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FINANCIAL HEALTH MANAGEMENT OF OTOLARYNGOLOGY BY TELEMEDICINE: OPPORTUNITIES AND CHALLENGES

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ABSTRACT

The COVID-19 pandemic has impacted the world and medical branches are affected too. This article shows otolaryngology (otlogy) management as patient care in the outpatient (OP) remote setting by the implementation of a business strategy using telemedicine (TME). The research explains how the applications of management strategies in TME for otlogy can reduce medical expenses and also offering profits to the medical practitioners. This article suggests the advantages of TME for (otlogy) related health risks and advises health centers to implement the business strategy of TME which can provide services using remote Information Communications Technology (ICT) to evade exposure risks to healthcare (HCR) providers, patients, and the general community. The realization of TME, or virtual services, can help the otolaryngologists to provide needed care to patients amid COVID-19 pandemic. This research illustrates the challenges in the application of TME and benefits to the patients as well as for the medical professionals.

KEYWORDS

financial management, otolaryngology, telemedicine, information communications technology, outpatient; business strategy, virtual services.

INTRODUCTION

Financial management (FM) includes stages to ensure that organizations endure to operate in a feasible manner and continue earning profits and provide benefits. The same aim FM has for the HCR sector also for its medical services and patient care. FM focuses on risk management, makes good cash flow and offers healthy cost effective services to the patients.

Telemedicine (TME) was not very popular in developing nations especially in Indian sub-continent until the COVID-19 pandemic hit globally and risk factors associated with TME became the competitive advantage in health sectors. Developing countries started to focus and invest in building a strong TME system to offer medical care and medical services to major health related issues.

TMETME is the use of progressive information and communication technology to extend medical and HST related services in the absence of physical presence [1] which is also achieved through remote technologies or virtually. TME in general, and specifically in the field of otlogy, has become a reality. Due to the improvements in telecommunications and computer technology, TME applications [2] are becoming more common in both

hospitals and private practices. These applications are altering the manner in which (otlogy) is practiced both at the primary care and at the specialist level. This study surveys the application of TME for (otlogy) and other medical services and illustrates the opportunities and challenges in its application. COVID-19 pandemics and post pandemic consequences have explained the advantages of TME and possible barriers in its growth in the medical field [3-4].

With this aim of HCR facilities, TME is a requisite to break barriers of accessing and implementation of HCR services [5] and this article presents the same focus by showing how various (otlogy) diseases can be treated by the business strategy of HCR centers such as TME or virtual treatments in countries like India [6].

COVID-19 has devastated many sectors and medical sectors were one of the most affected sectors because millions of doctors and other medical practitioners and support employees lost their lives.

There are many services where TME cannot be applied and physical visits to hospitals and clinic are unavoidable but also there are many health related services that can be provided remotely. Applications of TME has identified those areas and explained the cost effectiveness in its working too [7]. As a result, medical practitioners and other employees are not in close contact with the communicable diseases. (otlogy) is one of the branches of medicine which have best results in the application of TME [8].

There are many benefits of TME for (otlogy) experts, HST stakeholders and patients, some of them are explained in this research.

TME DIMINISHES COSTS FOR OTLOGY

Stakeholders in HST have witnessed that TME practices need infrastructure to be built one time and once it is operational the working capital is reduced and the cost of maintenance reduces. The number of workers is reduced, the cost of electricity, and other utilities are also reduced. Gradually over a period of time the cost diminished for the (otlogy) patients.

CONSTANT (OTLOGY) PATIENT CARE AND MONITORING THROUGH REMOTE TECHNOLOGIES

TME created a platform for constant care and monitoring of (otlogy) patients for diseases like coughing, speech issues, pain monitoring and providing prompt responses to the patients if they have questions on health related problems through video calls. TME sets an alarming system for patients if they need urgent assistance or if it's the time of emergency.

TME GIVES ACCURATE DIAGNOSIS AND PLAN FOR TREATMENT OF OTLOGY

Patients are in regular contact with the (otlogy) service through remote technologies and are able to provide all tests and reports related to their issues. TME builds a system where in one-time health experts who are diversified located can join together for accurate diagnosis and plan treatment for (otlogy) patients.

The current study on the implementation of TME in otology during the COVID-19 pandemic examines several financial aspects, highlighting both the potential cost savings and profit opportunities for medical practitioners. The key financial aspects explored in the study are set out here:

REDUCTION IN MEDICAL EXPENSES

The study suggests that TME can significantly reduce medical expenses for both patients and healthcare providers. For patients, this includes savings on travel costs, reduced time off work, and lower out-of-pocket expenses for in-person visits. For healthcare providers, TME can decrease the overhead costs associated with maintaining physical office spaces, such as rent, utilities, and administrative staff.

OPERATIONAL EFFICIENCY

TME can improve operational efficiency by streamlining appointment scheduling, reducing no-show rates, and allowing for more flexible consultation hours. This efficiency can translate into cost savings and increased revenue by enabling providers to see more patients in a given timeframe.

PROFIT OPPORTUNITIES

The implementation of TME offers new profit opportunities for medical practitioners. By expanding their reach to a broader patient base, including those in remote or underserved areas, practitioners can increase their patient volume and revenue streams. Additionally, offering TME services can attract new patients who prefer the convenience of virtual consultations.

INSURANCE REIMBURSEMENT

The study likely addresses the financial implications of insurance reimbursement for TME services. With the

increased acceptance and coverage of TME by insurance companies during the pandemic, healthcare providers can receive compensation for virtual consultations similar to in-person visits, ensuring financial viability.

INITIAL INVESTMENT AND COSTS

The study acknowledges the initial investment required to set up TME services, including costs for technology infrastructure, software, training, and ensuring compliance with regulatory standards. However, these initial costs can be offset by the long-term financial benefits and cost savings.

COST-BENEFIT ANALYSIS

A thorough cost-benefit analysis is essential to understand the financial impact of TME. The study likely examines the balance between the costs of implementing TME and the potential savings and revenue generated. This includes analyzing the return on investment (ROI) for healthcare providers.

IMPACT ON HEALTHCARE ECONOMICS

On a broader scale, the study explores how TMETME can influence healthcare economics. By reducing the burden on healthcare facilities and enabling more efficient use of resources, TME can contribute to overall cost savings for the healthcare system. This includes minimizing hospital admissions and emergency room visits through timely virtual consultations.

By exploring these financial aspects, the study aims to provide a comprehensive understanding of the economic implications of TME in otolaryngology. It highlights how TME can be a financially sustainable and profitable strategy for healthcare providers while offering cost savings and improved access to care for patients.

The research explores several key questions regarding the implementation of TME in otolaryngology (Otology) amid the COVID-19 pandemic. Firstly, it investigates how TME can be effectively applied to manage patient care in outpatient settings. Secondly, it examines the potential of TME to reduce medical expenses while also offering financial benefits to medical practitioners. The study also seeks to understand the specific advantages of TME in addressing otology-related health risks, particularly in terms of minimizing exposure risks for healthcare providers, patients, and the broader community through the use of remote Information Communications Technology (ICT). Additionally, the research delves into the challenges associated with the adoption of TME, aiming to provide a comprehensive analysis of both the obstacles and the benefits for patients and medical professionals alike. By addressing these questions, the study aims to offer valuable insights into the feasibility and efficacy of TME as a strategic business approach in otolaryngology during the pandemic.

