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Surgical Informatics: Defining the Role of Informatics in the Current Surgical Training Paradigm

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Digital transformation is impacting all aspects of life and many industries, such as banking and transportation. Digital tools have similar potential to improve health care delivery, including surgical care. Since the implementation of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, the adoption of certified electronic health records (EHRs) and the development of technological tools to allow patients and providers to share information has increased significantly.(1) With the majority of clinical care now being recorded electronically, there is an opportunity to leverage these data and other novel technologies to improve and advance surgical care delivery. In order to realize the value of informatics in surgical care, we need a workforce that understands surgical needs and can interface with technical teams. In this perspective, we define the field of clinical informatics, describe the potential of informatics to improve surgical care, and propose a framework to train surgical informaticians.

What is clinical informatics?

Clinical informatics (CI) is the application of information technology to healthcare delivery (2) and includes a wide range of technology such as EHRs, picture archiving and communication systems (PACS) for medical images, and smartphone-based secure messaging. Significant technological advances already touch the perioperative space such as navigation devices to guide interventions and complex intraoperative patient monitoring. Our understanding of the value of standardized best-practices in perioperative care, from pre-operative patient evaluation to postoperative approaches to enhanced recovery,

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emphasize the significant implementation challenges and need to master the informatics issues specific to surgical patients. It is important to separate the role of a clinical informatician from that of information technology (IT) professionals who help build, implement, and support clinical information systems. Clinical informaticians leverage their clinical, technical and leadership training to lead and organize the implementation and integration of information systems. Surgeons with formal clinical informatics training are indispensable to ensure that information technologies optimally support surgical practice and research.

Current role of informatics in surgery

There are endless opportunities to combine elements of surgical practice with information technology. In 2017, an expert panel convened at the Surgical Outcomes Club meeting to discuss opportunities for surgical innovation and quality improvement using health information technology.(3) Overall, there is a widespread interest in leveraging EHRs to improve and automate data collection; current manual data extraction and collection methods are expensive and burdensome to implement and maintain. Moreover, both patients and clinicians have expressed an interest in improving overall communication via technology. An example can be seen by the early adoption of patient portals to enhance patient engagement and encourage multidisciplinary approaches to surgical problems. At Vanderbilt University Medical Center, an online patient portal for postoperative visits was accepted by the majority of patients and many surgeons reported that online visits were equally or more effective than in-person visits.(4) As this technology becomes increasingly utilized, the true effects of portals and secure messaging applications must be rigorously studied and appropriate compensation for virtual care must be considered.(3)

A recent review demonstrated the benefits of informatics in various elements of surgical care including enhanced quality of surgical documentation in the EHR, increased adherence to guidelines, and improved surgical outcomes secondary to the development advanced clinical decision support tools and alerting systems.(5) Clinical documentation can be further improved to capture structured data to automate data extraction for existing clinical databases and registries. Technology can be utilized to collect data that were previously difficult or impossible to capture, such as patient reported outcome metrics (PROMs) and biometrics. The technology can also be employed to minimize duplicative work and administrative burden, addressing surgeons' wellbeing and effectiveness. A study published earlier this year demonstrated improved provider satisfaction with the adoption of speech recognition solutions for clinical documentation.(6) Furthermore, access to more sophisticated and accurate data is fueling techniques within predictive analytics including advanced data visualization, machine learning, and artificial intelligence that can lead to a wide range of progressive changes for a surgeons' practice, from real-time case optimization to improved clinical decision support systems.

The integration of informatics in surgical training

The true potential of these technological advances to benefit surgeons can be achieved by formally training surgical informaticians. Formal training provides future informaticians

with opportunities to learn how to implement and evaluate information systems, to adapt to evolving technology, to support clinician users and to promote wide adoption of systems that sustains and elevates clinical objectives. The need for specialized training in informatics was first raised by Dr. Kunstaetter who wrote, “The medical profession has to become directly involved by establishing and supporting medical informatics as a new specialty. To do otherwise would be equivalent to leaving the practice of radiology to physicists or medical therapeutics to the pharmaceutical industry.”(7) CI was first launched as an American Board of Medical Specialties subspecialty in 2013 and since then, over 1,100 physicians have become board certified.(8) It is a unique training paradigm in that board-eligible or board-certified physicians from all specialties can enter the CI subspecialty. In 2008, the American Medical Informatics Association (AMIA) board of directors approved the core content and program requirements for clinical informatics fellowships and the American Board of Preventative Medicine (ABPM) became the home of the CI board certification process.(9) A wide range of job opportunities exist for trained clinical informaticians spanning clinical operations, research, academics, and industry.

