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TELE-HEALTHCARE AND THE USE OF VIRTUAL COMMUNICATION TECHNOLOGIES IN MEDICAL RESEARCH AND APPLICATION: THE FUTURE OF TELEMEDICINE IS NOW!

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ABSTRACT

Contemporary world events are demonstrating the need to embrace and further develop tele-health options for assessment and delivery of biopsychosocial healthcare services. This is now possible, given advances in communication technologies allowing virtual connections of medical personnel with constituents, as well as necessary, in light of recent challenges posed by infectious conditions and growing needs for travel restrictions, social distancing, and isolation of large portions of populations. Moreover, the opportunity to virtually connect with persons through ubiquitous computer-based and handheld communication devices allows comprehensive care provision to include underserved areas, where restricted, walk-in access to brick-and-mortar establishments has long been recognized as a limiting factor in healthcare. This review examines evolving approaches of tele-healthcare, with a specific focus on telemedicine as a bridge between traditional, in-person approaches to diagnose and treat medical conditions and new healthcare opportunities developing to meet changing societal needs. The three purposes of the review are: discuss background information, with a brief look at policy and procedure guiding applications of tele-techniques in healthcare practices; identify relevant scientific studies to show the breadth of new evidence-based research for telemedicine practices; and, discuss challenges for the further development of telemedicine as healthcare systems in the United States evolve to meet current and projected healthcare needs.

KEYWORDS: telemedicine, tele-healthcare, tele-techniques, virtual communication technologies, integrated primary care-behavioral healthcare, mental health

Background

The need for healthcare to be responsive to environmental concerns has never been greater. As this article is being written, challenges for healthcare providers are growing exponentially, with calls for wide-ranging solutions to meet unprecedented needs posed by the novel coronavirus – COVID-19 [1]. Among these concerns are: more efficient testing procedures to pinpoint virus spread, community containment and contact tracing strategies to isolate hot spots of contagion [1,2], and nuanced implementation of strategies to minimize iatrogenic effects of widespread economic disruption. In addition, the need to better protect first-responders and front-line medical personnel has been pushing the use of virtual communication for remote diagnoses, advice, and triage systems [3]. In the United States, persons experiencing symptoms are told to avoid, if possible, going to the hospital emergency room and to first call the doctor or clinic before showing up in person; following a consultation and diagnosis, persons with less than severe symptoms are advised to isolate at home. Telemedical services are increasingly being utilized and developed to handle these initial communications with patients as well as a wide variety of needed follow-ups. While many of the adjustments made to healthcare are being forced by the logistics of COVID-19 treatment and care, the further development of tele-procedures is expected to continue to reshape the biopsychosocial delivery of services beyond the current crisis and into the future [4–6].

Telemedicine and Growth of Tele-healthcare

Telemedicine includes the use of information and communication technology devices to deliver professional services across geographical distance and time [7,8]. While the concept of telemedicine has been discussed as potentially useful in practice for decades [9,10], the continuing lack of empirical validation for tele- techniques, overall, has led many physicians to move cautiously toward modification of traditional practice guidelines. In short, not all physicians have been convinced that patients would be well served (not to mention better served) by significant alterations of traditional face-to-face interactions occurring inside brick-and-mortar establishments [11]. The circumstances prompting the use of tele-techniques, however, has now changed with the exigencies of the COVID-19 crisis. Against the backdrop of ever-rising healthcare costs [12], projected shortages of professionals to meet growing healthcare challenges [13], and increasing needs to manage chronic health-related conditions [13], physicians are being encouraged to consider whether more rapid incorporation of telemedicine into medical practices is warranted [1].

Consumer-demand issues are also driving the market toward the adoption of tele- techniques in healthcare [14]. Use of virtual technologies outside the realm of healthcare has become common and familiar; phones are now computers, and comparison shopping has become an everyday activity for many people. Research shows that consumers now expect choices and often look beyond price to range of services offered [15]. The healthcare industry has shown sensitivity to this trend, with hospitals and physicians developing and using websites to advertise and gauge demand. In turn, just as retail consumers have shown a preference for comprehensive business systems – consider Walmart and Amazon, the ultimate one stop shops – consumers in the healthcare marketplace are now similarly beginning to look for comprehensive care provision. As an example, the development of integrated primary care-behavioral healthcare (PCBH) models over the last decade in the United States has broadened many medical service delivery practices to include psychological and social forms of care previously ignored or accessed only through off-site referrals by medical practitioners [16,17]. The more comprehensive PCBH systems have provided choice for persons with mental health issues, who still rely on physicians as a first line of defense [18]. Rather than not knowing where else to go or having no choices, though, data now show that persons in need of mental health interventions can and do search online for inclusive service delivery, where medical, psychological and social care are accessible in a single practice [19,17]. The PCBH systems have been early in the move to adopt virtual care delivery, sometimes using telehealth techniques to facilitate service delivery onsite but, more typically, using tele-techniques such as videoconferencing when too few professionals are available onsite and services must be accessed and shared across virtual space [16]. The sharing of resources has been particularly relevant for rural areas, where medical and mental health professionals are in great demand, although there are shortages of psychiatrists and psychologists in many urban areas, as well [20]. As mental illness is now recognized as a leading cause of disability [21], and the conjoint presence of mental and physical health problems affects one in four persons in the United States [22], a persuasive argument can be made that use of tele-techniques offers potential to alleviate suffering and aid in provision of treatments for a significant number of people.