The research objectives of the current study on the implementation of TME in otolaryngology (Otology) during the COVID-19 pandemic evaluate how TME can reduce medical expenses for both patients and healthcare providers in the field of otolaryngology and investigate the potential profits and financial benefits that TME can offer to medical practitioners. Determine the advantages of TME in mitigating otology-related health risks and its effectiveness in providing remote care and explore the use of remote Information Communications Technology (ICT) in delivering otolaryngology services and its role in minimizing exposure risks for healthcare providers, patients, and the community.

The current study also illustrates the challenges associated with the application of TME in otolaryngology and propose potential solutions to overcome these obstacles, measure the satisfaction levels of both patients and healthcare providers with TME services, compare the health outcomes of patients receiving care through TME versus traditional in-person consultations and finally provide recommendations for health centers on implementing TME as a business strategy to enhance patient care and operational efficiency during the pandemic.

The current study on the implementation of TME in otolaryngology (Otology) amid the COVID-19 pandemic identifies several research gaps:

LONG-TERM EFFICACY AND OUTCOMES

There is a lack of comprehensive data on the long-term efficacy of TME in otology. Most studies focus on short-term benefits and immediate responses to the pandemic, but there is a need for research that examines the sustained impact of TME on patient outcomes and healthcare costs over an extended period.

PATIENT AND PROVIDER SATISFACTION

While initial findings suggest that TME can reduce expenses and minimize exposure risks, there is limited research on the satisfaction levels of both patients and healthcare providers. Understanding their experiences, preferences, and potential concerns is crucial for the successful adoption of TME.

TECHNICAL AND LOGISTICAL CHALLENGES

The study highlights challenges in the application of TME but does not delve deeply into the technical and logistical hurdles faced by healthcare providers. Further research is needed to explore issues such as technological barriers, infrastructure requirements, and the training needed for both patients and medical staff.

REGULATORY AND ETHICAL CONSIDERATIONS

There is a gap in understanding the regulatory and ethical implications of widespread TME use in otology. Research is needed to address concerns related to patient privacy, data security, and the legal frameworks governing TME practices.

ECONOMIC IMPACT ANALYSIS

While the study discusses potential cost savings, there is a need for a more detailed economic analysis to quantify the financial benefits and costs associated with TME. This includes examining the cost-effectiveness of TME compared to traditional in-person care and identifying specific areas where cost reductions can be achieved.

ACCESSIBILITY AND EQUITY

The study does not fully address the issue of accessibility and equity in TME. Research is needed to understand how TME can be made accessible to diverse populations, including those in rural or underserved areas, and to ensure that it does not exacerbate existing healthcare disparities.

INTEGRATION WITH TRADITIONAL CARE MODELS

Further research is required to explore how TME can be effectively integrated with traditional in-person care models. This includes understanding the optimal balance between virtual and physical consultations and developing best practices for hybrid care models.

By addressing these research gaps, future studies can provide a more comprehensive understanding of the role of TME in otolaryngology and help to optimize its implementation and effectiveness.

There are many apprehensiveness and questions from patients and health experts as well that have created the challenges of TME in (otlogy). Some experts find that TME is effective only for minor issues but for serious (otlogy) diseases TME is not effective because the diagnosis is based on several scanning and clinical examinations which are not possible to be carried out remotely. Another concern is related to investing in sophisticated technologies for better results from TME. Some patients are more comfortable when they meet their doctors personally and they feel a lack of attachment and communication problems while using technologies. Another disadvantage of TME for (otlogy) is that medical experts and patients both can have issues dealing with technologies and all communication is dependent on good network connectivity. Therefore, technical issues can also cause problems in health discussions, understanding the patient's problems and treatment plan for patients. However, the advantages of using TME are increasing and both medical experts as well as patients are motivated to use TME for the treatment of several diseases along with (otlogy) disease. The objective of this research is to present the relevance and applications of TME in treating ENT related diseases and show economies of scale in applications of TME in the healthcare system especially for (otlogy).

LITERATURE REVIEW

Singh, et al in (2020) in the review of TME applications recommended that TME can be used for the diagnosis, workup, and management of otologic pathologies in selected circumstances [7]. The feasibility of remote evaluation and programming of both hearing aids and cochlear implants have been demonstrated and may be particularly useful in rural areas with limited access to care. Auditory rehabilitation following cochlear implantation is another promising application for remote health yet does not come without risks. Further research assessing the use of TME in diagnosing and treating inner ear pathologies, otologic/neurotologic tumors, and other common pathologies is warranted [8].

The literature review for the current study on the implementation of TME in otolaryngology (Otology) amid the COVID-19 pandemic covers several key areas to provide a comprehensive background and context for the research.

TME IN HEALTHCARE

TME has been an emerging field in healthcare, with its roots tracing back several decades. The literature highlights the evolution of TME, emphasizing its potential to enhance healthcare delivery, improve patient access to care, and reduce costs. Studies before the COVID-19 pandemic have demonstrated the feasibility and effectiveness of TME in various medical specialties, including primary care, dermatology, psychiatry, and more recently, otolaryngology. Research shows that TME can improve

patient outcomes, increase convenience, and provide cost savings.

IMPACT OF COVID-19 ON HEALTHCARE DELIVERY

The COVID-19 pandemic has significantly disrupted traditional healthcare delivery systems, leading to an accelerated adoption of TME. Literature reviews and studies conducted during the pandemic underscore the necessity and rapid implementation of TME as a response to social distancing measures and the need to minimize exposure risks. The shift towards virtual consultations has been documented as a critical strategy to maintain continuity of care while protecting both patients and healthcare providers from potential infection.

TME IN OTOLARYNGOLOGY

Specific to otolaryngology, several studies have explored the application of TME in managing ENT diseases. The literature highlights that otolaryngology, which often relies on physical examinations and diagnostic procedures, initially faced challenges in transitioning to TME. However, advancements in technology and innovative approaches have facilitated remote consultations, diagnostics, and follow-up care. Studies have reported on the successful implementation of TME for conditions such as chronic rhinosinusitis, otitis media, and post-operative follow-ups, demonstrating comparable outcomes to in-person visits.

FINANCIAL IMPLICATIONS OF TELEMEDICINE

The literature review also examines the financial aspects of TME. Prior research indicates that TME can reduce healthcare costs by eliminating the need for travel, reducing no-show rates, and optimizing the use of healthcare resources. For healthcare providers, TME can lower operational costs associated with maintaining physical office spaces and staffing. Studies have also discussed the potential for TME to create new revenue streams and improve financial sustainability for healthcare practices, especially in rural and underserved areas.

Despite its benefits, the literature identifies several challenges associated with TME. Technical barriers, such as internet connectivity issues and the digital divide, can hinder access to TME services. There are also concerns regarding the quality of care, particularly for complex cases requiring physical examination or specialized equipment. Additionally, regulatory and reimbursement issues pose significant hurdles to the widespread adoption of TME. The literature suggests that addressing these challenges requires targeted interventions, including policy changes, infrastructure development, and training for both providers and patients.

