***ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE* (APNOR)**

INSTITUTO POLITÉCNICO DE BRAGANÇA

India Medical Tourism analysis and forecasting

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Supervisors:

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Professor João Paulo Teixeira

***Bragança*, July, 2019.**

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Abstract

Medical tourism worldwide and in India is on rise. Figures of medical tourism arrivals in India for 2014, 2015 & 2016 suggest of a significant growth.

The medical tourism nowadays in India is a leading player in the medical tourist/healthcare facilitation industry. It is increasingly emerging as the destination of choice for a wide range of medical procedures. There are numerous advantages of going to India for treatment.

A number of actions have been taken by the Government to attract medical tourists to the country. This study was undertaken to analyse the growth trends in medical tourism in India over a period of 2014-2017 and also to project the medical tourism arrivals over the next couple of years using the sophisticated ARIMA method of trend projection.

A major rise in tourist arrivals was noted in the year 2016 when the number of Medical Tourism Arrivals (MTA) shot up from 234 thousand in 2015 to 427 thousand in the year 2016. This was a rise of 83% over the last years and changed tendencies for the projections for the years to come.

The made forecast for medical tourism arrivals in India for the years 2018-2020 is encouraging. The projections show a great potential for the country to earn valuable foreign exchange through medical tourism. The average figure of the forecast is 662 thousand tourists in 2018 and 791 thousand tourists in 2019 and 925 thousand tourists in 2020.

India has a huge cost and expertise advantage which if leveraged through proper publicity can make it one of the leading medical tourism destinations in the days to come. The Government should step-up its efforts in this direction with aggressive publicity policies.

Keywords: India, Medical Tourism, Inbound Medical Tourism, Forecast, ARIMA model.

Resumo

O turismo médico em todo o mundo e na Índia está em ascensão. Os números de chegadas de turistas médicos na Índia para 2014, 2015 e 2016 sugerem um crescimento significativo.

O turismo médico hoje em dia na Índia é um líder na indústria de facilitação de turismo/assistência médica. É cada vez mais emergente como o destino de escolha para uma ampla gama de procedimentos médicos. Existem inúmeras vantagens de ir à Índia para tratamento.

Várias medidas foram tomadas pelo governo para atrair turistas médicos para o país. Este estudo foi realizado para analisar as tendências de crescimento no turismo médico na Índia durante um período de 2014-2017 e também para projetar as chegadas de turistas médicos ao longo dos próximos dois anos usando o sofisticado método ARIMA de projeção de tendência.

Um grande aumento nas chegadas de turistas foi observado no ano de 2016 quando o número de chegadas de turistas subiu de 234 mil em 2015 para 427 mil no ano de 2016. Este foi um aumento de 83% nos últimos anos e mudou as tendências para as projeções para os anos seguintes.

A previsão feita para chegadas de turistas médicos na Índia para os anos de 2018-2020 é animadora. As projeções mostram um grande potencial para o país ganhar valiosas divisas através do turismo médico. O valor médio da previsão é de 662 mil de turistas em 2018 e 791 mil de turistas em 2019 e 925 mil de turistas em 2020.

A Índia tem uma vantagem enorme em termos de custo e conhecimento, que se aproveitada através de publicidade adequada pode torná-lo um dos principais destinos turísticos médicos nos próximos dias. O governo deve intensificar os seus esforços nessa direção com políticas publicitárias agressivas.

Palavras-chave: Índia, Turismo médico, Turismo médico emissor, Previsão, modelo ARIMA.

To my loving family

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Acronyms

AC – Autocorrelation

ACA – Affordable Care Act

ACF – Autocorrelation function

ADF – Augmented Dickey-Fuller

ARIMA – Autoregressive Integrated Moving Average

AYUSH – Ayurveda Yoga Unani Siddha and Homeopathy

BC – Before Christ

ENT – Ear, nose, throat

E-tourist – Electronic Tourist

FTA – The foreign Tourist Arrivals

IGRT – Image-guided Radiation Therapy

IMRT – Intensity Modulated Radiation Therapy

MAE – Mean absolute error

MAPE – Mean absolute percentage error

MTA – Medical Tourism Arrivals

MVT – Medical Values Travel

PACF – Partial autocorrelation function

RMSE – Root mean square error

SD – Standard Deviation

SEPC – Service Export Promotion Council

TIC – Theil's inequality coefficient

UK – United Kingdom

USA – United States of America

USD/$ – United States Dollar

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Introduction

Medical tourism is defined as a term for the phenomena of people travelling to another country seeking medical treatment. It is one of the main trends for the last decade, which shows that more and more people in the world who prefer the best prices and the best alternatives to get well. India is a popular destination. The country is well known for natural herbs and Ayurveda across the world. It acts as a huge magnet for attracting foreign patients for medical treatments with general tourism on the rise. Medical Tourism is one of the most booming tourism sector in India valued at $3 billion (US dollar) and is expected to touch the $8 billion mark by 2020. The main influencing factors helping India become more and more popular destination of medical tourism are: patients who seek better and cheaper options for treatment in India; skilled doctors present in the country; low-cost treatments and excellent healthcare infrastructure. India show exponential growth in medical tourism sector – the next crown jewel that could shape the future economy and health care of India.

Research purpose of thesis work is to study theoretical basis of India's Medical Tourism analysis of its current state and conduct forecasting based on the use of ARIMA modelling.

The following tasks were set and solved in the thesis work in order to achieve this goal:

- essence and importance of medical tourism, role of medical tourism in India as well as its advantage were researched;
- methodical approaches for conducting ARIMA modelling were analysed;
- the researched methodology was made (objectives, collecting data process, sample, applied methods were chosen)
- review of the medical tourism in India was done with collecting annual and monthly data of medical tourists visiting in India;
- Analysis of past four years (2014-2017) data of medical tourists in India was made with application of the ARIMA method to analyse the historical data for the past 48 months and presentation of its results was given;
- Forecast of next three years data of likely medical tourism visitors to India was made and presentation of its results was given

The practical object of the study was to conduct analysis of medical tourism in India, identify trends and do forecasting of medical tourism in India via ARIMA model, use the results to define average projection for 2018- 2020.

The research sample consists of 48 observations in total: quantities of tourists between 2014-2017 years with division by 12 month, where 2019-2020 observations are forecasted.

The subject of the thesis work was a set of theoretical and methodological and applied aspects of implementation of analysis and forecasting of medical tourism statistics.

Methodology used for data collection included conducting research. Research methods were based on general scientific and empirical methodological techniques of economics. During the literature review economic-statistical and mathematical methods of analysis, abstraction techniques were used. Also such general theoretical methods of scientific knowledge as synthesis, deduction, induction and other methods were used. Concerning methodical approaches, according to specific scientific (empirical) research of selected topics was conducted, among them the most frequently used in the work were calculation and analytical methods of comparison, data grouping, summarizing. The main method used during practical part was ARIMA modelling conducted using Gretl software.

The information base for research is articles, books and other scientific works of scientists, Ministry acts, plans and projects regarding the importance and role of medical tourism, methodical approaches to the implementation of ARIMA modelling, as well as tutorials. Secondary data was retrieved from statistical, annual reports of Ministry of Tourism Government of India for the period 2014-2017.

The thesis work is divided into three main parts: theoretical, methodology and practical chapter. Theoretical chapter includes literature review on medical tourism across the globe, discussion on why the world is moving towards medical tourism, summing up the role of medical tourism in India and its advantage, covering current state and government support of it and what is India standing in the world with a reference to medical tourism. Methodology chapter includes settlement of objectives of the study, description of data collection and its analysis. Practical chapter includes sample characterization, presentation and analysis of statistics for ARIMA modelling, model parameters, its autocorrelation and forecasted data. Moreover, the final part summarizes and gives conclusions on the subject, discusses the out limits and suggests future research lines.

1. Literature review

1.1. Medical tourism across the globe

Medical tourism is a health practice worldwide where patients travel internationally with the aim of receiving medical services. It describes the planned pursuit of privately purchased medical services by patients outside the health systems in their domestic national territory. The practice of traveling to foreign nations to obtain medical, surgical, dental, and wellness care is known as “medical tourism,” “health tourism,” or “wellness tourism.” Despite these different names, the main intention of this type of traveling is far from recreational. Medical tourists generally originate from developed nations, and a large majority of them seek treatments in developing nations. Specifically, the main flow of medical tourists is from the United States of America and Western Europe to mainly South and Southeast Asian countries, including India, Malaysia, Thailand, South Korea and Singapore and European countries, including Czech Republic, Latvia, and Hungary. Mexico, Brazil, Costa Rica, Guatemala, and other Latin American nations also attract medical tourists, particularly from the United States of America. Many Middle Eastern nations were initially sources of medical tourists, however, now these nations attract patients from affluent developed nations (Medical tourism index 2016-2017 Report).

Medical tourists from developed nations also seek treatment and medical procedures in other developed countries. For instance, Canada provides medical treatment to many Americans (Gatrell, 2011). Europeans traveling within Europe for fertility treatment are also common (Shenfield et al., 2010), largely because some European nations restrict certain fertility procedures, forcing their procurement elsewhere. The European Society for Human Reproduction and Embryology has reported that between 20,000 and 25,000 cross-border fertility treatments are carried out each year. Over half of all UK women who seek treatment abroad go to the Czech Republic, where it is easier to obtain donated eggs. Many Italians to avoid legal restrictions at home travel to Spain for egg donation and to Switzerland for sperm

donation. Women from France go to Belgium for the latter (Gatrell, 2011). Some of the most well-travelled medical tourists are from England. Around 50,000 UK residents seek treatment abroad every year (Lunt, Mannion & Exworthy, 2013). Significant numbers of medical tourists also come from the U.S.A., many of whom are among the nearly 50 million Americans who lack any kind of health insurance and 108 million who lack a dental insurance (Warf, 2010). Though the new "Affordable Healthcare for America Act" is expected to reduce the number of uninsured and underinsured USA citizens, only time will tell how this might influence the number of Americans seeking health care outside the USA.

Medical tourism is nothing new – it has existed in different forms for the centuries together (Hancock, 2006; Goodrich, 1994), but its frequency has intensified thanks to contemporary globalization (Horowitz & Rosensweig, 2007; Hopkins, Labonte, Runnels & Packer, 2010). According to Hancock (2006), "medical tourism is one of the fastest growing businesses on earth" (p. vii). Gill and Singh (2011) have claimed that "More travellers than ever before are now traveling abroad to get high quality medical treatments for less cost, which includes treatments such as general surgery, transplant surgery, cancer treatment, stem cell therapies, dental implant, facial for many relevant businesses and industries both in destination and source countries" (Gill & Singh, 2011). Some USA companies are promoting medical tourism; in fact, some insurance companies offer sops to patients willing to go abroad for health care (Pafford, 2009). In 2006, Blue Ridge Paper Products, Inc., a company based in North Carolina, encouraged its employees to travel to India for surgeries of non-emergency types (Burkett, 2007). Similarly, a European owned supermarket chain in the U.S. also encouraged medical tourism in India among its employees owing to the high cost of treatments in the USA (Hopkins, Labonte, Runnels & Packer, 2010). This phenomenon of savings and incentives benefits all the stakeholders – the insurance companies, the employers, and the employees.

