

Tablet in the Consultation Room and Physician Satisfaction

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ABSTRACT

The purpose of the study is to investigate patient-physician interactions during a clinical encounter to ascertain the impact of tablet computing on physician satisfaction during a clinical encounter. This study was conducted at a primary care clinic, and the physicians who participated could use a tablet during their clinical encounters. The authors compared satisfaction between physicians who used the tablet during a clinical encounter and those who did not using data from 122 clinical encounters involving 82 patients. The results indicate that physicians who used the tablet during clinical encounters are more satisfied than those who did not. Additionally, there was a meaning difference in satisfaction between physicians who used the tablet to educate patients and share information than those who did not. HITs have potential benefits, but they also come with risks. To effectively manage the risks and benefits of HITs, healthcare providers should be deliberate and strategic in the implementation of HITs.

KEYWORDS

Clinical Encounter, EHR, Health Information Technologies, Medical Consultation, Physician Satisfaction, Primary Care, Tablet

INTRODUCTION

Primary healthcare is a critical component of any healthcare system because of the fundamental role of preventive care in healthcare services. Advances in computing technologies and government regulations, such as Health Insurance Portability and Accountability Act (HIPAA) and General Data Protection Regulation (GDPR), are making it necessary for health management organizations (HMOs) to integrate health information technologies (HITs) into primary healthcare. In addition to these motivations, the strive for efficiency and competitive advantage is driving many HMOs and primary healthcare providers to integrate HITs in the provision of healthcare services (Karahanna et al., 2019; Hamel et al., 2014). As these HITs become popular in primary healthcare, it is important to evaluate these technologies to understand how they impact health care outcomes.

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Primary healthcare is community-based non-emergency health service provided by physicians, such as internists, pediatricians, and geriatricians. Primary healthcare services may be followed by referral to specialist care which may determine long-term treatment options for patients. Physician-patient interactions are critical to the delivery of primary healthcare and HITs are frequently used during clinical encounters to facilitate these interactions (Collier, 2017; Coopmans and Biddle 2008; Patel et al., 2012; Shaarani et al., 2017). There are several types of HITs, many of which rely on a variety of devices and software packages. Studies on how these HITs impact patient care can inform policy makers, researchers, HMOs, and primary healthcare providers on how to create value from using HITs. This study examines the impact of tablet computing on physician satisfaction during clinical encounters in a primary healthcare setting. Specifically, it explores the impact of real-time use of tablet computing on physician satisfaction in a clinical encounter and compares satisfaction between physician who used tablet applications to educate patients and share information and those who did not.

The drive towards a patient-centered healthcare has increasingly underscored patient satisfaction as a critical measure of physician-patient interaction in a clinical encounter (Reychav, et al., 2016; Antoun et al., 2019; Rozenblum et al., 2013). However, the outcomes of patient-physician interaction in a clinical encounter also depend on the attitudes and perception of physicians. Physicians' attitudes, perceptions, and empathy influence patient satisfaction (Eide et al., 2003). Consequently, exploring physician satisfaction in a clinical encounter can provide insights into how to achieve positive outcomes from physician-patient interaction. Physician dissatisfaction with HITs can undermine the outcome of physician-patient interaction in primary health services.

Considering the importance of primary healthcare and popularity of HITs in clinical encounters, it is important to evaluate how these HITs influence the provision of healthcare. Yet, few studies have examined the impact of tablet computing during a clinical encounter in a primary healthcare setting. It is the goal of this study to supplement the prior research on HITs by addressing two research questions. First, does the integration of real-time tablet computing influence physician satisfaction? Second, does the use of specific tablet applications influences physician satisfaction? Answers to these questions complements the prior literature on HITs, shed more light on patient-physician interactions during clinical encounters, and inform healthcare institutions on how to manage HIT implementations to create value.

BACKGROUND

Mobile Technology in Clinical Encounters

Compliance and potential benefits of HITs are driving many healthcare providers to integrate computing technologies into medical consultations and primary healthcare. Clinical encounters between physicians and patients are fundamental to primary care. Thus, physician-patient clinical encounters are essential to primary healthcare services and yet these encounters are fraught with challenges, and sometimes the outcomes are unpleasant for either physicians or patients.

