

A Study on Teleophthalmology in Krishna District, Andhra Pradesh: Is Addressing the Visual problems of rural unreached

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Abstract

Purpose: To study the procedure of Screening, early detection, diagnosis, primary treatment and appropriate referrals through teleophthalmology and effectiveness of Teleophthalmology. This article reviews the present status of the application of telemedicine in the field of ophthalmology and how this technology may be used to provide ophthalmologic services to rural, underserved, and impoverished parts of India.

Methods: This is a retrospective study done in Krishna district, AndhraPradesh during the period of February 2018 to August 2019. All the Patients who attended to Vision Centres/Tele ophthalmology centres in Krishna District during the study period were included in the study.To determine users' requirements, a questionnaire was designed based on the literature review (14-17). The questionnaire included 53 closed questions.Feedback from the beneficiaries was taken after services were delivered. The patients were asked questions regarding teleconsultation over the mobile numbers given at the time of registration.

Results: In Krishna district, AndhraPradesh, Teleophthalmology centres have screened 1,04,466 patients during the period of February 2018 to August 2019. Among them, Males were 38%, females were 62%. In the age group less than 18 years 6944 patients, between the age group of 18-60 years 76907 patients and in the age group of above 60 years,20615 patients were screened. Out of the 1,04,466 patients, 62546 were provided with spectacles of which Myopic glasses were 19.62%, Hyperopic glasses were 80.38%. Among fundus check ups 2.78% were identified as Diabetic retinopathy, Hypertension were 0.13%, Macular diseases were 0.37%, Glaucoma cases were 0.60% and Cataract cases were 23.85%.

Conclusion: Teleophthalmology is an exciting new technology which can help in integration of all urban and rural health care centers in India and improve the quality of medical services in the presently underserved and impoverished sections particularly in remote rural areas of developing countries like India.Indian telemedicine establishments also need periodic evaluation to rationalize the main objective of the technology, that is, patient care, patient satisfaction, and patient opinion, all leading to patient empowerment.

Keywords: Teleophthalmology; Patient screening; Underserved areas; Effectiveness.

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I. Introduction

In the recent years, information and communication technology (ICT) has been developed and applied to different areas of health care. Using this technology, health care services have changed to be more accessible and effective, especially when distance is a major concern. In fact, to overcome geographical health disparities, telemedicine has emerged as a discipline to improve healthcare services across the globe (1, 2). Telemedicine services can be used in different areas of healthcare, such as diagnosis, treatment, prevention, education, and research (3), and have been applied in different medical specialties, such as oncology, dermatology, radiology, and pathology (4). The trends in increasing spread of technology worldwide, mobile broadband use, use of social media, and increasing e-commerce have allowed health care fraternities to incorporate information technology for eye care.

In many developing countries where resources are unavailable / limited, the benefits of teleophthalmology have been tried and proven, especially in the underserved and remote population worldwide.(5-8). However, utilization of teleophthalmology services is yet to gain wide acceptance in many countries due to various reasons.(9,10). The majority of the current teleophthalmology services concentrate on patient screening and appropriate referral to experts. Some models also demonstrate efficient follow-up systems.(11).

Telemedicine has special significance to India considering its vast geographical spread and predominant rural population where medical care is neither available nor accessible(15). While 72% of India's 1.2 billion people live in rural areas, over 70% of the doctors practice in urban areas.

Few examples of TeleOphthalmology Models in India are :

One of the important projects in telemedicine started by Madras Diabetic Research Foundation (MDRF), in a cluster of 42 villages around Chunampet in Kancheepuram District, Tamilnadu, India. Screening is carried out for diabetes and its complications especially diabetic eye diseases by using a mobile telemedicine van with satellite connectivity,

The teleophthalmology project conducted by Sankara Nethralaya Medical Research Foundation at Chennai uses a customized mobile van with an in-built ophthalmic examination facility having satellite connectivity, along with a social worker and an optometrist. Real-time interaction by the ophthalmologist with the examining optometrist, as well as the patient, is then established using the videoconferencing system,

Another example of application of technology in rural health care is the Aravind Teleophthalmology Network. A mobile eye-screening van fitted with a satellite has been specially designed to screen the diabetic patients in the camps, hospitals, and clinics of diabetologists.