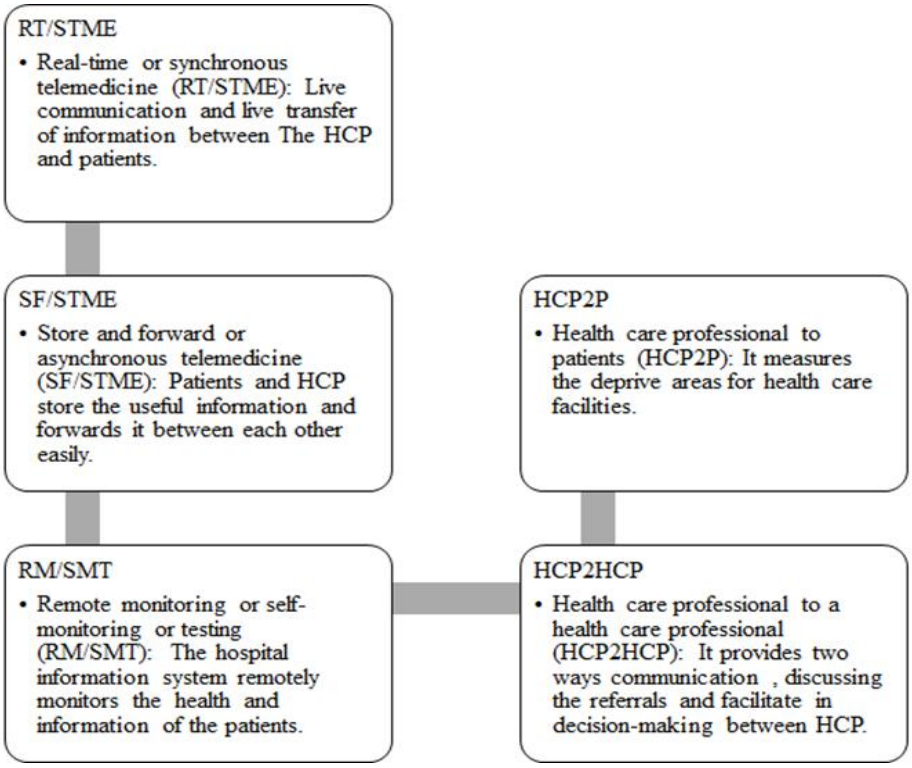
Researchers advocate for continued innovation in TME technologies, integration with electronic health records (EHRs), and the development of hybrid care models that combine in-person and virtual consultations. Recommendations also include enhancing patient and provider education on TME, improving regulatory frameworks, and conducting further research to establish best practices and guidelines for TME in otolaryngology and other medical specialties.

By synthesizing findings from existing research, the literature review provides a solid foundation for the current study, highlighting the relevance and importance of investigating the implementation and impact of TME in otolaryngology during the COVID-19 pandemic.

TME is a combination of information and communication technologies (ICTs) with medical science. TME involves a constant exchange of information between the patient and the service provider. Like SARS, CoV-2, the recent pandemic has changed the world completely. The same example for the COVID-19 situation can be considered and developing countries where a large population lives in closed contacts needs remote HCR facilities such as TME at a larger extent. Social distancing and travel restrictions have affected the economy of all the countries in the world and the HST therefore the application of TME services is in the hour of need for urban as well as in rural areas because many other diseases are ignored or unable to get treatment due to this pandemic [9].

The World Health Organization (WHO) and the USA Centre for Disease Control have recommended TME for non-chronic to chronic diseases and WHO has defined the TME as the delivery of HCR facilities where distance is a barrier by all HCR professionals (HCP) using ICT to exchange information regarding diagnosis, management, and continuing medical education for HCPs. The use of TME for providing better HCR facilities by using five types of TME [10] and this article fills the gap of using the same directives for (otlogy) diseases. Figure 1 explains the five types of TME that can be used for offering HCR facilities.

FIGURE 1: APPLICATION OF TME IN HCR [11]



Since 2020, the WHO has emphasized the urgent need for strengthening healthcare systems, particularly in underdeveloped and densely populated developing countries like India. Key recommendations include ensuring equitable access to essential medical services, ramping up investments in healthcare infrastructure, and enhancing the availability of trained medical personnel. Additionally, the WHO advocates for improved pandemic preparedness through robust surveillance systems and universal vaccination programs to mitigate the impact of health crises on vulnerable populations [11]. April and May' 2021 were disastrous periods for India showing the death rate of 4000 per day due to the new variant of COVID-19. Major causes were inhibitions for vaccination as well as unavailability along with lack of medical facilities, limited personal protective equipment and social distancing [12-14]. WHO has expressed the importance of TME in this situation to create awareness among the general population and develop a behavior towards dealing with this disease. During COVID-19: Pandemic, several services opted for virtual mode like medical services and showed the positive impact on providing medical services virtually by the application of TME. It can be made available irrespective of time, place, and socioeconomic status [15]. TME works efficiently for many types of health related issues and ENT is one of the best examples of application of TME in its management.

RESEARCH METHODS

The study employs a quantitative research method to examine the implementation of TME in otology during the COVID-19 pandemic. This method provides a comprehensive understanding of the impact, challenges, and benefits of TME in this medical specialty.

Surveys were conducted to gather data from a broader population of healthcare services receivers and patients who have been using TME as consumers in the northern region of Indian Subcontinent. These surveys collected quantitative data on aspects such as satisfaction levels, frequency of TME use, cost savings, and health outcomes. The survey results provided statistical evidence to support the qualitative findings and help quantify the impact of TME on patient care and operational efficiency.

The study analyzes existing data from healthcare records available on the public disclosure cite and TME platforms to assess the financial impact and healthcare outcomes associated with TME. These healthcare centers were

private hospitals and clinics in the northern Indian subcontinents. Data was collected from five healthcare centers in the region. However, to ensure privacy and confidentiality, the names of these centers have not been disclosed. This includes examining metrics such as the number of virtual consultations, cost savings, reduction in no-show rates, and changes in patient health outcomes. Statistical analysis is used to identify trends, correlations, and significant differences in these metrics before and after the implementation of TME.

This research is based on a quantitative method. Data is collected from 100 respondents who were patients of ENT diseases. They had experience with traditional medical services as well as TME services. These respondents have paid the health related services for traditional and TME services and have experience on financial aspects of HST.

This research employs a quantitative method, collecting data from 100 respondents who are patients with ENT diseases and have experienced both traditional medical services and TME services. A semi-structured questionnaire was designed to collect data from 100 respondents and paper based survey was conducted because the healthcare centers in the northern Indian Subcontinent did not disclose the information of their patients. There were nine semi-structured questions were designed to collect data in the traditional survey. These respondents have paid for health-related services in both settings and have insights into the financial aspects of healthcare service transactions (HST). By analyzing their experiences and financial data, the study aims to quantitatively assess the cost differences, financial benefits, and overall satisfaction associated with TME compared to traditional medical services. This approach provides a statistically significant understanding of the economic impact and patient perspectives on the use of TME in otolaryngology.
Research Question (RQ1): TME has significant benefits in the field of (otlogy).

H1: TME has direct relation with the experience of applications.

H2: TME success increases the satisfaction level and manages costs.

H3: Last experience of TME adds positive and negative impact on the benefits of (otlogy) in terms of costs.

H4: Solution of health issues through directly affect satisfaction level for cure and finances.

H5: Success Factors increase the satisfaction level.

Figure 2 shows the relationship of research objectives with the applied framework of hypothesis applied in this research.

