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Academy of Medical Royal Colleges

Utilisation of modern technologies in post-graduate medical education and curricula

Academy Resident Doctors' Committee

The Academy Resident Doctors' Committee (ARDC) represents residents in postgraduate training. It has over 60 representatives drawn from the 23 medical royal colleges and faculties in the UK and Ireland. The members are all at different stages of their postgraduate training pathways. By working together to identify issues and challenges that affect resident doctors and suggesting solutions, we strive to implement changes across the whole health service. In particular, we look at ways to improve the support given to resident doctors throughout their postgraduate years to enhance training, recruitment and retention of this crucial component of the workforce.

Background

Medicine is advancing at a rapid pace. Artificial intelligence [AI] and other technological advances are the latest developments to offer the prospect of real advances in patient care, experiences and outcomes. AI in particular is held up as a potential game-changer and a 'silver bullet' that could solve many of the NHS' ills, which have been so vividly outlined by Lord Darzi's Independent Investigation of the NHS in England.[1] In response, the Government has announced £21 million to support AI roll out.[2]

While much has been written about the potential, transformative benefits of AI, Virtual Reality [VR] and other technological advances in healthcare delivery,[3-8] much less has been written about what this might mean for postgraduate medical education, with a limited number of academic papers being published over recent years.[9-11] This paper seeks to shine a light on this often neglected aspect of technological advances, to explore what this means for education, curricula and training experiences from a resident doctors' perspective.

We need to put ourselves in the best place to utilise the technology we already have today and embrace the development of the latest new technologies so that we improve training and best prepare doctors to deliver 21st century healthcare.

In this paper, we explore how we can ensure that the UK's medical education and training integrates modern technological advancements into education and curricula. In doing so, we underline that the adoption of new technologies should be based on rigorous scientific evidence and trials to ensure their effectiveness and safety before they are widely implemented, with due consideration of issues relating to transparency and accountability, interoperability, privacy and security, and wider ethical considerations.

We focus here on all specialities, including those resident doctors working in secondary care, primary care, public health, diagnostics, and pharmaceutical medicine. We specifically focus on both the huge innovations such as Artificial Intelligence and Virtual Reality, and longer established technologies such as ultrasound.

In particular we identify gaps in eight key areas, which are currently preventing us from realising the full benefits of technological advances. The first four gaps focus on the big ticket developments, while the second four relate to specific technologies which can improve particular aspects of medicine:

- Artificial intelligence
- Virtual reality
- Clinical informatics
- Telemedicine
- Video-based assessment
- Standardised robotic curricula
- Vascular access ultrasound
- Focused ultrasound and echocardiography.

In exploring current gaps and initial thinking about potential solutions, the ARDC is clear that any consideration about additions to specialty curricula should be part of wider conversations about updating and rationalising curricula, training and trainer capacity, and funding for training. The ARDC is also clear that requirements may vary between specialties.

It is also important to record that our overriding goal when seeking to improve how we utilise technology in training, is to improve patient-centred care and outcomes. Work specifically focused on ensuring technologies are accessible, affordable, and easy to use for patients from diverse backgrounds, is underway elsewhere and complements what is set out here.

1. Artificial Intelligence

The utilisation of Artificial Intelligence (AI) applications is rapidly expanding in various facets of our daily lives. As we envision the future of healthcare, AI emerges as a transformative technology poised to enhance patient outcomes by assisting healthcare professionals, alleviating workload burdens, and optimising the efficiency of healthcare delivery. However, there are numerous challenges associated with the development, deployment, and implementation of AI in healthcare. As the NHS endeavours to embrace these technologies, it becomes imperative for resident doctors and doctors at all stages of their career to comprehend the nature of AI, understand how to evaluate its applications and grasp the broader ethical and regulatory frameworks governing its use. It is of course important that any discussions about additions to curricula take place alongside other considerations about trainer capacity, and the wider modernisation of the curricula, including discussions about what comes out, so that we ensure that training load is manageable.

Gaps

There is a need to define and shape how AI is practically incorporated into curricula, so that we delineate the essential knowledge and skills needed by doctors.

We need to leverage platforms like e-Learning for Healthcare (e-LfH) in England and equivalent systems in the other nations of the UK, to ensure accessibility and effectiveness which will require specialty-specific and cross-discipline solutions.

