technology in this conceptual paper to answer several outstanding medical tourism concerns. We conclude that technology from Blockchain can serve as the basis for future study. Medical tourism. The four primary objectives that may be reached using Blockchain technology, namely to improve tourism experience, to reward sustainable behavior and to provide benefits for local communities, and to reduce worries about privacy, center on Smart Tourism Destinations. The report also discusses the main hurdles to deploy this new technology successfully. This study seeks to better improve existing understanding regarding blockchain technology's prospective ramifications within the smart tourism field, particular destinations for smart tourism. In this paper, we have provided the strong need of medical tourism and the significance of Blockchain in secured and reliable medical tourism. Medical record sharing on global platform is security concern for doctor and patients. Blockchain Technology can be silver bullet for enhancing medical tourism for Global medical treatment.

Keywords: Blockchain Technology · Privacy · Efficiency · Medical Tourism · Healthcare

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1 Introduction

The ‘sharing economy’ also reduces local transit costs internationally, providing alternative, affordable lodging options. In the travel and tourism sectors, emerging technologies provide new consumer focused instruments [2]. The influence of technology is emphasized by tourism research and helps develop continuous initiatives to improve medical satisfaction.

Due to the demand for quick and affordable medical procedures during the past 20 years, medical tourism has gained in importance, appeal, and acceptance. Long public health wait times, high private health insurance premiums, low reimbursement rates, and a lack of local knowledge all contribute to this tendency. Along with life-saving surgeries like organ transplants, medical tourism also offers minor prosthesis and aesthetic procedures. Medical tourism positively affects economic growth in nearby industries including tourism, traffic, pharmaceuticals, and hospitality [1]. This emerging specialist industry aims to exceed passengers’ high standards for service. The number of developing countries has increased, and the availability of services at affordable rates is expanding. Additionally, improved income accessibility, technology advancements, and rising competition (Fig. 1).

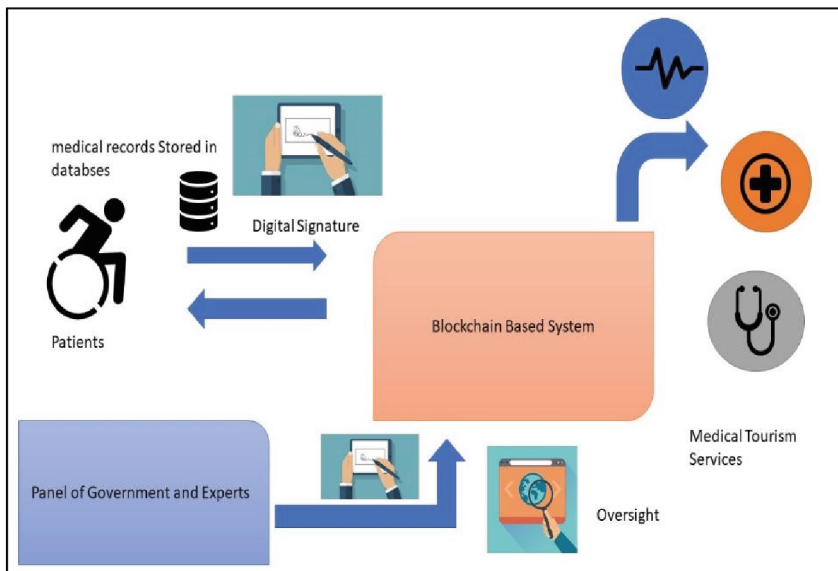


Fig. 1. Medical Tourism Overview

The promise of wellness systems, created by this ancient civilization’s expertise over many ages, would be completely realised. This is accomplished through portraying India as a hub for spirituality, which has long been a part of Indian culture, as well as for Ayurveda, Yoga, Sidha, Naturopathy, etc. Guidelines for wellness tourism have been created by the ministry of tourism. These standards cover topics including providing

high-quality advertising materials, educating and equipping service providers, taking part in national and international wellness-related events, etc. The proliferation of wellness facilities around the nation has increased demand for high-quality care. Medical tourism refers to the rapidly expanding practise of crossing international borders in search of healthcare services. It is also known as medical travel, health tourism, or global healthcare. Elective operations, complicated surgeries, etc. are frequently requested services by tourists. Many hospitals in India have access to cutting-edge medical and diagnostic technology from large international enterprises. The best nurses in the world come from India. Nearly 10,000 nurses are graduated each year from India's nearly 1000 accredited nurse training programmes, the majority of which are affiliated with teaching hospitals.