The research does not involve human or animal subjects as it solely focuses on the satisfaction levels of patients regarding TME in otology, with an emphasis on its implications for the financial management of healthcare centers. Data was collected through direct survey, where respondents voluntarily shared their experiences without personal identifiers being disclosed, ensuring anonymity and privacy. Since no interventions, treatments, or experiments were conducted on human or animal subjects, and the study's nature is observational and analytical, it does not require approval from the National Health and Medical Research Council (NHMRC) or equivalent ethical standards. Furthermore, participant privacy was strictly maintained, and no identifying information, such as names or photographs, has been published.
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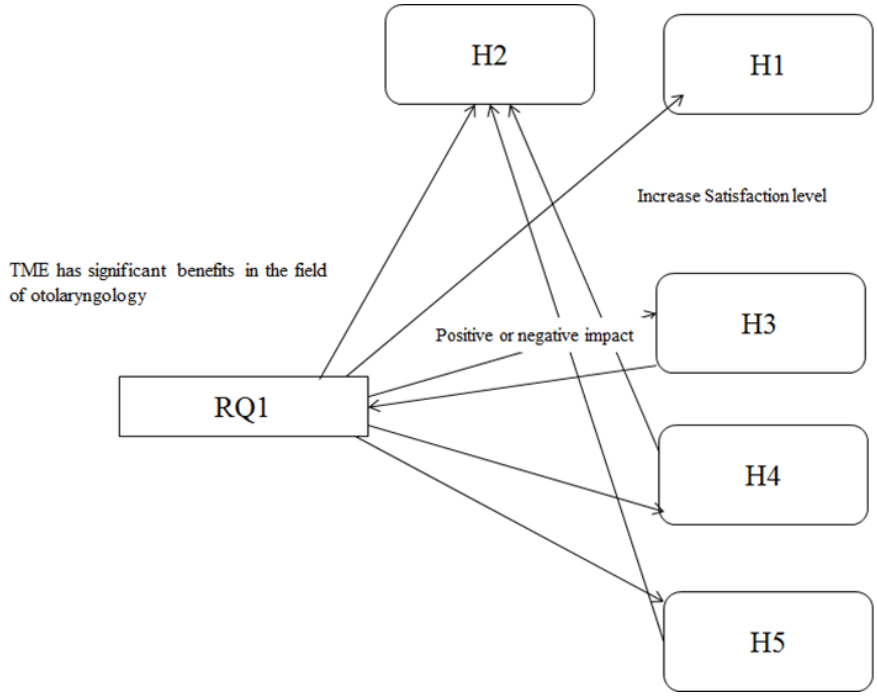
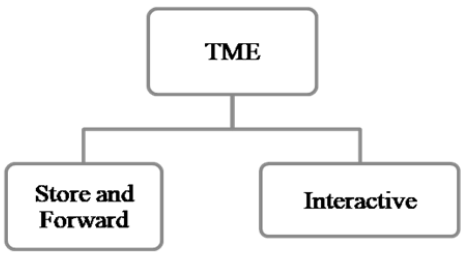
FIGURE 2. FRAMEWORK OF THE RESEARCH HYPOTHESIS AND THEIR RELATIONSHIP



DISCUSSION

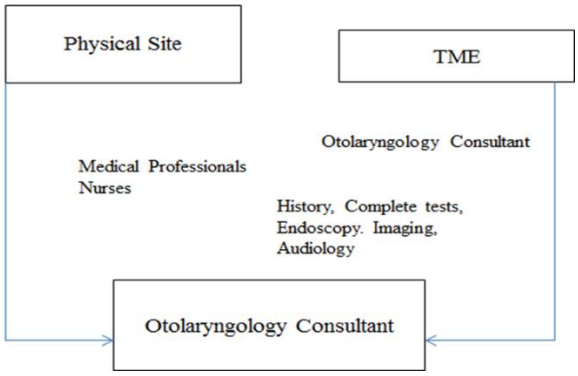
Patients of (otlogy) services have increased due to drastic spread of viral infection generally and specifically because of COVID-19, in this situation TME identified its drastic growth and implications for referring the patients remotely. TME offered consultation for various medical and health issues not only this certain medical test and follow up were also made through TME. The tests and advices were related to X-ray tests, tumor marker tests, educating patients about HCR, giving online prescription, follow up with the pharmacists and other medical specialists Most suitable methods of TME are through having two ways communication between the patients and (otlogy) specialist and method of storing the patient data and forwarding to the next related medical branch. Figure 3 shows the methods in which TME can be applied [16].

FIGURE 3. METHODS OF TME [17]



For the purpose of diagnosis and consultation (otlogy)surgeons use store and forward (SaF) and Interactive methods for facilitating the patients. In a (SaF) consultation, the referring (otlogy) surgeon collects all relevant information and forwards it to the remote specialist of the related branch or the same branch. Immediate response is not expected in this type of TME, doctors can view at their own flexi hours. Such a situation is usually under routine check or general enquiry. Also, this method is applied for the diagnosis based on any tests, clinical reports because (otlogy) specialists need time to correlate the tests reports, patient's history and complaints. There are many conditions where the SaF method is suitably applicable. Such situations are testing for diseases, taking samples and sending for biopsy reporting, screening and elucidation from the results of radiology and endoscopic procedures [18]. Figure 4 shows the working of (otlogy) by the application of TME.

FIGURE 4. WORKING OF (OTLOGY) THROUGH TME [19]



In the second method of TME which is interactive consultation, (otlogy) specialists aim to use TME to reconstruct the medical diagnosis in which the patient is available remotely for an interactive session with the (otlogy) expert. TME allows a complete diagnosis and treatment in a virtual environment.

These (otlogy) experts are not alone in the TME sessions, other experts like physicians, nurses and other related medical professionals are also connected remotely to make a full diagnosis and treatment through TME [20].

In treating (otlogy) related diseases, TME uses various technologies such as Interactive video teleconferencing (VTC) which is defined as model-based technology depending on the integration of online platforms for both patients and (otlogy) experts. Patients' attributes and cultural factors along with the applications of TME define the options of considering the use of Saf [21]. The (otlogy) specialist uses VTC for conducting the screenings, operating or even endoscopic examination remotely but in the real time situation. VTC appeared to prevent private communication with the (otlogy) specialist, it, in fact, represents a wider communication system with more medium of contact points, treatment, and information, while allowing the patients many methods to join in the consultation and treatment [19]. The current Public Health Emergency (PHE) surrounding the COVID-19 pandemic has required (otlogy) practices to rapidly change from conventional face-to-face services to the provision of TME and also commonly known as virtual or online mode [22]. The USA Centers for Medicare & Medicaid Services (CMS), of the Department of Health and Human Services (DHHS) released guidance on March 30, 2020, further broadening access to Medicare TME services so that Medicare beneficiaries may receive a wider range of services from Otolaryngologists without having to travel to a healthcare facility. Figure 5 shows the (otlogy) treatment through TME culture [23].

specialists in (otlogy) use many services of TME in the diagnosis as well as for the consultation of ENT related diseases. Telehealth (TLH) is one of them that include the benefits of TME (TM) also however there is a significant difference realized by the (otlogy) specialists between these two [25]. TLH is the use of electronic information and telecommunications technologies to support and promote long-distance clinical HCR, patient and professional health-related education, public health and health administration." [26]. Table 1 explains the difference between TLH and TM from the viewpoint of (otlogy) specialists.