Medical travel started with the history. In the past, many people visited spas and health centres for getting relief to their health problems. Neolithic and Bronze age people travelled to neighbouring countries for health related reasons. Sumerians, Greeks, Romans, Japanese, Chinese and Indian cultures also showed evidences of people who travelled to spas and mineral springs for medical treatments. In 4000 BC, the Sumerians built health complexes near health spas along the mineral springs (Jyothis, 2016). Bronze Age tools and votive cups were the evidences of such medical travels during the Sumerian age. Temple healings were prevalent during the Greek ages. Greek pilgrims travelled to the Asclepeion temples from all over the Mediterranean. A temple near the Epidaurus in Greek was the popular among healing temples. This temple had baths, the springs, the gymnasiums, an exercise area and the snake farms. The emergence of medical tourism can be traced with the Greek trend of travelling to healing temples. In the nineteenth, century wealthy Europeans travelled to various health destinations in Greek. Ancient Roman Thermal, Indian Yoga, Japanese Onsen, and Chinese Traditional Medicine also attracted many travellers from around the world. Even though Spa is considered to be originated in the Belgium town of Spa, iron rich hot springs are rampant throughout Europe. These hot springs had medical benefits for healing diseases such as gout, rheumatism, intestinal disorders and so on. During

the time of the Romans luxury, health complexes were built along these hot springs. Even though the hot springs had medical benefits, wealthy people visited such health complexes to enjoy social networking. Onsen near Beppu in Japan Early Islamic civilization also attracted many medical travellers from around the world. The Al-Mansuri hospital was one such hospital in Cairo that attracted many people. It had an in-patient capacity of 8000 patient beds. Japanese Onsen was considered to have healing properties for arthritis aches. Warriors visited these Onsens to alleviate pain, healing wounds and to regain the energy lost during the war. History of Indian Yoga dates back to 5000 years. There was a constant flow of patients and medical students from Middle East and European countries to India during the ancient period (Mothiravally, 2012).

Types of Medical Tourism (Somaiya, 2017):

- Outbound. This type of medical tourism occurs when patients travel from the home country to a foreign country to receive medical treatment.
- Inbound. This type involves patients traveling from a foreign country to the home country in search of medical care.
- Domestic tourism refers to patients traveling to another part of their own country. No international travel happens.

1.2. Why the world is moving towards medical tourism

Medical tourists have good cause to seek out care beyond the home country for many reasons. In some regions of the world, state-of-the-art medical facilities are hard to come by, if they exist at all; in other countries, the public health-care system is so overburdened that it can take years to get needed care. In Britain and Canada, for instance, the waiting period for a hip prosthesis replacement can be a year or more, while in Bangkok or Bangalore, a patient can be in the operating room the morning after getting off a plane (Hutchinson, 2005).

For many medical tourists, though, the real attraction is price. The cost of surgery in India, Thailand or South Africa can be one-tenth of what it is in the United States or Western Europe, and sometimes even less. A heart-valve replacement that would cost $200,000 or more in the USA, for example, goes for $10,000 in India – and that includes round-trip airfare and a brief vacation package. Similarly, a metal-free dental bridge worth $5,500 in the USA and costs $500 in India, a knee prosthesis replacement in Thailand with six days of physical therapy costs about one-fifth of what it would in USA, and Lasik eye surgery worth $3,700 in the USA is available in many other countries for only $730. Cosmetic surgery savings are even greater: A full facelift that would cost $20,000 in the USA runs about $1,250 in South Africa (Hutchinson, 2005).

Any person in need of a surgery will forget of its savings. All, of course, is in a comparison. The balance of savings versus risk is the best option for medical tourism and for a fact is influencing one's decision.

The widespread thought that Third World surgery cannot possibly be as good as that available in the United States, nowadays a mistake. In fact, there have been cases of botched plastic surgery, particularly from Mexican clinics in the days before anyone figured out what a gold mine cheap, high-quality care could be for the developing countries. Yet, the hospitals and clinics that cater to the tourist market often are among the best in the world, and many are staffed by physicians trained at major medical centres in the United States and Europe. Bangkok's Bumrundgrad hospital has more than 200 surgeons who are board-certified in the United States, and one of Singapore's major hospitals is a branch of the prestigious Johns Hopkins University in Baltimore. In a field where experience is as important as technology, Escorts Heart Institute and Research Center in Delhi and Faridabad, India, performs nearly 15,000 heart operations every year, and the death rate among patients during surgery is only 0.8 percent – less than half that of most major hospitals in the United States (Hutchinson, 2005).

In some countries, clinics are backed by sophisticated research infrastructures as well. India is among the world's leading countries for biotechnology research, while both India and South Korea are pushing ahead with stem cell research at a level approached only in Britain. In many foreign clinics, too, the doctors are supported by more registered nurses per patient than in any Western facility, and some clinics provide single-patient rooms that resemble guestrooms in four-star hotels, with a nurse dedicated to each patient 24 hours a day (Hutchinson, 2005).

Add to this the fact that some clinics assign patients a personal assistant for the post-hospital recovery period and throw in a vacation incentive as well, and the deal gets even more attractive. Additionally, many Asian airlines offer frequent-flyer miles to ease the cost of returning for follow-up visits.

In their article, Béland and Zarzeczny (2018) have drawn on the existing literature to discuss a comparative research agenda on medical tourism that stressed the multidimensional relationship between medical tourism and the institutional characteristics of national health care systems. While on one hand, it is claimed that such characteristics shape the demand for medical tourism in each country, on the other hand, the institutional characteristics of each countries health care system can shape the very nature of the influence of medical tourism on that particular nation.

Research from Alberta, Canada, suggested that the financial costs associated with treating complications from medical tourism for bariatric surgery are quite huge, and complication rates are sizably higher than similar surgeries conducted in Alberta (42.2-56.1% versus 12.3% locally) (Kimetal, 2016).

Despite the enactment of the Affordable Care Act (ACA) in 2010 in the USA healthcare system, about 9% of the population remains uninsured (Cohen, Martinez & Zammitti, 2016) and people who lacked

insurance coverage but who faced a medical need might go to some other country to seek cheaper treatment. In fact, the higher cost of care in the US has been recognized as a major factor pushing US citizens to seek care at lower cost outside the USA, an option that is facilitated by health care globalization. At the same time, differences in regional health system institutions within the two countries can also affect the demand for medical tourism within their borders. For example, in states like Texas, where the elected officials have so far refused to expand Medicaid as part of the ACA (Béland, Rocco & Waddan, 2016) large number of people live without health care coverage than elsewhere, about 18% of the population as of March 2016 (Mangan, 2016), which may push them to look to Mexico for a cheaper health care. The extent of these concerns differs depending on the urgency of the issue and whether it falls within the purview of hospital and physician services covered by the universal system (versus, for instance, dental care where public coverage is more limited) (Snyder et al., 2017).

Chun (2017) referring the 13th Five-year Plan of China that as proposed the strategy of "healthy China", felt that medical tourism the country was developing rapidly in that environment. The author concluded by saying that Medical tourism in China started late and was in its initial development stage. In addition, the medical literature was quite insufficient.

Investigating challenges faced by main stakeholders in medical tourism Thayarnsin and Douglas (2017) have opined that due to the expansion of the global tourism industry, medical tourism destinations were competing with each other in the international marketplace.

Some medical tourists even purchase medical complication insurance because of the concerns like complications during treatment (Braverman, 2016).

Stephano (n/d) has listed the most common medical conditions treated in medical tourists from USA:

- Dentistry;
- Cosmetic surgery;
- Cardiac conditions;
- In vitro fertility;
- Weight loss;
- Dermatology;
- Liver, kidney transplants;
- Spine surgery.

The primary concern of Americans considering medical and surgical treatment in hospitals and clinics outside the United States is the quality of the care. The Joint Commission (formerly the Joint Commission on Accreditation of Hospitals) began to evaluate, inspect, and accredit hospitals outside the United States in 1998. Many overseas hospitals are staffed in part by physicians and other health professionals

who were trained in USA hospitals. One hospital in India has 200 USA-trained board-certified surgeons (Boyd, McGrath & Maa, 2011).

All of the historical experiences create more motivational ways for the improvement the medical tourism. Where there is development, there will be created a demand.

1.3. Role of Medical Tourism in India

It is an age old practice to travel abroad to obtain medical or health care services. In ancient times, people from developing countries travelled to developed countries to obtain treatment that were not available in their home country. Recently, the practice has changed paving way for people from developed countries to travel down to developing countries for obtaining quality health care at affordable prices with minimum waiting time along with the opportunity to enjoy the tourism sites during the recovery period. This phenomenon is referred to as medical tourism. Simply to put in a nutshell healthcare offered along with tourism product is known as medical tourism. It is an economic activity that entails trade in services and represents the mixing of two world's largest industries: medicine and tourism. Thus, it makes the medical tourism the fastest growing multi – billion industries around the world. Medical tourism (also called medical travel or health tourism) is a term initially coined by travel agencies and the mass media to describe the rapidly growing practice of travelling to another country to obtain healthcare. Goodrich (1994, p. 227) defined medical tourism as "the best attempt on the part of a tourist facility or destination to attract tourists by deliberately promoting its healthcare services and facilities in addition to its regular tourists' amenities". Such services include elective procedures as well as complex specialized surgeries such as joint replacement, cardiac surgery, dental surgery, cosmetic surgeries, alternative and traditional medicines.

1.4. Indian Advantage

When it comes to Medical tourism, India is considered as a one of the best choices to travel to. Here are main characteristics and reasons for that. The advantages given below were explored by Mohite (2016) and Varpal (2016).

1. Quality and Range of Services

> India has number of hospitals offering world class treatments in nearly every medical sector such as cardiology and cardiothoracic surgery, joint replacement, orthopaedic surgery, gastroenterology, ophthalmology, transplants and urology to name a few. The various specialties covered are Neurology, Neurosurgery, Oncology, Ophthalmology, Rheumatology, Endocrinology, ENT, Paediatrics, Paediatric Surgery, Paediatric Neurology, Urology, Nephrology, Dermatology,

Dentistry, Plastic Surgery, Gynaecology, Pulmonology, Psychiatry, General Medicine & General Surgery. For its quality of services and the infrastructure available, India is attracting a vast pool of tourists from the Middle East, Africa etc. As Indian corporate hospitals like Apollo, Max HealthCare, Fortis etc. are on par with the best hospitals in Thailand, Malaysia and Singapore there is scope for improvement, and the country is becoming a preferred medical destination.

2. Manpower

India has a large pool of doctors (approx. 600,000), nurses & paramedics with required Specialization and expertise and the language advantage (English speaking skills). The medical education system caters to the ever-increasing demand for the delivery of the quality health care services all over the country.

3. The Price Advantage

For long promoted for its cultural and scenic beauty, India is now being put up on international map as a heaven for those seeking quality and affordable healthcare. With 50 million Americans without health insurance and the waiting lists for state-run facilities often endless in the UK, Canada and Europe, foreigners are increasingly flocking to India because it offers quality treatment at a fifth of the cost abroad.

In India, complicated surgical procedures are being done at 1/10th the cost as compare with the procedures in the developed countries. Not only this, the hospitals are well equipped to handle the data and information through computerized Hospital Information Systems. The hospitalization and the procedural price advantage also is supported by Lower Medication cost. If a liver transplant costs in the range of 137 thousand USD – 160 thousand USD in Europe and double that in the US, a few Indian hospitals have the wherewithal to do it in around 34 thousand USD – 46 thousand USD. Similarly, if a heart surgery in the US costs about 46 kUSD, a leading Indian hospital will do it in roughly 4,6 kUSD (www.indian-medical-tourism.com).

