Designing and Developing Technologies to Facilitate Clinician-Patient Communication

Fateme Rajabiyazdi
University of Calgary
2500 University Dr NW
Calgary, AB T2N 1N4 Canada
frajabiy@ucalgary.ca

Abstract

The goal of my research is to design and develop new interactive technologies to facilitate in-clinic clinician-patient communication. While there have been a few successful communication technologies designed for specific purposes, supporting things such as planning knee surgery, communicating with deaf patients, and supporting play therapy, in general this challenge is still open. My intention is to work closely with both clinicians and patients to develop a better understanding of both their perspectives. I will leverage this understanding to developing more supportive in-clinic communication technologies. This research may help us gain a better understanding of how to characterize in-clinic communication and how to design communication technology for this setting. Therefore through this research, first, I will increase our understanding of clinician-patient communication challenges. Next, by applying this understanding, I will design, develop and study potential interactive technology prototypes to support in-clinic clinician-patient communication.

Author Keywords

clinician-patient communication; interactive technology; qualitative evaluation

ACM Classification Keywords

H.5.3 [Information interfaces and presentation (e.g., HCI)]: Group and Organization Interfaces.

Introduction

Effective in-clinic clinician-patient communication is essential for building good relationships between clinicians and patients, as well as for achieving the best results in improving people's health [4, 5, 14, 6]. However, while effective clinician-patient communication positively impacts patients' lives, misunderstandings between clinicians and patients can cause substantial harm to patients, at worst, even death [12]. Thus, it is important to work towards the improvement of communication to provide clinicians with access to the best, most focused, and richest information about the patients' conditions.

Previous research in HCI has shown that technology *can be* a solution to addressing some communication challenges between clinicians and patients in specific diseases (e.g., [13, 3, 15, 9]). However, designing and developing technologies for improving communication among clinicians and patients is still far from a solved problem. It is still unclear if and when technologies are appropriate for supporting the communication between patients and clinicians. In addition, there are no guidelines to design technology for supporting this communication.

In particular, I focus on design of communication technologies to improve communication between clinicians and patients during an in-clinic visit when patients present their medical issues to clinicians during a typical visit. An example of this type of communication occurs when a patient visits his/her clinician complaining of experiencing several symptoms and the clinician is trying to understand the patient, diagnose, and suggest treatment.

My first step was to establish close collaborations with medical practitioners both locally at the Ward of the 21st Century [2]- a health research based institute based in the University of Calgary and the Calgary Zone of Alberta Health Services - and in Vancouver through the Chronic Pain Research Institute [1]. Through these collaborations, I have been able to conduct and be involved with a series of in-depth field studies. Drawing upon Grounded Theory [17], a deep analysis of several of these studies is still in progress. From these investigations, I am working towards gaining a more holistic understanding of the communication mechanisms between clinicians and patients. I am synthesizing the results of these studies with the relevant literature and in consultation with my collaborators. From these synthesized results and again in discussion with my collaborators, I chose starting points for technology and visualization prototype design. My design process will use thorough human computer design and, where appropriate, information visualization methodology, iteratively working through design, prototyping, implementation, and feedback.

While the exact specification of the technologies to be developed is still emerging from the analysis, potential technological opportunities are emerging including: 1) the possibility of designing a new visualization that allows clinicians and patients to collaboratively select a surgeon for the patients' care with consideration of both parties' criteria, 2) the possibility of designing a new technology that allows both clinicians and patients to collaboratively select the necessary data entries for monitoring, and 3) the potential of designing new technology to incorporate patients' goals in their follow up care with consideration of clinicians' expert opinions.

Research Objectives and Methodology

To date, there are communication technologies designed for specific purposes. These technologies demonstrate a few successful solution points designed for improving communication among clinicians and patients. Designing more solution points in this context may eventually help us shape a holistic understanding of how to design technology for supporting in-clinic communication.

The topic of my research draws upon the three fields of human-computer interaction, computer supported cooperative work, and information visualization. In particular, I will work towards completing the following objectives:

Objective 1: Strengthening Current Understanding of In-Clinic Clinician-Patient Communication Issues
To reach my goals in Objective 1, through a series of field studies, I have gained a more holistic understanding of the challenges that clinicians and patients face while communicating in an in-clinic visit. First, I interviewed with a mixed group of physicians and front line health professionals involved in the treatment and observation of patients and asked them about the challenges they face when communicating with their patients. Then, I collaborated with medical practitioners at the Ward of the 21st Century in their field study to understand clinicians' and patients' perspectives on how to develop a patient-centered care plan for patients.

