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New Technologies and Nursing Communication: Literature Review and Future Directions

Yan Tian
University of Missouri-St. Louis

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Yan Tian

University of Missouri—St. Louis

Abstract

This article reviews literature on the role of new technologies in nursing communication. Review of nursing literature suggests that research on new technologies in the nursing field covers various aspects of nursing communication including nursing education, communication among nurses, and nurse-patient communication, while review of communication literature indicates that research in the field of communication on this topic focuses mainly on patient-provider communication through telemedicine systems. Meanwhile, communication scholarship focuses more on technologies such as videophones and web-based communication systems, nursing scholarship covers a variety of technologies ranging from the traditional AAC tools to various Internet-based technologies such as virtual reality, social media, and mobile apps. The article suggests that future research should explore topics such as mobile divide, patient and nurse training, patients who need special accommodations, evaluation systems, cutting-edge technologies, innovative methodologies, and interdisciplinary scholarship.

Keywords: communication technology, nursing communication, nursing education

Introduction

New information and communication technologies (ICTs) are transforming the health care industry. From Intranets to the Internet, from Web 1.0 platforms to Web 2.0 platforms, from desktop or laptop computer-based programs to mobile device apps, technologies play an increasingly important role in nursing communication. With new technologies being so ubiquitous in our daily life, ICTs can potentially change the way individuals use health services by providing increased information access and various types of support transcending geographic boundaries (White & Dewsbury, 2011). According to Pew Research Center (2018a), 89% of American adults use the Internet, and 65% have broadband at home. Meanwhile, 77% of American adults own a smart phone, and 53% own a tablet (Pew Research Center, 2018b). As new technologies offer more interactive channels for patients to access information and to interact with each other as well as with their health care providers (HCPs), researchers in different fields such as nursing, communication, information science, and education have been investigating the impacts of new ICTs on various aspects of nursing communication. As such, this article will review scholarship in nursing and communication to provide an integrative understanding of the role of ICTs in nursing communication, and future research directions will be discussed.

Nursing Literature

New ICTs can affect many dimensions of nursing communication. For example, how do physicians communicate with nurses using new ICTs? How do new ICTs affect the way nurses communicate with each other? How are nurses trained and educated with new technologies? And perhaps most importantly, how are ICTs impacting nurse-patient communication? In this section, nursing literature on the adoption and impacts of new technologies on nursing education and communication among nurses as well as nurse-patient communication will be reviewed.

Nursing Education and Communication among Nurses

With the development of new ICTs, it is necessary for nurses to familiarize themselves with new resources, materials and techniques, and the use of technology is an essential part of nursing education and training (Theofanidis, 2015). Nurses need to gain knowledge and skills in various new technologies from basic computer skills to sophisticated communication tools customized for the health care industry.

New ICTs are providing HCPs with new learning and communication opportunities. As online education has become an integral part in today's education, general technology-based education tools such as discussion boards, blogs, wikis, and videoconferencing

are used to promote student engagement and critical thinking (Foronda, Godsall, & Trybulski, 2013). For example, a study using supplementary podcasts for a biological science course, a challenging course in nursing education, suggests that the majority of the nursing students who used the podcasts found the podcasts beneficial in helping them learn and understand the course materials (Mostyn, Jenkinson, McCormick, Meade, & Lymn, 2013).

Since nursing education involves both theories and practices, new communication tools are needed to cater for the clinical aspect of nursing communication (Foronda et al., 2013). For instance, the use of virtual simulation, or a three-dimensional (3D) virtual world is an innovative tool in nursing education. In a simulated virtual world, nursing students can learn nursing knowledge and skills in areas such as fluid calculation and lab result checking. They can also have live communication with instructors, colleagues, and patients through the system (Foronda et al., 2013). A project using Second Life, an online 3D virtual world, to build a virtual nursing acute care unit allowed nursing students to experience scenarios involving safety issues with adverse medication events, difficult inter-professional communications, and setting priorities setting through avatars. Participating students identified the potential benefits of virtual simulation such as effective learning and skill improvement (Aebersold, Tschannen, Stephens, Anderson, & Lei, 2012). Nevertheless, an integrative review of literature suggests that research on virtual simulation in nursing education is limited, with empirical data indicating both promises and challenges of adopting virtual simulation in nursing education (Foronda et al., 2013).