4. Tourism Attraction

India has a 5000 year old civilization and is known for its cultural and religious diversity with diverse geographical landmarks. The traditional arts and crafts add to its appeal as a tourist’s favourite. Along with this, Indians enjoy freedom, vibrant democracy and women empowerment.

5. Alternative Therapy

India offers not just treatment but spiritual and mental healing as well. India needs to club together a couple of 'pathies' (methods to deal with any kind of suffering) because it has a very strong base of alternative healing therapies like yoga, naturopathy, Ayurveda Kerala’s health retreats, etc.

6. No Waiting

In addition to the increasingly top class medical care, a big draw for foreign patients is also the very minimal or hardly any waitlist as is common in European or American hospitals. Hospitals now are starting to attract foreign patients from industrialized countries, and especially from Britain, USA, Canada, where patients are becoming fed up with long waits for elective surgery under overstretched government health plans.

1.5. Medical Tourism in India

1.5.1. Current state and government support of medical tourism in India

As per the Ministry of Tourism Government of India (2018) “the Foreign Tourist Arrivals (FTA) in India on medical visa during 2016 and 2017 were estimated at 427 thousand and 495 thousand respectively, registering a positive growth of 15.9%.”

In a reply to a Lok Sabha question, the Ministry of Tourism Government of India has given the following explanation on Medical Tourism (2018, q. 1951):

> “Medical Tourism holds immense potential for India. The Indian systems of medicines, Ayurveda, Yoga, Panchakarma, Rejuvenation Therapy, etc., are among the most ancient systems of medical treatment in the world. India can provide medical and health care of international standards at low costs. India excels in the state of the art medical facilities, reputed health care professionals, quality nursing facilities and traditional healthcare therapies” (Medical Tourism , q. 1951, 2018).

The Ministry of Tourism Government of India has taken various steps to promote Medical Tourism which inter-alia include:

- Launch of campaigns in the international markets including for medical tourism under the Incredible India brand-line; conducting Road Shows, Know India Seminars;
- Ministry produces brochures, CDs, films and other publicity material for promotion of Medical and Health Tourism. The film on Medical Tourism film was aired in the Middle East and North African Market. On social media Medical Tourism is being promoted across various platforms;
- In order to provide dedicated institutional framework to take forward the cause of promotion of Medical Tourism, a National Medical and Wellness Tourism Board has been constituted;
- Department of Commerce and Services Export Promotion Council have launched a Healthcare Portal India healthcare tourism, as a single source platform providing comprehensive information to medical travellers on the top healthcare institutions in the country in various languages;

- The e-tourist visa regime has been expanded to include medical visits as well. Medical and Medical attendant visa has been introduced to ease the travel process of medical tourists. The maximum duration of stay in India under the e-Medical visa is a longer duration of six months.

In an answer to another Lok Sabha question, the Ministry of Tourism Government of India has stated as under:

> India has emerged as a major Medical Tourism destination. Ministry of Commerce informs that as per Information Medical Statistics of a Federation of Indian Chambers of Commerce and Industry Association of Business organisations in India given in a Knowledge Paper titled, 'Medical Value travel in India: Enhancing value in MVT', published in 2016, India is amongst the top 6 MVT (Medical Value Travel) destinations of the world which include Thailand, Singapore, India, Malaysia, Taiwan and Mexico (India ranked third in the world in 2015). It is further informed that as per the above report, through adequate focus and effective execution, Indian Medical Value Travel, pegged at 3 billion USD in 2015, can be a 9 billion USD opportunity by 2020. Ministry of Tourism Government of India has recognised Medical and Wellness Tourism as Niche Tourism Product for promotion. The Ministry offers financial support as Marketing Development Assistance, for Publicity, and for organising Wellness and Medical Tourism Promotion shows as well as workshop/events/seminars to accredited Medical and Wellness Tourism Service Providers and Chambers of Commerce, etc. A film on Medical Tourism has been produced in association with BBC and is used at various fora for promotional purposes. Medical and Medical attendant visa has been introduced to ease the travel process of medical tourists. The e-tourist visa regime has also been expanded to include medical visits as well. The Department of Commerce and Services Export Promotion Council (SEPC) have launched a Healthcare Portal www.indiahealthcaretourism.com, as a single source platform providing comprehensive information to medical travellers on the top healthcare institutions in the country. This portal is available in English, Arabic, Russian and French. A National Medical and Wellness Tourism Board has been constituted to provide a dedicated institutional framework to take forward the cause of promotion of Medical and Wellness Tourism including Ayurveda and any other format of Indian system of medicine covered by Ayurveda, Yoga, Unani, Siddha and Homeopathy (AYUSH). The Board works as an umbrella organization to promote this segment of tourism in an organized manner and therefore integrates AYUSH streams into the purview of Medical Tourism. There are no schemes in the Ministry of Tourism Government of India for setting up of medical facilitation centres/medical hubs to cater to medical tourists. However, it has been decided to set up facilitation counters at the major airports of Delhi, Mumbai, Chennai, Kolkata, Hyderabad and Bengaluru for tourists arriving on Medical Visas. (Government of India, p.130, 2017).

The Ministry of Tourism Government of India (2018) has given the list of countries from where tourists have visited India recently on Medical visas that is given on the Table 1.

As shown on the Table 1, there are 60 countries presented and the most people that are visiting India on medical reasons are coming from Bangladesh, Afghanistan, Iraq, Maldives, Oman.

Table 1. Key nations from which medical tourists visit India.

№	Nationality	№	Nationality	№	Nationality	№	Nationality
1	Bangladesh	16	Myanmar (Burma)	31	Cambodia (Kampuchea)	46	Comoros
2	Afghanistan	17	Pakistan	32	Malawi	47	Angola
3	Iraq	18	Tajikistan	33	United Arab Emirates	48	Eritrea
4	Maldives	19	Mauritius	34	Madagascar	49	Lebanon
5	Oman	20	Uganda	35	Australia	50	Netherlands
6	Yemen	21	Rwanda	36	Liberia	51	Sierra Leone
7	Uzbekistan	22	Bahrain	37	South Africa	52	Congo
8	Ethiopia	23	Kuwait	38	Jordan	53	Qatar
9	Kenya	24	Seychelles	39	Ukraine	54	Bulgaria
10	Sudan	25	Fiji	40	Tuvalu	55	Norway
11	Nigeria	26	Turkmenistan	41	Germany	56	Niger
12	United Republic of Tanzania	27	United Kingdom	42	Iran	57	Singapore
13	Somalia	28	Zambia	43	Palestine	58	Italy
14	Saudi Arabia	29	United states	44	Burundi	59	Gambia
15	Sri Lanka	30	Zimbabwe	45	France	60	Botswana

Source: Medical tourism index (n/d).

1.5.2. India's standing in the world with reference to medical tourism

Medical Tourism Index (n/d) has given the following particulars about India's standing in the world medical tourism:

> When it comes to tourism, this developing nation (India) only welcomed 7.7 million international visitors, which can be attributed to the visa requirements for almost all nationalities travelling for tourism.
>
> Healthcare in India is mainly dominated by the private sector and most of the healthcare expenses are paid out-of-pocket, as insurance is not yet popular in this destination. Although there are public healthcare facilities owned, control and run by the government, its unreliability makes the private medical sector the main source of healthcare for as many as 7 out of 10 households. This makes the private sector bigger than the public one and thirsty for incremental business including medical tourism, which can take advantage of its not so strong currency and already achieved economies of scale (Medical Tourism Index, n/d).

The website of Medical tourism index has given the following indexing, which is presented in Table 2.

Table 2. World medical tourism indexing, in score out of 100 points.

#	Country environment		#	Destination attractiveness		#	Medical tourism costs		#	Facility & services	
1	Canada	78.69	1	Costa Rica	83.49	1	Canada	75.7	1	Israel	81.6
2	UK	77.3	2	Israel	82.75	2	Costa Rica	74.69	2	Singapore	78.17
3	Singapore	73.26	3	Jamaica	82.74	3	India	74.07	3	Germany	77.88
4	Israel	67.57	4	France	81.02	4	Philippines	73.17	4	India	77.11
5	Germany	67.5	5	Italy	80.24	5	Colombia	73.07	5	Canada	77.02

Source: Medical Tourism Index (n/d).

Country environment sub-index assesses the overall economy of the country, the safety and image of the country, favourability of exchange rate as well as cultural aspects such as cultural or language similarities. Worldwide the first place in this category belongs to Canada. In case of India it ranked at 12th place (Medical Tourism Index, n/d).

Destination attractiveness sub-index assesses the attractiveness of a country as a tourism destination in terms of popularity of tourism destination, weather conditions or cultural and natural attractions/sites.

Medical tourism costs sub-index assesses costs associated with medical tourism such as cost of treatment, costs of accommodation or costs of travel. India is ranked at 3rd place (Table 2).

Facility & services sub-index assesses the quality of care such as doctor's expertise, healthcare standards, or medical equipment. It also assesses the reputation of doctors or hospital as well as internationalization of staff and accreditation of facility. Finally, it also considers the overall patient experience such as friendliness of staff and doctors. India is ranked at 4th place (Table 2).

Healthcare in India has become one of India's largest sectors and continue growing in terms of both revenue & employment (Kalia, & Nafees, 2018). According to Kalia and Nafees (2018) among advantages that helped to achieved this are:

- Facilities:
  India's health care system is above global standards due to its robust accreditation system, a large number of accredited facilities and 22 of Joint Commission International accredited hospitals.

- Frontier technologies:
  India characterized by investment in the newest medical diagnostics and medical procedures technologies. All the latest advancements in health care are available in India (for example robotic/radiation surgery, radiotherapies with cyber knife, IMRT/IGRT, transplant support systems, advanced neuro and spinal options).

- Finest doctors:

  The best technologies are complemented by skilled doctors and medical personnel. The country had the largest number of doctors and paramedics in South Asia and approximately 0.8 million formally trained Ayurvedic doctors.

- Financial Savings:

  Quality of care in the healthcare industry is an important factor for patients however more important one is the quality at an affordable cost. This advantage had made India the preferred destination. The difference in the cost of the treatments can range from 1/5 to 1/10 in comparison with Western countries and 4/5 to 9/10 in comparison with other South Asian medical destinations.

- Fast Track-Zero Waiting Time:

  Besides quality and affordability, what attracted the patients was zero waiting time for surgeries and all interventions.

- Feeling the pulse:

  India has the highest percentage of English language speaking people resulting in a better understanding of the patients thus reassuring hospitality and providing good aftercare.

All of these factors provide rapid development in India's medical tourism and growing position in world ranking.

2. Research methodology

2.1. Objectives of the study

The study was carried based on secondary data. The main objective was to analyse last four years data pertaining to visits by medical tourists to India and to project the next three years data based on the historical data.

Following objectives were set for this study:

a. To review the medical tourism in India (Collect the last four years data of medical tourists visiting India, carry a monthly split of the annual data on the basis of total monthly tourist visits);

b. To analyse past four years data of medical tourism in India (Apply the ARIMA method to analyse the historical data for the past 48 months (4 years: 2014-2017);

c. To project three years data of likely medical tourism visitors to India.

