Workforce innovation

Embracing emerging technologies

CPD

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Background
In a rapidly evolving digital world, it is crucial that general practice embraces the potential of artificial intelligence (AI) and virtual reality (VR) in a real and proactive manner.

Objective
Using examples of AI and VR, the article outlines some of the benefits and challenges we face in integrating these digital tools into daily clinical practice and our training programs.

Discussion
It is clear that AI and VR digital innovations will continue to grow in significance, with more and more options being offered to clinicians. As we increase our understanding of the benefits of these technologies, adapting our traditional curricula and daily clinical practice will require an openness to change. This is somewhat easier with VR, as it is a low-risk intervention that is providing an additional clinical intervention modality. AI is generating more challenges that will require a balanced, ongoing discussion involving clinicians and AI practitioners.

AS EDUCATORS, it is now increasingly important that we embrace the growing role of technological innovation in day-to-day clinical care and train our future workforce to incorporate this innovation in their practice. Two current innovations that are offering exciting and interesting opportunities are artificial intelligence (AI) and virtual reality (VR). In the future, we may each have our own personal full-time AI doctor who knows our gene sequences and vulnerabilities to particular diseases. Our AI doctor could continually monitor blood pressure, sugar levels, sleep and exercise. Future versions of smartphones or fitness watches may regularly take personal photos to identify melanomas and eye disease.[1]

AI robots are being used in Japan (carebots) to provide support for elderly people with cognitive decline and limited mobility.[2] Thirty per cent of an aged care or disabled care worker's current responsibilities could be supported by AI, such as data entry, recording a patient's health and response to treatment, and monitoring of equipment to ensure it is functioning correctly.[3]

This article examines the evolving role of AI and VR in healthcare delivery and then discusses how we can adapt our workforce training programs to proactively respond to the influence of these digital innovations. The evidence base for the role of VR in clinical scenarios is growing exponentially. Meanwhile, the role of AI in influencing our day-to-day clinical care is providing challenges and some fascinating innovative opportunities.

At present, however, technology is unable to be patient-focused, intuitive and adaptive.[4] Health practitioners will still remain the key to the delivery of clinical care. We need to be trained to better use these digital tools within the consultation. Digital technology will transform, not revolutionise, how we deliver our clinical care. Creating the flexibility and innovation in our training programs to proactively adjust the curricula in real time to embrace the evolving digital revolution should now be a priority.

Artificial intelligence

AI is an area of computer science that aims to 'mimic human thought processes, learning processes and knowledge storage'.[5] AI uses natural language processes to map and collate complex medical records and then correlate this clinical information with the diverse published medical literature.[4] Using techniques such as machine learning, deep learning and cognitive computing (Box 1), we may be able to increasingly personalise our clinical advice.

Machine learning using big data (Box 1) has the potential to identify unique phenotypes of heterogenous cardiovascular conditions, such as hypertension and coronary artery disease, and thereby individualise treatment. Deep learning can identify additional patient risk factors for stroke, and IBM Watson, a well-known cognitive computer, uses continuous learning from datasets to make outcome predictions that are more accurate than those made by humans.[5] Miller has outlined the use of AI in accurately mapping the trajectory of patients with complex multi-organ involvement, conducting histopathological assessments and generating patient problem lists from substantial electronic medical records, aligned with relevant medical literature.[4]

The potential to use AI in clinical practice to identify hidden patterns in large complex datasets is substantial. What we need now is the creation of a balanced partnership between AI technicians and clinicians so that patients can benefit from this unique technology.[6] Altman argues that this partnership is vital as we learn that the outputs of 'learning systems' can be valuable to decision makers, clinicians and, ultimately, patients and their families.[6] This evolving discussion will also have to grapple with issues such as privacy, data integrity, intellectual property and regulatory concerns.

Other commentators and entrepreneurs, while totally aware of the potential of AI in healthcare, have cautioned against a rapid explosion of innovations.[7] They have cited concerns regarding the natural conservatory nature of health service providers, reluctance to embrace new technologies that do not provide tangible outcomes and the oversell of electronic health records and possible benefits of interrogating these records. They advocate the need to pilot and map how these AI systems could fit into a clinician's daily work patterns.[7]

Clinical decision making is complex, and the more we can readily and easily access patient-specific data, the better the decision making. The emerging AI technologies are pushing us to the real possibility that personalised diagnosis and personalised management will be available at a tap of a keyboard.

