The Past, Present and Future of Surgical Education in Ireland

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Received: 2 June 2021 / Accepted: 7 June 2021 / Published online: 22 June 2021
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Abstract

The Royal College of Surgeons in Ireland (RCSI) was founded primarily to advance the standards of surgical training and surgical practice in Ireland. Over the course of almost 240 years, the College evolved as a comprehensive University of Medicine and Health Sciences, delivering education not only in Surgery but also in Medicine, Physiotherapy, Pharmacy and Nursing. RCSI today has a large global footprint and runs healthcare education programmes in several international locations. The College works in close collaboration with the other surgical Royal Colleges in Great Britain and the four colleges have a common surgical curriculum. RCSI recognises the increasing challenges facing traditional surgical training models and therefore has developed structured education programmes to support the conventional apprenticeship model. Surgical training in Ireland includes comprehensive training in both technical (operative) skills and non-technical (human factors) skills. RCSI is committed to the integration of simulation in surgical training and has invested heavily in state-of-the-art simulation facilities and in next-generation education technologies such as virtual reality, augmented reality and Artificial Intelligence-based educational technologies. Formal surgical training programmes in Ireland are complemented by a range of Masters programmes in Surgical Science and Practice and also Human Factors in Patient Safety.

Keywords History of surgical training · Human factors in surgery · Simulation in surgical training · Next-generation education technology

During mediaeval times, the practice of surgery in Ireland was licensed by the Barber-Surgeons' Guild, also known at the time as the Guild of St. Mary Magdalene. Guild membership was obtained by a 3-year apprenticeship followed by 2 years as a master. In 1446, the Barber-Surgeons' Guild was incorporated by royal decree of King Henry VI, becoming the first medical corporation in Britain or Ireland [1]. For more than 300 years, this was the general format of surgical training in Ireland.

The Royal College of Surgeons in Ireland (RCSI) was founded at the behest of a group of Irish surgeons who had formed the Dublin Society of Surgeons and who wished to promote the professional standards of surgical training and surgical practice in Ireland. These surgeons aspired to have a separate college from the barbers, developed along the lines of the College de St Cosme in Paris which had been regulating French surgeons since the thirteenth century

[2]. The Royal College of Surgeons in Ireland (RCSI) was founded formally on 11 February 1784 by royal charter of King George III, then monarch of Great Britain and Ireland. This historic landmark is celebrated at an annual Charter Day Meeting which is the premier surgical scientific conference in Ireland.

In its early years, RCSI had no permanent home and College meetings were held in one of Dublin's hospitals. The College acquired its current headquarters site on Dublin's St. Stephens Green and in 1810 built the Surgeons' Hall, which still forms part of our College buildings to this day (Fig. 1). RCSI has continued to develop its physical infrastructure and now has a large modern healthcare campus in the centre of Dublin.

Over the course of almost 240 years, RCSI has extended its healthcare education activities beyond surgical postgraduate training. In 1885, the College founded an undergraduate medical school. This set the College apart from its three sister colleges in Great Britain which focus exclusively on surgical training and practice. The RCSI Medical School is now the largest medical school in Ireland. In 1999, RCSI founded an undergraduate School of Physiotherapy and

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Fig. 1 a Original Surgeons' Hall, 1810. b RCSI, 1837, incorporating Surgeons' Hall

3 years later, in 2002, established a School of Pharmacy. At a postgraduate level, RCSI runs training programmes in Nursing, Radiology, Dentistry, Sports and Exercise Medicine and Physician Associates studies in addition to extensive programmes in Surgery and Emergency Medicine. RCSI also has a very vibrant research programme, focusing mainly on vascular biology, breast cancer, neurological disorders, cystic fibrosis and regenerative medicine. The research programmes currently attract €24 million per annum in research funding income. RCSI also has a very successful Institute of Leadership which runs various Masters programmes on healthcare leadership, management and quality and safety.

From the earliest times, RCSI has had a strong international perspective. Doctors from all over the world (including many hundreds from India) have come to study in RCSI at both undergraduate and postgraduate level. Today, RCSI has more than 21,000 alumni in 94 countries around the world and 9600 Fellows and Members (surgeons) working in 86 countries. These doctors are attracted to Ireland by the high quality of medical education and postgraduate training. Most have fond memories of their time in Ireland, a friendly country with a long tradition of welcoming international students from around the world and incorporating their families into Irish life.