Since ARIMA is not the only technique of time series modelling, the data forecasting was also done using the least squares method. Both the results were compared to get a better insight of the projections.

In the Table 3, total Tourists Arrivals by month are given and the Figure 1 contains their percentage meaning.

The monthly data of foreign tourist arrivals was taken from the Tourism Statistics Report (2017) published by the Ministry of Tourism. Figures for 2018 were forecasted from the earlier years' figures.

In the total by the years, increasing trend also can be noticed: in 2015 comparing to 2014 the number of tourists rise by 8,26 %, in 2016 comparing to 2015 – by 9,68 %, in 2017 comparing to 2016 – by 15,59 %. The last one can be explained by lack of accuracy of used method.

Table 3. Monthly total tourist arrivals in India (2014-2017 of historical data).

Month	2014	2015	2016	2017
January	731 021	790 854	844 533	983 413
February	649 203	761 007	848 782	956 337
March	628 148	729 154	809 107	904 888
April	535 823	541 551	592 004	740 275
May	499 320	509 869	527 466	630 438
June	545 725	512 341	546 972	669 989
July	645 420	628 323	733 834	788 377
August	569 538	599 478	652 111	724 067
September	506 300	542 600	608 177	722 567
October	621 124	683 286	741 770	875 838
November	669 602	815 947	878 280	1 004 826
December	813 633	912 723	1 021 375	1 176 233
Total	**7 414 857**	**8 027 133**	**8 804 411**	**10 177 248**

Source: Author's own elaboration based on Tourism Statistics Report (2017).

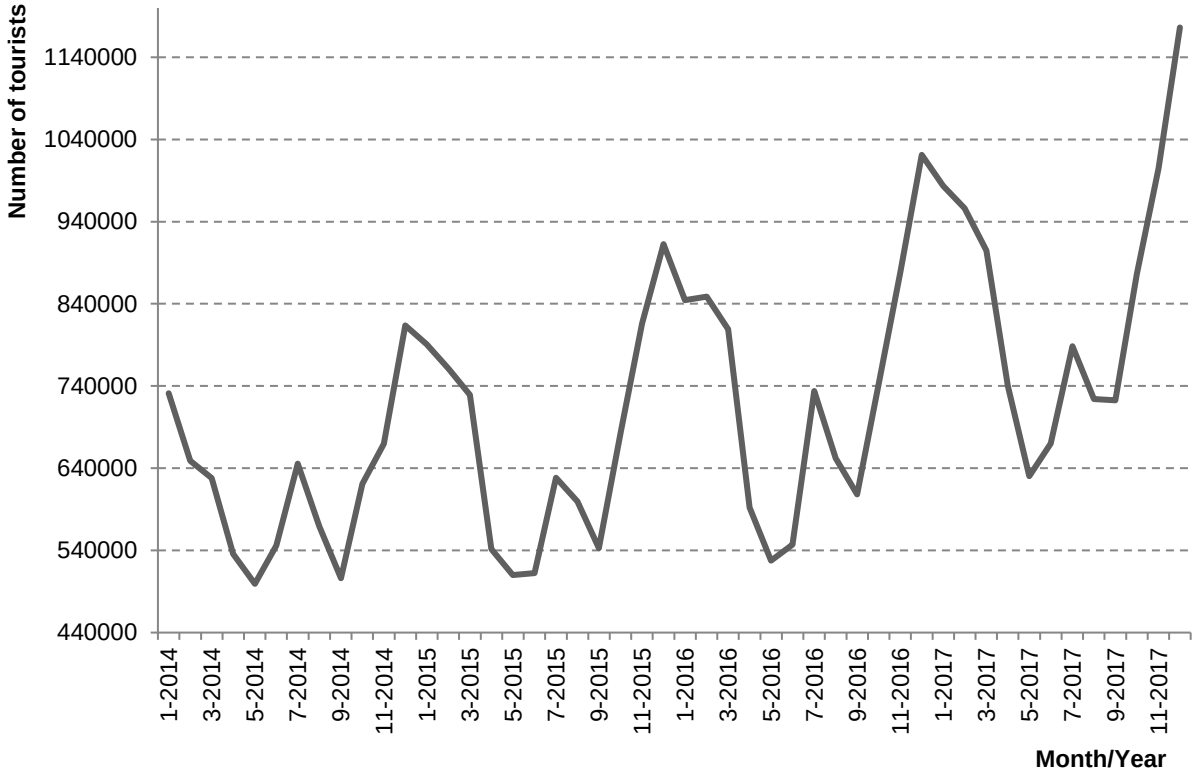

Figure 1. Tourist arrivals in India.

Source: Author's own elaboration.

The time series plot of the international tourists' arrival in India is given in the Figure 1. Two characteristics are observed from the data sets. One, there has been a non-linearly increasing trend. Two, the seasonality is clearly evident, with continuously increasing variability between the seasonal intervals. For example, the tourists' arrival is higher during December of every researched year. One of

the reasons is that December through February covering the winter season and presenting better conditions for travelling to India. Another example of seasonality is duration between May and September, characterized with lower international tourists turnover as the weather is too hot, temperature reaching around 40°C and above in almost every part of India.

2.2. Description of data collection

The objectives of the study were developed after preliminary analysis and understanding of the medical tourism industry in India. First, it was done through study of existing academic literature. Secondly, the research data was collected using annual reports and projects of Ministry of Indian Tourism available online, as well as gathering information from sources such as Ministry of Tourism, Ministry of Health, hospitals, medical tourism associations and blogs.

The duration of researched data was the period of 2014 to 2017. All of the data was collected in February-April of 2018. The last 2018 was not taken into account because of the lack/absence in annual reports on this year.

Mostly, the data was collected using information available in Ministry of Tourism Government of India and website Medical Tourism Index.

2.3. Description of data analysis

There are different methods of analysing time series data. Some of the popular methods include, Least Squares Method. An important assumption in this method is that expected value of all squared error terms, would be the same at any given point of time. This assumption is known as homoscedasticity and it might not hold good for all types of data wherein the error terms may be reasonably expected to be higher for some ranges or points of the data than for others. Such state is referred as a state that is suffering from heteroscedasticity. The standard disclaimer in this case is that in the presence of heteroscedasticity, the regression coefficients for an ordinary least squares regression would still be unbiased, but the standard errors and confidence intervals estimates by the conventional procedures would be too narrow, giving an erroneous feeling of precision with the model. Hence a better alternative is to use a more sophisticated method like ARIMA (AR-autoregressive, I-integrated, M-moving, A-average). Lags of the stationeries series in the forecasting equation are called "autoregressive" terms, lags of the forecast errors are called "moving average" terms, and a time series which needs to be differenced to be made stationary is said to be an "integrated" version of a stationary series. Random-walk and random-trend models, autoregressive models, and exponential smoothing models are all special cases of ARIMA models.

A time series model explains a variable about its own past and a random disturbance term. Particular attention is paid to exploring the historic trends and patterns (such as seasonality) of the time series involved, and to predict the future of this series based on the trends and patterns identified in the model. Since time series models only require historical observations of a variable, it is less costly in data collection and model estimation.

Time series models have been widely used for tourism demand forecasting in the past four decades with the dominance of the integrated autoregressive moving-average models (ARIMA) proposed by Box and Jenkins (1970). Different versions of the ARIMA models have been applied in over two-thirds of the post-2000 studies that utilised the time series forecasting techniques. Depending on the frequency of the time series, either simple ARIMA or seasonal ARIMA (i.e., SARIMA) models could be used with the latter gaining an increasing popularity over the last few years, as seasonality is such a dominant feature of the tourism industry that decision makers are very much interested in the seasonal variation in tourism demand. Regarding the forecasting performance of the ARIMA and SARIMA models, empirical studies present contradictory evidence.

The ARIMA model (*p,d,q*), in which p corresponds to the order of the Autoregressive process (AR), d is the number of differences or integrations, and q corresponds to the order of the Moving Averages process (MA), is represented by the following Equation 1 (Zou & Yang, 2004; Fernandes, Teixeira, Ferreira & Azevedo, 2008):

$$\phi_p(B)\nabla^d Y_t = \theta_q(B)e_t \quad [1]$$

ARIMA models are normally used with quarterly, monthly or even weekly, daily or hourly data, or, in other words, in a context of short-term forecasting. For such purposes, ARIMA models will be used to capture seasonal behaviour, in a manner that is identical to the treatment of the regular (or non-seasonal) component of the series. In such applications, it is not customary to work with just one ARIMA model (*p,d,q*), but with the product of the models: ARIMA (*p,d,q*)(*P,D,Q*) in which the first part corresponds to the regular part and the second to the seasonal part, corresponding to the following Equation 2 (Zou & Yang, 2004; Fernandes, Teixeira, Ferreira & Azevedo, 2008):

$$\phi_p(B)\Phi_P(B^S)(1-B)^d(1-B^S)^D Y_t = \theta_q(B)\Theta_Q(B^S)e_t \quad [2]$$

The forecasts made with the ARIMA model, based on historical data, are given by the forecasting function (Equation 3):

$$Y_t^*(m) = \mathrm{E}\{Y_{t+m}/Y_t, Y_{t-1}, Y_{t-2}, \ldots\} \quad [3]$$

ARIMA model building method is an empirically driven methodology of systematically identifying, estimating, diagnosing and forecasting time series (Cuhadar, 2014).

ARIMA (*p,d,q*) modelling includes 4 main step:

1) determine (*d*);
2) determine (*p*) and (*q*);
3) estimate ARIMA (*p,d,q*);
4) forecast ARIMA (*p,d,q*).

In order to determine meaning of 'd', Augmented Dickey-Fuller (ADF) test is used as one of the unit root tests. Its main goal is to check the null hypothesis on whether the data is predictable. d=0, if time series does not need to difference data to make it stationary and d=1, when difference need to be made to make time series stationary.

Before ADF unit root test in order to determine integration, time series plot should be build, it will show data constant and its trend. However to perform ADF unit root test come from this null hypothesis (d=1) – series contain unit root against alternative the series does not contain unit root (in these case the null hypothesis should be rejected. The conclusion should be made based on using both time series plot and ADF test.

In order to determine meaning of '*p*' and '*q*', Correlogram function (analysis of the Box-Jenkins method) is the use of the model identification procedure. The procedure involves plotting of the initial data. The source data is run to determine the appropriate model. The Box-Jenkins procedure requires the data to be stationary. This requires input data to be adjusted to form a stationary series, one whose value may vary more or less uniformly about the fixed level. But before directly going to this step, one needs the answer to this question, "Does the data require being made stationary?" This can be answered by analysing the plot of the data. The ACF and PACF plot of the series can give indications of whether it is necessary to change or transform the data into a stationary series. If the initial data series display neither trend nor seasonality and residual plot shows values within the confidence interval. Then the process can be continued without any hindrance. Sample Autocorrelations of the Series Differencing: none.

It produces ACF and PACF plots. Based on the plots the researchers make conclusions on the meaning of '*p*' and '*q*'. If ACF plot shows the decay of data '*q*'=1, if it show escalation '*q*'=0. The same relation PACF plot is having in relation of the '*p*' meaning.

