An Inquiry into – "The Role of Telemedicine in Health Services of Maharashtra"

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1.   Abstract

There is a tremendous difference in the distribution of health care in a growing country like India. Although about 75% of the Indian practitioners reside in ru- urban, and nearly 75% of medical professionals reside in urban areas. Most of the rural population (Approximately 620 million) do not have primary medical facilities. The Indian Government spends about 0.9% of its GDP on health services. A large chunk of it goes to urban areas and rural areas receive very little part of the allocated money

In modern times most governments of all countries in the world are facing the common problem of providing quality health services at an affordable cost to their citizens. The biggest hurdle in this issue is to bring the health workers/doctors and patients together at a commonplace and at the same time. To make it happen either of the group has to travel. However, Internet-enabled communication technology has made it easy, convenient, and cost-effective. None of the parties have to travel to reach a commonplace. This has brought a tremendous opportunity to all governments to improve the quality of health services throughout the world.

Telemedicine has the ability to improve all Indians' access to high-quality health care. India has poor and average patient care, with only one doctor per 1,445 people. This discrepancy is particularly prevalent in the rural and tribal areas because most doctors prefer and choose to practice in cities. According to a WHO study, 59.2% of all health workers are located in urban areas which constitute 27.8% of the total population. However, 40.8% of all health workers are working in rural areas, which, are home to 72.2% of the population. Telemedicine can help exacerbate this inequality by allowing doctors in urban areas to consult with local people, including specialized care when needed.

2.   Concept of Telemedicine

The World Health Organization (WHO) elucidates Telemedicine as, "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities."

"Telemedicine is the use of information and communications technology, to provide healthcare services to individuals who are at a far distance from the healthcare providers. Rather than being a single technology, telemedicine is part of a wider process or chain of care. It has been assumed that telemedicine can improve this chain and thus enhance the quality and efficiency of health care. Telemedicine is also expected to increase the fairness and equality of the distribution of services, because the accessibility of health services, especially in remote areas, can be improved."[2] Apart from the uses of telephone, fax, etc. The telemedicine system is using the modern innovations in internet-enabled networks and modern machines.

India has a huge population of poor people. The count runs into millions (approximately 80 million) and the telemedicine initiative has the capacity of providing, quality, health care

services that are specialized and is well said by Dr. Devi Shetty: "In terms of disease management, there is 99% possibility that the person who is unwell does not require an operation. You can be anywhere since the decision on healthcare management isbased on history and interpretation of images and chemistry, so technically speaking, 99% of health-care problems can be managed by the doctors staying at a remote place— linked by telemedicine."[3]

Communication Methods for Telemedicine

The Selection of a communication method for telemedicine is based on the objective of, Interaction,

➢ Video

"Video consultations are closest to in-person consultations. Communication is two-way, interactive, and real-time. Patient identification is straightforward. This mode allows inspecting and getting visual cues from the patient. It also provides an opportunity to examine patients and demonstrate certain activities to the patients."[4]

➢ Audio

"Audio consultation is more convenient and readily available compared to video consultation. The interaction is dynamic and real-time. The information provided can be exchanged iteratively, between the provider and the receiver. Audio consultation provides verbal cues, but misses non-verbal cues and is not suitable for conditions that are required for visual inspection."[5]

➢ Text-Based

"Text-based consultations are convenient and quick. These may be either real-time when the interaction is simultaneous, or delayed, like in 'store and forward systems. These are best for follow-ups and second opinions. The text-based platforms also help in better transmission of documents, including the test reports and previous medical records.

However, text-based platforms lack both visual and verbal cues."[6]

i. Telemedicine Types

Telemedicine can be categorized into three types

• Store-and-forward

• Remote monitoring

• Interactive services

Store-and-forward

"Store-and-forward telemedicine system replaces the need for the medical practitioner to meet in person with a patient. Instead, patient-related data such as medical images or bio- signals, and case history, are sent to the specialist as needed when it has been acquired from the patient. This practice is common in the medical fields."[7]

"With proper structure and care, store-and-forward telemedicine can save time and allow medical practitioners to serve the public, with their services more fully. However, this form of telemedicine relies on a history report and documented information or images, rather than a physical examination, which has the potential to cause complications such as misdiagnosis."[8]

Remote monitoring

"Also known as self-monitoring or self-testing, remote monitoring uses a range of technological devices to monitor the health and clinical signs of a patient remotely. This isextensively used in the management of chronic diseases such as cardiovascular disease, diabetes mellitus, and asthma."[9]

Remote monitoring type of telemedicine results in some benefits such as frequent monitoring, more economical, and higher patient satisfaction. Since patients carry out the tests themselves there is the possibility of error (however it is rare) but in most cases, the test results are comparable to professionals.

