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Patient Perceptions of Google Glass in the Outpatient Dermatology Setting

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ABSTRACT

PATIENT PERCEPTIONS OF GOOGLE GLASS IN THE OUTPATIENT DERMATOLOGY SETTING

Background: The ubiquitous use of electronic health record (EHRs) during medical office visits using a computer monitor and keyboard can be distracting and disrupt patient-healthcare provider (HCP) non-verbal eye contact cues, which are integral to effective communication. Provider use of a remote medical scribe with face-mounted eyeglass technology, such as Google Glass (GG), may preserve patient-HCP communication in the healthcare setting by allowing providers to access other parts of the patient's EHR (e.g. laboratory results, current medications, immunization records) all while maintaining direct eye contact with their patients. The medical scribe is able to chart patient encounters in real-time working on or off site, documenting the visit directly into the EHR and freeing the HCP to focus only on the patient.

Objective: The purpose of this study was to examine patient perceptions of their interaction with a HCP who used GG with a remote medical scribe during office visits. Additionally, the author sought to identify any associations between patient privacy and trust in their HCP when GG is used in the medical office setting.

Methods: For this descriptive, cross-sectional study, a convenience sample of patients was recruited from an outpatient dermatology clinic in Northern California. Participants provided demographic data and completed a 12-item questionnaire to assess their familiarity, comfort, privacy, and perceptions following routine office visits with a HCP where GG was used to document the clinical encounter. Data were analyzed using appropriate descriptive and inferential statistics.

Results: Over half (59.4%, n = 102) of the 170 study participants were female, Caucasian (60%, n = 102), Asian (24.1%, n = 41), college-educated (89%, n = 151), and ranged between 18 and 90 years of age (M = 50.5, SD = 17.4). The majority of participants (69.4%, n = 118) were familiar with GG, not concerned with a privacy issues (77.6%, n = 132), and stated the use of GG did not affect their trust in the HCP (81.8%, n = 139). Moreover, participants comfortable with the use of GG were less likely to be concerned about privacy ($p < .001$) and participants who trusted their HCP were less likely to be concerned about them using GG ($p < .009$). Almost one third (29%, n = 49) stated they would likely adopt technology early on and 87% (n = 148) preferred their HCP use GG if it delivered better care.

Conclusions: Study findings support the use of GG for outpatient dermatology visits. Future research should explore the use of GG in other areas of healthcare and strive to include a diverse socioeconomic patient population in study samples.

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CHAPTER 1: INTRODUCTION

Technological advancements in healthcare, particularly the use of the electronic health record (EHR), have influenced and changed the clinical interaction between patients and their healthcare providers (HCP). While the goal of widespread EHR implementation under the Health Information Technology for Economic and Clinical Health (HITECH) Act (HITECH, 2009) was to improve healthcare quality and outcomes and reduce cost, several notable unintended consequences of EHRs have been recognized. HCPs are increasingly displaying symptoms of clinician burnout and the administrative tasks of medicine including tasks enabled by EHRs are cited as a key root cause (Bodenheimer and Sinsky, 2014). Electronic log data from EHRs highlight significant time spent by clinicians in non-face-to-face clinical activities, with data from some centers indicating that this time exceeds time spent in direct patient contact (Tai-Seale et al, 2017; Arndt et al, 2017). While effective communication in the healthcare setting facilitates a positive patient-HCP relationship and promotes patient engagement, poor communication between HCP and patients affects rapport, patient satisfaction, adherence to treatment, clinical outcomes, and patient trust (Shachak, Hadas-Dayagi, Ziv, & Reis, 2009; Tabler et al., 2014). Time spent by providers listening and making eye contact is perceived by patients to reflect HCP empathy (Kraft-Todd et al, 2017). Yet, providers now often interact with the EHR during the office visit in an attempt to minimize post encounter non-face-to-face work, drawing their attention away from patients (Asan, Young, Chewning, & Montague, 2015; Margalit, Roter, Dunevant, Larson, & Reis, 2006).

A study by Montague et al. (2012) classified HCP behavior while using the EHR as technology-centered vs. human-centered and found that those who

demonstrated human-centered behaviors had more positive verbal and non-verbal communication with patients compared with those who were focused more on typing and gazing at the computer. Poor communication between HCP and patients can also affect rapport, patient satisfaction, adherence to treatment, clinical outcomes, and patient trust (Shachak, Hadas-Dayagi, Ziv, & Reis, 2009; Tabler et al., 2014), highlighting the importance and need for solutions to preserve the connection that patients need with their providers.