Seasonality is one of the major factors affecting the variations of a time series. Seasonal ARIMA (SARIMA) model given in Equation 4, incorporates both non-seasonal and seasonal factors in a multiplicative model, denoted by SARIMA (*p,d,q*)(*P,D,Q*) (Ishara & Wijekoon, 2017).

$$\Phi_p\left(B^s \emptyset(B) \nabla_S^D \nabla^d Z_t = \alpha + O_Q(B^S)\theta(B)a_t\right) \quad [4]$$

where *p,d,q* are the parameters in non-seasonal ARIMA model as mentioned above;

- Z_t is the Auto regressive process $a_t$is the Moving-average process;
- *s* is the seasonal term, α is the constant term and B is the back shift operator;

- *P* is the number of seasonal autoregressive terms;
- *D* is the number of seasonal differences;
- *Q* is the number of seasonal moving average terms.

While estimating ARIMA models, using summary statistics on ARIMA modelling of the MTA with time series method, AR and MA compared and the model with lower values should be chosen. Time series forecast models can both make predictions and provide a confidence interval for those predictions. Confidence intervals provide an upper and lower expectation for the real observation. They are used for assessing the range of real possible outcomes for prediction and for better understanding the skill model.

After creating forecast, it should be evaluated. One of the ways to do that is check the goodness of fit (the forecast accuracy).

To measure the forecast accuracy, the Root mean squared error (RMSE), Mean absolute error (MAE), Mean absolute percentage error (MAPE) and Theil's inequality coefficient (TIC) are used. Their formulas are given in Equation 5-8 (Lewis, 1982):

$$RMSE = \sqrt{\frac{\sum e_t^2}{n}} \quad [5]$$

MAE is a common measure of the forecast error in time series analysis, which measures the average magnitude of the errors in a set of forecasts:

$$MAE = \frac{1}{n}\sum_{t=1}^{n}|e_t| \quad [6]$$

$$MAPE = \left[\frac{\frac{\sum|e_t|}{Y_t}}{n}\right] \times 100 \quad [7]$$

where e_t is the forecast error in the period *t*. Y_t is the real value of the time period *t*. Also *n* is the observations in the period.

Evaluation of the MAPE meaning (Lewis, 1982):

if MAPE ≤ 10% – High accuracy forecasting;

10% < MAPE ≤ 20% – Good forecasting;

20% < MAPE ≤ 50% – Reasonable forecasting;

MAPE > 50% – Inaccurate forecasting.

$$Theil's\ U = \frac{\sqrt{\frac{1}{n}\sum_{t=1}^{n}(\hat{Y}t - Yt)^2}}{\sqrt{\frac{1}{n}\sum_{t=1}^{n}\widehat{Yt}^2} + \sqrt{\frac{1}{n}\sum_{t=1}^{n}Yt^2}} \quad [8]$$

where $\sum_{t=1}^{n}\left(\hat{Y}t - Yt\right)^2$, sum of squared forecast errors;

$\sum_{t=1}^{n}\widehat{Yt}^2$, sum of squared forecast values $\hat{Y}t$;

$\sum_{t=1}^{n} Yt^2$, sum of squared forecast values Yt.

U=0, means full equality, which is the case of perfect forecast. The smallest meaning is better for forecast.

Based on the comparison of results of those indicators between few models, the decision on the best ARIMA model will be made.

3. Presentation and Analysis of Results

3.1. Sample characterisation

The sample consists of quantities of tourists between 2014-2017 years with division by 12 month, containing 48 observations.

First and main data, while analysing Medical tourism, is medical tourism arrivals, which means the number of people traveling with medical visas.

Statistics on arrivals of medical tourism has been taken from Ministry of Tourism Government of India and are presented in Table 4.

Table 4. Annual medical tourism arrivals (MTA).

Year	MTA	Absolute deviation	Relative deviation, %
2014	184 298	-	-
2015	233 917	49 619	26.92
2016	427 015	193 098	82.55
2017	495 056	68 041	15.93

Source: Author's own elaboration based on Tourism Statistics Report (2017).

The MTA has a clear rising trend during 2014-2017 years: in 2015 comparing to 2014 the number of medical tourism rise by 26.92 %, in 2016 comparing to 2015 – by 82.55 % (one of the main reasons of such high increase in 2016 is that India has a simplified e-medical visa facility which allows three visits to the country). In addition, in 2017 comparing to 2016 – by 15.93 %.

Based on the monthly data of the total foreign tourist arrivals the following annual data (Table 4) of medical tourism arrivals was split into monthly data (Appendix I, Table A 1). The data in Table A 1 is split in the same proportion of total foreign tourist arrivals as given in Table 3.

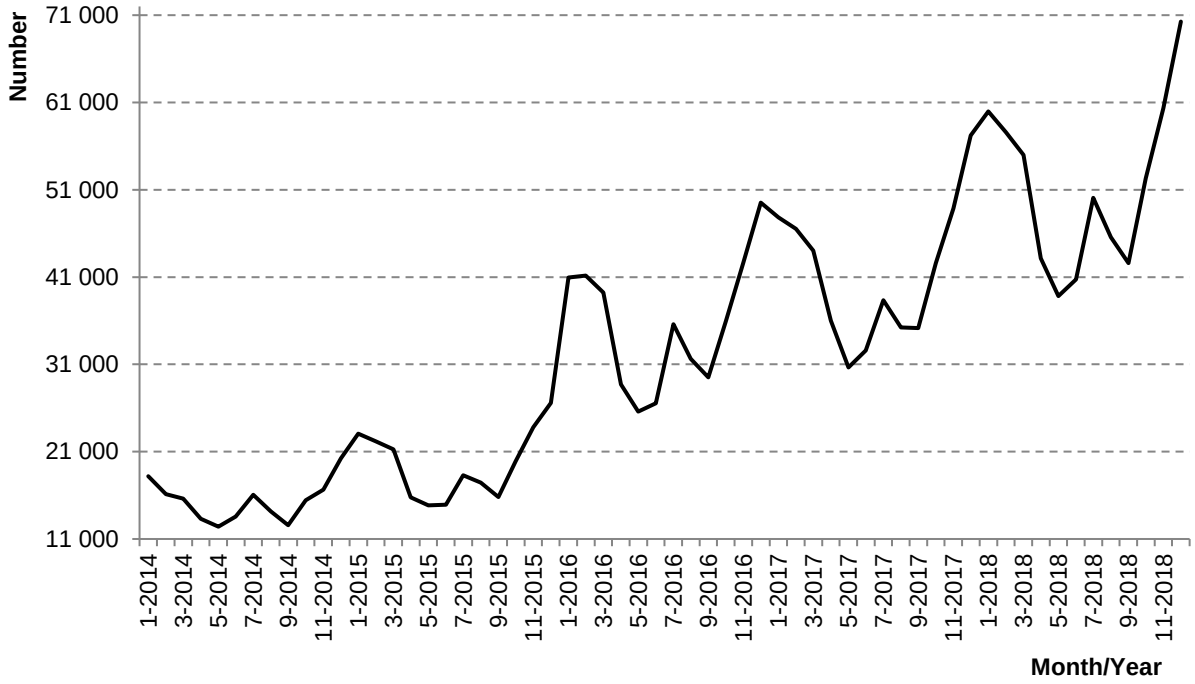

Figure 2. Monthly medical tourism arrivals (MTA).

The Figure 2 visually evaluates the potential stationarity as the first basic assumption for applying ARIMA model and gives visualisation on behaviour of medical tourists monthly.

The data of MTA have similar characteristics like tourists in general.

According to Table A 1 and Figure 2, the clear trend in numbers of tourist it can be observed two trends of increase and decrease in the movement of the time series, suggesting that some of its characteristics imply non-stationarity. Specifically, it is obvious that the series has different average values and variances in various sub-periods of the sample.

Seasonality still can be read as well. All of this is connected to extreme weather conditions. Figure 3 gives conclusive information on the tourist flow by month.

Based on Table A 1, the next can be concluded. Among months of increase trend in number of medical tourists in India comparing to the previous month are:

- January (2015 – increase of 13.96 %, 2016 – 54%, 2017 – exception decrease of 3.43 %);
- June (2014 – increase of 9.29 %, 2015 – 0.48%, 2016 – 3.7 %, 2017 – 6.27 %);
- July (2014 – increase of 18.27 %, 2015 – 22.64 %, 2016 – 34.16 %, 2017 – 17.67 %);
- October (2014 – increase of 22.68 %, 2015 – 25.93 %, 2016 – 21.96 %, 2017 – 21.21 %);
- November (2014 – increase of 7.81 %, 2015 – 19.41 %, 2016 – 18.4 %, 2017 – 14.73 %);
- December (2014 – increase of 21.51 %, 2015 – 11.86 %, 2016 – 16.29 %, 2017 – 17.06 %).

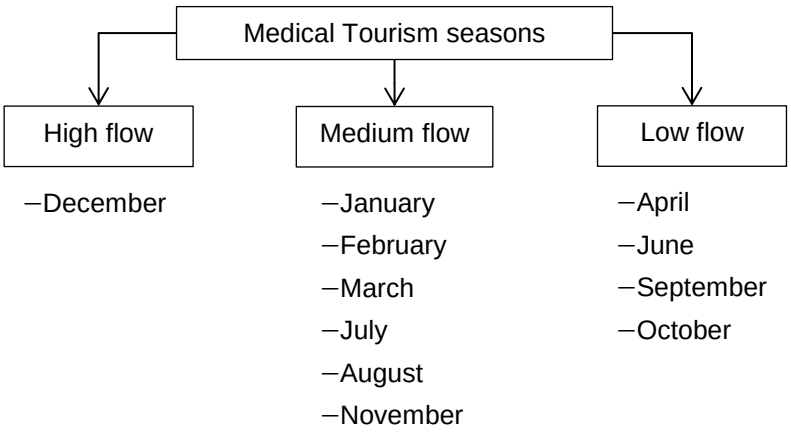

Figure 3. Medical Tourism flow chart.

Source: Author's own elaboration.

This trend of increase can be explained by winter season which provides best climate condition for medical procedures (the average temperature varies around 20 ºC) and takes place through October to January and by rainy season (the peak is June and July) which provides cooler temperatures.

Among months of decrease trend in number of medical tourists in India comparing to the previous month are:

- February (2014 – decrease of 11.19 %, 2015 – 3.78%, 2016 – exception increase of 0.5 %, 2017 – decrease of 2.76 %);
- March (2014 – decrease of 3.24 %, 2015 – 4.18%, 2016 – 4.67 %, 2017 – 5.38 %);
- April (2014 – decrease of 14.7 %, 2015 – 25.73 %, 2016 – 26.83 %, 2017 – 18.19 %);
- May (2014 – decrease of 6.81 %, 2015 – 5.85 %, 2016 – 10.9 %, 2017 – 14.84 %);
- August (2014 – decrease of 11.76 %, 2015 – 4.59 %, 2016 – 11.14 %, 2017 – 8.16 %);
- September (2014 – decrease of 11.1 %, 2015 – 9.49 %, 2016 – 6.73 %, 2017 – 0.21 %).

This trend of decrease can be explained by summer season (February through May) by more extreme temperature (August and September).

3.2. Statistics for ARIMA modelling

Thus, there were 48 (12 months x 4 years) past data points and on those ARIMA method was applied to analyses past data and get the projections for the next three years (36 months). Descriptive statistics on the sample is given in the Table 5.

The minimum MTA of 12411 corresponds to the month of May 2014 whereas the maximum MTA of 57216 corresponds to the month of December, 2017. The standard deviation (SD) is 12291.418 and is around 50% of the mean of 27922.63.