Real-time interactive services

"Interactive services can provide immediate advice to patients who require medical attention. There are several different mediums utilized for this purpose, including phone, online, and home visits. A medical history and consultation about presenting symptoms can be undertaken, followed by an assessment similar

to that which is usually conducted during face-to-face appointments."[10]

ii. Benefits of Telemedicine

The important benefit of Telemedicine is to overcome geographical barriers and deliver health services to tribal and rural areas. Telemedicine is very useful to people residing in remote and far-off destinations. The following are some of the advantages of Telemedicine:

(a) Helps to minimize the treatment cost, traveling time, and traveling cost. As well as increases the opportunities for quality health services.

(b) In some cases, the movement of the patient is restricted, in such cases, telemedicine comes in handy.

(c) Telemedicine has the ability to provide specialized health care services to rural patients.

(d) Telemedicine increases the feasibility of access and interaction between special Practitioners and rural general practitioners and health workers.

iii Disadvantages of Telemedicine

Although Telemedicine is an important and useful tool in expanding healthcare coverage across barriers, it cannot replace in-person medical practice. Telemedicine is bound by certain drawbacks, some of which are listed below

(a) Physical presence of the patient becomes inevitable in many cases, where diagnosis and treatment are not possible without a hands-on approach

(b) Telemedicine may not be possible when the diagnosis is dependent on certain tests, where the doctor needs in-person or direct feedback from the patient

(c) Maintaining doctor-patient confidentiality and securing the patient's privacy becomes difficult with Telemedicine and hence it may not be suitable for certain sensitive issues

(d) Telemedicine may not be covered under many popular insurance schemes Appropriate technology or facilities may not be available in rural areas where telemedicine is needed the most.

3. Role of Telemedicine during Covid-19

" eSanjeevani" is the telemedicine program of the Government of India under the initiative Digital India" and eSanjeevani was introduced on 9th August 2020. During the lockdown caused due to the Pandemic of Covid-19, many health workers used telemedicine to treat a patient who was far off distance. "The platform currently permits two types of telemedicine services: Doctor to Doctor (*eSanjeevani*) and Patient-to-Doctor (*eSanjeevani* OPD). These services are part of the larger government scheme, to connect larger hospitals to smaller health centers in remote areas"[11]. The Government has developed a Hub and Spokes model in this case large Government hospitals and medical colleges are working as "HUB" and that will provide consultation services. Primary health centers will act as SPOKE. Using this model, the country has provided consultation services to approximately 3 million non- Covid patients.

"The telemedicine experience of a diabetes super-specialty hospital at Chennai, in the Southern state of Tamilnadu, has been documented**.** Diabetes, a chronic condition, requires patients to frequently visit the hospital for treatment. During the lockdown, with

the implementation of telemedicine guidelines, the hospital started offering these services at more than 50 diabetes centers in 32 cities across India. Consultant physicians accessed an already available cloud-based electronic medical record system, on their smartphones or computers. They conducted a total of 2864 teleconsultations between April and December 2020, all after seeking the consent of the patient and enquiring about each person's condition and symptoms"[12]. In the telemedicine system, the patients and doctors save on waiting time, traveling time, and traveling costs too but many doctors and patients have reported their dissatisfaction with missing the personal touch and rapport.

"The ongoing efforts of the government for expanding the use of telemedicine in the face of the COVID-19 Pandemic, including the e-Sanjeevani experience, along with private sector initiatives, offer promises for mitigating the dire limitations of healthcare in India."[13]It is recommended that even after a Pandemic is over telemedicine system be used in day to day practice it will save time, cost and improved access.