The Aim of this study to clinical study of the procedure of Screening, early detection, diagnosis, primary treatment and appropriate referrals through Tele-ophthalmology and effectiveness of Tele-ophthalmology.

II. Materials and Methods:

This is a retrospective study done in Krishna district, Andhra Pradesh during the period of February 2018 to August 2019. All the Patients who attended to Vision Centres/Tele ophthalmology centres in Krishna District during the study period were included in the study.

To determine users' requirements, a questionnaire was designed based on the literature review (14-17). The questionnaire included 53 closed questions which were divided into two main parts: a) required data elements for optometrists and ophthalmologists.

Feedback from the beneficiaries was taken after services were delivered. The patients were asked questions regarding teleconsultation over the mobile numbers given at the time of registration.

We defined patient outcomes under two major domains:

1. Tele-ophthalmology as a clinical tool- impact in diagnosis and management.
2. Patient-defined outcome in terms of satisfaction and quality of life..

Indicators for Performing for Mukyamanthri e-kendram (teleophthalmology centres in Krishna district

Percentage of reporting of ocular images within 6 hours

Percentage of SMS triggered to the patient by the service provider 2 days prior to the delivery of spectacles

Percentage of spectacles delivered, as per the prescribed power with 10days from the data of intimation

Percentage of spectacles which meet prescription specifications

Percentage of corrected spectacles delivered in 10days from the data of receipt at the Tele Ophthalmology centre

TeleOphthalmology Project In Krishna District, southern India

The State Government of Andhra Pradesh initiated and Launched TeleOphthalmology Project over entire Andhra Pradesh with collaboration of Apollo health care as Public Private Partnership model. The Government of Andhra Pradesh initially started 115 Vision centres named as Mukyamanthri e- kendrams in entire Andhrapradesh. Each Mukyamanthri e-kendram (teleophthalmology centres) covering the population of around 5,00,000 population.

In our Krishna district, government launched 10 Mukyamanthri e- kendrams /Vision centres (Tele ophthalmology centres). Each Teleophthalmolgy centre consists of room with equipment related to vision and broadband connectivity. Vision centres having Visual acuity equipment like snellens chart, trial box, frames, mirror, automated refractometers, Fundus camera for posterior and digital camera support for anterior segment imaging. And also having computer system with Broadband internet connectivity for registration of Patients. The images of both anterior and posterior segment can be transferred to Ophthalmologist working at base centre of Apollo health care through internet connectivity.

One Government Ophthalmic assistant is placed at the Mukyamanthri e- eye centres/Vision centres (Tele ophthalmology centres) to look after the ophthalmic related activities like vision, imaging, transferring the data and receiving the opinion, advice to patients, spectacle prescription, generation and issued to the patients. One Equipment assistant to look after registration, connectivity related, system related activities and equipment maintenance.

Work Flow is that firstly the patient will be registered by Aadhar Number. Secondly the complaints will be taken, then Visual acuity and refraction will be done. Anterior segment is examined by the torch and

Loupe. If Vision and anterior segment is normal, the patient will be sent by giving education regarding eye care. If the patient is having refractive error, the glasses will be prescribed online with entering mobile number of patient. SMS will be sent to patient when the spectacles are ready to delivery. Spectacles will be Provided at free of cost.

If the patient is not improving with Glasses, History of Diabetes Mellitus, Hypertension, CVA or any other complaints of the images will be taken by digital camera/fundus camera. The images will be sent to service centre/ base hospital of Apollo health care. The opinion and advice will be received back to centre by 30 min to one hour. Depending upon the opinion and advice the treatment will be given or Refer cases to nearest Referral centre.