Table 5. Summary statistics on ARIMA modelling of the MTA series.

Variable	n	Minimum	Maximum	Mean	Standard Deviation
MTA	48	12 411	57 216	27 922.63	12 291.42

Preparation for modelling includes setting a range of our model. In present study, MTA contains monthly data from January 2014 to December 2017, considering there are 48 observations in sample data.

3.3. Autocorrelation

First step in identification of proper ARIMA model, as it was mentioned in methodology part, is to determine (*d*).

ADF test needs to have maximum lag order determined. Its results are given in the Table A 2. Lag order using sample size was round up to 4 lags. Knowing mean series is not zero (Figure 2), the constant and trend was checked in ADF test. P-value equals to 0.01876 (less than 0.05), which means the null hypothesis is rejected. It means that there is no need to difference data to make it stationary. Thus, the meaning of '*d*' equals to zero in ARIMA (*p,d,q*).

Second step is identifying (*p* and *q*) using ACF and PACF plots given in the Figures 4-5 below. As shown, there is a positive and negative correlation between ACF and PACF is observed. When the points are lag 1 is spike, same with lowest decay and other lag are not showing same proportion. The analysis of both function presented in figures above reveals that both ACF and PACF spike up and decay gradually until lag 18 and there is no regularity in the movement of the autocorrelation coefficients, from which model could be identified.

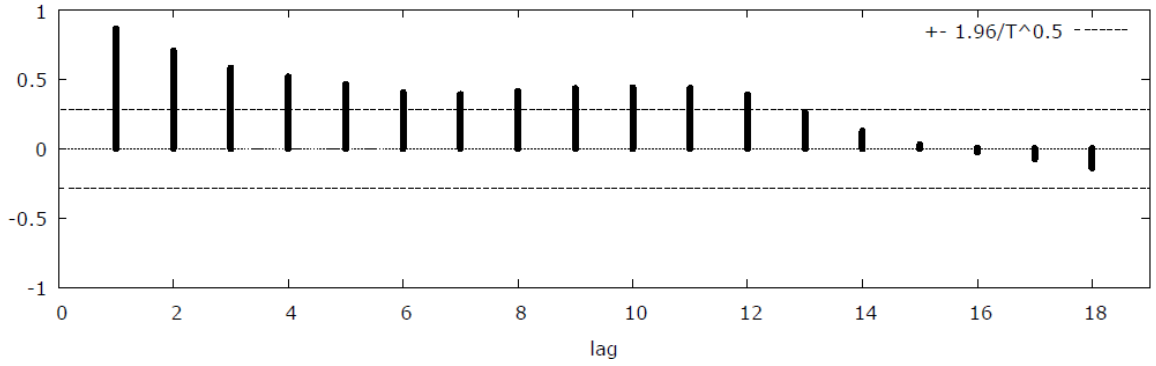

Figure 4. ACF plot for ARIMA (MTA).

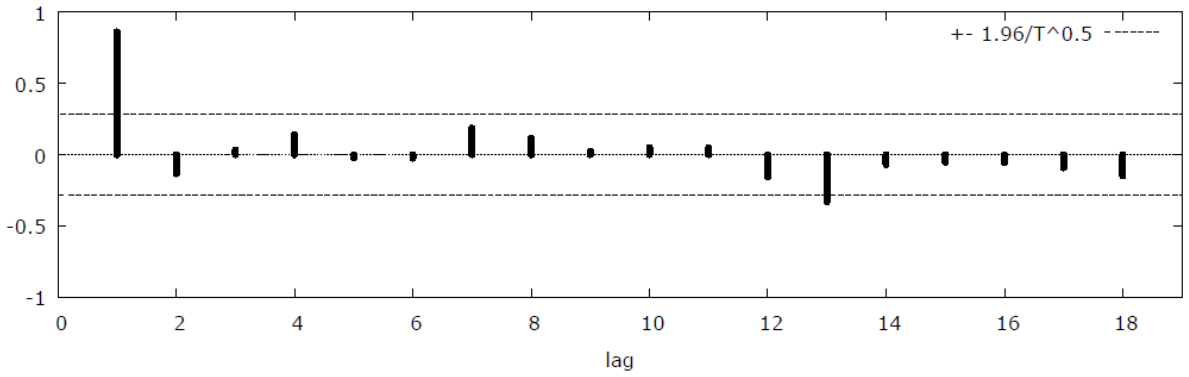

Figure 5. PACF plot for ARIMA (MTA).

For determining *p* and *q* the function of correlogram (Table A 3) was used providing visualization of the pattern of ACF and PACF. Lag was set at 18. According to Figure 4 and 5, both ACF and PACF contain almost the same pattern. These two functions are decreasing. Both having an escalating pattern which is pointed out that *p* and *q*=1. Thus, both meanings of '*p*' and '*q*' equals to one in ARIMA (*p,d,q*).

The determined model is ARIMA (1,0,1) in non-seasonal criteria. In seasonal criteria ARIMA (*P,D,Q*) conclusively after evaluating Figure 2, *P*=0; *D*=1; *Q*=1 and makes it an adequate addition model. The final model is ARIMA (1,0,1) (0,1,1).

3.4. Model parameters

ARIMA (1,0,1) (0,1,1) now is ready to be estimated. In order to make the model forecasting, January 2018 to December 2020 must be included in the sample range. The dependent variable is MTA numbers. The results of model estimation are given in the Table 6.

The analysis is made, generated data shows the first coefficient component constant is equal to 0.715623 and statically significant and second coefficient 0.204519 represent AR component is statically significant as well, third coefficient represent MA component and is also statically significant.

The two alternative specification were used in order to model the original series ARIMA (1,0,1) and ARIMA (0,1,1). That represents the original time series in an adequate manner. The model is estimated along with the accompanying diagnostic are shown in Table 6. As can be seen in the table, seasonal ARIMA (0,1,1) model has slightly lower adjusted coefficient of determination comparing to the competing model (1,0,1) (Table A 4-5). However all parameters in the model are statistically significant in contrast to ARIMA (1,0,1), in which the MA term is not significant even at 10%, in both models .

Table 6. ARIMA test (1,0,1)(0,1,1).

	Coefficient	Std. Error	z	p-value
Constant	9746.43	1164.92	8.367	5.93e-017 ***
phi_1	0.663652	0.151682	4.375	1.21e-05 ***
theta_1	0.210817	0.183902	1.146	0.2516
Theta_1	−0.756767	0.546721	−1.384	0.1663
Results on ARIMA model				
Mean dependent variable	8632.167	S.D. dependent variable	5898.599	
Mean of innovations	−199.2633	S.D. of innovations	2886.132	
Log-likelihood	−342.7627	Akaike criterion	695.5254	
Schwarz criterion	703.4430	Hannan-Quinn	698.2888	
	Real		**Frequency**	
AR Root 1	1.5068		0.0000	
MA Root 1	-4.7434		0.5000	
MA (Seasonal) Root 1	1.3214		0.0000	

In emerged model, the inverted AR roots have modulus values higher than one (i.e, they lie outside the unit circle). This is not true for the MA terms, too, whose roots lie outside the unit circle with negative values much lower than one. The same goes for seasonal (MA). The results confirm that the two models that emerged are covariance stationary and invertible, thus making them appropriate for forecasting. Moreover, lastly the values the Akaike and Schwarz information and Hannan-Quinn criteria are not so similar (Table A 4-5), in separate ARIMA models their meaning is much higher. As it is well known, these two criteria show better fit of the model, the smaller they are. It suggests that both models in emerged ARIMA (1,0,1)(0,1,1) perform better in an emerged case.

After using summary statistics on ARIMA modelling of the MTA with time series method, goodness of fit was evaluated (Table 7). The goodness of fit of a statistical model describes how well it fits a set of observations. Measures of goodness of fit typically summarize the discrepancy between observed values and the values expected under the model in question. In addition, goodness of fit indicator is MAPE.

Table 7. Goodness of fit statistics.

Mean Error	-199.26
Root Mean Squared Error	2886.1
Mean Absolute Error	2210.8
Mean Percentage Error	-2.4176
Mean Absolute Percentage Error	7.1966
Theil's U	0.55165

In the present study MAPE equals 7.1966 % so it is MAPE < 10% and means that the forecasting is a high accuracy forecasting.

After fitting the model, determination on whether the model is appropriate made by residual analysis. Correlogram of Q statistics test display the autocorrelation and partial correlation function of the specified

series together with the Q statistics and p-value associated with each lag. The table of predictions and residuals given in Table A 6 and shows the results for the actual data based on the model as well as prediction values. For example in case of the 1st month, while the actual value MTA was 23046, the result as per ARIMA (projected value) worked out to be 25580.67, leaving the residual (difference between the two) of -2534.67. For months 49 through 84, the figures are projections. Presentation of residuals of the model is given in the Table 8 and shown on the Figure 6-7.

Table 8. Residual autocorrelation function.

LAG	**ACF**	**PACF**	**Q-stat.**	**[p-value]**
1	0.0327	0.0327		
2	0.0704	0.0695		
3	-0.1348	-0.1401		
4	0.0981	0.1056	1.4066	[0.236]
5	0.0205	0.0319	1.4252	[0.490]
6	-0.1326	-0.1752	2.2267	[0.527]
7	-0.2377	-0.2107	4.8926	[0.298]
8	-0.0627	-0.0262	5.0846	[0.406]
9	0.0552	0.0513	5.2390	[0.514]
10	-0.0229	-0.0611	5.2667	[0.627]
11	0.0951	0.1409	5.7620	[0.674]
12	-0.1105	-0.1030	6.4576	[0.693]
13	0.1263	0.0345	7.4066	[0.687]
14	-0.0876	-0.1199	7.8843	[0.724]
15	-0.0646	-0.1412	8.1562	[0.773]
16	-0.0827	-0.0208	8.6240	[0.801]
17	0.0293	0.0385	8.6857	[0.851]
18	-0.1787	-0.2014	11.1126	[0.745]

The analysis above is taking a lag ranging from 0 to 18. The table analyses auto correlation and partial correlation for the lag period for the Residuals (MTA actual less the ARIMA projected value).

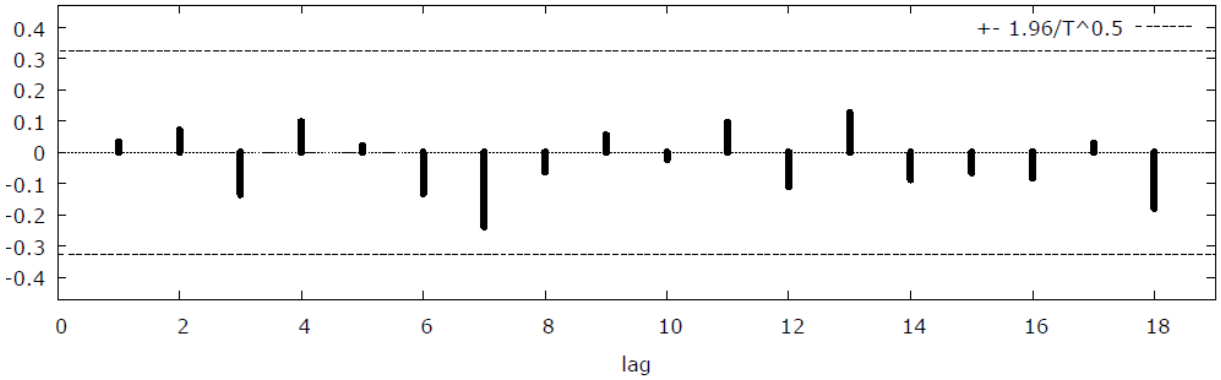

Figure 6. ACF plot for ARIMA residuals (MTA).

