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An Evolutionary Examination of Telemedicine: A Health and Computer-Mediated Communication Perspective

Gerald-Mark Breen and

Research assistant in the Department of Public Affairs at the University of Central Florida. He specializes in health communication, social policy, and media studies

Jonathan Matusitz, Ph.D.

Assistant professor in the Nicholson School of Communication at the University of Central Florida. His academic interests include communication and technology, health communication, and organizational communication

Abstract

Telemedicine, the use of advanced communication technologies in the healthcare context, has a rich history and a clear evolutionary course. In this paper, the authors identify telemedicine as operationally defined, the services and technologies it comprises, the direction telemedicine has taken, along with its increased acceptance in the healthcare communities. The authors also describe some of the key pitfalls warred with by researchers and activists to advance telemedicine to its full potential and lead to an unobstructed team of technicians to identify telemedicine's diverse utilities. A discussion and future directions section is included to provide fresh ideas to health communication and computer-mediated scholars wishing to delve into this area and make a difference to enhance public understanding of this field.

Keywords

communication; healthcare; e-health; Internet; technology; telemedicine

Introduction

The purpose of this paper is to provide an evolutionary examination of telemedicine, by both applying a combined perspective, and deriving jargon and an analytical approach, from specific authorities in the health (Doolittle et al., 2005; Turner, 2003; Whitten, Davenport Sypher, & Patterson, 2000) and computer-mediated (Walther, Gay, & Hancock, 2005) communication disciplines. One of the main premises set forth by the authors is that telemedicine services have become successful in delivering and exchanging healthcare information. This paper begins with a general overview of telemedicine, how it has been defined by published specialists in the communication and healthcare fields, and the essential forms of telemedicine discussed in publications of various sorts generations ago, in recent years, and even up to the present day. The authors then proceed with a section of greater detail on how telemedicine originated and how it was introduced to the public, and particularly the healthcare industry, where it could be applied for the direct benefit of patients. This sort of historical breakdown paves the way for a subsequent discussion on how telemedicine gained increased acceptance in the medical field and the public sphere. Thus, this perception of telemedicine drives the authors to discuss the

later and inevitable development of telemedicine devices previously and still somewhat regarded as highly sophisticated technology, which continue to be engaged pervasively in the healthcare system.

What comes next is a discussion of e-health, a conglomeration of telemedicine services that, above all, make ready access of medical and pharmaceutical information available to those who have Internet service on their or others' computers. After finishing the evolutionary segment covering telemedicine's developmental course, the authors address reasons why telemedicine has suffered interference and resistance in its advancement by various external factors, such as legal issues surrounding the practice and a deficiency in training and expertise in the usage of telemedicine technologies. The paper ends with a discussion section and provides future direction for researchers interested in the field of health and computer-mediated communication, and identifies potential solutions to ease the progress of telemedicine's integration in the healthcare and public sectors.

Telemedicine Overviewed

In this section, the authors provide a general overview of telemedicine. Particularly discussed are definitions of telemedicine, its typical applications, and other relevant knowledge to readers otherwise partial, limited, or uninformed in their understanding of this complex and technical specialty.

Telemedicine is defined as the use of advanced communication technologies, within the context of clinical health, that deliver care across considerable physical distance (Breen & Matusitz, 2007; Latifi, 2008; Matusitz & Breen, 2007; Matusitz & Breen, in press; Mort, May & Williams, 2003; Turner, Thomas, & Reinsch, 2004). As such, it enables and ensures the delivery of tele-healthcare to specifically benefit medical patients (Turner, 2003; Whitten, Doolittle, & Mackert, 2004; Wootton, 2001). Such communication technologies encompass a variety of advanced, computerized equipment, allowing physicians, nurses, and other similar health professionals to provide complex healthcare thousands of miles away from the location of service (Eysenbach, 2001; Turner, 2003; Whitten, Davenport Sypher, & Patterson, 2000). Besides, not only is telemedicine a system that can be practiced in a diversity of medical settings, but it can also assist and hasten communication (i.e., correspondence, dialogue, and interchange) between medical practitioners and their patients. It does so between locations of clinical practice in order to provide relief and/or guidance (Ausserresses, 1995; Matusitz & Breen, 2007). The vast range of applications for telemedicine consists of patient care (Wootton, 2001), training, research, and public health to diagnose, administer care (Whitten, Davenport Sypher, & Patterson, 2000), send and receive health information (Mort, May, & Williams, 2003), analyze x-rays, and educate health professionals (Turner, Thomas, & Reinsch, 2004).

