# Implementing Scenarios as an Evaluation Method of the Patient-Physician Interaction in Decision Aids

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**Abstract.** Decision aids are being used in the exam room to assist physicians with diagnosing. Past research on computer-based decision aids examined perceived physician capabilities and degree of liability, and their impact on the patient-physician interaction. However, no one has contrasted the use of physical aids (physician's desk reference) with computerized aids on these characteristics. In this study, participants were given a scenario in which they took on the role of the patient and were asked to rate the physician's capabilities and degree of liability given a negative outcome. There were no significant differences between the no types (computer, physical, or no) employed on physician capabilities or liability. However, we suggest that scenarios can effectively be used to assess the impact of decision aids on the physician-patient interaction.

**Keywords:** scenario, decision aid, patient-physician interaction.

## 1 Introduction

Evaluating the user experience is very important in Human-Computer Interaction (HCI) as correcting design flaws leads to the development of better experiences. One area growing exponentially is medical devices, especially within the domain of decision aids in Electronic Medical Records (EMRs). These designs are strenuously scrutinized because they assist the physician in recording the patient-physician interaction and generating a differential diagnosis.

The patient-physician interaction can be improved or harmed by decision aids. Decision aids are known to affect patient compliance, patient perception of physician capabilities, and, in some instances, liability in malpractice cases. Decision aids take on physical and electronic forms. Traditionally, physical aids such as a physician's desk reference were ubiquitous. The physician created a differential by using their clinical knowledge, which they cross referenced against their desk references. However, now computer aids allow physicians to input patient symptoms and compare their differential diagnosis with that of the computer's to exhaust the possibilities thereby reducing the incidence of misdiagnosis.

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Computer-based decision aids have been used since the 1960's. In addition to providing an exhaustive search during diagnosis, computer-based aids are not subject to forgetting. It has been shown that recertification scores decrease over the years – as reported by the American Board of Internal Medicine – suggesting that some medical knowledge may be less accessible over time (Leigh, Young, & Haley, 1993; Ramsey et al., 1991). Therefore, it would be logical for physicians' computer aid usage to increase over the years. As a caveat, although it is logical for people to use computer aids more as their medical knowledge declines, that does not mean they are more likely to actually use them. They may gain a tacit knowledge, e.g., "gut feeling", about their craft over the years allowing them to make better diagnoses and that knowledge cannot be captured in these test scores. However, the benefit to computer aid usage is clear; computer aids have been shown to increase correct diagnosis from 39.5% to 45.9% (Friedman, Elstein, & Wolfe, 1999). A 6.4% increase in diagnosis accuracy is substantial considering its real-world impact on patients.

The goal of this research project was to first replicate Arkes, Shaffer, and Meadow's 2007 study to see the effects of physician use of different diagnostic aids on participant's ratings of physician effectiveness and liability. Second, we hoped to further explore the role computer decision aids play in patient-physician interactions compared to traditional physical aids. Through this process we introduce some of the history of the medical decision making literature, patient-computer-physician interaction findings, and methods for evaluating the patient-physician interaction. Finally, we discuss the use of scenarios as a new explorative method to test potential computer interactions intended for use in high risk situations.

## 1.1 History of Computerized Decision Aids

Decision aids have been an integral part of medical diagnostics for decades and have been shown to significantly reduce medication errors (Bates, Teich, & Lee, 1999). There are different types of decision aids. Traditional physical aids (e.g., research articles) and computer decision aids summarize and organize information obtained from clinical findings to assist physicians in determining a differential diagnosis. As early as 1960 computer decision aids were designed and used Bayesian analysis to provide information from clinical findings and reviewed the existing literature.

In 1968, Gorry and Barnett developed a method for converting new clinical findings into a form usable for generating differential diagnoses. Between 1972 and 1983 the INTEREST-1 system was developed for a similar purpose; it reviewed all available literature in its database and generated a differential diagnosis (Miller, 2009). In 1984 the Quick Medical Reference (QMR) was developed. This system used the existing knowledge base from the INTEREST-1, reviewed clinical findings, and provided information on how relevant the information was to the current case

(Miller, 2009). Later, guidelines stemming from various medical associations (e.g., American Heart Association) were built into the diagnostic aids providing physician with valuable, up-to-date information (Pennachio, 2004).

