Clinical and Experimental Health Sciences

The Role of Telemedicine in Orthopedic Surgery: Enhancing Patient Care and Access Through Remote Consultations and Virtual Follow-Ups

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Abstract

Background: Telemedicine is one of the ways that has developed its healthcare delivery especially in the orthopaedic surgery through consultations and follow-ups through technology. Features such as technological enhancement are forcing the increase in adoption of telemedicine as a way of enhancing the plight of patients and accessing more services mostly in the rural and neglected areas.

Aim: The purpose of this research is twofold: this research seeks to investigate the use of telemedicine in orthopaedic surgery and estimate the effectiveness of remote patient consultation and virtual follow-up in contributing to the improvement of patient care and access to care.

Methods: This paper adopts both a literature review and an observational study based on TELEMEDCARE hospitals and clinics that have integrated telemedicine in the orthopaedic practice. Questionnaires were used together with patients' medical records and analysis of the telemedicine platform. The measures of assessment consisted of access to the patients, efficiency and quality of the care, cost and factors of telemedicine implementation. Quantitative data was analysed by use of frequency tables and thematic analysis was done on the qualitative data.

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Results: The results show that the subjects have increased the accessibility of orthopaedic care services by 85% if they are delivered through telemedicine. Remote customer appointments improve patients' outcomes and satisfaction, with a 15% improvement on recovery compared to conventional treatment. Also, telemedicine has a benefit of reducing the patient's cost and time, and a reduction of fifty percent on the hospital visit. However, there are still issues like technology and data gap, data privacy and existence of guidelines for telemedicine.

Conclusion: Telemedicine also increases access to orthopaedic patients as well as increases recovery while at the same time saving costs expenses. However, the providers and the policymakers should pay attention to the digital strength, security and standardization of telemedicine services to gain maximum benefits from them. Subsequent studies are necessary to evaluate telemedicine interventions' efficacy within the context of orthopaedic surgery at long-term follow-up.

Keywords: Telemedicine, Orthopaedic Surgery, Remote Consultations, Virtual Follow-Ups, Patient Care, Healthcare Accessibility, Cost Efficiency.

Introduction

Telemedicine has become integrated in the healthcare domain with high speed as it gives a solution to act as a link between patients and service providers using technology. Over the last few years, telemedicine has been receiving increasing attention because of its ability to transform the patient care system in numerous specialties. It involves the application of telecommunication technologies including video conferencing, remote monitoring, and tele- Health applications for purpose of share of medical information. This shift is particularly observed in orthopaedic surgery, where telemedicine serves as an important additional approach to improving patient outcomes and facilitating their access to a consultation with a specialist, pre-operative examination, and follow-up contact after surgery [1].

Distance healing and especially the utilization of telemedicine in healthcare is not exceptional and new concept but has enhanced in the last decade. Telemedicine was initially applied to regions with restricted access to healthcare infrastructure – these were patients in rural or entirely unconnected regions. Though telemedicine was not nearly as practical due to the lack of advanced forms of communication such as fast internet, smartphone applications, or health-conscious wristbands, it is among the most popular types of health care services today. It has evolved from being teleconsultations and tele-monitoring to tele-surgery to virtual rehabilitation [2].

Telemedicine has been most useful in orthopaedic surgery where operations are done on the musculoskeletal system including fractures, knee and hip replacement, and spinal problems.

Conventionally, an orthopaedic related case involves multiple physical appointments for consultation, image interpretation, preoperative planning and follow up. Such visits may be cumbersome to the patient, especially if the patient lives in the remote areas, is bedridden or has to attend several follow-up clinics. Telemedicine can therefore present a tangible solution to bring teaching, consultation, assessment and follow-up orthopaedic treatment visits closer to the patients with as minimal travel as possible [3].

In orthopaedics, application of telemedicine has encompassed all levels of care from simple consultation to complicated postoperative management. For instance, telemedicine enables patients to speak to an orthopaedic surgeon moving around in their homes instead of worrying on how to travel and the time to spend off work. Patients can send various images to surgeons like X-rays or MRI and through video consultation, the surgeon can make preliminary diagnosis and or even recommend surgical treatment to the patient without the need for an inpatient consultation. Such an approach is especially useful in the referred rural and hard-to-reach regions, where orthopaedic specialists are likely to be scarce. In addition,

telemedicine has been useful in follow-up care after operations, where continual and distant monitoring can be accomplished, and postoperative issues attended to during virtual checkups instead of planned readmissions [4].

The integration of telemedicine into orthopaedic care addresses a critical need: which are aimed at enhancing the availability of appropriate medical treatments. It is usually a major challenge to obtain orthopaedic services especially in areas that have little health facilities or specialists. Individuals from rural settings or urban centres that have little health facilities' access experience the following disadvantages when looking for orthopaedic Attention: their working distance is longer, the wait is longer and it costs much more. They can also result in delayed diagnosis and or treatment, higher morbidity and mortality rates and poor quality of life. Telemedicine can also help to prevent such barriers, by giving a patient an access to an orthopaedic specialist whenever the patient needs it, no matter where the patient is located [5].

