Telemedicine and the Provider-Patient Relationship: What We Know So Far

Report Prepared for the Nuffield Council's Working Party on
Medical Profiling and Online Medicine:
The Ethics of 'Personalised' Medicine in a Consumer Age

Submitted January 17, 2010

Report Author:

Edward Alan Miller, Ph.D., M.P.A.

Department of Gerontology
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125-3393
United States of America

Phone: +1-617-287-7313
Fax: +1-617-287-7080
Email: edward.miller@umb.edu

Table of Contents

1.0. Executive Summary

Telemedicine involves the use of telecommunications and computer technology in the delivery of health services to enable provider-patient and provider-provider consultation across geographic boundaries. Despite growth there is a general feeling that telemedicine has a long way to go before it reaches its full potential. A large proportion of rural and urban communities that could benefit continue to lack access to telemedicine; so too do many developing nations. Furthermore, those programs that are initiated tend to be short-lived while those that do survive frequently experience disappointing levels of usage.

A number of factors contribute to this state of affairs. Impediments include financial barriers, ethical and legal concerns, piecemeal development of the telecommunications infrastructure, and lack of resources necessary to sustain telemedicine use, particularly in some regions and nations and among certain vulnerable populations. Another often sited barrier is a dearth of systematically collected and analyzed evaluation data, including the impact of telemedicine on the provider-patient relationship. This is important for several reasons.

By affecting consultation behavior telemedicine may impact trust, which can facilitate patient disclosure and cooperation. It may also influence the extent of patient and physician participation during medical encounters, either facilitating movement toward patient-centered and consumerist patterns or reinforcing traditional paternalistic patterns. Understanding the impact of telemedicine is also important because it may help overcome prevailing resistance to the technology, thereby promoting further use where appropriate. Perhaps most importantly elucidating the effects of telemedicine on provider-patient communication is necessary because telemedicine may impact important outcomes, including satisfaction, adherence and compliance, health and clinical status, recall and understanding, and psychological well-being.

A conceptual framework is proposed that posits that patient, provider, and contextual characteristics influence the nature and content of provider-patient communication, all of which, in turn, affects various health outcomes. How this process unfolds, however, depends, in part, on the medium through which consultation takes place, whether in-person, over the telephone, via fax or email, or through two-way interactive video. Consultations that take place through two-way, interactive video often serve as substitutes for in person encounters. Since participants in video consultations rarely meet face-to-face, it is important that the impact of substituting video for in person contact with health and medical professionals be delineated.

Telemedicine's influence on the nature and content of provider-patient communication stems from both its technical aspects and interpersonal aspects. Technically, telemedicine may impact provider-patient communication through depersonalization of the provider-patient relationship, participatory enhancements and impediments, and sensory and non-verbal limitations. Interpersonally, telemedicine may impact communication through third party participation, social and professional distancing, and underdeveloped norms and standards.

Despite methodological and conceptual weaknesses, prevailing research reveals high levels of patient satisfaction with telemedicine, particularly with respect travel, waiting time, and access to specialist care. More often than not findings also favor provider-patient communication with telemedicine, with the only exceptions being lack of touch and non-verbal behavior.

Since most existing research relies on post-encounter surveys of providers and patients there is little information about more subtle and detailed changes in communication that take place over televideo. To obtain a fuller understanding of the effects of telemedicine on the provider-patient relationship, it is critical that more in depth investigations of actual medical encounter behavior be undertaken. Particularly important in this regard is verbal content analysis,

which uses interaction analysis systems to fully describe and categorize what communication takes place.

Due to differences in methodology and context it difficult to generalize across ten interaction analysis studies that have been conducted to date. Findings from several are consistent with provider-patient research in traditional, face-to-face settings, findings from others are not. First, just as in the traditional setting, provider utterances tend to predominate in telemedicine encounters, though, in one study, patient utterances tended to predominate. Second, on-site providers tended to be substantially less active than off-site providers. This suggests that presenters typically serve as facilitators and observers more than active participants. Third, the traditional pattern of more task-focused than socioemotional utterances tended to persist in telemedicine, though some comparisons indicated that telemedicine might be less patient-centered; others that it might be more so.

In addition to comparing electronically mediated to conventional health system interaction it is critical that future research compare telemedicine consultations to each other, across different specialties and technical specifications. Furthermore, once patterns of communication are understood, researchers should examine the relationship between these patterns and patient, provider and contextual characteristics, as well as important outcomes. Results from studies such as these would facilitate development of training programs and other interventions that improve provider-patient communication in telemedicine, not to mention the development and adoption of more user friendly interfaces. Ultimately, additional research is necessary if we are to more fully understand the theoretical benefits, challenges, subtractive and enhancing effects of telemedicine on the provider-patient relationship.

2.0. Introduction

Telemedicine involves the use of telecommunications and computer technology in the delivery of health services to enable provider-patient and provider-provider consultation across geographic boundaries. It encompasses several different forms of information transmission (voice, sound, video, still picture, text), communication technologies (standard telephone lines, coaxial cable, satellite, microwave, digital wireless, ISDN, Internet), and user interfaces (desktop computers, laptop computers, personal digital assistants, Fax machines, telephones, mobile phones, videophones, various stand alone systems and peripheries) (Figure I). These permit a range of activities, most prominent of which include: ***store-and-forward applications***, which involve the asynchronous transmission of medical information, patient/provider communications and other data; live ***audiographic encounters***, which combine sound with still pictures; and perhaps, most noteworthy, ***live two-way interactive video consultations***. There are also several potential uses. This is reflected in the prevailing terminology, with "telemedicine" often being used to describe clinical, patient care applications, and "telehealth" being used more broadly to describe both clinical *and* non-clinical applications in the way of education, administration, and research.[i]

[Figure I about Here]

The potential for telemedicine to provide high-quality care to remote patients living in medically underserved communities is frequently highlighted (George, Hamilson and Baker 2008; Hassol, et al. 1997; Nesbitt, Ellis and Kuenneth 1999). Because doctors and advanced

[i] Still another term "e-health" refers even more broadly to health information technology (HIT), though it is most often used in reference to computers, the Internet and related hardware and software, including electronic medical records, email, and rapid access to reliable medical information from the World Wide Web and other sources (Bodenheimer and Grumbach 2003; Kaushal, et al. 2005; Miller and West 2009; West and Miller 2009).

technologies tend to be concentrated in certain regions and countries, rural residents and those living in inner city areas and developing nations typically go without sufficient levels of service. It is widely believed that telemedicine may be an efficient way of bridging this gap in "care capacity," thereby improving access to high-quality health care both within and across nations. The manifestation of this belief is evidenced in remarkable growth in telemedicine applications since the early 1990s. This is reflected in one 2003 survey which found that more than 85,000 non-radiology patient-provider teleconsultations took place in the United States in 2003 in 88 responding telehealth networks involving more than 2,000 health care facilities located in 39 states and the District of Columbia (Grigsby 2004). The average number of non-radiology teleconsultations per U.S. network increased nearly three times since 2000, from 682 to 1,806. Including 57 non-responding but active networks, there were a total of 145 telehealth programs in 45 states and the District that year, up from just 10 programs ten years earlier. Furthermore, the average network size nearly doubled from 16 to 27 sites. Fifty-four non-U.S. programs operating in 6,823 sites in 20 countries also were identified, with half deriving from the United Kingdom (9 networks), Canada (10), and Australia (8).

Barriers to Telemedicine Growth and Development

Despite growth there is a general feeling that telemedicine has a long way to go before it reaches its full potential. A large proportion of rural and urban communities that could benefit continue to lack access to telemedicine; so too do many developing nations. Furthermore, those programs that are initiated tend to be short-lived while those that do survive frequently experience disappointing levels of usage. A number of factors contribute to this state of affairs (Figure II). Impediments include financial barriers; in particular, the high costs of setting-up and implementing such systems and the prevailing lack of third party reimbursement for providers

who operate and use them (Center for Telemedicine Law 2003; Grigsby 2004; Miller, et al. 2005; Miller and Sim 2004; Middleton 2005; Wallwiener, et al. 2009). Impediments include ethical and legal concerns; especially those related to confidentiality—to what extent can privacy be ensured (Parrot, et al. 1989; Starr 1999), professional portability—to what extent can health care professionals "move in person or virtually across barriers, and among and between jurisdictions" (Goldberg, et al. 2005), and uncertain malpractice exposure—to what extent does current legal criteria apply to novel consultation mediums such as this (Blum 2003; Kuszler 1999; Sanders 1995; Spielberg 1998). Impediments include the piecemeal development of the telecommunications infrastructure which, due to a lack of interoperability, promotes use of technologies that cannot speak with or understand one another (Craft 2005; Kleinke 2005; Walker, et al. 2005). Impediments include the lack of infrastructure and resources necessary to sustain telemedicine use, particularly in some regions and nations and among certain vulnerable populations; for example, the elderly, disabled, members of certain minority groups, those with low literacy, low income, limited English proficiency, living in rural areas and situated in undeveloped nations (Miller and West 2007, 2009; Miller, West, and Wasserman 2007; Risk and Peterson 20002; West and Miller 2005 2009; Wootton, Jebamani and Dow 2005). Dearth of systematically collected and analyzed evaluation data regarding telemedicine's impact on cost, quality and access is another often cited barrier (Bashshur 1998; Bashshur, Shannon and Sapci 2005; Demiris and Tao 2004; Field 1996; Grigsby, et al. 1995a; Hailey, Ohinmaa and Roine 2004; Hjelm 2005; Joint Working Group on Telemedicine 2000; Miller 2007; Reardon 2005).

[Figure II about Here]

Scholarly activity related to telemedicine has exploded (Brown 2005). Perhaps this is best reflected in growth in the professional literature, with, for example, the number of telemedicine

articles increasing from but a handful per year prior to 1990 to several hundred or more per year after 1998 (Moser, et al. 2004). However, of 1,321 articles published in the two leading peer-reviewed journals—*Journal of Telemedicine and Telecare* and *Telemedicine Journal*—few could be classified as clinical trials (4.7%) or evaluation studies (5.5%) (Demiris and Donghua 2004). Most are case reports, research syntheses, and small-scale qualitative investigations. This implies that while the existing literature supports the feasibility of telemedicine for specific clinical applications (e.g., psychiatry, pathology, radiology, cardiology, home monitoring) (Jennett, et al. 2003), there exists a paucity of high quality research evidence documenting its impact on various outcomes. "Claims of telemedicine program efficacy," Bashshur, Shannon and Sapci (2005) argue, "pertaining to improved access, equal or enhanced quality compared with traditional medical care, and reduced costs cannot be made with strong assurance"

The Importance of the Provider-Patient Relationship in Telemedicine

Several frameworks have been proposed for evaluating telemedicine over the last ten years (Bashshur, Shannon and Sapci 2005; Grigsby, et al. 2005b; Grigsby, Brega and Devore 2005; Esser and Gossens 2009; Joint Working Group on Telemedicine 2000; Sisk and Sanders 1998; Miller 2002; Wootton, Jebamani and Dow 2005). These suggest a variety of research methods ranging from randomized experiments to quasi-experimental designs to secondary data analyses to in depth qualitative investigations. They also suggest rigorous comparisons of costs and benefits, or costs and effects, including telemedicine's impact on quality and access. This includes the impact of telemedicine on the provider-patient relationship. Does telemedicine enhance or damage the therapeutic relationship or the traditional practice of medicine? Does telemedicine facilitate or inhibit patient communication of their discomfort, symptoms, or socio-emotional state? Does telemedicine encourage or inhibit providers' communication of treatment

instructions or expressions of empathy or caring? The key to answering questions such as these requires research systematically examining the impact of telemedicine on the nature and content of the communication used (Anonymous 1995; Bashshur 1995; Beisecker 1996; Beisecker and Beisecker 1996; Esser and Goossens 2009; Miller 2002; Ornor and Misan 2005; Wooton and Darkins 1997). This is important for several reasons.

Barnsley, et al. (1999) suggest that interpersonal communication "provides the basis for establishing comfort and trust, for exchanging information that will be used to make health-care decisions and for negotiating patient and physician decision-making roles." By affecting consultation behavior telemedicine may impact trust, which can facilitate patient disclosure and cooperation, while reducing the likelihood of complaints, disputes, and lawsuits (Mechanic 1998a, 1998b). It may also influence the extent of patient and physician participation during medical encounters (Szasz and Hollender 1956), either facilitating movement toward patient-centered and consumerist patterns (Haug and Lavin 1983; Moskop 1981), or reinforcing traditional paternalistic patterns (Freidson 1970; Parsons 1951; Waitzkin 1991). With paternalistic interactions, physicians mainly exhibit what has been referred to as "doctor-centered" behaviors (e.g., giving directions, asking closed-ended questions), aimed at efficiently gathering sufficient information to make a diagnosis and consider treatment options in the least amount of time necessary (Roter and Hall 1992). This is in contrast to patient-centered interactions which recognize patients as collaborators who bring strengths and resources to the interaction. This includes not only knowledge of their biomedical state (i.e., physical condition and well-being) but also knowledge of their psychosocial situation (e.g., personality, culture, living arrangements, relationships). Physician behaviors that encourage patient participation

include asking more open ended questions, ensuring and confirming patient comprehension, requesting patient opinions, and making statements of concern, agreement and approval.

Understanding the impact of telemedicine on the provider-patient relationship is also important because it may help overcome prevailing resistance to the technology, thereby promoting further use where appropriate. Perhaps this is best reflected in a recent study that examined the impact of remote monitoring on mortality, complications, and length of stay (LOS) among intensive care unit (ICU) patients served in a large, non-profit health care system located in the Gulf Coast region of the United States (Thomas, et al. 2009). Each ICU patient received traditional on-site care in addition to remote 24 hour audiovisual and vital signs monitoring by an off-site specialist. Physicians in the monitored units, however, could choose the level of outside intervention received, either minimal delegation, where the intervention would only take place in life threatening situations, or full delegation, where, in addition to life threatening situations, remote staff could give routine orders and change treatment plans. While remote monitoring was associated with improved outcomes among the sickest patients, no association was found between implementation of the telemedicine technology and outcomes more generally. The authors attribute the lack of broader impact, in part, to a lack of acceptance by on-site staff. Local physicians delegated full treatment authority for a little less than one-third of the patients enrolled; for the remainder, remote specialists were granted the authority to intervene only during life-threatening events. Had local physicians been less reluctant to rely on remote monitoring additional improvements may be have been detected. Reluctance to delegate derived from a variety of sources (Chen 2010). Some feared that telemedicine might adversely affect care, say, by intruding on the autonomy of local providers or interrupting traditional workflow

patterns. Others felt that remote monitoring would adversely impact the relationships between on-site providers and their patients.

Perhaps most importantly elucidating the effects of telemedicine on provider-patient communication is important because telemedicine may impact consultation outcomes by influencing the way providers and patients interact with one another. These include process outcomes during the medical encounter itself (e.g., patient assertiveness, provider empathy), short-term outcomes immediately after medical encounter completion (e.g., satisfaction, tension release, knowledge acquisition), intermediate outcomes within a few weeks or months after consultation (e.g., treatment compliance, psychological well-being, recall, understanding), and long-term outcomes recorded over more extensive periods of time (e.g., health status, symptom resolution, physiologic status, survival) (Beckman, Kaplan and Frankel 1989; Ong, et al. 1989). Since a large body of research indicates that communication behaviors are an important determinant of health care outcomes (see below), it is likely that if telemedicine impacts outcomes, it will do so, in part, through changes in the way doctors and patients communicate with one another.

Overview

This report begins by introducing a conceptual model to guide communication research in telemedicine. This is followed by examination of the technical and interpersonal aspects of the telemedicine context which may influence the nature and content of the communication that takes place. Extant evidence on the relationship between telemedicine and provider-patient communication is next discussed. The report concludes with some thoughts on future directions.

3.0. Conceptual Framework

Miller (2002) introduced a conceptual model to guide research investigating the relationship between telemedicine and provider-patient communication. Figure III reports the framework; Table I illustrative examples of each concept included. This model posits that patient, provider, and contextual characteristics influence the nature and content of provider-patient communication, all of which, in turn, affects various health outcomes. How this process unfolds, however, depends, in part, on the medium through which consultation takes place, whether in-person, over the telephone, via fax or email, or through two-way interactive video.

