

Applications, Limitations, and Guidelines for the Use of Telemedicine in Medical Departments

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APPLICATIONS, LIMITATIONS, AND GUIDELINES FOR THE U...

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APPLICATIONS, LIMITATIONS, AND GUIDELINES FOR THE U...

1. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF NEUROLOGICAL DISEASES

Headache

Primary headaches have high prevalence and great effect; however, most of the cases with primary headaches are not properly detected and treated . This is also true in other regions, including developed ones. This difficulty in access has encouraged initiatives investigating the use of telemedicine and teleconsultations in the care of these cases. The search for the terms “headache AND telemedicine” returned 55 papers in the PubMed database. Many were small group investigations, case reports, and e-Health studies investigating electronic headache diaries and digital tools to improve adherence to treatment. Eleven were considered the most important, since they were controlled clinical trial investigations comparing telemedicine with conventional face-to-face appointments. Some studies included all non-acute headache types and some were restricted to specific cases, such as people suffering from migraine and medication-overuse headache. The first parameter analyzed in the investigations was the effectiveness of telemedicine care when compared to face-to-face

interaction in terms of clinical outcomes, such as a decrease in the frequency of headache attacks. The investigations revealed that the findings obtained with the use of telemedicine were not inferior or significantly different from those obtained with face-to-face care as regards the decrease or improvement of attacks evaluated by scales such as the Migraine Disability Assessment (MIDAS) and the Headache Impact Test (HIT-6), and comorbidities. Another parameter assessed was safety in detecting potential secondary headaches. In this regard, the investigations revealed that after an initial adequate monitoring performed by a primary care service physician or an initial consultation with a specialist, patients' follow-up through teleconsultations was comparable to face-to-face care in finding the need for neuroimaging evaluations, abnormalities in neuroimaging tests, the need for hospitalization, and headaches due to more serious disorders. One investigation calculated that over 20,000 telemedicine consultations are crucial to miss the diagnosis of one case of secondary headache. The investigations also revealed good cost-effectiveness, decreased travel costs, increased access, and high user satisfaction. Small investigations also showed the feasibility of telemedicine in the treatment of children with primary headaches. As yet there are no satisfactory results on the safety and effectiveness of telemedicine for emergency headache treatment.

Multiple Sclerosis

The aspects assessed include therapeutic follow-up, remote evaluation of functional status, use of technologies to assist rehabilitation (telerehabilitation), remote neurocognitive evaluation, remote psychological interventions, including cognitive-behavioral treatment, mindfulness, and neuropsychological rehabilitation, remote evaluation of activities, and evaluation of adherence to medical treatment. With regard to therapeutic follow-up, some small investigations revealed the potential benefits of telemedicine as regards access to health professionals outside regular office hours, with the convenience of staying at home. One of them compared face-to-face with telemedicine care in cases recruited at a referral center, showing the latter to be feasible, cost-effective, and appealing to subjects with multiple sclerosis (MS) as well as physicians, and supporting its application as an additional method in the care of MS cases. The evaluation of functional status via telemedicine in cases with MS was assessed. The expanded disability status scale (EDSS) evaluation by telemedicine and by face-to-face evaluation was revealed to obtain very close results; however, assessment of some neurological examination items was shown to be inferior by telemedicine, including that of sensitivity, brain stem functions, cerebellum, and functional system. Home rehabilitation with the

help of telemedicine revealed promise according to some small investigations, with increased patient engagement and positive findings in variables such as muscle strength and adherence to physical exercise. Telemedicine was assessed for neuropsychological and mental health evaluation in MS cases. Another study evaluated the application of digital tools for neuropsychological rehabilitation in cases with MS. These investigations revealed positive contributions of the application of technology both for the assessment and for rehabilitation of these cases. In general, these evaluations showed the potential of telemedicine to decrease costs and achieve a good level of satisfaction with the use of digital tools, whether by cases, caregivers, or professionals. Therefore, they proposed a positive contribution of telemedicine for the evaluation and monitoring of cases with, MS as well as by offering assistance in their rehabilitation, with a complementary role in relation to conventional treatments.

Vestibular Disorders

Regarding recurrent vertigo, an investigation with 37 cases assessed the use of a video of the patient's eyes during the Dix-Hallpike maneuver, recorded by smartphone, in the diagnosis of vestibular disorders. Seven cases were diagnosed with BPPV, the sensitivity of the method for this diagnosis being 92.86% and the specificity

100%. In the emergency care context, there was a recommendation in the literature for the creation of TeleVertigo systems, to remotely diagnose and manage cases with acute vertigo and dizziness, aiming at diagnostic clarification between peripheral or central origin. This protocol proposes the use of the quantitative horizontal video head impulse test (vHIT) to evaluate the vestibule-ocular reflex. A randomized controlled trial with 322 subjects with chronic vestibular syndromes revealed that internet-based vestibular rehabilitation led to a significant reduction in vestibular manifestations at six months, compared with usual treatment.

Movement Disorders

The majority of investigations were with Parkinson's disease (PD) cases. In general, they are cohorts or experiments (before and after treatment), without a control group. Most included small groups of cases. Their findings were mostly promising and well assessed by doctors and cases. In a cross-over investigation using a tablet for teleconsultations compared with regular consultations, PD cases had similar Unified Parkinson's Disease Scale (UPDRS) and Hoehn and Yahr (H&Y) scales. A small clinical trial with PD cases showed better outcomes in quality of life and UPDRS than those observed after regular visit. Another investigation revealed similar outcomes

for the same variables. Another clinical trial with a larger group (total of 86 cases) showed a similar level of satisfaction and better UPDRS outcomes. A large randomized clinical trial was performed with 195 PD subjects followed for one year by teleconsultations or regular consultations and showed no difference in quality of life or MDS-UPDRS. Regarding the DBS follow-up, a series with cases was reported. Most investigations revealed a preference of the cases for the use of telemedicine, in addition to a good assessment by the physicians. On the other hand, two telerehabilitation investigations revealed problems with video quality and training time. Moreover, assessment through video conferencing of scales UPDRS, Unified Huntington's Disease Scale (UHDRS) and Abnormal Involuntary Movements Scale (AIMS) showed similar to face-to-face assessment. Another evaluation used in the context of movement disorder, Montreal Cognitive Assessment (MoCA) can be used by online videoconference for cases with PD and Huntington's disease. Psychiatric support for cases with movement diseases by telemedicine revealed to have satisfactory assessments. The telemedicine rehabilitation program for functional disorders is thought to improve quality of life as evaluated by scales. Furthermore, a telephone support program seems to improve apathy in cases with PD when compared to subjects without a support program.

Recommended Guidelines

Telemedicine was incorporated into neurology due to the requirement to provide access to acute stroke management. The present review has revealed that the application of this tool has by now expanded into other areas of neurology. Telemedicine has shown to be a useful tool which can be used in a complementary or hybrid way along with face-to-face visits, always aiming at improving care access and increasing patient satisfaction. More investigations are required, among them nationwide investigations assessing the peculiarities of the use of these tools in our population. Telemedicine will never replace face-to-face assistance. Instead, it will improve it. A definitive telemedicine regulation will improve the safe practice of telemedicine for the physicians as well as the cases involved. We have included in this book dealing with the provision of neurological assistance by neurologists with the application of telemedicine. Teleneurology is and must always be carried out by neurologists, following the same principles of quality, commitment, and safety that guide the conventional care provided to all cases in all settings in this specialty.

2. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF CARDIAC AND RENAL DISEASES

Telemedicine and Heart Failure

The SEDIC investigation assessed the suitability of a telemedicine program in the context of clinical home monitoring beginning in 2007. The patient's care is organized based on the collection of results entered by the patient and sent to the educational evaluating center. This data collection corresponds to a randomized, open, multicenter prospective trial investigating the effect of educational follow-up via telemedicine for a period of three months in cases over the age of 65 who have been hospitalized for acute heart failure (LVEF <45%). The main assessment criterion is the number of days of hospitalization for an acute cardiac event at the one-year mark. The preliminary findings after three months deal with 73 cases, of whom 35 were randomized into the conventional management arm and 38 into the telemedicine arm. There was no significant difference in the main assessment criterion. At the conclusion of this investigation, 1040 days of hospitalization for acute heart failure were recorded. Educational telemedicine evaluation

made it possible to decrease the number of days (control group: 590 days vs. telemedicine group: 450 days). Quality-of-life factors increased similarly in the two groups. A significant reduction in cardiovascular mortality was found.

Several points and findings are worth highlighting and discussing in view of the results from the literature. In the SEDIC investigation, the average age of cases was 76.8 years, higher than in other investigations, such as the average age of 61 years in Tele-HF ("Telemonitoring to Improve Heart Failure Outcomes"). In terms of treatment, the cases coming out of the SEDIC investigation received better treatment than those in Tele-HF. In the SEDIC investigation, 20% of cases had one or more cardiovascular events within three months (death or rehospitalization), findings similar to those of Rich et al.. The findings after the first three months of the SEDIC investigation, though not statistically significant, reinforce the notion that telemedicine is of practical interest in the follow-up care of elderly cases with heart failure.