FIGURE 5. (OTLOGY) TREATMENTS THROUGH TME CULTURE [24]

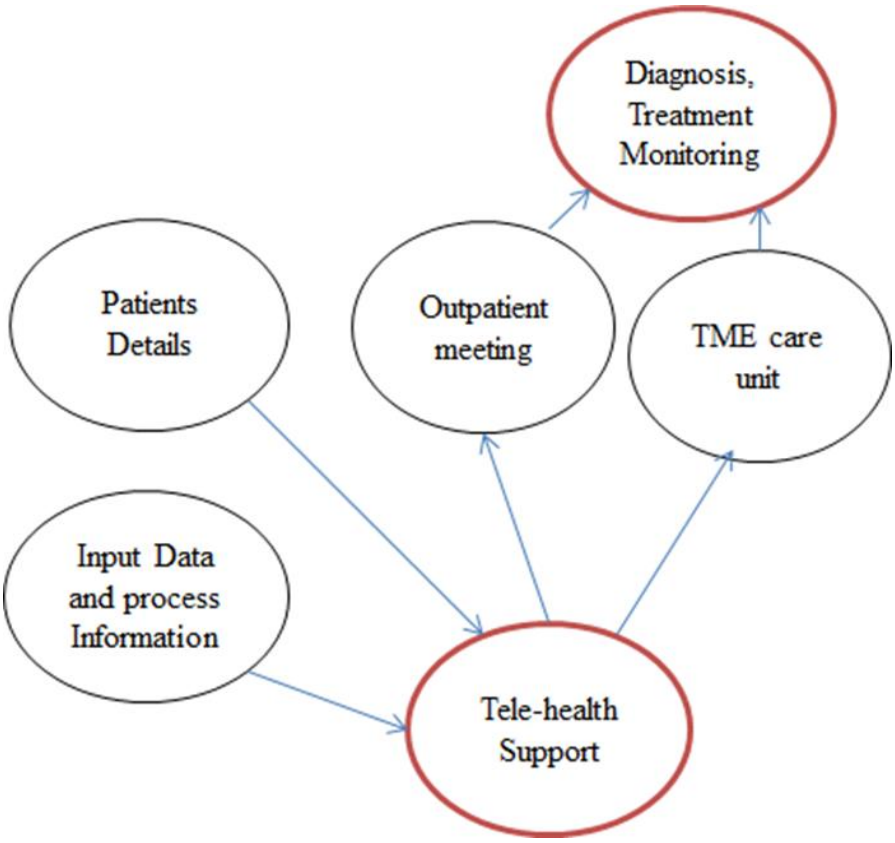


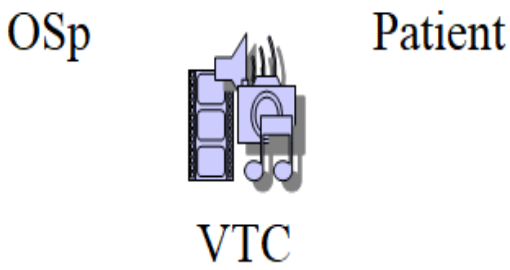
TABLE 1. DIFFERENCE BETWEEN TLH AND TM [26]

TLH	TM
Virtual healthcare services in general	Virtual clinical services.
Online non-clinical services	Online query handing
Online training and administrative meeting	Online calls/ Online appointments
Online continuing medical education	Online Review

The PHE surrounding the COVID-19 pandemic gave more relevance to TME and stressed to check the major implementation of TME for most of the medical services such as in Otolaryngic care. Many (otlogy) specialists implemented TME promptly in their practice for treating their patients by integrating the multiple practice sites to a one site and start treating simple ENT related diseases like cough, cold, allergy under the consequence and awareness of COVID-19 virus. Implementing virtual services in (otlogy) practice made important current and future clinical and financial viability also along with treating the patients remotely [27].

Specialists in (otlogy) have significantly started to use TME in this pandemic for some common ENT related problems such as speech problems. With the help of TME (otlogy) specialists could introduce Remote-Based Speech Pathology (RBSP), [20] where TME made a reliable, beneficial, and acceptable method of virtual treatment. Patients responded positively to the RBSP and speech disorders were treated under an online environment. RBSP prescribes what necessary treatment is required for the patients and how TME can be implemented. Specialists of (otlogy) make a diagnosis and make a treatment after RBSP report for the patients by conducting discussion sessions, verbal speech sessions and other speech therapy in a virtual mode. VTC as one of the applications of TME is very effective for RBSP because it allows watching the gestures, facial expressions and other physical activities of the patients and if the transmission's quality is good without buffering, this method was able to treat the speech disorder effectively. Figure 6 shows how TME works with the help of VTC for RBSP

FIGURE 6. WORKING OF VTC FOR SPEECH DISORDER [27]

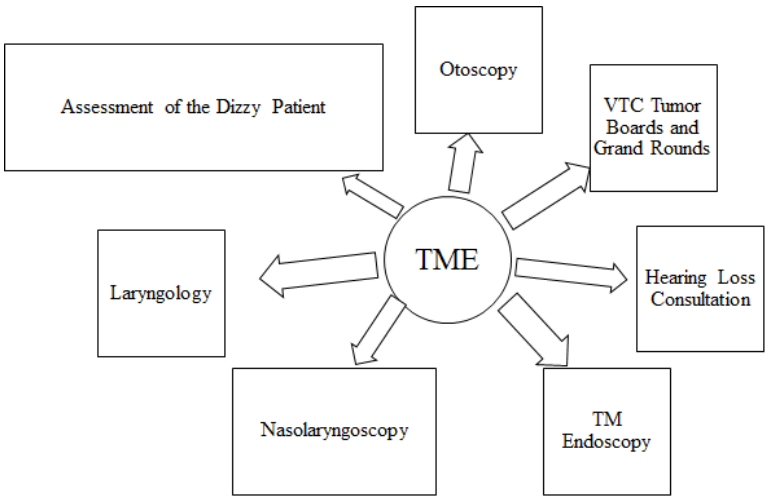


TME is successfully used for developing RBSP. There are two actors in this process Obstructive Sleep Apnea (Osp) and Patients and both are connected with each other remotely by the VTC, both actors can view each other clearly through the camera on one's monitors [28]. OSp asks the patients to adjust the camera focusing on the facial part of the patient. The focus is on the movement of mouth part and through the verbal examination monitor the speech and treat the disorder by providing speech pathology consultation for a number of psychogenic and neurogenic disorders. This session is recorded by the OSp for future consultation and other legal considerations.

Telesurgery (TLS) is another effective option for OSp for treating ENT related diseases [29]. TLS is conducted on patients through the mode of external mentoring by (otlogy) specialists who can take applied Consultation during the TLS. The process of TLS is conducted in the presence of (otlogy) specialists and other medical staff who are experts in TME and TLS operations. In the current

scenario many medical centers are extensively using TLS services and operating patients successfully [30]. VTC has also shown a positive impact on conducting (otlogy) surgery. Another important success of TME is to use TLS for operating complex surgeries like endoscopic nasal and sinus surgery. This operation is effectively done by the OSp using TLS where (otlogy) surgeons are physically present to monitor in case of emergency but the (otlogy) surgeon and physician primarily control the process in the operating room. These (otlogy) surgeons remotely attend and use VTC and TLS for the successful operation. OSp uses TLS for operating the patients by (otlogy) doctors in the operating room (control) or the attending physician proctoring from a remote site via VTC (experimental) and TLS are reported to be a very successful TME option [31]. Figure 7 shows various treatments in (otlogy) through the application of TME.