As the medical field has so progressively harnessed and exploded with innovative, complex technological devices for healthcare delivery, telemedicine now even includes hundreds of reliable, Internet-based medical sites that provide an enormous amount of information about diseases, treatments, pharmaceuticals, and images of pathology (Oudshoorn, 2008). These types of services are known as a form of telemedicine called e-health (Breen & Matusitz, 2007; Matusitz & Breen, 2007), a recent breakthrough in telemedicine technology discussed in detail later. Some of the primary e-health applications validate how telemedicine has, to a great extent, culminated into an invaluable mine of resources accessible via any computer (i.e., PC and laptop computers, etc.) linked to the Internet (Latifi, 2008; Oudshoorn, 2008).

In the next section, the authors discuss how telemedicine was introduced to society and the original forms of telemedicine that were utilized for healthcare purposes. Although the subsequent segment of this paper focuses on early types of telemedicine applications, it also

emphasizes that many of these initial services remain active and commonly used within healthcare and other similar environments where benefits from these tools can still be seen.

Original Telemedicine Applications

The origin or introduction of telemedicine, that is, distant medical assistance through communication and technology, can be traced back to the time during which electronic devices emerged in the public eye (Turner, 2003). In the last century, the amateur engagement of telegraphy, radio, telephones (including cellular telephones, blackberries), television, and wireless communication have assisted in physician-patient communication (Turner, Thomas, & Reinsch, 2004).

Even though much debate has surrounded the “what, how, when, and where” of the first official and *real* telemedicine services, the earliest cited application, according to Turner (2003), occurred in 1959. Through the use of intensive research into the history of telemedicine, literature (i.e., Wittson & Benschoter, 1972) has shown that this first telemedicine study was designed and later conducted to illustrate the advantages of a unique form of telecommunication in a psychiatric context. Specifically, the use of a two-way closed-circuit microwave television system enabled successful telemedicine communication, education, and research between the Nebraska Psychiatric Institute and Norfolk State Hospital in Nebraska (Matusitz & Breen, in press; Mort, May, & Williams, 2003; Perednia & Allen, 1995; Turner, 2003; Turner, Thomas, & Reinsch, 2004; Wittson & Benschoter, 1972).

Interestingly, the National Aeronautics and Space Administration (NASA), when first established, launched further research and development into the area of telemedicine with their newly operative, space-bound astronauts. As novice and precautionous explorers in the unpredictable and uncharted territory beyond Earth’s boundaries, astronauts naturally were required, by NASA, to receive constant monitoring of their physical and mental statuses (Cermack, 2006). Through NASA’s sophisticated designs and efforts, the crew’s special suits (those that enabled them to exit the spacecraft and enter outer space) contained devices that continuously checked and reported their physiological conditions via communication satellites. In this way, NASA could successfully act as distance, supervisors to their astral voyagers, especially with a well-staffed team of medical technicians at their disposal and exclusive to monitoring the astronauts in their delicate surroundings and conditions (Cermack, 2006).

These improvements in space technology were observed by other organizations and later applied to rural medicine in the early 1970s through the Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC) program (Mort, May, & Williams, 2003; Turner, 2003), as well as distant areas (Preston, Brown, & Hartley, 1992), remote communities deficient in medical care (i.e., arctic regions, islands, in mountainous areas, and open plains absent regular technology) (Cermack, 2006), and developing and Third World countries (Turner, Thomas, & Reinsch, 2004; Wright, 1998). Telemedicine has worked well in Africa (Malami, 2008).