Furthermore, in this population, telemedicine may decrease mortality. In the TEN-HMS investigation (Trans-European Network-Home-Care Management System), the cases assessed via telemedicine lost fewer days of life when compared with the cases in the conventional monitoring group. The meta-analyses are positive, with a decrease in morbidity and mortality in the telemonitored groups; these

meta-analyses include those carried out by the Cochrane Group and by Inglis et al..

With regard to the SEDIC investigation, over the course of three months of telemonitoring, the 42 cases sent out 319 alerts; only four cases sent out no alerts. The top cause for these alerts was the aggravation of respiratory manifestations, followed by weight gain. Nurses responded to 204 alerts. The most common paramedical response was a reinforcement of therapeutic education, along with advice to consult the patient's physician in the absence of clinical improvement. It is worth noting that the telemonitoring system suffered from the issuing of false notifications, in particular for weight gain. As for the cases who did not respond to this educational telemedicine in the SEDIC investigation, 16 of the 45 cases in the educational telemedicine group died or were rehospitalized for acute heart failure within the year (36%). The nonresponsive cases were more often symptomatic upon enrollment in the investigation, with more impaired quality of life and a higher geriatric depression score. On the other hand, none of the strong prognostic mediators of heart failure, such as BNP, left bundle branch block, LVEF, six-minute walk test, or hemoglobin level, stood out in univariate evaluation. Therefore, cases who were nonresponsive to educational telemedicine were more often symptomatic and had a higher depression score upon enrollment than the

responsive cases.

Telemedicine and Arrhythmias

Dary P et al. performed an investigation on the telemonitoring of atrial fibrillation. The monitoring was ambulatory in nature, through the daily application of a monitor for an average period of 11 days, 11 hours per day, with detection of arrhythmia and automatic ECG transmission. This monitoring took place daily from 8 to 12 o'clock, changing day/night periods. This monitor was programmed to conduct an electrocardiogram every hour for better evaluation. On average, 266 readings were taken per case, for a total of over 51,000, all cases combined. In all, 200 cases had been enrolled from the start of the investigation: 45% male and 55% female, with a mean age of 67 years. 16% of the enrolled cases were over the age of 80. 35% had a history of treated arrhythmias. A distinction was created between two groups. The first group was in sinus rhythm upon enrollment in the investigation, with the discovery of an atrial fibrillation in 31% of them and regular episodes of tachycardia in 24%. The second group was already in arrhythmia, with a choice between evaluating heart rate (62%) and rhythm (38%). For the 200 cases enrolled in the investigation, 63 had a known arrhythmia and 137 cases were in sinus rhythm as of the initiation of the investigation. Out of the latter group of 137 cases, 61 had a

normal pattern, 43 cases (22%) had a detected atrial fibrillation, and 33 cases (16%) had episodes of tachycardia. For the 63 cases in arrhythmia, 24 cases had their rhythm assessed, while 39 patients' heart rate was assessed. Therefore, in this investigation, for 33% of the cases, the telemonitoring improved the diagnosis and treatment of atrial fibrillation, allowing the therapy to be adjusted and secured according to the rhythm, rate, and conduction time.

As for telemedicine in cardiology, the telemonitoring of implanted cardiac rhythm devices (pacemakers and defibrillators) is known as a developing field in France. Therefore, the ECOST investigation, coordinated by Salem Kacet, and Philippe Mabo's EVATEL investigation are the first two investigations performed in this area. The EVATEL investigation has not resulted in any publications, but its findings were disappointing overall. The ECOST investigation reveals that the telemonitoring of implantable defibrillators can have a medico-economic effect, with a decrease of inappropriate shocks due to early modulations and a decrease of the hospitalizations related to these shocks. The average savings made amount to 315 euros per patient per year, by lowering outpatient costs and follow-up costs (baseline consultations and transport), but the program had no impact on hospital costs.

As the TRUST investigation reveals, the telemonitoring of cardiac defibrillators also allows

for a decrease in the frequency of face-to-face assessing without any effect on major undesirable events such as death or stroke.

The ECOST and EVATEL investigations, performed in France on 433 and 1501 cases, respectively, approved the safety of telemonitoring of defibrillators on “hard” composite criteria, including mortality, cardiovascular hospitalizations, and system malfunction. Moreover, telemonitoring made it possible to decrease the incidence of inappropriate shocks by 52% in ECOST and by 37% in EVATEL, with the potential for additional improvement to the longevity of the devices (evaluation of the ECOST investigation).

Perspectives Regarding New Developments in Telemedicine

The challenge for “tomorrow” telemedicine is to develop new telemedicine capacities or projects, including and resolving several medical problems and difficulties, such as:

- 1) The specificities (no appetite for new technologies and new uses) and problems (e.g., falls, malnutrition, mild cognitive impairment, etc.) of elderly cases, who are the main cases affected by chronic disorders.
- 2) The coexistence of several chronic pathologies

(e.g., CHF, DM, chronic obstructive pulmonary disease [COPD], etc.) and comorbidities (arterial hypertension, renal failure, etc.) in the same subject, while providing comprehensive and “global” treatment for the individual case in all its medical and societal aspects.

3) The multiplicity of treatment structures and medical organizations (e.g., with or without human resources, telemedical center, etc.).

4) The logistical barriers to implementing telehealth approving to be significant, as many health systems are not yet produced for these technologies to be integrated within existing information systems.

In the chronic disease condition, new remote sensors and tailored questionnaires are presently being integrated into telemedicine platform, including remote glucose meters, actimeters, and electronic spirometers, along with new knowledge in the form of ontologies in order to increase the telemedicine platform and broaden its utility to other chronic disorders like Diabetes Mellitus (DM) and COPD. In this regard, further personnel and specific protocols are essential that must be specific for each chronic disease and targeted for each case, while integrating the possibility for each patient to show more than one chronic disease. Most of these protocols must still be funded by means of existing budgets or external funds.

These disorders share a number of points with HF

in terms of epidemiology and natural history. Like HF, DM and COPD are among the most frequent disorders in developed regions and therefore represent a major public health concern for our societies. Crucially, like HF, they are accompanied by common hospital admissions and readmissions for well-known causes. These causal factors can be found, enabling professionals to act ahead of time, as in CHF, thereby avoiding disease progression. Developing warning alerts for these chronic disorders should enrich the existing system.

3. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF INTERNAL AND DERMATOLOGICAL DISEASES

History of Telemedicine in Dermatology

In scientific words, telemedicine is "the application of medicinal knowledge borrowed from one place to another via computerized transmission for improving the clinical health condition of a patient." Telemedicine and telepath, as generally used today, can be considered interchangeable. Broadcasting of radiologic photographs (teleradiology) is the most common employed and comprehensively assessed telemedicine application. Another specialty of telemedicine that commonly involves no patient contact is telepathology.

The oldest application of telecommunications in healthcare can be traced to the period of the Civil War when telegraphs were applied for conveying casualty lists and ordering supplies. The creation of the telephone, the radio, and other modern means of wireless and satellite-based communication more resulted in the advancement in medicinal telecommunication. The only documented

reference to telemedicine comprises teleradiology and remote transmission and interpretation of radiographic figures. Improvements in technology have resulted in the growth and expansion of telehealth. As we entered the 21st century and with the advancement and development of the World Wide Web - which, through websites and its application, produced content from one user to another more accessible through a network that communicated across the globe despite having different electronic devices as the device on which they could work. Web 2.0 also aided in developing Voice Over Internet Protocol viable and other means of audiovisual connections. The mobile device and tablet-based industries have paid attention to the requirement for live discussions for medical doctors to collaborate and debate more effectively.

The COVID-19 epidemic has wreaked unmatched social and economic havoc with more than 37.8 million subjects and over 1 million fatalities globally. The healthcare industry has shown a beneficial transition due to creative solutions that strive to reduce the harmful effects of COVID-19 on human health. For example, telehealth application has increased due to the current public health crisis. For example, India, a developing and lower-middle-income nation, is now experiencing a lack of healthcare professionals, including medical doctors, nurses, and midwives. About 70% of Indians reside in isolated, rural communities without access to

even the most basic medical health cares. In such cases, telemedicine substantially has role in providing quality and affordable healthcare to India's poorest citizens and is anticipated to close the health disparity between rural and urban regions. It is uncertain whether telemedicine technology will successfully offer appropriate healthcare services to the underprivileged, isolated, and rural subjects. Telehealth may, in the future, significantly improve health care, according to persuasive findings. However, to fully use telehealth's potential and revolutionize healthcare for the entire world's population, its viability and implementation in resource-constrained environments and low- and middle-income regions must be established. A global agreement on definitions, restrictions, protocols, oversight, assessment, and data protection is urgently needed, given the rapid development of telehealth.

It is inexplicable how telemedicine is applied in traditional healthcare, given the effectiveness of online visits for healthcare. Puskin and Sanders (1995) divided the number of impediments to the full implementation of telemedicine systems into three main types: (1) technological or organizational infrastructure of telecommunications; (2) organizational or human infrastructure of organizations; and (3) financial infrastructure of health system.

