

## Apprenticeship Model in 21st Century's Surgical Education: Should it Perish?

Saadia Shahzad, Muhammad Idrees Anwar

**IMPORTANCE** Traditionally the Apprenticeship has remained the backbone of any surgical training model for decades. This model ensures optimal surgical training quality by ensuring optimal trainer-trainee relationship and adequate exposure to the disease and operative spectrum. In this 21st century, both the quality of meaningful trainer-trainee interaction and operative or clinical exposure has come at stake due to multiple factors. These factors include rapidly advancing technology, more residents, the evolution of subspecialties, reducing working hours, and many others, which greatly compromise the strength and quality of apprenticeship. Keeping in view the strengths and benefits, and also identifying the need in the 21st century this model needs reincarnation. Newer pursuits like Proficiency-Based Progression (PBP) through Osler and Halstedian Model, quality assured assessment, use of simulated settings, augmented reality, and robotics are few choices. A carefully planned incorporation of strategies into these newer learning models is pivotal to maintain the essence of apprenticeship for not only keeping this model alive but also ensuring the quality of meaningful trainer-trainee interaction and adequate clinical exposure in surgical training.

**KEYWORDS** Surgical Training, Apprenticeship Model, Medical Education, Residents, Trainees

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### Perspective

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Surgical training, traditionally, has remained more challenging, as the trainers not only have to impart on the clinical decision making and soft skills but also to the technical and motor skill realm. Going back in the history of surgical education it is very clear that since its inception, surgical education and training have undergone marked evolution. The initial attempt to improve surgical education was made in 1210 when in France clear differentiation and distinction was made between the 'academic surgeons' and 'barber surgeons'; where the first category was to be labeled so based on previous relevant university training in this regard. As a result, specified to the first category of academic surgeons 'The College de Saint Come' was established to systematically and methodically train the barbers in surgery<sup>1</sup>. For decades, the training has been my "role modeling' however the very first model of surgical training adopted, developed, and introduced in the 19th century is the 'apprenticeship model'. This method of training is ideally used to start at the age of 12-13 years and it would usually take 5-7 years of training for the students to become skilled surgeon<sup>2</sup>. The students were supposed to learn surgical skills through direct observation of their mentor and were then meant to replicate the same skills in a similar environment of an operating room (OR). The application of the apprenticeship model significantly improved surgical education, as an experienced mentor instructed the trainee, shared collective knowledge, and taught the surgical skill by demonstration, repetition, and scaffolding. The

apprenticeship model also promoted the "cult of the individual," with the development of masters who helped in developing competing "schools of surgery".

This model over many decades produced reliable training outcomes; however, few important challenges did emerge over some time. The major drawback was that it lacked structured programs available as to what skills were needed to be taught. It was based more on subjectivity and opportunity. Also less clear was the fact that for how long the training period should be? Who would be the eligible student for this training? <sup>2</sup>

Impressed by the German way of surgical training, William Halsted was the first to propose and implement a more robust structured way of surgical training at Johns Hopkins at the start of this century. Halstedian Residency training model soon gained support and, in 1928, the American Medical Association House of Delegates approved the application of this model in a more generalized way<sup>3</sup>. This model was based on the principle of 'see one, do one and teach one. It worked on the premise that acquiring increased responsibility by the surgical students' entails their becoming near-independent in the field of surgery. This model has successfully produced quality surgeons, teachers, and leaders in the field of a surgery over the last century<sup>3</sup>. Many developing countries still rely on this model of surgical training or a variant of it. Hence, Dr. Halsted is still

considered the father of modern structured clinical training in surgery

Halstedian model did not abrogate the apprenticeship model in principle but provided a structure and standardization to it. The master and the mentor still holds the key position in training and resident modeling. Over the past century, the Halstedian approach has evolved into Osler and Mall's competency-based progression in surgical training. These models have effectively produced well standardized, competent, and finest surgeons, who have performed brilliantly in American as well as international perspectives and still prevalent in many training programs.