Blockchain's increased popularity is due to its capacity to build a credible network where the value of Blockchain may be shared. The technique has a broad range of applications across the industry. Academic academics and industrial practitioners that strive to resolve chronic issues in various fields are increasingly paying attention to Blockchain technology. While the influence of Blockchain is an important subject of research that might generate major alterations in the field of tourism, thorough research in its emerging field remains lacking [3]. The quick digitalization of health care is likely to have major consequences for healthcare services for medical tourists with the advent of Blockchain technology. For instance, medical tourism producers are struggling to convince potential clients of the quality and the security of medical centers. Transparency of a Blockchain is due to the fact that each public address is available to observing the holding and transaction. It cannot be amended while the data is kept in the ledger. You don't have the power to change things, no matter who you are. If an error occurs, the error should be reversed by a new transaction. Both transactions are apparent at that moment. In the recorded ledger, the first transaction is seen as a mistake. The confirmed transaction then contributes with additional transactions that create a new data block. If a person wants to give Blockchain information using a specific connection key and a public address, the transaction is signed with a private key. Transparency of a Blockchain is due to the fact that each public address is available to observing the holding and transaction. It cannot be amended while the data is kept in the ledger. You don't have the power to change things, no matter who you are. If an error occurs, the error should be reversed by a new transaction. Both transactions are apparent at that moment. In the recorded ledger, the first transaction is seen as a mistake. The confirmed transaction then contributes with additional transactions that create a new data block. If a person wants to give Blockchain information using a specific connection key and a public address, the transaction is signed with a private key. This type of information is very safe, because it doubles thousands of times and every hacker has to alter over 51% of nodes. Physical movement and transmission of medical information is fundamental requirement for medical tourism. Medical tourism is required for getting treatment from global expertise for the predicted disease.

2 Literature Review

Many authors have provided their literature for explaining the significance of Blockchain in medical tourism. In [1] authors have explained the need and availability of various smart healthcare systems in India. They have also explained the requirement of these

types of remote medical services in India. In [2] authors have shared their concern about the privacy and security of patients Electronic Health Records (EHR) and the accessibility authentication of the users. They have proposed and implemented Blockchain based technology for securing Telemedicine systems. In [3–5] authors have commonly shared their advance implementation of blockchain based algorithm for user authentication of accessing these remote medical systems. They used the term Threefactor authentication for this security protocols.

Several centuries ago, there was medical tourism, which involved going overseas for medical treatment. Many Europeans visited isolated spas in the 18th and 19th centuries because they were thought to have health-improving qualities [16]. Yoga and Ayurveda are ancient healing practises that have drawn tourists from around the world seeking to enhance their health for more than 5000 years [17]. For more than a millennium, people have travelled to Japan's mineral springs for medicinal treatment [18]. As international travel becomes more and more common, an increasing number of people are doing so in order to get healthcare services.

The researchers conducted study on medical tourism from various angles and in a range of settings. One of the first academic studies in the area [19, 20], suggested that the idea of medical tourism may be exploited as a successful marketing tactic. Studies have made an effort to define the significance of medical travel.

3 E-Healthcare or Telemedicine System

Doctors, nurses, pharmacists, and patients can all access a variety of healthcare services through the e-Healthcare system, which is built on information and communication technology [11]. Usually, these services are provided online. Telemedicine, commonly referred to as tele-health or e-medicine, is the delivery of medical services remotely, such as examinations and consultations, using a telecommunications network [22–24]. With the help of telemedicine, medical practitioners can assess, identify, and treat patients without having to visit them in person. Patients can use personal equipment or visit a telehealth kiosk to consult doctors from the comfort of their homes [25, 26]. (Fig. 2).

Three broad categories can be used to categorize telemedicine:

- Dynamic telemedicine/telehealth: enables real-time communication between doctors and patients. These sessions can be held in a designated medical kiosk or at the patient's house. Conversations over the phone or the usage of HIPAA compliant video conferencing software are examples of interactions.
- Through the use of mobile devices that record information on a patient's temperature, blood sugar levels, blood pressure, and other vital indicators, remote patient monitoring, sometimes referred to as telemonitoring, enables patients to be observed in their homes [12, 27].
- One healthcare provider can transmit patient information, such as lab results, with another healthcare provider via store-and-forward, also referred to as asynchronous telemedicine [13].

AI & ML, Cloud Computing, IoT and Blockchain [28–31] these are some advanced technologies support the functionality of Telemedicine systems.