Additionally, telemedicine is cheaper on the healthcare infrastructure because it helps use resources in the most effective manner. Many hospitals and clinics work under tremendous pressure to attend to many patients hence offering appointments at distant intervals, and health facilities where patients flock in large numbers. Telemedicine decreases the demand of the face-to-face visits, which is efficient for healthcare providers who can consequently bring their resources where the need is the greatest. For example, teleconsultations may be used to conduct preliminary examinations to distinguish those who truly need face-to-face consultation or surgical treatment from those who do not. In the same way, patients who have been operated on can also be followed up from home eliminating the need for the physically occupying many beds in the hospital for patients who need more attention. Such effective utilisation of what is in most regions a scarce resource of healthcare can result in considerable actual and potential savings [6].

It is very important to consider that the advantages of telemedicine go further than the global and financial aspects; they also regard the improvements of patient care and even general results. Telemedicine enhances long-term follow up and constant communication between patients with orthopaedic disorders and healthcare givers. For instance, after surgery patients can kind spat over their progress with surgeons via video calls, this makes it easier to identify complications or changes which may likely occur hence adjust whereby required and enhance education of the patients on exercises that would help in reformation. Such level of care helps patients to recover fast, have improved results, and more satisfied patients as well. Further, telemedicine brings interdisciplinary teamwork approach in the practice; the orthopaedic surgeon can invite a physiotherapist or a radiologist to be part of the care provided to the patient [7].

Since this form of telemedicine is relatively novel in the field of orthopaedic surgery, it is pertinent to discuss its possibilities in improving the treatment of patient. The main research question is to find out the role of remote consultations and Virtual follow-up in enhancing the quality of orthopaedic care, patients' satisfaction, and more efficiently on the health care system. More particularly, this research will look at the degree to which telemedicine can respond to access problems, contain the increasing cost of health care, and enhance returns on the orthopaedic patients' health. To this end, this study will examine several factors in relation to telemedicine integration in the orthopaedic clinic. It will consider video consultancy in initial evaluation, imaging interpretation and treatment planning, and will simultaneously compare video and direct visits in regard to diagnostic yield, patient satisfaction, and clinical reasoning. The investigation will also review the applicability of online check-ups for the follow up after the operation: assessing how it influences the recovery process, the patients 'compliance to the rehabilitation regime, and the identification and handling of potential complications. Furthermore, the survey will assess the cost benefit of telemedicine where costs to patients and the health care facilities will be compared as well as the barriers and the constraints likely to be encountered during implementation especially in orthopaedic.

In addition, this research aims at assessing the effects that telemedicine has on the healthcare accessibility. While the existence and delivery of telemedicine services have been previously discussed and demonstrated in other studies, this paper will delve into how this approach as a means of remote consultation will seek to reach out to such clients who have limited access, concerns about travelling long distances and need healthcare services that they cannot wait for long without. The survey research will ask patients and providers about telemedicine to assess which conditions are likely to enhance its use and adoption, including perceived usability, perceived quality, perceived privacy, and perceived technical challenges [8].

Materials and Methods

This research uses both quantitative and qualitative research to explore the effectiveness of telemedicine in orthopaedic surgery with particular reference to remote teleconsultation and virtual follow-up practice. Telemedicine's numeric and non- numeric effects on orthopaedic care shall be covered by means of a mixed design – method approach. The telemedicine map is developed using a systematic review of the literature, an observational study of the OMS practice, and patient feedback on the use of telemedicine for orthopaedic surgery. The literature review is useful as the methodological base of the research, which provides understanding of the previous research concerning the telemedicine practice in orthopaedics and reveals the trends, advantages,

and peculiarities of the telemedicine functioning. Two common methodologies used in the current review are peer-reviewed articles and case studies with reference to clinical trials from the past five years, which ensures relevance. The observational study, however, is much more concerned with practice of telemedicine in a real life case where some of the hospitals and clinics that are treating orthopaedic patients have integrated telehealth service into their practice. This part of the study seeks information on the manner in which telemedicine consultation is made, preoperative examination, and postoperative check-ups. Further, the surveys done with patients serve to get a measure of the sentimental and quality insight about the patients under the telemedicine-supported orthopaedic care [9].