One way to mitigate provider time spent documenting in the EHR is via the use of a scribe who enters data from the clinical encounter into the patient chart for the provider, thereby allowing HCPs to focus their attention on the patient (Gidwani, et al., 2017). Now in this EHR era, it has become possible for scribes to do this work while present in-person, but they can also be available in a remote fashion.

A recent innovation in wearable technology is Google Glass (GG) and the use of a live remote scribe. With GG, HCPs can review and record data in medical records, while addressing patients face-to-face. Use of GG can maintain patient-provider eye contact and may preserve the interaction and communication between patient and provider. For example, a dermatology provider can be hands free when examining and education a patient regarding their skin condition.

Problem Statement

A review of the current literature indicates there is a knowledge gap in utilizing technology designed to improve patient-provider communication. As technological advances continue to evolve, it is important to understand society's acceptance of emerging technology. There is a need to evaluate Google Glass

technology to support patient-centered care with the goal of enhanced patient-provider relationships.

Purpose

The purpose of this study is to evaluate patient's perception of GG device with a remote scribe and its effect on patient-provider relationship.

Background

Patient satisfaction is an indicator of effective patient-provider communication. Studies show communication styles incorporating a patient-centered approach improves patient satisfaction. Health information technology (HIT) increases patient-centered communication resulting in improved patient outcomes including clinical care, patient needs, shared decision-making and provider-patient communication (Finney Rutten, Agunwamba, Greene, Mazor, Ebbert & St. Sauver, 2014). The GG device has the potential to improve patient-provider communication by allowing the provider to focus on the patient and not on EHR. Maintaining high levels of eye contact with the physician was found to improve patient satisfaction (Montague, 2011). A thorough literature search found few studies related to using GG technology in outpatient healthcare and its effect on the patient-provider satisfaction. This study will add information to the current gap in knowledge by evaluating patients' perception of GG and the effect on patient-provider relationship.

Significance

The patient-provider relationship is built on a foundation of trust and reciprocity which leads to adherence in treatment, continuity of care and improved patient satisfaction. The use of health information technology increases patient-

centered communication. This higher level of patient and provider interpersonal communication contributes to a patient's trust in their provider and their perception of the provider's competence. Providers who have poor communication with patients tend to decrease patient involvement in care and adherence to treatment which influences patient satisfaction (Thom et al., 2011). This study will document the benefits of technology on patient outcomes including improved patient-provider relationship.

Theoretical Framework

Clinicians are challenged to sustain a caring practice while responding to technological demands and complexities. This study will draw on two theories regarding the use of technology with caring and technology adoption. Technology in healthcare is becoming ubiquitous leading to the risk of the depersonalization of patients.

The Technological Competency as Caring in Nursing (TCCN) theory (Rozzano Locsin, 2015), describes how technology and caring can co-exist harmoniously when caring for patients. The TCCN provides a framework whereby clinicians can use technology while preserving the humanness of the patient. As providers gain technological competency, they develop a new way of understanding the patient that encompasses the whole individual with compassion (Locsin, 2015). Some patients have a perception that technology may distance clinicians from patients and portray a lack of caring. Locsin explains (2005) the coexistence of traditional caring and technological competency can enhance nursing practice.

Patients' individual acceptance to new technology is challenging and well described in the Technology Adoption Lifecycle (TALC) theory (Rogers, 2003).

This widely used model is based on people's acceptance to new technologies. Loomis, Ries, Saywell & Thakker (2002) reported results from a cross-sectional survey that applied the chasm framework to family physicians to determine the differences in attitudes and perceptions of those who did and did not use EHRs. The authors found nonusers (late majority) to exhibit greater concerns and less confidence in security and confidentiality compared to the users (early adopters). Another study by Ford, Menachemi & Phillips (2006) applied the Diffusion Model to evaluate the adoption rate of EHR use by physicians in small and solo practices and found these physicians to be late majority and laggards in the adoption cycle.

The healthcare environment has changed over the past decade with health information technology being the norm. Technology will continue to advance and become further integrated into the system. As providers, we need to be proficient in using technology to provide quality patient-centered care. TCCN theory is the most relevant to the emerging growth of technology and impact on patient care. The theory addresses the possibility to be competent in using technology while at the same time, exhibiting caring behavior. As an example, in this project, the competent use of GG with remote scribes will incorporate new technology assisting providers in maintaining their focus on the patient's human aspect. The success and acceptance of this project will depend on the patient's perception and willingness to accept this new technology and will improve their satisfaction.