New ICTs are also affecting the way in which HCPs, including nurses, communicate with each other. Researchers have identified the positive role of hands-free communication devices (HCDs), or specifically, the Vocera communication system, in nursing communication. The Vocera system provides a wireless platform for coworkers to communicate with each other through a light-weight badge using voice recognition (Richardson & Ash, 2010). An analysis of interview and observation data on staff nurses, nurse managers, and IT staff from two hospital organizations using the Vocera system reveals that while subjects felt the HCD system improved communication access, helped them better understand clinical work, and provided greater access to other departments, they also felt challenged by how to socially control their communication through the system. Health care organizations need to provide additional training to recognize organizational changes, and to be aware of alternative communication channels when HCD system does not work (Richardson & Ash, 2010).

Nurse-Patient Communication

New ICTs are also changing the way in which nurses communicate with their patients. With HCPs and patients having more access to more interactive technologies, patient-provider communication no longer has to be face-to-face. Instead, in some situations a patient no longer has to be physically present in a physician or a nurse's office to get information or treatment. Technologies such as video calls or telemedicine systems can save time and resources for both patients and providers. As a matter of fact, governments are providing incentives for HCPs to use new technologies to better serve their patients. For example, in the U.S., Medicare pays for eligible Part B services provided through telecommunication systems. Practitioners including physicians and nurse practitioners at a distant site can receive payment for telehealth services on beneficiaries at the originating site through interactive audio and video telecommunication systems (Centers for Medicare & Medicaid Services, 2016).

It is also important to adopt new technologies for nurse-patient communication when patients need special accommodations. Patients with communication disabilities can use non-electronic and electronic alternative communication channels ranging from traditional communication boards to the Internet (Costello, Patak, & Pritchard, 2010). Each communication technology has its own advantages and disadvantages. As summarized by Richardson and Ash (2010), while planning boards allow for time-based overview, and telephones offer familiarity and synchronous and asynchronous communication, planning boards and landline telephones require travel distance to have physical access to the technologies. Pagers and cell phones, on the other hand, allow for wireless communication, but pagers provide minimal communication contexts and limited feedback, and cell phones can be bulky and interfere with medical devices. Therefore, it is important to match communication technologies with different phases of patients' hospitalization based on patients' medical status and their ability to communicate with medical staffs and family members (Costello et al., 2010). For example, patients who wake up in ICU can use specified switches to call a nurse to get attention. For patients who have increased awareness, they need to communicate basic information with medical staff and family members, and the interactions can happen through alphabet boards, picture boards, speech generation devices, and amplification systems. Finally, for patients who need broad and diverse communication access, they use tools such as computers, the Internet, and mobile devices to communicate with medical staffs and family members (Costello et al., 2010).

Despite the effectiveness of traditional Augmentative and Alternative Communication (AAC) tools such as communication boards and speech generation devices, patient and nurse access to these communication tools can be limited, especially for patients with disabilities (Sharpe & Hemsley, 2016). Communication technologies based on mobile devices provide more accessible and

more communication support to patients with communication disabilities. For example, mobile apps can convert text to speech or convert image to speech, which can be customized to accommodate the patient's need of communication. Since both patients and nurses are likely to have mobile phones or tablets, mobile apps have the potential to be economic and efficient tools for communication between nurses and patients with disabilities (Shane et al., 2011; Sharpe & Hemsley, 2016). However, empirical data suggest that while nurses have some positive perceptions of using mobile devices to communicate with patients with disabilities, there are barriers such as unavailability of devices, lack of training, and confidentiality and privacy concerns (Sharpe & Hemsley, 2016).