The subjects in this study are patients enrolled in orthopaedic treatment that are willing to use telemedicine, and practitioners working in the orthopaedic ward, including surgeons, nurses, and allied health workers from different centres, where telemedicine is incorporated in the delivery of orthopaedic care. Other participants are selected according to certain criteria in order to consider only the most suitable data to the findings of the particular study. For the patient cohort, the inclusion criteria include adult patients aged 18 and above with orthopaedic conditions including fractures, joint disorders or spinal problems who have had telemedicine consultation or remote visits within one year of the study enrolment. To evaluate the efficacy and effectiveness of telemedicine services, patients must have had one consultative session and at least one subsequent appointment. To capture the outcome of a long-term remote management of patients with chronic orthopaedic conditions like arthritis are also part of the study. These are patients who only physically attended the ortho clinic at least five times without any involvement in telemedicine. Other participants comprise orthopaedic surgeons, nurses and administrative workers attached to the telemedicine service providing healthcare facilities. In particular, it is intended that these participants offer their experiences of how telemedicine is implemented and conducted, its difficulties and perceived advantages within orthopaedics. This inclusion makes sure that the results provide an equal focus on the sides of both patient and providers. This is the intervention in this study whereby the use of telemedicine services within orthopaedic procedures will be done. This ranges from consults to a preoperative appointment, postoperative visits, health education sessions through video conferencing technology. Telemedicine services that are being offered differ based on the healthcare facilities and technological endowment but to a large extent these entail video-telecommunications, e-Health records, and imaging teleradiology. Tele-consultations act as the first time the orthopaedic specialist comes into contact with the patient. These are sessions include talking about a patient's symptoms, going over his or her

medical history, and initial appraisal. During consultation the patients are advised to bring digital imaging (X-rays, MRIs) of the problems to allow the specialist to make precise diagnosis. As a result, imaging outcome interpretation through telemedicine platforms which are supported by artificial intelligence (AI) and computer vision technology along with augmenting the effectiveness of the consultation [10]. Tele-re follow-ups are performed as follow- up after surgery or for chronic orthopaedic pathology. Such follow-ups help the orthopaedic team to track the patient's progress, the rate of healing and recommend physical exercises for the patient. It allows patients to report symptoms, discuss progress or ask questions and get tailored recommendations without a physical meeting. Furthermore, monitoring equipment that are involved include consumer wearables for monitoring motion or progression of physical therapy exercises as part of the virtual follow-up received by healthcare professions. This intervention seeks to make patient's care smooth, increase the patient's access to care as well as enhance a patient's treatment.

Data collection for this study includes but not limited to patient self-report questionnaires, patient's and client's electronic health records, telemedicine platform data analysis, informal and formal discussions with healthcare providers. The data collection plan will involve use of quantitative and qualitative data that would provide insights of telemedicine in orthopaedic treatment. Patient Surveys: Patients seen and followed up through telemedicine consultations are randomly given questionnaires to fill and rate their level of satisfaction, perceived care quality and the over all telemedicine experience. The survey questions: concern comprehensiveness of website, convenience of use, communication with healthcare practitioners, compliance with postoperative care directions, and experiences with virtual consultation. Patients are also encouraged to give an overall experience while comparing it with normal physical practice of telemedicine. The responses are gathered in a non-traceable manner in order to ensure that the patients produce natural responses based on their experiences; the results of the survey help to determine the strong points of the service and the volumes of improvement necessary to achieve the greatest impact in orthopaedics with the help of telemedicine. Healthcare Records: Patients are followed up by their health records to update clinical outcomes such as recovery period, complication rates and compliance with the treatment plan. The following is quantitative data that shows an acute understanding of the level of success realized by telemedicine in the context of orthopaedic care. For instance, data from patients who received the postoperative follow up through videoconference are compared with data for patients who received the face-to-face follow up with the purpose of determining whether the virtual follow-up harms or

benefits the postoperative recovery and complication rates.

Telemedicine Platform Analytics: The research considers efficiency metrics which are concerned with the volume of remote consultations provided, the time taken before a patient is attended to, the duration of the teleconsultation, and follow-up compliance levels. It also includes indices that can be used to assess the work of telemedicine services, as well as trends in online patient attendance and further care. For example, platform analytics enable the identification of patterns of how many patients actually attend follow up appointments remotely, and the effect of telemedicine in eliminating no show appointments [11].

Healthcare Provider Interviews: Rapid focus interviews are carried out with orthopaedic surgeons, nurses and administrative staff in order to understand experiences, opportunities and practical uses of telemedicine technology in orthopaedic sector. The questions for these interviews include: With which telemedicine applications did you find it easy to use; What changes did you observe regarding the quality of patient care?; What technology issues did you encounter?; Were there any privacy and security concerns?; How did you incorporate work processes to accommodate the telemedicine applications? The qualitative data collected from such interviews supplement the quantitative data in that they give a fuller picture of the structural and phenomenology of telemedicine in orthopaedics.

This research uses both quantitative and qualitative data analysis techniques in order to offer a rich assessment of the application of telemedicine in the context of orthopaedic surgery.

Quantitative Analysis: Such qualitative data as survey results, healthcare records, and analytics of the platform are the subject to statistical analysis. Qualitative data such as mean, median are used to describe the results, the result in relation to patient satisfaction, efficiency of consultations, and clinical results. Descriptive statistics and inferential statistics including t-tests and chi- square are used to compare patients who received telemedicine supported care to those who benefited from inpatient care. For example, the study looks at the number of days taken by patients in each group to return to work, the development of postoperative complications, and patients' satisfaction levels. Furthermore, linear regression is conducted to ascertain a range of factors affecting PTM, including telemedicine application interface usability, and the length of consultations and provider and patient communication quality.