These shifts in societal needs and consumer expectations toward a virtual consumer market for medical services have recently been supported by reformulations of policy by professional organizations [23,12], resulting in a broader range of practitioner credentials approved for tele-practice modalities [17]. In March 2020, the United States Federal Government, under the direction of the president, declared that COVID-19 represented a national emergency and invoked the National Emergencies Act (NEA) to temporarily loosen restrictions on use of telemedicine and telehealth interventions, broadly defined [1]. Among those professionals moving quickly to incorporate and/or further expand use of tele-techniques were physicians, psychiatrists, psychologists, nurses, counselors, and social workers, with additional professionals (e.g., occupational therapists) operating under the aegis of integrated practices [10]. This rush to market for virtual service delivery has not, however, been ignored or quietly accepted by all healthcare professionals. Editorials and commentary in medical circles have been issued and note the continuing need to hold the empirical line for science to guide the direction and future development of telemedicine [24,25]. This response is consistent with the NEA, which holds as a first principle that national emergency responses must strike a balance between public health and individual rights and insure that interventions are evidence-based through scientific studies and not representative of political concerns [1].

Telemedicine Practice Areas

As tele-service provision is relatively new, overall, literature reviews to gauge its use and effectiveness typically cover studies across various uses of the term tele-. For example, a search for the term "telemedicine" in medical databases results in research-based articles for telemedicine [26], but also articles for tele-health [27,10,28], tele-rehabilitation [29,30], e-consults [31], eHealth [8], mHealth [32], and tele-practice [33]. Similarly, a search for "telemedicine" across science and health literature databases, in general, results in studies that employ such comprehensive terms as technology-driven interventions [34], information and commu-

nication technology devices [35], innovative assistive technologies [36], and digital health interventions [37]. This abbreviated list does not include research for mental health issues, typically covered under such terms as tele-psychology [38] and tele-mental health [39,40], nor does it address studies increasingly identifying roles in virtual delivery of mental health services by practitioners (e.g., social workers) operating as behavioral health providers [16,17]. For purposes of clarity, this overview will use the term telemedicine and primarily focus on studies clearly indicative of use of tele-techniques for medically-directed interventions.

Research literature made available since the declaration of the pandemic by the World Health Organization on March 11, 2020 [41] highlights evidence for when telemedicine service delivery might be useful as stand-alone or adjunctive therapies and, further, defines areas of medical practice for which telemedicine may not be appropriate [23,42]. An overview of these recent, evidence-based studies shows that tele-interventions are useful in: allergy/immunology practices [8]; cancer and radiotherapy treatments [43]; chronic respiratory disease treatment [44]; palliative care for Parkinson's and neurocognitive disorders [45]; and, treatment, monitoring, and/or rehabilitation of persons with cardiovascular conditions [46], type 2 diabetes [47,43]), stroke conditions [48], asthma [42], and chronic obstructive pulmonary disease [49]. Further, recent studies have supported the use of telemedicine techniques in ophthalmology [25], treatments of opioid use disorder [50], chronic pain care [51], anxiety and depression [52], and in post-trauma treatments within a primary care-behavioral health framework of integrated care [17]. In addition, tele-techniques have been shown to be efficacious: for children [53], adolescents [54,55], and adults of all ages [43]; in urban [43] as well as rural areas [56]; for medical [47], psychological [52], and social problems [57]; with acceptance by clinicians [58], nurses [59], and clients and their caregivers [58,44]; when used in primary care [23] and home settings [60]; and, for acute [17], postacute [61], and long term care [56].