As time passed, and as medicine rapidly developed into a far more sophisticated sphere, especially at the technological level, telemedicine generated greater importance and visibility by the 1980s. This is the time when costs decreased for much of the information and communication technologies on which the efforts relied (Doolittle et al., 2005; Turner, Thomas, & Reinsch, 2004; Whitten, Davenport Sypher, & Patterson, 2000). In the following section, the authors go into detail on how and why telemedicine gained increased acceptance in relevant public and private sectors, and how the development of telemedicine devices led to even more advanced designing, manufacturing, and use of telemedicine in various ways and in diverse settings.

Increased Acceptance and Development of Telemedicine Devices

When telemedicine, as a practical resource (which included a multitude of devices), became generally accepted in healthcare and other communities proven to benefit from its services (Bloom, 1996; Turner, 2003), it turned out to be categorized, niche-oriented, and narrowed down to provide specific services for particular sectors, contexts, and applications. For instance, telemedicine became segmented into applications used exclusively in the management of various diseases, conditions, or pathologies (Matusitz & Breen, in press; Turner, 2003; Turner, Thomas, & Reinsch, 2004), such as those related to cardiological (Wirthlin et al., 1998), dermatological (Leshner et al., 1998), neurological (Craig et al., 1999; Turner, 2003), and respiratory (Nuccio, 2004) diseases. In these contexts, a specific diagnosis is rendered and then the pathology is treated using the most apposite form of telemedicine services within reach.

Earlier studies have even substantiated that increased access to telemedical devices has been embraced among individuals with chronic and debilitating diseases (Tetzlaff, 1997; Turner, Thomas, & Reinsch, 2004), especially neurological, pulmonary, and cancerous pathologies (Doolittle et al., 2005; Whitten, Doolittle, & Mackert, 2004), which can be terminal or life-threatening illnesses. More recently, Caceres et al. (2006) discovered that telemedicine technologies can even benefit those in the latest, or most final, stages of HIV/AIDS. Given the severity of this disease, and the stigma attached to it, acceptance of telemedicine in helping patients with this pathology should increase and human contact, where people feel uncomfortable and at risk of infection, may probably decrease.

Telemedicine also became classified in terms of the technological form it took on. In the past few decades, and even up to today, everyday electronic devices, including camera light boxes, e-mail services, fax machines, interactive television units, multimedia, remote monitoring systems (Cermack, 2006), telephones, and videoconferencing (Capner, 2000; Matusitz & Breen, in press; Mort, May, & Williams, 2003; Turner, 2003) have taken the many forms that comprise telemedicine technologies. More recently, Matusitz and Breen (2007) itemized newly patented telemedicine devices; these consist of, among others, order entry systems and smart alarms. These mechanisms are intended to deliver medical care to minimize the gap between the availability of expertise and services in unequipped or technologically deficient sites. For instance, smart alarms are identified as telemedicine systems because they are technological apparatuses that communicate vital physical information about a patient to medical personnel when a clinical emergency is transpiring. Order entry systems are inventory control systems that transmit health-related needs between the provider and the patient (i.e., medication refills, increasing and decreasing dosages, discontinuing medications) (Mort, May, & Williams, 2003; Turner, Thomas, & Reinsch, 2004).

Besides the typical healthcare settings where telemedicine practices are applied, telemedicine has been moderately, but critically, used in military combat situations (Mort, May, & Williams, 2003; Turner, 2003; Turner, Thomas, & Reinsch, 2004). This comprises another sort of sub-category in which telemedicine has been sectioned off. In the military arena, telemedicine can provide rapid communicative services to medics treating direct gunfire or shrapnel-pierced casualties in firefights.

Walther (1996; 1997) would argue that this is a critical form of interpersonal computer-mediated communication. With this type of technological maneuvering, telemedicine services can circumvent the requirement of an on-site physician, a usual condition for managing and caring for serious military-related wounds (Cermack, 2006; Matusitz & Breen, in press; Turner, Thomas, & Reinsch, 2004).