Overall, I gained a holistic view of the two-sided communication challenge by comparing and contrasting our interview results (the clinicians' perspectives) with communication challenges drawn from the literature (the patients' perspectives). In this process, I identified both similarities and differences between patients' and clinicians' perspectives. I discussed seven challenges that

both clinicians in our study and patients (from the literature) experience as communication issues: patients' anxiety; patients' emotions; lack of mutual expectations; increasing patients' engagement; clinicians educating patients; information on the internet; and patients using medical terms. Although patients and clinicians talk about the same challenge, both parties are usually facing this challenge for different reasons. I focused on these subtle differences in order to shed light on these subtleties: different groups of people can experience the same challenges and issues, but their thinking, reasons and reactions can be different.

Understanding these differences is crucial for designing technologies, especially when such technology is dedicated to help these two groups of people communicate with each other. The results of these studies will help me in the design and development of my proposed technology prototypes.

Objective 2: Introducing the Design and Development of Interactive Technology Prototypes to Enhance Clinician-Patient Communication
From the results of the first study, reviewing the literature, and the discussions with my medical team collaborators, I have selected two different communication challenges. Below, I will explain in more detail, each communication challenge and my proposed prototype technology in order to address the challenge.

WEST: Visualizing non-Emergency Surgery Waiting Times
One of the problems that patients face in finding a surgeon for their surgery is the different goals and criteria that they have in mind than their family physician. A family physician normally refers patients to a surgeon who is currently available or who they personally know. However, patients may be concerned with the surgeon's

long waiting time or low rating and would like to be part of the process of choosing their surgeon.

I designed and developed a new visualization that represents all the surgeons in BC with their ratings, waiting times, the waiting times of the hospital's where they practice medicine, and the hospital's rating [16]. I chose province of BC since I had access to their dataset, however this visualization is a proof of concept and it could be extended to datasets or provinces. This visualization could support both patients and clinicians letting them collaboratively select a surgeon and a hospital that matches the best with both patients' and clinicians' criteria and goals.

Currently, there are a few visualizations on the web that visualize waiting time for receiving a medical procedure or a medical visit. These existing visualizations usually focus only on one dimension, the waiting time. However, these datasets have multiple facets, including geographical information and hospitals' and physicians' ratings that is not normally considered in the existing visualizations.

WEST (http://rajabiyazdi.com/BC-Surgery/) includes a variety of datasets and represents these datasets in detail, in contrast to techniques which involve a one dimensional view that may hide important information. For this project, I used the following datasets: the surgeons' waiting times, the hospitals' waiting time, hospitals' and physicians' ratings, BC health authorities' populations, and the number of households in the province of BC. I employed a series of interaction techniques to improve the accessibility and readability of my visualization such as zooming, overview and detail-on-demand.

WEST (Figure 1) represents available information about surgeons and lets patients and clinicians collaboratively

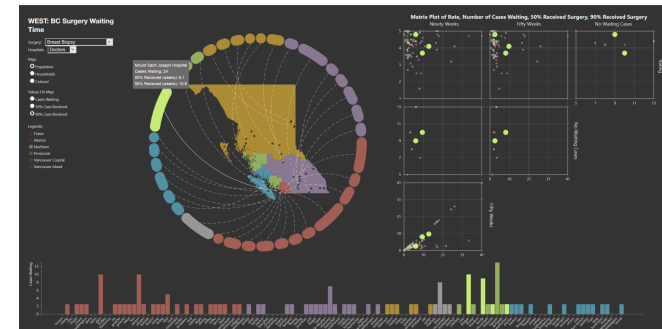select the best option for the patient's surgery.

Figure 1: WEST overview shows the hospital waiting times for a requested surgery.

Visualizing Patient-Generated Data for Clinicians
Collecting patient-generated data is becoming common for disease management. Patients use various tools and software to collect health and life style data. However, effective use of this data is a challenge for patients. Some patients use this data to make smarter decisions regarding their disease or treatment, some use their data to improve their life quality, and some are willing to share their data with their clinicians to support clinicians in making decisions about their diagnoses or treatment. However, most of these tools do not support collaborative data sharing between clinicians and patients which makes it challenging for both parties to benefit from the data [8, 10, 11].

For this project, I am conducting interviews with patients with chronic conditions who regularly collect health data. I asked patients to bring the tools (e.g., Excel sheet, notebooks, smartphone Apps) they use for collecting data as well as a sample of their data to the interview session. This will give me an opportunity to have access to a real

sample of patient collected data and investigate their needs and challenges.

Next, I will conduct interviews with several clinicians who have experience visiting patients who share their health data with them. The results of the clinician interviews will give me an opportunity to gain a better understanding of the clinicians' perspectives and their challenges.

Currently, from results of the interviews that I have conducted so far and the literature review on this context, I am designing communication technology prototypes to enhance data sharing process. I will use an iterative process involving several phases of design, implementation, and feedback from both clinicians and patients to refine the prototype. Once the prototype is complete, I will work towards evaluating the prototype to investigate the clinicians' and patients' receptions using the prototype while communicating. I will also propose strategies and guidelines for design of technology in this context.