During clinical encounters, doctors solicit information from the patient and may reference medical information to diagnose and recommend treatment options. Primary care physicians engage patients with diverse conditions, including preventive, chronic, and acute conditions. The diversity of care provided by primary care physicians require tremendous amount of information to be effective. Physicians make several diagnostic decisions depending on the nature of the clinical encounter. To facilitate these clinical encounters, many physicians rely on some form of HITs.

HIT has the capacity to influence many aspects of healthcare delivery. HIT can improve quality of care by lowering mortality rates, reducing medical errors, and improving patient satisfaction (Karahanna et al., 2019). Mobile and tablet technologies are becoming popular in healthcare because these technologies are more adaptable and malleable to primary healthcare settings than rolling

workstation carts. In 2013, the Manhattan Research annual market research report on how physician use tablet observed that tablet adoption among U.S physicians has risen to 72% from 62% the previous year. According to the report, the iPad is the preferred platform among physicians who use these devices to look up information, consume content, interact with patients, and read emails (Manhattan Research, 2013).

Tablet and mobile health related technologies have become so popular that it was estimated that by 2108 there will be 1.7 billion mobile health application users worldwide (Hamel et al., 2014). Due to the prevalence of tablet and mobile technologies in healthcare services, more studies are needed to fully investigate how these technologies impact service delivery.

In addition to flexibility, mobile and tablet devices have useful clinical applications. Some of the applications on these tablet and mobile devices include drug information and interaction, content search tools, electronic textbooks and readers, clinical calculators, medical research databases, and clinical decision support tools. These tools and applications are frequently used during medical consultations (Sousa and Zaroukian 2003). Many of these mobile devices and applications have been shown to result in a variety of positive outcomes because of their capacity to assist in decision-making, facilitate care monitoring, and seamless access to reference material (Sweeney et al., 2018; Harper et al., 2019)

For example, using of personal digital assistants (PDAs) positively influenced decision making and diagnostic tasks in several simulated patient cases (Coopmans and Biddle, 2008). Additionally, using electronic handheld devices for clinical reference resulted in improved patient safety, process improvement, increased quality care delivery, and safer care (Rothschild et al. 2006; Patel et al. 2012). When physicians use handheld computers to access pharmacopeia, they are more likely to minimize medical errors and provide safer care (Rouf et al., 2007; Rothschild et al. 2006). Glogoza et al., (2020) observed that tablet ultrasound devices increased the number of point-of-care ultrasound exams.

Thus, computing technologies can enhance the capacity of the physician during medical consultations (Sweeney et al., 2018). The potential benefit of improving the quality of care and operational efficiency make HITs appealing to many HMOs and primary care providers. Nevertheless, some physicians believe that the use of these technologies will not improve the physician-patient encounter, and thus, resist the adoption and integration of these technologies in primary care delivery (Sclafani et al., 2013).

Furthermore, some of the evidence in the prior literature suggest that the use of computing technologies does not make any difference in patient satisfaction or patient-doctor communication (Alkureishi et al., 2016; Babbott et al., 2014; Pizziferria et al., 2005). For example, Solomon and Dechter (1995) observed that using computer record-taking during consultation did not make a difference in patient satisfaction or assessment of physician distraction or the quality of physician listening. Pizziferria et al., (2005) also noted that the use of HITs did not make any difference in the amount of time spent during medical consultations.

Computing technologies in the consultation room may minimize the personal touch of the physician and distract the physician from focusing attention on the patient. Thus, computing technologies in the consultation room can adversely affect communication between patients and physicians (Rouf et al., 2007; Collier, 2017; Arndt et al, 2017). In the U.S, it is estimated that physicians spend only 24% of average clinical visits on patient communication (Downing et al., 2018; Arndt et al, 2017). The demands of primary care and increasing use of HITs during clinical encounters are major factors in physician burnout (Weng et al., 2011). Thus, physician satisfaction with HITs has been a barrier to integrating HITs into medical consultation (Hudson et al., 2018).