Feedback from the beneficiaries will be taken after services are delivered. The patients were asked questions regarding tele-consultation over the mobile numbers given at the time of registration.

III. Results:

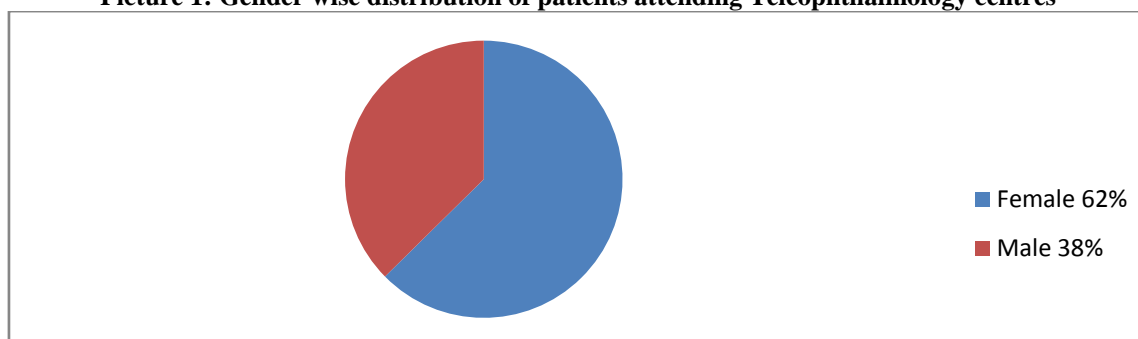
Table 1 : Teleophthalmology centerwise report in Krishna district

Total No.of Patients	Fundus Checkup Report	Refractions report	Spectacles Ordered Report
104466	27590	95518	12275 50271

Table 2 : Diseases identified through Teleophthalmology

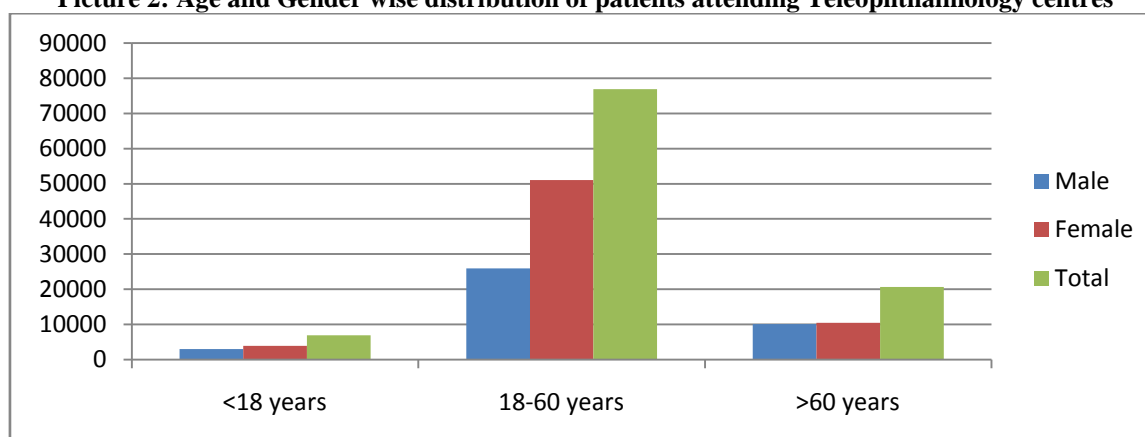
No. of Diabetic Retinopathy Cases	No. of Hyper tensive Retinopathy Cases	No. of Macular Degeneration Cases	No. of Cataract Cases	No. of Glacuoma Cases
766	36	104	6579	167

Picture 1: Gender wise distribution of patients attending Teleophthalmology centres



In Krishna district, AndhraPradesh, the Mukyamanthri e-kendram (Teleophthalmology centres) have screened 1,04,466 patients during the period of February 2018 to August 2019. Among them , Males were 39047(38%), females were 65419(62%) screened.