Telemedicine had the following advantages/benefits during the Pandemic –

1. Eliminated the need to send patients to overpopulated hospitals

2. Prevented direct physical contact and hence prevented the transmission of the virus to frontline healthcare workers

3. Helped in tracking the extent of spread and impact of the virus in localities which further aided decision making during the pandemic

4. It provides concurrent screening of symptoms, examining rules, and enables expert advice on the issue to the patient and health care services to the recipient and his location

5. Patients were properly guided as to whether or not they needed to be quarantined and if they did, they were quickly directed to the nearest available quarantine facility/center

6. "Patients with mild symptoms were treated using telemedicine, which in turn ensured that the hospital beds were available for patients, with severe and critical symptoms reduced the use of public transportation, and reduced viral transmission risk, from in-person contacts"[14]

7. "The beneficiaries are given clear and accurate information, as a result, there is no communication gap "[15]

8. Reduced the burden on healthcare facilities and resources

4. Challenges Faced by Telemedicine

Effective implementation of a telemedicine system requires excellent technological support

(a) Lack of awareness

(b) Lack of basic infrastructure (Rural and Tribal areas)

(c) Communication barriers due to multiple languages

(d) Acceptance of telemedicine by both doctors and patients will be a challenge

(e) Absence of rules and regulations by the government

Barriers to Telemedicine:

1) **Doctor-patient relationship**: "Some resistance is seen amongst doctors. Doctors in the government sector tend to look upon telemedicine as an additional duty or workload. Therefore, there is a need to weave telemedicine into the routine duties of the doctors."[16]

2) **Cost Effective**: Most people think that Telemedicine is very costly: whereas it is cost-effective compared to traveling costs, time, and, energy. It needs an internet connection, CPU, Screen, and software which is within the reach of most government hospitals.

3) **Reliability:** In the case of diagnostic Science, the quality of images and reports is requiredto meet the International Standard (such as high color resolution, the field of view, etc.)

4) **Reimbursement Issues**: "There should be a format to calculate the investment and recurring cost of the telemedicine system. The insurance companies have to decide whether the cost of telehealthcare could be reimbursed or not."[17]

5) **Availability of Skilled Manpower**: "There is a lack of training facilities, with regard to the application of IT, in the field of medicine. Most healthcare and IT professionals are not familiar with the terms commonly used in telemedicine, such as HIS, EMR, PACS, etc. Telemedicine is also not part of the course curriculum in medical schools."[18]

6) **Confidentiality and Safety Concerns**: "There are many issues that should be considered regarding the security, privacy, and confidentiality of patient data, in telemedicine consultations - How are patients' rights of confidentiality of their personal data ensured and protected; how to ensure the security of the data and restrict its availability to only those for whom it is intended and who is authorized and entitled to view it?"[19]

5. History of Telemedicine in India

"The activities related to telemedicine started in 1999 in India, though the government recognized the potential of telemedicine in the year 2000. The Indian Space Research Organization deployed the first nationwide SATCOM-based telemedicine network in 2001."[20]

"ISRO (Indian Space Research Organization)

was the pioneer of telemedicine in India, with a Telemedicine Pilot Project in 2001, linking Chennai's Apollo Hospital with the Apollo Rural Hospital at Aragonda village, in the Chittoor district of Andhra Pradesh."[21]

To bring the betterment of the cause Central Government of India has established integration of the networks for Cancer, Telemedicine, Rural Hospitals, and the network of Medical Colleges along with a Digital Medical Library. "The setting up of standardized telemedicine practice guidelines by the DIT in the Government of India, and the setting up of a National Telemedicine Task Force by the Health Ministry, in 2005, were some of the other positive steps by the government. International projects such as the Pan African e- network Project

and the SAARC (South Asian Association for Regional Co-operation) Telemedicine Network Projects have also been taken up as an initiative of the External Affairs Ministry, strategically placing Indian telemedicine in the global scenario."[22]

The Central Government of India has recommended the extensive use of digital tools to increase the reach of the health care system. Under the Ayushman Bharat scheme, the government has guided the state governments to leverage the use of information communication technology and connect the health and wellness centers with the network of medical colleges.