For these reasons, some studies conclude that increasing use of HITs may undermine healthcare services. The prior literature is replete with studies that conclude that the outcomes of using HITs are not always positive. Thus, although computer technology can improve patient-doctor relationship during clinical encounters, there are also challenges, including information overload and reduced focus on patients, that can reverse these benefits (Alkureishi et al., 2016; Noordman et al., 2010; Chaudhry et al., 2006; Makoul et al., 2001; Sweeney et al., 2018). The evidence from the prior literature on

information overload and physician burnout makes it critical to examine how these mobile and tablet technologies influence physician-patient interaction to devise appropriate intervention policies.

HITs come with several applications and features, some of which assist physicians to perform specific tasks during medical consultation. During clinical encounters, physicians may use HITs to educate patients or share information with patients. To educate patients using HITs, physician identify relevant information and convey the meaning and import of the information to patients. Physician may use the table to reference information to share explanations of underlining concepts to patients. On the other hand, when physicians use HITs for information sharing, they typically identify relevant information and share the source and content but leave patients to explore and digest the content for themselves. To ascertain whether using tablet application influences physician satisfaction, this study compares satisfaction between physicians who used the HIT application to share information or educate patients and those who did not.

Extent literature indicates that information technologies improve organizational performance, however evidence from studies on HITs are mixed. These mixed results can be baffling to policy makers and HMOs. However, as more studies on HITs are conducted, patterns and trends may emerge that can inform policy makers and management of HMOs on how HIT can create value in the provision of health services. Hence, this study adds to prior studies by examining physicians' satisfaction to ascertain whether real-time use of tablet during a clinical encounter influence physician satisfaction.

METHODS AND MATERIALS

Study Design and Procedure

The study was approved by the local institution review board (IRB) and the institutional research committee and was conducted at Maccabi Healthcare Services (MHS), the second largest HMO in Israel with about 120,000 patients. The experiment was conducted during scheduled clinical encounters between primary care physician and patients during an 8-week period. During the 8-week period, clinical encounters were observed on each weekday from 7.00AM to 1.00PM, and from 4.00PM pm to 7.00PM.

Use of HITs in Israel is mandatory during medical consultation, thus all physicians have access to personal desktop computers during medical consultations. Physicians use these desktop computers to document their interactions with patients and review patient records prior to consultation. In this study, physicians had the option to use the tablet in real-time during the medical consultations to look up patient information and make decisions during the medical consultations. Unlike the personal computers mandated by the HMO, the tablets provided in this study were used in real-time and interactively during clinical encounters. Five family physicians in one of Maccabi Healthcare Services (MHS) locations were asked to participate in the study. However, one physician declined to participate because of concerns about time-consuming questionnaires. Prior to the study, physicians were briefed on the goals of this study. During the study, physicians completed a pre-survey questionnaire prior to consultation with the patient and then completed post-survey immediately after the medical consultations.

Study Procedure

The study provided a tablet with Wi-Fi connection to each physician. The home screen of the tablets has links to medical databases and general health information hosted by the Ministry of Health and Maccabi Healthcare Services. These websites include a medical knowledgebase site, electronic health record portal, and the Ministry of Health website. Screen shots of these health-related websites are displayed in Figure 1. The Ministry of Health portal contains both general medical information (e.g., recommended screening, information on symptoms, information on drugs etc.) and personal information including lab results, imaging results, and recommended personal screening.

Figure 1. User interface of eHealth sites



With the aid of tablets, during the consultation with the patient, patients and the physicians can share information on the patient’s condition, update medical records, and review recommendations.

Measures

We designed online questionnaires using Qualtrics and conducted a pilot study prior to the actual study. To measure the satisfaction of physicians during a clinical encounter, we adapted a scale from Bhattacharjee (2001). The satisfaction scale was a two-item Likert scale that examined the level of satisfaction among physicians during clinical encounter while using a tablet. To determine whether physicians used tablet applications to educate patients or share information with patients, we isolated the clinical encounters that used the tablet and surveyed each physician to determine how they used the tablet. This part of the study used scales adapted from Davis (1989) to assess how physicians used the tablet during consultations. All the survey questions used in this study have been validated in prior studies and are widely used in information system research and other disciplines. All the survey items are listed in the Appendix.

