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COMMENTARY

Teaching millennial surgeons

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Abstract

Surgical training has been evolving with time. We describe the major drivers for these changes that have taken surgical training to where it is today. As we look forward to training the millennial generation, we need to reflect on the current mass adoption of technology. The simplicity and improved access to communication and information is now revolutionising the way we practice health care and the way surgeons train.

Keywords: *simulation; education; millennial; surgeons; surgical; training*

Today we find ourselves immersed in technology and there is high expectation for information and processes to be digital, on demand and up to date. In fact, separation from smart devices and the internet can often lead to anxiety.

The millennial surgical trainee differs in many ways from the previous generations of surgeons. We describe how and why surgical apprenticeship has evolved, how millennial surgeons think, followed by an exploration of tools that will contribute to the future of training.

The formalization of the apprenticeship model used today in medical training is often attributed to Dr William Stewart Halsted (1882–1922) of Johns Hopkins Hospital. Dr Halsted described a system where progression was pyramidal and the relationships hierarchical.[1] The system has since seen improvement by other educators but its fundamentals remain very similar in modern day training.

The drivers for changes in the way we train rely on significant events, which face strong resistance even in the face of evidence. A great example of a change in medical training was the work time and pattern changes to combat medical errors caused by overworked staff. These changes would not have been implemented if the existing practices had not been challenged by court cases such as the Libby Zion case in United States, where doctors were prosecuted for murder on the grounds of negligence.[1] The European Working Time Directive has also placed heavy limitations on the legal limits on maximum weekly working time limits, night time work and the need for breaks. These changes help to support the well-being of staff but they have also reduced the clinical exposure of the trainees. This has caused concerns as to clinical competence as the training infrastructure is mostly based on years in training.

Another important shift to hit medical education resulted from the Institute of Medicine report "To Err is Human".[2] This report highlighted the high levels of preventable errors seen in clinical practice. Alarmingly a follow-up paper[3] looking at more up-to-date studies showed that a more realistic estimate is more than twice to four times the originally estimated yearly 98,000 errors in the "To Err is Human" report. This was a wake-up call for a revision of the systems in place that led to error. A large drive for additional training followed this report based on lessons learnt from other high-risk industries leading to the boom of simulation.

Not all shifts in the way we train are a result of negative events. A great example is the independent review led by Professor David Greenaway entitled Shape of training: securing the future of excellent patient care. The report was important as it sets a framework for evolving the way we train to better manage changing needs of the patient population while minimizing the disruption to the service provided to patients.[4]

We are now in the midst of the next shift in health care and education due to the boom of the smartphone. Since the release of the smartphone, we have witnessed mass self-adoption of technology with the capability to access and view audio, video and interactive applications, referred to as apps. Although educators have not widely embraced this opportunity, we can see from research that there has been a natural uptake of apps and the internet as educational and referencing resources.[5]

The smartphone has revolutionised the way we access information and the way we communicate with each other. Information has become accessible through the World Wide Web on a portable and affordable device that is notably faster than the traditional computers we find in hospitals. Now learners are able to easily access the traditional online resources, and through apps they may access information made available offline.[6] The growth of Wi-Fi access in health care and academic institutions has been a key factor in improving quick access to resources, where previously there have been long-term problems with cell phone reception and slow desktop computers.

The natural approach for searching for information online has been problematic however. Learners tend to use a generic search engine and most frequently end up on non-medical websites such as Wikipedia. These sites are mostly text based and are not intended to be resources for clinicians. A number of deficiencies, primarily omissions, have been identified, such as pathophysiology, signs and symptoms, diagnosis and treatment options, as well as omission of classification systems.[7] However, the data on Wikipedia show that the number of updates do correlate with clinical accuracy.[7]

From a survey study, we see that medical students and junior doctors have naturally taken up apps to help them. The app usage pertains to learning or checking information on the go and organizational or communicational usage. Each of these purposes of apps has been used to deliver training, and it is a common finding that most medical students and residents own a smartphone and regularly use medical apps.[6]

Improving accessibility of textbooks and other structured learning resources is by no means novel. We have seen large publishers provide digital platforms, such as Elsevier with Student Consult, for use in accessing and searching for information on the web. Access to textbook resources is now also reaching smartphones and tablets as apps or e-books. As well as the traditional publishers, we can also see new organizations creating professional content for trainees and medical students. These are good for learning or revising on the go or as a method to quickly check information while working. Reference material apps and medical score calculator apps are the most prevalent apps available for use during clinical attachments.[8] Access to learning resources does not have to be through dedicated medical apps but can be through video streaming apps such as YouTube, book reading apps, or even the app-based web browsers.