"Village Resource Center (VRC): The VRC concept has been developed by ISRO to provide a variety of services such as education, telemedicine, online-decision support, interactive farmers' advisory services, tele-fishery, e-governance Service, weather services, and water management. The VRCs not only act as learning centers; - but also provide connectivity to specialty hospitals, thus bringing the services of expert doctors to the villages. Nearly 500 such VRCs have been established in the country."[23]

"Telemedicine services in the country come under the combined jurisdiction of the Ministry of Health and Family Welfare and the Department of Information Technology. The Telemedicine division of MoHFW, GOI has set up a National Telemedicine Portal for implementing a greenfield project on e-health establishing a National Medical College."[24]

"Network (NMCN), for interlinking the Medical Colleges across the country, with the purpose of e-Education and a National Rural Telemedicine Network for e-Healthcare delivery."[25]

Figure 1 : ISRO Telemedicine network in India
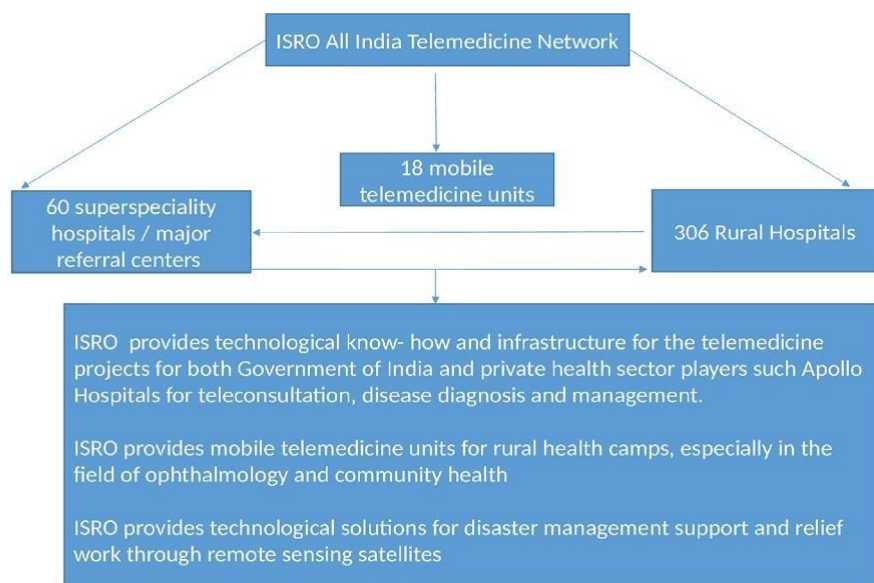
Source : http://www.isro.gov.in/applications/tele-medicine

6. Background of Maharashtra State

"Maharashtra is the third largest state in India, both in area and population. The state is bounded by the Arabian Sea in the west, Gujarat in the North West, Madhya Pradesh in the north and the east, Andhra Pradesh in the southeast, and Karnataka and Goa in the south. The state of Maharashtra has an area of 307,713 sq. km. and a population of 96.88 million. There are 37 districts, 358 blocks, and 43711 villages. The State has a population density of 314 per sq. km. (as against the national average of 312). The decadal growth rate of the state is 22.73% (against 21.54% for the country) and the population of the state continues to grow, at a much faster rate than the national rate"[26]. Mumbai is the capital of the state and is also its financial capital. Pune, the second biggest city, . is the cultural and educational capital of the state.

1. Maharashtra Population Data

"As per the details from Census 2011, Maharashtra has a population of 11.24 Crores, an increase from the figure of 9.69 Crore in the 2001 census. The total population of Maharashtra as per the 2011 census is 112,374,333 of which males and females are 58,243,056 and 54,131,277 respectively. The population of Maharashtra forms 9.28 percent of India in 2011".[26] We do not have the latest official population data as the 2021 Census has been postponed due to the Covid-19 pandemic. "However, the World Population Review estimates the population in Maharashtra in 2022, to be around 125,674,334."[27] Thisis an increase of 11.83 % compared to 2011

Table-1: Comparison of Important Indicators - Maharashtra and India

Features	Maharashtra	India
Area (Square Km.) (1000)	307.7	3287
% Of State area to total area in Country	9.4	-
No. of Districts	36	640
No. of Sub Districts	355	5924
No. of Towns (Inc. CT)	534	7933
No. of Villages	43662	640930
Population (in million)	112.37	1210.72
% State Population to Total population of thecountry	9.28	-
Urban Population (in million)	50.818	377.10
% Of Urban Population to Total Population	45.22	31.15
Rural Population (in million)	61.556	833.62
% Of Rural Population to Total Population	54.77	68.85
Population Density / Sq. Km.	365	382
Sex Ratio	929	943
Child Sex Ratio	894	919
Literacy Rate (%)	82.91	74.04
Female Literacy Rate (%)	75.48	65.46