Future of Telemedicine

The aim and vision of incorporating telemedicine and virtual care in the healthcare system were to provide optimum healthcare, which facilitated addressing long waiting hours and the threat of disease progression in social distancing, assistance to hospitals, and clinics. Decrease in real-time visits to the medical centers and minimizing one-on-one interchange between doctors and their cases, virtual treatment, and assessment of solutions reduce the transmission of potent microbiological agents and shield medical practitioners from disorders. Telemedicine and telehealth have also successfully managed important acute respiratory infections like Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). With the advent of COVID-19, canceling and postponing many in-person outpatient medical appointments have been common.

Telemedicine in Occupational Dermatology

Occupational dermatology is characterized by applied dermatology in the field of occupational and environmental dermatoses, with a particular focus on exogenous skin diseases predominantly resulted from a patient's occupational activity. This associates both with dermatitis triggered by exposure at the workplace and, increasingly, also to

skin malignancy induced by occupational carcinogens or natural UV radiation. Since the introduction of the dermatologist's intervention in the 1970s, expert medical evaluation and care of cases with known occupational skin disorders, which initially dominated the field of occupational dermatology, have increasingly been supplemented by prevention. To date, teledermatology techniques have only rarely been employed in occupational dermatology. One typical example of its use involves the medical support for workers affected by skin diseases who are deployed to regions where dermatological expertise is not accessible. Coastal states are needed to provide telemedical assistance services (TMASs) for ship crews. Given that skin diseases are a common reason for visiting the TMASs, telemedical assistance services cooperate with dermatologists in order to enable medical care centers on board and thus avoid costly evacuations. In a similar way, the German armed forces have for some time now depended on telemedicine and teledermatology support based in Germany during foreign missions. The benefit of SAF teledermatology in occupational health care was approved in a case series of railroad workers. By bringing in dermatological expertise, it was possible to find skin lesions occurring at the workplace as phototoxic reactions and to remove the hazard by decreasing the exposure and implementing protective measures. A prospective comparative investigation on SAF teledermatology at the

workplace among workers in "wet" occupations showed that subjects of incipient hand dermatitis could be diagnosed by teledermatology with a high degree of accuracy; there was, however, a tendency to overestimate the severity of hand dermatitis. Teledermatology evaluation of the "Osnabrück Hand Eczema Severity Index" (OHSI) and the "Hand Eczema Severity Index" (HECSI), which are approved scoring methods for hand dermatitis, showed that a specific score was effective when evaluating incipient hand dermatitis using teledermatology. Since 1973, the Occupational Safety Act (ASiG) has made the mandatory legal basis for occupational health care of employees in the Federal Republic of Germany. Tele-visit between occupational health practitioners and dermatologists play a effective role in optimizing occupational preventive care. On the one hand, this may contribute to enhancing and ensuring the quality of occupational health care; on the other hand, it may help save employers and employees time and budget as it allows employees to directly present to an off-site specialist. Given the lesser amount of time and other resources needed, the store-and-forward technique is likely to be superior to a video visit. Especially with respect to the treatment of chronic wounds, it has been reported that SAF techniques are diagnostically reliable and that the treatment plans made from SAF techniques match those forming from face-to-face visits. The time and travel needed for skin patch assessment, which is commonly part of the

guideline-based diagnostic workup during the dermatologist's intervention, could be decreased by using telemedical techniques. With regard to the diagnosis of UV-induced skin malignancies by means of teledermatology, especially nonmelanoma skin cancer, it is not yet possible to come to a conclusive evaluation. While teledermatology was correlated with a high degree of diagnostic accuracy in a Brazilian investigation, a US investigation showed teledermatology to be only moderately reliable. In this context, however, it is critical to keep in mind that non-dermatologists frequently select plaques that are not appropriate for teledermatology, which may propose a false degree of identifying accuracy.

4. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF OPHTHALMOLOGICAL DISEASES

World Health Organization (WHO) Guidelines for Digital Health

In 2019, WHO initiated developing a framework for the adoption of digital innovations and technology in health system. The WHO suggestions on digital interventions in healthcare promotes evaluation on the basis of 'benefits, harms, acceptability, feasibility, resource use and equity considerations', and views these tools as still very much that tools in the journey to providing universal health coverage and sustainability.

There are several digital interventions that have been used for review by the WHO. Of relevance to this discussion are: the application of client-to-provider telemedicine to complement health service delivery; the application of provider-to-provider telemedicine; targeted customized health information transmission; health worker decision making support; digitized health data tracking; and education. In all these scenarios, the review shows

the requirement for assessing of patient safety, privacy, traceability, accountability and security, with plans in place to address any breaches. Mechanisms for these have been innate within the pharmaceutical and other medical devices industries, and new technological entrants to this traditional sector should consider these during development of the services. There will also be ethical consideration that have yet to be articulated and debated. The engaged clinician should seek to be involved in the development of these new advances to closely align any innovations to solve unmet clinical requirements. Simultaneously, clinicians should evaluate if any innovation complies with quality, ethical, and sustainable healthcare, as legislation invariably gaps behind such momentous leaps in innovation.

5th Generation (5G) Telecommunications

5G wireless communications was designed to meet the challenges of serving large-scale complex network communications. These networks have extremely low latency, higher capacity, and improve the speed of data transmission through the application of higher frequency millimeter waves compared to existing networks. Latency in 5G transmission can be less than 1 ms of delay in comparison with about 70 milliseconds on the 4G network, and give significant improvement to the

users' perception of the service. Download speeds on 5G networks can be increased 20 fold from the current 1 gigabit per second on 4G. And all this magnitude enhance in function whilst simultaneously decreasing energy consumption by the connected devices. 5G networks will deliver an end-to-end latency of less than 5 milli-seconds and over-the-air latency of less than 1 ms which is one-tenth of the 4G network latency.

5G uses small cells, which are miniature base stations that have low power needs. However, because 5G transmits at higher frequencies, signal attenuation becomes a greater challenge, and these base stations require to be placed closer than 4G base stations (every 250 m or so). To ensure consistent signal transmission, base stations will require to be densely populated. Despite the base stations being smaller in size, the increased infrastructure requires of a 5G network with these cells will not be practical in sparsely populated rural regions. Therefore, whilst telemedicine has been traditionally regarded as being able to have role in healthcare delivery to these regions in a meaningful way, it may in fact continue to exclude those who already struggle to access physical care.

In addition to being able to support increasing bandwidth demands from users and patients, 5G provides Ultra-High-Definition (UHD) multimedia streaming with increased user experience. The high-resolution figures can be more easily

transferred. Better quality and reliable video-visits with improved patient experience may have role in forging better physician-patient relationship. Real-time slitlamp evaluations streamed in high-definition has the potential to become common place. With imperceptible latency, the clinician could control a slit-lamp remotely whilst looking at a mobile device showing the eye being evaluated remotely. The immersive experience promised by 5G can also be applied to augment the learning experience, especially the visually-based tasks such as surgery.

Only 35–50% of managed care cases receive the suggested annual eye evaluation. A 2008 investigation from the National Health and Nutrition Examination Survey revealed that over 70% of those with diabetic retinopathy were unaware of their disease. The Department of Veterans Affairs has the largest telemedicine diabetic retinopathy monitoring program in the United States which has led to reduced travel time for eye evaluations monitoring at younger ages, and the detection of more known patients with diabetic retinopathy. The Indian Health Service-Joslin Vision Network also uses teleophthalmology at over 80 primary medical centers for monitoring remote at-risk cases including American and Alaskan Natives. The University of Wisconsin-Madison applies a Topcon NW400 non-mydriatic retinal camera to provide tele-ophthalmology services at their

primary medical centers. Upon the primary care physician's suggestion, the patient goes to the tele-ophthalmology department to receive fundus photographs prior to going home. These are assessed remotely by an eye physician after the visit. The primary care physician and the case both receive a copy of the reports. There are a few active tele-Retinopathy of Prematurity (ROP) monitoring programs in the nation, including one at South Shore Hospital in Massachusetts in conjunction with Boston Children's Hospital and another at Stanford University in conjunction with five community neonatal intensive care departments. Findings have been supportive thus far; a 6-year retrospective analysis at Stanford University's tele-ROP program revealed sensitivity and specificity both approaching 100%. Due to the high stakes involved in ROP and limited view of the periphery with the RetCam product line which is clinically approved as an adjunct to indirect biomicroscopy, the AAO and the American Academy of Pediatrics still suggest at least 1 in-person ROP assessment. There is currently no active hospital- or clinic-based established tele-ophthalmology monitoring program for age-related macular degeneration (AMD). Investigations have approved the application of non-mydriatic digital fundus cameras in identifying patients with AMD; although some investigators have claimed that incorporating OCT images will increase reliability. Tele-ophthalmology is not limited to retinal disorders. Glaucoma affects

3 million Americans and is known as the second leading cause of irreversible blindness in the United States. An investigation comparing cup-to-disc ratio by tele-ophthalmology compared to in-person evaluations by glaucoma specialists revealed a positive predictive value of 77.5% and negative predictive value of 82.2%. Investigations on tele-ophthalmology in glaucoma revealed that it has increased referral rates, reduced patient travel time, and is cost-effective. Tele-medicine is also playing an increasing role in glasses prescriptions. Opternative is a Chicago-based healthcare providing company that provides online refractions for glasses and contact lenses. Netra is a smartphone-based auto-refractor. An investigation of 152 eyes revealed the mean relative difference in spherical equivalent between the Netra smartphone refraction and an in-office manifest refraction was only -0.27 diopters.