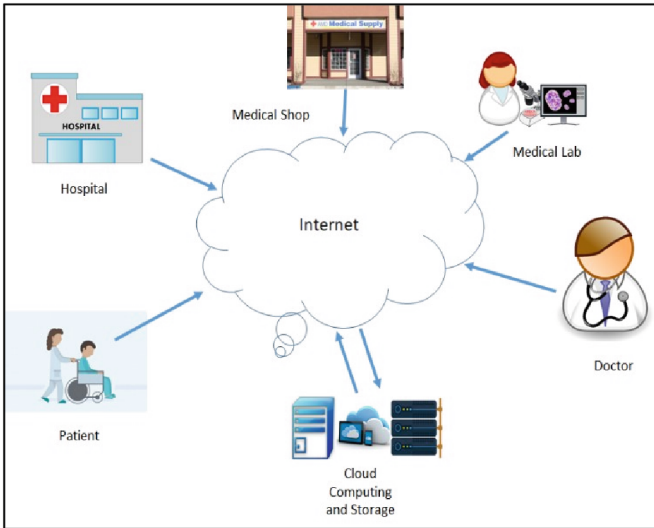


Fig. 2. E-Healthcare/Tele-Medicine System (Basic Model)

3.1 A. Significance of Cloud Computing in E-Healthcare

A wide range of technology and delivery methods are used in telehealth to provide virtual medical, health, and educational services. Patients with long-term medical issues frequently receive support through telehealth. Both patients and clinicians can benefit from telehealth; it can assist patients in better managing and understanding long-term health conditions, and it can assist clinicians in monitoring their patients' health statuses and intervening as needed when potentially harmful trends or abnormal measurements are noticed (Fig. 2). A cloud computing concept called "cloud storage" places digital data on remote servers that are accessed through the Internet. A hosting provider like AWS (Amazon Web Services), Microsoft, or IBM owns and maintains the physical infrastructure. Along with offering complete data protection and availability, these providers are in charge of maintaining data and applications. Companies can use storage capacity they purchase or lease from suppliers to execute apps and store data.

3.2 Significance of Machine Learning in E-Healthcare

Large amounts of data are produced by the growing usage of information technology in healthcare and the digitization of patient data. Numerous systems store data in a variety of formats. The majority of health data about 80% is unstructured. The primary use of the data is the provision of healthcare services, along with planning, management, research, public health, and quality improvement (secondary use). Fast and automated manufacturing of machine-learning algorithms able to evaluate complicated data with precise findings is made possible by the combination of vast volumes of varied data, more computer power, and better approaches. It is necessary to protect the privacy of personal health information. Data must be sufficient, relevant, and limited to what is required to

achieve the purposes for which it is processed, according to GDPR. Patients must be fully aware of the purpose behind data processing before they may decide whether or not to consent to the use of their data in an algorithm. The algorithm may make inaccurate predictions. Both overfitting and underfitting are typical causes of this. Because it has discovered random patterns in the training data rather than a larger pattern explaining the fluctuation, the algorithm underperforms on the fresh data when there is overfitting.

4 Medical Tourism

Public health care is frequently of fundamental importance in many nations, particularly in industrialized parts of the world, whereas private health insurance is expensive and may penalize those with medical problems that are already in place. With the worldwide technology gap being reduced, the price of medical care has become an important factor for changing medical travelers' patterns and flows. Moreover, numerous medical destinations respond to the "tourist-patients" growing need of inexpensive healthcare and achieve a competitive position and cost advantage in the worldwide market (Fig. 3).

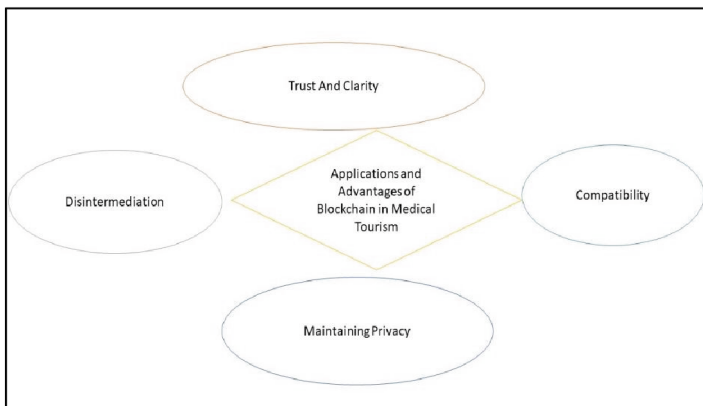


Fig. 3. Advantage of Medical Tourism

5 Blockchain Technology Potentials in the Field of Medical Tourism

We focus in this essay primarily on the aspects that might affect the field of medical tourism. Increasing demand for medical tourism has allowed medical intermediaries to act as mediators between global patients and suppliers of medical services. In the medical tourism business traditional tourist companies retain a strong position, resulting in opportunist behavior. Instead of establishing strong links between medical institutions and patients, the function of the Medical Tourism Intermediaries led to a paternalistic relationship paradigm. These entities' medical tourism packages are typically supplied at