Results

Descriptive Statistics

To compare satisfaction between physicians who used the tablet and those who did not, we used Stata/IC 16.0 and independent-samples T-test procedure to analyze 122 clinical encounters. All tests were performed at a 5% level of significance. Four physicians and 82 patients at an outpatient medical facility participated in this study and observations from 122 clinical encounter consultations were recorded. Table 1 displays descriptive statistics on the physicians who participated in the study.

The average age of the physicians is 46 years with an average of 14.5 years of professional experience. The physicians also have experience using mobile and tablet technologies. The average years of experience using tablet computing is 2.75 years and the average years of experience using mobile computing is 18 years. As shown in Table 2, 82 patients participated in the study including 32 males and 50 females, and their ages range from 18 to 80 years.

Table 1. Physician descriptive statistics*

	Average	Years
Age		46
Professional Experience		14.5
Experience with Tablet Computing		2.8
Experience with Mobile Technology		18

*Four family doctors participated in the study

The average age of the patients is 40.1 years. The educational levels of the patient are diverse, ranging from doctorate to primary school, and majority of the patients have bachelor’s degrees. Out of the 82 participants, 1.2 percent have only primary education, 19.5 percent have middle school education, 19.5 percent have high school education, 36.6 percent have bachelor’s degrees, 15.9 percent have master’s degrees, and 7.3 percent have doctorate degrees. As reported in Table 2, 57 of the patients are employed, 14 are retired, and 11 are unemployed.

ANALYSIS

As reported in Table 3, among the 112 medical encounters, 84 encounters did not use the tablet and 38 encounters used a tablet (Use tablet n = 38; No tablet n =84). A comparison of satisfaction between the medical encounters that used the tablet and those encounters that did not use the tablet are displayed in Table 3 and illustrated in the bar charts in Figure 2. As displayed in Table 3, a comparison of the average satisfaction is displayed in the histogram in Figure 2.

The average physician satisfaction is significantly higher for the 38 medical encounters that used the tablet ($M= 4.1, SD= 0.8$) than the 84 medical encounters that did not used the tablet. The analysis used independent T-test to assess the difference between physician satisfaction for the medical consultation that used the tablet and those consultations that did not. The result of the T-test ($t(120) = 5.5, p\text{-value} < 0.05$) indicate a meaningful difference in physician satisfaction between the medical encounters that use the tablet and those that did not. Thus, the result suggests real-time use of tablet during a medical encounter increase physician satisfaction.

To further explore how physicians used the tablet during the medical consultation, this study surveyed the physicians who used the tablet (n=38) to ascertain if specific application of HIT influence satisfaction. After the consultation with the patient, the physicians were surveyed on whether the tablet helped them to educate patients or share information with patient, and their level of satisfaction after the clinical encounter.

We used a Likert scale to record responses from the observations, then classified the responses into low and high users based on the value of the response. The responses range from strongly disagree, disagree, neutral, agree, and strongly agree. Thus, we categorized strongly disagree, disagree, and

Table 2. Patient descriptive statistics*

	No.	Percentage	Low	High	Average
Age			18	80	40.1
Male	32	39.1			
Female	50	60.9			
Employed	57	69.5			
Retired	14	17.1			
Unemployed	11	13.4			