Benefits to Ophthalmologists

Ophthalmologists stand to benefit considerably from advances in tele-ophthalmology. Studies reveal that there is a shortage of ophthalmologists in the country, and with an aging population, the demand for eye practitioners is likely to increase. Teleophthalmology may, therefore, assist eye practitioners provide cost-effective care for a large population by monitoring and triaging

cases before being seen in the office. This could lead to practitioners only seeing surgical cases or cases with active disease needing treatment or close investigating, while common monitoring and annual evaluations are assessed remotely. It may also broaden ophthalmologist's reach, allowing remote evaluations to take place in common underserved communities. Lastly, it is plausible that post-operative cases could eventually be assessed via tele-ophthalmic care, either completely electronically or through co-managed care with local optometrists and technicians. Taken together, telehealth reimbursement is considerably lower than in-person case care visits, but this has changed considerably in the setting of the COVID-19 pandemic. It is unknown what the future holds for tele-ophthalmology, but should pay parity for remote and face-to-face evaluations persist, then telemedicine could open up considerable new revenue streams for ophthalmic managements.

5. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF ORAL DISEASES (DENTAL INTERVENTIONS)

Periodontics

The history of teledentistry goes back to 1994, when the first trial was performed on 15 cases referred for periodontal surgery to a clinic 120 miles away from where they lived. Referral was based on intraoral figures that were captured and sent with the assistance of a dental image management system to the specialist clinic. The periodontal surgery was carried out, and following the surgical interventions, suture removal was carried out in their town clinic. New images were captured and sent to the physicians. Results of this investigation showed that 14 out of the 15 cases avoided the return trip to the specialist clinic and felt that they had received good care.

Preventive Dentistry and Pediatric Dentistry

Kopycka-Kedzierawski and colleagues performed a series of investigations addressing the role of teledentistry in the detection and diagnosis of

early childhood caries through intraoral images; their findings proposed that teledentistry could be a potentially efficient means of screening schoolchildren for signs of early childhood caries. Amavel et al. approved the results of Kopycka-Kedzierawski and coworkers and reported that more investigations addressing the financial aspect of teledentistry should be carried out.

Oral Medicine and Diagnosis

The application of teledentistry in oral medicine and diagnosis was assessed through an investigation that was performed in Belfast, Northern Ireland, where the investigators applied a prototype teledentistry system as part of a service improvement scheme and showed that teledentistry may represent an alternative approach to manage referrals in oral medicine. The feasibility of distance-diagnosis of oral mucosal disorders through email and a store-and-forward image system was assessed using transmission of digital images to distant clinicians. Findings showed that distance-diagnosis of oral disorders can be an effective tool in diagnosis of oral plaques and that the involvement of more than one consultant improved diagnostic accuracy. The investigators showed that primary care clinics can benefit from the application of digital cameras and that teledentistry can improve the oral healthcare in remote regions where specialists are not

available. Teledentistry has the potential to provide populations of underserved cases with much-needed oral health services. In an investigation performed by Summerfelt, teledentistry was applied as a tool to allow dental hygienists to provide oral healthcare to underserved populations through connection with a distant oral health team.

Patient Education

A feasibility investigation was carried out to evaluate the application of interactive real-time videoconferencing as a mode of oral hygiene training for subjects with tetraplegia, and the satisfaction of the cases was reported. An economic investigation to evaluate a teledentistry project performed in the United Kingdom showed that teledentistry could offer timely services to cases in remote areas and cost saving in the long run. In this case teleconsultation can become a constant part of dental service. The application of teledentistry was shown to be an efficient tool to educate orthodontic cases in relation to minor emergencies that may be encountered during the course of management. These problems may be easily resolved using teleconsultation while the case is at home; such problems generally include rubber ligature displacement and discomfort due to the appliance or irritation of cheeks. This approach was shown to be reassuring to both cases and parents and has the benefit of limiting the requirement to

visit the dental offices.

Role in Oral and Maxillofacial Surgery

Duka M et al. revealed that diagnostic evaluation of the clinical diagnosis of affected or semi-affected third molars assisted by the telemedicine approach was equal to the real-time evaluation of clinical diagnosis. According to Rollert MK et al., telemedicine visits, in appropriately investigating cases for dentoalveolar treatment with general anesthesia and nasotracheal intubation, are as reliable as those performed by conventional techniques and that telecommunication is an efficient and cost-effective mechanism to provide pre-operative assessment in conditions in which case transport is difficult or costly. Brickley M reported that there is a requirement and demand for change in the referral system for oral operation specialist care. Telemedicine could conceivably be one path to improve availability of specialist oral surgery treatment. Aziz SR and Ziccardi VB reported that Smartphones allow fast and clear access to electronically mailed digital figures and provides the oral/maxillofacial surgeon free mobility, not limited by the constraints of a desktop personal system. This in turn provides improved efficiency of the specialty visit and improved monitoring, finally providing improved care to the maxillofacial case.

Role in Pediatric and Preventive Dentistry

Kopycka-Kedzierawski DT and Billings RJ revealed that teledentistry is as good as visual/tactile evaluations for dental caries monitoring in young cases. Kopycka-Kedzierawski DT et al. proposed that teledentistry offers a potentially efficient means of monitoring high-risk preschool cases for manifestations of early childhood caries. They successfully showed a teledentistry project made in inner-city child-care centers in Rochester, NY. Amavel R et al. reported that remote diagnosis of children dental problems based on noninvasive images constitute a valid resource. Kopycka-Kedzierawski DT et al. showed that the intraoral camera is a feasible and potentially cost-effective alternative to a visual oral evaluation for caries monitoring, especially early childhood caries, in preschool children attending childcare centers.

Ethical and Legal Issues

Concerns about the confidentiality of dental data arise from the transfer of medical histories and reports as well as from general security issues of electronic data stored in systems. The physicians of teledentistry should take utmost care to ensure that subject privacy is not affected by unauthorized entities. However, cases should be made aware that their data is to be transmitted electronically

and the possibility exists that the data will be intercepted, despite maximum efforts to maintain security. Concerns also may arise about the correct modality of informing cases of the potential transmission of their information. Informed consent in teledentistry should cover everything that exists in a standard, common consent form. The subject should be informed of the inherent risk of wrong diagnosis and/or management due to failure of the modality involved. In teledentistry practice, medicolegal and copyright issues also have to be noted. These problems arise primarily because of lack of well-defined values. Currently, there is no way to ensure quality, safety, efficiency, or effectiveness of data or its exchange. There are privacy and security issues as well as reward, fiscal and taxation issues related to electronic commerce. Many of the legal issues, such as licensure, jurisdiction, and malpractice, have not yet been definitively chosen by legislative or judicial branches of various governments. In 2000, 20 states in the US enforced restrictive licensure laws needing teledentistry physicians to achieve full licenses to practice across state lines. In spite of this, data on teledentistry licensure does not appear to be readily available today.

6. TELEMEDICINE GUIDELINE FOR THE SURGICAL CARES

Benefits of Telesurgery

Telesurgery provides safe and accurate surgical interventions for cases who are unable to travel a long-distance. With the advancement of robotics and wireless connection technology, this form of surgery is becoming more feasible.

Provides high-quality surgery to medically underserved regions such as rural areas, battlefields, and spacecraft. Eliminates the requirement for long-distance travels, along with travel-related financial burden and dangers. Today's 3-Dimensional show system provides a shared, high-definition visual feedback to surgeons at different centers simultaneously. Allows for surgical cooperation amongst surgeons at different medical centers in real-time. Operator's physiologic tremor can be canceled out in real-time with accelerometer capacities, improving surgical accuracy and decreasing injury to adjacent healthy organs.

Advancements in Telesurgery Since 2001

There have been different technological

advancements in telesurgery since the world's first telesurgery in 2001, which was carried out by a surgical team in New York, USA using the ZEUS robotic system. This project provided a successful two-hour-long laparoscopic cholecystectomy, which was carried out on a female case at a hospital in Strasbourg, France. The case had an uneventful recovery.

Emerging Telesurgical Technologies

Although in its infancy, tele-neurosurgical technology is currently being assessed. In 2007, O'Malley and Weinstein performed a successful cadaveric skull base surgery using a trans-oral approach. And about a decade later, Wirz et al. showed an endonasal feasibility investigation for trans-sphenoidal resection of a pituitary tumor with 10 milliseconds of latency time, with the surgeons agreeing that using the device did not feel considerably different from handling a conventional endoscope.

Zhao et al. recently reported a feasibility investigation of the integration of a floating 3D visual feedback system in telesurgery. This integration allows multiple surgeons to see a floating, holographic image of the surgical field simultaneously, increasing the detail of the shared visual display and real-time cooperation amongst medical professionals across the border.