Aim of Research

Questions to be Answered

1. What are the perceptions of patients who are being seen by a dermatologist using GG technology during their visit?

2. Are there any associations between concerns with privacy and trust and use of GG?

Relevance to Continuing Work in Field

The healthcare environment continues to change with the ubiquitous use of health information technology. The initial study by Prochaska et al. (2016) is one of the first studies evaluating wearable technology in hospitalized patients. Further studies are needed to evaluate different clinical settings and patient perception. As new technology becomes adopted into healthcare, the issues of privacy and physician trust will need to be studied. Provider efficiency and quality of care are other areas of relevance for future study in the field of healthcare technology.

CHAPTER 2: LITERATURE REVIEW

This chapter will provide a review of the literature regarding the use of technology in healthcare.

Using a quantitative design, Prochaska et al. (2016) examined patient (*n*=86) perceptions of wearable technology and the effect on doctor-patient relationship. The largely female patients ranged in age from 19-88 years and were hospitalized general medicine at University of Chicago. Participants were interviewed and responded verbally to five Likert-type questions regarding privacy and their perception of Google Glass. Study findings noted many (46% *n*=39) patients had concerns about their privacy but did not feel that it effected trust in their provider (76% *n*=65). The majority of patients (65% *n*=56) were in favor of their providers using GG technology if it improved their healthcare. Study findings were limited to the sample drawn from a single urban academic center, limiting generalizability. Other limitations include the large variation in patient ethnicity, Google Glass was the only technology available at the time and patient's initial perceptions may have led to premature opinions. This study is one of the first studies to evaluate patient perceptions and adaption of GG technology in a patient care setting.

In another study, Walker, Johnson, Ford & Huerta (2017) evaluated whether privacy and security concerns contributed to patient health information (PHI) withholding behavior. Using Health Information and National Trends Survey (HINTS) data, their sample included 3,959 respondents from 2011 and 3,677 from 2014 of randomly selected residential addresses of non-institutionalized adults. The HINTS survey consisted of 4 questions regarding privacy, security concerns and withholding behavior and perception of quality of

care. One example of a question was “Do you have concerns about unauthorized access to your medical information when it is transferred electronically between providers?” No associations regarding privacy and security concerns and withholding behavior were reported. The perception of greater quality care was found to significantly lower the odds of withholding behavior (p value .87). A strength from the analysis showed despite patients’ concerns with security and privacy, patient’s perceived quality of care fosters trust and builds the patient-provider relationship. The population may be willing to accept greater privacy risks as a trade-off for greater quality of care (Walker et al., 2017).

Another study by Montague and Asan (2012) also investigated patient trust in health technology and the relationship with care providers. Data was collected from a Trust in Medical Technology instrument. Participants included 101 women who recently gave birth and used electronic fetal heart monitors. Two models were created for results: 1) trust in technology and all correlations were significant (p <0.01); and 2) trust in care provider and all correlations were significant (p <0.01). The results of this study create possibilities for measuring trust relationships with active and passive users and various technologies in the future.

Asan, Smith and Montague (2014) examined physician-patient communication using paper medical records compared to electronic health records (EHR). Their aim was to understand the impact of health information technology (HIT) on provider-patient interaction in designing better EHRs. The authors found physicians spent more time looking at the EHR screen than paper records and less time looking at the patient.

The use of technology can provide patients with health information to increase their participation in care, decision-making and improve health outcomes but concerns with privacy and patients’ aversion to change contribute to their slow

adoption of technology. Cook et al. (2016) looked at the barriers and facilitators which influence patient's decisions to adopt technology. The study design used qualitative one -to-one semi-structured interviews. The sample consisted of adults between 24 -92 years old, with a range of diagnosis, who were users and non-users of the Cambridgeshire Community Services Assistive Telehealth and Telecare service. The key barriers to adoption were lack of information, lack of experience and confidence, stigma associated with using the equipment and inconvenience. The key facilitators were positive attitude toward usability and reliability of the technology (Cook et al., 2016).

Li, Jing, Gao and Shi (2015) examined predictors of an individual's adoption of healthcare wearable devices based on the Privacy Calculus Theory. Data was collected utilizing a survey from two large, social network groups with 333 actual users of healthcare wearable devices. The study revealed that individuals adopt wearable devices based on benefit as weighed against the privacy risk (Li et al., 2015). These findings are in congruence with the conclusions of Cook et al. (2016), suggesting that people prioritize positive impacts over potential concerns when adopting new technology.