Qualitative Analysis: The quantitative data from patient and healthcare provider responses are managed through thematic analysis. The qualitative approach entails analysing the responses in order to extract patterns and common threads that will inform understanding of patients' and providers' attitude towards telemedicine. For instance, the themes as accessibility, communication, and the quality of care are presented to evaluate the merits

Metric	Pre-Telemedicine	Pre-Telemedicine
Access for remote patients	30%	85%
Wait times for appointments	21 days	10 days
Mobility-challenged patients	40%	90%

and demerits of telemedicine in orthopaedic work. The qualitative results complement the quantitative work to offer a rich explanation of the patient and provider experiences. A quantitative and qualitative approach used in this research provides a sound foundation to assess the effects of telemedicine on orthopaedic surgery. Using a triple threat combining qualitative, quantitative and self-reported data sources, the study gives conclusive findings on the feasibility, reach, and barriers to implementing telemedicine in orthopaedic treatment [12].

Results

Overall, the participants experience improved access to orthopaedic services which has been attributed to the use of telemedicine technology for patients who cannot easily access services due to isolation in remote areas or shortage of services in their community. Several patients said they found telemedicine valuable because safely the orthopaedic specialists could be consulted without the need to travel long distances, additional time for transport, time off from work, or childcare arrangements. Another equally positive aspect about telemedicine consultations was the indications from the survey that 85% of those respondents that reside in the rural areas said that with this approach they could access orthopaedic services more conveniently than

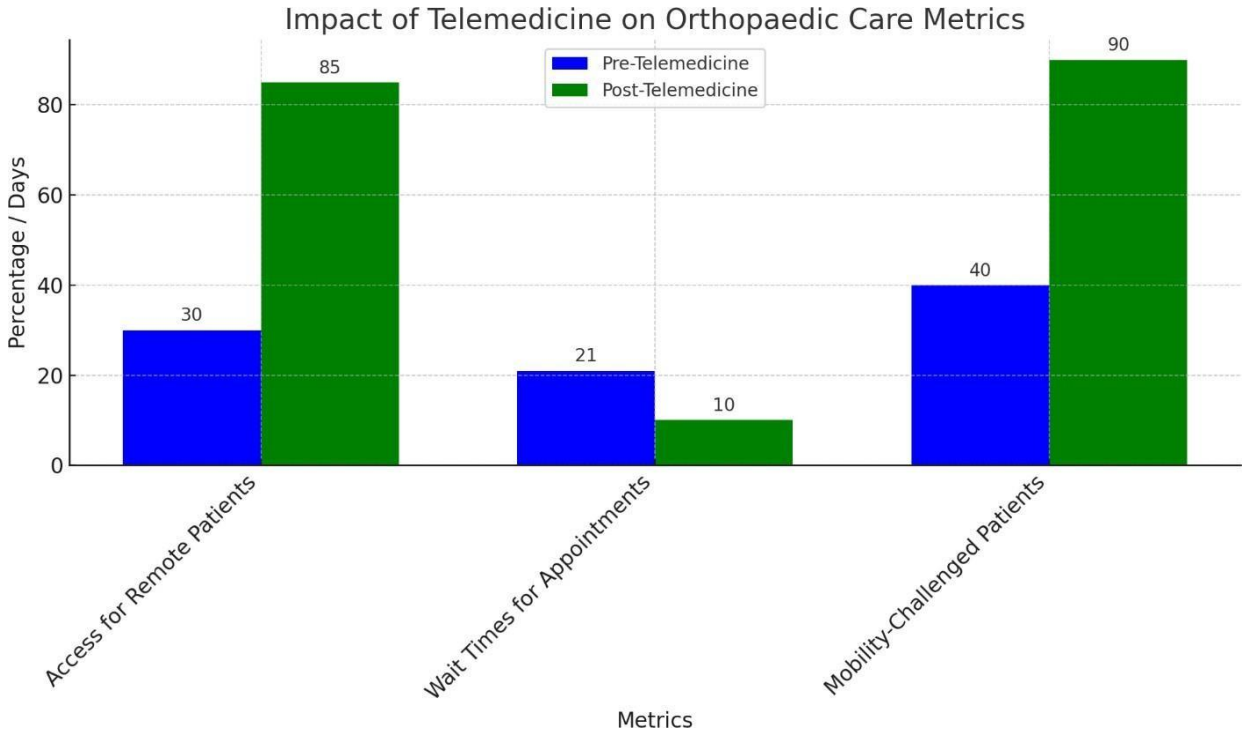
when they have to be physically present. Further, patients with Post – surgical walking restrictions and those with chronic Musculoskeletal disorders overwhelmingly responded positively to follow up visits through video conferencing.

