

GUEST EDITORIAL

The evolving roles of physicians in the era of Artificial Intelligence (AI)

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Being a doctor is a dream of many schoolboys and girls worldwide. But when they are being asked: “*Why do you want to be a doctor?*”, you hear that typical answer: “*to help (poor, sick, helpless, ... etc.) people*”. Almost all professionals help people in different ways, but I wonder how their answers would change after their graduation from medical schools. Let me start with a nostalgic glimpse when our high school teacher asked: “*What doctors do?*” Most of my fellows said: “*They treat patients*”, but I replied: “*Doctors diagnose AND treat patients*”. The teacher was impressed with my comprehensive answer, but is it still valid today?

Scholars in medical education are invited to contemplate on what doctors are expected to *do* today and tomorrow. The roles of the (medical) *teachers* have been discussed earlier (Harden and Crosby, 2000), which can be re-examined now. We also need to move one step backwards and *reconsider* what we used to know about the roles of physicians, particularly in the evolving technology, particularly related to Artificial Intelligence (AI). AI can be simply defined as the behaviours by computer software that are designed to mimic and extend human rational thinking and actions (Poole D, Mackworth A, 1998). The roles of physicians have evolved over the past two decades and they have to be clearly defined to indicate the key outcomes of graduates of medical schools. Let's try to anticipate how AI is expected to moderate the roles of *future* doctors.

A couple of scenarios can be portrayed for the future of clinical practice in the AI era. The 1st scenario predicts that AI will remain a *tool* (like a stethoscope) in the hands of doctors to augment the accuracy of their diagnosis and clinical decisions. This scenario does not anticipate a great change in the roles of future physicians, who should be at least *updated* on the new technology whenever possible. Patient will continue to trust humans to communicate with them, reassure their families and perform surgeries. There is 2nd scenario of some AI-phobic doctors who are apprehensive of being replaced by *robots*. Though, it seems as inspired by science-fiction movies, I empathize with these implicit fears, in view of recent AI-related studies that compared *Man vs. Machine* in diagnosis and treatments. For instance, expert dermatologists were outperformed by the deep

learning convolutional neural networks (CNN) in melanoma detection (Haenssle *et al.*, 2018). Also, surgical robotics have demonstrated great potentials to transform healthcare practice, particularly with the incorporation of augmented reality and intelligent robots with AI software (Porpiglia *et al.*, 2018; Stiegler and Schemmer, 2018; Stravodimos *et al.*, 2019) that is expected to perform surgery without humans in the near future.

If AI can offer better diagnosis and treatment, what is left to be done by future doctors? Some argue that patients may still need (human) doctors to show empathy and keep that humanistic touch in clinical practice. Unfortunately, we (as humans) are losing this edge with the reported decline of empathy levels among medical students as they progress through their medical degrees (Hojat *et al.*, 2009). What about trust? How far can you trust an AI doctor? Today, patients still need validation of AI-made decision by expert physicians (Fink *et al.*, 2018). Yet, future generations of patients may have different attitudes towards AI. To view the trend of trust in Man vs. Machine, ask yourself: How often do you check Google Maps on your mobile when you get lost, as compared with consulting people? Why future patient will still go to hospital and clinics instead of consulting their mobile applications? Chances are that we are moving fast to an era of personalized self-help medical care, where patients might by-pass doctors and interact directly with AI systems in an huge global network, as humans evolve into Homo Nodus (Masters, 2015), a node on a huge network of the Internet of Things.

Such a scary scenario! Yet, it's a wake-up call for physicians who expect to keep practicing medicine the same way for the next decade. AI is here to stay, and it will renovate everything in our lives today, including medical education. We need to predict how AI will transform the responsibilities of physicians and plan the future of medical education accordingly. New set of skills need to be addressed to empower future medical students and residents to *manage* AI. The basic medical informative, electronic medical records (EMRs) and AI design principles have to be explicitly taught in medical curricula. As AI has been gradually embedded in almost all aspects of diagnosis, treatment and hospital information systems, medical students and residents need to learn the basics of machine learning and

data science during their training period (Kolachalama and Garg, 2018). We need to effectively communicate with AI, learn its language and take *Machines* to our side, otherwise they will be the ‘terminators’ of reluctant and outdated physicians.

A 3rd *symbiotic* scenario can be foreseen that doctors will not be replaced, but their roles have to evolve. Doctors and AI (scholars) should not compete to prove who should dominate the future of clinical practice, but both parties have complimentary responsibilities. Doctors and AI have much to learn from and support each other in reciprocity. For instance, doctors need to teach AI system and feed them with data until AI is taught to collect patient information and process them to enhance diagnosis and decision-making (Masters, 2019). Good AI systems can be designed using the principles of inter-professional education (IPE) (Hammick, Olckers and Campion-Smith, 2009) by experts from medicine, education and computer sciences. The worst-case scenario is when our graduates lambast themselves for becoming doctors in *AI-run healthcare system*, when they feel like *cavemen* who wake up to a new reality after few years, but seems like hundreds of years later.

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