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Editorial

Paediatric Diagnosis: When Human Mind Meets Artificial Intelligence

It is hard to disagree, even in this technology-driven world in the twenty-first century, that the most revered components of the practice of clinical medicine remains to be a well-taken history followed by a carefully conducted physical examination. In children with heart conditions and prolonged fever, one is obliged to look for 'ephemeral spots of a painful nodular erythema, chiefly in the skin of the hands and feet',[1] although young residents let alone medical students may know little of the 'Father of Modern Medicine' who lent his name to this cutaneous manifestation referred to as Osler's nodes. 'Just listen to your patient, he is telling you the diagnosis', unsurprisingly remarked by Dr Osler who placed his firm belief on the centrality of history taking and physical examination in each of the clinical encounters. By contrast, the fictional Dr McCoy, the iconic physician in *Star Trek*, begins his diagnosis almost without exception using the tricorder, the non-invasive medical scanner, among the numerous other medical gadgets on board *Star Trek*. To the people of the past, this fictional character and his gadgets belong to an unimaginable future. To us, perhaps, we are a step closer to seeing the realisation of Dr McCoy's tricorder. To us, we are facing a non-fictional new breed of digital physicians who is creeping into the consultation clinics and hospital wards and finding its way to potentially transform the future of medicine.

As vividly described by Obermeyer and Lee,[2] 'In the good old days, clinicians thought in groups; "rounding", whether on the wards or in the radiology reading room, was a chance for colleagues to work together on problems too difficult for any single mind to solve.' This time-honoured approach remains central to our daily clinical practice and is illustrated in the diagnosis of the various paediatric conditions highlighted in the current issue of the *Journal*: enteroviral meningitis,[3] childhood hydatid disease,[4] syndromal disorders including 15q duplications syndrome,[5] Reye's syndrome,[6] and Denys Drash syndrome,[7] and rare clinical presentations of paediatric surgical conditions including intestinal malrotation after neonatal period[8] and an extramural duodenal ectopic pancreas.[9]

Clinical diagnosis involves the connection of dots: dots of pieces of information in the history provided by patients, parents and caretakers, dots of physical signs obtained through physical examination, dots of past experience whether good or bad being imprinted over the years of practice, dots of intuition, and dots of the yet unknown to be unveiled through exchanges with colleagues and, in the present era, the use of search engines. It is inarguable, however, that medical knowledge and clinical data are expanding rapidly, expanding at a pace beyond the ability of the human brain to assimilate, to analyze and to apply in a timely manner. On the other hand, artificial intelligence, the mimicking of human cognition by computers, is becoming a reality in medicine.[10] For some, the combination of big data and artificial

intelligence represents the next industrial revolution.[11]

The beating of the grandmaster of Go, an ancient Chinese abstract strategy board game, by AlphaGo Zero of Google DeepMind has made its way to the news headline. Its ability to master the game without human knowledge is discussed in a recent article in *Nature*.[12] By their very nature, the two players of Go are competing against each other, one destined to become the winner, while the other would inevitably be called the loser. The AlphaGo Zero story that, to some, may implicate direct confrontation between artificial intelligence and the human mind is probably not the best example to illustrate the potentials of translating artificial intelligence to clinical care. Multidisciplinary input from different members of the healthcare profession is an important component in clinical diagnosis, decision making and management. The way to incorporate the protean of artificial intelligence technologies, including data mining, machine learning, case-based reasoning, Bayesian modeling, and artificial neural network into the clinical diagnostic and management pathways is becoming the crux of the question for the present and future generations of healthcare professionals.

In paediatrics, reports on the potential applications of artificial intelligence are emerging. Kruszka et al from the National Human Genome Research Institute, US, and their international collaborators recently reported on the successful use of facial recognition software to diagnose 22q11.2 deletion syndrome in diverse populations.[13] Machine learning algorithm based on the face scanning patterns may be able to identify children with autistic spectrum disorders.[14] The paediatric intensive care setting, with the wealth of data, may be the ideal interface between paediatric intensivist and artificial intelligence technologies.[15] Big datasets coupled with machine learning has also been explored to determine brain maturation in preterm infants[16] and to predict the relapse of acute lymphoblastic leukaemia in children.[17]

Would the rise of artificial intelligence herald the diminution of human touch in clinical medicine? In paediatrics, the touch is the touch of sympathy, empathy, and affection. Human touch is integral to the art of medicine. The late Stephen Hawking said, 'In short, the rise of powerful artificial intelligence will be either the best, or the worst thing, ever to happen to humanity.' When the mind of human physician meets artificial intelligence, who is to decide the outcome?

YF Cheung
Chief Editor

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