Source - Census 2011

7. History of Telemedicine in Maharashtra

Stated Below is a broad timeline of Telemedicine in Maharashtra –

* "7 Sept. 2006 – Pilot Project in collaboration with ISRO started in Maharashtra, Speciality Center KEM Hospital, Mumbai with five remote centers (District Hospital Latur, Beed, Nandurbar, Sindhudurg, and sub-district hospital Karad)"[28]

• In 2007-2008 – Maharashtra Telemedicine services were extended to, 20 District hospitals, and, 2 sub-district hospitals, and a few more medical colleges (GMC Nagpur, GMC Aurangabad, B.J. Medical College Pune, Grant Medical College Mumbai)

• In 2011 Telemedicine Broadband Network was shifted to BSNL/MTNL broadband network

• 2011-2012- Maharashtra Telemedicine network was made available to another 30 Govt. Rural Hospitals, and Govt. Sub District Hospitals.

• 2014-2015 –Maharashtra Govt. made special arrangements to make Telemedicine facilities available to selected 5 Tribal areas (Manchar, Sangamner, Chikladara, Golkonda, and Nanded District Hospital.)

9. Telemedicine Uses Process

To improve the reach and quality of health services in rural parts of the country, the World Health Organization (WHO) and the Government of India have undertaken the initiative of telemedicine under National Rural Health Mission. The project of telemedicine in Maharashtra is a part of NRHM. "The Government of Maharashtra launched its pilot project on Telemedicine, in the year 2007, with one Specialist node at KEM Hospital, Parel, Mumbai, and 5 sub-district hospitals. The prime target areas for this intervention were tribal areas such as those of Sindhudurg, Nandurbar, Beed, and Satara."[29] In the next phase of the spread of telemedicine: The Maharashtra Government has added 5 government colleges at Aurangabad, Nagpur, Pune, and Nanavati hospital and J. J. Hospital in Mumbai. They are empowered and connected with the network of telemedicine. In addition to this,