Meanwhile, social media, characterized as a "two-way engaging process that allows for feedback, criticism, and conversation" (Ferguson, 2013, p. 746), are also providing important platforms for nurse-patient communication. As 69% of U.S. adults are using social media (Pew Research Center, 2018c), social media can provide channels for open communication between HCPs and health care consumers, and health care consumers can be actively engaged in the decision-making process through social media (Ferguson, 2013). Although there have been debates about whether HCPs should use social media to communicate with patients (Krowchuk, Lane, & Twaddell, 2010), social media, when used appropriately, can help promote communication and information dissemination, and can potentially contribute to shared decision-making in health care (Ferguson, 2013).

Barriers for applying social media in nursing practice include technology issues associated with mobile devices such as "safety, infection transmission, data storage, wireless network security" and cost issues (Ferguson, 2013, p. 746). In addition, knowledge, psychological factors, patient confidentiality, and practice ethics are also serious factors that have to be taken into consideration for applying social media into nursing practice (Ferguson, 2013).

Mobile apps, or programs developed for mobile devices (e.g., cell phones, tablets), are also becoming an emerging theme in nursing communication. Mobile apps are easy to access for many nurses and patients, and have the potential to change the way health information is delivered and communicated. A research team in Denmark, for instance, designed a mobile app and tested how the app affected nurse-patient communication (Danbjørg, Wagner, & Clemensen, 2014). The study included nurses and new families with postnatal mothers using a mobile app characterized by asynchronous communication, a repository of relevant articles and videos, and automatically issued notifications. The study reveals that the participating families were confident using the app and found the app helpful in providing postnatal follow-up support, and they did not feel difficulties communicating with the nurses through the app. The nurses, however, did not feel confident introducing the app to the families, and they had a difficult time integrating the app-related work into their working routines (Danbjørg et al., 2014).

Another newer type of technology that is garnering attention in nursing communication is wearable activity tracking devices. With activity trackers such as Fitbit and Apple Watch being adopted by an increasing number of people in our society, these devices can potentially help patients by measuring their exercise activities, heart rate, calorie consumption, and the like. From a nursing perspective, nurse practitioners can help patients choose appropriate devices, and they can also teach patients how to use the devices and help patients manage chronic conditions such as obesity and diabetes through the devices (Mancuso, Thompson, Tietze, Kelk, & Roux, 2014).

Communication Literature

Research focusing on nursing communication and ICTs in scholarly journals in communication is limited. However, studying e-health (using ICTs in health care) and m-health (using mobile technologies in health care) has been an important matter in health communication (Ratzan, 2010; Schweitzer & Synowiec, 2012). While early e-health is characterized by health information websites and telemedicine systems, it has evolved with more interactive and participant-centered approaches through communication channels such as wikis, blogs, mobile phones, and podcasts (Ratzan, 2010). E-health helps improve remote health services, knowledge sharing, patient-provider communication, and peer communication (Ratzan, 2010), and each of these functions could be related to nursing communication.

Telemedicine, a key component of e-health, allows patients to be treated remotely, while providing a technology-mediated space for HCPs and patients to communicate with each other (Robinson, Turner, Levine, & Tian, 2011). Nurses, being an important part of an HCP team, can use this virtual space to interact with patients, and therefore to help physicians and patients communicate on important health topics in more efficient ways. According to Matusitz and Breen (2007), telemedicine systems have the following attributes: "(a) transcend geographical boundaries (b) transcend temporal boundaries (c) reduce costs (d) increase patient comfort, security, and satisfaction and (e) digitize health communication via Web-based services" (p. 76).

Earlier research showed positive effects of telemedicine systems. For instance, a bi-state project using telehospice (hospice service through telemedicine) allowed hospice providers, including nurses and social workers, to communicate with hospice patients through videophones to complement traditional hospice care

(Whitten, Doolittle, & Hellmich, 2001). Data analysis suggested that the providers had favorable perceptions of the telehospice equipment but mixed feelings about the effectiveness of the system initially, whereas the patients and caregivers were more enthusiastic about the system (Whitten, Doolittle, & Hellmich, 2001). Another study indicates that patients who received telehospice services at home in Michigan were very positive about the telehospice system but also felt frustrated that nurses did not use the system more often (Whitten et al., 2004). On the other hand, nurses in a dialysis unit enjoyed communication with doctors through telemedicine because they felt that they were given more control and responsibility (Turner, 2003).