2. Virtual Reality

Virtual reality (VR) technology presents a promising avenue for augmenting medical education, offering versatility, cost-effectiveness, and reproducibility. It provides a high-fidelity platform for procedural, clinical skills, and simulated scenario-based learning, while removing patient safety concerns. This benefits both learners and patients, fostering a safety-conscious culture and addressing human factors' impact. VR allows for the creation of uncommon scenarios inaccessible in traditional training environments due to safety limitations, thus mitigating regional disparities in learning opportunities. Additionally, VR facilitates communication skills training in complex and challenging scenarios, offering a psychologically secure environment without direct patient or colleague involvement. This is particularly relevant in enhancing patient-centred communication skills, such as delivering bad news or handling ethically challenging cases. VR holds promise in supporting learners at risk of differential attainment, including those with specific learning differences or international medical graduates adapting to UK practice. Furthermore, VR enables the development of leadership and teamworking skills, aligning with the GMC's Generic Professional Capabilities Framework and promoting sound

clinical leadership for improved patient care and safety. Many medical schools have VR technology, so those resident doctors working in centres that are co-located with medical schools can use it, but we need to collectively look at how we support all resident doctors to access VR technology.

Gaps

Efficient VR booking systems and dedicated spaces.

Where they do not already exist, we need regional hubs equipped with VR technology, supported by the identification of regional education leads.

We should consider creating clinical education fellow positions to oversee VR program implementation and provide necessary training.

There is an opportunity for medical royal colleges and faculties to explore VR's potential for blended learning in specialty training and develop guidance for local training leads.

We need collaborative purchasing arrangements with healthcare education bodies to share resources, such as headsets, and recoup expenses via loaning agreements.

3. Clinical Informatics

Clinical informatics is a multidisciplinary field which merges digital technologies and their application to healthcare settings to improve patient outcomes, enhance efficiency, and manage health related information. There is increasing demand to develop capacity for clinical informatics tailored to the specific needs of clinical specialties.[12]

Clinical informatics requires a unique set of skills and knowledge, blending clinical and IT expertise, which may justify the latter. This has become increasingly important given the increasing pre-requisite for digital technologies such as electronic patient records, digital imaging, remote clinics or telemedicine as a routine part of clinical care. This also intersects with managing and ensuring the privacy and security of sensitive patient data. It is worth noting that different healthcare organisations use different software and systems, requiring bespoke training.

At present Clinical Informatics Officers [CIOs] can come from a variety of backgrounds and clinical experience before taking on the role. However, no single body is charged with credentialling CIOs within the NHS.

Gap

There is a need to identify a credentialing organisation/process for Clinical Informatics Officers across the NHS. This would help to integrate clinical informatics within and between clinical specialties, either in the form of a cross-specialty shared clinical informatics credential or separate specialty of 'clinical informatics' frameworks.

4. Telemedicine

During the COVID-19 pandemic governments worldwide promoted increased use of remote healthcare delivery models within healthcare settings. The use of telemedicine expanded significantly during this time, helping reduce the number of in-person consultations and mitigate against spread of COVID-19. Although the experience of telemedicine and remote healthcare delivery is mixed among physicians, there is a high level of satisfaction among patients accessing these services.[13-14] There is currently uncertainty whether telemedicine is complementary or a substitute for in-person care; whether telemedicine leads to reduced need for further care or leads to duplication with further in-person consultations. There is also an increased need to consider safeguarding and patient confidentiality when using telemedicine as the clinician (you can't see who else may be present), and also the risk of bias against those with no access to mobile phones or good Wi-Fi.

The reality is that telemedicine has become a core part of business as usual in many healthcare organisations. This is, however, an evolving space as technological innovation may further enhance the ability to deliver remote healthcare through the use of digital devices by providing accurate observations or supporting remote examination e.g. heart rate, ECG monitoring. Possible benefits of remote healthcare delivery for patients include enhancing access to healthcare for various patient groups such as underserved groups, working-age patients or those in rural settings. A recent report commissioned by the Organisation for Economic Co-operation and Development recommends further research into current practices of remote healthcare and its implementation, and development of healthcare models to integrate these services seamlessly with in-person services.[14]

Gap

There is a need for programmes which incorporate training on the integration of remote health care delivery specific to the specialty and support research and innovation in developing this model of health care delivery further.