23 districts and 4 sub-district hospitals with all medical facilities are included in Telemedicine - Maharashtra. Telemedicine facilities at medical colleges are working as specialists end and the other end is working as Patient Centre. "Furthermore these centers provide consultation services through teleconferencing to all government hospitals - all district government hospitals are connected with each other and to specialist end with latest telecommunication network equipment."[30]
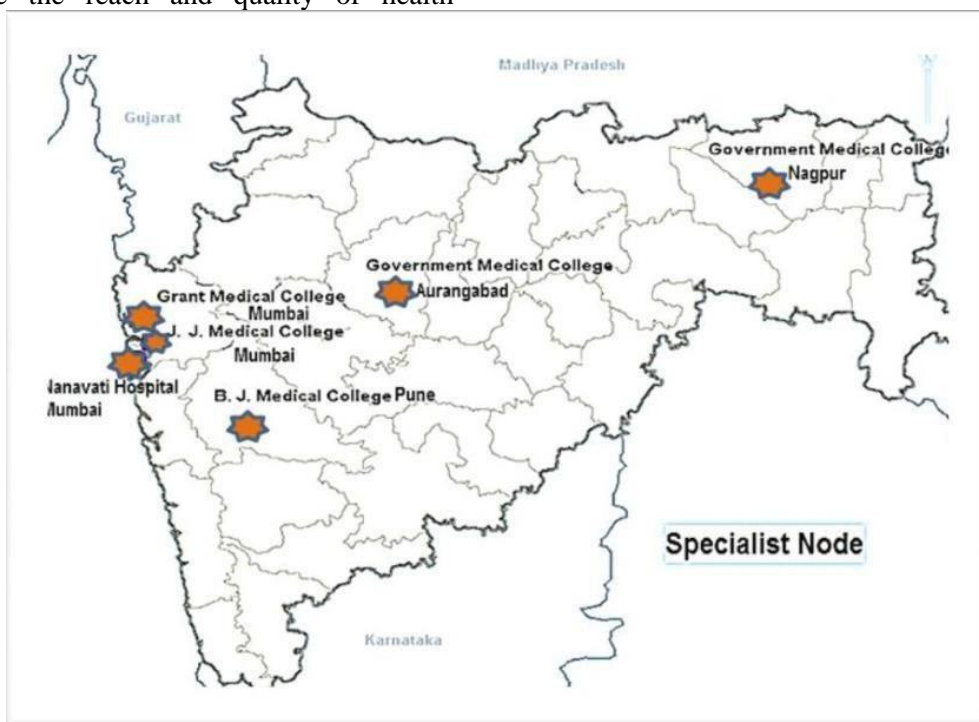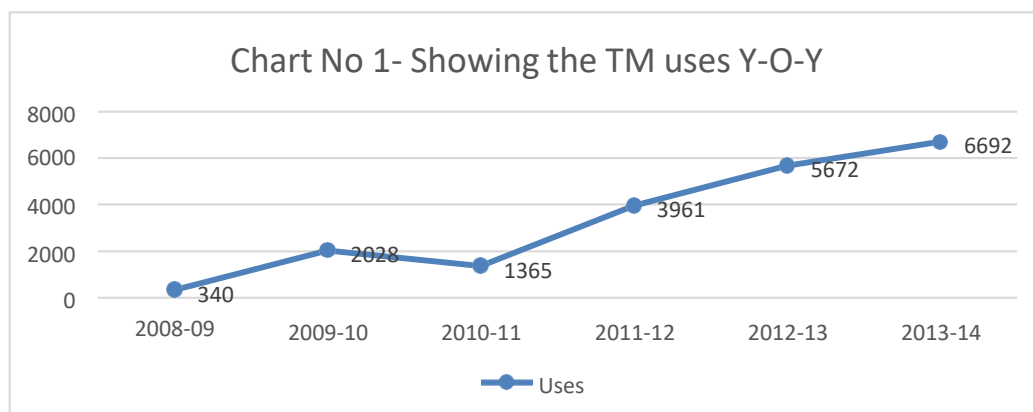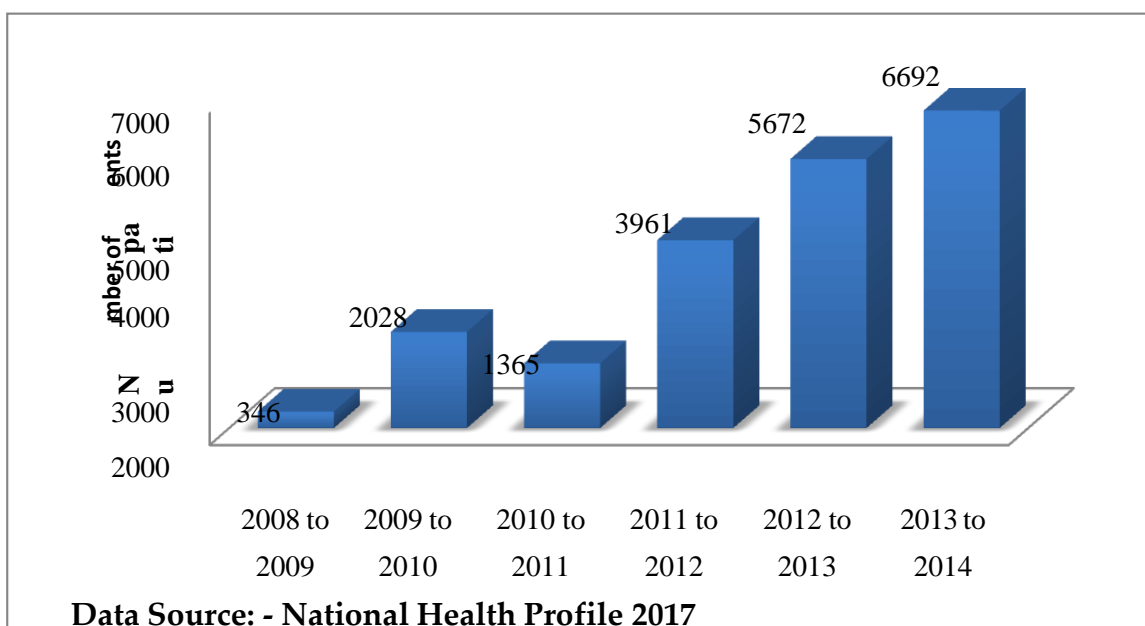
Telemedicine in KEM Hospital:

"KEM Telemedicine Centre offers consultation in all specialties and super-specialties including- Medicine, Surgery, Obstetrics and Gynecology, Pediatrics, Pediatric Surgery, Cardiology, Cardio surgery, Neurology, Chest Medicine, Ophthalmology, Skin and VD, ENT, Orthopedics, Radiology, Hematology, Nephrology, Gastrointestinal Surgery, Neonatology, Ayurveda, Anesthesia, Endocrinology, Urology, Dentistry, Psychiatry, etc."31

Consultation process at KEM Center.

