7-1-2013

Physician's Perceived EMR-Communication Fit: Towards Developing A Measurement Instrument

Sharone Lev
Ben Gurion University of the Negev, Be'er Sheva, Israel, sha17187@gmail.com

Tsipi Heart
Ben Gurion University of the Negev, Be'er Sheva, Israel, heart@bgu.ac.il

Shiri Hassid
Ben Gurion University of the Negev, Be'er Sheva, Israel, hassids@gmail.com

PHYSICIAN'S PERCEIVED EMR-COMMUNICATION FIT: TOWARDS DEVELOPING A MEASUREMENT INSTRUMENT

Research in Progress

Sharone Lev , Ben Gurion University of the Negev, Be'er Sheva, Israel, sharones@post.bgu.ac.il
Tsipi Heart , Ben Gurion University of the Negev, Be'er Sheva, Israel, heart@bgu.ac.il
Shiri Assis-Hassid , Ben Gurion University of the Negev, Be'er Sheva, Israel, hassids@gmail.com
Iris Reichav , Ariel University, Ariel, Israel, irisre@ariel.ac.il
Joseph Pliskin , Ben Gurion University of the Negev, Be'er Sheva, Israel, jpliskin@bgu.ac.il

Abstract

In this research we define the construct 'physician's perceived fit 'which refers to the fit between the EMR (Electronic Medical Record) system and the task of establishing effective communication with the patient during the medical encounter in primary care. This is the first stage of a study aimed at developing and examining a validated measurement instrument for this construct. Effective physician-patient communication (PPC) during a medical interview was found as a critical factor for the success of the patient's treatments. Since the introduction of the EMR system to clinics, there is a possible negative influence of the system on the physician's ability to establish effective communication. If this is true then it is likely that the fit between the EMR system and the task of establishing PPC is sub-optimal. Perceived fit in this context is defined as "The degree to which a physician believes that use of the EMR system during the medical encounter supports establishing effective communication with the patient." We identified four factors as composing the construct's content domain: Sharing information, Task-Flow Support, Ease of Use and Information quality. This study serves as the foundation for developing a measurement instrument for the Fit construct.

Keywords: Task Technology Fit (TTF), EMR, physician-patient communication, perceived fit, primary care, service blueprint

1 Introduction

This study intends to measure the physician's perceived fit of the Electronic Medical Record (EMR) with the task of establishing effective communication with patients during the medical encounter in primary care. The communication between physician and patient was found to be a key factor in the success of the medical treatment including patient satisfaction, patient's compliance and clinical outcomes (Shachak & Reis, 2009). Accordingly, physicians are trained to perform certain behaviours that drive positive communication.

Recently, more physicians are using an EMR system during the medical encounter in primary care to manage patients' medical records, to the extent that it has become a third 'party' in the medical encounter, and possibly has a negative effect on the physician-patient communication. This may be caused by several physician behaviours while using the EMR, such as screen gazing, heavy keyboarding, loosing eye contact with the patient etc., which were all found to cause loss of rapport between physician and patient (Margalit, Roter, Dunevant, Larson, & Reis, 2006). Nonetheless, the EMR can also be used to empower patients for example by sharing online information (Shachak & Reis, 2009). Therefore, the EMR system possibly impedes the PPC but at the same time has the potential to enhance it. This study's primary goal is to evaluate physicians' perception of fit between the EMR and their ability to establish effective communication with their patients. The theoretical framework that has been set as the foundation of our research is the task-technology fit (TTF) theory (Goodhue and Thompson, 1995) that hypothesises that user perception of fit leads to extensive system use and improved performance.

We define the physician's perceived fit as "the degree to which a physician believes that using an EMR system during the medical encounter supports establishing effective communication with the patient". Following this definition, we intend to develop and validate a context-specific questionnaire in order to assess the physician's perceived fit between the communication task and the EMR system use during a clinical visit. This paperis a research in progress, and describes the development of the content domain of the composite construct 'physician's perceived fit' based on multi-disciplinary previous research and theoretical models and tools.