Benefits of Telesurgery

The potential benefits relate to cost, convenience and increased efficacy. Money might be saved through decreased travel costs of cases and specialists. The expertise is brought to the case, with national or international specialists available to advise or treat the case remotely. Telesurgery may also increase and extend the skill and range of the surgeon through its application of a robotic interface. Laparoscopic surgery has commonly involved the surgeon viewing the surgical site on a small two-dimensional screen, often inconveniently positioned across the table, with a staff controlling the camera. The absence of shadows and movement parallax make it difficult to indicate spatial distance and movements appropriately although, with experience, the surgeon can compensate. Furthermore, any movement in the camera may resulted in motion sickness in viewers. The AESOP robotic arm, used in the ZEUS telesurgery technology, was designed to relieve these problems. It attaches to the surgical table, and is assessed by voice commands or with a foot switch. Magnified three-dimensional figures allow exact positioning of tools. In the da VinciTM technology this is obtained by the practitioner wearing specialized binoculars. Telesurgery technology robotic arms and their computer controller can operate at an accuracy of around $\pm 5 \mu\text{m}$, compared with $\pm 50 \mu\text{m}$ for the best microsurgeons. Tremor is removed

and movements can be scaled so that a 1-cm movement of the surgeon's finger may translate to an actual movement of 1 mm at the remote location. This sort of technology provides condition for surgeons to conduct tasks that would otherwise be impossible, such as retinal vein cannulation. In cardiac surgery, control technologies can generate a virtual heart arrest, providing the surgeon to work on a motionless figure of the heart while the movements of the surgery are automatically gated to the beating. Robotic devices can also be used to be intrinsically safe, with movement limited to a location where it can do no impairment, and extremely large or small forces can be safely used. It is estimated that up to 54 percent of surgical errors might be reduced, and direct intervention of an expert via telesurgery may make better the standard of surgical treatment throughout the world. Ultimately, the application of telesurgical consoles decreases fatigue in the operating surgeon and the surgeon's efficacy should therefore remain optimal for longer.

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7. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF ENT DISEASES

Diseases of the Oral Cavity, Pharynx, and Larynx

Telemedicine is a useful method for the diagnosis and treatment of diseases affecting the oral cavity, nasopharynx, pharynx, and larynx. In most patients using existing technology, a skill examiner can capture a high-quality image of a plaque at any of these sites. A portfolio of these images can be effective not only for establishing a diagnosis and management plan but also for following disease progression or treatment effect. For example, serial imaging of laryngeal carcinoma throughout treatment has been shown by the author to significantly increase patient education and compliance as well as disease documentation. Imaging the upper aerodigestive tract presents unique problems. The medical devices require to capture the highest quality images (dental camera for oral cavity and oropharynx and chip-in-tip flexible laryngoscope for hypopharynx and larynx) are expensive and, because of their high cost, not yet widely accessible. As these devices proliferate and high-quality images become more readily available,

telemedicine usages will become more attractive for these anatomic regions. Capturing the dynamic function of the larynx is crucial to diagnose many diseases. Although real-time video teleconferencing has been revealed to be effective for this aim, it needs the simultaneous availability of the case and providers as well as significant bandwidth. Store-and-forward usages with the capability to asynchronously transfer short (up to 1 minute) video files may offer a more efficient solution. Moreover, more intensive training and quality control is needed if a non-otolaryngologist will be providing images of the nasopharynx or larynx.

Telemedicine: Store and Forward versus Live Feeds

The live and interactive technology is intuitively appealing since it most closely approximates a real-life case encounter; however, the application of a live visit needs a level of coordination between the case, referring practitioner, and specialist physician that makes this technology of teleconsultation both more expensive and more challenging logistically. The second type of telemedicine visit is frequently known as store and forward. This involves the referring practitioner collecting and forwarding all of the relevant case data, including history and imaging, to the consulting practitioner who then can assess the information at a later time. One advantage of this type of visit is

that it does not need the physical presence of the referring practitioner or the case. In 1997, Sclafani and colleagues at the New York Eye and Ear Infirmary reported an investigation at the annual congress of the American Academy of Otolaryngology - Head and Neck Surgery evaluating the use of live and store-and-forward telemedicine in their otolaryngology practice. Cases were assessed by a chief resident in otolaryngology who conducted a relevant physical exam and flexible fiberoptic nasopharyngolaryngoscopy and who then presented his results to two groups: a locally available otolaryngologist and a remote otolaryngologist. Both the local and remote otolaryngologists could see the interaction as well as a fiberoptic nasopharyngolaryngoscopy and to direct the chief resident. Afterward, another otolaryngologist, who was not present for the live encounter, was requested to assess the electronic patient reports. The authors showed concordance rates of 92% between the local and remote otolaryngologists (live videoconference) with a slightly lower concordance of 64% between the live practitioner and the delayed remote practitioner (store and forward). The authors clarified the diagnostic discordance seen with the store-and-forward remote practitioner as primarily the result of technical problems: color-shifting phenomenon, degraded video quality, and an insufficient quantity of high-quality figures. Sclafani and colleagues reported that these are problems that are easily

remedied by the capability of new technology to provide a higher number of higher-quality still and video images. They stated that remote interactive tele-otolaryngology can be applied to assess a range of patient complaints with a high degree of diagnostic reliability.

Telemedicine and Video Otoscopic Imaging

Otitis media is one of the most frequent encountered diagnoses in both pediatric and otolaryngologic practice, and the cost correlated with the diagnosis and management of the disease is estimated to be in excess of 5.3 billion dollars per year. Acute otitis media is the most frequent bacterial infection in children and is the most common indication for antimicrobial treatment in the pediatric population. Cases who suffer from either recurrent acute otitis media or chronic otitis media are often managed with tympanostomy tube insertion, which is currently one of the most frequent interventions conducted in children in the United States. After surgery, cases are visited in follow-up in the clinic to evaluate the patency of the tympanostomy tubes. This follow-up commonly occurs 1 month following the surgery and at regular intervals thereafter. Because a significant proportion of the United States subjects lives in rural regions without nearby access to subspecialty surgical treatment, arranging follow-up for these

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cases can be challenging, which presents a unique opportunity for telemedicine to play a significant role in the postsurgical follow-up of cases with tympanostomy tubes.

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8. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF PSYCHIATRIC DISEASES

How to Get Started in Telepsychiatry

Different commercial companies and entrepreneurial startup organizations are providing telepsychiatry services and other augmented models of treatment, especially in camera equipped smartphone apps. Consumers can download apps to their mobile devices to communicate with a psychiatrist or psychotherapist over secure video chat channels. How can one assess and classify all of these services and projects? A 2012 expert consensus reported four key factors to be important: process and acceptability, clinical outcomes, availability, and cost. Considerations for process and acceptability include case satisfaction, provider satisfaction, coordination of treatment, integration of treatment, usability, rapport, stigma, and motivational readiness. Clinical outcomes include evaluation of percent of no shows (e.g., for failed technology or other logistical causes), accuracy of evaluation, symptom outcomes, completion of care, quality of treatment (e.g., through HEDIS system performance measures

and concordance with treatment guidelines), and treatment utilization. Access includes the number of additional services that can be received, numbers served (e.g., through relative value units), wait times, length of session, distance to service, the likelihood of using telemental health versus traditional treatment, and cultural access.

Efficiency of Telepsychiatry

In order to evaluate the efficacy of telepsychiatric services, an electronic search was performed for papers published between 1998 and 2006 in the MEDLINE, EMBASE, PsychINFO and Telemedicine and Information Exchange (TIE) databases. The search was conducted using the following keywords: telepsychiatry, videoconferencing and telepsychology. A total of 178 papers were found from peer-reviewed journals and based on review of the abstracts, 72 full text papers were chosen as being specific to efficacy, cost-effectiveness and satisfaction with psychiatric services delivered using videoconferencing. There are many clinical approvals of telepsychiatry programs which can be found when evaluating the literature. It has been found to be highly feasible for managing and evaluating elderly cases and also adolescents and children with mental health diseases. There are also examples of its application for managing many different disorders including delivering cognitive behavioural treatment to cases with

agoraphobia or depression providing psychotherapy to cases with brain injury. Although there are different descriptions of feasible uses for this technology, careful consideration is required to find its effectiveness. Findings from outcomes investigations have provided some preliminary evidence that cases can improve with services delivered using videoconferencing. In a recent project evaluating elderly cases, telemedicine was shown to be as accurate as in-person clinical evaluation in establishing a diagnosis of dementia. In other investigations where telepsychiatry was compared with in-person visit, no differences were found in clinical outcomes or attendance. A recently published article assessed mental health outcomes and showed that telepsychiatry clients approved significant improvements on pre- and post-SF12 mental health variables. Literature has shown the strengths and weaknesses of telepsychiatry within different clinical conditions showing that it can be an appropriate alternative to in-person visit, although additional research is needed to determine the reliability of telepsychiatry for specific subjects.