Matusitz and Breen (2007) and Turner (2003) addressed how the variety of telemedicine services has benefited medical practitioners, patients, and general healthcare consumers in multiple ways. They classified these benefits in terms of telemedicine's abilities. The first is that telemedicine can transcend geographical boundaries. In other words, it boosts the availability of health communication services among disadvantaged, isolated (Cermack, 2006), and restricted communities and citizens. Telemedicine also has the ability to circumvent temporal boundaries (Mort, May, & Williams, 2003; Turner, 2003; Whitten, Davenport Sypher, & Patterson, 2000). This means that telemedicine services can ameliorate health communication by reducing time constraints caused by limited time allocated to appointment visits between doctors and patients.

In line with these contentions, telemedicine can reduce clinical and patient costs in various ways (Turner, 2003). For example, as a general assumption, the costs needed to make emergency transfers of patients to other states (using helicopters, airplanes, or ambulances) or even other countries (such as between the US and Mexico or Canada) can be colossal to many individuals who lack adequate financial backing. Hence, ready access to telemedicine for instance, using videoconferencing between advanced hospitals with specialists and small clinical facilities with general practitioners – can save time, money, and lives for that matter (Allen & Hayes, 1994; Allen, Roman, Cox, & Cardwell, 1996).

Turner (2003) also looked at reasons for patient satisfaction with telemedicine, and, in reviewing data reported by Gutske et al. (2000), deduced that a decrease in waiting time, travel time, and hassles in arranging appointments through telephone systems and excessive hold times, brought about increased acceptance of telemedicine in some communities. In line with how computer-mediated communication is typically described (Walther, 1996; 1997; Walther, Gay, & Hancock, 2005), telemedicine increases patient satisfaction in many cases and also serves as suitable alternatives to traditional methods of medical administration, especially in debilitated and terminal patient populations (Doolittle et al., 2005; Whitten, Doolittle, & Mackert, 2004). Terminal patient populations sometimes exist in hospice settings, which are medical site of palliative care and for the imminently, terminally ill. For those patients in hospice settings, where such palliative care is administered, telemedicine can become a crucial element to a smooth transition from life to death (Caceres et al., 2006; Whitten, Doolittle, & Mackert, 2004).

Clearly, it makes logical sense that telemedicine has advanced, developed, and thus gained increased acceptance from several communities where it can be tapped into and applied. It provides patients and doctors, in its many forms, with computer-mediated, health communication channels that would otherwise be unavailable in its absence. In the next section, the authors look at the most recent breakthrough in telemedicine technology: E-health. These extraordinary lines of services will be discussed at length and in depth.

A New Form of Telemedicine: E-Health

The reality of the 21st century world is that it has turned into a massive-scale “cyber-planet.” In our new digital 21st century, telemedicine has become a standard tool in the way of Internet-based medical sites (Mort, May, & Williams, 2003). WebMD.com, Medlineplus.gov, Medscape.com, and Mentalhelp.net are only a few of these Internet-based resources, yet they also represent some of the prominent forerunners in the e-health industry (Breen & Matusitz, 2007; Matusitz & Breen, in press). For instance, because we are now in an era of widespread, almost excessive, diagnosis of psychiatric illness and subsequent pharmaceutical treatment for the management of these conditions (Nelson, Barnard, & Cain, 2006; Shear et al., 2006), such patients, as well as individuals who suspect they might have a mental malady, can use e-health services to obtain information on many psychological conditions or treatments (Nelson,

Barnard, Cain, 2006). In other words, many of their psychological questions can be answered with the information provided on e-health web sites.

One most common psychological condition investigated on-line using e-health sites include depression, especially among youths (Nelson, Barnard, Cain, 2006). Too, names of doctors who are within close proximity to them and who may specialize in a particular area of mental illness can be brought to their computer monitors for them to see (Owen & Fang, 2003). This service generally enables patients to receive the most appropriate form of medical care from the right type of provider. With regard to dermatology, diagnosed patients – as well as anxious individuals who believe they might have a dermatological pathology (i.e., carcinomas, mole deformities, etc.) – can readily obtain images and information of many known and idiopathic conditions via e-health services. In a similar vein, e-health services also have the potential to enhance the concern of “telecompetence.” Telecompetence is the rationale, access, expertise, and the set of norms and rules that influence the accomplishment of organizational dimension in a virtual environment such as telemedicine (Turner & Peterson, 1998).