2 Background

2.1 Physician-Patient Communication (PPC) and the Effect of EMR Use

Previous research asserts that there is a direct correlation between the physician-patient communication and improved health outcome (McGrath, Arar, & Pugh, 2007). When good communication is established, patients tend to be more satisfied, more informed and involved in decision making, carry out higher adherence, and are more attentive to medical recommendations (Zolnierek & DiMatteo, 2009). To this end the physician should ask patients questions not only concerning physical aspects, but also about their feeling and concerns, verify patient's understanding and encourage patient to participate in decisions concerning the therapy (Schirmer et al., 2005). There is a significant value for the nonverbal communication as well, which can be carried out by hand shaking, eye contact, smiling etc. Nonverbal behavioursare associated with patient satisfaction, patient recall of medical information, compliance with keeping appointments, and compliance with medical regimens (McGrath et al., 2007). Effective physician verbal and nonverbal communication acts were found to increase patient adherence by 216 percent (Zolnierek & DiMatteo, 2009).

An Electronic Medical Record (EMR) is a medical information system that allows storage, retrieval and modification of medical records. It is believed that EMR, among other things, will improve the quality and safety of medical care (McGrath et al., 2007). But along with the many benefits, The EMR system has become a third ‘party’ in the visit that demands a significant portion of visit time, and it may have a negative influence on the physician-patient communication (Ventres et al., 2006); hence, it

is important to assess the perceived fit since perceived fit is theorized to affect user satisfaction, system's use, and overall performance (Goodhue and Thompson, 1995).

According to an observation of Israeli primary care encounters it was found that physicians spend between one-quarter to 42% of visit time gazing at the computer screen and/or keyboarding. Prior research found that extensive use of EMR diminished levels of nonverbal acts including eye contact (Margalit et al., 2006), which are all considered essential to establishing effective PPC.As far as we know, no empirical study has investigated the fit of the EMR to the physician's communication task, in spite of previous studies showing the importance of establishing effective communication with the patient (Schirmer et al., 2005; Zolnierek & DiMatteo, 2009) and the effects of the EMR system on the PPC (Margalit et al., 2006; Shachak & Reis, 2009; Ventres et al., 2006).

2.2 Task Technology Fit (TTF) and the Service Blueprint Technique

The TTF framework was developed by Goodhue and Thompson (Goodhue & Thompson, 1995), suggesting that positive performance impact results if there is a high correspondence between the technology and the task requirements as perceived by the users. Recent studies supported this hypothesis (Wan & Ortiz, 2010). Goodhue (1998) developed the content domain of the 'perceived fit' construct for a general task on the job, suggesting that it was composed of eight factors. The TTF concept is the basis for defining the perceived fit in this study, yet we modified its content domain for the specific task at hand, using the service blueprint technique to analyse the medical task. The service blueprint (Figure 1) is a technique used to describe a service. The blueprint, developed by Lynn Shostack in 1984, was used in many contexts, and provides an organization with a precise overview of the process it seeks to analyse (Shostack, 1984).