FIGURE 7. TME FOR (OTLOGY) RELATED TREATMENTS [31]



To show the success rate of TLS, patients with speech disorders were asked their intentions to opt for TLS in COVID:19 pandemics The survey was conducted in the small ENT polyclinic in the gulf area and 100 Patients were interviewed. The survey was conducted in three months and most of the patients had speech disorder and already had good experience of VTC in TME. These patients have experienced the same services in a physical environment also and could compare the costs between two HST platforms.

RESULTS

The branch of (otlogy) has been impacted widely by the application of TME and results show the positive control of its applications in surgeries as well as in consultations. Patients were able to realize the advantages of TLS in terms of cost effectiveness and receiving expertise remotely. Table 2 presents the semi closed ended questionnaire showing absolute advantages of TME and TLS

TABLE 2. QUESTIONNAIRE FOR THE TME EXPERIENCE FOR PATIENTS

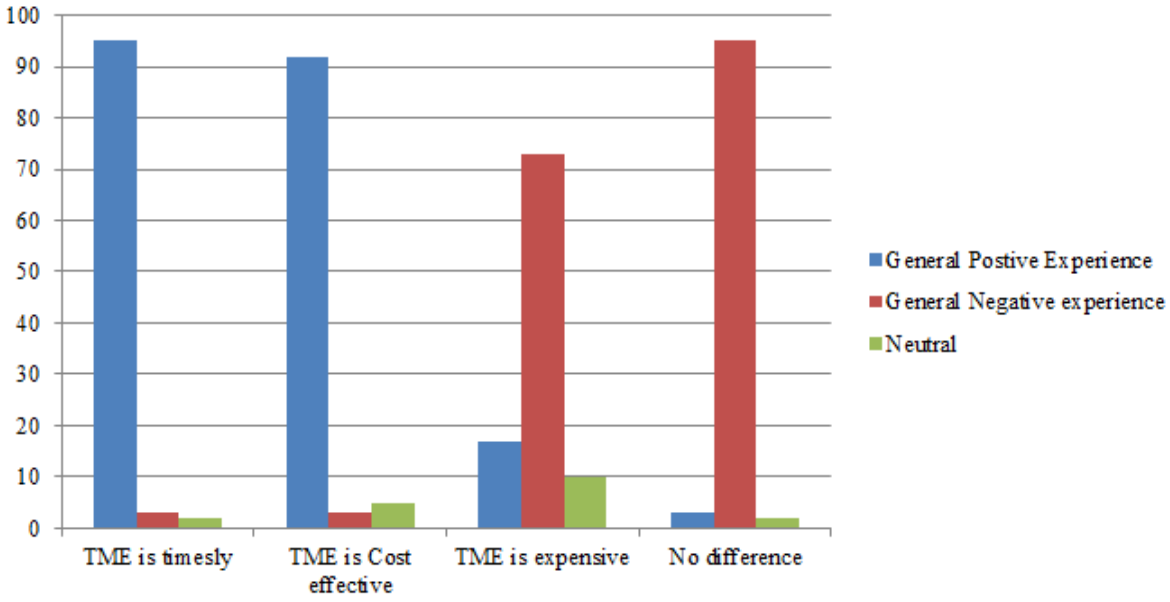
Questions	Descriptions
1	Have you experienced TME for any medical services? Was it more expensive than the physical visits?
2	Are you satisfied with TME for its services and price for the service?
3	When did you last receive medical services through TME?
4	Which health issues can be solved best with TME?
5	Is it easy to make follow up for medical services through TME?
6	Would you use TLS for yourself?
7	Would you recommend TLS to your family and friends?
8	What is the most important factor for opting TLS? Is the financial aspect the most important factor for using TLS?
9	What disadvantage do you think TME has?

H1: TME has direct relation with the experience of applications.

H3: Last experience of TME adds positive and negative impact on the benefits of (otlogy) in terms of costs.

There were 100 respondents for the survey questions. Question 1 has four parts related to the TME experience for its cost effectiveness, timely, if the services were expensive and if there were no differences in both the platforms. The responses show a high positive impact of TME for its services and cost effectiveness for (otlogy) patients.

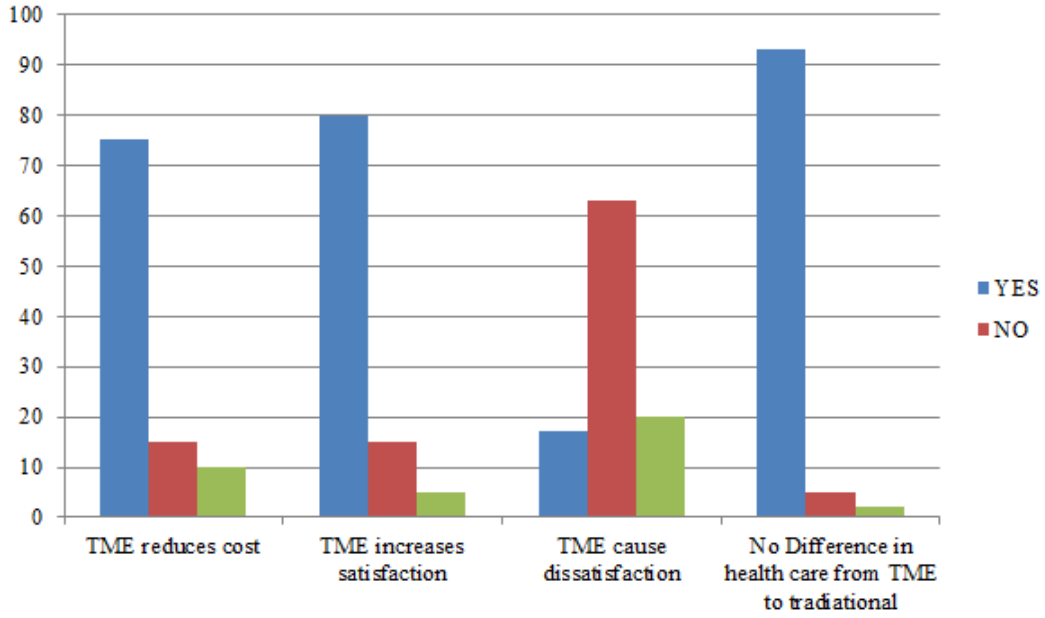
FIGURE 8. RESPONSE ON THE EXPERIENCE OF TME FOR ITS IMPACT AND COST EFFECTIVENESS



H2: TME success increases the satisfaction level and manages costs.