Chang (2004), one authority in the e-health field, has also identified that e-health can fulfill the needs of *all*: citizens, healthcare consumers, medical doctors and healthcare professionals, policy makers, and so on. E-health services comprise a variety of services, such as health education, nursing, and medication prescription or refills via e-prescribing. Walgreens.com is one such company that enables this easy type of automatic refilling process of prescription drugs via their corporate web site. E-mail, another type of e-health, also provides a conduit by which providers and patients can communicate about health, an invaluable and cost-effective method to discuss patient status and doctor recommendations (Della Mea, 1999). Therefore, e-health services are particularly useful to individuals who hesitate to visit medical doctors because of the costs involved in receiving direct healthcare. With the increasing use of the Internet, and the online surfing and searching for health-related information (Rice & Katz, 2001), e-health services have significant implications from both patients’ and practitioners’ perspectives.

Hindrances Decelerating Telemedicine’s Progressive Evolution

Telemedicine, as a whole, may well have been far ahead of where it could be at the present time had hindrances not impeded or interfered with the scientists and technicians who specialize and strive to develop its diverse technological, social, and healthcare services (Blair, Bambas, & Stone, 1998; Turner, 2003). One such issue has to do with its licensing and legal implications (Dickens & Cook, 2006). For example, legal liabilities, interstate licensing, and institutional credentialing of physicians can create scenarios in which “pointing the finger” at the responsible party for a medical malpractice incident may become litigiously difficult to resolve (Dickens & Cook, 2006; Granade, 1995). Too, when documents or records pass through multiple hands, or even across digital spaces (i.e., Internet, e-mail, etc.) or computer-mediated communication systems (Walther, 1996), patient privacy becomes threatened. Lawyers, hospital administrators, medical practitioners, and patients alike are all concerned about these potential privacy hazards (Granade, 1995; Turner, 2003; Whitten, Davenport Sypher, & Patterson, 2000).

Another logical source of resistance comes from health insurance companies, whose money is typically sought after for coverage in many of these cases involving telemedicine applications (Turner, 2003; Turner, Thomas, & Reinsch, 2004). Thus, insurance companies are careful, reluctant, and almost skeptical to accept any untraditional methods of healthcare administration other than their comfortable, standard practices that have existed for generations. However, organizations and empowered individuals are working hard to produce and present persuasive messages to insurance companies to gain their general acceptance of the tremendous

advantages and savings telemedicine can offer in the healthcare environment (Matusitz & Breen, in press; Turner, 2003; Turner, Thomas, & Reinsch, 2004).

The whole United States, conversely, does not suffer from a complete insurance *barricade*. Certain states have insurance companies that grant exceptions to these practices. These states include California, Oklahoma, and Texas (Turner, 2003). Eventually, other states should, through persuasion from specialized groups, begin adopting policies that allow telemedicine applications to be covered by health insurance companies either specific to those states or through national healthcare organizations.

Probably the most crucial hindrance to the progressive evolution of telemedicine is a general lack of educated personnel who know how to use the equipment and technology that comprise telemedicine (Turner, 2003). In simple terms, there is limited knowledge and expertise in telemedicine services (Matusitz & Breen, 2007). This shortage of expertise and proficiency in telemedicine also, in turn, obstructs the creative mind from thinking up more efficient and effective modalities of telemedicine applications (Turner, Thomas, & Reinsch, 2004). This paucity of knowledge also yields the inability for education of medical practitioners. In effect, fresh physicians out of schooling are unable to learn and adopt these innovative methods of delivering health services. As such, this dilemma has forced a deceleration in the overall implementation of telemedicine technology and services (Turner & Peterson, 1998; Whitten, 1995), a nasty and an almost self-defeating route for telemedicine's future.

Because we are not in a perfect world, that is, a utopian society, we face challenges and have to work to overcome them or find alternatives through stratagem. Telemedicine, as an overall resource, has faced far too many challenges (Dickens & Cook, 2006; Whitten, Davenport Sypher, & Patterson, 2000), but, thankfully, scholars, researchers, spokespersons, and others have dedicated their efforts to attempting to resolve these hindrances so that telemedicine can advance in its proper course and in due time. The next section provides a final discussion of this paper and suggests ideas and avenues for future health communication and computer-mediated communication researchers interested in telemedicine in general and ways to improve its current standing, acceptance, availability, and advancement.