Recommendations for Telepsychiatry

The field of telepsychiatry is an exciting research field within which to investigate. Compared with the past, there is now a rapidly changing and much more hospitable legislative and business

climate, a solid evidence base, and enthusiasm for the approach from both psychiatrists and cases. Telemedicine, with telepsychiatry at the forefront, will continue to be actively improved by cases and increasingly by younger generations of providers and health leaders. At a policy level, telepsychiatry is increasingly being improved by health insurers, given increasing efforts for telemedicine reimbursement parity, a new telemedicine accreditation program for telemedicine medical service companies from the American Telemedicine Association, and telemedicine's move beyond national borders. Eventually, there will be hybrid models of treatment that combine both in-person and technology-driven care, the latter of which can include e-mail, instant messaging, asynchronous telemedicine, and more. We envision seeing telepsychiatry taught commonly in medical schools, residency training, and continuing medical education programs.

9. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF PEDIATRIC DISEASES

Background of Remote Patient Monitoring

RPM for pediatric cases can be used effectively in many different settings for a variety of disorders and with a variety of emerging technologies. In some cases, pediatric cases are assessed in the hospital by a physician who is in a remote location. In other cases, hospitals are using technologies to assess cases in the hospital, but without contact, therefore, reducing the likelihood of infection or other adverse health effects. Another exciting aspect of RPM is that of assessing cases at their home via continuous monitors or via self-uploading of patient data from a monitoring device at the home. The majority of investigations we have reviewed show significant positive findings, such as improved health outcomes and cost savings to cases and providers, regarding cases who are vulnerable in terms of cardiac health or diabetes. The following sections summarize the emerging themes found in our scoping review, which evaluate the role of RPM technologies and provide support for their efficacy.

Home Assessment of Cardiovascular Implantable Devices

Cardiovascular implantable devices are commonly being applied in the pediatric population as a method of long-term RPM. A variety of research investigations have evaluated the role of RPM with implantable devices in reducing the incidence of adverse cardiac events. In these investigations, cases with newly implanted cardiac devices were followed either prospectively or retrospectively via RPM and compared with cases with the same devices who were assessed traditionally. All 4 investigations showed here used automated data sent from cases to a cardiac or pacemaker care center. At the cardiac care center, data were assessed by a cardiac physician or care nurse and contact to cases and families was initiated via the internet, telephone, or short message service text messaging depending on the findings, commonly in the form of an electrocardiograph (ECG). In two cases, patients could report their manifestations and record specific suspected cardiac events to be sent to the cardiac care team.

Inpatient

In urgent clinical conditions, telemedicine visits can enable pediatric subspecialists to extend the reach

of their expertise to children receiving treatment in distant urban and rural medically underserved areas. Telemedicine is increasingly applied to provide specialty visits to infants and children receiving treatment in community and rural hospitals. The application of live interactive videoconferencing, coupled with the optional application of peripheral devices, including stethoscopes, otoscopes and ophthalmoscopes, and ultrasonography machines, can initiate an in-person bedside visit with a specialist. These uses are often used for cases with unanticipated specialty requirements, including newborn infants delivered at level I or II nurseries, pediatric cases hospitalized without local access to pediatric specialists, and infants, children, and adolescents presenting to emergency units with acute medical emergencies. For pediatric cases located in medical centers with limited pediatric expertise, telemedicine can be applied to access specialists who are not otherwise available in the community. The application of this technology overcomes the barriers of time and distance, allowing specialists, such as pediatric hospitalists, emergency medicine specialists, and critical care practitioners, to bring their skills to the bedside of the child in need. Models of treatment include connecting community and rural nurseries to perinatal and neonatal specialists for common advice or assistance during emergencies. This assistance includes assessments for critical illness, congenital heart disease, genetic abnormalities, and

retinopathy of prematurity. Telemedicine has also been increasingly applied to provide other specialty visits, including critical care and pharmacy services, to children hospitalized in general pediatric units or nonpediatric intensive care units. The use of telemedicine in these conditions has been revealed to decrease unnecessary patient transports. The final aim of this model of care is that hospitalized children are more commonly able to receive treatment in their local communities, leading to less disruption to the family. Telemedicine has even proved effective in regions that already have access to pediatric subspecialty treatments. Attending practitioners at home can use telemedicine to help treatment for cases who are being managed by residents and fellows in teaching medical centers, allowing a quicker response time, backed up by attending practitioners coming into the hospital at night if the patient's problems cannot be treated completely via a telemedical connection. For infants, children, and cases who present to an emergency department that may lack pediatric expertise, telemedicine can be an effective technology to assist in the diagnostic workup, therapeutic choices, and decisions about disposition. Physical abuse cases provide an excellent model to approve the ability of telemedicine to improve emergency department assessment of pediatric cases. Currently, more than 15 telemedical programs in different centers throughout the United States are providing

telemedicine visits to pediatric cases in remote emergency units. Similar to investigations in adult emergency medicine for acute stroke cases, investigations assessing this model of treatment for pediatric cases propose that telemedicine visits can lead to higher parent satisfaction, higher emergency department physician satisfaction, and higher quality of treatment. Results also suggest that this model of care leads to a decrease of unnecessary transports and an overall decrease in costs, given the lower rates of transport and less common use of helicopters. Telemedicine has also been shown to change newborn referral patterns and reduce infant mortality statewide.

Outpatient

Teleconsultation can be applied for common, less time-critical visits. Such visits can occur via a live AV link or through store-and-forward technology. Although telemedicine can be applied to provide outpatient teleconsultations for any subspecialty, pediatric dermatology provides a clear and well-documented example of the application of both live and store-and-forward visits. Less urgent teleconsultations provide many of the same benefits as emergency and urgent critical care visits. cases can receive these visits in their own medical home, thus increasing its utility and significance. Because local access to visit makes appointments easier to keep, the consultant has less difficulty with cases

who fail to keep their appointments, and local care providers can be included in the consultations, increasing opportunities for care coordination and collaboration.

10. TELEMEDICINE GUIDELINE FOR THE MANAGEMENT OF GYNECOLOGICAL AND UROLOGIC DISEASES

Gaps to Access

With the emergence of telemedicine in urology came socioeconomic inequalities in treatment. Many cases do not possess the basic technology needed for a robust telehealth visit. In the initial PHE rules, telephone encounters were not included creating an access gap for those who did not have appropriate Internet, smartphones, or computers. On March 31, 2020, CMS allowed for telephone services to be covered during the PHE (Current Procedural Terminology code 99441-99443), including providing parity between telephone and televideo visits. This bridged a considerable access gap for those unable to perform video visits. Prior to the PHE, coverage and reimbursement for telephone calls were significantly limited. G2021 Healthcare Common Procedure Coding System (HCPCS) code (brief communication technologybased service) seldom was applied and had limited reimbursement. Although telephone coverage expanded access, researchers are evaluating its adequacy as a

telemedical platform. The application of telephone calls was assessed by Safir and colleagues, who compared telephone with face-to-face encounters for hematuria visits in the VA population. They showed access improved from 72 days to 12 days, although overall satisfaction with communication was higher in the face-to-face visit cohort (92% VS 84%).

Telesimulation and Telesurgical Rehearsal

Simulators now are being applied to teach minimally invasive surgical methods. A network of simulators can help teaching and investigating novice surgeons and those who desire improvement. Simulators can standardize teaching and as well allow for interactive proctoring during the simulated interventions. A surgical dress rehearsal may be possible before the actual operation. Currently, urology patient specific simulations are in development that could be integrated into established educational programs rapidly and easily.

Preconception Counseling

A significant component of the well-woman consultation for a reproductive-aged woman is a discussion about her life plan on reproduction. The case can undergo monitoring and evaluations

depending on her history, manifestations, and risk factors. This time is the ideal time when PCC, infertility evaluation, health care related to sexually transmitted disorders, and a discussion on the full range of contraceptive choices that are available can take place. The aim of PCC is not just to help a case gain pregnancy but to establish a favorable pregnancy outcome with a healthy mother and a child.

PCC is an extension of a well-woman consultation. A detailed discussion on lifestyle habits, body weight and nutrition, monitoring examinations for antibody condition that need vaccination as well as monitoring for a medical situation should be conducted in addition to common gynecology evaluation. When something is identified or if the case has known chronic medical situations, these require to be addressed, controlled, and assessed. Reproductive history, including recurrent pregnancy loss (RPL), previous stillbirth, history of delivery of an infant with congenital anomalies, history of preterm labor, gestational diabetes, or preeclampsia, is meaningful data. Genetic visit and monitoring can be offered to cases with increased risks of genetic disease. Initial PCC using TM/TH can be either performed with a general OB-GYN doctor, primary care physician (PCP), NP, or PA; then, if something abnormal is identified, the case can be referred for specialist visit using the TM/TH system. Ideal candidates for these visits are

women with known medical problems, for example, seizure diseases, blood clotting diseases, thyroid disease, chronic hypertension, diabetes, history of pregestational diabetes, poor obstetric history, and RPL. Evaluation of body habitus can be performed by measuring the BMI. Depending on BMI, the case can be referred for visiting by a nutritionist and/or referral for bariatric management if adequate. TM/TH can be applied not only for specialist visit but also for general PCC. Lifestyle changes, like smoking, alcohol, and recreational drug cessation, are a crucial component of PCC and can be performed using TM/TH.