5. Video based assessment

Video based assessment is increasingly important across a number of specialties. For example, a significant portion of surgical training, regardless of level, is dedicated to acquiring procedural skills, with video assessment as a key component. Currently, resident doctors undergo assessment through a portfolio of written procedural reflections and evaluations, such as Procedure-Based Assessment and Case-Based Discussions. However, a study by ASiT in 2020 revealed regional inconsistencies in the required number of assessments, with 90% of resident doctors reporting knowledge of inaccuracies in assessment submissions and 67% aware of doctors making comments on behalf of their trainers. While operative video technology is already established, with recording hardware available in many theatres, particularly in specialties performing minimally invasive

procedures, there remains a decline in resident doctor-logged operative cases. Video-Based Assessment presents an opportunity to enhance the efficiency of doctor learning and reflection during the assessment process.

Gap

There is a need to integrate standardised video-based assessment into procedural evaluations at all stages of training so that we mitigate regional disparities in assessment practices and optimise the resident doctors' learning efficiency from evaluated cases. It is important that specialty-specific development involve key stakeholders such as the Joint Committee on Surgical Training [JCST].

6. Standardised Robotic Curricula

Robotics is becoming an increasingly important aspect of healthcare, particularly in some specialties. According to the Royal College of Surgeons of England's Future of Surgery[15] report, it is anticipated that within the next 20 years, virtually all surgical specialties will incorporate some form of robotic system into their practices. However, in the UK, there is currently no standardised pathway for robotic surgery training. While various courses are available, organised by individual associations and often by industry, there exists significant disparity in access to robotics training among different hospitals, different regions and doctors in training groups. Moreover, the availability of different platforms with unique training pathways exacerbates these barriers to access and inequities among resident doctors.

Gap

We need further work involving resident doctors and key stakeholders across and within individual specialties on specialty-specific standardised robotic training pathways and platforms.

7. Vascular access ultrasound

While ultrasound has been often stated as a potential replacement for the traditional stethoscope, its growing importance in the medical field cannot be denied. Vascular access, a critical aspect of every doctor's career, poses challenges, particularly with the increasing number of patients with complex morbidities and repeated interventions and hospital stays. It is imperative that we equip new doctors with the necessary skills to perform vascular access safely and effectively, especially in challenging cases. Research has shown multiple needle insertion attempts causes patients to lose trust in their health care providers and experience anxiety in an already difficult time of their life.[16] With evidence to support increased first pass success with ultrasound usage,[17] more

so in difficult cases, and our foundation programme doctors representatives requesting to learn this skill as part of their core curriculum should be supported. It is important to acknowledge that the expansion of training capacity will have financial and capacity implications, in terms of the number of ultrasound machines required and trainer capacity.

Gap

Not all foundation doctors currently have the opportunity to learn how to use vascular access ultrasound. There is a need to regionally coordinate the delivery of this training, as part of protected training time, with no additional personal cost to resident doctors, and with the provision of appropriate equipment.

8. Focused ultrasound and echocardiography

The final thing we look at is another established technology, ultrasound and echocardiography. There is currently insufficient capacity within the UK's cardiac physiologist workforce to deliver emergency ultrasound and echocardiography services round the clock to acutely unwell patients.[18] In hemodynamically shocked patients, focused ultrasound and echocardiography can offer crucial diagnostic insights that may lead to life-saving interventions.[19] Increasingly, a variety of specialty doctors managing acutely unwell patients have acquired skills in focused ultrasound and echocardiography, often through commercially run courses and investing their own personal time to complete accreditation.

Acute internal medicine has spearheaded the integration of point-of-care ultrasound into its curriculum, making it a mandatory competency. Emergency Medicine is now in the process of adopting similar measures. However, a substantial hurdle remains in ensuring uniform access to training, exacerbated by significant regional variations in mentor availability and allotted training time within rotations. Again, any expansion will have implications for equipment numbers and trainer capacity, and it is important that we factor these into any discussions.

Gap

Not all resident doctors who manage acutely unwell patients in shock have access to training in focused ultrasound and echocardiography skills. There is the potential for greater regional coordination of such training provision, to ensure that it can take place in protected training time, and without incurring additional costs to resident doctors.

Conclusion

Technological innovation has the potential to transform how we deliver healthcare in the 21st century over the coming decades. In order to maximise the benefit for patients we need to ensure that resident doctors have access to and learn how to use both established technology such as ultrasound equipment, and the latest big developments such as AI and VR as part of their core training, and that this opportunity is available to all those in training.

In this paper, the ARDC has identified a series of gaps which we believe are preventing us from fully embedding technological advances into postgraduate medical training. We stand ready to work with a range of key partners to find solutions that enable us to maximise the potential of these advances.

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On behalf of the following members:

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