Discussion and Future Directions

What this paper has demonstrated is that telemedicine has followed an evolutionary course that can be traced and described through the perspectives of those who specialize in or primarily study in the areas of health and computer-mediated communication (Doolittle et al., 2005; Turner, Thomas, & Reinsch, 2004; Walther, Gay, & Hancock, 2005). Clearly, telemedicine has a distinct and well-established history, especially with regard to the rich scholarly coverage it has received from famous authorities in the research and healthcare fields (Turner, 2003; Whitten, Doolittle, & Mackert, 2004; Wittson & Benschoter, 1972). It has been developed by insightful and ingenious technicians who understand its utility and potential. Medical practitioners and patients have benefited from telemedicine in various ways since its advent.

However, how much telemedicine could have actually grown and delivered to its recipients remains unclear, as hindrances fell in its face from the start and prohibited and/or created hurdles to its development. All sorts of factors, such as legal walls (Dickens & Cook, 2006), patient privacy issues, distance issues (Mort, May, & Williams, 2003), and a general scarcity in qualified technicians to use these tools, have created a sort of developmental and technological straitjacket that has forced those individuals motivated enough to vigorously break free from the tough boundaries and fight to attempt to remedy what obstacles stood (and continue to remain as roadblocks) in their way so that full exposure of telemedicine's capabilities could be unleashed.

These issues logically lead up to why future researchers must continue to investigate how, through legal, communicative, and/or other means, telemedicine can be advanced as rapidly as possible – while keeping in mind ethical and unavoidable boundaries – so that the technology can be furthered and provide more and unique healthcare benefits and advantages to those who truly need it.

Health communication scholars in particular must delve into these impediments that may be outside their realms of expertise – such as the esoteric legal aspects – and attempt to collaborate with those who can put together proposals that can crush the barriers that block telemedicine from flourishing more than it does now. Those who would be ideal for collaboration would be attorneys who do work in liability law, interstate licensing procedural law, and serve on or have an affiliation with boards responsible for managing the institutional credentialing of physicians. These impediments have been shown to be serious hurdles to telemedicine's development.

Specific computer-mediated communication scholars also have their contributions to make to find ways to work around these same issues. Because a plethora of Internet-based web sites exist, such as WebMD.com, Medlineplus.gov, Medscape.com, and Mentalhelp.net (Matusitz & Breen, in press; Mort, May, & Williams, 2003), computer-mediated communication experts and researchers must work together with web designers and database compilers in order to maximize the efficiency, quality, and quantity of the healthcare information and resources available via these sites. Accuracy of information is also a crucial issue when it comes to the distribution of healthcare information on the Internet, especially through the sites listed above. Although disclaimers exist that protect and/or exempt companies from liabilities stemming from misinformation, misinterpretation, or injurious incidents related to people who disobey or overlook these disclaimers, law suits are always capable of slithering through the almost airtight verbiage nested in statutes and statements of non-liability.

For sensitive and potentially contagious and deadly diseases such as HIV/AIDS, some medical practitioners are simply afraid to work with patients who are in these pathological states, for fear of disease transmission. Even though telemedicine technologies have been invented and recently used (Caceres et al., 2006) on these types of patients, educational and motivational programs should be put in place to encourage medical personnel to decrease their fear and increase their presence in these suffering patients. Health communication scholars in particular can collaborate specifically with the medical practitioners to devise some techniques to reduce or eliminate the concern and aversion to work with these types of patients.

As diseases become increasingly dangerous for others without the diseases to be around, more and more technological devices will be invented to avoid contact and the anxiety experienced by those who wish to directly help and benefit patients with deadly and perceivably contagious diseases. Perhaps the future will show us that telemedicine will be increasingly found in replacing humans working with other humans who are infected with diseases of the greatest gravity. After all, telemedicine is designed to allow computers and technology to facilitate healthcare delivery. If telemedicine can bring fruits to these sensitive medical areas, there is a strong chance that more acceptance of telemedicine technologies will be seen and greater usage of the various telemedicine technologies will be utilized.