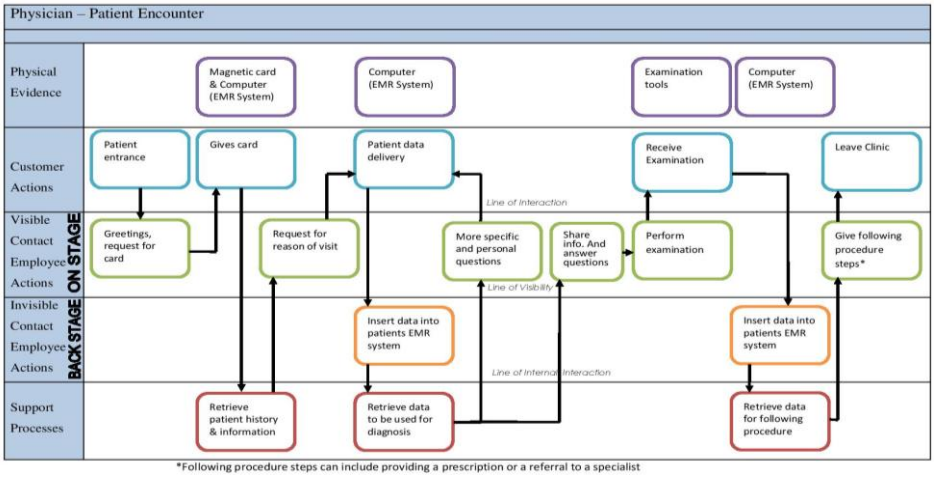

Figure 1- A service blueprint for a typical clinical visit in Israel

The blueprint includes all the different entities that take part in the service, including the back stage ones which aren't physically present. It is unique for its line divisions. *Line of interaction* separates the customer action area from the service provider area, representing the interactions between them. *Line of Visibility* differentiates between actions visible and invisible to the costumer. *Line of internal interaction* distinguishes between the front and back office activities. In addition, the top component of the scheme represents the *Physical evidence* which contains all the tangibles that the customers are exposed to that can influence their quality perceptions. We use this technique to analyse the PPC task.

Figure 1 depicts, by a service blueprint, the flow of the medical visit in Israeli primary care, based on the largely accepted task analysis suggested by Makoul (2001). Blueprinting the typical medical interview assists in revealing how and where the EMR integrates in the encounter and due to its exclusive division of components allows us to reveal where the EMR may carry the physician's attention away from the patient. We next detail the first two steps of the measurement instrument development, following the rigorous methodology suggested by MacKenzie et al. (2011).

2.3 Theoretical Development of the Perceived Fit Content Domain

Defining 'Perceived fit' in the present context is a focal step in the instrument development methodology (MacKenzie et al. 2011). The term 'fit' is adapted from the Task Technology Fit framework, referring to the user's perception of how well the technology is able to support the user's task. The first stage in defining the fit would be to define the level of analysis. In our case *the physician* is defined as the level of analysis, since what is actually measured is his or her perception of fit between the technology and task. **The technology** discussed here is *the EMR* used by the physician during the medical encounter with a patient at the primary care clinic (as opposed to in a hospital, where the EMR has a whole different role). **The task** is defined as the activities carried out by the physician *aimed at establishing effective communication with the patient*.

Although it seems reasonable to use the TTF construct brought by Goodhue as is, it would be inaccurate for several reasons. First, it has been criticized for its lack of definition of the task (Zigurs & Buckland, 1998). Second, their measurement instrument (Goodhue, 1998) was only partially validated, and last, they clarify that the tasks they refer to are "those that might move a user to rely more heavily on certain aspects of the information technology" (Goodhue & Thompson, 1995, p.216), whereas in this case the task of establishing effective communication does not solely rely on EMR use, but is likely to be affected by it (Inbar & Tractinsky, 2011; Margalit et al., 2006; Ventres et al., 2006). Some sub-tasks of the communication establishing task, however, rely more heavily on the system; for example – sharing medical information with the patient to enhance professional confidence and trust as seen in the service blueprint (Figure 1). Poor fit between system and task may negatively affect performance (Goodhue & Thompson, 1995), yet EMR use is mandatory in many countries (e.g., Israel, Finland, Netherlands) which mean that physicians will have to use the system regardless of their perceived degree of system's fit with establishing effective communication.

Following the original TTF notion, perceived fit is defined here as "*the degree to which a physician believes that use of the EMR system during the medical encounter supports establishing effective communication with the patient*", whereas effective communication includes verbal and nonverbal acts (Schirmer et al., 2005).

2.3.1 Defining the Perceived Content Domain

The proposed content universe of the physician's perceived fit (Figure 2) is based on the rationale brought by Ventres et al., (2006) who identified factors influencing the manner by which physicians use the EMR with patients (e.g., Monitor position, Physician's style), the relevant items described in the TTF framework by Goodhue & Thompson, (1995) and the TAM and TAM2 frameworks (Davis, 1989; Venkatesh & Davis, 2000). In this study, we will not address factors related to the user characteristics, assuming that most physicians are quite capable in computer use hence usage difficulty will be mostly attributed to system design. Additionally, we limit our investigation and exclude System Quality and Service Quality suggested by DeLone and McLean (2003), leaving this for future enhancement. The proposed four factors are divided into task characteristics and system characteristics (Figure 2). The two task-related factors are 'Perceived Sharing Information Capabilities' and 'Perceived Task-Flow Support'. We will hereafter omit the 'perceived' for brevity sake.