Although most of these studies did not include GG technology, there were similarities applicable to this project. Google Glass has been used in other settings including medical education to evaluate medical student's interpersonal communication and nonverbal behaviors during clinical encounters (Tully, Dameff, Kaib, & Moffitt, 2015) and to train neurosurgery residents in difficult procedures (e. g. spinal cord tumor resection, brain biopsy) (Sahyouni et al., 2017). Patient care applications for GG have included telemedicine for remote electrocardiogram interpretation (Jeroudi et al., 2015) to evaluate accuracy and triage times among paramedics in the field communicating with a physician

elsewhere (Cicero et al., 2015), monitoring vital signs during surgical procedures (Liebert et al., 2016), and radiological intervention procedures (Vorraber et al., 2014). With growing applications for GG in patient care, patient perceptions of the technology remain to be understood. There is limited research on the subject of Google Glass technology on patient-provider interaction and this project will add to the body of knowledge

CHAPTER 3: METHODOLOGY

This prospective cross-sectional study captured patient's perceptions of GG from HCPs who use Google Glass technology for medical record documentation. Human subject's approval from Fresno State University and Sutter Health's Institutional Review boards was obtained before data collection began. The original questionnaire was created by Micah T. Prochaska (2016). Permission was obtained from the author to utilize and modify the tool. The tool underwent content and face validity examination by subject matter experts.

Research Design

A quantitative, descriptive, cross-sectional study design was used for this study.

Population

Although more patients were asked to participate than consented, the sample size recruited was one hundred seventy participants. Adults who met the following inclusion criteria were eligible to participate in the study: age 18-90, male and female, English speaking, all ethnicities and levels of education. Special populations who were unable to give informed consent were excluded including minors, those unable to consent for themselves, those who were illiterate, those who did not read or speak English and those who could not complete an online survey.

Setting

A convenience sample of patients over 18 years of age, who could read and write English, and who were being seen in the outpatient dermatology clinic in Northern California for a routine office visit were invited to participate.

Augmedix, a health care documentation platform, using GG provided the study's remote scribe service. At the time of data collection, the dermatology department had been using the service for approximately 12 months. The technology was funded by the health care organization who contracted with Augmedix to supply GG hardware, software, support and scribes.

Health care providers logged into Augmedix and connected with remote scribes located in India. Remote scribes were trained and adhere to Health Insurance Portability and Accountability Act (HIPAA) regulations. All communication between the scribe and HCP was encrypted and follows HIPAA operational, security, and privacy protocols to safeguard patient information. Health care providers obtained verbal permission to use GG from their patients at the beginning of each visit with GG removed from the room for patients not granting permission. Scribes document into the EHR in real-time based on provider dictation during the visit. Following the visit, HCPs review the EHR note and attest that they have read and validated it for accuracy.

How Google Glass Works

The GG unit has the capability to connect to a phone via WIFI enabling hands-free internet access. A small optical display is mounted above the right eye and a camera, microphone, speaker and wireless connectivity is built into an eyeglass frame which is operated through voice commands and a touchpad (see Figure 1). Each HCP in the study facility were assigned their own pair of GG. Custom lens compatible with GG were available for HCPs requiring prescription glasses. GG can provide patient information within the field of vision, so the HCP can simultaneously perform other tasks or procedures. HCPs have the ability to retrieve data and input patient information through the small screen within GG

which is only discernible to the wearer and prevents them from having to look away to another screen, allowing them instead to focus on the patient. The HCP dictates his or her subjective and objective findings along with the diagnosis and plan to a remote scribe. Any comments or questions that the scribe has are communicated back via written messages that appear on the GG display and are only visible to the HCP.