1. TM Center of KEM hospital receives cases that are referred by doctors from various district/ rural hospitals. (May use special software)

2. After reviewing the case study/investigation report, the specialist offers opinions.

3. If necessary specialist may speak/see the patient using the webcam.

4. The district /Rural hospital referred patients are advised for appropriate follow-up, and supportive care is offered by a specialist.

.9. Telemedicine Uses Data and Analysis

Figure No 2-Cases Examined at KEM TM Centre

Data Source: - National Health Profile 2017

Data Source: Figure no 2 on page number 12.

When we refer to Figure Number 2, which shows the telemedicine usage data atKEM Hospital, it reflects the following:

a. In the year 2009-10, there was a whopping increase of 496% in the usage of telemedicine, which means that its usage has increased 5 times which is a very high figure.

b. For reasons unknown, the telemedicine usage rate has decreased by 33% in the year 2010-11.

c. Thereafter, in the following years, the usage rate has increased by 190%, 43% and 18% in the years 2011-12, 2012-13 and 2013-14 respectively.

d. The data shows the usage growth rate has increased at an exponential rateand, there is a huge scope for the spread, growth, and usage rate of telemedicine, which could lead to a great amount of saving on community expenses, which could, in turn, benefit the rural population, to a great extent.

Table No 2- Cases Examined specialty wise

Department	May 08 - March 09	April 09 - March 10	April 10 - March 11	April 11- March 12	April 12 – March 13	April 13- March 14
Medicine	100	131	94	865	818	711
Surgery	14	51	8	88	90	118
OBGY	8	24	5	84	51	81
Pediatrics	32	52	56	350	335	226
Cardiology	27	24	10	75	62	117
Neurology	30	13	8	53	82	74
ENT & Ophth	21	33	22	94	108	213
Skin VD	16	34	21	242	400	516
Orthopedics	24	136	151	219	326	290
Radiology	42	1472	955	1248	2754	3118
Others	32	58	35	643	646	1263
Total	346	2028	1365	3961	5672	6727

Data Source: - National Health Profile 2017

Chart No2: Telemedicine usage growth rate
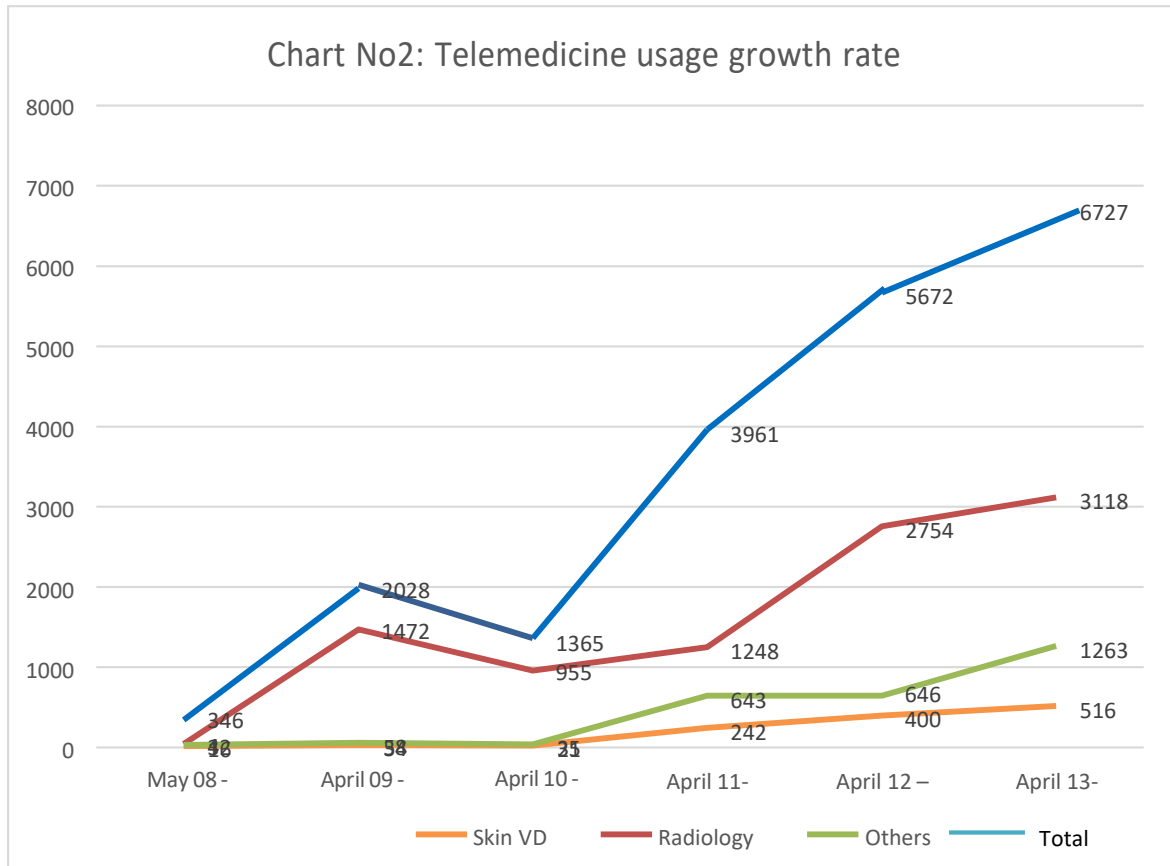
Source: Table no 1 on page number 13.