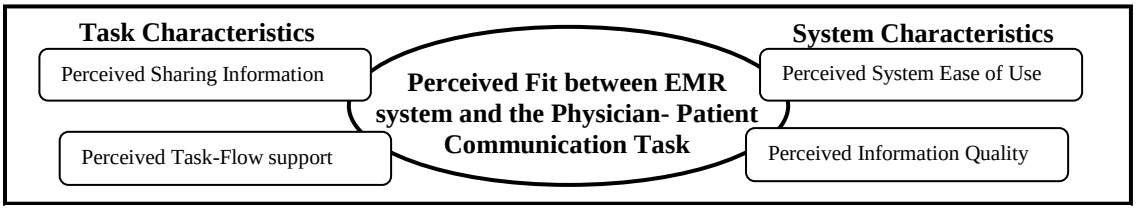

Figure 2 - The four factors reflecting the perceived fit content domain

Sharing Information is defined as *the degree to which the physician believes that the EMR system supports sharing information with the patient during the medical encounter***.** The 'line of visibility' (Figure 1) separates between the actions the physician does which include patient participation in the

process from the ones that are done individually by the physician (onstage and backstage respectively). This "line" can be lowered by sharing information with the patient and is proposed to enhance the trust of the patient in the physician (Inbar & Tractinsky, 2011; Ventres et al., 2006). Patient trust in the physician was found as a key feature in their relationship, significantly associated with patient satisfaction (Shachak & Reis, 2009), and a main outcome of effective PPC. Sharing information can be expressed by presenting through the system the data concerning the diagnostic procedures, teaching patients of their body and situation and/or by offering the patient a copy of the data. These acts of educating the patient are highly effective with regarding the communication (Shachak & Reis, 2009). Sharing information is also related to giving patients more control over their own medical record. Patient control is proposed to improve the effectiveness of the service encounter and patient's trust in the service provider (Inbar & Tractinsky, 2011), which could be reached by confirming patient's understating, encouraging the patient to ask questions, giving him/her opportunities to glance at the screen and point at it (Makoul, 2001). Thus, this factor tests whether the EMR system supports sharing and allowing patient control in the physician's opinion. For example sharing would be possible if the system's interface is understandable by a non-educated patient; and as long as all the displayed fields that are not confidential and can be revealed to the patient, etc.

Task-Flow Support is defined as *the degree to which the physician perceives that the EMR system design supports the planned flow of the task*. Supporting the task flow, or the encounter stages, refers to the degree to which the physician generally believes that the system integrates well with the planned flow of the task, thereby supports, or at least does not interfere with, creating effective communication with the patient. Non-supportive characteristics of the system are those which interrupt the flow of the encounter, or require the physician to perform acts which were found to be "un-socio-emotional acts" such as long screen gaze and heavy keyboarding (Margalit et al., 2006). Hence, a positive fit between a system and task-flow would be one where the technology is perceived to support the task or at least not interfere it. Preferably, the EMR system should guide the encounter through, and according to, the accepted stages of the medical interview. As seen in the service blueprint (Figure 1), data insertion and retrieval are part of the 'backstage' phase of the encounter, and these actions demand keyboarding and shifting eye contact which interfere socio emotional acts. Minimizing these actions lengths or "blurring" the lines of interaction and visibility between the physician and patient may correlate with high communication.