[Figure 3 and Table 1 about Here]

3.1. Communication Behaviors

Synthesizing the results of 61 studies Roter, Hall and colleagues collapsed 247 variables describing medical encounter communication into 6 general categories of provider and physician behavior. Because information exchange carries both cognitive meaning (factual information) and emotional meaning (uncertainty and anxiety), they distinguish between instrumental behaviors (information giving and information seeking) and affective behaviors (positive talk and negative talk) (Hall, Roter and Katz 1988; Roter 1989; Roter and Hall 1992; Roter, Hall and Katz 1988). They also identify two additional categories, social conversation and partnership building, the last of which pertains to physicians only, and "represents the physician's attempts to engage the patient more fully in the medical dialogue." There is also non-verbal communication. This includes voice quality and tone, eye contact, gaze, posture, laughter, facial expressions, body positioning, proximity, touch, activity (e.g., chart reviewing, computer usage) and other cues that modify the meaning of verbal utterances (e.g., hesitations) (Stile and Putnam 1989). Non-verbal behaviors are particularly important to patients because they are often used to

express empathy and caring and sometimes "leak" information that providers do not necessary wish to reveal (e.g., severity, prognosis).

3.2. Health Care Outcomes

As noted, an extensive literature has examined the relationship between provider-patient communication and health outcomes. Patients of physicians who engage in more information giving and positive talk, for example, report higher satisfaction and compliance, better recall and understanding, and more favorable health status ratings and clinical outcomes (Hall, Roter and Katz 1988; Kaplan, Greenfield and Ware 1989). Patients of physicians who encourage more active patient involvement also experience better results. These and other behaviors have been shown to promote ***satisfaction*** (Hall, Roter and Katz 1988; Hall, Roter and Rand 1981; Roter, Hall and Katz 1988; Roter, et al., 1997); ***adherence and compliance*** (Hall, Roter and Katz 1988; Hall, Roter and Rand 1981; Roter, et al. 1998; Roter, Hall and Katz 1988); ***health and clinical status*** (Bass, et al. 1986; Egbert, et al. 1964; Hulka, Kupper and Cassel 1975; Kaplan, Greenfield and Ware 1989; Mumford, Schlesinger and Glass 1982; Orth, et al. 1987); ***recall and understanding*** (Carter, et al. 1982; Hall, Roter and Katz 1988; Larson and Smith 1981; Roter, Hall and Katz 1988); and ***psychological well-being*** (Followfield, et al. 1990; Ong, et al. 1995).

3.3. Patient Characteristics

Communication researchers have identified a number of patient characteristics that influence how providers and patients communicate with one another. While older patients tend to ask more questions, for example, they are more likely to accept authority and exhibit passive behavior during their encounters with medical personnel (Haug and Lavin 1983; Sleath, et al. 1999). Furthermore, physicians tend to provide less information to patients who are lower in social class even though patients do not differ in the amount of information desired (Roter and

Hall 1992; Waitzkin 1985). Patient characteristics commonly shown to influence medical communication behavior include: ***age*** (Greene, et al. 1986; Haug and Lavin 1983; Roter and Hall 1992; Sleath, et al. 1999; Waitzkin 1985); ***gender*** (Meeuwesen, Schaap and Van der Staak 1991; Pendleton and Bochner 1980; Roter and Hall 1992; Waitzkin 1985); ***social class***, typically measured using income, education, or occupational status (Hall, Roter and Katz 1988; Korsch, Gozzi and Francis 1968; Roter and Hall 1992; Waitzkin 1985); and ***health status*** (e.g., severity of illness, level of disability) (Hall, et al. 1996).

3.4. Provider Characteristics

Communication researchers have identified a number of provider characteristics that influence how doctors and patients communicate with one another. In general, for example, younger physicians are more likely to engage in partnership building behaviors than older physicians (Barnsley, et al. 1999; Haug and Lavin 1983; Linn and Lewis 1979). Furthermore, physicians that have experienced a malpractice claim are less likely to laugh, use humor, solicit patients' opinions, check patients' understandings, and encourage patients to talk (Levinson, et al. 1997). Provider characteristics commonly shown to influence medical encounter communication include: ***age*** (Barnsley, et al. 1999; Haug and Lavin 1983; Linn and Lewis 1979; Roter, et al. 1997); ***gender*** (Barnsley, et al. 1999; Meeuwesen, Schaap, and Van der Staak 1991; Rosenberg, et al. 1997; Roter, et al. 1997; Roter and Hall 1998; Roter, Liplin and Korsgaard 1991; Waitzkin 1984); ***social class*** (Haug and Lavin 1983; Waitkzin 1985); and ***specialty/practice experience*** (Levinson and Chaumeton 1999; Levinson, et al. 1997).

3.5. Contextual Characteristics

Most extant research examines the impact of patient and provider characteristics on the nature and content of provider-patient communication. Few examine the impact of broader

contextual characteristics. Most commonly studied, though, is the ***number of participating actors***. This has typically involved examining the impact of a third party—whether the patient's companion or second health care provider—on medical encounter behavior (Bourhis, Sharon and MacQueen 1989; Greene, et al. 1994; Hasselkus 1992; Hadlow and Pitts 1991; Labrecque, et al. 1991; van Dulmen 1999). Labrecque, et al. (1991), for example, found that physicians tend to provide more information and time but less emotional support to cancer patients who had been accompanied by a family member. ***Length of acquaintance*** is another contextual factor examined (van Dulmen 1999; van Dulmen, Verhaak and Bilo 1997; Waitzkin 1985). So too is ***type of practice*** (Ross and Duff 1982). Other potentially important contextual elements include culture, geographic location (urban, rural, suburban) and clinical setting (hospital, physician's office or clinic, patient's home, nursing home).

3.6. Consultation Medium

So far available research evidence supports the notion in Figure III that patient, provider, and contextual characteristics influence the nature and content of provider-patient communication, which, in turn, affects various health outcomes. But how this process unfolds, depends, in part, on the medium through which medical consultation occurs. Most extant research examines provider-patient behavior during face-to-face encounters. Other mediums such email, secure electronic messaging, and two-way interactive video are becoming increasingly important, however, both as supplements to conventional encounters and as potential substitutes (Blumenthol 2002; Miller and West 2009). That electronic communication modes may influence outcomes is highlighted by Balas, et al. (1997) which reviewed controlled clinical trial evidence published between 1966 and 1996 on the efficacy of distance medical technologies in clinical practice. In short, the authors found an association between computerized

communications—in the way of transmitting medical data—and telephone communications—in the way of follow-up, counseling, reminders, screening, after-hours access, and touch-tone interactive systems—and positive outcomes in 63% of the studies reviewed.

It would seem that if communication mediums such as email or secure electronic messaging serve to influence health outcomes, they do so primarily by supplementing conventional, face-to-face contact as most of the interventions reviewed by Balas, et al. (1997) do. Because email contact is contingent on prior access to physicians and other health care professionals; patients can only contact their providers digitally if that possibility is made available to them by those providers.[ii] Consultations that take place through two-way, interactive video, on the other hand, more often serve as substitutes for in person encounters. This is especially true for rural residents and other isolated populations who would either have to go without health care or travel long distances to see a clinician. Since participants in two-way interactive video consultations rarely meet in person, it is especially important that the impact of substituting video for in person consultations be delineated.

[ii] Currently, relatively few physicians provide patients with the opportunity to send email or secure messages (Audet, et al. 2004; Miller and West 2009; Wallwiener, et al. 2009).

4.0. Communicating via Two-Way Interactive Video

Use of real-time videoconferencing continues to expand in light of barriers to receiving traditional face-to-face services. With a telemedicine visit, the videoconferencing technology connects the healthcare provider (e.g., physician or other specialist) with the patient at the distant site. At the distant site, the adjunct coordinator, typically a general practitioner, nurse or other non-physician provider introduces the patient to the equipment and assists them during the visit. This individual is called the telemedicine "presenter." Family members also participate in many telemedicine encounters. Miller (2003) suggests that telemedicine's influence on the nature and content of provider-patient communication stems from both its technical aspects and interpersonal aspects. The technical aspects are primarily concerned with the communication technologies used, including hardware, software, standards, and support services, as well as the clinical processes enabled by those technologies, including case finding, diagnosis, treatment, and follow-up. The interpersonal aspects are primarily concerned with relationships among system personnel, providers, and patients, and the way those relationships are organized. Technically, telemedicine may impact provider-patient communication through depersonalization of the provider-patient relationship, participatory enhancements and impediments, and sensory and non-verbal limitations. Interpersonally, telemedicine may impact provider-patient communication through third party participation, social and professional distancing, and underdeveloped norms and standards. Each is addressed in turn.

4.1. Technical Aspects: Depersonalization of the Provider-Patient Relationship

Some observers believe that the doctor-patient relationship has become more impersonal as physicians increasingly rely on high-tech instruments during their encounters with patients (Evans 1993). Since telemedicine relies on advanced communication technologies, it would

seem to continue modern medicine's movement in this direction. Such has been a concern of researchers who fear that "telemedicine may be mechanistic and interfere with the development of a personal physician-patient relationship" (Sisk and Sanders 1998), or that providers may not be able to establish rapport or empathy with remote clients because of the impersonal nature of the service (Gosh, McLaren and Watson 1997). Some speculate that by "dehumanizing, dissocializing and depersonalizing" human contact telemedicine exerts a subtractive impact on the provider-patient relationship (Matusitz and Breen 2007).

In contrast to in person encounters where providers and patients are both located in the same setting, telemedicine participants usually use specially equipped rooms within their respective facilities. Stoeckle (1987) argues that when institutional office space is used by a large number of physicians it is typically "devoid of personal mementos that might suggest the individuality of the practitioner," providing no or little insight into practitioner personality and other attributes. Since the "hub" room is typically used by many different providers, it is often standardized in appearance, and therefore does not provide the remote patient information regarding the physician's humanistic qualities and authority. For this reason Onor and Misan (2005) suggest paying special attention to context; in addition to removing distracting items (and people) from the background, objects establishing the doctor's authority—special clothing, a plaque—should be included. It further is suggested that a sense of confidence and authority can be promoted by ensuring that the physician's face and torso are clearly visible.

It also is possible that the distancing effect of telemedicine may help create a less threatening environment. Whereas psychiatric patients may feel less inhibited discussing their problems over video (McLaren, et al. 1995), those with sensitive conditions (e.g., sexually transmitted diseases) may be more likely to seek treatment. Telemedicine may also infuse

physicians' advice and information with greater respect and authority (Sisk and Sanders 1998). Even the necessity of sharing institutional space may have its advantages. Not only might it provide an environment free of the usual distractions, but it may also provide patients with the sense that a particular time and place has been set aside specially for them (Gammon, et al. 1998). Remote consultation via telemedicine may also be less stressful for patients who would otherwise need to travel long distances for their appointments (Agha, et al. 2009; Elford et al. 2000). This could impact communication favorably as well.

Although video may be more impersonal than in person consultations, it is more personal than consultations that take place entirely over the telephone. As Cukor, et al. (1998) observe with respect to psychiatric consultations, the added value of the video channel is the creation of a "social presence" that allows consultation participants to share a virtual space and to feel comfortable discussing complex issues. Patients may be less anxious when visual cues are present (Ball, et al. 1995).

4.2. Technical Aspects: Participatory Enhancements and Impediments

Unique aspects of telemedicine may empower participants and increase their control over the medical encounter. Telemedicine, for example, often requires greater patient participation since consulted physicians are unable to perform certain components of the physical examination that they could otherwise within the face-to-face format (Tachakra and Rajani 2002). Telemedicine systems may also expand on the conventional array of verbal and non-verbal communication possibilities by giving patients and providers control over aspects of the video-feed (Kavanagh and Yellowlees 1995). Novelty may also promote participation. This may be reflected in positive excitement generated, say, from being "on TV" or participating in the "cutting edge" of medicine (Baigent, et al. 1997; Gammon, et al. 1998; Holtan 1998; Pedersen

and Holand 1995). Although enthusiasm with new technologies surely dissipates with time, greater use creates familiarity that likely increases long-term comfort and acceptance for some.

It also is likely, however, that aspects of the technology will increase anxiety and discomfort among certain participants who may become more self-conscious and inhibited. This is particularly a risk with patients whose images, clinical information, and other intimate data are being recorded and transferred between multiple sites. This comparative lack of privacy associated with telemedicine likely hinders patient communication during some encounters. Being on camera may also make some clinicians uncomfortable (Allen and Doolittle 1997' Elford, et al. 2000); others, by contrast, may need to balance a number of different activities simultaneously—consulting with the patient and their onsite provider, taking notes, looking items up on their computer, etc. (Torppa, et al. 2006). Perceived lack of confidence and distraction, in turn, could adversely impact patient trust, satisfaction and other outcomes.

Evidence is mixed regarding length of consultation. Some studies find consultations longer under telemedicine (Agha, et al. 2009; Tachakra and Rajani 2002); others find consultations longer in person (Demiris, Edison and Vijaykumar 2005; Liu, et al. 2007); still others that there is no difference between the two caregiving modalities (Agha, Roter and Schapira 2009). Regardless, though, there is often pressure to use telemedicine systems as efficiently and productively as possible. This may lead some clinicians to provide patients with comparatively fewer opportunities to participate, something which may be diluted even further should technical issues arise. Less active patient involvement is likely to lead to greater emphasis on biomedical information exchange at the expense of psychosocial exchange, possibly compromising patents' psychological state and satisfaction, not to mention the ability of providers

to detect social problems. Patient-centered communication may be at risk (Agha, Roter and Schapira 2009; Nelson, Miller and Larson 2010; Street, Wheeler and McCaughan 2000).

4.3. Technical Aspects: Sensory and Non-Verbal Limitations

Telemedicine is primarily a visual and auditory medium. Lack of access to tactile and olfactory information may compromise physicians' ability to make diagnoses, while lowering their confidence in the diagnoses they do make. Some consider this a major limitation in using two-way interactive video (Brick 1997) although most of the core sensory data used in clinical decision making is in fact visual and auditory in nature. The absence of "laying on the hands," in particular, may adversely affect the emotional and psychological bond between doctors and patients. A number of qualities have been associated with this aspect of the physical examination beyond the placebo effect, including a sense of comfort, relaxation, self-assertion and pleasure (Entralgo 1969). Most experts, for example, recommend that physicians should break bad news in person, that they should sit close to their patients, avoid physical barriers and rely on touch when appropriate (Ptacek and Eberhardt 1996). The separation inherent in two-way interactive video makes following prescriptions such as these on the part of consultants impossible.

Separation between consultation participants limits non-verbal communication as well. Cukor, et al. (1998), for example, concluded that although most clinical information was carried on the audio channel, important non-verbal cues—nods, blinks, facial expressions, and body language—were missing, possible making video a potentially ineffective tool for interpersonal communications. Gosh, Mclaren and Watson (1997) came to a similar conclusion, noting that while neither participant seemed inhibited or uncomfortable in exploring issues, useful body language and appearance information was largely absent, while the therapist was unable to perform certain supportive gestures such as supplying their patients with tissues. In some

instances visual information is lost when doctors check their notes or lean forward to convey intimacy or empathy with their patients (Ball, et al. 1995; McLaren, et al. 1995). In others instances missing information makes it difficult for patients to show side effects or symptoms (Ball, et al. 1995). In certain cases, however, missing information may actually facilitate interaction by removing potentially distractive behaviors from view (McLaren et al. 1995, 1996). There is also evidence to suggest that excellent eye contact can be maintained even during encounters using cellular phone sized video screens (Suzuki, et al. 2006). It would also seem that lack of non-verbal communication between a remote doctor and patient can made up, in part, by the presence of a second on-site provider.

4.4. Interpersonal Aspects: Third Party Participation

Telemedicine typically adds a second health care professional—whether a primary care physician, nurse, nurse practitioner, or physician assistant—to the consultation situation. Like with traditional in person encounters that add a third party to the traditional doctor-patient dyad the result may be more information giving on the part of the consulting provider, but less emotional and psychosocial support and less patient involvement (Agha, Roter and Schapira 2009; Nelson, Miller and Larson 2009; Street, Wheeler and McCaughan 2000). Not only might patients participate less in such encounters, but there is also a concern that attendants and consults may communicate with each other to the exclusion of patients, which may decrease patient trust, satisfaction, and adherence to treatment protocols.