11. TELEMEDICINE GUIDELINE FOR THE REHABILITATION DEPARTMENT

Telehealth, Telemedicine, and Telestroke

Telehealth is a general term that is used for all forms of health information exchange and interaction that use advanced technology and communication systems such as the Internet and cellular broadband. This includes longdistance learning and health care transfer. Telemedicine is not a treatment modality, but rather it is a subdivision of telehealth methodology applied to facilitate health care. Cellular broadband transmission has enabled telemedicine providers to conduct medical interventions or evaluations and review data remotely. This facilitates interactions between case and provider and multiple providers. Telemedicine can be an especially effective tool in time-sensitive medical emergencies, such as acute ischemic stroke, when videoconferencing equipment can be applied to conduct a real-time teleconsultation. Telestroke is an effective delivery modality for stroke specialist care to remote hospitals that do not have much stroke proficiency on-site. However, there are a few implementation barriers due to up-front costs of

initial acquisition and installation of telestroke instruments and training of physicians and ambiguous patterns of reimbursement. Surveys performed among stroke specialists and emergency practitioners propose that telestroke can be an effective way to bridge geographical barriers to stroke expertise and may be superior to telephone visit. Moreover, cost analysis of telestroke utilization care suggests that long-term outcomes are improved and medical costs overall are lower, which negates short-term installation costs. That is to say, the cost of the installation of the needed hardware, cameras, and monitors for telemedicine is more than paid for by the decreased neurological deficits that are a result of the application of the technology. Long-term care for cases with more severe neurological deficits is more costly than the telemedicine hardware and installation. For example, the intravenous application of rtPA decreases neurological disability, and telestroke programs are correlated with increased rtPA usage. The greater application of tele-consultation and the related increased usage of rtPA will likely continue to improve neurological outcomes in stroke cases geographically outside the reach of PSCs. Furthermore, telestroke can offer a more comprehensive stroke treatment beyond the acute thrombolysis phase and has the potential to improve investigation efficiency. Investigations have revealed that the National Institutes of Health Stroke Scale (NIHSS) can be reliably conducted via

telestroke.

Multiple Sclerosis

Cases with multiple sclerosis (MS) are at risk for developing long-term problems. Rehabilitation provides treatments and managements to reduce the impact of disability and improve function; however, access to those services is difficult by limited mobility, fatigue, and related issues. It has been revealed that subjects with MS are willing to receive rehabilitative services through telemedicine. However, cases with moderate-to-severe disability may experience technical difficulties due to cognitive and physical disability. Charvet and colleagues have applied an adaptive online cognitive improvement program to train cases with MS at home. The cases were randomly assigned to either a common adaptive cognitive improvement program or an active control of ordinary computer games. This telerehabilitation technology provided modest improvement in cognitive efficacy as assessed by changes in a composite of neuropsychological duties. Khan and colleagues performed a systematic review of the application of telerehabilitation to provide or supplement treatment to subjects with MS. The investigations assessed included multiple delivery modalities, some complex, with more than one rehabilitation component and included physical activity, educational, behavioral, and manifestation management programs. With such heterogeneous

methodology, it was concluded that there is limited findings on the efficacy of telerehabilitation in improving functional activities, fatigue, and quality of life in cases with MS. The review also showed that evidence supporting telerehabilitation in the longer term for improved function, impairment, quality of life, and psychological outcomes is poor. A very recent randomized clinical study provides higher-quality evidence that telerehabilitation is technically feasible, desirable, and effective in improving gait and other outcomes in cases with MS. An ongoing investigation is assessing the delivery of complementary and alternative medicine sessions at home to rural and low-income cases with MS versus the same intervention delivered in the clinic by a health care provider.

12. TELEMEDICINE GUIDELINE FOR THE IMAGING AND RADIOLOGICAL DEPARTMENT

Obstacles and Limitations to Teleradiology

The regulatory and legal environment in the U.S. is known as the limiting factor. For full/comprehensive services with final reading, radiologists required to be licensed in the remote institution's state, credentialed in the institution and insured for medicolegal liability. This is not a trivial undertaking and the regulatory environment is years behind the improvements in technology. For example, some states and hospitals need personal attendance at continuing medical education (CME) sessions, as well as training for security/Health Insurance Portability Accountability Act (HIPAA) to the same level as an in-house practitioner. Even simple report keeping can be daunting with each state having different CME and licensing requirements. Each new institution commonly needs written approval of good standing from all the other institutions a radiologist has been associated with, sometimes for 5–10 years.

Comprehensive Services with Academic and Educational Components

This is the natural next step in teleradiology functionality as the specialty of radiology becomes even more subspecialized and the legal standard of treatment is a national one rather than a local standard as in the 1980s and before. Even the largest pediatric institutions in the U.S. have problem in providing cutting edge advanced imaging services such as functional MR urography. The growth of complex interspecialty fetal and neonatal imaging, as well as the sophisticated MR and CT protocols needed tax even the big institutions. If the consortium model approves successful financially, the large consortium institutions may have one superspecialist for a particular evaluation and share that individual between them and the associated smaller institutions. Evening and overnight volume is commonly too small in most institutions to support the salary of an overnight radiologist, but one radiologist can reasonably and profitably cover multiple centers. The smaller, but academic/training institutions related to the developing consortia benefit by being able to view and interact over the internet with presenters at teaching sessions or case review conferences. Even international teaching sessions have been successfully carried out.

Commercial International Teleradiology

In the future there will be no difference between PACS and teleradiology. Virtual imaging organizations will become reality. The following question will be created: Will teleradiology significantly change the way we manage our profession? Can radiology services almost completely be outsourced when we keep in mind that less than 10% of the total radiology imaging, namely vascular and interventional radiology, is exempt from outsourcing? Theoretically yes, but more possibly no. Radiologists have many other duties besides reporting images such as: justification of need, ad hoc problem solving, optimizing and tailoring individual evaluation methods, conferencing in multidisciplinary groups, organizing workflow and quality control. On the other hand in many centers there is a growing tendency towards overflow of workload, which can be clarified by the increasing demand for imaging interventions throughout Europe. This overflow could be managed by teleradiology. Teleradiology should be regarded as a valuable choice for managing this type of overflow problems. Introducing teleradiology however is not plug-and-play. Before initiating to send images using teleradiology the stakeholders require to formulate a clear agreement about the following aspects:

- How the clinical data is transmitted and integrated?
- How the previous images/interventions and the records are made available?
- How quality assurance is organized?
- Is single or double reading needed?
- What turn around time is required?
- What language is applied in the condition of cross-border teleradiology?
- What legislation is involved in the country of the case?
- What about privacy and integrity of information?
- How the communication between referring practitioners and radiologists is assured?
- How are all these processes validated?
- What medico-legal aspects are to be dealt with?

In the last decade several commercial cross-border teleradiology centers have been working in Europe. These centers can develop an unmatched concentration of expertise and industry-level quality controls. Also in the field of mass-monitoring programmes these centers can play a significant role. At the moment in several European regions mass-monitoring programmes are put out to tender. It is expected that the role of teleradiology will increase and that teleradiology centers will take up their role in the delivery of imaging services.

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APPLICATIONS, LIMITATIONS, AND GUIDELINES FOR THE U...

13. TELEMEDICINE GUIDELINE FOR THE ORTHOPEDIC AND SPORTS MEDICINE DEPARTMENTS

Telerehabilitation for the Postoperative Orthopedic Patient

In particular, strong evidence approves that virtual physical therapy management for knee arthroplasty is noninferior to standard face-to-face physiotherapy following total knee replacement. Systematic reviews on total knee arthroplasty cases showed that telerehabilitation treatment led to comparable pain relief, and significantly higher extension range and quadriceps strength than face-to-face rehabilitation. Perhaps the more substantial gains in functional recovery are clarified by the convenience of telerehabilitation and possible enhanced compliance. Less literature exists evaluating telerehabilitation for the upper extremity; however, the existing literature is promising. A recent investigation established evidence for the efficacy of telerehabilitation after shoulder arthroscopy in impingement syndrome. This investigation revealed that a virtual

rehabilitation exercise program with ROM and strengthening of the rotator cuff and scapula stabilizers was comparable and noninferior to traditional face-to-face physical treatment.

Virtual Yoga

Yoga is popular form of complementary and integrative medicine that complement standard medical treatment, and investigations provide evidence that yoga via telehealth provides comparable satisfaction and health improvement to in-person yoga. An investigation evaluating a clinical yoga program at a Veteran Affairs Medical Center showed high patient satisfaction and revealed 88% of subjects showed some degree of subjective symptom improvement, including pain, energy level, depression, or anxiety. Those who participated via telehealth did not significantly differ from in-person subjects in any level of satisfaction, overall improvement, or improvement in any of 16 specific health problems. Investigations support the application of yoga in health care settings, and reveal that delivering yoga to a wide range of cases within a health care setting is thought to be feasible and acceptable, when delivered in-person and via telehealth.