The next two factors relate to the EMR as a software system, and are mostly borrowed from the TTF framework. These factors are important for two reasons. First, using the EMR during the encounter may lengthen the consultation. Figure 1depicts the stages where the EMR system participates more heavily. These stages are at the backstage and support processes of the encounter, where the patient does not necessarily have an active role. Lengthening these visit phases result in silence and leave the patient sitting idle waiting for the physician to finish working (Ventres et al., 2006), periods likely to hinder the physician-patient communication. The second reason for addressing these factors deal with the frustration the physician might experience due to system faults and un-intuitive use. Negative physician feelings towards the use of EMR may be carried over to the clinical interactions, and some physicians comment about their dissatisfactions in front of patients (Ventres et al., 2006) which may introduce unwanted 'noise' into the medical encounter possibly hindering the PPC. Factors found in the IS literature that are related to the system design and may affect the PPC through the user satisfaction have been adopted. These are 'Physician's Perceived System Ease of Use' and' Perceived Information Quality'. Here too, 'perceived' is omitted.

System Ease of Use is defined as *the degree to which the physician believes that using the EMR system will be free of effort* .The term 'perceived ease-of-use' was brought by Davis (1989) in the TAM model and includes 'ease of learning', since a strong relation was found between these two constructs, and therefore the two are congruent. Another aspect relative to the system's characteristics that might influence the physician's feelings and behaviour is 'Locatability' borrowed from the TTF model, which relates to the physician's perception of ease of determining what data is available and where (Goodhue & Thompson, 1995). These variables were united into this factor representing the physician's system-

use capabilities due to system's structure that affects usage efficiency. This factor is relevant since the attitude of the physician may reflect the amount of time and cognitive resource he/she believes are needed to perform the job while using the system. Increased perceived ease-of-use, ease of learning and locatability of the EMR system, proposed to compose the System Ease of Use factor, reflect the physician's perception that system use during the encounter is not resource-consuming on the expense of the PPC task, thus increase the perceived fit between the EMR and the communication task.

Information Quality is defined as *the degree to which the physician believes that the information retrieved from the EMR system is of high quality*. The perceived quality of the information is an item found both in the TTF model and TAM2 (Goodhue & Thompson, 1995; Venkatesh & Davis, 2000). The importance of the perceived EMR's information quality comes about in several aspects. It is of high importance to elicit accurate data concerning the patient's treatment history. Inaccurate data could result in frustration, wrong decision making, and ineffective treatment. In the communication aspect it may result in longer and extensive use of the EMR. In addition, if the physician would like to ask psychosocial questions based on the patient's history and information presented in the EMR, inaccurate data may lead to inconvenience and patient lack of trust. Makoul (2001) claims that in order to understand the patient perspective the physician must acknowledge the patient's process and accomplishments. This will be difficult to do with non accurate data. Likewise, part of the medical encounter that affects the physician-patient communication is the patient education stage, which can be significantly improved if supported by high quality computerized information that is also well presented. Low quality of the information retrieved from the EMR system may result in extensive use of the EMR and physician frustration which are profound to decrease the perceived fit between the EMR and the communication task.In addition, the factor merges two measures borrowed from the original TTF model, 'Accuracy- Correctness of data' and 'Accessibility- Access to desired data' (Goodhue & Thompson, 1995) which were dropped and did not appear in the final TTF model, but in our context it seems relevant and therefore added. These two measures are known as dimensions of "Data Quality" (Pipino et al., 2002) and are therefore ascribed to the present factor. A low degree of 'Information Quality' may lengthen the 'support process' component of the encounter (as depicted in the service blueprint in Figure 1). Having the accurate data available on time maintains the flow of the encounter and facilitates physician-patient communication supported by computerized information.

We intentionally leaved out Perceived Usefulness, since according to the TTF model perceived usefulness is affected by the fit and is not a factor affecting it. In addition, in our study we do not ask if the system is useful as it is already used for over 20 years in Israeli primary care and there is a consensus that it is useful to the overall medical task. In spite of this common assertion, physicians often complain (and this is supported by research briefly brought in our paper) that it hinders PPC, the sub-task that is the focus of the present study. Therefore, we believe that measuring perceived usefulness may distract respondents from the main issue of whether the EMR system disturbs the PPC, regardless of its usefulness of the system to accomplishing the medical task as a whole.