* 82 patients participated in the study

Table 3. Average Physician Satisfaction

Used Tablet	Not Use
(n= 38) 4.1	(n= 84) 3.1

Figure 2. Physician satisfaction

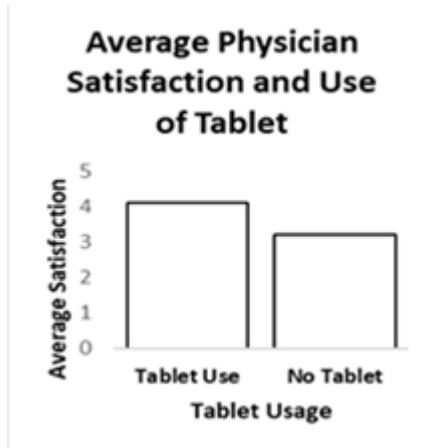


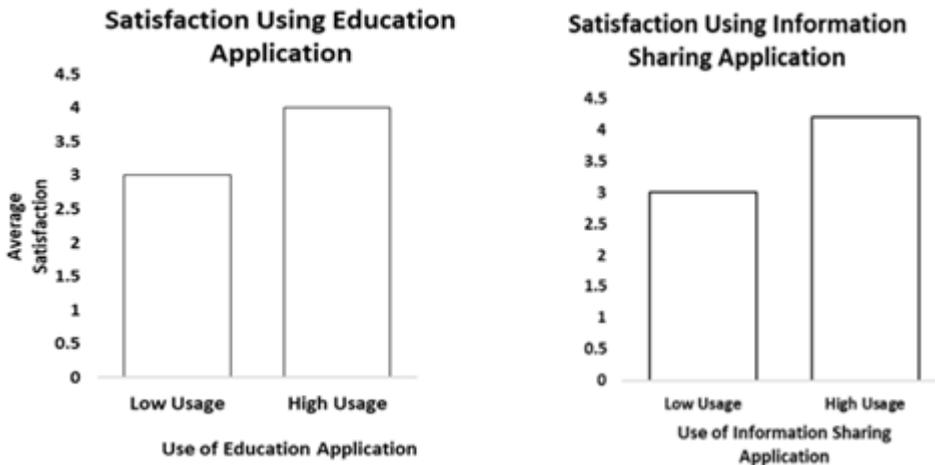
Table 4. Average satisfaction and HIT application

	Education Application	Information Application
	Average Satisfaction	Average Satisfaction
Low Usage	(n= 14) 3.0	(n= 18) 3.0
High Usage	(n=24) 4.0	(n=20) 4.2

neutral responses as low usage, and agree, and strongly agree responses were classified as high usage. The categorization of high and low usage is reported in Table 5.

As illustrated with histograms in Figure 3, among the physicians who used the application to educate patients, the average satisfaction for the high-level users is 4.0, while the average satisfaction for the low-level users is 3.0. Among the physicians who used the tablet and supporting applications

Figure 3. Physician satisfaction among tablet users



to share information with patients, the average satisfaction for high-level users is 4.2, while the average satisfaction of for low level users is 3.0. The results suggest that physicians who used the tablet to educate patients or inform patient are, on the average, more satisfied than those who did not. To further explore the post-encounter responses on satisfaction, we performed a student's t test to determine if the difference in mean satisfaction is statistically significant.

Thus, we compared mean satisfaction between the 14 clinical encounters with high level use of application to educate patients ($M = 3.0, SD = 0.7$) and the 24 clinical encounters with low level use of application to educate patients ($M = 4.0, SD = 0.9$). The t-test results indicate a statistically significant difference in satisfaction; $t(33.4) = 3.9, p < .01$. between the medical encounters that used tablet applications to educate patients frequently than those that did not. Similarly, we compared satisfaction between the 20 clinical encounters with high level use of application to inform patients ($M = 4.2, SD = 0.7$) and the 18 clinical encounters with low level use of application to inform patient ($M = 3.0, SD = 0.6$). The results indicate a statistically significant difference in satisfaction; $t(35.4) = 3.9, p < .01$. The t-test results indicate a statistically significant difference in satisfaction between the medical encounters that used tablet applications to share information with patients frequently than those that did not. These results demonstrate that using education and information sharing applications during medical consultation can make a difference on average satisfaction among physicians.

DISCUSSION

Results from the analysis indicate that real-time use of tablet technologies influence physician satisfaction. Furthermore, the level or intensity of using specific tablet application, such as educating patients or sharing information with patients can influence physician satisfaction. The implications for HMOs and hospital administrators are that physician-patient interactions can benefit from mobile and tablet technologies.

Our analysis demonstrates that physicians who used the tablet during clinical encounters are more satisfied that those who did not. The outcome seems to lend support to the prior research that computing technologies influence the outcomes of patient-physician interaction (Collier, 2017; Arndt et al, 2017; Kruse et al. 2015), specifically, physician satisfaction.