high prices, characterized by healthcare providers' actual expenses. In addition, because of their affiliation to specialist medical providers they are sending their patients exclusively, medical middlemen are likely to restrict the available alternatives. Since they specialize in an objective or resource market, they might direct patients using nutrient supplementation and a high referral fee to inappropriate physicians. More problematic are these middlemen in medical tourism who are not actually medical professionals, as they are not legal responsible for any problems. The asymmetric influence of medical tourism intermediaries can be greatly reduced by Blockchain technology. Blockchain technology, for example, allows medical tourists to communicate directly with international healthcare professionals. This allows you to objectively check your credentials, certifications and procedure expenses. Therefore, the technology contains an unrealized potential to reveal new value since it lowers the imbalance between information and medical facility transparency [2, 15, 16]. The use of blockchain technology makes rational and well-informed judgments for potential health tourists. In this planning stage, prospective medical visitors might utilize blockchain-enabled systems, by getting extensive, authentic and verified information on institutions of medical tourism, to improve the search for medical services. This involves validated curriculum vitae of healthcare personnel, accreditation of institutions and certificates for services or procedures. This technique has two advantages: firstly, before entering the foreign medical system, it will improve the confidence of the traveler. Secondly, suppliers of medical tourism may create their brand capital from the outset and keep their consumer's consistent brand image. Blockchain incorporation into the health tourism sector can contribute to trustworthy, comprehensive medical and non-medical information. Throughout their social, cultural, or linguistic history, these systems can support medical tourists in making educated decision-making [2, 15]. The internet is an extension of Internet links to common physical objects. Internet of things Incorporated with electronics, internet connectivity and other physical forms, such gadgets may communicate with, interact with and monitor distant devices through the internet. Because of the rigorous IoT networking requirements, blockchain looks to be. Highly suitable for manipulative network assaults that target saved data and provide a safe platform for communication between devices on each other within the network. This paradigm is helpful for small-scale IoT networks, but it has poor scalability. Additionally, it is expensive to set up extensive IoT networks, maintain centralized clouds, and connect all the equipment. IoT devices must also be resistant to attacks on both the physical and informational levels. Although many of the currently used methods offer security for IoT systems, they are complex and inefficient for low-resource IoT devices. Discover the limitations of existing paradigms and what blockchain pledges leads to the paradigm of IoT-based e-health. Most of the presently used IoT networks depend on the client server architecture, which recognizes, authorizes and links to all devices through cloud server, and has enormous storage and processing capabilities. Moreover, even if the devices are adjacent to one other, all communication between these devices must be over the Internet.

6 Digitalization and Interoperability Improvement

As a consequence, online sharing of health information should not ignore interoperability, safety and privacy problems as part of the experience in medical tourism. Blockchain technology can give a full and thorough evaluation of an individual's health by enabling a patient-centric paradigm for information management. This may be done by actively tracking the full history of patients, through sophisticating health records record management and enhanced data access control. An ecosystem built on blockchain technology enables patients outside the world to maintain a higher level of health information control and to actively promote contact between their local and foreign health providers. Blockchain can thereby overcome major interoperability concerns inherited from existing health information technology systems, allowing the unrestricted, fast and safe sharing of health information between medical tourists, international health service providers and other stakeholders. Blockchain can also be considerably improved by the caliber of medical treatments provided to medical tourists. By employing cryptocurrencies, medical tourists can quickly and securely collect payments while lowering the cost of transactions [2, 16]. When medical tourists return home, there may be delays and interruptions since there is no continuity of care for the patients and insufficient interoperability of their external health data. Furthermore, if a patient's complete medical records are not available, there is a higher probability of a diagnosis error. Additionally, the suggested therapy can include drugs that are unavailable in the countries of origin. The persistent issue of medical data fragmentation can be effectively solved by blockchain technology, which can also be used to match prescribed pharmaceuticals.

6.1 Electronic Health Records (EHRs)

The EHRs are a computerized collection of medical records for patients. Electronic medical records that will be kept at the hospital or clinical throughout time are saved electronically. All vital clinical data, including MRI, previous medical examination, immunization, laboratory results and all forms of patient's allergy, are contained in these medical records, which is critical for patient care that is kept by a particular care provider [2, 16]. These records are real-time records, patient records that a patient or doctor may easily access.