A third party, on the other hand, may help compensate for some of the interpersonal deficits associated with two way interactive video consultations, by, for example, making up for the loss of non-verbal cues (Gelber and Alexander 1999; Torppa, et al. 2006), supporting patients through difficult consultations (e.g., treatment failure, tumor reoccurrence) (Pedersen and Holand

1995), focusing on the social and emotional dimensions of patient care (Holtan 1998), and compensating for the loss of tactile and other sensory deficits that may compromise rapport development and diagnostic reliability (Collins and Sypher 1996; Torppa, et al. 2006). Onsite practitioners may also mediate between the "everyday" language of patients and the "medical language" and technical jargon of consultants and system coordinators. They may further serve as patient advocates (MacFarlane et al. 2006; Torppa, et al. 2006), while increasing patient confidence in the quality of care received (i.e., because 'two doctors are better than one') (Harrison et al. 2006; Matusitz and Breen 2007).

4.5. Interpersonal Aspects: Social and Professional Distancing

Telemedicine often brings together unfamiliar combinations of patients and clinicians. Not only are remote patients less likely to know their consulting providers, but they are also less likely to derive from similar social, economic, cultural, and linguistic backgrounds. Without telemedicine, for example, rural residents often rely exclusively on local providers. With telemedicine, however, rural residents can consult with tertiary care specialists at urban centers without leaving their local communities. The result is greater social distance among consultation participants, which has been shown to compromise the communication process, including rapport development and psychosocial exchange (Roter and Hall 1992; Waitzkin 1985).

In others ways, however, telemedicine may serve to reduce social distance. This may be because it is often easier and less intimidating to engage someone of "hire status" and authority when one is not in the same room as them. It may also be because use of telemedicine allows for better patient and provider matching than might otherwise be possible, say, by providing recent immigrants with the opportunity to consult with someone who speaks their language rather than relying on an interpreter (Mucic 2008). It is also reasonable to suppose that how communication

unfolds may depend, in part, on the level of familiarity that exists among the participants involved (Torppa, et al. 2006). Those participants that have met previously are likely to communicate quite differently, say, with more warmth and social conversation, than those who had never met before.

Differences in professional training, philosophy, and status may increase social distance among presenting generalists and consulting specialists as well. While specialists tend to focus primarily on biomedical issues, generalists, including nurses and other primary care practitioners, tend to adopt a broader view of health that also includes a concern for patients' psychosocial environments (Mathews 1983; MacFarlane, et al. 2006). Usual differences between generalists and specialists such as these are further complicated with telemedicine because practice patterns and communication styles typically differ between rural and urban physicians (Wells and Lemak 1996). Anticipating difficulties communicating with consulting specialists may make some rural physicians uneasy about using telemedicine. As with patients, however, resulting interpersonal difficulties may be surmounted if participating physicians already know and respect each other (Gammon, et al. 1998; MacFarlane, et al. 2006).

4.6. Interpersonal Aspects: Underdeveloped Norms and Standards

Providers and patients have been socialized through repeated exposure to face-to-face consultations. Consequently, varying degrees of uncertainty exists regarding how they should behave during consultations that take place via telemedicine, resulting in a certain degree of hesitancy, anxiety, and conflict as doctors and patients try to negotiate this comparatively unfamiliar terrain. For telemedicine to reach its full potential, normative standards of behavior need to be developed that go beyond those used in conventional encounters (Bashshur 1995; Loane and Wooton 2002; Pappas and Seal 2009). Some of these may develop organically through

a process of trial-and-error learning whereby, for example, a new etiquette emerges that reduces the likelihood that participants will interrupt one another (Whitten and Doolittle 1997), delays in video transmissions are adjusted for, say, by using shorter sentences and waiting before replying (Gosh, McLaren and Watson 1997), and participants learn how to position themselves physically so as best to be seen (Pappas and Seale 2009). Although seemingly minor, examples such as these illustrate how more encompassing behavioral norms might develop spontaneously over time.

Standards of behavior may also be promulgated formally. Prominent observers such as Bashshur (1997) have highlighted the need for "establishing norms of professional conduct for quality performance and guidelines for clinical practice," including a formal and explicit triage system, code of ethics, and outcome-based criteria and standards. Few technical and clinical guidelines exist, however (Loane and Wooton 2002). The diversity of applications and rapid development of technologies poses a significant challenge in this regard.

Another option would be to focus on the formulation and promulgation of behavioral norms that maximize the effectiveness of the encounter from both the doctor and patient's perspective. There is a long history of designing, implementing, and evaluating interventions to influence doctor-patient behavior, which indicate that it is surprisingly simple and inexpensive to make changes that significantly alter medical encounter processes and outcomes (Roter and Hall 1992; Roter, et al. 1998). While most successful interventions for patients increase their confidence in their knowledge and ability to participate actively in their own medical affairs, most successful interventions for physicians focus on promoting an appreciation of patients' experience and insights. Perhaps similar interventions would increase patient and provider comfort with unfamiliar consultation modalities such as telemedicine.

Rather than waiting for behavioral norms to arise naturally or as a result of the adoption of formal standards or clinical interventions, a fourth option is to adapt telemedicine technologies to existing behavioral patterns through improvements in the human/technology interface (Bashshur 1999). The more accommodating the human-machine interface is to existing consultation norms the more acceptable telemedicine is likely to be to patients and providers. Not only would more "user friendly" equipment ease patient and provide trepidation with an otherwise unfamiliar consultation modality, but it would also facilitate incorporation of telemedicine into existing medical practice more generally (Buck 2009; Esser and Goossens 2009).

5.0. Extant Evidence: Telemedicine & Provider-Patient Relations

Comparatively little empirical research has been conducted to investigate the impact of telemedicine on provider-patient relations. There have been several pertinent literatures reviews, however. Whitten and colleagues systematically reviewed studies examining satisfaction with telemedicine; most of which relied on simple survey questionnaires (Whitten and Mair 2000; Whitten and Love 2005). Despite methodological and conceptual weaknesses with most of the studies examined, the authors conclude that prevailing research reveals high levels of patient satisfaction with telemedicine, particularly with respect travel, waiting time, and access to comprehensive specialist care, but "some disquiet" in the area of provider-patient communication. This is contrast to providers who, while also generally positive, appear to hold more caveats, particularly with respect telemedicine's capabilities and uses. It was posited that patients may appreciate telemedicine more because they benefit most immediately vis-à-vis traveling and scheduling. Providers, on the other hand, may need to see greater benefits; otherwise, the additional training, technical requirements and implementation costs associated with using telemedicine may be viewed as an unnecessary intrusion on their day-to-day routines and activities.

Miller (2001) focused more explicitly on the doctor-patient relationship, reviewing 38 studies that examine the nature and content of doctor-patient communication under telemedicine in a variety of specialty areas, most prominent of which include psychiatry, otolaryngology, and dermatology. The findings from each study were coded according to 23 categories and a positive and negative rating assigned to each of 213 communication results. Approximately 80% of abstracted findings favored doctor-patient interaction, with all but two of the 23 categories analyzed (non-verbal behavior and lack of touch) reporting more positive than negative results.

Attributes that were ranked especially favorably include both patient and provider comfort, understanding, and explanation, patient-provider relations, communicative efficacy, rapport development, embarrassment, anxiety/nervousness, audio quality, video quality, patient involvement, and multiple providers.

This more general review was subsequently replicated with 57 studies that examine the nature and content of provider-patient communication in the area of telepsychiatry where more has been written about than, perhaps, any other telemedicine specialty area (Miller 2002). Here, findings from each study were coded according to 23 categories and a positive and negative rating assigned to each of 550 communication results abstracted. More than 75% of the findings favored telemedicine. Particularly striking in this regard were patient and provider expression, comfort, and understanding, participant relations, communicative efficacy, embarrassment, anxiety/nervousness, outcome/care quality, patient involvement, multiple providers, satisfaction, assessment/diagnosis, video versus in person consultation, and assessment/diagnosis. Non-verbal behavior was the only area for which the number of positive findings did not exceed the number of negative findings.

Four types of communication studies can be identified in the literature. These include:

- ***pre-experience examinations of provider and community attitudes*** (Bashshur 1978; Brick, et al. 1997; Gelber and Alexander 1999; George, Hamilton and Baker 2009; Tilford, et al. 1997; Wakefield, et al. 1997; Whitten and Franken 1995);
- ***post-medical encounter surveys of patients and providers*** (Aarnio, et al. 1999; Agha, et al. 2009; Allen and Hayes 1994, 1995; Baer, et al. 1995; Bashshur, 1978; Baigent, et al. 1997; Blackmon, Kaak and Ranseen 1997; Bose, et al. 2001;

Brennan, et al. 1998, 1999; Callahan, Hilty and Nesbit 1998; Chae, et al. 2000; Clarke 1997; Dick, Filler and Pavan 1999; Dongier, et al. 1986; Doze, et al. 1999; Doze and Simpson 1997; D'Souza 2000; Elford, et al. 2000, 2001; Freir, et al. 1999; Glueckauf, et al. 2002; Gustke, et al. 2000; Harrison, et al. 1999; Huston and Burton 1997; Kirkwood, Peck and Bennie 2000; Kopel, Nunn and Dossetor 2001; Loane, et al. 1998; Lowitt, et al. 1998; Made, et al. 1999; McConnell, et al. 1999; McLaren, et al. 1996; Mekhjian, et al. 1999; Mielonen, et al. 1998, 2000; Mucic 2008; Pedersen and Holand 1995; Simpson, et al. 2001a, 2001b; Spaulding, Davis and Patterson 2008; Zarate, et al. 1997);

- ***in-depth qualitative investigations*** (Cukor, et al. 1998; Day and Schneider 2000; Gammon, et al. 1998; Gosh, McLaren and Watson 1997; Harrison, et al. 2006; Hill, Allman, and Ditzler 2001; Holtan 1998; Hufford, Glueckauf, and Webb 1999; Kavanagh and Yellowless 1995; MacFarlane, et al. 2006; May, et al. 2000; McLaren, et al. 1995, 1996; Montani, et al. 1996, 1997; Pappas and Seale 2009; Schopp, Johnstonne and Merell 2000; Simpson 2001; Torppa et al. 2006; Turner 2001; Whitten, Collins and Mair 1998; Whitten and Collins 1998; Whitten, Mair and Collins 1997; Zaylor 1999); and
- ***interaction analysis studies*** (Agha, Roter and Schapira 2009; Ball, et al. 1995; Demiris, et al. 2003; Demiris, Edison and Vijaykumar 2005; Liu, et al. 2007; Nelson, Miller and Larson 2010; Savenstedt, et al. 2002; Street, Wheeler and McCaughan 2000; Tachakra and Rajani 2002; Wakefield, et al. 2008).

Although current evidence appears to favor communication via telemedicine, the generalizeability of these results may be limited. This is because most studies included in the

aforementioned reviews focus on overall system performance and satisfaction with telemedicine attributes rather than communication per se. Furthermore, most rely on post-encounter surveys of medical encounter participants. This likely biases results in favor of telemedicine since patients routinely report high levels of satisfaction with the care that they receive (Hall and Doran 1988). It also provides little information about more subtle and detailed changes in communication that take place over televideo and how such changes may affect patient outcomes over time.

To obtain a fuller understanding of the effects of telemedicine on the provider-patient relationship, it is critical that post-encounter assessments of medical encounter participants be supplemented with more in depth investigations of actual medical encounter content. While the results of additional qualitative investigations may or may not reinforce the conclusions drawn from post-encounter surveys, they almost certainly will provide insights unavailable to researchers relying solely on retrospective participant assessments. Particularly important in this regard is verbal content analysis, which uses interaction analysis systems to describe and categorize communication behaviors. The dearth of verbal content studies in telemedicine contrasts markedly with the long tradition of using interaction analysis techniques to study the way providers and patients communicate during conventional medical encounters. Not only have face-to-face researchers used the findings of verbal content studies to develop theoretical models of the doctor-patient relationship but they have also developed instruments for quantifying communication events within multiple settings (Roter and Hall 1989; Roter and Larson 2002), the results of which have been correlated with patient, provider, and system attributes and outcomes (Roter and Hall and Hall 1992; Miller 2002; Ong, et al. 1995).

In general, interaction analysis systems describe and categorize communication behaviors. Most employ an exhaustive taxonomy for classifying verbal events or utterances. A

verbal utterance may be defined as "the smallest meaningful and distinguishable speech segment, conveying only one thought or relating to one item of interest" (Ong, et al. 1995). The Roter Interaction Analysis System (RIAS), for example, uses 34 categories to describe physician behavior and 28 categories to describe patient behavior (Roter 2002). These can be grouped into broader categories for analysis; for example, socio-emotional or affective (care-oriented) behavior and instrumental or task-focused (cure-oriented) behavior (see Table 1). Systems may also keep track of non-verbal behaviors such as eye contact, facial expressions, voice tone, physical proximity, hand gesturing, body positioning, and touch. In addition to the behaviors measured (instrumental/affective, verbal/non-verbal,), particular instruments may also be distinguished by their relevance to various patient types and medical settings. They also differ in their observation strategies. Coding, for example, may be accomplished using videotape, audiotape, direct observation, or literal transcripts. Although most of the forty-four verbal content analysis instruments included in one review had not been adequately tested for their validity, the majority had been shown reliable (Boon and Stewart 1998). There have been recent efforts to adapt to the RIAS to telemedicine, specifically (Miller and Nelson 2005; Nelson, Miller and Larson 2010).

The following sections provide a more comprehensive look at the most recent attitudinal, post-encounter, and in-depth qualitative studies that have investigated the relationship between telemedicine and provider-patient communication. They also review each of the ten interaction analysis studies that have been conducted to date in this area.

5.1. Community Attitudes

George, Hamilton and Baker (2009) conducted 10 focus groups consisting of 87 African American and Latino participants in South Central Los Angeles in order to assess their pre-

experience perceptions of telemedicine. Both groups perceived similar advantages, including reducing waiting times, allowing for immediate feedback, and increasing access to specialists and multiple opinions. Disadvantages varied somewhat. African American participants were concerned about the physical absence of the specialist and the inability to monitor the specialist's qualifications. Latino participants were concerned about whether the benefits of telemedicine would be made available to uninsured/undocumented individuals. Both were concerned about privacy/ confidentiality and the adequacy of telemedicine for making accurate diagnoses, though Latinos to a lesser extent.

This study is consistent with prior research demonstrating general consumer acceptance with telemedicine, particularly with respect to convenience and specialist access. It also reveals a certain degree of optimism regarding the benefits of consulting with more than one provider simultaneously. At the same time, however, it highlights potential trepidation deriving from the technology's novelty, particularly among those who have never used it before. It further highlights the potential influence of broader political forces and experiences on people's views. Compared to other racial and ethnic groups, African Americans, due to a legacy of racial discrimination, tend to have greater distrust for institutions, including the health and medical system. This appears to extend to concern regarding specialists' qualifications in telemedicine. In a similar vein Latinos may be concerned about the availability of telemedicine in light of recent efforts on the part of some jurisdictions in the U.S. to restrict access to health care financing among undocumented aliens.

5.2. Post-Encounter Surveys

Agha, et al. (2009) randomly assigned 221 pulmonary, endocrine, and rheumatology patients to receive a consultation with a physician either in person or via a telemedicine link with

the Milwaukee Veterans Affairs Medical Center. Post-encounter questions indicate that patients were similarly satisfied with physician's patient-centered communication, clinical competence, and interpersonal skills during in person and telemedicine consultations. There were also no differences in patients' ability to hear or understand the physicians, or difference in concerns about privacy. Patients, however, were more satisfied with the convenience of telemedicine than face-to-face consultation. The authors conclude that "patients were equally satisfied with physician's ability to develop rapport, use shared decision making, and promote patient-centered communication during [telemedicine] and [in person] consultations."