Tablet and mobile technologies enhance the capacity of physicians to interact with patients during clinical encounters to make informed decision on the patients' condition. The medical field has accumulated enormous amount of scientific information and resources on symptoms, diagnosis, treatments, as well as the benefits and side effects of various treatment options. Unlike desktop computers, and rolling workstation carts, tablet technologies can facilitate real-time access to many of these resources. For example, tablet and mobile technologies can make it easier for physicians to have timely access to relevant information on drugs from pharmacopeia references and other resources needed for medical consultation. These tools empower physicians and enhance their effectiveness, thus, the meaningful difference in satisfaction between physicians who used the tablet and those that did not.

As demonstrated in this study, the intensity of usage and the level of usage of specific tablet applications can influence the satisfaction of physicians. In this study, the results indicate that using tablet applications to educate patients and share information with patients seem to influence physician satisfaction. HITs have the capacity to influence all aspects of healthcare delivery. These technologies have several built-in applications, some of which may be useful to physician-patient interaction, while others are required for compliance and regulation. In the context of primary healthcare services, application suites that facilitate patient-physician interaction are more likely to improve the short-term outcomes of medical consultation than those intended for compliance and regulation.

Although, mobile and tablet technologies improved physician satisfaction, the adoption of these technologies by primary health care providers should be managed cautiously to ensure that they do not disrupt the essential element of primary health care, the patient-physician interaction. The outcomes from prior studies suggest that HITs do not always have positive outcomes in healthcare

delivery. These mixed results are partly due to context, types of HITs application evaluated and what outcomes are measured to assess the technology. Patient-physician interaction is essential to primary healthcare and patient satisfaction. It is apparent and intuitive that technologies that facilitate information exchange can improve that interaction, however, these technologies can also disrupt patient-physician interaction during a clinical encounter.

As many HITs vendors include functionalities and features to meet government regulation and compliance, physicians and care providers are assuming more administrative duties related to HITs. Information overload, lack of focused attention on the patient, interruptions during consultations can impact the outcomes of physician-patient interaction. Given these considerations, it is important to precede any integration of HIT into medical consultation with planning and stakeholder involvement. Although HIT may facilitate interaction between the physician and patients, it may not always yield positive outcomes. HITs and supporting applications are intended to facilitate the interaction between the patient and physician, but if the potential risk outweighs the benefits, then physicians and other healthcare providers may resist attempts to integrate HITs into primary healthcare.

A major limitation of this study is the scope of the study. The study was conducted in a single health facility, Maccabi Healthcare Services, and only four physicians participated in the 82 medical encounters. Thus, the results and outcomes may not readily apply to other HMOs. Due to small sample size, we caution against blanket generalization of the results, however, the practical implications of the outcome are noteworthy for future studies and exploration of HIT and physician satisfaction.

CONCLUSION

Physicians provide important health care information to patients during clinical encounters; thus, physicians should have the capacity to understand and process large amounts of information and make informed decision and recommendations. Tablet and mobile technologies can empower physicians with the tools to be effective during clinical encounters. Beyond physician-patient interaction, mobile and tablet technologies have the capacity to influence every aspect of healthcare delivery. Tablets and supporting mobile devices do influence physician satisfaction, however, not all applications and functionality will have a positive influence on physician-patient interaction. This implies that when organizations and healthcare providers plan to integrate HITs, they should carefully evaluate the proposed system and include all stakeholders in the planning and implementation.

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APPENDIX

Table 5.

IDNO	Provide your identifying number. This is your initials plus the last four digits of your ID
Consultation	Please select the type of consultation (Check-up; Follow-up; Diagnosis)
Use Tablet	Did you use the tablet during the medical consultation
Demographics	How old are you (in years)?
	What is your gender?
	How many years of experience do you have as a physician?

Table 6.

During the medical consultation	Strongly Disagree		Neutral		Strongly Agree
	1	2	3	4	5
I used applications that helped me share information with the patient.					
I used features that helped me educate the patient on his/her health.					
	Very Dissatisfied		Neutral		Very Satisfied
	1	2	3	4	5
I feel _____ with the discussion with the patient during the medical consultation.					
I feel _____ with use of the tablet for the medical consultation					

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