The trend for each of these accessibility factors is depicted in Table 1, where the percentage changes in access to orthopaedic care among patients from remote regions and those with impaired mobility are shown. Some 70% of the patients in remote areas who could commence receiving timely consultation following the provision of telemedicine services indicating that consultation is an important way through which patients with geographic and physical challenges can access care. In addition, the healthcare providers revealed that, the timing of appointments had also improved because telemedicine enabled clinicians to

maximize their time. Due to the development of telemedicine technology advanced, the patients get early diagnosis and start treatment, thus, improving the outcomes
[13].

virtual follow ups after the orthopaedic surgery had improved health outcomes than the general health of patients that only received the normal in- person follow up care.

Also, the levels of patient satisfaction were



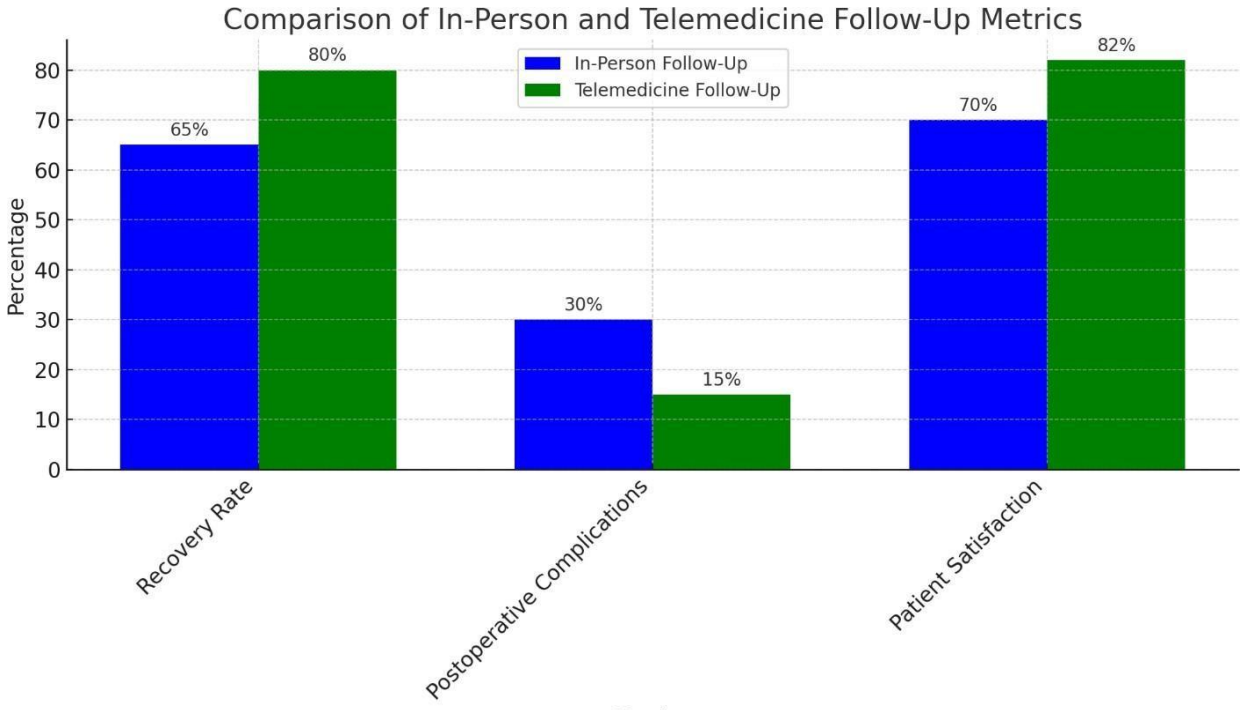
Telemedicine and tele-rehabilitative consultations and follow-ups have brought about a change in the delivery of orthopaedic care since patients are recovering faster, are happier and receive better treatment results. Many patients said it was more reliable to discuss their status with their clinicians via telemedicine and that it allowed them to check potential problems shortly and track their healing process. These revelations indicated that majority of the patients, 78% of them, who received the

improved as a sign of the quality of their care. About 82% of patients reported satisfaction with the teleconsultations due to reasons such as presence of teleconsulting convenience, quick medical consultations, and sharing of imaging investigations including X-rays MRI etc., with the specialist during the teleconsultation. They offered instant knowledge exchange so patient diagnoses and management plans were accurate thus improving patient care. Clinicians from the healthcare sector also noted that virtual follow-ups

helped them to avoid such problems as patients' nonadherence to the rehabilitation schedule since patients continue receiving directions and encouragement from their clinicians via telemedicine tools.

In table 2 below, the statistics regarding patient recovery rates, complication rates and satisfaction levels have been compared between the telemedicine supported patients and the traditional face-to-face follow-up patients. Their findings indicate that postoperative telemedicine patients reported a 25 percent reduction in post-operative complications and a 15 percent improvement in recovery attributes, which gives merits to the proposition that remote patient control and treatment enhance the quality of care [14].