Mucic (2008) used post-encounter surveys to assess the experience of 30 patients with a telepsychiatry service that provided mental health care in patients' own languages. Here, cross-cultural patient groups in Denmark (e.g., asylum seekers, refugees, migrants) were able to receive care from clinicians in Sweden who spoke Arabic, Polish, Kurdish, or the ex-Yugoslavian languages. All patients reported high levels of acceptance with the consultations that had taken place. Furthermore, results support the expectation that patients would prefer telepsychiatry in their own tongue rather in-person consultations through an interpreter.

Spaulding, Davis and Patterson (2008) compared the perceptions of 919 rural-based school professionals in Kansas who received education about students with chronic illness in person to the perceptions of 417 who did so through videoconferencing. Results reveal high levels of satisfaction with both mediums, both overall and with respect to such specific items as comfort, perceived preparedness, and convenience, though the face-to-face group rated many of these items significantly higher.

In short, the results from these three recent studies are consistent with the broader literature documenting general satisfaction with telemedicine using post-encounter surveys and

analyses. In doing so, they reveal high levels of satisfaction and acceptance with telemedicine, both in-and-of-itself and in comparison to traditional in person encounters. In fact, there is evidence to suggest that patients may be especially satisfied with the convenience that telemedicine offers, not only with respect to travel and appointments but also with respect to being able to consult with particular types of providers, say, for example, those who share their own culture and language.

5.3. In-Depth Qualitative Investigations

Harrison, et al. (2006) used semi-structured interviews to identify factors underlying satisfaction/dissatisfaction among 28 patients participating in joint teleconsultations between an on-site general practitioner (GP) and off-site specialist. Results indicate that patients appreciated the reduced costs, improved convenience, and reduced waiting times associated with telemedicine. Although most GPs did little during the teleconsultation; having them there provided some patients with greater confidence in the proceedings while enabling the GP to explain what had taken place afterward. Whereas some patients felt that they received more undivided attention from the specialist than otherwise would have been the case, others felt excluded from the consultation with the GP involved; still others felt a sense of alienation, describing the specialist as “distant or very far away.”

MacFarlane, et al. (2006) used semi-structured interviews to examine the relationship between general practitioners and specialists during joint teleconsultations. Respondents agreed that the primary interaction pattern occurred between specialists and patients, with GPs observing and listening but not assuming an active role. For their part specialists expressed frustration with the comparatively passive stances of the GPs. The GPs, on the other hand,

believed it important for patients to tell their own stories and for them to provide information and serve as patient advocates when necessary.

Pappas and Seale (2009) used conversation analysis to analyze the opening phases of ten video-mediated telemedicine consultations (cardiology, vascular) in the United Kingdom. Results demonstrate that "for health care professionals and patients, video-mediated telemedicine is unfamiliar terrain, where communication requires constant negotiation of skills and roles." This unfamiliarity results both from the novelty of the technology used as well as the presence of multiple professionals. The opening of the consultations thus reveals 'floor negotiations' among participants regarding the content and flow of the interaction. This occurs both among the professionals and among the professionals and patients. The novelty of the setting also leads participants to negotiate use of the physical space—the spatial and organization context—within which consultation takes place. New skills need to be learned to navigate this new terrain. These can be adapted from traditional contexts—whether social or professional—or developed a new via trial and error learning.

Torppa, et al. (2006) examined 30 primary care telconsultations between an on-site nurse and patient and off-site physician in Finland. The nurse served in an active role, facilitating the interaction, serving as an advocate for the patient and secretary of the doctor while mediating the doctor's therapeutic influence (say by acting as the doctor's hands—performing physical examinations as instructed). The doctor had to do a number of things at once and, as such, could not always give the patient their undivided attention. Patients frequently relied on the nurse for information. Nurses, however, frequently changed their target of identification during the course of the typical interview; sometimes identifying with the patient, other times with the physician. This made it to difficult for the doctor to maintain his central role. Familiarity of the patient, both

with the doctor and the nurse seemed to matter as well. With more familiar patients, doctors were less formal and better able to take an active role in directing how the consultation unfolded. The authors conclude that doctor-patient communication through telemedicine is often more complex than through conventional face-to-face contact, not least of which is because discussion is not private but occurs in a group.

A common theme among the four recent in depth qualitative investigations reviewed is the role of a third party—that is, an on-site nurse or GP—during telemedicine encounters between an on-site patient and off-site specialist. Extant research, which has been dominated by post-encounter surveys with patients and providers, reveals positive feelings regarding the role of multiple providers during teleconsultations. The four qualitative investigations reviewed here, however, reveal a more complicated dynamic. Two found that most interaction took place between patients and specialists, with the GP assuming more of a background role (Harrison, et al. 2006; MacFarlane, et al. 2006). While results indicate that the presence of a second provider might increase patient confidence, they also indicate that passive engagement could prove frustrating for specialists who, under certain circumstances, might prefer more active involvement. The latter appears to have been the case in the remaining two studies, which highlight the benefits and drawbacks associated with more active third party participation (Pappas and Seale 2009; Torppa, et al. 2006). Clearly, on-site providers can play a critical role in providing information, advocating for patients, and mediating therapeutic influence. The novelty of telemedicine necessitates constant negotiation, however, both over the content and flow of the interaction and over physical space. It would seem that such negotiation would be more difficult during triadic medical encounters, particularly since they are considerably less common than the traditional doctor-patient dyad with which most people have become accustomed face-to-face.

5.4. Interaction Analysis Studies

Nelson, Miller and Larson (2010) used an adapted version of the RIAS to examine the verbal content of 46 teleconsultations that took place between an on-site patient and nurse/social worker and one of a number of different types of off-site specialists based at Kansas University (see Table II for additional details on this and other interaction analysis studies). Traditional RIAS categories proved reliable in telemedicine; so too did an aggregate technology-related category, though there were few technology-related utterances overall (<1% of total). Most utterances were made by providers (57%), followed by patients (27%), family members (10%), and presenters (6%). There were considerably more task-focused than socio-emotional utterances. Patients most commonly gave information (62%), showed agreement (13%), and made personal remarks (6%). Providers most commonly asked closed-ended questions (18%), showed agreement (17%), and gave information (14%). The authors conclude that limited technology-related utterances imply a certain degree of comfort with two-way interactive video.

Agha, Roter, and Schapira (2009) used the RIAS to compare the verbal content of 8 in person consultations and 11 teleconsultations between an onsite patient and nurse and off-site pulmonary specialist based at the Milwaukee Veteran Affairs Medical Center in Wisconsin. On average, results reveal equal proportions of utterances by physicians and patients with in person visits (46% each); however, physicians accounted for more utterances than patients under telemedicine (48% v. 38%). Nurses contributed just 6.0% of total utterances in telemedicine; companions 7% in telemedicine, 9% in person. There was far more biomedical than psychosocial information exchange during both types of consultations. Physicians were more likely to use orientation statements during in person visits; patients more likely to make requests for repetition during telemedicine. The authors conclude that telemedicine visits are more physician-centered

than in person consultations, with physicians controlling the dialogue and patients assuming a more passive role.

Wakefield, et al. (2008) used the RIAS to compare the verbal content of 42 telephone consultations with 42 video consultations between patients at home who had previously been hospitalized for heart failure and an off-site nurse case manager based in Iowa. On average, nurses made slightly more utterances than patients during both video- and telephone consultations (52% v. 48%). In general, nurses were more likely to gather data, build relationships and partnerships, whereas patients were more likely to give information. Nurses, however, were more likely to ask open-ended questions, make back-channel responses (indicating listening), friendly jokes, and checks for understanding with telephone visits; compliments given and partnership were more common with video. Patients were more likely to give lifestyle information and approval comments with telephone visits; closed-ended questions were more common with video. Neither patient satisfaction nor nurse perceptions differed across the two medium; both were ranked positively. The authors conclude that the value added by using low cost videophone technology did not appear to be worth the additional complexities, at least in the instance studied here.

Liu, et al. (2007) used verbal content analysis to compare 20 in person consultations to 20 teleconsultations between an "on-site" patient and "off-site" internist, the latter of which took place in two rooms within Gunma University Hospital in Japan. Results reveal significantly more utterances with in person than telemedicine consultations, with patients making more utterances than physicians in both settings (~56% v. ~44%). They also reveal significantly more conversational turns during in person visits; greater requests for repetition during telemedicine. Physicians were less likely to make facilitation, empathy or praise utterances during telemedicine

visits. There were no differences in closed- or open-questions asked. Medical records were less complete with telemedicine. Patients ranked both mediums highly. Physicians ranked telemedicine lower. The authors conclude by suggesting a new training program for improving doctors' communication skills and ability to express empathy during telemedicine.

Demiris, Edison and Vijaykumar (2005) used verbal content analysis to compare 40 in person consultations to 54 teleconsultations between a on-site patient and off-site dermatology clinic in Missouri. Small talk took place in 20% of in person consultations and 29.6% of telemedicine visits. Clinical assessment took place in all consultations. While not significant, 90% of in person visits included a patient education component as compared to 78% of telemedicine visits. Comparable percentages of telemedicine and in person visits addressed treatment, compliance, psychosocial, and administrative issues. Technical issues were raised in just 14.8% of telemedicine visits. The authors conclude that communication patterns in telemedicine and in patient visits were comparable.

Demiris, et al. (2003) used patient and provider self-reports to assess 122 virtual visits between chronically ill elderly patients at home and off-site nurses based at one of three Minnesota home care agencies. They also used verbal content analysis to examine a subset of 30 of these visits. Technical quality was given an average rating of 95 out of 100; problems establishing a connection was recorded just 8.0% of the time. The highest proportion of time was spent assessing patients' clinical status (42%), followed by compliance (13%), psychosocial issues (10%), and education and informal talk (both 8%). On average, nurses spoke for 59% of the time; they also made 67% of the utterances. The authors conclude that technical problems do not interfere with the care provided during virtual visits.

Tachakra and Rajani (2002) used verbal content analysis to compare 30 in person consultations with 30 teleconsultations between an on-site patient and nurse practitioner and off-site physician at a minor accident and treatment service in the United Kingdom. Results indicate that both doctor-patient and doctor-nurse communication exhibited more words and higher rates of turn taking, interruptions, and backchannel responses with telemedicine than in person consultation. There was little difference in patient-nurse communication between the two settings. The authors conclude that telemedicine empowered patients to ask more questions while the doctor took greater care to achieve coordination of beliefs with patients due, perhaps, in part to the lack of lack of multi-sensory feedback.

Savenstedt, et al. (2002) used verbal content analysis to examine 15 teleconsultations between an on-site nurse based at a geriatric nursing home and an off-site geriatrician based at a university hospital in Northern Sweden. Results indicate that most problems or tasks (69%) could be dealt with either by telephone or teleconsultation. They also indicate that the teleconsultations approximated that of a traditional ward round. Behaviors analyzed included: (1) nurses' presentation of the problem and tasks (how they were presented, types of questions asked, aim); (2) physician's response (how, types of questions); and (3) use of videoconferencing (10% of consultations did not fully exploit it). The authors conclude that by requiring more systematic presentation and more preparation teleconsultation improves the structure of work but that mutual trust is important to the success of the interaction.

Street, Wheeler and McCaughan (2000) used verbal content analysis to examine 26 teleconsultations between an on-site patient and primary care practitioner (PCP) and off-site physician specializing in one of a number of different areas based at the Texas Tech Health Science Center. Results reveal very little group discussion among participants, with most talk

occurring between the doctor and PCP or patient and little talk between the PCP and patient. Most utterances were made by the specialists (45%), followed by the PCPs (34%) and patients (23%). Information-giving was more equally distributed, though patients received the least amount (17%) and specialists the most (55%). The authors conclude that, overall, the specialists dominated, asking the most questions, exerting the most control and being talked to the most often. By contrast, patients were the least active, making the fewest utterances, asking the fewest questions, exerting the least control and receiving the least amount of information.

Ball, et al. (1995) used verbal content analysis to compare visual (in person, video) and non-visual (telephone, hands-free telephone) psychiatric examinations received by each of six patients in London. Results suggest that patients were more anxious in non-visual modes where they tended to adopt the least relaxed body postures. No matter what mode doctors' angle of recline was always greater than that of patients while participants displayed high mutual gaze both in person and over video. No differences in verbal content measures indicative of partnership building, information giving, or question asking could be discerned. In all modes the level of patient satisfaction was high; so too were the level of reassurance and sense of being understood. Though not significant, patients appeared to be least anxious in visual models; for providers, understanding the patient, rapport and frustration were best with visual cues. The authors conclude that visual cues are important to both patients and doctors but that in person consultations are not the only way to provide them.

It is difficult to generalize across the ten interaction analysis studies conducted to date. It is because each study focused on a different specialty area, including psychiatry, dermatology, emergency medicine, pulmonary care, internal medicine, gerontology, and home care, not to mention those few that included consultations reflective of multiple specialties. It is because

different data collection instruments were used: for example, the RIAS (4 studies) versus other, typically unspecified instruments (6 studies). It is because the number categories abstracted differed, ranging from the full complement of 38 RIAS categories in some investigations (3 studies) to 13 to 17 categories (5 studies) to less than 5 (2 studies). It is because some studies employed one or more comparison groups, comparing telemedicine to in person (5 studies) or telephone visits (2 studies) while others did not include a comparison group in their design (4 studies). It is because some studies included a second, on-site provider of various types (a GP, nurse, nurse practitioner, or physician assistant) (4 studies), occasionally even a family member or other companion (2 studies). It is because the consulting provider was typically a physician (8 studies) but occasionally a nurse (2 studies). It is because some focused explicitly on analyzing partial/entire visits, initial/follow-up encounters, and/or participants with no/some previous experience with the technologies used. The number of teleconsultations analyzed were typically quite small as well (n=6, 11, 15, 20, 26, 30, 30, 42, 46, 54). Still, results are promising, hinting at the utility of undertaking further such analyses in the future.

Findings from several of the aforementioned studies are consistent with provider-patient research in traditional, face-to-face settings, other are not. First, just as in the traditional face-to-face setting, provider utterances tended to predominate in telemedicine encounters, with fewer utterances being made by patients, on-site providers, and family members (Agha, Roter, and Schapira 2009; Nelson, Miller and Larson 2010; Street, Wheeler and McCaughan 2000); in one study, however, patient utterances tended to predominate (Liu, et al. 2007). Second, on-site providers were substantially less active than off-site providers. This suggest that presenters typically serve as facilitators and observers more than active participants (Nelson, Miller and Larson 2010; Street, Wheeler and McCaughan 2000; Tachakra and Rajani 2002). Third, the

traditional pattern of more task-focused than socioemotional utterances tended to persist in telemedicine. Roter and Hall (1992) conclude that during the typical in person encounter physicians spend most of their time giving information (35.3%) and seeking information (22.6%) followed by positive talk (15.0%), partnership building (10.6%), social conversation (6.0%), and negative talk (1.3%). Patients, by contrast, typically spend most of their time giving information (46.9%) and comparatively little asking questions (7.0%). Patients also tend to spend more time talking both negatively (8.3%) and positively (18.7%) as well as socially (13.4%). Although the specific distribution of behaviors varied, biomedical, task focused exchange tended to predominate as with traditional face-to-face settings. This is reflected both in the telemedicine-only studies reviewed as well as in those studies showing no significant differences in behavior between telemedicine and in person encounters (Ball, et al, 1995; Demiris, Edison and Vijaykumar 2005; Nelson, Miller and Larson 2010; Street, Wheeler and McCaughan 2000). Others comparisons, however, indicated that telemedicine might be less patient-centered than conventional contact (Agha, Roter, and Schapira 2009); still others that it might be more so (Tachakra and Rajani 2002).

6.0. Future Directions

Several observers call for more scientifically robust research examining the relationship between telemedicine and provider-patient communication (Miller 2001, 2002, and 2003; Orna and Misan 2005; Whitten and Mair 2000). These calls typically include more in depth qualitative investigations in addition to the application of interaction analysis instruments to electronically mediated communications. Those studies identifying comparable relationships between telemedicine and conventional care would provide persuasive research data justifying user confidence, systems development, reimbursement, and liability protection, among other things.