References

- Allen A, Hayes J. Patient satisfaction with telemedicine in a rural clinic. *American Journal of Public Health* 1994;6(5):18–19.
- Allen A, Roman L, Cox R, Cardwell B. Home health visits using a cable television network: User satisfaction. *Journal of Telemedicine and Telecare* 1996;2:92–94. [PubMed: 9375106]

- Ausserresses A. Telecommunications requirements for telemedicine. *Journal of Medical Systems* 1995;19 (2):143–151. [PubMed: 7602246]
- Blair, P.; Bambas, A.; Stone, H. Legal and ethical issues. In: Viegas, S.; Dunn, K., editors. *Telemedicine: Practicing in the information age*. New York: Lippincott-Raven; 1998. p. 49-59.
- Bloom D. Viewpoint: The acceptability of telemedicine among health-care providers and rural patients. *Telemedicine Today* 1996;4(3):35–50.
- Breen GM, Matusitz J. An interpersonal examination of telemedicine: Applying relevant communication theories. *eHealth International Journal* 2007;3(1):18–23.
- Caceres C, Gomez EJ, Garcia F, Gatell JM, del Pozo F. An integral care telemedicine system for HIV/AIDS patients. *International Journal of Medical Informatics* 2006;75(9):638–642. [PubMed: 16759900]
- Capner M. Videoconferencing in the provision of psychological services at a distance. *Journal of Telemedicine and Telecare* 2000;6:311–319. [PubMed: 11265099]
- Cermack M. Monitoring and telemedicine support in remote environments and in human space flight. *British Journal of Anesthesia* 2006;97(1):107–114.
- Chang BL. Internet intervention for community elders: Process and feasibility. *Western Journal of Nursing Research* 2004;26:461–466. [PubMed: 15155029]
- Craig JJ, McConville JP, Patterson VH, Wootton R. Neurological examination is possible using telemedicine. *Journal of Telemedicine and Telecare* 1999;5(3):177–181. [PubMed: 10628033]
- Della Mea V. Internet electronic mail: A tool for low-cost telemedicine. *Journal of Telemedicine and Telecare* 1999;5(2):84–89. [PubMed: 10628017]
- Dickens BM, Cook RJ. Legal and ethical issues in telemedicine and robotics. *International Journal of Gynecology & Obstetrics* 2006;94(1):73–78. [PubMed: 16777109]
- Doolittle G, Whitten P, McCartney M, Cook D, Nazir N. An empirical chart analysis of the suitability of telemedicine for hospice visits. *Telemedicine and E-Health* 2005;11(1):90–97. [PubMed: 15785226]
- Eysenbach G. What is e-health? *Journal of Medical Internet Research* 2001;3(2):e20. [PubMed: 11720962]
- Granade P. Malpractice issues in the practice of telemedicine. *Telemedicine Journal* 1995;1(2):87–89. [PubMed: 10165336]
- Gutske S, Balch D, West V, Rogers L. Patient satisfaction with telemedicine. *Telemedicine Journal* 2000;6(1):5–13.
- Latifi, R. Current principles and practices of telemedicine and e-health: Studies in health technology and informatics (Volume 131). Fairfax, VA: IOS Press; 2008.
- Leshner JL, Davis LS, Gourdin FW, English D, Thompson WO. Telemedicine evaluation of cutaneous diseases: A blinded comparative study. *Journal of the American Academy of Dermatology* 1998;38 (1):27–31. [PubMed: 9448201]
- Malami SA. Use of telemedicine for cytology training in Africa. *Journal of Telemedicine & Telecare* 2008;14(2):105–106. [PubMed: 18348759]
- Matusitz J, Breen GM. Telemedicine: Its effects on health communication. *Health Communication* 2007;21(1):73–83. [PubMed: 17461754]
- Matusitz J, Breen GM. E-health: A new kind of telemedicine. *Social Work in Public Health*. (in press).
- Mort M, May CR, Williams T. Remote doctors and absent patients: Acting at a distance in telemedicine? *Science, Technology, and Human Values* 2003;28(2):274–296.
- Nelson E, Barnard M, Cain S. Feasibility of telemedicine intervention for childhood depression. *Counseling & Psychotherapy Research* 2006;6(3):125–129.
- Nuccio P. Telemedicine: The future is now. *The Journal of Respiratory Care Practitioners* 2004;4(1):15–23.
- Oudshoorn N. Diagnosis at a distance: the invisible work of patients and healthcare professionals in cardiac telemonitoring technology. *Sociology of Health & Illness* 2008;30(2):p272–288.
- Owen DJ, Fang ME. Information-seeking behavior in complementary and alternative medicine (CAM): An online survey of faculty at a health sciences campus. *Journal of the Medical Library Association* 2003;91(3):311–321. [PubMed: 12883563]