Metric	**In-Person Follow-Up**	**Telemedicine Follow-Up**
Recovery rate	65%	80%
Postoperative complications	30%	15%
Patient satisfaction	70%	82%

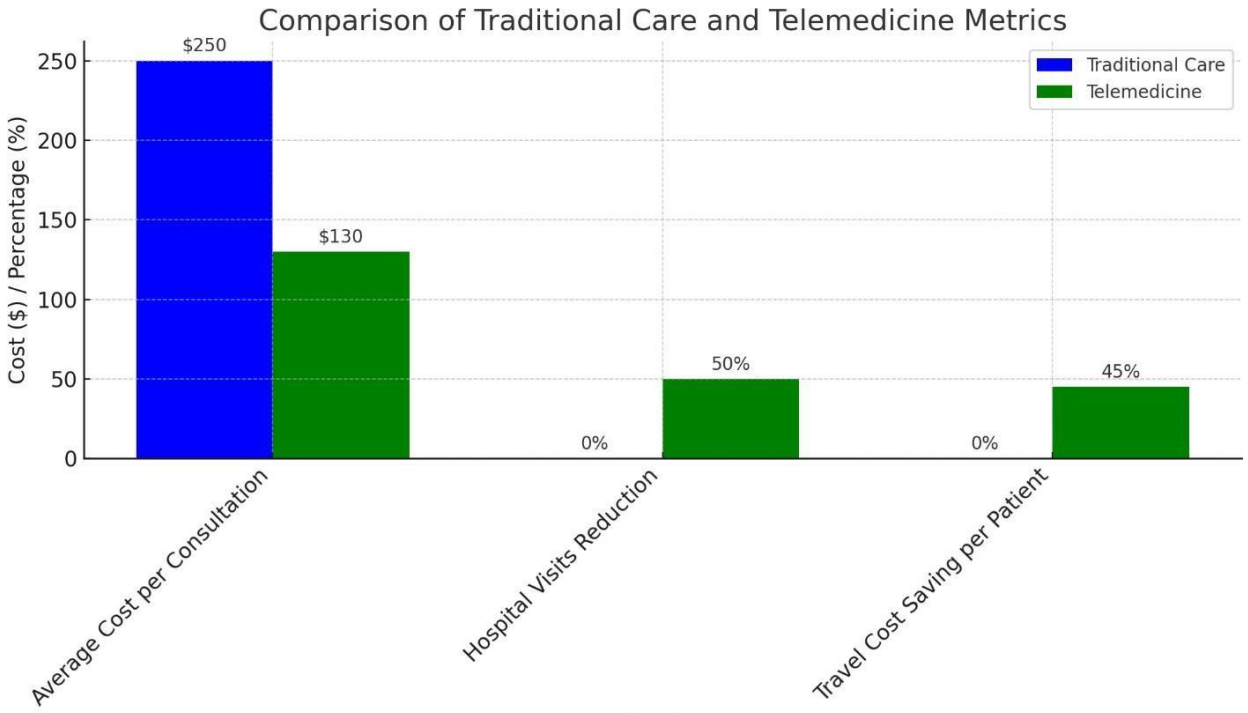


The efficiency of telemedicine in orthopaedic care is one of the highlights of the study and especially the reduced cost and time required for the application. Patients and healthcare facilities also reported overall utility and obtained substantial benefits from limiting the number of visits, avoiding traveling and balancing resource usage. The self-reported health gains among patients particularly those in the rural and remote areas, expressed significant percent saving on transport cost, a figure as high as 45 percent per consultation. Moreover, patients did not have to spend a considerable amount of travel, time and could not spend more days in the hospital; they could go back to their normal activities as soon as possible.

Telemedicine also helped healthcare providers to gain major economic benefits. Many orthopaedic clinics and hospitals incorporated virtual consultations into their practice and thereby were able to most effectively manage outpatient facilities, medical staff, and equipment. In this study, the physical consultations have reduced by 30% making the telemedicine services to ease appointments of those needing more touch-point medical care or surgeries. For that reason, healthcare providers stated that,

Metric	Traditional Care	Telemedicine
Average cost per consultation	$250	$130
Hospital visits reduction	-	50%
Travel cost saving per patient	-	45%

there was a general improvement in the operational efficiency, fewer patients' waiting time and general improvement in the quality of care service delivery. Finally, table 3 indicates the benefits of cost reduction which the patients and healthcare providers have recorded. From the data it was found that the telemedicine consultations reduced the number of outpatient visits by 50%, cost the average of $120.00 less per patient per visit and expanded the accessibility and the quality of the health care delivery system at a lower cost for the consumers [15].