More recent communication research has documented the positive relationships among HCP-patient electronic communication, health behaviors, and health outcomes. For example, a study of a Web-based monitoring system on Native American patients diagnosed with diabetes mellitus suggests that patient blood glucose monitoring activities were related to the frequency of HCP-patient social support messages (e.g., information social support messages, tangible social support messages) communicated through the telemedicine system (Robinson et al., 2011). Similarly, patient glycosulated hemoglobin improvement was found to be related to emotional social support messages communicated through the telemedicine system (Turner et al., 2013).

A case study on a nurse working with a telemedicine system (Robinson, Turner, Levine, & Tian, 2014) suggests that the nurse had concerns about the system at the beginning in terms of patient computer access, patient willingness to share information through emails, and asking patients about their diet through emails. But soon she found out that patients became enthusiastic about the system quickly, and the system was beneficial to her and her patients because of the effectiveness of the system in helping some of her patients improve quality of life through direct and timely interactions. In addition, the system helped her appreciate patient and cultural sensitivity more, and it also helped her develop high-quality working relationships with her patients (Robinson et al., 2014).

In addition, research on communication between HCPs and family caregivers also suggests the importance of new technology in health services. Wittenberg-Lyles, Oliver, Demiris, and Baldwin (2010) conducted a study on hospice teams (including nurses, chaplains, social workers, and medical directors) and family caregivers of hospice patients who had team meetings through videophone technology. The researchers found that caregivers were comfortable using the technology to communicate with team members, and there was a positive relationship between team's active use behaviors and caregivers' active participations (Wittenberg-Lyles et al., 2010).

Despite all the advantages telemedicine systems have, telemedicine faces challenges including "(a) licensing and legal issues, (b) challenges to patient privacy, (c) resistance from health insurance companies, and (d) limited knowledge and expertise in telemedicine" (Matusitz & Breen, 2007, p. 78). The case study by Robinson et al. (2014) also discusses barriers for further adoptions of telemedicine systems such as financial resources and technical support to maintain the system, physicians' willingness to use the system, potential legal complications, and incentives to get patients to be involved with the system.

Commentary on the Literatures

The literature review in this article is far from exhaustive concerning the impact of new ICTs on nursing communication, but it does suggest that new ICTs are playing an increasingly important role in nursing communication. The review of nursing literature suggests that research on the adoption and impacts of new ICTs in the nursing field covers various aspects of nursing communication including nursing education, communication among nurses, and nurse-patient communication, while review of communication literature indicates that research in the field of communication on this topic focuses mainly on patient-provider communication through telemedicine systems. Meanwhile, whereas communication scholarship focuses more on technologies such as videophones and web-based communication systems, nursing scholarship covers more technologies ranging from the traditional AAC tools to various Internet-based technologies such as virtual reality, social media, and mobile apps.

Nevertheless, studies from both nursing and communication have revealed advantages and challenges of applying new ICTs into nursing communication. Advantages of adopting new ICTs in nursing communication include increasing connectedness, facilitating timely interactions, transcending geographic boundaries, and providing social support. On the other hand, challenges of applying new ICTs into nursing communication include security concerns, privacy concerns, financial commitment, ethical issues, legal complications, access problem, and patient and provider training.

Research Agenda: Directions for the Future

While Internet penetration rate in the U.S. is close to 90%, only 77% of adults have a smartphone (Pew Research Center, 2018b). Specifically, 94% of U.S. adults aged between 18 and 29, 89% of those aged between 30-49, 73% of those aged between 50-64, and 46% of those being 65 and older have a smartphone (Pew Research Center, 2018b), so access to e-health or m-health could be a serious problem for those who do

not have a smartphone. Given that senior citizens are more likely to have chronicle health conditions or serious health issues and less likely to have a smartphone compared to their younger counterparts, it is imperative to find ways to bridge this new type of digital divide or mobile divide so that older patients can have access to quality health services provided through e-health or m-health.