Online structured resources that are available on smart technology may allow for better delivery of information during opportunistic moments. The materials can also be personalized for the learner. We have seen streaming of curated mobile broadcast content to medical students in the form of podcasts with great success,[9] but information can be obtained from lectures, videos, links and other resources. Institutions have also used apps to build upon and document learning and reflection. In one study, residents who have used dedicated apps as a workplace reflection tool have reflected on their practice more often, captured more learning opportunities and reported more progress in their learning than their non-app-using colleagues. Trials have also demonstrated that app-based logbooks have improved usage.[6]

We can also see that a new wave of communication opportunities has been opened up by smartphones for health data collection, input and even telementoring. Health care professionals, for the purpose of teaching, have also used communication apps such as WhatsApp as part of a structured educational programme.[10] Social media apps such as Twitter have been adopted at surgical conferences as a tool to supplement the activities and interaction with the learners.[11]

Past academic research on e-learning has lingered on the non-inferiority/superiority of the new technology in comparison with non-intervention or traditional teaching. For e-learning to progress, the focus of future e-learning research will need to be on the evolution and deployment of these novel training tools.[12] Another issue faced by research is the pace at which technology is growing and the speed at which new apps are being released. Until there is a research effort able to tackle this, we can look for content that is curated by leading associations or where particular apps carry endorsements from such associations. The US Food and Drugs Administration and Medicines and Healthcare products Regulatory Agency in the United Kingdom have already begun to regulate medical apps that can be classified as medical devices.[13] We should expect further regulation, guidance and endorsement procedures to come in the future. We expect there will be a growing need to the filter the content and approve apps for clinical use, and work is already underway to understand the landscape.[8] Seabrook et al.[8] reveal that most medical apps are reference tools followed by learning apps, then diaries/monitoring, then calculators. Other app purposes included patient records, conferences, diagnostic aids, medical reminders, alternative medicine and nutrition/diet. Of the medical apps available for clinicians, we see the most prevalent target is general surgery (38%) followed by plastic surgery (24%), orthopaedics (16%), urology (10%), cardiac (7%) and neurosurgery (5%).[13]

A further shift developing is the evolution of wearable smart devices. A smart device is an object that can interface with its environment, other devices, or local/external networks via sensors, Bluetooth, Wi-Fi, modem or other connectivity methods. A smart device becomes a wearable device when it is designed to be wearable as a personal accessory (like glasses, watches or jewellery) or integrated into clothing or a new creation (such as fitness bands). The wearable has been the cause of much excitement in the medical world for its application to patients. Wearable technology allows us to submit and access data with little distraction to our current activity. We have seen applications of wearable technology in surgical practice and in surgical education. A notable device to receive media coverage for its use in surgery was the Glass (Google, California, USA), a head-mounted near-eye display with camera and microphone. Example uses for Google Glass in the operating room include monitoring of patient vitals by anesthetists,[14] accessing patient imaging by surgeons[15] and overlaying fluorescence imaging into the surgeons view to find sentinel lymph nodes[16] and cancer cells.[17] Data collection is also possible such as taking photos, videos and audio recordings for documentation or for education purposes. The ability to be connected to the internet has also allowed for examples of tele-proctoring[18] and live broadcasting of surgical procedures from the surgeon's view for the education of students.[19,20] However, until wearable technology becomes affordable and self-procured by the trainees, we suspect it will not become part of everyday practice in the way we have seen with the smartphone.

Conclusions

There is widespread natural adoption of smartphone technology by the general population, including surgical trainees and medical students. This technology provides a platform that breaks down the traditional barriers to accessing information and the ways we can curate and distribute that information. With time, we expect an improvement in the regulatory processes and pathways for content endorsement. Augmented reality and wearable technology is also making its way into health care delivery and education. As this technology matures, we will begin to see scalable use cases in surgical training.

Conflict of interest

Andre Chow and Jean Nehme are directors of Touch Surgery, a smartphone-based surgical simulator. Ali Nehme Bahsoun currently works at Touch Surgery and collaborates with academic institutions to facilitate research.

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