Chart Number 2, showing the telemedicine usage by the specialty for the period of 2008-09 to 2013-14 reveals that the average usage rate is increasing at a healthy rate. The growth rate is discussed below.

1. The average usage rate of the Medicine specialty has grown by 33%

2. The average usage rate of the Surgery specialty has grown by 32%

3. The average usage rate of the OB and GY specialty has grown by 76%

4. The average usage rate of the Pediatrics specialty has grown by 16%

5. The average usage rate of the Cardiology specialty has grown by 131%

6. The average usage rate of the Neurology specialty has grown by 102%

7. The average usage rate of the ENT and OPTH specialty has grown by 93%

8. he average usage rate of the Skin and VD specialty has grown by 244%

9. The average usage rate of the Orthopedic specialty has grown by 117%

10. The average usage rate of the Radiology specialty has grown by 707%

11. The average usage rate of the Other Specialties has grown by 374%

The highest growth rate is registered by Radiology (from 42 to 2754), followed by Other Specialties at 374% (from 32 to 5672) and the third-highest growth rate is shown by Skin and VD at 244% (from 16 to 400). The average growth rate of the usage of telemedicine is registered at 1924% which is an almost 20 times increase.

10. Limitations of the Study

Following are the limitations of the study

•   The data from 2014-15 onwards was not available for access

- The concept of telemedicine is new and the practice of telemedicine is of recent origin. Hence not too much primary data is available on the concept.

11. Conclusion

The data analysis for the period of 2008-09 to 2014 shows that the overall usage rate has increased almost 20 times, in just 5-6 years, which indicates that there is a great need, demand, and scope for further growth of the usage of telemedicine. This will result in greater penetration of the availability of health services. Furthermore, this could also improve the reach and quality of health services and may result in its availability, at a nominal price or almost free of cost.

In 1970, Alvin Toffler, in his book *Future Shock* mentioned that 'Distance is dead'. This has come true in the telemedicine system as well.

Effective implementation of telemedicine or telehealth delivery services has to be a positive integration of

a. Internet-enabled Communication system

b. Information technology

c. Biomedical sciences

d. Medical sciences and services

The cohesive integration of all the faculties, mentioned above, would make the telemedicine system more effective, efficient, and popular among the masses, especially the rural and tribal population.

From the given data one can infer that telemedicine success is not dependent on technology only but it is also needed the support of e-governance, effective use of policy environment, involvement of stakeholders, human resource involvement, and capacity building.

Since telemedicine is in the developing stage in Maharashtra State, it has still demonstrated its practical applicability and usefulness on several parameters.

However, advanced research is required on how to increase it usage. The evaluation of the, impact on e-health services can be understood, depending on the feedback of the users and stakeholders.

One thing is for sure - telemedicine will bring betterment in the overall quality of life, among the tribal, rural, and, marginalized citizens of Maharashtra State in particular, and Indian citizens at large.

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