6.2 Methods/Services Offered by Blockchain in Medical Tourism

Blockchain technology is viewed as a fundamental technology since it may be the basis for future social and economic systems. Recent research in the fields of tourism and hospitality has focused heavily on blockchain technology and cryptocurrencies. Only a small number of published studies have examined the effects of blockchain technology on medical tourism, nevertheless, in terms of study on the topic (Fig. 4).

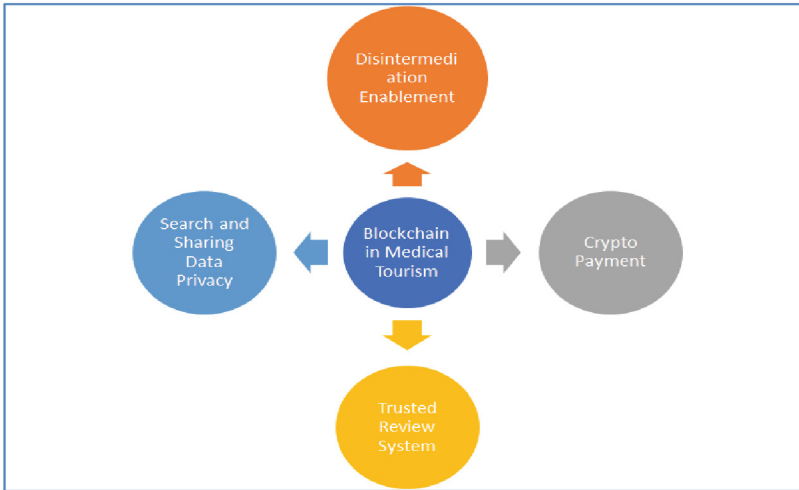


Fig. 4. Service offered by Blockchain in Medical Tourism

Regarding patient-doctor trust, procedure and risk openness, and medical record privacy, discuss some unanswered questions in medical tourism. Blockchain and other cutting-edge technology can facilitate the ongoing expansion of medical tourism.

7 Challenges

If tele-based administrations begin to confront the genuine situation and answer such frantic issues it should receive a nonexclusive methodology that blends both the worldwide and the neighborhood wellbeing frameworks. This is the solitary way tele-based wellbeing innovation can win hearts and can give a wide scope of clinical medical care administrations through teleconsultations, telediagnosis, teletreatments, by extending more noteworthy information and aptitude in this field through suitable learning and preparing of people associated with medical care. It should be expressed here that it isn't the penultimate answer for the issue, in any case, can help in the improvement of the current circumstance. When telemedical frameworks will be carried out in a complex way, it will assist immature nations with getting to better and sound clinical consideration. With this, tele-based medical services ought to have the option to save money on schedule and costs moreover it improves the appropriateness of admission to crises and clinic divisions as needs are. [2, 16].

Challenge	Meaning
Abominable Management	With innovation and clinical practices, there is additionally the need of “being prepared” to acknowledge the resuscitated medical care overseeing frameworks. It is all human brain science, for an invaluable working of tele-based medical care frameworks, there should not be any obstruction, which must be acquired when there is appropriate mindfulness and eagerness inside individuals to acknowledge and receive the adjustment of the human prosperity
Inadequacy of Awareness	There is a mistaken understanding of associated medical care innovation (CHT) among individuals. The need of great importance is to grow a more prominent establishment of sufficient information among average folks and experts so fabulous expertise and happy possibilities can be chipped away at
Lack of Medic Pupils	To manage the deficiency of clinical crew identified with telehealthcare, more HR can be prepared and used at various levels

8 Conclusion

Medical tourism is one of the social need. As we are well aware that a lot of movement is happening for treatment of disease from one country to another country. The travel made by the humans for their medical treatment come under the medical tourism. As we have defined in this paper that there are many areas where blockchain is used for securing and maintain privacy of the data accessed and stored related to their medical treatment. Each year, millions of Americans seek medical treatment abroad. Medical tourists from the United States frequently travel to Mexico, Canada, as well as countries in Central America, South America, and the Caribbean. The epidemic affected many facets of travel, including medical tourism. In order to address this issue, the study has detailed various prospects for blockchain technology implementation in the current context, such as the decrease of processing times for all government-issued travel-related papers, including visas, and the authenticity guarantee of these documents. The article provides a summary of the various difficulties the pandemic has caused for the medical tourism sector. There are many reasons why a patient might travel for medical treatment, including cost or to have a procedure that would be less expensive abroad.

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