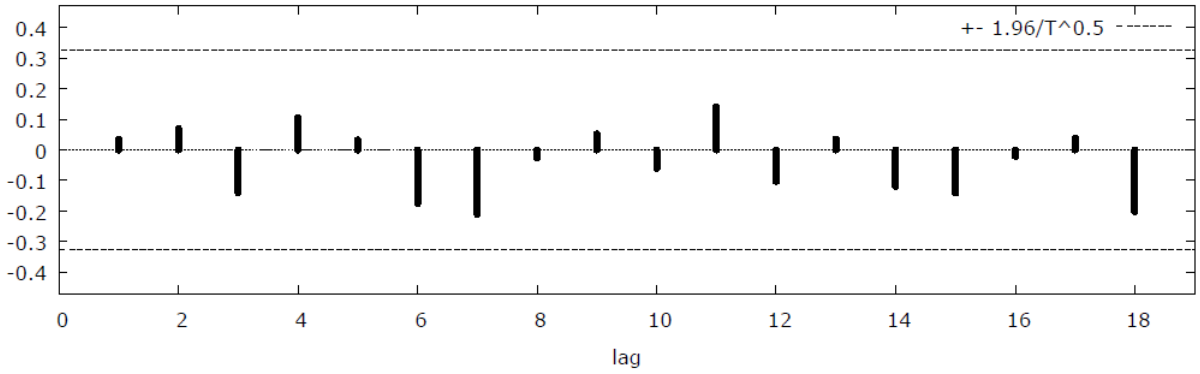

Figure 7. PACF plot for ARIMA residuals (MTA).

The residuals appear approximately normally same distributed. All lags that are greater 0 correspond to insignificant autocorrelation. Therefore, the residuals are correlated in time with ACF and PACF lag 4 and lag 11 both shows upward so both residual shows same proportionality. It indicates that there is no significant estimated residual autocorrelations in the selected model of the actual fitted and residuals series of the estimated. However, residuals are useful for ARIMA model to determine the ARIMA(1,0,1)(0,1,1) weather model adequately capture information in a data. According to made research, the residual are uncorrelated; have 0 mean; constant variance between constant trends hence model is good for forecasting.

3.5. Presentation of forecasted data

Next step is to estimate ARIMA model after creating forecast by using observation.

After conducting and getting all needed information, the forecast for the next 36 months (years 2018-2020) can be done (Table 9).

In order to forecast for further three year from January 2018 to December 2020 (firstly the data sample was restricted in four year from January 2014 to December 2017), there is a clear need to alter sample range setting it to the range from January 2014 to December 2020. It is considered, that there are 48 observations of real data, 36 forecasted observations in sample data, making it total of 84 observations. Finally, ready to forecast model from start to end point, the automatic forecast function was used to forecast. The number of pre forecasted observation is 48, the confidence interval 0.95 and plot confidence interval using low and high lines. The results of made forecast is give in the Table 9 and visual representation of the results and made model is shown on the Figure 8.

Table 9. The ARIMA model forecast for 2015-2017 and next 36 months

Month	2015	2016	2017	2018	2019	2020
January	25 581	33 016	54 793	61 456	68 212	77 937
February	22 218	39 465	45 320	59 038	66 800	76 532
March	22 576	38 404	45 445	56 492	64 922	74 659
April	19 164	32 970	37 577	48 981	57 853	67 593
May	16 157	26 805	34 624	45 799	54 965	64 707
June	17 546	26 736	32 624	46 568	55 929	65 673
July	19 395	30 668	39 471	51 757	61 248	70 993
August	18 579	33 870	37 220	49 089	58 666	68 412
September	17 631	29 129	34 806	47 690	57 324	67 070
October	20 691	33 151	41 154	53 054	62 726	72 471
November	23 528	38 400	47 391	57 734	67 431	77 177
December	28 988	44 540	53 528	63 344	73 057	82 803
Total	**252 054**	**407 155**	**50 3953**	**641 002**	**749 134**	**866 027**

Thus for 2018 the MTA arrival is forecasted at 641 002 whereas for the year 2019 the same is forecasted at 749 134 (as per ARIMA method) and 2020 is 866 027. The visual for forecast is given in the figure above. The visual for forecast is given in the Fig. 8

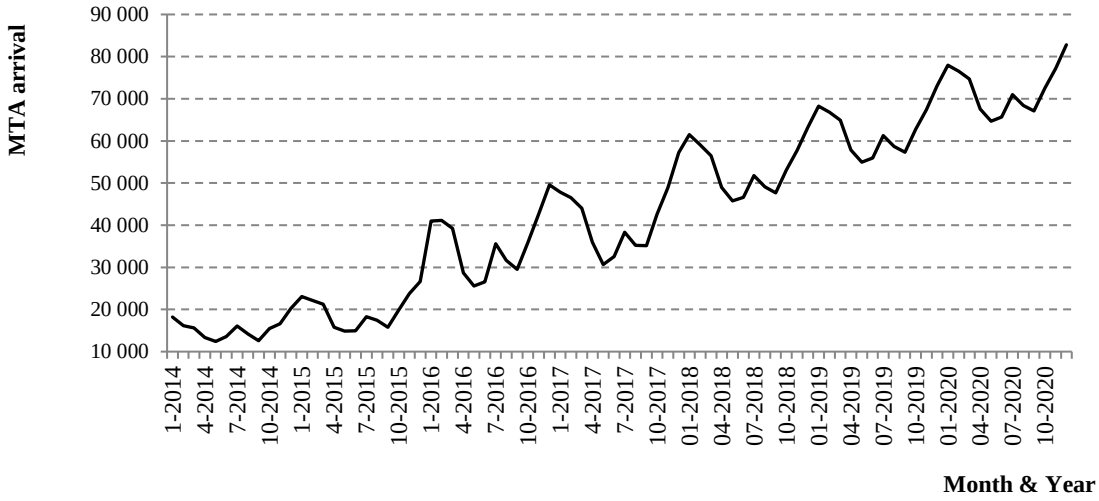

Figure 8. MTA in India using ARIMA model.

The annual forecasting is done on the basis of annual data using the least squares method is as under (Table 10) with graphic presentation of data shown in Figure 9.

Thus for 2018 the MTA arrival is forecasted at 683 765, for 2019 forecasted at 834 318, whereas for the year 2020 the same value is forecasted at 984 872 (as per least square method).

Table 10. The Least Squares method forecast

Year	MTA
2014	81 550
2015	232 104
2016	382 657
2017	533 211
2018	683 765
2019	834 318
2020	984 872

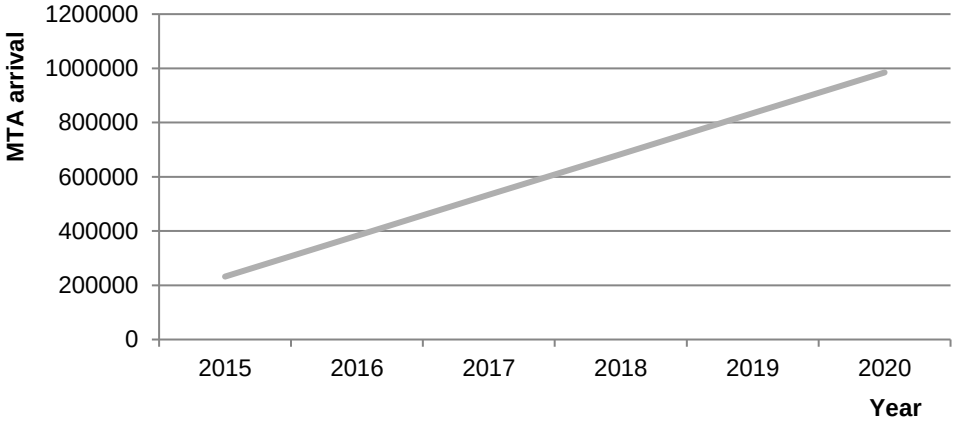

Figure 9. MTA in India using least squares method.

Comparison of forecasts of MTA as per two different methods is given in the Table 11.

Table 11. Comparison of forecasts of MTA as per two different methods and averaging.

Method	2018	2019	2020	Average MAPE (2014-2017)	Year	MAPE
ARIMA	641 002	749 134	866 027	7.2%	2015	7.97 %
					2016	8.37 %
					2017	5.10 %
Least Squares	683 765	834 318	984 872	28.2%	2014	55.75 %
					2015	19.80 %
					2016	18.34 %
					2017	18.30 %
Average	662 384	791 726	925 450	-	-	-

Despite the fact that Least squares model shows more positive and bigger values than ARIMA model. The main indicator influencing the decision on which model should be kept is MAPE. According to result on both models, the MAPE for ARIMA model equals 7.2% and for least Square Model, its meaning is higher and equals 28.2%. In case of ARIMA model, it has better performance and accuracy, because the MAPE ≤ 10% meaning high accuracy forecasting for all years ($MAPE_{2015}$=7.97%; $MAPE_{2016}$=8.37% and $MAPE_{2017}$=5.10%). In case of least Squares Model, the average of MAPE is between 20% and 50% meaning reasonable forecasting. The lower meaning of MAPE is better, as it shows better forecast.

Conclusions, Limitations and Future Research Lines

India is popular tourist destination for medical service due to affordability, good developed medical infrastructure, skilled doctors and personnel, and besides, the country is a great cultural attraction on its own.

This thesis work is dedicated to conducting analysis of medical tourism of India and making forecast using ARIMA model.

The model as per ARIMA that emerged on the basis of past 48 months data has given next results:

1) The forecast for medical tourism arrivals in India for the years 2018-2020 are quite encouraging. The ARIMA method may be considered as more accurate as it involved a monthly forecasting for 36 months. The annual summations for 2018-2020 are a total of 12 monthly summations of the three forecasted years;

2) A major upswing was noted in the year 2016 when the number of MTA shot up from 233918 in 2015 to 427014 in the year 2016. This was a rise of 83% over the year. This is one swing that has more positive direction in the projections for further years;

3) Whenever more than one set of forecasts is available the standard practice is to take an average figure of the forecast, which in this case has given as next projections: it is expected to be 662,384 tourist average in 2018; it is expected to have 791,726 tourists in average out of two methods (ARIMA and Least Squares) in 2019; and 925,450 tourists in average in 2020.

As for suggestions, given the highly encouraging projections for the next three years, Government should take all measures possible to make it a reality. These numbers can be taken as targets and efforts can be stepped up in achieving these.

Government and the Ministry of Tourism Government of India should use effectively use publicity campaign to highlight “Advantage India” for medical treatment in the form of low cost and expertise.

It suggested for the Government to try and come out with a scheme for medical insurance for foreign nationals including non-resident Indians. In India, the health insurance business has gained immense foothold in recent years and it can attract even foreigners. The Government should try and tie-up with Foreign Governments with blanket insurance for a fixed number of medical tourists based on past historical data. It is suggested to take into consideration existing statistics to provide a better medical tourism service (insurance, travel and hospital care). By looking through statistics it is easy to see which translators should be available in hospitals as well.