3 Summary

This paper defines the physician's perceived fit between the EMR system and the task of establishing effective communication with the patient during the medical encounter in primary care. Since the EMR system has a possible negative effecton the physician's ability to carry out socio-emotional behaviours which were found to drive the effectiveness of the PPC, it is of high value to measure the fit of the system to the task, following the TTF framework. As far as we know, IS theories have rarely been implemented regarding the EMR system in previous literature and are believed to be of high value in this context. The definitions in this project were modified to the task athand and four factors were described to define the perceived fit content domain, as presented in Figure 2. The findings of this study set the foundation for developing and validating a modified TTF questionnaire that will specifically address the medical encounter and communication task in which each factor will be composed of several measures taken from previous frameworks and questionnaires. If validated, it will

contribute first in the ability to assess the fit of EMRs and second, in suggesting characteristics the EMR system must consist in order to fit the communication task that should be taken into consideration when designing an EMR system for a medical clinic.

The paper is limited since the suggested "task characteristics" are not taken from a valid theory as opposed to the "system characteristics" but were developed based on literature using a well established technique: the service blueprint. Second, external validity was not taken into consideration, as the paper refers to medical clinics in Israel, using the 'Clicks' EMR system. We suggest that further research examines other systems and countries to extend external validity.

References

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly,* 13(3), 319-340.

Delone, W. H., & McLean, E.R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of management information systems*, 19(4), 9-30.

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly*, 19(2) , 213-236.

Goodhue, D.L., (1998), Development and Measurement Validity of a Task-Technology Fit Instrument for User Evaluations of Information System. *Decision Sciences* 9(1), pp. 105-138.

Inbar, O., & Tractinsky, N. (2011). Lowering the line of visibility: Incidental users in service encounters.*Behaviour & Information Technology*, 245-260

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS Quarterly*, 35(2), 293-334.

Makoul, G. (2001). The SEGUE framework for teaching and assessing communication skills. *Patient Education and Counseling, 45*(1), 23-34.

Margalit, R. S., Roter, D., Dunevant, M. A., Larson, S., & Reis, S. (2006). Electronic medical record use and physician–patient communication: An observational study of israeli primary care encounters. *Patient Education and Counseling, 61*(1), 134-141.

McGrath, J. M., Arar, N. H., & Pugh, J. A. (2007). The influence of electronic medical record usage on nonverbal communication in the medical interview. *Health Informatics Journal, 13*(2), 105-118.

Pipino, L. L., Lee, Y. W., & Wang, R. Y. (2002). Data quality assessment.*Communications of the ACM, 45(4)*, 211-218.

Schirmer, J. M., Mauksch, L., Lang, F., Marvel, M. K., Zoppi, K., Epstein, R. M., Pryzbylski, M. (2005). Assessing communication competence:A review of current tools. *Fam Med, 37*(3), 184-192

Shachak, A., & Reis, S. (2009). The impact of electronic medical records on patient–doctor communication during consultation: A narrative literature review. *Journal of Evaluation in Clinical Practice, 15*(4), 641-649.

Shostack, G. L. (1984). Designing services that deliver. *Harvard Business Review, 62*(1), 133-139.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science,* 4(2), 186-204.

Ventres, W., Kooienga, S., Vuckovic, N., Marlin, R., Nygren, P., & Stewart, V. (2006). Physicians, patients, and the electronic health record: An ethnographic analysis. *The Annals of Family Medicine, 4*(2), 124-131.

Wan, G. M. B. T. T. H., & Ortiz, J. (2010). Information technology adoption in rural health clinics: A theoretical analysis. *Journal of Information Technology Impact*, 10(1), 1-14.

Zigurs, I., & Buckland, B. K. (1998). A theory of task/technology fit and group support systems effectiveness. *MIS Quarterly,* 22(3) , 313-334.

Zolnierek, K. B. H., & DiMatteo, M. R. (2009). Physician communication and patient adherence to treatment: A meta-analysis. *Medical Care, 47*(8), 826-834.