Those studies identifying differences between telemedicine and conventional health system contact would enable researchers to address potential difficulties in provider-patient interaction before widespread implementation of particular technologies took place. In addition to comparing electronically mediated to conventional interaction it is critical that further research compare telemedicine consultations to each other, across different specialties and technical specifications. This is a particularly important issue for providers establishing a new telehealth clinic, who must, on the one hand, select clinically effective technologies that support the therapeutic relationship, but on the other hand, do so in as cost-effective a manner as possible. Information provided would help address these concerns by showing how different technology speeds and formats affect the provider-patient relationship.

Once patterns of communication are understood, researchers should examine the relationship between these patterns and patient, provider and contextual characteristics, as well as important outcomes such as satisfaction compliance, recall, understanding, and health/clinical status. By enabling researchers and practitioners to identify what interaction patterns lead to best outcomes, moreover, results from studies such as these would facilitate development of training programs and other interventions that improve provider-patient communication in telemedicine, not to mention the development and adoption of more user friendly interfaces. Ultimately, additional research is necessary if we are to more fully understand the theoretical benefits, challenges, subtractive and enhancing effects of telemedicine on the provider-patient relationship.

Figure I. Telemedicine Building Blocks

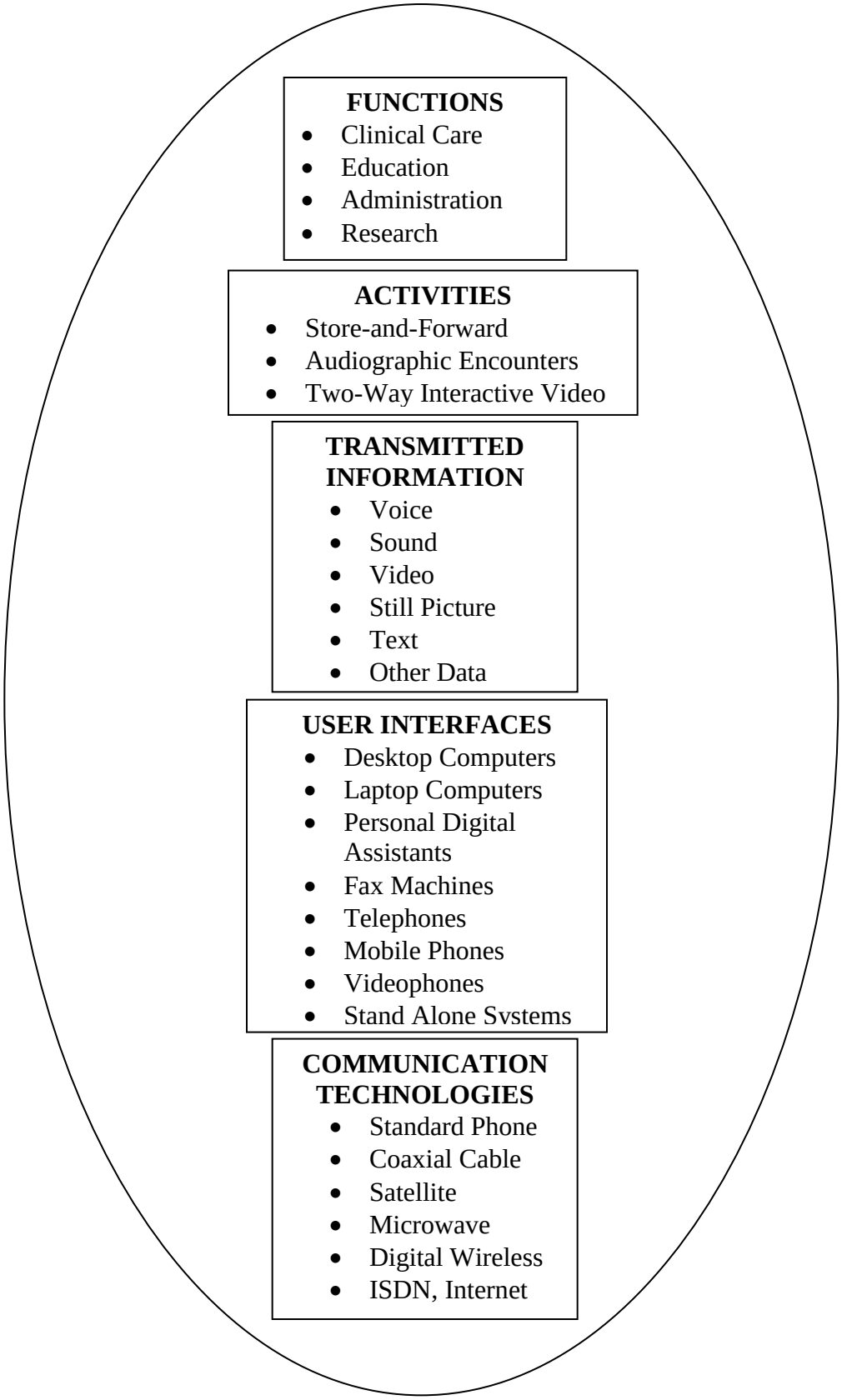

Figure II. Barriers to Telemedicine Adoption

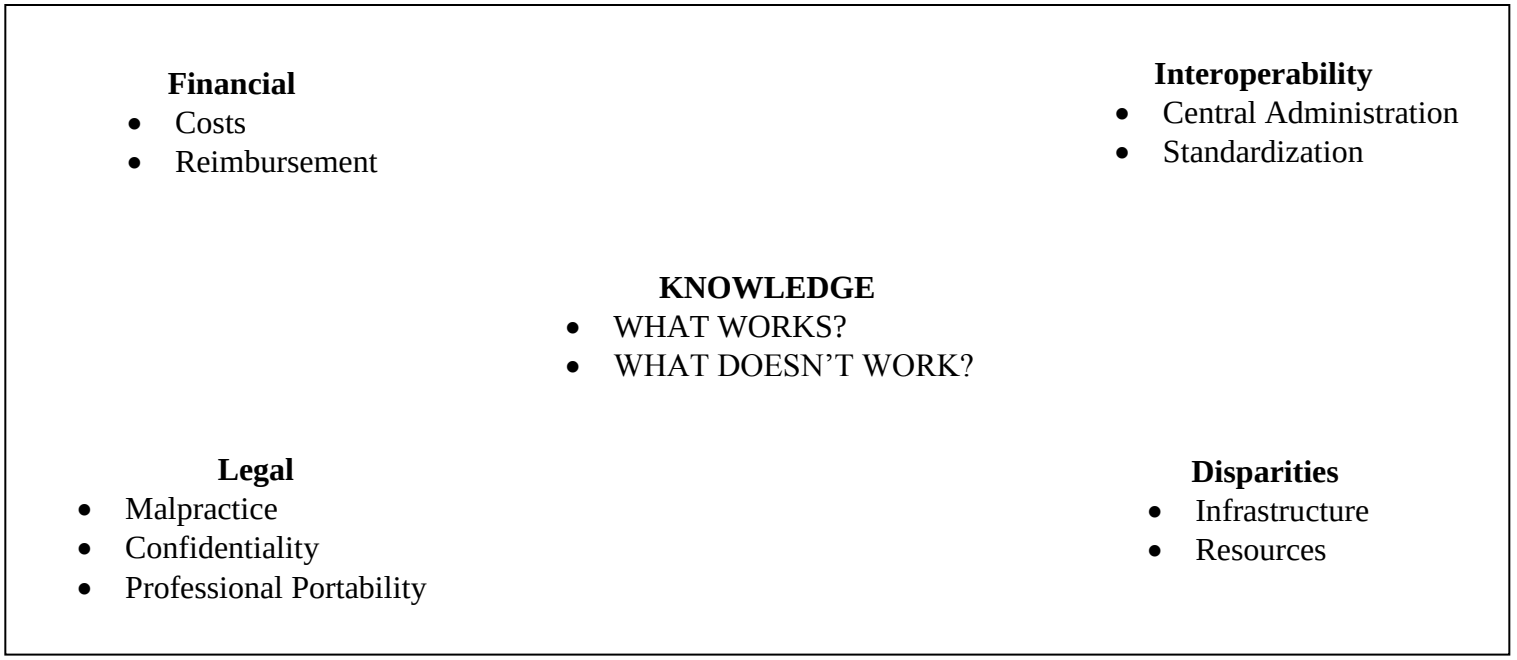

Figure 3. Conceptual Framework

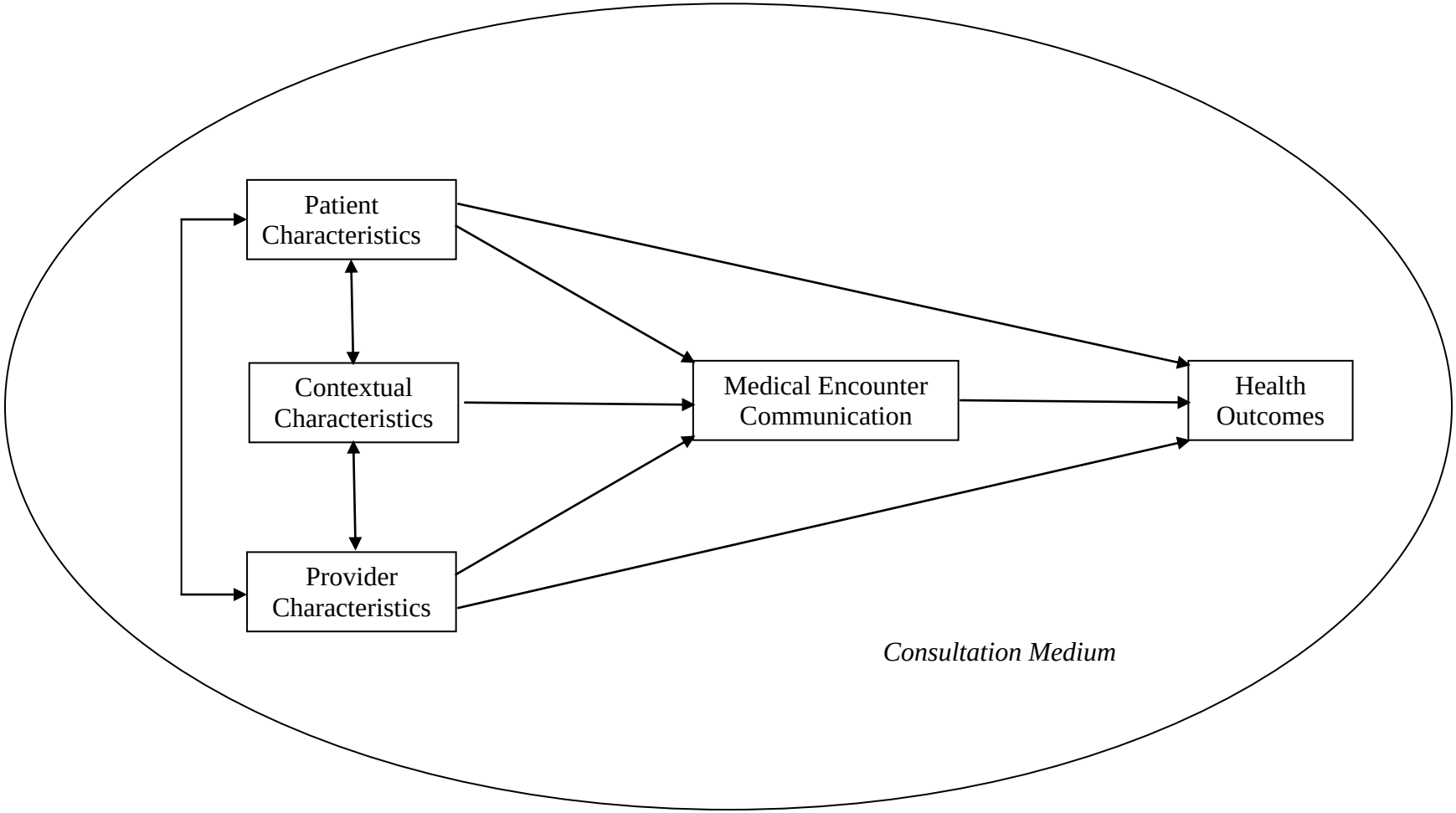

Table I. Definitions for Conceptual Framework

Part of Model	Factors/Categories Included
Consultation Medium	Face-to-face, two-way interactive video, telephone, fax, e-mail, other Internet
Patient Characteristics	Age, education, social class, income, gender, marital status, religion, race, ethnicity, physical appearance, payment method, prior experiences with medical care, visit objectives, concerns, attitudes, coping style, sense of self-efficacy, medical problem, diagnosis, prognosis, health status, emotional state
Provider Characteristics	Age, gender, income, race, ethnicity, personality, specialty, medical training, professional experience, social class, knowledge of patient concerns and information needs, attitudes toward patients, interpersonal skills, ideology
Contextual Characteristics	Culture, geographic location (rural, urban), clinical setting (hospital, physician's office or clinic, nursing home, patient's home), provider organization (solo practice, group practice), length of acquaintance, third party presence (patient's companion, other providers, technicians)
Verbal and Non-Verbal Medical Encounter Communication:[i] Providers	Instrumental behavior—information giving to patient or other provider, information seeking from patient or other providers; social conversation; affective behavior—positive talk, negative talk; partnership building
Verbal and Non-Verbal Medical Encounter Communication:[i] Patients	Instrumental behavior—information giving to provider(s), information seeking from provider(s); social conversation; affective behavior—positive talk, negative talk
Health Outcomes	Satisfaction, compliance, recall, understanding, health status, clinical outcomes, psychological state

[i] Roter and Hall's (1992) six conceptual categories of patient and physician behavior, each of which can be broken down into more detailed behaviors. For **providers**, examples include: **information giving** (gives information, opinion, explanation, orientation, suggestion, instruction, answers patient questions, discusses diagnosis, illness, treatment, self care, prevention, seriousness, lifestyle, findings), **information seeking** (asks questions, asks for information, instructions, about compliance, seeks patient ideas, takes medical history), **social conversation** (greetings, personal remarks, social remarks, casual conversation, discusses family/social matters), **positive talk** (agrees, shows approval, laughs, shows solidarity, gives reassurance, shows empathy), **negative talk** (disagrees, confronts, shows antagonism, anxiety), and **partnership building** (asks patient opinion, understanding, suggestions, requests questions, ideas, makes interpretations, reflects patients' statements, facilitates patient response, makes acknowledgement). For **patients**, examples include: **information giving** (presents symptoms, answers questions, responds to instructions, gives suggestions, opinions, orientation), **information seeking** (asks for orientation, opinion, instructions, suggestion, asks questions-general, asks about medication, treatment, lifestyle, prevention, self-care), **social conversation** (social exchange, social remarks, introductory phrases, family/social conversation), **positive talk** (laughter, friendliness, tension release, agreement, approval, solidarity), and **negative talk** (shows antagonism, disagreement, tension, anxiety).

Table II. Telemedicine and Provider-Patient Communication: Interaction Analysis Studies

Authors	Setting	Consultation Type	Methods	Communication/other Findings
Nelson, Miller, and Larson (2010)	Kansas. Four rural settings (peripheral sites). Kansas University (central site). Video conference-ing at 128-384 kbps over ISDN	Consultation with on-site nurse or social worker and off-site specialist (doctor) in multiple specialties (cardiology, oncology, psychiatry/psychology, rheumatology). Family members sometimes present as well	Convenience sample of 46 consultations (10 initial, 36 follow-up). Used adapted version of the Roter Interaction Analysis System (RIAS). Coded utterances using 26 standard RIAS categories and 13 technology-related. On-site: 44 patients, 22 family members, 7 nurses or nurse practitioners, 1 social worker. Off-site: 8 doctors	Traditional RIAS categories proved reliable in telemedicine (TM). Although there were few technology-related utterances (<1% of total), coding of this category provide reliable when aggregated across specific behaviors. Most utterances by providers (57%), followed by patients (27%), family members (10%), and presenters (6%). Most utterances were task-focused rather than socioemotional. Patients most commonly gave information (62%), showed agreement (13%), and made personal remarks (6%). Providers most commonly asked closed-ended questions (18%), showed agreement (17%), and gave information (14%). Limited technology-related utterances imply a certain degree of comfort with two-way interactive video.
Agha, Roter, and Schapira (2009)	Iron Mountain Veterans Affairs Medical Center (VAMC) in Michigan (peripheral site). Milwaukee VAMC in Wisconsin (central site). Video conferencing units at 384 kpbs	Some patients had a TM consultation with an on-site nurse and off-site pulmonary physician. Others had an in-person (IP) consultation with an on-site pulmonary physician. Companions sometimes present also	Compared TM to IP consultations. Sample of 19 consultations. Used RIAS. Coded 38 types of utterances and global affect in 11 areas. TM [On-site: 11 patients, 2 nurses, 5 companions. Off-site: 3 physicians]. IP [8 patients, 3 physicians , 5 companions].	No differences in length or total utterances between TM and IP. There were equal percentages of physician and patient utterances, on average, with IP visits (46% each); however, physicians accounted for more utterances than patients under TM (48% v. 38%). Nurses contributed just 6.0% of total utterances in TM; companions 7% in TM, 9% IP. There was far more biomedical than psychosocial information exchange in both, though somewhat more biomedical in TM and psychosocial IP (not statistically significant). Physicians were more likely to use orientation statements during IP; patients more requests for repetition during TM. No differences in global affect ratings were detected. Concludes that TM visits are more physician-centered, with physicians controlling the dialogue and patients taking a more passive role.