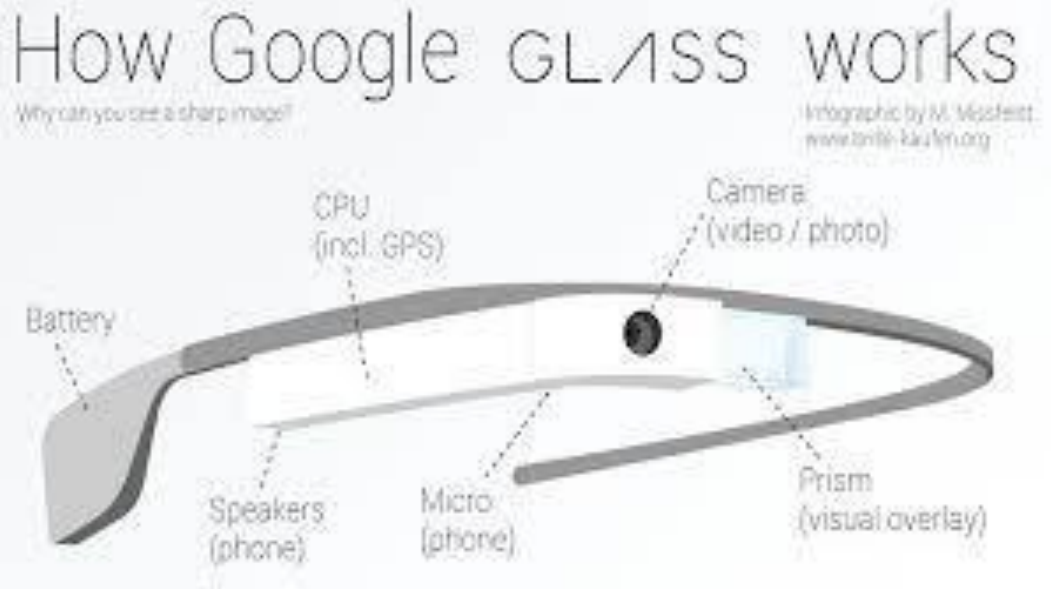

Figure 1. Google Glass Specifications.
Reprinted from https://www.outsource-force.com/blog/google-glass-specs-revealed/

At the time of data collection, the unit used was The SmartGlass 3 (GG Enterprise Edition + Smartphone), weighing 50g equipped with an Intel Atom CPU (central processing unit) with 32-bit OS, 2 Gbytes RAM, 32 Gbytes of ROM, 5.0-Mpixel camera, 640 x 360 transparent display and a lithium-ion battery 780 mAH. Google Glass was connected via WIFI dual-band 2.4 + 5GHz 802.11a/b/g /n/ac through a Samsung Android 4.0.4 which also operated as an external battery

(Hall, 2017). The features utilized included sending/receiving messages, camera, and real time communication. The recording or video features were not used.

Procedure and Measures

Patients were approached by the primary researcher (PI) after their office visit, provided with a description of the study, and asked if they were interested in participating. Those wishing to participate were taken to a private room where the PI or research assistant further explained the study. Patients meeting study criteria were informed that all data collected as part of the study was strictly confidential and no self-identifying data would be asked for. Patients wishing to take part in the study completed questionnaires on tablets using Qualtrics software.

Participants completed demographic data (gender, age, race, education level) and perceptions of GG with a modified 12-item questionnaire developed by Prochaska et al. (2016). The 12 items assess patient familiarity, comfort, and privacy level with GG. Participants rated trust in their HCP on a 4-point Likert scale from 1 (more likely trust) to 4 (I don't know). Relationship and communication with the HCP was rated on a 10-point scale, from 1 (poor relationship/communication) to 10 (excellent relationship/communication). Participants also rated their level of technology adoption (innovator, early adopter, early majority, late majority, laggard). At the end of the survey, participants were prompted to provide any additional comments they wanted to share with the researchers. The total amount of time required for completion of the questionnaire was approximately 5 minutes. There were two volunteer research assistants who had CITI certification assisting with data collection. Respondents were not paid for participating in the study.

Special Procedures

No special procedures were utilized in the project.

Duration

Subjects were recruited, and data collected over four days in September 2017.

Benefits

There was no benefit to the patient for participating in the study and no alternatives if they choose not to take part in the study. The study will add information to the current gap in knowledge by evaluating patient's perception of technology and the effect on their provider relationship.

Risks

Loss of privacy was a small risk with participation in the study. No protected health information or patient identifiers were collected. Inconvenience was a possible risk from participation in the study. This risk was minimized by attempting to be efficient and avoid technological obstacles. The tablet device was protected with Sutter Health security. The data will be stored at Qualtrics secure data centers.

Investigative Techniques

A survey was used as the investigative technique to collect data. There was no specific training or intervention required.

Data Analysis Plan

Participant characteristics and questionnaire data were analyzed using descriptive statistics (frequencies, means, and measures of central tendency).

Inferential statistics including Chi Square and ANOVA were used to identity associations between variables.

Ethical Consideration

Institutional Review Board approval was obtained from Sutter Health and Fresno State University prior to the start of study. Confidentiality was obtained by compliance with HIPAA guidelines. The tablet device utilized a secure network with firewall software and password accessibility. All data was stored at Qualtrics secure data centers. The questionnaire was identified with a Qualtrics survey number and no name was recorded. There was no linkage between survey number and name. No protected health information or personal identifiers were collected.