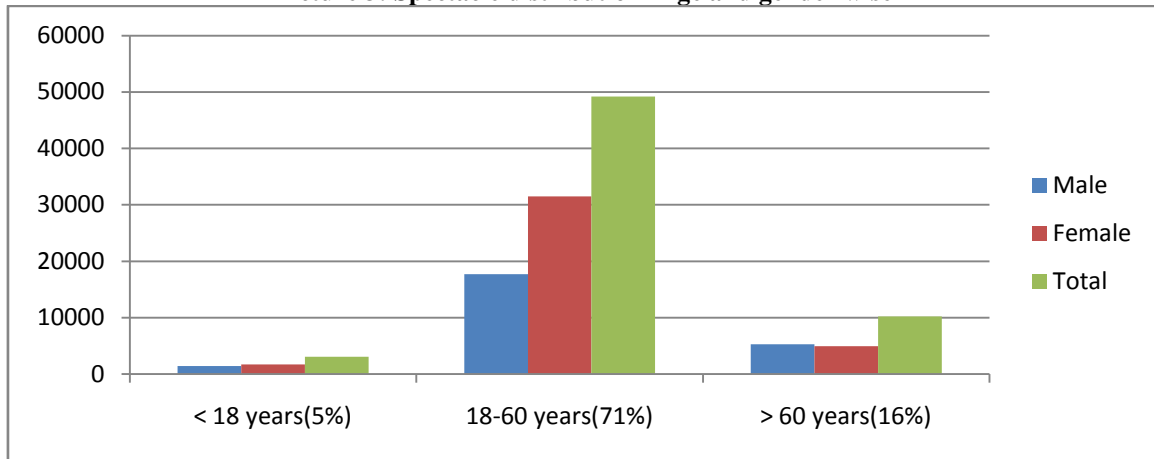
Picture 2: Age and Gender wise distribution of patients attending Teleophthalmology centres



The patients for Mukhyamanthri e-eye kendrams (Teleophthalmology centres) have been divided in to three groups, less than 18 years group, 18to 60 years age group and above 60 years group. The age group less than 18 years males were 3041, females were 3903and total of 6944 patients were screened. Between the age

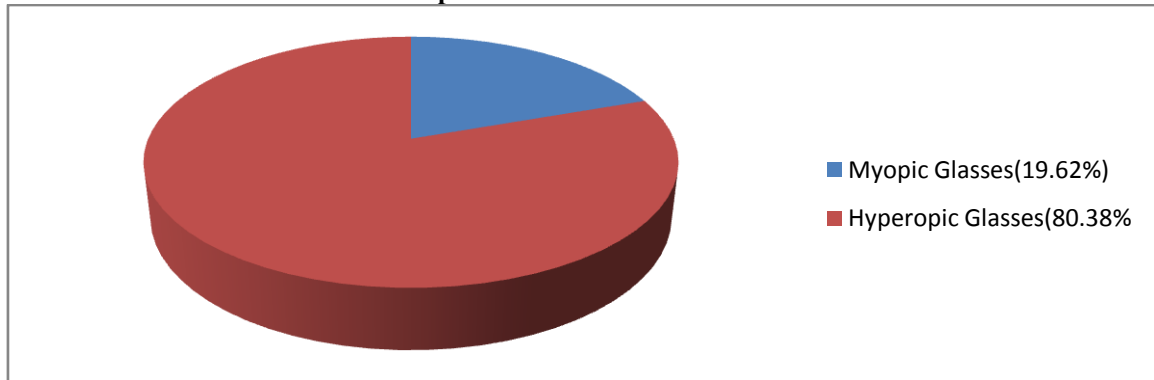
group of 18-60 years males are 25895, females are 51012 and total of 76907 patients were screened. In the age group of above 60 years, 20615 patients were screened.