Table II. Continued

Authors	Setting	Consultation Type	Methods	Communication/other Findings
Wakefield, et al. (2008)	Patients' homes (peripheral sites). Iowa City VAMC (central site). Videophone technology with a resolution of 176 x 144 pixels transmitting at 15 frames per second	Some patients had a TM consultation with an off-site nurse case manager. Others had a telephone (TP) consultation. Patients were elderly veterans who had previously been hospitalized with heart failure	Compared TM and telephone (TP) interventions that sought to promote compliance and partnership, monitor symptoms, and discuss health information with patients. Sample of 84 interactions, 3 each for 28 patients over 90 days. Used RIAS to code 38 types of utterances. Also assessed nurse perceptions and patient satisfaction. TM [On-site: 14 patients. Off-site: nurses]. TP [On-site: 14 patients. Off-site: nurses]	On average, nurses made slightly more utterances than patients during both TM and TP visits (52% v. 48%). Whereas nurses were more likely to gather data, build relationships, and build partnerships; patients were more likely to give information. Nurses were more likely to make open-ended questions, back-channel responses (indicating listening), friendly jokes, and checks for understanding with TP; compliments given and partnership were more common with TM. Patients were more likely to give lifestyle information and approval comments with TP; closed-ended questions were more common with TM. Neither patient satisfaction nor nurse perceptions differed across TP or TM; both were ranked positively. There were no significant differences over time
Liu, et al. (2007)	Japan. Two rooms with Gunma University Hospital. Homecare system at 380 kbps	Patients had a TM consultation with an 'off-site' physician specializing in internal medicine. They also had an IP consultation with a physician. Neither patients nor physicians had previous experience with TM	Compared TM and IP consultations. Each patient had a TM and IP consultation with a different doctor on the same day. Used verbal content analysis to code 14 behaviors. Also examined medical records and assessed patient and physician satisfaction. TM ['On-site': 20 patients, 'Off-site': 5 physicians]. IP [20 patients, 5 physicians]	On average, TM consultations were considerably shorter than IP consultations (13.6 v. 20.6 minutes). There were significantly more utterances with IP than TM, with patients making more utterances than physicians in both settings (~56% v. ~44%). There were significantly more conversational turns during IP visits; greater requests for repetition during TM. Physicians were less likely to make facilitation, empathy or praise utterances during TM than IP visits. There were no differences in closed- or open-questions asked. Medical records were less complete with TM. Patients ranked both TM and IP highly. Physicians ranked TM lower than IP

Table II. Continued

Authors	Setting	Consultation Type	Methods	Communication/other Findings
Demiris, Edison and Vijaykumar (2005)	Missouri. Rural settings (peripheral sites). University of Missouri (central site). Various videoconferencing technologies	Some patients had a TM consultation with an off-site dermatology clinic. Others had an IP consultation with the clinic	Compared TM and IP consultations. All eligible subjects attending either the TM or in-person clinic over a 4-month period were recruited. Used verbal content analysis to code the presence and duration of 13 behaviors/ themes. TM [On-site: 54 patients. Off-site: clinic staff]. IP [40 patients, clinic staff]	TM visits were shorter than IP visits (9 v. 11 minutes). Small talk took place in 20% of IP and 29.6% of TM visits. Clinical assessment took place in all consultations. While not significant 90% of IP visits had patient education as compared to 78% of TM visits. Comparable percentages of TM and IP visits addressed treatment, compliance, psychosocial, and administrative issues. Technical issues were raised in just 14.8% of TM visits. Concludes that communication patterns in TM and IP visits were comparable
Demiris, et al. (2003)	Minnesota. Patients' homes (peripheral sites). Two rural and one urban home care agency (central sites). Analogue videophone using patients telephone, TV, and a portable camera	Elderly patients with chronic conditions (heart failure, diabetes, COPD) had a TM visit with an off-site nurse	Sample of 122 virtual visits were used to assess technical quality using provider and patient self-reports. Verbal content analysis was applied to a subsample of 30 visits to identify 13 behaviors/themes. On-site: 10 patients. Off-site: 10 nurses	Visits lasted an average of 20.4 minutes. Technical quality was given an average rating of 95 out of 100; perfect scores on technical quality were recorded for 64% of the visits; problems establishing a connection were recorded for 8.0% of visits. The highest proportion of time was spent assessing patients' clinical status (42%), followed by compliance (13%), psychosocial issues (10%), and education and informal talk (both 8%). On average, nurses spoke for 59% of the time; they also made 67% of the utterances. Concludes that technical problems do not interfere with the care provided during virtual visits

Table II. Continued

Authors	Setting	Consultation Type	Methods	Communication/other Findings
Tachakra and Rajani (2002)	United Kingdom. Minor accident and treatment service (MATS) (peripheral site). Main hospital (central site). Videoconferencing at 384 kbps	Some patients had a TM consultation with an on-site emergency nurse practitioner and off-site physician. Others had an IP consultation with a nurse practitioner and physician	Compared TM and IP consultations. NPs led TM consultations based on a pre-established protocol. Used verbal content analysis to describe 5 behaviors. TM ['On-site': 30 patients, 1 nurse practitioner (NP). Off-site: 1 physician]. IP [30 patients, 1 nurse practitioner, 1 physician-same as with TM].	Consultations averaged longer with TM than IP (951 v. 247 seconds). Both doctor-patient and doctor-nurse communication exhibited more words and higher rates of turn taking, interruptions, and backchannel responses with TM than IP. There was little difference in patient-nurse communication between the two settings. Concludes that TM empowered patients to ask more questions while the doctor took greater care to achieve coordination of beliefs with patients due, perhaps, in part to the lack of lack of multi-sensory feedback. Verbal cues must be more regularly initiated to provide continuity and confirmation
Savenstedt, et al. (2002)	Northern Sweden. Two wards at a geriatric nursing home (peripheral sites). University Hospital of Umea (central site). Desktop videoconferencing units at 384 kbps	Consultation between an on-site nurse and an off-site geriatrician. Nurses also equipped with digital cameras. The purpose was to replace twice weekly ward rounds	Sample of 15 consultations that took place between 11/99 and 6/00. Used a modified version of the RIAS to describe 17 behaviors/themes. Also analyzed interviews with participating providers. On-site: 5 nurses. Off-site: 1 physician	101 problem or tasks were dealt with during the 15 teleconsultations, including dosage adjustments to medications. Most tasks (69%) could be dealt with either by telephone or teleconsultation. Tele-consultations approximated that of a traditional ward round. Behaviors analyzed included: (1) nurses' presentation of the problem and tasks (how they were presented, types of questions asked, aim); (2) physician's response (how, types of questions); and (3) use of videoconferencing (10% of consultations did not fully exploit it). It was felt that teleconsultation improved the structure of work (more systematic presentation requires more preparation) but that mutual trust is important to the interaction

Table II. Continued

Authors	Setting.	Consultation Type	Methods	Communication/other Findings
Street, Wheeler and McCaughan (2000)	West Texas. Three rural clinics (peripheral sites). Four Campuses of the Texas Tech Health Science Center (Lubock) (central sites). Videoconferencing over T1 lines	Consultation with on-site primary care practitioner (PCP),either a doctor or physician assistant (PA) and off-site physician in multiple specialty areas, including neurology, endocrinology, orthopedics, and dermatology	Convenience sample of 26 consultations taking place from 1994 to 1996. Used verbal content analysis. Coded four types of utterances. Used first 10 minutes of each consultation. On-site: 3 physicians, 2 PAs. Off-site: 20 physicians	Very little group discussion took place among participants. Most talk occurred between the doctor and PCP or patient. Little talk between PCP and patient. Most utterances by specialist (45%), followed by PCP (34%) and patient (23%). Information-giving more equally distributed, though patients received the least amount (17%) and specialists the most (55%). Specialists exerted the most control (63%), while patient-centered talk was rare. Overall, specialists dominated, asking the most questions, exerting the most control and being talked to most often. Patients were the least active, making fewest utterances, asking fewest questions, exerting least control and receiving the least amount of information
Ball, et al. (1995)	London, UK. Acute psychiatric unit. Two rooms in adjacent wards. Low-cost videoconferencing system running at either 25or 12.5 frames per second	Psychiatric examination with 'off-site' psychiatrists	Compared visual (face-to-face, video) and non-visual (telephone, hands-free telephone (HFT) interaction. Each doctor-patient pair repeated consultation in all four modes within a week. Utilized observation, video analysis of non-verbal behavior, verbal content analysis (four categories), and self-report measures. TM, TP, HFT ['On-site': 6 patients. 'Off-site': 6 physicians]. IP [6 patients, 6 physicians]	Information was lost with TM when doctor checked notes or leaned forward, or patients showed side-effects. Patients were more anxious in non-visual modes, adopting least relaxed body posture. Doctors' angle of recline always greater than that of patients no matter what the mode. Both participants displayed high mutual gaze. No differences in self-report or verbal content measures indicative of partnership building, information giving, and question asking. Mean video self-reports were favorable both with respect to patients and providers. Though no significant differences, patients were least anxious in visual models and most frustrated, disappointed and least understood with video. For providers, understanding patient, rapport and frustration best with visual cues

References

Aarnio P, Lamminen H, Lepisto J, Alho A. A prospective study of teleconferencing for orthopaedic consultations. *Journal of Telemedicine and Telecare* 1999;5:62-6.

Agha Z, Roter DL, Schapira RM. An evaluation of patient-physician communication style during telemedicine consultations. *Journal of Medical Internet Research* 2009;11:e36.

Agha Z, Schapira RM, Laud PW, McNutt G, Roter DL. Patient satisfaction with physician-patient communication during telemedicine. *Telemedicine and E-Health* 2009;15:830-39.

Allen A, Doolittle G. Teleoncology. In *Telemedicine: Theory and Practice*, Bashshur RL., Sanders, JH., Shannon, GW., eds. Springfield, Illinois: Charles C Thomas Publisher, LTC. 1997:249-64.

Allen A, Hayes J. Patient satisfaction with telemedicine in a rural clinic. *American Journal of Public Health* 1994;84:1693.

Allen A, Hayes J. Patient satisfaction with teleoncology: A pilot study. *Telemedicine Journal* 1995;1:41-6.

Anonymous. Chapter 4: Telecommunications infrastructure: The human dimension. *Telemedicine Journal* 1995;1:351-56.

Audet AM, Doty M, Peugh J, Shamasdin J, Zapert K, Schoenbaum S. Information technologies: when will they make it into physicians' black bags? *Medscape General Medicine* 2004;6:2.

Baer L, Cukor P, Jenike MA, Leahy L, O'Laughlen J, Coyle JT. Pilot studies of telemedicine for patients with obsessive-compulsive disorder. *American Journal of Psychiatry* 1995;152:1383-85.

Baigent MF, Lloyd CJ, Kavanagh SJ, Ben-Tovim DI, Yellowlees PM, Kalucy RS, Bond MJ. Telepsychiatry: 'tele' yes, but what about the 'psychiatry'? *Journal of Telemedicine and Telecare* 1997;3:3-5.

Balas EA, Jaffrey F, Kuperman GJ, Boren SA, Brown GD, Pinciroli F, Mitchell JA. Electronic communication with patients: Evaluation of distance medicine technology. *Journal of the American Medical Association* 1997 278:152-59.

Ball CJ, McLaren M, Summerfield, Lipsedge MS, Watson JP. A comparison of communication modes in adult psychiatry. *Journal of Telemedicine and Telecare* 1995;1:22-6.

Bass MJ, Buck C, Turner L, Dickie G, Pratt G, Robinson HC. The physician's actions and the outcome of illness in family practice. *Journal of Family Practice* 1986;23:43-7.

Barnsley J, Williams AP, Cockerill R, Tanner J. Physician characteristics and the physician-patient relationship: Impact of sex, year of graduation, and specialty. *Canadian Family Physician* 1999;45:935-42.

Bashshur RL. Critical issues in telemedicine. *Telemedicine Journal* 1997;3:113-26.

Bashshur RL. On the definition and evaluation of telemedicine. *Telemedicine Journal* 1995;1:19-30.

Bashshur RL. Public acceptance of telemedicine in a rural community. *Biosciences Communication* 1978;4:17-38.

Bashshur RL. Rethinking the evaluation and priorities in telemedicine. *Telemedicine Journal* 1998;4:1-4.

Bashshur RL. Lathan CE. Human factors in telemedicine. *Telemedicine Journal* 1999;5:127-28.

Bashshur R, Shannon G, Sapci H. Telemedicine evaluation. *Telemedicine Journal and E-Health*. 2005;11:296-316.

Beckman H, Kaplan SH, Frankel R. Outcome based research on doctor-patient communication: A review. In *Communicating with Medical Patients,* M. Stewart, D. Roter, eds. Newbury Park: Sage Publications. 1989;223-27.

Beisecker AE, Beisecker TD. Research issues related to physician-elderly patient interactions. *Research on Aging* 1996;18:3-8.

Beisecker AE. Older persons' medical encounters and their outcomes. *Research on Aging* 1996:18:9-31.

Blackmon LA, Kaak HO, Ranseen J. Consumer satisfaction with telemedicine child psychiatry consultation in rural Kentucky. *Psychiatric Services* 1997;48:1464-66.

Blum JD. Internet medicine and the evolving legal status of the physician-patient relationship. *Journal of Legal Medicine* 2003;24:413-55.

Blumenthal D. Doctors in a wired world: Can professionalism survive connectivity? *Milbank Quarterly* 2002;80:525-46.

Boon H, Stewart M. Patient-physician communication assessment instruments: 1986 to 1996 in review. *Patient Education and Counseling* 1998;35:161-76.

Bose U, McLaren P, Riley A, Mohammedali A. The use of telepsychiatry in the brief counseling of non-psychotic patients from an inner-London general practice. *Journal of Telemedicine and Telecare* 2001;7(suppl. 1): 8-10

Bourhis RY, Sharon R, MacQueen G. Communication in hospital settings: A survey of medical and everyday language use amongst patients, nurses, and doctors. 1989;28:339-46.

Brennan JA, Kealy JA, Gerardi LH, Shih R, Allegra J, Sannipoli L, Lutz D. A randomized controlled trial of telemedicine in an emergency department. *Journal of Telemedicine and Telecare* 1998;4:18-20.

Brennan JA, Kealy JA, Geradi LH, Shih R, Allegra J, Sannipoli L, Lutz D. Telemedicine in the emergency department: A randomized controlled trial. *Journal of Telemedicine and Telecare* 1999;5:18-22.

Brick JE. Telemedicine and primary care. In *Telemedicine: Theory and Practice*, Bashshur RL, Sanders, JH., Shannon, GW., eds. Springfield, Illinois: Charles C Thomas Publisher, LTC. 1997:211-24.

Brick JE, Bashshur RL, Brick JF, D'Alessandri RM. Public knowledge, perception, and expressed choice of telemedicine in rural West Virginia. *Telemedicine Journal* 1997;3:159-71.