Meanwhile, it is also important to improve knowledge and skills of using new ICTs for both HCPs and patients. As previous research indicates, HCPs (including nurses) may not always feel confident using new technologies, and many patients can have problems with new technologies as well. Future research in nursing communication should explore innovative ways for nursing and communication researchers and practitioners to help improve knowledge and skills of using new ICTs for both HCPs and patients.

Research should also investigate how new technologies can help patients who need special accommodations. The literature review has shown that there are a variety of tools available for communication with patients who have disabilities (e.g., speech generation devices, computers, mobile apps), but there are barriers for patients to use some of the tools (e.g., lack of access to a device, or lack of skills to use a device). Nursing communication researchers can help make the devices and apps more accessible and customize them for specific target groups by sharing theoretical understandings and offering practical advice and trainings.

Furthermore, an evaluation system is needed to assess if new communication practices based on new technologies for nursing communication is efficacious and cost effective. So far, most of the studies in nursing and communication on new technologies have user perceptions or psychological factors (e.g., to what degree the nurses/patients perceive the system to be effective, how satisfied participating nurses/ patients are with communication through the system) as outcome variables, and few studies have measured actual health outcomes of the system (i.e., to what degree the patients' health status has improved). While direct relationships between use of new technologies in nursing communication and change of health outcomes may not always exist, it could be interesting and meaningful to study the non-direct relationships. For example, could those user perceptions or psychological factors act as mediators between technology use and health outcomes? Or would there be variables that moderate the effects of using new ICTs in nursing communication on changes of health status? Investigating those questions can help us better understand how new technologies are changing the way we think, the way we communicate, and what we gain through the communication in the context of health care.

Future inquiry should also address the newest technologies that are potentially applicable to nursing communication, which will have both theoretical and practical implications. With new technologies becoming available each and every day, nursing communication researchers need to keep up with the cutting-edge technologies and explore their potential contributions to nursing communication. The literature review on mobile apps and wearable activity trackers illustrates how the newer technologies can impact the format and content of nursing communication, and with the ever-changing new technologies, traditional theories need to be refined, and practices in nursing communication can be improved with updated research.

New technologies are also providing researchers in nursing communication with exciting opportunities from a methodological perspective. While self-report (e.g., survey, interview, focus group) remains to be an essential measurement tool in nursing communication research, new technologies allow researchers to use more innovative measures. Investigators can conduct digital ethnography, observing nurse and patient interactions in an online community or a telemedicine system. Researchers can also use content analysis to analyze communication transcripts based on a technology-mediated system. Moreover, researchers can use data provided by the technology/system to measure independent and/or dependent variables. For example, exercise activities recorded by a wearable tracker could be a more objectively measured outcome variable compared to some self-report items (e.g., "I exercised a lot today") for one study, whereas patients' use of a telemedicine system (e.g., communication frequency on the system) could be an objectively measured independent variable for another study. The big data approach can also be applied in analyzing nursing communication based on new technologies.

Finally, as adoptions of new technologies in nursing communication face technical, economical, ethical, and legal barriers, interdisciplinary research needs to be conducted to address those barriers. Nursing and communication scholars can collaborate with researchers from information science, economics, education, and law to enhance nurses' and patients' use of new technologies for health communication and, therefore, to improve the quality of health care.

Conclusion

Technologies are constantly evolving and they are constantly transforming health care in general and nursing communication in particular. Nevertheless, what remains unchanged in nursing communication is that nurses help patients manage their health conditions and improve their health status through effective communication. From traditional face-to-face communication to today's telemedicine systems, online communities, virtual realities, mobile apps, and tracking

devices, nursing and communication professionals choose among all the available communication tools what is most appropriate for each specific patient under each specific situation to capitalize on the strength of each communication tool. Researchers in nursing communication should take advantage of the new ICTs to make both theoretical and practical contributions to the field and to eventually help optimize the outcomes of health care through communication.

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