Picture 3: Spectacle distribution- Age and gender wise



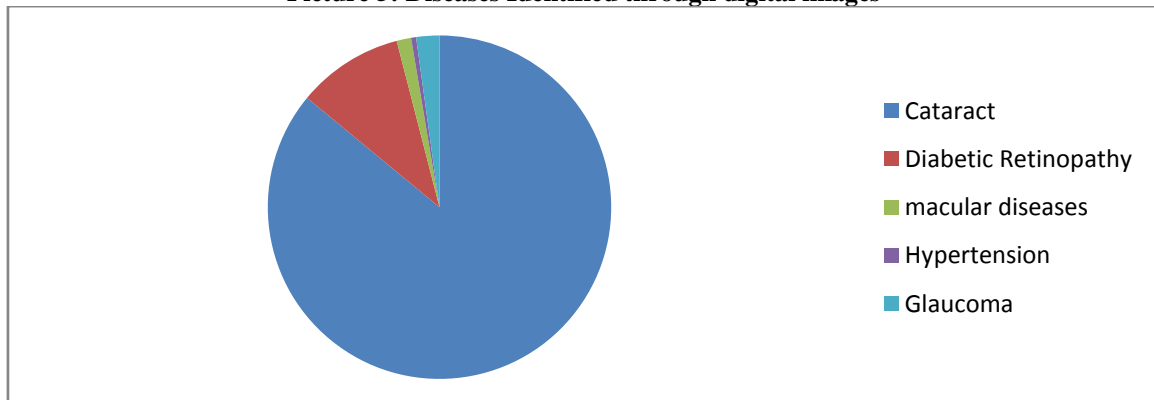
Out of the 1,04,466 patients, 95518 were screened for refraction. Patients of 62546 were provided with spectacles of myopic glasses 12275 and hyperopic with presbyopic glasses are 50271. Only among spectacle of 62546, myopic 19.62%, hyperopic are 80.38%. Among the total spectacle, 24372 males (39%) and 38174 (61%) females have been prescribed glasses. 3083 spectacles have been provided for Less than 18 years group i.e 5%. For the age group 18 to 60 years, 49232 spectacles have been provided i.e 79%. for more than 60 years group 10231 spectacles have been provided i.e 16%.

Picture 4: Spectacle distribution- Refraction wise



Out of the 1,04,466 patients, 95518 were screened for refraction. Patients of 62546 were provided with spectacles of myopic glasses 12275 and hyperopic with presbyopic glasses are 50271. Only among spectacles of 62546, Myopic glasses were 19.62%, Hyperopic glasses were 80.38%.

Picture 5: Diseases Identified through digital images



Out of 121277 population, 27590 are checked for fundus, images are taken and transmit to the service centre. 22.75% of fundus and digital images were taken as per the guidelines. Among fundus check ups 766 cases are identified as Diabetic retinopathy (2.78%), Hypertension were 36 (0.13%), Macular diseases were 104(0.37%), Glaucoma cases were 167(0.60%) and Cataract cases were 6579(23.85%).

IV. Discussion

This study shows 104466 persons have been utilized teleophthalmology services during the period from February 2018 to August 2019 from rural areas where specialist's services not accessible.

Among the population, majority of the females have not access to the Ophthalmologist's services due to limitations of work at home, travel, finance. Our study shows females of all age groups got more benefitted of utilizing teleophthalmology services which available at their accessible areas. Among the 1,04,466 total patients of 65419 (62%) females were utilized.

The study also shows that majority of the patients were females between the age group 18 years to 60 years 51012, females in the age group less than 18 years were 3903 and the females age group above 60 years were 10504. It may indicate the age group less than 18 years have schools and the least access to the teleophthalmology services as they are at fixed time and centre. The condition of fixed time may also apply for the males as they are with working hours and place may be different with teleophthalmology services.