The remote scribes were located in India and trained and supervised to adhere to HIPAA compliance regulations. The communication between the scribe and provider was encrypted and followed all HIPAA operational, security and privacy protocols to safeguard patient information.

No consent form was used due to minimal risk and no introductory statement was given before the information sheet. Patients were given an information sheet to read and an opportunity to ask questions. By proceeding with the survey, they consented to participate in the research. Taking part in the research study was completely voluntary. If they decided to be in this study, they could stop participating at any time. If they decided not to be in the study, or stop participating at any time, they were not penalized and did not lose any benefits for which they otherwise qualify.

CHAPTER 4: RESULTS

Statistics and Data Analysis

Participant Characteristics

Of the 170 participants who completed study questionnaires, over half (59.4%, *n* = 102) were female. The largest ethnic demographic was Caucasian (60%, *n* = 102) and second was Asian (24.1%, *n* = 41). The majority were college-educated or beyond (89%, *n* = 151). Patient age ranged between 18 and 90 years of age (*M* = 50.5, *SD* = 17.4) (see Table 1).

Table 1

Participant Characteristics

Characteristic	Totals
Age	
Range 18 - 90	170 (%)
Mean 50.5 (SD=17.4)	
Gender	
Female	99 (60%)
Male	66 (40%)
Ethnicity	
Caucasian	98 (59.4%)
Asian	37 (22.4%)
Hispanic/Latino	8 (4.8%)
African American	2 (1.2%)
Other	20 (12.2%)
Education Level	
Completed high school	9 (5.5%)
Some college, no degree	15 (9.1%)
College degree	59 (35.8%)
Post graduate	81 (49.0%)
Prefer not to answer	1 (0.6%)

Level of Technology. When asked to describe feelings about new technologies, 25 participants (14.7%) classified themselves as innovators (the first

to adopt new technologies) and 24 (14.1%) were an early majority (adopt new technology when it's still new but most people don't have it). Seventy-three (42.9%) classified themselves as early adopters (selective in adopting new technology), 41 (24.1%) rated themselves as late majority (adopt new technology after the majority of people are using it and it becomes commonplace), and 7 (4.1%) were laggards (one of the last to adopt new technology, you wait until all the bugs are out and it's inexpensive to purchase). Participants with a higher level of education were significantly more likely be among the first to adopt new technology [X2 (24, N = 170) = 64.83, p <.001].

When asked about having any concerns with the use of GG, the majority (73.9%, n = 122) stated having no concerns, few (8.8%, n = 15) stated having concerns with security, and very few (1.2%, n = *2*) stated GG might be distracting.

Familiarity and Comfort with Google Glass. A large number of participants (69.4%, n = 118) reported being very or somewhat familiar with GG, 87.1% (n = 148) were extremely or somewhat comfortable with their HCP using GG during the office visit, and 87.1% (n = 148) preferred their HCP use GG if it helped them deliver better care. Additionally, participants who were comfortable with their HCP using GG were less likely to be concerned about privacy [X2 (16, N = 170) = 89.40, p <.001].

Privacy and Trust. Few (22.4%, n = 38) participants reported being very or somewhat concerned with privacy. The majority (81.8%, n = 139) reported no change in their level of trust with the use of GG with 12.9% (n = 22) reporting the use of GG would increase trust in their HCP. A significant relationship was noted between participant's level of privacy concern with the use of GG and trust in their HCP [X2 (12, N = 170) = 26.51, p <.009].

Relationship and Communication. Participants rated relationship with their HCP on average of 9.4 (sd = 0.93) and communication was rated on average of 9.5 (sd = 1.10) on 10-point scales (see Appendix A). Chi square tests of independence were performed to examine relationships between variables. Please see Appendix A for complete survey results.

Participant Narrative Comments

Fifty-five participants (32.4%) provided narrative comments at the end of their surveys. Comments conveyed not noticing the HCP was using GG, for example "I was so involved in our visit, I didn't even notice," and "I didn't really even notice GG for most of the visit," as well as an overall feeling of GG providing better care, "If it helps her keep track of my care, I am all for it," "I feel more details are being documented," and "If it helps with transcription then it is a great idea." Comments also conveyed patient satisfaction, for example, "If it provides more face time with the doctor, I think it is worth it," and "It is nice to have more interaction with the doctor versus them looking at the computer to take notes."

Discussion of Results

This is the first study to examine patient perceptions of GG in an outpatient clinical setting, and it builds upon the work of Prochaska et al. (2016) who examined patient perceptions of GG in the hospital setting. The majority of the sample was Caucasian 59.4% (*n*=98) with only 2.4% (*n* = 4) African Americans versus 69% (*n* = 59) Africans in Prochaska et al. (2016). The findings are in agreement to those of Prochaska et al. (2016) who found 65% of respondents would want their doctor to wear GG if it improved their care.