Given RCSI's international focus, it was a natural progression that it would develop education programmes in overseas sites. In collaboration with University College Dublin, RCSI opened its first overseas medical school in Penang, Malaysia in 1996. RCSI went on to open medical schools in Bahrain in 2004 and in Perdana, Malaysia in 2011. The College also opened a satellite Institute of Leadership in Dubai in 2005. In collaboration with the Irish government, the College developed an important relationship with the

College of Surgeons of East, Central and Southern Africa (COSECSA) in 2007. This collaboration was to help with development of surgical training in some of the most disadvantaged countries of Africa, whereby surgeons are trained in their native country rather than having to spend time overseas. In 2020, RCSI launched its Institute of Global Surgery and appointed Professor Mark Shrive to the O'Brien Chair of Global Surgery.

In 2019, the College was officially designated as a university by the Government of Ireland (RCSI University of Medicine and Health Sciences) and is the only not-for-profit, entirely independent third level institution. As such, RCSI charts its own course in pursuit of an exceptional education for future healthcare leaders. RCSI is currently ranked in the top 2% in the Times Higher Education World University rankings [3]. RCSI also achieved Ireland's highest position in the Times Higher Education (THE) University Impact Rankings 2021, coming joint second in the world for "Good Health and Wellbeing". THE University Impact Rankings recognise universities around the world for their social and economic impact based on the United Nations' 17 Sustainable Development Goals (SDGs) [4].

RCSI has developed well beyond the aspirations of its founding fathers. Despite the breadth and diversity of the healthcare education programmes now delivered by RCSI, surgical education and training and supporting standards of surgical practice remain a core function. RCSI is the postgraduate training body for surgery for Ireland accredited by the Irish Medical Council.

For many generations, surgical training in Ireland followed the "apprenticeship model" described above and popularised by the great American surgeon William Halsted [5]. Surgical trainees were attached to individual

surgeons in hospitals and learned the art and craft of surgery by experiential immersion. Surgical training was largely unstructured: trainees commenced surgical training at the level of “senior house officer”, progressed to higher levels as a “registrar” and eventually were subjectively deemed to have been “trained”. Many Irish surgical trainees went to Great Britain for 3 to 5 years before returning to Ireland to take up registrar posts. The only formal assessment was the FRCSI (Fellowship) examination, usually taken after the first 3 years of training and no further examinations took place at the end of training.

The apprenticeship model worked well and produced generations of fine surgeons. However, there were two important ingredients which were (and still are) essential for the success of the apprenticeship model. The first was the opportunity to engage in a large volume of surgical practice and this entailed working long hours over many years. The second ingredient was the close professional relationship between trainer and trainee, a relationship in which the trainer really understood both the strengths and the learning needs of the trainee.

The first attempts to put real structure on surgical training were in the early to mid-1970s. Since then, three important developments have taken place.

Intercollegiate Structures

Increased collaboration has developed between the four Surgical Royal Colleges in Great Britain and Ireland (Royal College of Surgeons of England, Royal College of Surgeons of Edinburgh, Royal College of Physicians and Surgeons of Glasgow and Royal College of Surgeons in Ireland) that has resulted in a common approach to surgical training under the Joint Committee on Surgical Training (JCST) and Joint Committee on Intercollegiate Examinations (JCIE).

Surgical training was formalised as a time-based structure with the development of Basic Surgical Training (3 years, BST) and Higher Surgical Training (4 years, HST). In practice, surgical trainees usually spent 3 to 4 years between BST and HST during which they accrued additional surgical experience and engaged in academic research, usually leading to a higher degree by thesis. Furthermore, surgical trainees usually went overseas at the end of HST for a further 1 to 2 years of “fellowship training” before returning to Ireland to take up consultant posts. The reality was that, for most surgical trainees, training was 13 to 14 years in duration. Completion of training was an arbitrary event with no formal “sign-off” and no “exit examination”: surgeons were deemed to be competent by virtue of having completed a long and arduous apprenticeship.

Intercollegiate “Exit Examination”

During the early 1990s, the Fellowship Examination (FRCS), usually taken at the end of BST, was replaced by two new examinations. The Membership Examination (MRCS) was introduced to mark the completion of BST, usually taken after 2 years of surgical training. This examination now also takes place in numerous centres around the world including several centres in India. Success in the MRCS examination became a requirement for progression to HST. A new and more rigorous Intercollegiate Specialty Fellowship Examination (FRCS) was introduced at the end of surgical training. This is a true “exit examination” which examines the entire syllabus of surgical training [6].

Intercollegiate Surgical Curriculum Programme (ISCP)

The ISCP, introduced in 2007, is an agreed curriculum between the four Surgical Royal Colleges which defines the structure, content and assessment framework for surgical training in all surgical specialties [7]. It is, without doubt, the most comprehensive surgical curriculum in the world today. The structure of surgical training has become standardised across Great Britain and Ireland and now consists of 2 years Core Surgical Training (CST) with seamless transition to 6 years of Higher Specialty Training (HST). The 2-year CST programme (ST1/ST2) is designed to introduce surgical trainees to the principles of surgery in general before trainees embark on a chosen specialty (ST3–ST8). The ISCP places major emphasis on assessments during training with documentation of competencies and trainees required to maintain a detailed electronic logbook and portfolio. The rigour of assessments means that the Colleges can truly “stand over” the competence of trainees at the end of training.