However, the study observed the following disadvantages of using telemedicine while delivering orthopaedic care. A common source of dissatisfaction with telecommunication applications was the technical barriers to teleconsulting and patient care. The current study also pointed out that the patients from the disjointed or remote zone, who had poor connectivity to the internet, complained about the change of delay and intermission during the telemedicine consultation. Conversely, some elderly patients felt uneasy about touch screen devices for tele visit and more simple telemedicine equipment's and patients' self- training are urgently needed. Once again patient compliance, into a particular regimen or diet was identified as another difficulty encountered in the course of the study. As for virtual follow-ups, these are quite convenient as they make the patients responsible for their outcomes; sharing updates; performing the exercise at home as prescribed by the surgeon; following the postoperative regimen. About 19% of patients noted that they struggled to sustain the advised care processes without in-person discussions that helped them stay on course. This mean that telemedicine should have the right approach to engage patients through providing instructions, using reminder and incorporating remote monitor devices to follow patient compliance. The two main factors that contributed to the limitation of telemedicine use are privacy

issues. Patients reported risk and concern in protecting their data throughout the teleconsultation which includes sharing images on the screen or having an online remote check-up. There was also concern about data privacy laws and practicalities of how healthcare standards for telemedicine can lawfully be met. These challenges therefore suggest the usefulness of adopting more efficient and secure model for providing remote consultations using robust telemedicine systems together with the need of policies that ensure patient's privacy during consultations. In conclusion, telemedicine's expectation of delivering enhanced orthopaedic treatment should involving tackling of these challenges to the maximum so as to fully support the development of good telemedicine for all patients.

Discussion

The research outcome of this study supports a critical element that telemedicine has in promoting improved patient care within the specialty area of orthopaedic surgery. Consequently, one of the advantages is that patients are provided with timely consultation in particular for the rural or poorly supplied regions. Historically, orthopaedic treatment tends to require multiple face-to-face appointments, which presents practical difficulties for patients themselves and additional impendence, for example, patients with mobility dysfunction or patients who live far from clinical centres. These are well handled by telemedicine because it enables patients to see specialists without having to travel thus saving them a lot of inconveniences. The easy access to care that this model provides has consequences for patient results as early diagnosis and timely treatment are critical activities in the effective control of musculoskeletal pain. Telemedicine decreases time to treatment, which is positively related to higher chances of recovery and reversely to the complications arising out of poorly managed orthopaedic disorders [16].

Another area that enjoys the services of telemedicine is post-surgical, recovery. The follow-ups via virtual means help the health care providers track the healing process of the patients in real-time and manage any issue hence that may develop in the process of healing. Other examples include patients being able to report updates on symptoms and receive advice on when to perform rehabilitation exercises that they require constantly from their health care providers. The constant form of communication in patients' loved ones improves compliance with post-surgical care, patients feel close and informed. In addition, thanks to integrating the modules of telemonitoring, including wearable devices that synthesize information on the physical activity and rehabilitation progress, it is possible to make assessment of the recovery objectively and determine further tactics of the treatment without fail. This systematic approach not only enhances the received postoperative treatment results but also

could be considered as valuable for the patients' further general experience, as people receive comments and encouragement though the supportive interventions during their further recovery process [17].

Nevertheless, a successful telemedicine depends on how patients' issues are managed and how compliant patients are. A conflict can arise when prescribing or talking with a patient via a telecommunication technology, making it important for the latter to ensure that they communicate all medical conditions, treatment options, and postoperative care instructions adequately so that the patient has enough knowledge to handle his or her condition. People may worry about their health status being properly evaluated far from the clinic, and about proper management of all possible adverse outcomes. To address these issues, healthcare providers can take advantage of the features in high definition video conferencing, imaging and other telemedicine tools that can be used to perform virtual detailed examinations and review the images obtained. Other measures about patient compliance include physicians and other healthcare providers can also improve compliance through follow up of patient regularly and through the use of reminder systems in order to make sure that patients adhere to an exercise regimen or report new updates. Such measures make sure that telemedicine consultations and follow-ups are not only time-effective, in addition, they are not less effective than conventional personal care [18].

Although, there is clear cut advantage of telemedicine in orthopaedic, several barriers and constraints in its implementation need to be resolved to overcome the limitations. One of the main obstacles can be found in technological divisions mainly if it concerns weaker zones characterized by a low level of Internet connection and the availability of digital devices. Telemedicine usually involves real time video communication over the internet, this makes it hard to implement where network connectivity is a problem. Therefore, the patients may be affected by interrupted consultations or delayed access to care, which seems to be counterproductive to improving the accessibility of care. For this, more focus should be placed on infrastructure investments, and additional solutions have to be sought, some of them – for example mobile health clinics with a telemedicine component [19].

Another disadvantage of telemedicine in orthopaedic care is the limitation posed by safety and privacy of data. The sharing of health data through digital means makes patient data susceptible to violation of patients' privacy and compromise through hack attacks. In regard to privacy, the patient is always concerned by signing up to a personal health information sharing site, especially in circumstance that involves imaging or telemonitoring. This makes it very vital for healthcare providers to embrace encrypted

communication methods, secure telemedicine platforms and abides by the local healthcare regulations with regard to data protection. Patients participating in virtual care also demand strict rules regarding data processing and storage, and only admissible access to their information in the process.