Level of Technology. The study was conducted in Silicon Valley which is a global technology center. Naturally, the workforce and the community within Silicon Valley reflects the actual employees of technology companies, their families and other businesses catering to the technically savvy and highly educated citizens ("Educational Attainment," 2016). For many of Silicon Valley residents, leading edge technology is part of their normal lives (Ryan & Lewis, 2017). Majority of the participants (*n* =122) considered themselves early adopters of technology. This technology acumen could account for the participants' lack of concerns when using GG. It is possible that acceptance of GG would decrease in more rural and conservative areas.

Familiarity and Comfort. To further illustrate the technology bias of the study's participants, 69.4% were familiar with GG versus 27% in Prochaska et al. (2016). This familiarity and comfort may again be a consequence of overall higher technology adoption in this geographic region. Another potential factor leading to higher familiarity in the patient sample could be time. Prochaska's study was completed just one year after GG became offered to the public, and at that time it was a relatively unknown and obscure technology to most people as one of the only face-mounted technology devices available. By the time this study was completed, GG had been available for approximately two to three years and was likely more widely known. Although diverse, this study's population was largely college educated (*n* =151, 88%) which could contribute to their comfort and acceptance of the technology.

Privacy and Trust. Relatively few (*n* =38) participants in the study were concerned with their privacy of personal health information. This minimal concern did not change their level of trust in the provider and they preferred their HCP use

GG (87.1%) if it helped deliver better care. This suggests their privacy concerns may be alleviated by their trust in the HCP keeping their data protected.

Relationship and Communication. HCP's high ratings (9.5 out of 10) given by participants when communicating with the provider using GG appears to affect the patient's perception of the visit. HCPs who spend more time communicating face-to-face, focusing attention on the patient and less on the EHR, can positively influence the communication with the patient (Asan et al., 2014). Direct patient eye contact, feasible with use of GG, is an integral component of patient-provider interaction.

Qualitative comments. Patient comments reflected little concern with trust and privacy. They perceived better attention when the HCP used GG. HCPs who interacted less with their EHR had greater focus and communicated greater empathy to the patient. Improved HCP/patient interaction distracted patients from the GG technology and they became less aware of its use. Based on patient comments, participants were more satisfied with their visit when HCPs delivered a more personal experience and spent less time on the computer.

Healthcare provider burnout is multi-factorial with research citing the EHR as a contributing factor due to additional time spent charting versus face-to-face patient care (Bodenheimer & Sinsky, 2014; Tai-Seale et al., 2017). Spending more time looking at the EHR than the patient, can contribute to feelings of disconnect and isolation. Remote medical scribes can alleviate HCPs documentation burden and our findings support the use of scribes and GG given very few of participants were concerned/ somewhat concerned (22.4%) with the use of GG, 81.8% reported no change in their level of trust with the use of GG, and 87.1% wanted their HCP to use GG if it helped them deliver better care.

CHAPTER 5: DISCUSSION

Limitations

Study findings should be interpreted with caution given the largely insured and well-educated sample, limiting generalizability of findings to lower socioeconomic populations. Additionally, the study sample was drawn from one clinic location in Northern California located in Silicon Valley where people in general may accept technology more readily than in other parts of the United States. Not only are people in Silicon Valley more likely to be technologically savvy, healthcare providers also more likely to accept, be more comfortable, and integrate new technology into their practice compared to their peers in other areas. Additionally, this study evaluated patients in the dermatology clinic whose perceptions may or may not be indicative of patients or providers in other specialty areas. The study questionnaire was developed for use with hospitalized patients (Prochaska et al., 2016) and has not been validated for use with other patient populations, further limiting findings.

Implications for Nursing Practice and Conclusion

Study findings offer implications to influence providers' communication with patients. Integrating GG virtual dictation technology allows providers to be more attentive to patients during the visit using direct eye contact and body positioning. This may strengthen the patient-provider relationship by engaging patients verbally and nonverbally while maintaining patient-centered communication. For new or disruptive technologies to be accepted, it is necessary to understand how patients perceive the innovation and assess how and if it affects privacy and trust with the provider. As GG research in healthcare is scant, this

study fills a gap in information and demonstrates the need for further study on patients in other clinical settings and evaluate other benefits.

