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Do IT students prefer doctors who use IT?

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ABSTRACT

Several studies suggest that clinical decision support systems (CDSSs) reduce physician diagnostic errors, decrease medical costs, and improve the quality of patient care. However, despite the many potential benefits, physicians have been slow to adopt CDSSs and fail to use them when they are available. Some researchers have speculated that physicians are reluctant to adopt these diagnostic aids, in part, due to the widespread psychological bias that patients and peers feel against physicians who use them. This bias has been well documented among the general public. Many have assumed that this human-is-better attitude is limited to older and less computer savvy populations. We test this assumption with two vignette-based experiments. Our data suggest that, when it comes to physicians, even young participants with positive attitudes towards computers (i.e., IT students) have a human-is-better bias.

1. Introduction

Of all the problems currently facing the United States, perhaps the most pressing and most intractable is the challenge of providing high quality yet affordable health care to its citizens (Agarwal, Gao, & DesRoches, 2010). The United States spends significantly more on healthcare than any other developed nation (Sarpel, Vladeck, Divino, & Klotman, 2008). One out of every six dollars spent in the U.S. is healthcare-related (Catlin, Cowan, Hartman, Heffler, & National Health Expenditure Accounts Team, 2008). Still, over 50 million Americans lack basic health insurance, and millions of others delay, or forego, medical care due to the prohibitive costs (DeNavas-Walt, Proctor, & Smith, 2010).

Even Americans with health insurance often receive less than ideal care. Medical misdiagnosis is a common problem. Weed (1997) notes that for decades, error rates for medical professionals have been much higher than other industries would tolerate. According to the Institute of Medicine, nearly 100,000 people die each year due to errors in diagnosis and other preventable medical errors (Kohn & Corrigan, 2000). Autopsy studies of intensive care unit (ICU) deaths suggest diagnostic discrepancy rates may be as high as 31% (Coombes et al., 2004; Tai et al., 2001). In 44% of these misdiagnosed cases, knowledge of the actual condition would have resulted in an altered course of treatments and, perhaps, prolonged survival (Tai et al., 2001).

Fortunately, the use of information technology by healthcare providers both reduces costs and improves quality (Agarwal et al., 2010; Aron, Dutta, Janakiraman, & Pathak, 2011). In recent years, several technology and medical-related firms have developed highly accurate clinical decision support systems (CDSSs). Kaplan (2001) notes that many different types of health information systems are called CDSSs. For example, CDSSs may provide diagnostic reminders, recommend treatment regimes, monitor for medication or medical errors or provide support with other medical tasks. For this paper, we will focus on diagnostic systems, information systems that aid physicians in the diagnostic process.

According to Shaffer, Probst, Merkle, Arkes, and Medow (2012), CDSSs are typically implemented with electronic medical records (EMRs). These diagnostic decision aids help improve clinician diagnostic accuracy, promote the implementation of evidence-based medicine, and reduce costs (Garg et al., 2005; Pozen, D'Agostino, Selker, Sytkowski, & Hood, 1984; Sim, Gorman, & Greenes, 2001). Physicians who use computer based diagnostic support systems are more accurate compared to unaided physicians (de Dombal, Dallos, & McAdam, 1991; Friedman et al., 1999; Ramnarayan et al., 2006; Thomas et al., 2008). Garg et al. (2005) reviewed 100 studies and found that the overwhelming majority of these studies reported that physicians who use a decision aid outperform unaided diagnosticians. Ridderikhoff and van Herk (1997) showed that general practice physicians who use a computer-based diagnostic decision aid have more than two times the diagnostic accuracy of unaided physicians.

In related work, Pozen, D'Agostino, Selker, Sytkowski, and Hood (1984) indicated that a decision aid could reduce the number of inappropriate hospital admissions. Decision aids may also reduce the time needed to make a diagnosis. For example, Bogusevicius, Maleckas, Pundzius, and Skaudickas (2002) found that using a

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decision aid lowers the time needed to accurately diagnose a mechanical acute small bowel obstruction (SBO) from sixteen hours down to one hour. SBO's are one of the most common emergencies in general surgery, and accurate and rapid diagnosis is crucial for successful treatment (Bogusevicius et al., 2002).

However, despite the many potential benefits of CDSSs, physicians have been slow to adopt them and often resist using them when they are available (Kane & Labianca, 2011). As a result, these powerful, potentially lifesaving tools remain grossly underutilized. Shaffer et al. (2012) notes that despite the effectiveness and prevalence of CDSSs, they are among the least widely used components of EMRs. Corey and Merenstein (1987) showed that physicians fail to utilize decision aids even after the tool has been proven accurate and useful.

Extant literature suggests several reasons for the reluctance of physicians to use CDSSs. Inter alia, Arkes, Shaffer, and Medow (2007) suggested that many physicians consider using medical decision aids as "cookbook medicine" in which doctors simply enter the symptoms and the computer produces the diagnostic results. In his bestselling book, "How Doctors Think," Jerome Groopman wrote, "Algorithms discourage physicians from thinking independently and creatively" (Groopman, 2007).