Box 1. Definitions[5]

- Deep learning techniques mimic the operation of the human brain using multiple layers of artificial neuronal networks that generate automatic predictions from training datasets.
- Big data are extremely large data sets that cannot be analysed, searched or stored using traditional data processing methods.
- Machine learning represents various techniques for solving complicated problems with big data by identifying interaction patterns among variables.
- Cognitive computing involves self-learning systems using machine learning, pattern recognition and natural language processing to mimic the operations of human thought processes. IBM Watson is the best known medical example of cognitive computing, continuously learning from electronic health records using multiple algorithms to predict clinical outcomes.

Virtual reality

VR 'refers to the interactions between an individual and a computer-generated environment stimulating multiple sensory modalities including visual, auditory and haptic experience'.[2] There is an evolving evidence base that is charting and documenting the role of VR in clinical interventions for attention deficit disorders,[8] social anxiety,[9] cerebral palsy[10] and medical inpatients.[2] Dascal et al, in a systematic review of randomised controlled studies, found that VR was useful for pain management, eating disorders, novel rehabilitation for strokes, Parkinson's disease and brain injuries.[2] They concluded that VR has promising potential and can be tailored to the individual and the conditions being treated but added a cautionary comment around cost and the need to refine the platforms. One existing patient education VR model links diet with a three-dimensional view of a heart damaged by hypertension.[11]

In a systematic review of the role of VR and interactive video gaming in stroke rehabilitation, Laver et al found that these modalities were not any more effective than conventional therapy in upper limb rehabilitation.[12] There was insufficient evidence that either modality was useful in improving gait speed, balance, participation and quality of life.[12] Creation of educational VR tools in human anatomy,[13] common medical conditions such as irritable bowel symptoms[14] and surgical training[15] are revealing the breadth of the opportunities. These low-cost interventions are allowing students and health professionals to practise in controlled, repeatable scenarios with instant feedback.

General practice – Future opportunities

If a patient with type 2 diabetes with multimorbidities presents to a general practitioner (GP), AI tools would be able to rapidly extract and summarise all key clinical information such as personal data and results, review specialist and outpatient letters, align all current guidelines and provide the GP with specific recommendations of next clinical steps.[16] The GP would then need to continue their primary clinical management. This 'personalised' approach is only possible because AI is able to review and summarise enormous amounts of information rapidly. There is still significant trialling and testing to take place before these tools are authenticated and trusted to become part of day-to-day general practice. Other examples of how AI tools can aid GPs include reviewing of skin lesions, radiographs, retinal scans and ultrasonography results,[16] saving non-essential specialist referrals, including those for rural and remote patients.

As the role of digital technology – in this case, innovations led by AI and VR – grows in importance, we have to create and foster debate in all the GP workforce training frameworks that allow integration of new digital tools in a contemporary and real-time manner. It is important that we expose all future GPs to the benefits of these evolving digital technologies,[16] and learn where they can be a valuable and positive aid to providing optimum clinical care and improving the overall health of our community. Do all our trainees need to graduate with a set of defined digital competencies to allow them to respond to a rapidly evolving field? In a training and clinical sense, we have to work to educate GPs and trainees to maximise the benefits that these innovations can bring to our patients. This is an important first step as we watch this clinical technological paradigm mature.

The challenge now is determining how to integrate these rapidly changing opportunities into our traditional curricula. This is somewhat easier with VR, as it is a low-risk intervention that is providing an additional clinical intervention modality. AI is generating more challenges. Hamet argues that we have to make sure we do not allow our 'prejudices and fears for AI' to prevent us from gaining greater clarity of the benefits for personalising the delivery of our healthcare; then the whole of society will benefit.[17] Ethically, will we be comfortable with robots providing care to our patients, and can we rely on the accuracy and repeatability of information provided by humanoid robots?

Research and innovation

The digital innovations need personal data, including all our medical information. This raises issues for clinicians in terms of allowing access to a significant volume of sensitive data such as medical records. Privacy concerns surface with this increased access. A second, more significant question that surfaces when many groups and corporations gather large amounts of data is who owns and oversees these rich data sources. How can we best use this information for the benefit of society overall?[18] If, for example, within a primary health network there is a local infectious disease outbreak and these technologies allow us to combine online data from mobile phones, credit card transactions and security cameras with online general practice and emergency attendance information, we may be able to alert potential patients to be aware of certain symptoms.[18] This scenario raises fascinating issues regarding personal privacy and public health issues.

The clinical research opportunities with VR abound in many disciplines in rehabilitation, pain management and psychological disease.[19] Involving GP researchers in their own clinically run intervention trials is a logical next step. Similarly, general practice involvement in AI clinical studies is a necessity. As we move down this increasingly personalised journey, we have to learn how to successfully integrate new technologies into daily general practice and learn to trust the usefulness and accuracy of our medical records and information systems.

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