The study has projected data for the future three years. Projections are subject to limitations and are affected by a range of factors. In practice, the forecast cannot to come to life or have a completely different real life numbers due to economic, climate or safety changes. However, the researcher in this case has attempted to use a sophisticated model to minimize errors due to assumptions like homoscedasticity by using the ARIMA model.

As a Future Research Lines, other methods of projections can also be used to arrive at more number of projections. In fact, the ARIMA model itself has different methods and those can be used. An analysis of the past trends of medical tourism in the country also can range in the quantity and be used to project the future more practical and real estimates to gear-up well in time to meet the increased demand. The researchers can use implemented model in other branches of tourism. Another branch of the research of medical tourism can be language based research.

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Appendixes

Appendix I

Table A 1. Monthly medical tourism arrivals (MTA).

Month	2014	2015	2016	2017	relative deviation, 2015/2014 %	relative deviation, 2016/2015 %	relative deviation, 2017/2016 %	change in % to previous month (2014)	change in % to previous month (2015)	change in % to previous month (2016)	change in % to previous month (2017)
January	18170	23046	40960	47837	26,84	77,73	16,79	-	13,96	54,00	-3,43
February	16136	22176	41166	46519	37,43	85,63	13,00	-11,19	-3,78	0,50	-2,76
March	15613	21248	39242	44017	36,09	84,69	12,17	-3,24	-4,18	-4,67	-5,38
April	13318	15781	28712	36009	18,49	81,94	25,41	-14,70	-25,73	-26,83	-18,19
May	12411	14858	25582	30667	19,72	72,18	19,88	-6,81	-5,85	-10,90	-14,84
June	13564	14930	26528	32591	10,07	77,68	22,86	9,29	0,48	3,70	6,27
July	16042	18310	35591	38349	14,14	94,38	7,75	18,27	22,64	34,16	17,67
August	14156	17469	31627	35221	23,40	81,05	11,36	-11,76	-4,59	-11,14	-8,16
September	12584	15812	29497	35148	25,65	86,55	19,16	-11,10	-9,49	-6,73	-0,21
October	15438	19912	35976	42604	28,98	80,67	18,42	22,68	25,93	21,96	21,21
November	16643	23777	42597	48878	42,86	79,15	14,75	7,81	19,41	18,40	14,73
December	20223	26598	49537	57216	31,52	86,24	15,50	21,51	11,86	16,29	17,06
Total	184298	233917	427015	495056	26,92	82,55	15,93	-	-	-	-

Source: Tourism Statistics Report (2017).

Table A 2. Results of Augmented Dickey-Fuller test.

Descriptive statistics for conducting test				
Lags	4			
sample size	46			
Period	2014:03-2017:12			
unit-root null hypothesis	a = 1			
Augmented Dickey-Fuller regression (d_MTA)				
	coefficient	std. error	t-ratio	p-value
const	3072.60	1544.67	1.989	0.0532
MTA_1	− 0.384446	0.102321	-3.757	0.0188
d_MTA_1	0.500362	0.138793	3.605	0.0008
time	315.994	86.0529	3.672	0.0007
AIC:	896.052			
BIC:	903.366			
HQC:	898.792			

Table A 3. Autocorrelation function for MTA

LAG	ACF	PACF	Q-stat.	[p-value]
1	0.8608 ***	0.8608 ***	37.8350	[<0.001]
2	0.7063 ***	-0.1336	63.8641	[<0.001]
3	0.5823 ***	0.0318	81.9478	[<0.001]
4	0.5173 ***	0.1399	96.5448	[<0.001]
5	0.4628 ***	-0.0221	108.4967	[<0.001]
6	0.4040 ***	-0.0253	117.8227	[<0.001]
7	0.3908 ***	0.1843	126.7613	[<0.001]
8	0.4128 ***	0.1171	136.9862	[<0.001]
9	0.4341 ***	0.0218	148.5835	[<0.001]
10	0.4394 ***	0.0495	160.7754	[<0.001]
11	0.4349 ***	0.0459	173.0414	[<0.001]
12	0.3890 ***	-0.1548	183.1284	[<0.001]
13	0.2608 *	-0.3301**	187.7926	[<0.001]
14	0.1276	-0.0692	188.9422	[<0.001]
15	0.0282	-0.0530	189.0002	[<0.001]
16	-0.0226	-0.0543	189.0385	[<0.001]
17	-0.0712	-0.0927	189.4311	[<0.001]
18	-0.1385	-0.1491	190.9665	[<0.001]

Note: ***, **, * indicate significance at the 1%, 5%, 10% levels.

Table A 4. ARIMA test (1,0,1).

Standard errors based on Outer Products matrix				
	Coefficient	**Std. Error**	**z**	**p-value**
const	3174.9	9094.91	3.489	0.0005
phi_1	0.921930	0.0620266	14.86	5.69e-050
theta_1	0.357383	0.122474	2.918	0.0035
Results on ARIMA model				
Mean dependent var	27922.63	S.D. dependent var	12291.42	
Mean of innovations	319.4791	S.D. of innovations	4323.689	
Log-likelihood	−471.2601	Akaike criterion	950.5201	
Schwarz criterion	958.0049	Hannan-Quinn	953.3486	
	Real	**Modulus**	**Frequency**	
AR Root 1	1.0847	1.0847	0.0000	
MA Root 1	-2.7981	2.7981	0.5000	

Table A 5. SARIMA test (0,1,1).

Standard errors based on Outer Products matrix				
	Coefficient	**Std. Error**	**z**	**p-value**
const	9346.60	549.574	17.01	7.29e-065
theta_1	-0.683146	0.366763	-1.863	0.0625

Results on ARIMA model			
Mean dependent var	8632.167	S.D. dependent var	5898.599
Mean of innovations	-450.3847	S.D. of innovations	4550.572
Log-likelihood	−357.7904	Akaike criterion	721.5808
Schwarz criterion	726.3313	Hannan-Quinn	723.2389

	Real	**Modulus**	**Frequency**
MA Root 1 (seasonal)	1.4638	1.4638	0.0000

Table A 6. Predictions and residuals of the model.

Observations	**MTA**	**ARIMA (MTA)**	**Residuals**	**Standard error**	**Lower bound (95%)**	**Upper bound (95%)**
2015:01	23046.00	25580.67	-2534.67	-	-	-
2015:02	22176.00	22217.94	-41.94	-	-	-
2015:03	21248.00	22575.63	-1327.63	-	-	-
2015:04	15781.00	19163.51	-3382.51	-	-	-
2015:05	14858.00	16157.32	-1299.32	-	-	-
2015:06	14930.00	17546.39	-2616.39	-	-	-
2015:07	18310.00	19395.19	-1085.19	-	-	-
2015:08	17469.00	18578.99	-1109.99	-	-	-
2015:09	15812.00	17630.84	-1818.84	-	-	-
2015:10	19912.00	20691.17	-779.17	-	-	-
2015:11	23777.00	23528.12	248.88	-	-	-
2015:12	26598.00	28988.21	-2390.21	-	-	-
2016:01	40960.00	33015.88	7944.12	-	-	-
2016:02	41166.00	39465.39	1700.61	-	-	-
2016:03	39242.00	38403.90	838.10	-	-	-
2016:04	28712.00	32969.80	-4257.80	-	-	-
2016:05	25582.00	26805.16	-1223.16	-	-	-
2016:06	26528.00	26736.38	-208.38	-	-	-
2016:07	35591.00	30667.82	4923.18	-	-	-
2016:08	31627.00	33869.94	-2242.94	-	-	-
2016:09	29497.00	29129.37	367.63	-	-	-
2016:10	35976.00	33150.79	2825.21	-	-	-
2016:11	42597.00	38400.37	4196.63	-	-	-
2016:12	49537.00	44540.12	4996.88	-	-	-
2017:01	47837.00	54793.09	-6956.09	-	-	-
2017:02	46519.00	45319.80	1199.20	-	-	-
2017:03	44017.00	45444.89	-1427.89	-	-	-
2017:04	36009.00	37576.61	-1567.61	-	-	-
2017:05	30667.00	34624.29	-3957.29	-	-	-
2017:06	32591.00	32624.09	-33.09	-	-	-
2017:07	38349.00	39471.22	-1122.22	-	-	-
2017:08	35221.00	37219.85	-1998.85	-	-	-
2017:09	35148.00	34806.24	341.76	-	-	-
2017:10	42604.00	41153.54	1450.46	-	-	-
2017:11	48878.00	47390.64	1487.36	-	-	-
2017:12	57216.00	53528.33	3687.67	-	-	-

Table A 6. Predictions and residuals of the model (cont).

Observations	MTA	ARIMA (MTA)	Residuals	Standard error	Lower bound (95%)	Upper bound (95%)
2018:01	-	-	61455.7	2886.13	55799.0	67112.5
2018:02	-	-	59037.6	3833.99	51523.1	66552.0
2018:03	-	-	56492.4	4183.89	48292.1	64692.7
2018:04	-	-	48980.7	4329.04	40495.9	57465.4
2018:05	-	-	45798.7	4391.44	37191.6	54405.8
2018:06	-	-	46567.8	4418.65	37907.4	55228.2
2018:07	-	-	51757.4	4430.58	43073.7	60441.2
2018:08	-	-	49089.4	4435.82	40395.4	57783.5
2018:09	-	-	47690.3	4438.13	38991.7	56388.9
2018:10	-	-	53053.7	4439.15	44353.1	61754.3
2018:11	-	-	57734.2	4439.60	49032.7	66435.6
2018:12	-	-	63343.6	4439.79	54641.8	72045.4
2019:01	-	-	68212.2	4499.37	59393.6	77030.8
2019:02	-	-	66799.7	4543.58	57894.4	75704.9
2019:03	-	-	64922.0	4562.92	55978.8	73865.1
2019:04	-	-	57853.1	4571.41	48893.3	66812.9
2019:05	-	-	54965.1	4575.14	45998.0	63932.2
2019:06	-	-	55929.3	4576.78	46958.9	64899.6
2019:07	-	-	61248.4	4577.51	52276.7	70220.2
2019:08	-	-	58666.3	4577.83	49694.0	67638.7
2019:09	-	-	57324.2	4577.97	48351.5	66296.9
2019:10	-	-	62725.5	4578.03	53752.7	71698.3
2019:11	-	-	67431.1	4578.06	58458.2	76403.9
2019:12	-	-	73057.2	4578.07	64084.3	82030.0
2020:01	-	-	77936.8	4632.64	68857.0	87016.6
2020:02	-	-	76531.6	4673.74	67371.3	85692.0
2020:03	-	-	74658.8	4691.73	65463.2	83854.4
2020:04	-	-	67593.2	4699.63	58382.1	76804.3
2020:05	-	-	64707.3	4703.11	55489.4	73925.3
2020:06	-	-	65672.9	4704.64	56452.0	74893.8
2020:07	-	-	70993.0	4705.31	61770.7	80215.2
2020:08	-	-	68411.5	4705.61	59188.7	77634.4
2020:09	-	-	67069.8	4705.74	57846.7	76292.9
2020:10	-	-	72471.4	4705.80	63248.2	81694.6
2020:11	-	-	77177.1	4705.82	67953.9	86400.4
2020:12	-	-	82803.4	4705.83	73580.1	92026.6