# Will Medical Technology Deskill Doctors?

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**Abstract**

This paper discusses the impact of medical technology on health care in light of the fact that doctors are becoming more reliant on technology for obtaining patient information, making diagnoses and in carrying out treatments. Evidence has shown that technology can negatively affect doctor-patient communications, physical examination skills, and development of clinical knowledge. We propose three possible approaches to medical education and professional development to assist human doctors in acquiring a better understanding of the relative role of technology. The approaches include providing undergraduate and professional development training on using medical technology, helping students recognize the importance of clinical evidence, and helping doctors establish autonomy while interfacing with medical technology.

**Keywords:** medical technology, impact; cognition, doctor-patient communication, training

## 1. Introduction

Stephen Hawking (Cellan-Jones, 2014), the renowned physicist and cosmologist, and Elon Musk (Gibbs, 2014), a high tech entrepreneur, recently warned that the emergence of increasingly intelligent technology could mean an end to the human race. As health care technology comes to play an increasingly prominent role in diagnostic decision-making and patient management, could it mean an end to human doctors?

It has been reported that doctors are in fact becoming more reliant on technology in making diagnoses and carrying out treatments (Goodman, 2010). Medscape ranked over-testing as the number one issue for medicine in 2013. There are nearly 90% common but unnecessary tests and measures are being used according to Medscape's 2013 yearend report. A recent movement in medicine called "Less is More" aims at reducing the overuse of low value tests and treatments. Over reliance on technology could impair the development of doctors' clinical skills and the quality of patients' lives. According to annual statistics released by the American Board of Internal Medicine (ABIM), overall pass rates for first-time test takers of the Maintenance of Certification (MOC) internal Medicine Board Exam dropped from 90% in 2009 to 78% in 2013. Three possible explanations for this drop are related to the use of technology: (a) the ready access to search technology diminishes the willingness and motivation to learn and memorize basic knowledge, (b) big data of medical information and evidence is outpacing the human capacity to acquire and retain knowledge, and (c) electronic record keeping is weakening the ability of physicians to develop and refine their cognitive skills in clinical settings (Team, 2014). As physicians rely more on automation and technology in their daily work, the technology in also shaping the way they learn, make decisions, and communicate with patients and others.

## 2. Concerns on the Negative Effects of Medical Technology on Health Care

Undoubtedly, progress in medical technologies has improved the delivery of health care and the quality of life (OECD, 2014). This is, however, not a universal truth. For instance, the dramatic increase in the number of CT and MRI scans between 1997 and 2006 did not change the frequency of illness. Instead, it suggests an overuse of technology (Smith-Bindman, Miglioretti, & Larson, 2008). It has also been found that once such technologies have been introduced into practice, it is often difficult to reduce their use, even in situations where they have been shown to be ineffective or no more effective than less complex or less expensive alternatives (Statistics, 2010).

Furthermore, the over use of technology can have negative effects on clinical practices. Deskilling as an effect technology on physician is a major concern. Deskilling refers "a situation within an occupation or sphere of

work in which workers experience reduced discretion, autonomy, decision-making quality, and knowledge as they perform their jobs—all of which negatively affects their ability to perform these jobs in a manner they see fit" (Hoff, 2011, p. 338). First it can negatively affect doctor-patient communication. The communication skills of physicians have been found to deteriorate due to technology, which enable them to conveniently access and share information (Verghese, 2008) with patients [without human interactions]. Physicians are investing more time in reading information from technology assessments, and less time on doctor-patient interactions, which in turn leads to declining communication skills. The embodiment and intersubjectivity of doctor-patient interactions are critical to reasoning (Gallagher & Payne, 2015) because in clinical settings, diagnostic reasoning is developed based on more training, immediate pattern recognition of patient's symptoms and features obtained from the face-to-face communication. Furthermore, studies have found that electronic medical systems can impede communication with patients because physicians need to type up electronic medical records while simultaneously interacting with patients (Cummings, 2013).

The second concern is deteriorating bedside or physical examination skills. Experts feel that physicians are doing fewer physical examinations due to the prevalence of technology examinations (Verghese & Horwitz, 2009). The use of medical technology on clinical practice may blunt doctors' observation skills, a concern raised by Harvey Cushing in his 1903 *Boston Medical Surgery* article.

Moreover, using medical technology, such as Electronic Health Record (EHR), could also decrease narrative notes taking skills and clinical knowledge. In a study of seventy-eight primary care physicians in New York, Hoff found that most indicated they tended to cut-and-paste boilerplate text into their reports of patient visits. Hoff also found that physicians increasingly lost their ability to understand and abstract the richness and uniqueness of patients' information given the standardized EHR format, consequently undercutting their "ability to make informed decisions around diagnosis and treatment" (Hoff, 2011)

Both doctor-patient communication and physical examination skills have been and remain important venues for obtaining information critical for making correct diagnoses. Using them together is sufficient for making good diagnoses. Paley and colleagues (Cheitlin, 2011) showed that both junior (with around 4 years emergency department experience) and senior (with more than 20 years emergency department experience) doctors could make correct diagnoses 80% or more of the time on newly admitted patients based on basic clinical skills (history taking, physical examination, and basic lab tests). Thus, in the editor's view, history taking is still valuable, and medical technology is and should still be just an adjunct to diagnosis.