Currently, there are many suggestions regarding how to design future decisions aids. The following points represent some of the concerns pertinent to future design. In terms of accuracy and aid evaluation, decision aids should be able to generate the same differential as an unaided physician, the test cases used should mimic those in the real world, and the aids should be evaluated on their ability to solve medical cases with and without a physician (Miller, 2009; Promberger & Baron, 2006). In regards to interactions, the aid should not interfere with patient-physician interaction, the aid should follow the physician's thought process, it should present a list of possible diagnosis based on clinical findings, and the aid should alleviate paper work (Ridderikhoff & Van Herk, 1997).

### 1.2 The Patient-Computer-Physician Interaction

Patients interact with physicians in a wide variety of settings and EMR are employed in many of those settings (Chen, Ngo, Harrison, & Duong, 2011). EMRs have been used in the family practice, general hospital, specialty clinics, and most recently the emergency and operating rooms. Although decision aids are now included in EMRs, some physicians opt not to use them. Many believed that the use of a computer-based decision aid will reduce trust and rapport (Cruickshank, 1984; Larkin & Kelliher, 2011; Potter, 1981). This could result, in part, from the device acting as a physical barrier and from eye contact being broken as the physician switches between patient and the computer (Chen, Ngo, Harrison, & Duong, 2011; Scott, & Purves, 1996). Similarly, Bristowe and Patrick (2012) reported that computer-based aids can lead to feelings of less autonomy and disengagement, fewer resolved concerns, and a significant reduction in the ability to ask questions. Additional studies have found that patients also experience feelings of disengagement and feel as if the physician withheld information (Roter, Frankel, Hall, & Sluyter, 2006; Rouf, Whittle, Lu, & Schwartz, 2006; Waitzkin, 1984).

Research by Arkes, Shaffer, and Meadow (2007) examined the effect of electronic decision aids on ratings of professionalism, thoroughness, length of visit, diagnostic capability, and overall satisfaction of physicians. Physicians who used decision aids were rated lower. Medical students evaluated the physicians similarly. Shaffer, Probst, Merkle, Arkes, and Meadow (2012) found that physicians were perceived as being more effective when they did not use a decision aid and when they sought a colleague's advice. However, Pezzo and Pezzo (2006) reported that medical students reading mock court transcripts of malpractice cases, gave physicians less liability when they had followed the recommendations of a decision aid.

Although there are potential negative aspects associated with use of a decision-making aid, the potential exists for positive interactions. For example, Frankel et al.

(2005) reported that a simple movement of the computer screen had a positive effect on patient-physician interaction. Chen, Ngo, Harrison, and Duong (2011) examined this interaction further using an apparatus referred to as "Computers on Wheels" (COW). Physicians initially placed the apparatus in front of themselves while obtaining clinical findings and switched their attention between the COW and patient. The physician then positioned it to where physician and patient could view the diagnosis and treatment together. Based on these findings, it was suggested that the physician should have the COW close to them when entering their orders and initiate eye contact when the patient asked follow-up questions.

### 1.3 Methods for Evaluating the Patient-Computer-Physician Interaction

We focus on evaluating the patient-physician interaction and the role a decision aid plays. The exam room is a dynamic setting in which a tremendous amount of information is passed between the patient and the physician in order to reach a diagnosis and, ultimately, treatment. This setting presents many challenges for testing user experience, such as the confidential nature of the shared information. Therefore, alternative methods such as questionnaires, standardized patients, and scenarios ought to be used.

Questionnaires provide a common method for gathering information. Bieber, Muller, Nicolai, Hartmann, and Eich (2010) developed a survey to measure the quality of the patient-physician interaction. Previous questionnaires focused too heavily on quality of care without objective measures and were also criticized as being biased by social desirability, clinical, and socio-demographic variables. However, their Questionnaire on Quality of Physician-Patient Interaction (QQPPI) was found to have high reliability and did not appear to be biased by social desirability (Bieber, et al, 2010). Questionnaires are not the only method available to researchers. Linder et al. (2005) used standardized patients to evaluate a new decision aid. These patients were trained to present conditions that mimic what a physician would experience in a real medical case (Tamblyn, 1990). Linder et al. found that the standardized patient was treated like an actual patient, were able to evaluate physicians, and were realistic in their ability to display medical cases. Standardized patients are now being used in instances when the interaction between the patient and physician impacts the use of the system.

Traditionally, scenarios have been used in the design process to show how users would interact with the system. They also can be used to discover what activities, functions, and needs ought to be considered when designing the system (Sharp, Rogers, & Preece, 2007). Therefore, information collected via scenarios can help design teams see how users interact with the system. In this light, it seems reasonable to assume that scenarios could prove useful in examining physician decision-making aids. We will not be the first to apply scenarios to the study of medical decision making as they have been used to determine how patients view their physician's capabilities.