Notwithstanding these changes, the apprenticeship model came under pressure due to the long duration of training (12–14 years) when compared to more focused training programmes in North America (5–7 years). At the same time, legislative restrictions in many countries reduced the number of hours that trainees could work each week. Together, these pressures significantly affected the essential ingredients of an apprenticeship model, i.e. large-volume practice and a close relationship with the trainer. In addition, increasingly complex technology in surgical practice, e.g. minimally invasive surgery, began to limit opportunities for trainees to perform procedures and regulator-led requirements increased the need to verify and document competence of trainees. Finally, the public quite

understandably expected their surgical procedures to be performed by a senior surgeon and not a trainee.

RCSI has responded proactively to these challenges by developing programmes to support surgical training outside the hospital environment. As early adopters of simulation as an adjunct to workplace experiential learning, RCSI launched a simulation programme that this has grown over almost 20 years [8]. All surgical trainees now undertake Surgical Bootcamp in the first week of Core Surgical Training [9]. This 5-day intensive induction course teaches the skills necessary to optimise training in the clinical environment, e.g. knot-tying, suturing, anastomosis and core laparoscopic skills. It also teaches non-technical skills, e.g. decision-making, critical care and crisis management. After Bootcamp, all trainees return to the skills centre on 5 days each year for intensive skills/procedure training based on a clearly defined syllabus for operative surgery. The simulation teaching uses state-of-the-art simulators and models and is delivered by expert surgical faculty with a high tutor to trainee ratio. At the end of each year, all trainees have a formal high-stakes skills assessment which counts towards career progression.

All of the technical skill procedures which the trainees perform in the simulation centre can be recorded and uploaded onto each trainee's individual portfolio using a commercial learning management system, Learning Space [10]. This allows trainees to track their progress over time and compare their progress with their peers.

RCSI recognises that good surgical performance is not based solely on clinical knowledge or technical expertise. Human Factors play an increasingly recognised role in outcomes in many high-risk industries and activities, including surgery. For this reason, RCSI has developed a formal structured programme, Human Factors in Patient Safety, which is a mandatory component of training for all surgical trainees across the duration of their training programme [11]. All RCSI trainees attend for 3 days each year of Human Factors training according to a clearly defined curriculum. The Human Factors training is delivered by clinical psychologists along with senior surgical faculty in purpose-designed simulation facilities that include a fully equipped mock operating room, emergency department and intensive care unit.

As with the technical skills, there is an annual assessment of Human Factors performance which counts towards career progression. RCSI was the first training body in the world to introduce Human Factors training as an integral part of surgical training for all surgical specialties.

Arising from commitment to Human Factors in achieving good clinical outcomes, RCSI has developed a Postgraduate Diploma/Masters programme in Human Factors in Patient Safety. These programmes are accredited by the National University of Ireland and are delivered fully online. The programmes are taken part-time over 1 year (Postgraduate Diploma) or 2 years (Masters) and are open to surgical

healthcare professionals (doctors, nurses and allied healthcare professionals) anywhere in the world [12]. Current participants in the programme include surgeons and other healthcare professionals in the Far East, New Zealand, the Middle East and North America as well as Ireland. The programmes provide a strong academic foundation to the science of Human Factors in Patient Safety.

Recognising the importance of simulation in postgraduate surgical training, RCSI opened a brand new, purpose-designed, state-of-the-art simulation facility at its Dublin campus in 2017. This significant investment underpins RCSI's commitment to innovative teaching and learning techniques. Across almost 3500 m² of dedicated simulation facilities, RCSI students and surgical trainees are able to hone critical competencies in a safe, highly immersive and feedback-rich environment (Fig. 2).

Two years ago, RCSI introduced an innovative Masters in Surgical Science and Practice. This is a 1-year fulltime programme based on the curriculum for Core Surgical Training. Trainees on this Masters programme participate in all the activities of hospital life (ward rounds, outpatient clinics, operative sessions, nights "on call" and multidisciplinary team meetings) but in a fully simulated "virtual hospital" environment [13].

Looking to the future of surgical practice, it is important to consider how this will impact on surgical education and training needs.

Technology

The practice of surgery is becoming more and more embedded in complex technology. Technologies such as robotic surgery, advanced minimally invasive surgery and computer-assisted surgery are just some examples of how technology is radically changing the delivery of surgical care. Surgeons of the future will need to be trained, not only how to do surgical procedures, but also how to safely use the technology. It will not be appropriate that this training takes place in the real operating theatre while operating on live patients: instead, training for complex technology will need to take place in a simulated environment where surgeons can train to competence without putting patients at risk [14]. Furthermore, there will need to be a process for verification and documentation of competence (e.g. credentialling). Finally, surgeons will need to have recurrent training throughout their surgical career rather than just during their training years, much as happens presently in other high-risk industries. This will be a significant culture change for our surgeons of the future.