However, over time, the need for more advanced techniques kept evolving that could give enhanced safety and training structure. There was a very obvious limitation that was being overlooked for a long time in apprenticeship and Halsted model and that was: 'to err is human' according to the landmark report of Institute of Medicine in 1999; stating the fact that each year around 44000 – 98000 patients in the hospitals of USA die due to preventable medical errors<sup>4</sup>. Evidence suggests that trainee doctors are responsible for most prescribing errors<sup>5</sup>. The report also challenged the patient safety factor of the patients while students were trained by these models, and so alternative methods of surgical training and teaching were started gaining attention<sup>4</sup>. Another reason for shifting was the higher cost of training surgical residents in OR with the mentor<sup>6</sup>. Therefore, teaching surgical skills outside OR with the added benefit of enhanced patient safety, less stressful teaching environment; led to the foundation of virtual simulated-based training in surgical education<sup>7</sup>. This innovative model enables a surgical trainee to learn and practice minimally invasive surgery on synthetic models, animals, or cadavers; in virtual and augmented reality<sup>8</sup>. The quality of training in a simulated environment, however, remains inferior to real-life training opportunities. Advances in Minimally Invasive Surgery (MIS) and Robotic Surgery are pushing us to rely more on the simulated setting, virtual reality, and augmented reality to teach decision making and motor skills in a safer environment, which certainly has advantages and has proven to be beneficial for the surgical training. Few, however, fear losing adequate attention to clinical exposure and real-life operative exposure which have remained instrumental in making great surgeons in past.

Recently during the last couple of decades, the development of soft skills in surgeons has gained attention. Technological advancement, higher expectations of the stakeholders in health care, skyrocketing health care cost, and enhanced awareness on part of the patient; has led to the fact that besides a modernized and enhanced skill training program, soft skills of the surgical trainees must also be developed well, to ensure the satisfaction of the stakeholders in health care. The Royal College of Edinburgh labels these as non-technical skills in surgery (NOTSS) which can be broken

down as skills and behavior, situational awareness, decision making, communication skills, teamwork, and leadership behavior<sup>9</sup>. It's now long proven that errors in the surgical field occur not only because of technical faults, but these soft non-technical skills also have a major role to play in certain situations<sup>10</sup>.

You will all agree that now the training of surgery is not as robust as it used to be<sup>11</sup>. This could be attributed to changes in the training models, gradual shift to simulated settings, rising number of surgical trainees, training hour restrictions, ethical issues, and fewer operative opportunities. These have started eroding this interaction and thus the quality of resident training. This whole narrated context is tinkling my mind towards a query if apprenticeship model is not able to cope up with the evolving need for surgical education? How the basics of apprenticeship would hold in this changing training environment? Is the apprenticeship model of surgical training taking some last breaths? Is it perishing?

The authors' opinion "It's not!"

There is a uniform consensus among the surgical teachers that a meaningful trainee-trainer relationship, harmony, and interaction remains key to quality surgical training. Many components of the apprenticeship training model are still applicable in this day and the overarching umbrella principle of apprenticeship with its progressive step-by-step transfer of patient care responsibilities; with hierarchical autonomy in the OR, is still the main focal point in surgery training program. I would argue in favor of keeping the soul of the apprenticeship model alive in our newer training models and realms. A careful balance needs to be carved between the virtual realities / simulated setting-based curricula and real-life operative experience.

Why apprenticeship model still needs to live? My premises for this counter-argument are:

- Results of the apprenticeship model have consistently proven to be good in producing skill competency in surgical residents and interns.
- Advanced & complicated surgical skill-set training is more effective through apprenticeship, rather than by virtual reality. Clinical methods, clinical judgment, and rationalized clinical decision-making can ideally be taught by this model.
- Role modeling element of apprenticeship model is crucial for imparting affective domain training. The mentor, as a role model, is more effective in training soft skills (behaviorism & communication skills) to the students as compared to the virtual simulated technology;
- Emotional training and intelligence like keeping calm & composed in an emergency or, dealing with disruptive patients can be taught best by this model;

long-lasting mentor-mentee relation; & empathy is best taught by the apprenticeship model.

The authors suggest:

1. Adequacy of quality clinical and operative exposure and trainer-trainee interaction, which is the essence of the apprenticeship model, should remain an important component of any surgical curricular design. The trainer-trainee ratio, patient volume, and operative procedures performed under the supervision and independently should be standardized and competency-based quality assured.

2. Regular trainer's training programs, which can fulfill the role and responsibility of Mentor/Role model in the overarching umbrella of the apprenticeship model can be used to enhance the number of surgical residents and training.

There is no need for the apprenticeship model to bow out on the stage of surgical education! This is and would remain the backbone of any surgical training model. This model will lay back and will not perish.

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