Brown NA. Information on telemedicine. *Journal of Telemedicine and Telecare* 2005;11:117-26.

Bodenheimer T, Grumbach K. Electronic technology: A spark to revitalize primary care? *Journal of the American Medical Association* 2003;290:259-64.

Buck S. Nine human factors contributing to the user acceptance of telemedicine applications: A cognitive-emotional approach. *Journal of Telemedicine and Telecare* 2009;15:55-8.

Callahan EJ, Hilty DM, Nesbitt TS. Patient satisfaction with telemedicine consultation in primary care: Comparison of ratings of medical and mental health applications. *Telemedicine Journal* 1998;4:363-69.

Carter WB, Inui TS, Kukull W, Haigh V. Outcome-based doctor-patient interaction analysis: II. Identifying effective provider and patient behavior. *Medical Care* 1982;20:550-66.

Center for Telemedicine Law. *Telemedicine Reimbursement Report*. Report Prepared for the Office for the Advancement of Telehealth, Health Resources and Services Administration, U.S. Department of Health and Human Services, 2003, October. Available at: http://www.hrsa.gov/telehealth/pubs/reimbursement.htm (accessed January 13, 2010).

Chae YM, Park HJ, Cho JG, Hong GD, Cheon KA. The reliability and acceptability of telemedicine for patients with schizophrenia in Korea. *Journal of Telemedicine and Telecare* 2000;6:83-90.

Chen PW. Are doctors ready for virtual visits? *The New York Times*, 2010, January 7.Available at: www.nytimes.com/2010/01/07/health/07chen.html (accessed January 10, 2010).

Clarke PH. A referrer and patient evaluation of a telepsychiatry consultation-Liason service in South Australia. *Journal of Telemedicine and Telecare* 1997;3:12-4.

Collins B, Sypher H. Developing better relationships in telemedicine practice: Organizational and interpersonal factors. *Telemedicine Today* 1996;4:27, 42.

Cukor P, Baer L, Willis BS, Leahy L, O'Laughlen J, Murphy M, Withers M, Martin E. Use of videophones and low-cost standard telephone lines to provide a social presence in telepsychiatry. *Telemedicine Journal* 1998;4:313-31.

Craft RL. Toward technical interoperability in telemedicine. *Telemedicine Journal and E-Heatlh* 2005;11:384-404.

Day SX, Schneider P. The subjective experience of therapists in face-to-face, video, and audio sessions. In: Bloom JW, Waltz GR, eds. *Cybercounseling and cyberlearning: strategies and resources for the Millennium*. Alexandria, Virginia: American Counseling Association. ERIC/Counseling and Student Services Clearinghouse at the University of North Carolina, 2000: 203-18

Demiris G, Speedie S, Finkelstein S, Harris I. Communication patterns and technical quality of virtual visits in home care. *Journal of Telemedicine and Telecare* 2003;9:210-5.

Demiris G, Donghua T. An analysis of the specialized literature in the field of telemedicine. *Journal of Telemedicine and Telecare* 2005;11:316-19.

Demiris G, Edison K, Vijaykumar S. A comparison of communication models of traditional and video-mediated health care delivery. *International Journal of Medical Informatics* 2005;74:851-6.

Dick PT, Filler R, Pavan A. Participant satisfaction and comfort with multi-disciplinary pediatric telemedicine consultations. *Journal of Pediatric Surgery* 1999;34:137-41.

Dongier M, Tempier R, Lalinec-Michaud M, Meunier D. Telepsychiatry: Psychiatric consultation through two-way television: A controlled study. *Canadian Journal of Psychiatry* 1986;31:32-4.

Doze S, Simpson J, Hailey D, Jacobs P. Evaluation of a telepsychiatry pilot project. *Journal of Telemedicine and Telecare* 1999; 5: 38-46

Doze S, Simpson J, eds. *Evaluation of a Telepsychiatry Pilot Project.* Edmonton: Provincial Mental Health Advisory Board and Alberta Heritage Foundation for Medical Research, 1997

D'Souza R. Telemedicine for intensive support of psychiatric inpatients admitted to local hospitals. *Journal of Telemedicine and Telecare* 2000; 6(suppl. 1): 26-8

Egbert LD, Battit GE, Welch CE, Bartlett MK. Reduction of postoperative pain by encouragement and instruction of patients. *New England Journal of Medicine* 1964;270:825-7.

Elford R, White H, Bowering R, Ghandi A, Maddiggan B, St. John K, House M, Harnett J, West R, Battcok A. A randomized, controlled trial of child psychiatric assessments conducted using videoconferencing. *Journal of Telemedicine and Telecare* 2000;6:73-82.

Elford DR, White H, St. John K, Maddigan B, Ghandi M, Bowering R. A prospective satisfaction study and cost analysis of a pilot child telepsychiatry service in Newfounland *Journal of Telemedicine and Telecare* 2001;7:73-81

Entralgo PL. *Doctor and Patient*. New York: McGraw-Hill, 1969.

Esser PE, Goossens RHM. 2009. A framework for the design of user-centred teleconsulting systems. *Journal of Telemedicine and Telecare* 2009;15:32-9.

Evans HH. High tech vs "high touch': The impact of medical technology on patient care. In Clair JM, Allman RM, eds. *Sociomedical Perspectives on Patient Care*. Kentucky, The University Press of Kentucky, 1993:83-95.

Field, M.J, editor. *Telemedicine: A Guide to Assessing Telecommunications in Health Care.* Washington, D.C.: National Academy Press, 1996.

Fallowfield LJ, Hall A, Maguire GP, Baum M. Psychological outcomes of different treatment policies in women with early breast cancer outside a clinical trial. *British Medical Journal* 1990;301:575-80.

Freidson E. *Profession of medicine: A study of the sociology of applied knowledge.* New York: Dodd, Mead & Company, New York, 1970.

Freir V, Kirkwood K, Peck D, Robertson S, Scott-Lodge L, Zeffert S. Telemedicine for clinical psychology in the Highlands of Scotland. *Journal of Telemedicine and Telecare* 1999;5:157-61.

Gammon D, Sorlie T, Bergvik S, Hoifodt TS. Psychotherapy supervision conducted by videoconferencing: A qualitative study of users' experiences. *Journal of Telemedicine and Telecare* 1998;4:33-5.

Gelber H, Alexander M. An evaluation of an Australian videoconferencing project for child and adolescent telepsychiatry. *Journal of Telemedicine and Telecare* 1999;5:21-3.

George SM, Hamilton A, Baker R. Pre-experience Perceptions about Telemedicine among African Americans and Latinos in South Central Los Angeles. *Telemedicine and E-Health* 2008;15:525-30.

Glueckauf RL, Fritz SP, Ecklund-Johnson EP, Liss HJ, Dages P, Carney P. Videconferencing-based family counseling for rural teenagers with epilepsy: phase 1 findings. *Rehabilitation Psychology.* 2002;47:49-72.

Goldberg MA, Sharman Z, Bell B, Ho K, Patil N. E-health and the Universitas 21 Organization: 4. Professional portability. *Journal of Telemedicine and Telecare* 2005;11:230-33.

Gosh GJ. McLaren PM. Watson JP. Evaluating the alliance in videolink teletherapy. *Journal of Telemedicine and Telecare* 1997;3:33-5.

Gustke SS. Balch DC. West VL. Rogers LO. Patient satisfaction with telemedicine. *Telemedicine Journal* 2000;6:5-13.

Greene MG, Adelman R, Charon R, Hoffman S. Ageism and the medical encounter: An exploratory study of the language and behavior of doctors with their old and young patients. *Language and Communication* 1986;6:113-24.

Greene M, Majerovitz D, Adelman R, Rizzo C. The effects of the presence of a third person on the physician-older patient medical interview. *Journal of the American Geriatrics Society* 1994;42:413-9.

Grigsby B. *2004 TRC Report on US Telemedicine Activity, With an Overview of Non-US Activity*. Kingston, New Jersey: Civic Research Institute, Inc, 2004.

Grigsby J, Brega AG, Devore PA. The evaluation of telemedicine and health services research. *Telemedicine Journal and E Health* 2005;11:317-28.

Grigsby J, Kaehny MM, Sandberg EJ, Schlenker RE, Shaughnessy RW. Effects and effectiveness of telemedicine. *Health Care Financing Review* 1995a;17:115-31.

Grigsby J, Schlenker RE, Kaehny MM, Shaughnessy PW, Sandberg EJ. Analytic framework for evaluation of telemedicine. *Telemedicine Journal* 1995b;1:31-9.

Hadlow J, Pitts M. The understanding of common health terms by doctors, nurses, and patients. *Social Science and Medicine* 1991;32:193-96.

Hailey D, Ohinmaa A, Roine R. Study quality and evidence of benefit in recent assessments of telemedicine. *Journal of Telemedicine and Telecare* 2004;10:318-24.

Hall JA, Doran MC. Meta-analysis of satisfaction with medical care: Description of research design and analysis of overall satisfaction levels. *Social Science and Medicine* 1988;17;637-44.

Hall JA, Roter DL, Katz NR. Meta-analysis of correlates of provider behavior in medical encounters. *Medical Care* 1988;26:657-75

Hall JA, Roter DL, Milburn MA, Daltroy LH. Patients health as a predictor of physician and patient behavior in medical visits: A synthesis of four studies. *Medical Care* 1996;34:1205-18.

Hall JA, Roter DL, Rand CS. Communication of affect between patient and physician. *Journal of Health and Social Behaviour* 1981;22:18-30.

Hall JA, Roter DL, Katz NR. Meta-analysis of correlates of provider behavior in medical encounters. *Medical Care* 1988;26:657-75.

Harrison R, Clayton W, Wallace P. Virtual outreach: A telemedicine pilot study using a cluster-randomized controlled design. *Journal of Telemedicine and Telecare* 1999;5:126-30.

Harrison R, MacFarlane A, Murray E, Wallace P. Patients' perceptions of joint teleconsultations: a qualitative evaluation. *Health Expectations* 2006;9:81-90.

Hassol A, Irvin C, Gaumer G, Puskin D, Mintzer C, Grigsby J. Rural applications of telemedicine. *Telemedicine Journal* 1997;3:215-25.

Hasselkus BR. 1992. Three-track care: Older patients, family members, and physician in the medical visit. *Journal of Aging Studies* 1994;8:291-307.

Haug M, Lavin B. *Consumerism in medicine: Challenging physician authority.* BeverlyHills, California: Sage Publications, 1983.

Hill JV, Allman LR, Ditzler TF. Utility of real-time video teleconferencing in conducting family mental health sessions: two case reports. *Telemedicine Journal* 2001;7:55-9

Hjelm NM. Benefits and drawbacks of telemedicine. *Journal of Telemedicine and Telecare* 2005;11:60-70.

Holtan A. Patient reactions to specialist telemedicine consultations-A sociological approach. *Journal of Telemedicine and Telecare* 1998;4:206-13.

Hufford BJ, Glueckauf RL, Webb PM. Home-based, interactive videoconferencing for adolescents with epilepsy and their families. *Rehabilitation Psychology.* 1999;44:176-93.

Hulka BS, Kupper LL, Cassel JC. Doctor-patient communication and outcomes of diabetic patients. *Journal of Community Health* 1975;1:15-27.

Huston JL, Burton DC. Patient satisfaction with multispecialty interactive teleconsultations. *Journal of Telemedicine and Telecare* 1997;3:205-08.

Jennett PA, Hall LA, Hailey D, et al. The socio-economic impact of telehealth: A systematic review. *Journal of Telemedicine and Telecare* 2003;9:311-20.

Joint Working Group on Telemedicine, Department of Commerce. *Telemedicine Report to Congress* Available at: www.ntia.doc/gov/reports/telemed (accessed April 10, 2000). January 31, 1997.

Kaplan SH, Greenfield S, Ware JR. Assessing the effects of physician-patient interactions on the outcomes of chronic disease. *Med Care* 1989;27:S110-27.

Kaushal R, Bates DW, Poon EG, Jha AK, Blumenthal D, Harvard Interfaculty Program for Health Systems Improvement NHIN Working Group. Functional gaps in attaining a national health information network." *Health Affairs* 2005;24:1281-89.

Kavanagh SJ, Yellowlees PM. Telemedicine-Clinical applications in mental health. *Australian Family Physician* 1995;24:1242-7.

Kirkwood KT, Peck DF, Bennie L. The consistency of neuropsychological assessments performed via telecommunication and face to face. *Journal of Telemedicine and Telecare* 2000;6:147-51

Kleinke JD. Dot-gov: Market failure and the creation of a national health information technology system. *Health Affairs* 2005;24:1246-62.

Kopel H, Nunn K, Dossetor D. Evaluating satisfaction with a child and adolescent psychological telemedicine outreach service. *Journal of Telemedicine and Telecare* 2001;7(suppl. 2): 35-40

Korsch BM, Gozzi E, Francis V. Gaps in docor-patient communication. I. Doctor-patient interaction and patient satisfaction. *Pediatrics* 1968;42:855-71.

Kuszler PC. Telemedicine and integrated health care delivery: Compounding malpractice liability. *American Journal of Law and Medicine* 1999;25:297-326.

Labrecque MS. Blanchard CG. Ruckdeschel JC. Blanchard EB. The impact of family presence on the physician-cancer patient interaction. *Social Science and Medicine* 1991;33:1253-61.

Larsen KM, Smith CK. Assessment of non-verbal communication in the patient-physician interview. *Journal of Family Practice* 1981;12:481.

Levinson W, Chaumeton N. Communication between surgeons and patients in routine office visits. *Surgery* 1999;125:127-34.

Levinson W, Roter DL, Mullooly JP, Dull VT, Frankel RM. Physician-patient communication: The relationship between malpractice claims among primary care physicians and surgeons. *Journal of the American Medical Association* 1997;277:553-59.

Linn LS. Lewis CE. Attitudes toward self-care among practicing physicians. *Medical Care* 1979;80:1145-64.

Liu X, Sawada Y, Takizawa T, Sato H, Sato M, Sakamoto H, Utsugi T, Sato K, Sumino H, Okamura S, Sakamaki T. Doctor-patient communication: a comparison between telemedicine consultation and face-to-face consultation. *Internal Medicine* 2007;46:227-32.

Loane MA, Bloomer SE, Corbett R, Eedy DJ, Gore HE, Mathews C, Steele K, Wooton R. Patient satisfaction with realtime teledermatology in Northern Ireland. *Journal of Telemedicine and Telecare* 1998;4:36-40.

Loan MA, Wooton R. A review of guidelines and standards for telemedicine. *Journal of Telemedicine and Telecare* 2002;8:63-71.

Lowitt MH, Kessler II, Kauffman CL, Hooper FJ, Siegel E, Burnett JW. Teledermatology and in-person examinations. *Archives of Dermatology* 1998;134:471-76.

Made C, Carle L, Soderberg O, Hellstrom S. Tele-otolaryngology consultations between two rural primary-care centers in southern Laplan and the University Hospital of Umea. *Journal of Telemedicine and Telecare* 1999;5:93-4.

Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. *British Medical Journal* 2000;320:1517-20.

Matusitz J, Breen, G. Telemedicine: Its effects on health communication. *Health Communication* 2007;21:73-83.

McConnell ME, Steed RD, Tichenor JM, Hannon DW. Interactive telecardiology for the evaluation of heart murmurs in children. *Telemedicine Journal* 1999;5:157-61.

MacFarlane A, Harrison R, Murray E, Wallace, P. A qualitative study of communication during joint teleconsultations at the primary-secondary care interface. *Journal of Telemedicine and Telecare* 2006;12:24-6.

May C. Gask L. Ellis N. Atkinson T. Mair F. Smith C. Pidd S. Esmail A. Telepsychiatry evaluation in the north-west of England: preliminary results of a qualitative study. *Journal of Telemedicine and Telecare* 2000;6:S1:20-2.

McLaren P, Ball CJ, Summerfield AB, Watson JP, Lipsedge M. An evaluation of the use of interactive television in an acute psychiatric service. *Journal of Telemedicine and Telecare* 1995;1:79-85.