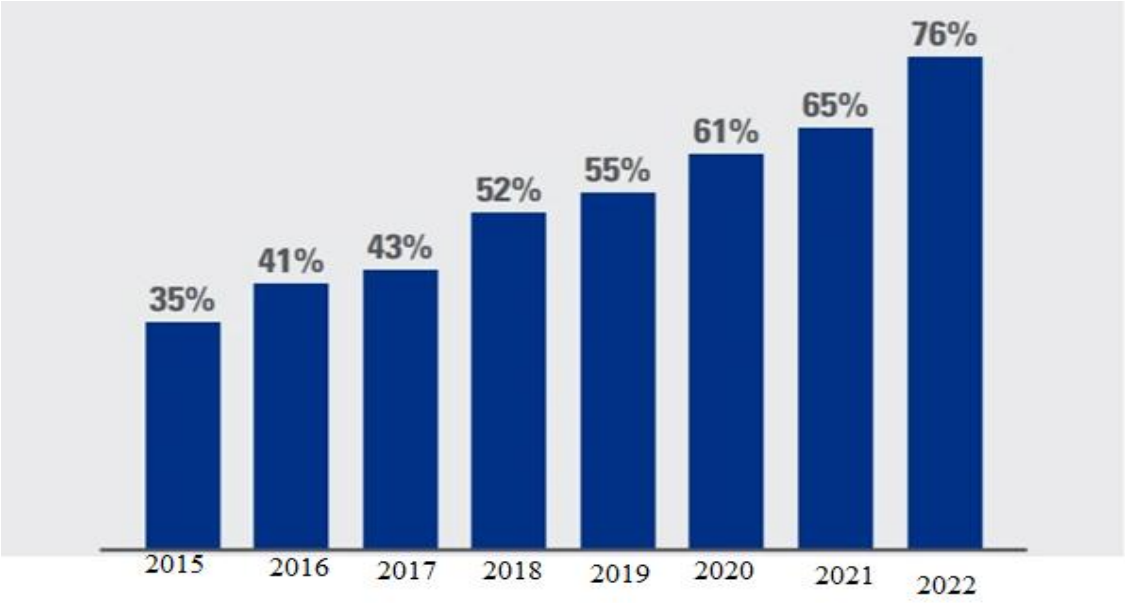
Question 2 measures the satisfaction level for TME and the results show mixed responses for TME.

FIGURE 9. RESPONSE ON SATISFACTION LEVEL FOR TME



Out of 100 respondents 85 patients were happy to use TME for their treatment but 15 percent patients were apprehensive with technology and were more comfortable with the traditional consultation.

FIGURE 10. USE OF TELEHEALTH IN HOSPITALS HAS GROWN FROM 2010 TO 2022



H4: Solution of health issues through directly affect satisfaction level for cure and finances.

Question 3 measured the last used TME for the treatments, this was an open ended question but based on the appointment dates all patients were during the COVID-19 situations. This question was very important because it measures the use of technology in a social distancing scenario. Question 4 was also open ended, although all patients were ENT related but we tried to measure their experience for general medical issues. The results show mostly patients preferred problems of speech disorders or dermatological related problems to be treated remotely. For the purpose of ease of use of TME, question 5 was asked from the patients and again most of the patients found it easy. This shows their knowhow and comfort for technology.

H2: TME success increases the satisfaction level and manages costs.

H3: Last experience of TME adds positive and negative impact on the benefits of (otlogy) in terms of costs.

For measuring the TME for the future we asked questions 6 and 7. Patients were willing to use TME for themselves but the fear factor was observed for the use for their family and friends.

H5: Success Factors also increase the satisfaction level. Patients have various reasons to choose for TME, in question 8 we asked the reasons for choosing TME for medical help. This question was close ended as we gave factors to choose for their reasons.