## 3. Help Doctors to Use Technologies Optimally in the Future

Thus, we must consider the use of medical technology in promoting health care without devaluing its importance. While earlier research has identified the danger that overdependence on technology will weaken patient care, the impact of technologies on physicians has seldom been explored (Ash, Sittig, Campbell, Guappone, & Dykstra, 2007), particularly with respect to medical education and professional development. In the face of increasingly smart technologies, there are a number of ways in which we need to help human doctors develop a better understanding of the relative roles of people and machines in health care.

- Training doctors to better understand and use medical technology appropriately and optimally. Given the importance of medical technology, there have been various programmes assessing its impact. The major focus has been patient-oriented such as its clinical efficacy, cost-effectiveness, safety, and impact on the health care system (Fineberg, 1985). Currently, there are international (http://www.inahta.org/) and local agencies (http://cadth.ca/) in charge of assessing health technology, but mainly at the professional and continuing education level.

However, it has been found that medical students and trainees receive little formal training in the use and application of technology (Goodman, 2010). Moreover, there are few serious investigations of the impact of technology on physician cognition. In recent years, researchers have begun to recognize and attend to the risks and side effects of technology, particularly in education (Spitzer, 2014), including its impact on memory and basic language skills. For example, a study in *Science* in 2011 reported that search engines made searching for information so easy that people tend to have low recall of difficult questions when primed to think of being able to seek for help from computers (Sparrow, Liu, & Wegner, 2011). Basic language skills, such as reading and writing, are impaired due to the fact that people engage in less handwriting or more reading and writing on the computer (Li & Wang, 2014; Tan, Xu, Chang, & Siok, 2013).

It has been suggested that physicians in training should learn about strengths and weaknesses of healthcare technology assessment so as to use it optimally in patient care (Allen, Brar, & Farrell, 2010). Improving the practice of technology assessment has profound implication for medical economics and policy decision-making

(Neumann, 2009). However, the focus of health technology assessment should go beyond a cost-benefit analysis for patients to its impact on the knowledge and skills of physicians themselves.

- Helping physicians and medical students recognize the importance of evidence from history and physical examinations in clinical decision-making. Evidence-based medicine has been promoted in healthcare. However, healthcare professionals must be able to recognize which evidence they need to focus on while interacting with technology. Earlier studies have demonstrated that histories play a major role in cost-effective diagnosis and lab investigations (Hampton, Harrison, Mitchell, Prichard, & Seymour, 1975; Peterson, Holbrook, Von Hales, Smith, & Staker, 1992). While medical technology has received much attention as it has improved, the teaching of bedside skills has languished. It has been found that students tend to use diagnostic tests while expert or experienced residents placed more value on taking histories. However, physician confidence increases when laboratory test evidence is added, even when the correct diagnosis is made (Peterson et al., 1992) without them. Research has also shown that the inappropriate use of laboratory tests not only have economic implications but also lead to physiological interventions and diagnostic errors that harm patients (Epner, Gans, & Graber, 2013). One reason for the growing use of medical technology may be the increased reliance on objective data from diagnostic tests to partially compensate for the reduced history and physical examination skills of physicians (Feddock, 2007).

- Helping doctors establish and maintain agency in clinical practice. In the process of adapting themselves to the idiosyncracies of medical innovations (e.g. EHR) and medical guidelines, doctors are surrendering their autonomy and discretion (Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999). Building self-confidence and understanding the importance of professional autonomy are critical not just for clinical decision making, but also for general practice. Research has shown that as senior doctors gain more experience and expertise, they tend to place greater importance on clinical evidence than on laboratory tests. This suggests that doctors' confidence in their medical judgment improves with experience (Markert et al., 2004). Greater awareness and confidence could help doctors to better deal with complex cases and with evidence from difference sources. Doctors might also be able to identify the signs or symptoms of such medical problems as tumors and cardiovascular disease more quickly effectively as it can be too late to treat them, if we rely entirely on machines. Doctors should develop an awareness of their patients, before their diseases become too advanced. They might want to look at how doctors of Chinese medicine make decisions by focusing on observation. Optimally combining technology and human intelligence could advance the goal of treating preventable disease.

## 4. Conclusions

The oft repeated line from *The Matrix*, "never send the man to do the machine's work" highlights the significance of relieving humans from lower level of cognitive tasks that can be done by machines. In return, humans can focus on higher level cognitive tasks and or social and emotional aspects of medicine. As we offload more and more work to machines, we might also need to take care that we "don't let the machine take our work", and most importantly, don't surrender ourselves to the developing intelligence of high technology. Meanwhile, we should be aware that our concerns about technology have little to do with technology itself, but rather with the way we design and use them in practice (Bailey, 2011; Hoff, 2011). Doctors should take the agency on when, how and why to use technology and not allow technology take it away from them.

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