Further, in medical school, physicians learn to diagnose patients without the use of diagnostic decision aids and may be reluctant to adopt new technologies and procedures after they leave school (Ayers, 2007). Moreover, early incarnations of computer-based decision aids were not as accurate or user friendly as current systems. As a result, physicians may be reluctant to use diagnostic support systems because they are unfamiliar with current research on diagnostic decision aids. Physicians who are aware of current research may also be hesitant to trust the results because of unfavorable experiences with earlier generations of CDSSs.

Perhaps the most salient reason for underutilization is the public's strong psychological bias against physicians who use CDSSs. Several studies suggested that physicians who adopt CDSSs run the risk of losing the respect of patients and colleagues (Arkes et al., 2007; Cruickshank, 1985; Kaplan, 2001; Shaffer et al., 2012).

Technology adoption studies have found that social factors influence information technology (IT) use (Moore & Benbasat, 1991; Thompson, Higgins, & Howell, 1991; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012). For example, Venkatesh et al. (2012) and Venkatesh et al. (2003) found that social influence (i.e., the opinions of important others) is an important driver of IT use. This is consistent with the finding of Moore and Benbasat (1991), that image (i.e., the effect of use on prestige or status) was positively correlated with IT use. Given these findings, a physician who values his or her reputation may be understandably reluctant to use a computer-based decision aid.

Experimental investigations of the subject have found that American 3rd-year medical students, Midwestern psychology students, and hospital clinic patients in both the US and the UK, all derogate the diagnostic ability of physicians who use CDSSs (Arkes et al., 2007; Cruickshank, 1985; Shaffer et al., 2012).

However, until now, no one has studied the attitudes of computer-oriented participants towards physicians who use CDSSs in the diagnostic process. Exposure to computers and health information technology are positively associated with increased acceptance of health information technology (e.g., Or & Karsh, 2009). Several studies have found that information technology students have higher computer self-efficacy (CSE) and more positive attitudes towards computing compared to students in other majors (e.g., Havelka, 2003; He & Freeman, 2010; Lopez, Giguette, & Schulte, 2006). It follows that computer-oriented participants will have more positive perceptions of computing technology and be more accepting of physicians who use a computer-based decision aid. In this work, we test this theory.

With this aim, we conducted two separate experiments using graduate and undergraduate information technology (IT) students. The paper proceeds as follows. Section 2 details the existing literature related to the public's bias against physicians who use CDSSs and society's preference for decisions reached by intuition over those reached using analysis. Section 3 outlines the research design and details the empirical analysis of both experiments. Section 4 discusses our results and their implications. In Section 5, we discuss the limitations of this work. Finally, we summarize the results and discuss possible extensions of the work in a concluding section.

2. Literature review

As Weed (1997) opined, in the current health care system, both physicians and patients are victims of the "predictable and undesirable internal constraints" of the human mind. CDSSs provide a way to move beyond these constraints and provide doctors and hospitals with access to the most effective and up-to-date medical knowledge. Over the past 40 years, several technology and medical-related firms have developed highly accurate CDSSs (Anderson, 1997). These CDSSs offer a way to decrease physician errors, reduce medical costs and improve the quality of patient care (Garg et al., 2005).

2.1. The bias against computer-based decision aids

Both Shaffer et al. (2012) and Arkes et al. (2007) found that patients and peers derogate the diagnostic ability of physicians who use a CDSS. In addition, their research suggests that patients rate physicians who use a computer-based decision aid as less thorough and less professional compared to unaided physicians. Similarly, Shaffer et al. (2012) found that participants did not disparage physicians who sought expert advice from other physicians, but did disparage the diagnostic abilities of physicians who consulted a non-human expert (i.e., a CDSS).

Promberger and Baron (2006) found that patients do not trust computer-generated diagnoses and are less likely to follow computer-generated treatment regimes. Cruickshank (1985) examined patients' opinions of their physicians before and after the introduction of a CDSS. After the installation of the diagnostic aid, patients expressed less positive attitudes about the thoroughness, cleverness, decisiveness, and thoughtfulness of their physician. Similarly, Arkes et al. (2007) found that American medical students and clinic patients rate the diagnostic ability of physicians who use a CDSSs significantly lower compared to the diagnostic ability of physicians who do not use a diagnostic decision aid.

In related work, Eastwood, Snook, and Luther (2011) reported that participants preferred physicians who made their prescription decisions based on intuition. Study participants where less positive about physicians who based their decisions on a statistical formula. Eastwood et al. (2011) used the phrase "human-is-better" attitude to describe the observed preference of clinical-based (i.e., intuition) strategies over actuarially (i.e., statistical) based ones.

Additionally, Pezzo and Pezzo (2006) found that participants judged physicians who use a diagnostic decision aid less negatively following a negative health outcome. The study also revealed that participants judged physicians who used a diagnostic decision aid less positively compared to unaided physicians following a positive health outcome. As a patient's health normally improves after a physician visit (a positive health outcome), physicians may be reluctant to adopt diagnostic decision aids because they may feel that they would receive less credit when the patient recovers.

Furthermore, patients may be hesitant to trust computer-based decision aids because they want their physicians to see them as individuals, not simply as data points. Dawes, Faust, and Meehl