In addition to treatment outcome studies, the telemedicine literature also covers a wide variety of practice issues as providers share knowledge for what needs attention. Assistive-technology needs of caregivers are discussed to support aging-in-place and independent living in light of the burgeoning and coming need for long-term care based on population aging [36,13]. Studies are available that call for "reimagining" medical education [5, p. 1127] and how best to prepare nurses for the "uncharted waters" of the COVID-produced "transformed workplace" [59, p. 288]. Issues such as licensing [8], ethics of practice [44], and reimbursement for specialty consultations outside of the "traditional inpatient consult structure" are discussed [31, p. 399] and provide insight for providers on how to best move forward. An examination of rural-urban disparities in care gives insight into the potential of tele-techniques to address perceived inequities in mental health care practice [62]. Some authors have provided in-depth examinations for what tele-techniques work in their practices – yes: smartphone monitoring in cardiology emergencies [46]; no: "breaking bad news" in an oncology setting [23, p. e879]. In an insightful commentary entitled, "Telemedicine: The unsung corona warrior", issues in the legal, technological, financial, ethical, and scientific domains were discussed as barriers that must be addressed before telehealth can reach its full potential [25]. It seems apparent that this burgeoning literature, albeit perhaps as a result of societal restrictions somewhat limiting access to traditional care, attests to a growing interest in tele-healthcare options. This cannot be determined at the present, however, and will most likely not be determined until the pandemic ends and full empirical assessments of the new treatment modalities are conducted.

Challenges for Telemedicine

There are numerous issues to address before use of tele-techniques can become the "new normal". There is an expressed need for training and education, necessary to manage complex aspects of technology of telehealthcare, although data exist showing that technology issues diminish for healthcare personnel with a higher frequency of usage [58]. Nonetheless, depending on the type of technology involved, virtual service delivery may require the assistance of an IT (information technology) person to set up and manage equipment used [16]. This is an issue with synchronous (i.e., real time) connections in a supervised setting, such as when videoconferencing allows face-to-face connections within a provider system; even with commercially-available programs designed for virtual connections, training for personnel responsible for scheduling and executing sessions [58], as well as a knowledgeable person to upload program updates and troubleshoot disconnections (e.g., during power surges and outages), may be useful. Similar technology concerns surround asynchronous communications, defined as automated and preprogrammed content of computer-based applications, when store-and-forward health provider information and remote-patient monitoring [8] are administered within practices by persons without backgrounds in information technology areas. Both synchronous and asynchronous issues are compounded when service delivery involves direct-to-consumer care and clients located offsite use their own equipment [8]. Although most people today have access to and know how to use smart phones, the types of technology involved in healthcare delivery, with stringent standards for such practice issues as informed consent and confidentiality, are often complex and beyond the capabilities of many consumers. This is particularly true for older adults, who are making gains in the virtual world but still lag behind younger persons in utilization of internet-based technologies [63,64].

A similar issue involves the non-uniform access in the United States to broadband, a problem highlighted through the pandemic by unmet needs of adults working remotely and children attending internet-based classes. An often cited advantage of tele-communications for healthcare is provision of services in rural areas, where access to brick-and-mortar institutions is restricted. Although phone service and internet-based computer connections have improved greatly in recent years and communication devices meeting healthcare standards (i.e., computers, laptops, tablets) are increasingly affordable, access is still limited or completely unavailable in many remote areas [62].

There are also practice issues associated with telehealth that may require further resolution, such as when boundaries overlap and professionals working in interdisciplinary settings adhere to different sets of practice guidelines [16]. While physicians are most often the acknowledged leaders of telemedicine teams, there are other providers working in close association with physicians, sometimes as employees but also through consultations, who may have their own guidelines for practice and ability to seek reimbursement for services rendered. One would think that the practice guidelines for different disciplines should be consistent in instances of team treatments of clients – for example, in primary care-behavioral health integrated practices – but preemptive conversations for clarification of possible differences can be useful. Licensure issues appear to be reaching consensus for telehealth providers in the United States, with professional licensure most typically required in the state of the client, regardless of practice and/or provider location [8]. Similarly, reimbursement for tele-services, at least during the temporary conditions granted by the NEA, are consistent with previous rates.

Conclusion

It is clear that the use of tele-techniques in practice settings predate the pandemic [10], but it is equally true that there has been an acceleration of telehealth service delivery driven by need and the rapid production and expansion of policies necessary to guide and protect providers. There is some concern, perhaps well-founded, that technological advances may outpace ethical guideline development [65]. It is true that the accelerated pace of change for technologies has become the expectation, particularly among young consumers, and it may be difficult to return from this forced immersion in the tele-health world to care approaches that are perceived as less convenient. In any evaluation, the pandemic has lasted a sufficient length of time for researches to begin establishing scientific validation for what aspects of telemedicine do and do not work in practice settings. It is doubtful that the insights gained through this process will be lost as COVID-19 is finally brought to heel. What is more certain is that the key to the continuation of telehealth lessons learned during the pandemic is acceptance by physicians [58], and acceptance by physicians depends upon establishing the empirical bases for tele-healthcare techniques [1].

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