The use of GG in the outpatient dermatology setting has the potential to reduce HCP documentation time, increase efficiency, reduce charting errors/omissions and reduce workflow stress. Healthcare providers can simply be talking to their patient, describing their findings, for example, the location of a lesion, the color, texture, and measurements, without the need to write anything down as the remote scribe has already entered the data directly into the patient's EHR in real time. Specialists (e.g., dermatologists) who have the support of virtual scribes with GG can see more patients per day increasing their revenue and patient satisfaction. This novel technology will help providers use EHRs more wisely while giving patients their full attention and ensuring better patient outcomes.

Healthcare organizations that see an increase in provider burnout and decrease in patient satisfaction should consider implementing remote scribes with GG. Our study findings identified a high level of patient acceptance to GG. Organizations should have the confidence that an investment in this technology would meet little patient resistance. Since EHRs are an integral part of any outpatient setting, healthcare organizations should aspire to seek new methods of using EHR in ways that improve provider satisfaction, organizational efficiencies, and patient-provider interactions.

Comparison with Prior Work

The findings are in agreement to those of Prochaska et al. (2016) where most participants were amenable to the use of GG even if they were unfamiliar with the technology. Physician trust and privacy of health information are common concerns with new technology. This study along with Prochaska et al. (2016) found patients to have minimal concerns with these issues and were willing to accept use of GG.

Conclusions

The process of EHR documentation afflicts today's healthcare. Navigating through the EHR to retrieve and input patient information lessens the time with the more important aspect of the clinical visit namely, interacting directly with the patient. The drudgery and monotony of EHR can also be a factor to provider burnout. Innovative technology often takes a leading role in the ongoing quest to increase provider efficiency and maintain quality of care. To maximize the effectiveness of each patient visit, providers must manifest caring and focus on the patient while using technology judiciously and efficiently.

Locsin's theory of caring and technology is easily applied as technology becomes further integrated into patient care. A provider's technology competence directly impacts the quality of care and the patient's perception that they are getting the best possible care. A provider who spends more time looking at their EHR screen will have a negative effect on the patient's perception of the visit. Patients want to participate in a conversation with their provider without the diversion of a computer screen and keyboard.

One solution to providing improved patient interaction and reduction in documentation time is GG technology in healthcare. GG innovative technology

allows the provider to engage with the patient without the distraction of a keyboard or computer screen. With the provider's use of GG, they are able to read a patient's facial expressions and body language transcending the patient visit from data input to patient conversation.

This study's findings provide support for continued use of GG in the outpatient healthcare setting. Future studies with wearable technology such as GG should strive to include patients in other clinical settings, more racial diversity, all socioeconomic levels and different geographies. These future studies should evaluate other complementary outcomes, for example, HCPs satisfaction with GG and its direct effect on efficiency and productivity.

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APPENDICES

APPENDIX A: SURVEY ITEMS AND RESULTS

Perception of Google Glass (N = 170)

Question	N (%)
Are you familiar with Google Glass?	
Very Familiar	16 (9.4%)
Somewhat familiar	102(60.0%)
Neither familiar or unfamiliar	16 (9.4%)
Somewhat unfamiliar	11 (6.5%)
Very unfamiliar	25 (14.7%)
How comfortable were you when your dermatology provider was wearing GG for documenting your visit?	
Extremely comfortable	110(64.7%)
Somewhat comfortable	38 (22.4%)
Neither comfortable or uncomfortable	19 (11.2%)
Somewhat uncomfortable	2 (1.2%)
Extremely uncomfortable	1 (0.6%)

Was privacy a concern when your dermatology provider was using GG?	10 (5.9%)
Very concerned	28 (16.5%)
Somewhat concerned	35 (20.6%)
Neither concerned or unconcerned	15 (8.8%)
Somewhat unconcerned	82 (48.2%)
Very unconcerned	
How does GG affect your trust in your dermatology provider?	
More likely to trust my provider	22 (12.9%)
No change	139(81.8%)
Less likely to trust my provider	2 (1.2%)
I don’t know	7 (4.1%)

If your dermatology provider said GG helped them deliver better care, would you want them to wear GG in your next visit?	
Yes	148(87.1%)
No	3 (1.8%)
I don't Know	11 (6.5%)
I need to know more	8 (4.7%)
Would you have concerns if your dermatology provider used GG during a visit? Check all that apply	
I would have no concerns	122(73.9%)
Security	15 (8.8%)
Privacy	28 (16.5%)
It may be distracting	2 (1.2)
Unfamiliar with GG	7 (4.1%)
Other: Security and Privacy	8 (4.7%)
Multiple answers	11 (6.6%)