This method was selected over the others due to its easy of employment. It afforded us an easy way to contrast traditional and electronic decision aids. Please note that this study does not set out to test which method would be the most effective.

## 2 Methods

Ninety-three undergraduate students (70 female) who were enrolled in introductory psychology courses participated in this study. We examined the effects of decision aids (no aid, computer aid, physical aid) on perceived physician effectiveness. A between-subjects design was used with participants distributed equally across the three conditions.

After informed consent was obtained, the participants read a scenario in which they took the role of a patient suffering from deep vein thrombosis. This scenario was taken directly from Arkes, Shaffer, and Medow (2007) and it depicted the interaction between a patient and physician. For each of the experimental groups, the physician could employ no aid, use a computer aid or a physical aid within the scenario. The participants read a scenario, which described the scene and interactions. The inclusion of a physical aid as a comparison condition is unique to this study. Next, participants used a seven-point likert scale (the same as Arkes et al., 2007) to rate the physician's effectiveness.

The survey focused on five key patient-physician interaction dimensions identified by the medical decision making literature; we added an additional question intended to gage liability. These are the dimensions and respective questions used in the survey: 1. Thoroughness: did the physician completely address the condition, 2. Length of visit: did the physician spend enough time to adequately diagnose the condition, 3. Diagnostic capabilities: did the physician appear to know how to assess the condition and what tests to order, 4. Professionalism: was the physician behaving appropriately, 5. Overall satisfaction: was the patient happy with their physician interaction, 6. Liability: how severe should a punishment be, given a negative outcome.

## 3 Results

A Kruskal-Wallis test was conducted that compared participant ratings on the perceived effectiveness of the physician given the different types of decision aids used. Mean rank for each condition appear in Table 1. A higher ranking indicates a better rating of the physician on that characteristic. There were no significant differences between the three aids on thoroughness ($H(2) = .04$, $p > .05$), length of visit ($H(2) = .26$, $p > .05$), diagnostic capabilities ($H(2) = 1.08$, $p > .05$), professionalism ($H(2) = 2.16$, $p > .05$), overall satisfaction ($H(2) = .33$, $p > .05$), or liability ($H(2) = 2.04$, $p > .05$).

**Table 1.** Mean Ranks for Physician Characteristic per Aid Type

| Physician Characteristic | Aid Type | Mean Rank |
|---|---|---|
| Thoroughness | None | 46.24 |
| | Computer | 47.35 |
| | Physical | 47.40 |
| Wait | None | 45.50 |
| | Computer | 46.68 |
| | Physical | 48.82 |
| Diagnostic Capabilities | None | 50.68 |
| | Computer | 46.56 |
| | Physical | 43.76 |
| Professionalism | None | 51.79 |
| | Computer | 47.05 |
| | Physical | 42.16 |
| Satisfaction | None | 46.65 |
| | Computer | 49.06 |
| | Physical | 45.29 |
| Liability | None | 42.37 |
| | Computer | 46.79 |
| | Physical | 51.84 |

## 4 Conclusion

Previous research on computer-based decision aids examined perceived physician capabilities and their impact on the patient-physician interaction. However, no one has contrasted the use of computerized aids with physical ones. Participants were given a scenario either containing a computerized, physical, or no decision aid in which they took on the role of the patient and were asked to rate the physician's capabilities and degree of liability given a negative outcome. The results indicated no significant differences, on any dimension, across the conditions.

This result stands in contrast to findings in the medical decision literature in which differences have been demonstrated between ratings of physician interactions using computer-based aids and those using no aid. Although our manipulation did not produce significant differences, our study introduces designers to an accepted measure of a physician’s effectiveness that has already been established in the medical decision making literature. In addition, understanding how decision aids are viewed by both patients and physicians can help developers create interfaces that are useful and provide good patient-physician interaction. These improvements could lead to increased diagnostic accuracy, patient compliance, and decrease stress amongst medical staff.

Although it is important to develop these technologies, medical decision making is high risk. Patients in these situations may feel intimidated or even depersonalized when observers are in the exam room. As such they may withhold vital information

that may lead to an incorrect diagnosis. These factors can preclude the use of several methods commonly used to evaluate interactions.

We believe that scenarios give the participant a situation mimicking the flow of information in a medical exam without the associated risk. Further, scenarios can be used to evaluate this interaction in different settings, such as the emergency room, physician training. They also provide a chance to evaluate communication between medical professionals, which normally is difficult to achieve given the associated privacy and liability issues. Ultimately, scenario use could facilitate the development of improved designs and improved patient-physician interactions.

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