Next Step
From the results of the studies and the literature review that I have conducted, the exploratory part of research is near to complete. My goal is to use existing tools such as tablets, wall-sized display, mobile devices etc. to focus on designing and developing new technologies.

However, while technologies might offer advantages to both patients and clinicians, there were specific raised concerns about how these technologies can negatively impact communication. For instance, the physical set up of computers in the exam room is known to be one of the causes of patient's anxiety [7]. The computer screen between patient and clinician can be an obstacle for establishing a smooth face-to-face communication.

One potential solution could be to design communication technologies using wall-sized displays to allow both parties view the information at the same time. This will support both patients and clinicians to maintain a face-to-face interaction while referring to the display. Another potential solution could to design tools on tablets to leverage patient participation in their care during a medical visit communication. Using tablet based tools, patients can have access to their medical record and interact in planning their care with clinician's collaboration.

My aim is to use the remaining part of my PhD to iterate upon and study technology prototypes for helping clinician-patient communication. I am starting by designing and developing a tablet based technology prototype for visualizing patient-generated data. Next, I will discuss the potentials of this prototypes with my clinical collaborators.

Acknowledgments

References
[1] The transforming pain research group.
[2] W21c research and innovation centre.
[3] Ananthanarayan, S., Sheh, M., Chien, A., Profita, H., and Siek, K. Pt viz: Towards a wearable device for visualizing knee rehabilitation exercises. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '13, ACM (New York, NY, USA, 2013), 1247–1250.
[4] Barry, C. A., Stevenson, F. A., Britten, N., Barber,

N., and Bradley, C. P. Giving voice to the lifeworld. more humane, more effective medical care? a qualitative study of doctor-patient communication in general practice. *Social Science & Medicine 53*, 4 (2001), 487 – 505.

[5] Buller, M. K., and Buller, D. B. Physicians' communication style and patient satisfaction. *Journal of Health and Social Behavior 28*, 4 (1987), pp. 375–388.

[6] Cegala, D. J., and Post, D. M. The impact of patients' participation on physicians' patient-centered communication. *Patient Education and Counseling 77*, 2 (2009), 202 – 208.

[7] Chen, Y., Ngo, V., Harrison, S., and Duong, V. Unpacking exam-room computing: Negotiating computer-use in patient-physician interactions. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '11, ACM (New York, NY, USA, 2011), 3343–3352.

[8] Chung, C.-F., Dew, K., Cole, A., Zia, J., Fogarty, J., Kientz, J. A., and Munson, S. A. Boundary negotiating artifacts in personal informatics patient-provider collaboration with patient generated data. In *Proceedings of the 2016 ACM Conference on Computer Supported Cooperative Work*, CSCW '16, ACM (New York, NY, USA, 2016).

[9] Hancock, M., ten Cate, T., Carpendale, S., and Isenberg, T. Supporting sandtray therapy on an interactive tabletop. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '10, ACM (New York, NY, USA, 2010), 2133–2142.

[10] MacLeod, H., Oakes, K., Geisler, D., Connelly, K., and Siek, K. Rare world: Towards technology for rare diseases. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, CHI '15, ACM (New York, NY, USA, 2015), 1145–1154.

[11] MacLeod, H., Tang, A., and Carpendale, S. Personal informatics in chronic illness management. In *Proceedings of Graphics Interface 2013*, GI '13, Canadian Information Processing Society (Toronto, Ont., Canada, Canada, 2013), 149–156.

[12] Mentis, H. M., Reddy, M., and Rosson, M. B. Invisible emotion: Information and interaction in an emergency room. In *Proceedings of the 2010 ACM Conference on Computer Supported Cooperative Work*, CSCW '10, ACM (New York, NY, USA, 2010), 311–320.

[13] Ni, T., Karlson, A. K., and Wigdor, D. Anatonme: Facilitating doctor-patient communication using a projection-based handheld device. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '11, ACM (New York, NY, USA, 2011), 3333–3342.

[14] Ong, L., de Haes, J., Hoos, A., and Lammes, F. Doctor-patient communication: A review of the literature. *Social Science & Medicine 40*, 7 (1995), 903 – 918.

[15] Piper, A. M., and Hollan, J. D. Supporting medical conversations between deaf and hearing individuals with tabletop displays. In *Proceedings of the 2008 ACM Conference on Computer Supported Cooperative Work*, CSCW '08, ACM (New York, NY, USA, 2008), 147–156.

[16] Rajabiyazdi, F., Perin, C., and Carpendale, S. West: Visualizing non-emergency surgery waiting times. *IEEE Transactions on Visualization and Computer Graphics* (2015).

[17] Strauss, A., and Corbin, J. M. *Grounded theory in practice*. Sage, 1997.