- Perednia D, Allen A. Telemedicine technology and clinical applications. *Journal of the American Medical Association* 1995;273(6):483–488. [PubMed: 7837367]
- Preston J, Brown FW, Hartley B. Using telemedicine to improve health care in distant areas. *Hospital and Community Psychiatry* 1992;43(1):25–32. [PubMed: 1544643]
- Rice, RE.; Katz, JE. *The Internet and health communication: Experiences and expectations*. Thousand Oaks, CA: Sage Publications; 2001.
- Shear K, Jin R, Ruscio AM, Walters EE, Kessler RC. Prevalence and correlates of estimated DSM-IV child and adult Separation Anxiety Disorder in the National Comorbidity Survey Replication. *American Journal of Psychiatry* 2006;163:1074–1083. [PubMed: 16741209]
- Tetzlaff L. Consumer informatics in chronic illness. *Journal of the American Medical Association* 1997;4(4):285–300.
- Turner, JW. Telemedicine: Expanding healthcare into virtual environments. In: Thompson, TL.; Dorsey, AM.; Miller, KI.; Parrott, R., editors. *Handbook of health communication*. 2003. p. 515-535.
- Mahwah, NJ.; Turner, JW.; Peterson, C. Lawrence Erlbaum Publishers. *Organizational telecompetence: Creating the virtual organization*. In: Viegas, S.; Dunn, K., editors. *Telemedicine: Practicing in the information age*. New York: Lippincott-Raven; 1998. p. 41-48.
- Turner JW, Thomas RJ, Reinsch NL. Willingness to try a new communication technology: Perpetual factors and task situations in a health care context. *Journal of Business Communication* 2004;41(1): 5–26.
- Walther JB. Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research* 1996;23:3–43.
- Walther JB. Group and interpersonal effects in international computer-mediated collaboration. *Human Communication Research* 1997;23:342–369.
- Walther JB, Gay G, Hancock JT. How do communication and technology researchers study the Internet? *Journal of Communication* 2005;55:632–657.
- Whitten P. Defining a structure for delivery of telemedical services. *The Journal of the HealthCare Information and Management System Society* 1995;9(3):23–33.
- Whitten P, Davenport Sypher B, Patterson JD. Transcending the technology of telemedicine: An analysis of telemedicine in North Carolina. *Health Communication* 2000;12(2):109–135. [PubMed: 10938909]
- Whitten P, Doolittle G, Mackert M. Telehospice in Michigan: Use and patient acceptance. *American Journal of Hospice and Palliative Medicine* 2004;21(3):191–195. [PubMed: 15188918]
- Wirthlin DJ, Buradagunta S, Edwards RA, Brewster DC, Cambria RP, et al. Telemedicine in vascular surgery: feasibility of digital imaging for remote management of wounds. *Journal of Vascular Surgery* 1998;27(6):1089–1099. [PubMed: 9652471]
- Wittson CL, Benschoter R. Two-way television: Helping the medical center reach out. *American Journal of Psychiatry* 1972;129:624–627. [PubMed: 4673018]
- Wootton R. Telemedicine. *British Medical Journal* 2001;323:557–560. [PubMed: 11546704]
- Wright D. Telemedicine and developing countries. *Journal of Telemedicine and Telecare* 1998;4(2):2–37.