FIGURE 11. RESPONSE ON EASE OF USE OF TME

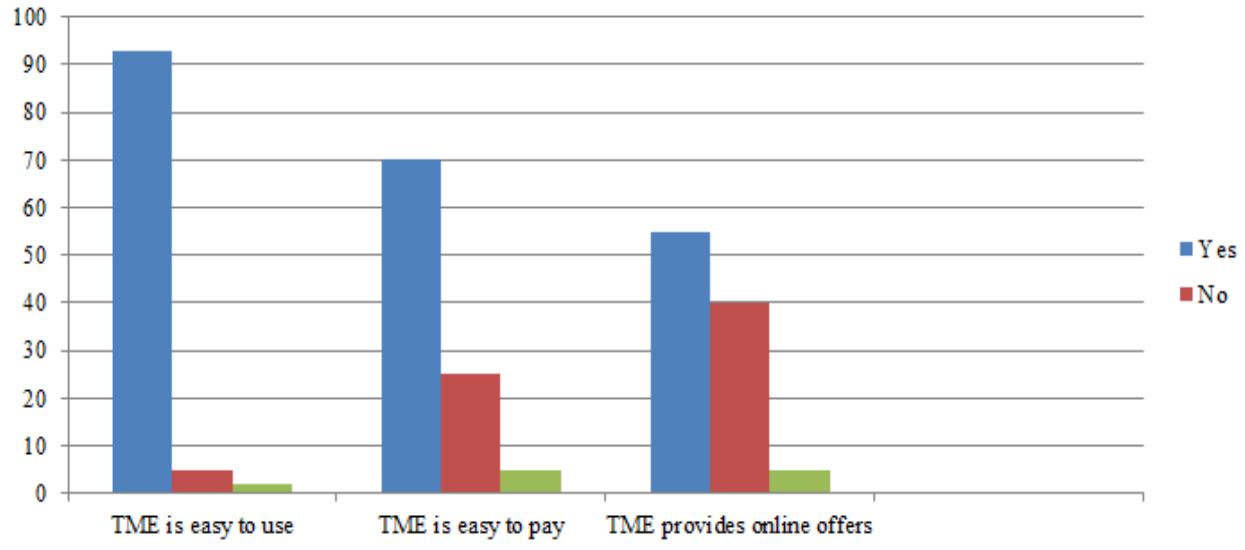


FIGURE 12. RESPONSE ON FUTURE USE OF TME

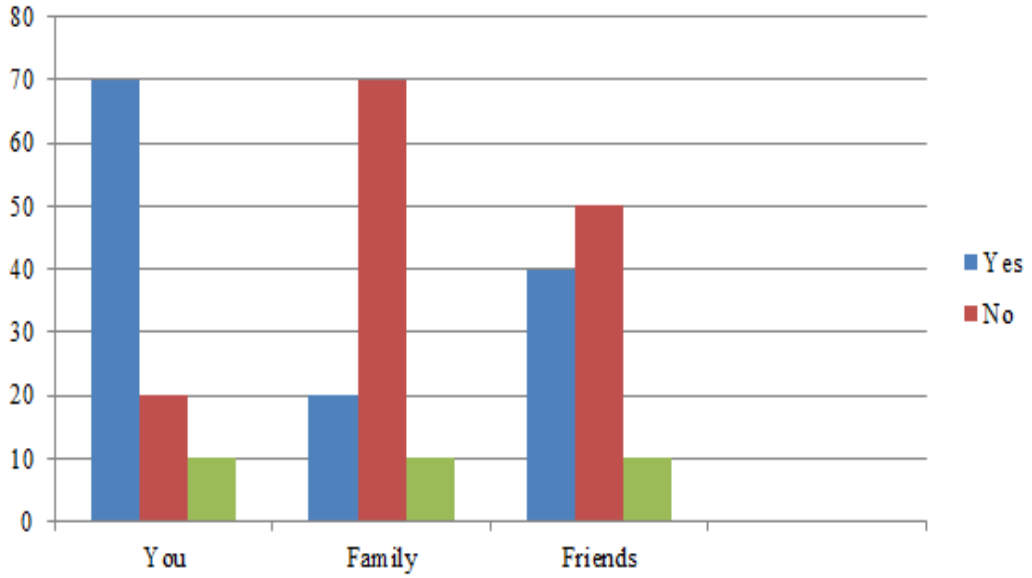
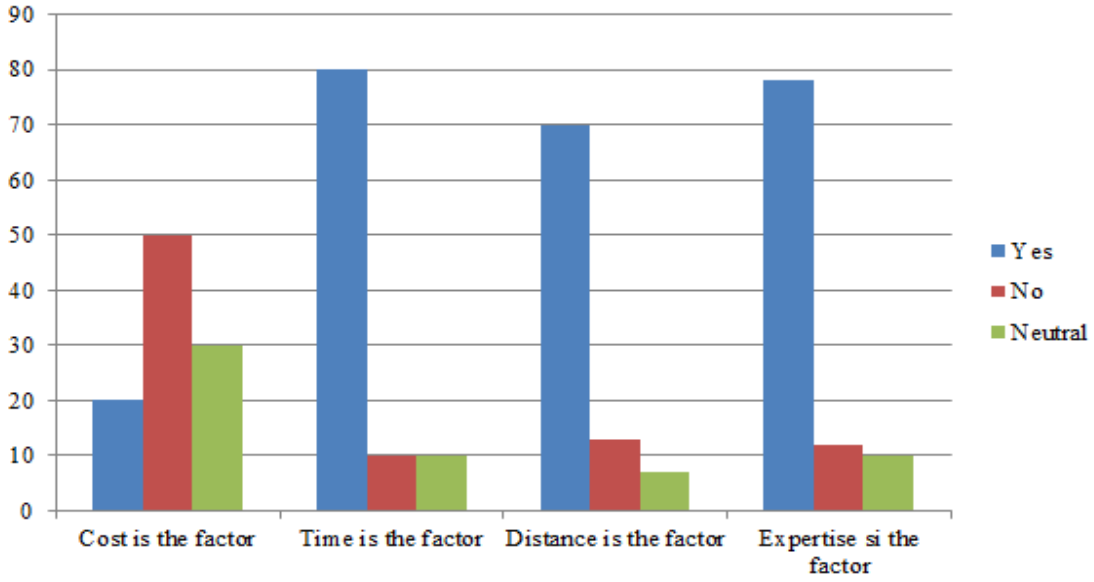


FIGURE 13. RESPONSE ON FACTORS FOR CHOOSING TME



Results show that time and expertise through online methods are the major factors for the use of TME. Questions 9 and 10 measure the problems and issues faced by ENT patients for TME and TLS, most of the patients have not experienced TLS but have information on disadvantages. These two questions were open ended questions. Respondents' express problems related to network, speed of application, and privacy and security issues in the use of TME but TLS disadvantages were more serious. Respondents expressed their fear of emergency cases and unavailability of experts in the traditional environment if any unseen problem arises.

The results of this study reveal several significant findings regarding the implementation of TME (TME) in otolaryngology (Otology) and its impact on patients with ENT diseases.

COST SAVINGS AND FINANCIAL BENEFITS

The data indicates a substantial reduction in healthcare expenses for patients utilizing TME compared to traditional medical services. Patients reported savings on travel costs, reduced need for time off work, and lower out-of-pocket expenses. The study quantifies these savings, showing that the average cost of a TME consultation was significantly

lower than that of an in-person visit. Additionally, healthcare providers also experienced reduced operational costs, such as lower overheads related to office space and administrative staff, leading to an overall increase in financial efficiency.

PATIENT SATISFACTION AND ACCESSIBILITY

Patient satisfaction levels with TME services were notably high. Many respondents appreciated the convenience and flexibility of virtual consultations, which allowed them to receive timely care without the need to travel. The study found that TME was particularly beneficial for patients in remote or underserved areas, enhancing accessibility to specialized otolaryngology care. This improved accessibility also contributed to better patient outcomes, as it enabled more consistent and frequent monitoring and management of ENT conditions.

COMPARATIVE HEALTH OUTCOMES

When comparing health outcomes, the study revealed that TME provided comparable results to traditional in-person consultations. Patients reported similar levels of improvement in their conditions, and healthcare providers were able to effectively diagnose and manage ENT diseases using TME platforms. This finding underscores the viability of TME as a reliable alternative to traditional care, especially in situations where in-person visits are challenging or risky.

CHALLENGES AND AREAS FOR IMPROVEMENT

Despite the positive outcomes, the study also identified several challenges in the implementation of TME. Technical issues, such as connectivity problems and difficulties in using TME platforms, were common barriers for some patients. Additionally, there were concerns about the limited scope of physical examinations that can be conducted remotely. These challenges highlight the need for ongoing technical support, patient education, and potential advancements in TME technology to enhance the user experience and diagnostic capabilities.

Overall, the study accomplishes that TME in otolaryngology offers significant financial and practical benefits for both patients and healthcare providers. It recommends broader adoption of TME practices, with a focus on improving technological infrastructure and addressing the identified challenges. The study suggests that health centers should continue to develop and refine TME strategies to maximize the benefits of remote care, ensuring that patients receive high-quality, accessible, and cost-effective healthcare services.

Some patients were technologically updated, they knew about methods of preserving security and privacy. Also, they have good experience on using virtual private networks and using encrypted data.

OSp are adapting TME for treating ENT diseases and are encouraging other medical fields to use the technological based treatment to a great extent. They suggest TME, VTC, Virtual appointments and visits especially in the current scenario.

The results show that TME has significant benefits in the field of (otlogy) and other medical field also. The satisfaction level for TME is based on the outcomes and benefits received by the patients in those specific services. The results show that last experience is more remembered for future use of TME in (otlogy). If the results are positive, patients are more encourages using TME for (otlogy) and other medical help and if the results are not satisfactorily, patients are reluctant in using in future. Four major factors are counted for the application of TME for (otlogy). Cost and distance were important factors but deciding factors for the application of TME for (otlogy) were experience and time.

CONCLUSION

TME applications are being developed and used worldwide in the many fields of (otlogy). As telecommunication and audio-visual technologies advance, these applications become more exacting and cost effective. TLS is still at the initial stage due to psychological factors and mistrust on technology for surgeries. There are many reasons for the patients to choose the TME and one of the most important reasons is to provide cost effectiveness, reduce price for medical consultations and other costs related to visiting personally to the site of clinics and hospitals. Also, TME helps hospitals to reduce the maintenance costs for managing the patients and their attendants.

The study concludes that TME (TME) in otolaryngology (Otology) offers substantial financial and practical benefits, significantly reducing healthcare costs for patients and operational expenses for providers. Patients report high satisfaction levels due to the convenience and accessibility of virtual consultations, particularly in remote areas. TME provides comparable health outcomes to traditional in-person visits, affirming its reliability as an alternative care

model. However, challenges such as technical issues and the limitations of remote physical examinations need to be addressed. The study recommends continued development and refinement of TME strategies to enhance patient care, maximize financial efficiency, and ensure broader adoption in the healthcare system.

OSp have understood the benefits of TME, VTC and TLS and are trying to implement it in treating ENT diseases. Also, OSp stresses on maintaining legal and ethical rules while working on TME. In future OSp will focus on TLS for head and neck surgeries. The success rate of TLS will encourage patients to choose TLS and help in overcoming their fears and apprehension.

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