McLaren PM, Blunden J, Lipsedge ML, Summerfield AB. Telepsychiatry in an inner-city community psychiatric service. *Journal of Telemedicine and Telecare* 1996;2:57-9.

Mechanic D. Public trust and initiatives for new health care partnerships. *Milbank Quarterly* 1998a;76:281-302.

Mechanic D. The functions and limitations of trust in the provision of medical care. *Journal of Health Politics, Policy and Law* 1998b;23:661-95.

Meeuwesen L, Schaap C, Van der Staak C. Verbal analysis of doctor-patient communication. *Social Science and Medicine* 1991;32:1143-50.

Mekhjian H, Turner JW, Gailiun M, McCain TA. Patient satisfaction with telemedicine in a prison environment. *Journal of Telemedicine and Telecare* 1999;5:55-61.

Middleton B. Achieving US health information technology adoption: The need for a third hand. *Health Affairs* 2005;24:1269-72.

Mielonen ML, Ohinmaa A, Moring J, Isohanni M. The use of videoconferencing for telepsychiatry in Finland. *Journal of Telemedicine and Telecare* 1998;4:125-31

Mielonen ML, Ohinmaa A, Moring J, Isohanni M. Psychiatric inpatient care planning via telemedicine. *Journal of Telemedicine and Telecare* 2000;6:152-7

Miller EA. Solving the disjuncture between research and practice: Telehealth trends in the 21st century. *Health Policy* 2007;82:133-41.

Miller, E.A. Telemedicine and doctor-patient communication: an analytical survey of the literature. *Journal of Telemedicine and Telecare* 2001;7:1-17.

Miller EA. Telemedicine and doctor-patient communication: A theoretical framework for evaluation. *Journal of Telemedicine and Telecare.* 2002;8:311-318.

Miller EA. The technical and interpersonal aspects of Telemedicine: Effects on doctor-patient communication. *Journal of Telemedicine and Telecare* 2003a;9:1-7.

Miller EA. Telepsychiatry and doctor-patient communication: An analysis of the empirical literature. In Wootton R, Yellowlees P, McLaren P, eds. *Telepsychiatry & e-mental health Care*. London, England: Royal Society of Medicine Press, 2003b:39-71.

Miller EA, Nelson EL. Modifying the Roter interaction analysis system to study provider-patient communication in telemedicine: promises, pitfalls, insights, and recommendations. *Telemedicine Journal* 2005;11:44-55.

Miller EA. West DM. Characteristics associated with use of public and private websites as sources of health care information: Results from a national survey. *Medical Care.* 2007;45:245-51.

Miller EA, West DM. Where's the revolution? Digital technology and health care communication in the internet age. *Journal of Health Politics, Policy and Law* 2009;34:261-84.

Miller EA, West DM, Wasserman M. Health information websites: Characteristics of US users by race and ethnicity. *Journal of Telemedicine and Telecare.* 2007;13:298-302.

Miller R, Hillman J, Given R. Physician use of IT: Results form the Deloitte research survey. *Journal of Health Information Management* 2004;18:72-80.

Miller RH, Sim I. Physicians' use of electronic medical records: Barriers and solutions. *Health Affairs* 2004;23:116-26.

Montani C, Billaud N, Tyrrell J, *et al*. Psychological impact of a remote psychometric consultation with hospitalized elderly people. *Journal of Telemedicine and Telecare* 1997;3:140-5

Montani C, Billaud N, Couturier P, *et al*. "Telepsychometry": A remote psychometry consultation in clinical gerontology: preliminary study. *Telemedicine Journal* 1996;2:145-50

Moser PL, Hauffe H, Lorenz IH, et al. Publication output in telemedicine during the period January 1964 to July 2003. *Journal of Telemedicine and Telecare* 2004;10:72-7.

Moskop JC. The nature and limits of the physician's authority. In *Doctors, Patients, and Society: Power and Authority in Medical Care*, Staum, MS. Larsen, DE., eds. Waterloo, Ontario, Canada: Wilfrid Laurier University Press. 1981; 29-44.

Mucic D. International telepsychiatry: A study of patient acceptability. *Journal of Telemedicine and Telecare* 2008;14:241-43.

Mumford E, Schlesinger HH, Glass GV. The effects of psychological intervention on recovery from surgery and heart attacks: An analysis of the literature. *American Journal of Public Health* 1982;72:141-51.

Nelson EL, Miller EA, Larson K. Reliability associated with the Roter interaction analysis system (RIAS) Adapted for the telemedicine context. *Patient Education and Counseling* 2010;78:72-78.

Nesbitt TS, Ellis JC, Kuenneth CA. A proposed model for telemedicine to supplement the physician workforce in the USA. *Journal of Telemedicine and Telecare* 1999;5(Supp 2):S20-S26.

Ong LML, De Haes JCJM, Hoos AM, Lammes FB. Doctor-patient communication: A review of the literature. *Social Science and Medicine* 1995;40:903-918.

Onor ML, Misan S. The clinical interview and the doctor relationship in telemedicine. *Telemedicine and E-Health.* 2005;11:102-05.

Orth JE. Stiles WB. Scherwitz L. Hennrikus D. Vallbona C. Patient exposition and provider explanation in routine interviews and hypertensive patients' blood pressure control. *Health Psychology* 1987;6:29-42.

Pappas Y, Seale C. The opening phase of telemedicine consultations: An Analysis of interaction. *Social Science and Medicine* 2009;68:1229-37.

Parrot R, Burgoon JK, Burgoon M, LePoire BA. Privacy between physicians and patients: More than a matter of confidentiality. *Social Science and Medicine* 1989;29:1381-85.

Parsons T. Illness and the role of the physician: A sociological perspective. *American Journal of Psychiatry* 1951;21:452-60.

Pedersen S, Holand U. Tele-endoscopic otorhinolaryngological examination: Preliminary study of patient satisfaction. *Telemedicine Journal* 1995;1:47-52.

Pendleton DA, Bochner S. The communication of medical information in general practice consultations as a function of patients' social class. *Social Science and Medicine* 1980;14:669-73.

Ptacek JT, Eberhardt TL. Breaking bad news: A review of the literature. *Journal of the American Medical Association* 1996;276:496-502.

Reardon T. Research findings and strategies for assessing telemedicine costs. *Telemedicine Journal and E-Health* 2005;11:348-69.

Rosenberg EE, Lussier MT,Beaudoin C. Lessons for clinicians from physician-patient communication literature. *Archives of Family Medicine* 1997;6:279-83.

Ross CE, Duff RS. Returning to the doctor: The effect of client characteristics, type of practice, and experiences with care. *Journal of Health and Social Behavior* 1982;23:119-31.

Roter D. Which Facets of Communication have Strong Effects on Outcome-A Meta Analysis. In *Communicating with Medical Patients,* M. Stewart, D. Roter, eds. Newbury Park: Sage Publications. 1989;183-96.

Roter D. *The Roter method of interaction process analysis.* Baltimore, Maryland: The Johns Hopkins University, 2002.

Roter DL, Hall JA. Studies of doctor-patient interaction. Annu Review of Public Health 1989;10:163-80.

Roter DL. Hall JA. Why physician gender matters in shaping the physician-patient relationship. *Journal of Women's Health* 1998;7:1093-97.

Roter DL, Hall JA. *Doctors Talking with Patients/ Patients Talking with Doctors: Improving Communication in Medical Visits.* Wesport, Connecticut: Auburn House, 1992.

Roter D, Hall J, Katz N. Patient-physician communication: A descriptive summary of the literature. *Patient Education Counseling* 1988;12:99-119.

Roter DL, Hall JA, Merisca R, Nordstrom B, Cretin D, Svarstad B. Effectiveness of interventions to improve patient compliance: A Meta-Analysis. *Medical Care* 1998;36:1138-61.

Roter D, Larson S. The Roter interaction analysis system (RIAS): Utility and flexibility for analysis of medical interactions. *Patient Education and Counseling* 2002;46:243-51.

Roter DL, Lipkin, Jr. M, Korsgaard A. Sex differences in patients' and physicians' communication during primary care medical visits. *Medical Care* 1991;29:1083-93.

Roter D, Stewart M, Putnam SM, Lipkin M, Stiles W, Inui T. The patient-physician relationship: Communication patterns of primary care physicians. *Journal of the American Association* 1997; 277:350-56.

Sanders J, Bashshur RL. Challenges to the implementation of telemedicine. *Telemedicine Journal* 1995;1:115-23.

Savenstedt S, Bucht G, Norberg L, Sandman PO. Nurse-doctor interaction in teleconsultations between a hospital and a geriatric nursing home. *Journal of Telemedicine and Telecare* 2002;8:11-18

Schopp L, Johnstone B, Merell D. Telehealth and neuropsychological assessment: new opportunities for psychologists. *Professional Psychology: Research and Practice.* 2000;31:179-83.

Simpson S. The provision of a telepsychology service to Shetland: client and therapist satisfaction and the ability to develop a therapeutic alliance. *Journal of Telemedicine and Telecare* 2001;7(suppl. 1):34-6.

Simpson J, Doze S, Urness D, Hailey D, Jacobs P. Telepsychiatry as a routine service: The perspective of the patient. *Journal of Telemedicine and Telecare* 2001a;7:155-60.

Simpson J, Doze S, Urness D, Hailey D, Jacobs P. Evaluation of a routine telepsychiatry service. *Journal of Telemedicine and Telecare* 2001b;7:90-8.

Sisk JE, Sanders JH. A proposed framework for economic evaluation of telemedicine. *Telemedicine Journal* 1998;4:31-7.

Sleath B, Roter D, Chewning B, Svarstad B. Asking questions about medication: Analysis of physician-patient interactions and physician perceptions. *Medical Care* 1999;37:1169-73.

Spaulding RJ, Davis K, Patterson J. A comparison of telehealth and face-to-face presentation for school professionals supporting students with chronic illness. *Journal of Telemedicine and Telecare* 2008;14:211-14.

Spielberg A. On Call and Online: Sociohistorical, legal, and ethical implications of e-mail for the patient-physician relationship. *Journal of the American Medical Association* 1998;280:1353-59.

Starr P. Health and the right to privacy. *American Journal of Law and Medicine* 1999;25:193-201.

Stewart MA, McWhitnney IR, Buck CW. The doctor-patient relationship and its effect upon outcomes. *Journal of Royal College of General Practice* 1979;29:77-82.

Stiles WB, Putnam SM. Analysis of verbal and nonverbal behavior in doctor-patient encounters. In Stewart M, Roter D, eds. *Communicating with Patients.* Newbury Park: Sage Publications, 1989:211-22.

Stoeckle JD. VI: The good relation. In Stoeckle, JD ed. *Encounters between Patients and Doctors: An Anthology*. Cambridge, Massachusetts: The MIT Press, 1987.

Street RL, Wheeler EJ, McCaughan WT. Specialist-primary care provider-patient communication in telemedicine consultations. *Telemedicine Journal* 2000;6:45-54.

Suzuki T, Murase S, Kitano A, Nagase H, Momoi S, Nakamaki M. Eye contact in medical examinations using videophones. *Telemedicine and e-Health* 2006;12:535-41.

Szasz TS, Hollender. A contribution to the philosophy of medicine: The basic models of the doctor-patient relationship. *Archives of Internal Medicine* 1956;97:585-92.

Tachakra S, Rajani R. Social presence in telemedicine. *Journal of Telemedicine an Telecare* 2002;8:226-30.

Tilford JM, Garner WE, Strode SW, Bynum AB. Rural Arkansas physicians and telemedicine technology: Attitudes in communities receiving equipment. *Telemedicine Journal* 1997;3:257-63.

Thomas EJ, Lucke JF, Wueste L, Weavind L, Patel B. Association of telemedicine for remote monitoring of intensive care patients with mortality, complications, and length of stay. *Journal of the American Medical Association* 2009;302:2671-78.

Torppa MA, Timonen O, Keinanen-Kiukaanniemi S, Larivaara P, Leiman M. Patient-nurse-doctor interaction in general practice teleconsultations: a qualitative analysis. *Journal of Telemedicine and Telecare* 2006;12:306-10.

Turner JW. Telepsychiatry as a case study of presence: Do you know what you are missing? *Journal of Computer-Mediated Communication* 2001;6(4). Available at: www.ascusc.org/jcmc/vol6/issue4/turner.html (accessed August 20, 2002).

van Dulmen AM. Communication during gynecological out-patient encounters. *Journal of Psychosomatic Obstetrics and Gynecology* 1999;20:118-26.

van Dulmen AM, Verhaak PFM, Bilo HJG. Shifts in doctor-patient communication during a series of outpatient consultations in non-insulin-dependent diabetes mellitus. *Patient Education and Counseling* 1997;30:227-37.

Waitzkin H. Information giving in medical care. *Journal of Health and Social Behavior.* 1985;26:81-101.

Waitzkin H. The micropolitics of medicine A contextual analysis. *International Journal of Health Services* 1984;14:339-78.

Waitzkin H. *The Politics of Medical Encounters: How Patients and Doctors Deal with Social Problems.* New Haven: Yale University Press, 1991.

Wakefield BJ, Bylund CL, Holman JE, Ray A, Scherubel M, Kienzle MG, Rosenthal GE. Nurse and patient communication profiles in a home-based telehealth intervention for heart failure management. *Patient Education and Counseling* 2008;71:285-92.

Wakefield DS. Kienzle MG. Zollo SA. Kash JB. Uden-Holman T. Health care providers' perceptions of telemedicine services. *Telemedicine Journal* 1997;3:59-65.

Walker J, Pan E, Johnston D, Adler-Milstein J, Bates DW, Middleton B. The value of health care information exchange and interoperability." Health Affairs 2005;Web-Exclusive(January 19):W5-10-W5-18.

Wallwiener M, Wallwiener CW, Kansy JK, Seeger H, Rajab TK. Impact of electronic messaging on the patient-physician interaction. *Journal of Telemedicine and Telecare* 2009;15:243-50.

Wells R, Lemak CH. Beyond adoption to sustained use: Telemedicine for rural communities. *Telemedicine Journal* 1996;2:285-93.

West DM, Miller EA. *Digital Medicine: Health Care in the Internet Era*. Washington, D.C. Brookings Institution, 2009.

West DM, Miller EA. The digital divide in public e-health: Barriers to accessibility and privacy in state health department websites. *Journal of Health Care for the Poor and Undeserved*. 2006;17:652-66.

Whitten P, Collins B, Mair F. Nurse and patient reactions to a developmental home telecar system. *Journal of Telemedicine and Telecare* 1998;4:152-60.

Whitten P, Collins B. Nurse reactions to a prototype home telemedicine system. *Journal of Telemedicine and Telecare* 1998;4:50-2.

Whitten P, Franken EA. Telemedicine for patient consultation: Factors affecting use by rural primary-care physicians in Kansas. *Journal of Telemedicine and Telecare* 1995;1:139-44.

Whitten P, Love B. Patient and provider satisfaction with the use of telemedicine: overview and rationale for cautious enthusiasm. *Journal of Postgraduate Education* 2005;51:294-300.

Whitten P, Mair F. Telemedicine and patient satisfaction: Current status and future directions. *Telemedicine Journal* 2000;6:417-23.

Whitten P, Mair F, Collins B. Home telenursing in Kansas: Patients' perceptions of uses and benefits. *Journal of Telemedicine and Telecare* 1997;3:67-9.

Wooton R. Darkins A. Telemedicine and the doctor-patient relationship. *Journal of the Royal College of Physicians of London* 1997;31:598-99.

Wootton R, Jebamani LS, Dow SA. E-health and the Universitas 21 Organization: 2. telemedicine and underserved populations. *Journal of Telemedicine and Telecare* 2005;11:221-24.

Yellowlees P. The use of telemedicine to perform psychiatric assessments under the Mental Health Act. *Journal of Telemedicine and Telecare* 1997;3:224-6

Zarate CA. Weinstock L. Cukor P. Morabito C. Leahy L. Burns C. Baer L. Applicability of telemedicine for assessing patients with schizophrenia. *Journal of Clinical Psychiatry* 1997;58:22-5.

Zaylor C. Clinical outcomes in telepsychiatry. *Journal of Telemedicine and Telecare* 1999 (Supp 1.):S59-60.