The study shows most of the cases attended for Teleophthalmology centres were having the problem of refractive errors which occupies the first place. Among the refractive errors majority were hyperopic glasses as the patients belongs to the age group between 18-60 years age group. The spectacles of hyperopic are 80.38% and myopic 19.62%

In this study, for 27590 (22.75%) patients were checked for fundus and digital images were taken and transmit to the service centre. of were taken as per the guidelines. As per the reports received the ophthalmic technicians identify 766 cases as Diabetic retinopathy (2.78%), Hypertension were 36 (0.13%), Macular diseases were 104(0.37%), Glaucoma cases were 167(0.60%) and Cataract cases were 6579(23.85%). 8% of the of individuals with diabetic retinopathy had previous eye examinations and have the awareness of that the eye disease affecting their vision.

The study which shows prevalence of Diabetic retinopathy (2.78%) of the patients whom fundus picture taken, is deviates with the Aravind Comprehensive Eye Survey Research Group Study up to July 2006 (18) showed that the prevalence of diabetic retinopathy was 10.5%. Only 8% of the of individuals with diabetic retinopathy had previous eye examinations and have the awareness of that the eye disease affecting their vision. It is correlates with in the Aravind Comprehensive Eye Survey Research Group Study(19) in the percentage of unawareness among the population as 6.7% of individuals with diabetic retinopathy had previous eye examinations.

As per the Indicators for Performing teleophthalmology centres, the Percentage of reporting of ocular images within 6 hours is 86%, 97% of SMS triggered to the patient by the service provider 2 days prior to the delivery of spectacles, 97% of spectacles delivered, as per the prescribed power with 10 days from the data of intimation, 98% of spectacles which meet prescription specifications, 100% of corrected spectacles delivered in 10 days from the data of receipt at the Tele Ophthalmology centre. The Study shows 95% have satisfaction over the refraction and spectacles. The population have the 91% satisfaction over the cataract referrals, diabetic retinopathy and other diseases.

This study shows that at the early stages of beginning, Ophthalmic technicians have expressed 70% easy to learn and operate the teleophthalmology unit as a clinical tool- impact in diagnosis and management. By continuous learning and operating the teleophthalmology, ophthalmic technician have expressed 90% as a clinical tool impact. By the reports and opinions, the technicians have expressed 50% satisfaction of education, reorientation on identify the diseases. This is study having the teleophthalmology of store-and-forward method, there is no video conferencing system. Only reports and opinions of ophthalmology received by the technician through net within the six hours after the images received from teleophthalmology centres.

In our study shows Teleophthalmology services have the benefits of rendering services of screening, correction of refractive errors, providing free customized spectacles, early identification of cataract, Diabetic retinopathy, Glaucoma, hypertensive retinopathy and macular disease and appropriate referral for the treatment. The study is correlates with other numerous studies have explored multiple benefits of teleophthalmology, such as reliability, cost-effectiveness, time efficiency, and accessibility, in scenarios where experts are unavailable. (19-22) There are limited studies that demonstrate patient outcome in teleophthalmology services. Lembcke stated that "the best measure of quality is not how well or how frequently a medical service is given, but how closely the result approaches the fundamental objectives of prolonging life, relieving distress, restoring function, and preventing disability". (23)

Despite the advantages of teleophthalmology technology, there are concerns about the quality of images and the accuracy of diagnoses (24). For example, Kiage *et al.* showed that poor quality images can severely limit the ability of glaucoma assessment to diagnose optic nerve damage and glaucoma (21).

V. Conclusion

Such a service can be considered as a basic ophthalmology service, and regardless of socioeconomic status, it may simply be available to people who are not able to visit a specialist. Some of the advantages of this method are saving costs, reducing unnecessary referrals to the specialists, reducing the number of unnecessary travels.

To conclude, teleophthalmology technology can be used easily by optometrists and ophthalmologists to improve eye health care services. Teleophthalmology is an exciting new technology which can help in integration of all urban and rural health care centers in India and improve the quality of eye health care services in the presently underserved and impoverished sections particularly in remote rural areas of developing countries like India. Indian telemedicine establishments also need periodic evaluation to rationalize the main objective of the technology, that is, patient care, patient satisfaction, and patient opinion, all leading to patient empowerment.

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