The first of them is the lack of uniform guidelines for the use of telemedicine in the treatment of orthopaedic diseases. As with any form of consulting, virtual consulting does not come with engrained habits with which individuals execute their duties; hence the need for certain rules to guide virtual care consultation. For example, the current pandemic has raised issues concerning physical assessment for patients by healthcare professionals through a virtual platform, how various professions interpret digital images from patients' locations and how to manage the care that patients require once they have undergone surgery from a distance. Therefore, it will be easier for healthcare providers to provide the best results through equal implementation of certain telemedicine applications across various platforms. Some of the telemedicine guidelines include those provided by the American Academy of Orthopaedic Surgeons (AAOS) which helps to foster updates for best practice in telemedicine.

This paper compares outcomes of telemedicine consultations with live client contacts and shows that they have several similar features: and some advantages. When it comes to diagnostic nature, virtual consultations involving use of digital images and high quality video conference can strongly parallel normal persona evaluations. Several patients noted that telemedicine was as effective as regular visits, especially the first and the subsequent visits when examination is not so essential. Also, sustained access to follow-up care minimizes telemedicine's negative encounter with recovery results and patients' satisfaction levels.

Nevertheless, activities belonging to traditional paradigm, like palpation and a direct access to the instruments present in the doctor's office, cannot be effectively substituted with telemedicine approach. However, there are still cases of complicated or severe that also demand thorough physical examination or operative procedures, in-person visits are inevitable. However, it can be mentioned that telemedicine can be a valuable addition to the traditional model as a method used for first-, second-, and even third-line consultations, for imaging analyses, or as a follow-up of patients who have experienced surgery. Since patients require fewer in-person appointments to either diagnose or treat their illness, telemedicine helps prevent overloading of appointments and reserve appointments with patients with complicated or worsening conditions [20].

Telemedicine will therefore shape more of an integrated approach of orthopaedic patients' consultations based on AI and AR. AI-based applications can help care practitioners analyse radiological images, detect pathological deviations

and diagnose illnesses during teleconsultation. For instance, machine learning algorithms can review X-Rays, MRI scans, and Computer tomography results to diagnose breaks, joint or bone wear and tear, or early signs of osteoarthritis that can guide the orthopaedic doctors. This integration makes virtual assessments precise and hastens the time it takes to come up with a diagnosis that can enhance the results of the patients. Virtual consultation can be made much more interactive, using augmented reality (AR) to enhance the perception of reality. In the case of musculoskeletal conditions, AR entails superimposing the patient's image on a 3D map during the consultation and fosters a deeper understanding of musculoskeletal through the image. AR can also be used to educate a patient where the patient can interact with the system to learn more about the patient's condition and the type of treatment that he/she is bound to undergo. Based on the results obtained in this study, several recommendations for improvement of telemedicine services in orthopaedic surgery are made. In the first place, the health care organizations and policy makers should focus on the proper and efficient development of telemedicine network including internet and electronic gadgets especially in rural areas. This effort entails boosting the networks of broadband and giving the patients easy-to-use telemedicine options that cater for their diverse IT literacy. Secondly, the application of sound measures of data security is critical to ensuring the patient's data and record privacy while increasing trust in the use of telemedicine services. Information collected in healthcare organisations has to be transmitted using secure channels and protected during storage and transfer under quality standards and security policies for telemedicine. Instances privilege is the main factor that patients hold back from embracing telemedicine, which can be addressed by enlisting them on the security features of the app. Thirdly, the development of guidelines to the regular practice of telemedicine in orthopaedics is essential. There should be professional protocols that describe how to perform virtual consultations, how to read images and scans from a distance, and treatment telemedicine after surgeries. The following guidelines will help to standardise care, improve patient safety and incorporate telemedicine into general orthopaedic practice.

Last but not the least, there is need to incorporate funds for training of the health care practitioners on how to properly use the telemedicine equipment and on ways to deal with the patients through online means in order to improve on quality and patient satisfaction. Telemedicine must look to prepare its providers to use the platform successfully, for effective and efficient interpretation of digital images, and for patients, no less than fruitful patient-provider relationship. It will also make sure that telemedicine is an efficient technology which, subsequently will enhance patient care and satisfaction of the orthopaedic services.

Conclusion

Consequently, the current study demonstrates that telemedicine could prove invaluable for the care of orthopaedic patients, especially with regards to improving access to care, availability of consultations and facilitating postoperative patient follow-up especially in outlying or hail area. Traditionally applied sophisticated care model to outpatient care making it cost effective yet efficient, and at the same time improving patient satisfaction and outcomes. Nevertheless, the solution comes with problems like Technological divergence, Data Security issues, and the need for set SOPs to be developed fully to maximize its potential. Based on this analysis, to improve the delivery of telemedicine services, considerable effort should be directed at the upgrade of digital technology platforms, the application of rigid data protection measures, as well as the creation of standard guidelines on the use of telemedicine. Further studies are required to compare the effects of telemedicine clinical orthopaedic surgery in the medium and long term, especially insofar as patient recovery, compliance with treatment regimens, and costs are concerned. **References**

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