Over the next few years, Artificial Intelligence will radically change the way we deliver surgical healthcare. Predictive analytics, computer-generated algorithms and intra-operative decision-support systems will have a profound

Fig. 2 **a** Mock ICU used for training health professionals during COVID pandemic. **b** Mock operating room with adjacent control and viewing room

impact on surgical practice. Training programmes will need to incorporate these innovations [15].

People

The people, both patients and professional colleagues, with whom surgeons interact are changing. Patients are becoming older, have increased comorbidities and, most importantly, have increased expectations of health care providers. Work colleagues now come from a wide variety of healthcare professional backgrounds. Surgeons of the future will need specific training in the non-technical/personal skills required to manage both patients and colleagues.

Regulation

There will undoubtedly be an increasing onus placed on surgical training bodies to verify and document the competence of future surgeons: this verification will need to be based on objective criteria which can withstand critical scrutiny. Regulators will no longer rely on “passage of time” or subjective rating by trainers who have a long-standing relationship with trainees to “sign-off” on the competence of surgical trainees.

Healthcare Process

Healthcare itself is becoming increasingly complex: healthcare economics, healthcare management, surgical innovation

and process improvement science are just some examples of issues which impact on surgical healthcare delivery. It will be important for surgeons of the future to have some education in these important areas in order to function effectively as part of a surgical healthcare team.

The next 5 to 10 years will be a very exciting time for surgical practice and for surgical education and training. Surgery is undergoing an immense transformation, probably greater than any change which has occurred in the past 100 years. RCSI is committed to being at the forefront of developing solutions to the challenges of producing competent, fit-for-purpose surgeons for the next generation. After all, these surgeons will be the people who care for us when we ourselves become ill: we must train them well!

Funding Open Access funding provided by the IReL Consortium

Declarations

Conflict of Interest The authors declare no competing interests.

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References

1. Ellis H (2001) The company of barbers and surgeons. *J R Soc Med* 94:548–549. <https://doi.org/10.1177/014107680109401022>
2. Franzese CB, Stringer SP (2007) The evolution of surgical training: perspectives on educational models from the past to the future. *Otolaryngol Clin N Am* 40:1227–1235. <https://doi.org/10.1016/j.otc.2007.07.004>
3. <https://www.timeshighereducation.com/world-university-rankings/rcsi-university-medicine-and-health-sciences>
4. https://www.timeshighereducation.com/rankings/impact/2021/good-health-and-well-being#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/undefined
5. Halsted WS (1904) The training of the surgeon. *The Johns Hopkins Hosp Bull* 162:267–275. <https://doi.org/10.1001/jama.1904.02500210043006>
6. <https://www.jcie.org.uk>
7. <https://www.iscp.ac.uk>
8. Dumon KR, Traynor O, Broos P, Gruwez JA, Darzi AW, Williams NN (2004) Surgical education in the new millennium: the European perspective. *Surg Clin North Am* 84:1471–1491. <https://doi.org/10.1016/j.suc.2004.06.005>
9. Heskin L, Mansour E, Lane B et al (2015) The impact of a surgical boot camp on early acquisition of technical and non-technical skills by novice surgical trainees. *Am J Surg* 210:570–577. <https://doi.org/10.1016/j.amjsurg.2014.12.046>
10. <https://www.caehealthcare.com/learningspace/>
11. O'Keeffe DA, Losty M, Traynor O, Doherty EM (2020) Objective assessment of surgical trainees' non-technical skills: improved performance following a two-year program of instruction. *Am J Surg* 220:1566–1571. <https://doi.org/10.1016/j.amjsurg.2020.04.039>
12. <https://www.rcsi.com/dublin/postgraduate/taught-courses/human-factors-in-patient-safety/why-human-factors>. Accessed 21 June 2021
13. <https://www.rcsi.com/dublin/postgraduate/taught-courses/surgical-science-and-practice/why-rcsi-dublin>. Accessed 21 June 2021
14. Buckley CE, Kavanagh DO, Traynor O, Neary PC (2014) Is the skillset obtained in surgical simulation transferable to the operating theatre? *Am J Surg* 207:146–157. <https://doi.org/10.1016/j.amjsurg.2013.06.017>
15. Keane PA, Topol EJ (2021) AI facilitated healthcare requires education of clinicians. *Lancet* 397:1254. [https://doi.org/10.1016/S0140-6736\(21\)00722-4](https://doi.org/10.1016/S0140-6736(21)00722-4)

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