Limitations of Telemedicine

Telemedicine has many good benefits regarding increasing efficiency and decreasing costs, but

limitations have been highlighted with the lack of in-person physical evaluations, barriers to accessibility, and the validity of the virtual evaluations, especially in acute and complex situations. According to an online survey of 781 cases that experienced telemedicine, the main benefits are the lack of hands-on care, the lack of intimacy, and technical difficulties. The main aim of telemedicine is to improve accessibility of professional expertise to the case. The opposite effect was seen when trying to implement such a system with the elderly subjects due to their limited access to the instrument or technical data necessary to participate in teleconsultations. For this reason, a lot of surgeons opted to use standard telephone visit to alleviate this issue. In-person physical communication and evaluations are a crucial part of the visit as it can directly express care, compassion, and comfort. Teleorthopedics does not allow this type of interaction which might affect the doctor-patient relationship and result in sub-optimal treatment. Investigations on the virtual physical evaluation have approved the ability to assess the range of motion in healthy subjects. With the current technology, it is not possible to remotely evaluate the temperature, to palpate, or to physically stress and examine joints. In that sense, the virtual physical evaluation provides very limited information and an incomplete clinical picture. Evidence to determine the role of teleconsultation in an acute manifestation or complication does

not exist. Investigations assessing case satisfaction with telemedicine may underestimate the role that in-person visits have in breaking social isolation and detecting child, elder, or domestic abuse and violence. In fact, one in six female cases presenting to an orthopedic fracture medical center is a victim of domestic abuse and almost 2% are presenting as a direct consequence of physical abuse. Orthopedic surgeons have a significant role and opportunity in detecting these patients. Telemedicine limits the ability to take a clear history and does not always provide the condition necessary for such disclosures or observation of interactions with their partner.

14. TELEMEDICINE GUIDELINE FOR THE PHARMACEUTICAL CONSULTATIONS

Telepharmacy

Telepharmacy, analogous to telemedicine, is a more recent technology that refers to pharmaceutical service provision. Strategies to address the barriers to accessing pharmacy services have led to the creation of several models of telepharmacy. The National Association of Boards of Pharmacy defines “telepharmacy” as “the provision of pharmaceutical treatment through the application of telecommunications and information technologies to care at a distance”. Telepharmacy delivers clinical pharmacy cares and the dispensing of a prescription at a remote region without the physical presence of a pharmacist. Typical telepharmacy involves cares such as medication order review, dispensing and compounding, drug information services, case counseling, and therapeutic drug assessment. Therefore, telepharmacy applies state-of-the-art technology that allows a qualified pharmacist situated at a central location to supervise a pharmacy help or a pharmacy technician situated at a remote site in the dispensing of pharmaceuticals through audio

and video computer connections. Telepharmacy acts as a potential alternative to around-the-clock on-site pharmacist medication review for remote medical centers. This has been adopted by many healthcare centers as an alternative strategy of extending pharmacy coverage in areas where 24-hours pharmacy services are not accessible. The emerging electronic health information systems and related technologies, such as fax, and electronic health reports make data more readily available to pharmacist for review before a dose is available for administration to a patient. These modalities are advancing telepharmacy cares and enabling pharmacist to have role efficiently in improving medication use.

Involvement of Pharmacists

In any telepharmacy type, pharmacist can play a pivotal role in the delivery of pharmacy cares. The pharmacist involving in telepharmacy models ensures high quality service for the community especially regions such as medication reviews and patient visit. A 2013 investigation of the effect of telepharmacy cares has revealed that the involvement of pharmacists in the remote review of medication orders when the hospital pharmacy was closed led to a reduced number of adverse drug events reported. Adverse drug events and other medication error have role in several thousand deaths each year. The annual

cost of preventable adverse drug events in the USA alone is estimated to be approximately US \$2 billion. Similarly, a 2012 US investigation has revealed that adverse patient outcomes including prolonged hospitalization and potential death may have been prevented using telepharmacy cares as potential alternatives to around-the-clock on-site pharmacist medication review for rural medical centers. With the growing population of cases with chronic medical conditions, all around the world involvement of pharmacists in telepharmacy models to improve assessment and encourage medication compliance can reduce the risk of medication errors, adverse drug events, reduced medication cost, and the chances for treatment failure. This means that we require to be cautious of some of the telepharmacy models that often exclude active pharmacist involvement including Internet pharmacies, vending machine models, mail-order pharmacies, and models that shift pharmacist's roles to other healthcare professionals such as physicians and nurses.

Pharmaceutical Counselling Activity

Home drug delivery (HDD) is a recently developed way of medicines delivery consisting in dispatching medicinal agents directly at home or at the workplace of cases. This allows time and money saving, especially for cases under chronic

pharmacological management and going often to a pharmacy or a hospital to get their medicines. HDD is of great interest and utility primarily in rural or in regions with relevant geographic dispersion. In Spain, this service was suggested to HIV (Human Immunodeficiency Virus) cases and was managed by hospital pharmacists. An in part similar initiative was developed in Denmark. This consisted in provision of remote pharmacist counselling for cases who obtained drugs via Internet or received them home. This counselling was provided commonly via telephone or video calls by community pharmacists. Both experiences reached the aims of guaranteeing appropriate management of cases. Not negligible findings were money and time saving and subject satisfaction.

15. TELEMEDICINE GUIDELINE FOR THE NURSING CARES

Clinical Applications of Telenursing

Telenursing has been provided for nursing practice as a means of providing electronic care readily to cases at a distance using telecommunications. Critics have questioned whether electronic care constitutes nursing care. The American Nurses Association (ANA) first endorsed telenursing in 1999 as an official form of nursing practice, and has approved that electronic nursing care has value to many cases. Telenursing also is referenced as telehealth, and these terms are applied interchangeably. According to the ANA, telenursing meets the standards of nursing practice because nurses using telenursing follow the common nursing process to formulate treatment plans and provide treatment to cases. These nurses still use their nursing recommendations and skills to evaluate, plan, initiate, and assess nursing procedures for their distant cases. Although they have no physical contact with their cases, telehealth nurses use their nursing knowledge to find clues from patients' tone of voice and facial expressions to evaluate and make nursing diagnoses. Telenursing

allows nurses to care for many cases at a distance. The value of telenursing to case is that skilled nurses are available to them for questions or concerns as they arise, enabling them to receive effective nursing service readily. Telenursing can reach many cases who otherwise may not be able to receive appropriate healthcare. It can be especially helpful for elderly cases with mobility problems, cases with debilitating disorders, and subjects living in rural regions where little or no healthcare is available. Telenursing promotes efficient accessibility to nurses with no geographic constraints. It is most common in its current uses for telecare nursing and telehomecare nursing. Telenursing includes any type of nursing service delivered at a distance wholly or partly through electronic means. Telecare nursing is a type of telenursing. Telecare nurses collect and interpret data on the phone from callers with different problems. These callers may be cases, their family members, or caregivers seeking advice. Telecare nurses refer these callers to adequate healthcare resources within a prescribed time. Using the nursing process, telecare nurses evaluate callers' problems with regard to urgency, plan and implement therapeutic service with adequate suggestions or referrals, and assess their nursing actions by callers' responses to the telephone advice. Callers do not have to accept the suggestion given to them by telecare nurses. The nurses are not held accountable for their disregarded suggestions, but they are held liable should they fail to warn callers

about the possible outcomes of noncompliance. To protect against liability, telecare nurses should report their dialogues with callers, as well as the warning they issued to the callers about rejecting suggestions made to them.

Improved Patient Monitoring

The remote treatment of chronic diseases can also be conducted in a convenient and cost-effective manner and is predicted to increase. An annual e-health forecast estimated an increase of home screening modalities in the next few years that will evolve into more streamlined agents. One home screening investigation managed by an APN and a cardiologist followed and managed heart failure cases at home with fewer readmissions with shorter hospitalization for heart failure than traditional outpatient consultations. The application of telehealth technology was shown to significantly improve heart failure treatment while decreasing the cost of care. In Japan, an asthma telemedicine investigation used a nurse under physician supervision to follow patients' medication compliance and peak flow values at home. Exacerbations were found earlier and managed with a zone-controlled plan that led to an 83% decrease in hospitalizations.

Preventative Services

Achievement of an annual monitoring for diabetic retinopathy is often logistically difficult for isolated and high-risk cases such as Native Americans on tribal lands. Digital imaging of the retina can be carried out by APNs and e-mailed for ophthalmologist interpretation at a distant monitoring center. Access to ophthalmological visit and referrals are improved while removing the waiting times, travel, and fees. Furthermore, the earlier retinal monitoring using telemedicine moves diabetic retinopathy subjects away from acute care and back to the realm of preventative medical center.

Role Complement

Increased independence can enrich the practice experience for both the case and health care provider. A nurse-led telemedicine service to the elderly in a rural Scottish village showed that combining a referral strategy with televideo visit was effective to cases, nurses, and practitioners alike. The cases were satisfied with its convenience and appreciated the nurses' role in clarifying points that they had not find out during the visit. Furthermore, the numbers of cases managed solely by the community health nurse increased considerably, while fewer cases required referral to a practitioner. Another investigation compared

APNs using telemedicine in three rural Missouri regions with APNs who did not use telemedicine. The APNs with the technology showed improved professional development and peer connectedness, citing both formal and informal learning choices, while those without it viewed the telemedicine capability as potentially supportive of increased patient care and professional satisfaction. The investigation concluded that the technology supports telemedicine in augmenting the role of the APN in different of rural regions.

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