Board certification in CI requires completion of the Practice Pathway (available through 2022) or formal training in an ACGME-accredited fellowship program. The two-year CI fellowship programs teach trainees to assess the information needs of clinicians and patients, refine clinical processes, and develop and/or implement technology solutions to meet these needs. At the conclusion of the fellowship, trainees are expected to demonstrate mastery of both their clinical specialty and informatics. In addition, they must demonstrate technical and nontechnical skills necessary to foster organizational change and lead the implementation and management of large-scale informatics projects.(9)

Despite the pervasiveness of information systems in surgery and the establishment of CI training, formal informatics training is unfamiliar to many surgeons. Significant challenges aligning surgical practice opportunities with the clinical informatics fellowship structure and an informatics career have been cited. A specific challenge is the timing of formal informatics training for surgeons. There are currently several options. For surgical trainees in a seven-year program with two years dedicated to research, a formal informatics fellowship may be completed during the research years. Recent changes by the American Board of Preventative Medicine allow surgical residents who have completed training in an ACGME-accredited fellowship in CI to sit for the CI Initial Certification Exam.(10) Trainees can also choose to enter a formal informatics training program after the completion of residency or subspecialty training. However, for surgeons who choose to complete both a subspecialty surgical and informatics fellowship, this can significantly lengthen the duration of their training at a high opportunity cost. Formal informatics training can also be pursued at a number of medical schools in the US that now offer clinical informatics courses as well as graduate degrees in biomedical and clinical informatics.(11) The National Library of Medicine (NLM) supports research training in biomedical informatics and data science at 16 institutions in the US.(12) The NLM programs provide trainees with a T15 grant that can be used to fund a graduate education in informatics.

Some institutions have created unique informatics programs for their trainees. UCLA developed a novel year-long program to provide formal training in clinical informatics for

residents and fellows in surgical or medical fields.(11) This program is comprised of didactics and journal clubs led by physician informaticists, a research informatics project with a stipend provided at completion, and access to EHR practice and build environments. (11) This program has been successful with applicants from many different training programs including several surgical subspecialties.(11) Institutional programs may provide a more formalized education for those assessing whether they want to pursue fellowship training and board certification and those who prefer an introduction and access to clinical informatics incorporated into their training.

Dr. Douglas Fridsma, the president of the American Medical Informatics Association (AMIA) recently proposed requiring informatics training for all students pursuing medical education.(13) Similarly, surgeons should view and pursue informatics as a subspecialty. Informatics didactics, formal rotations, and electives should be offered, if not required, during residency. Potential content that can be integrated within current surgical residency curriculums include legal and ethical use of health information, informatics approaches to improve surgical quality and safety, and health information technology implementations, benefits and unintended consequences. Trainees further interested in informatics should be given the opportunity to pursue longer rotations or the CI fellowship during or after residency. During residency, multiple avenues should be provided to trainees to pursue this field to increase the potential for future leaders in surgical informatics. With rapid advances in information technology, surgical informaticians will be critically important to the successful application of technology to strengthen surgical clinical decision making, improve physician well-being, power research with high quality data, and increase the value of healthcare.

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References:

1. Henry J, Pylypchuk Y, Searcy T, Patel V. Adoption of Electronic Health Record Systems among U.S. Non-Federal Acute Care Hospitals: 2008-2015 ONC Data Brief 35. The Office of the National Coordinator for Health Information Technology 5, 2016.
2. Clinical Informatics (2019). Retrieved from <https://www.amia.org/applications-informatics/clinical-informatics>
3. Jackson GP, Moffatt-Bruce SD, Melton GB. Leveraging Health Information Technologies to Support Surgical Practice. JAMA Surgery. 2018 11; 153(11): 981–982 [PubMed: 30140935]
4. Broman KK, Oyefule OO, Phillips SE et al. Postoperative care using a secure online patient portal: Changing the (inter)Face of General Surgery. J Am Coll Surg. 2015 12; 221(6): 1057–1066. [PubMed: 26453260]
5. Robinson JR, Huth H, Jackson GP. Review of information technology for surgical patient care. Journal of Surgical Research. 2016 6: 203:121–139. [PubMed: 27338543]
6. Saxena K, Diamond R, Congant RF et al. Provider Adoption of Speech Recognition and its Impact on Satisfaction, Documentation Quality, Efficiency, and Cost in an Inpatient EHR. AMIA Jt Summits Transl Sci Proc. 2018; 186–195. Published online 2018 5 18. [PubMed: 29888069]
7. Kunstaetter R, "The need for a new specialty: medical informatics," Can Med Assoc J, vol. 133, pp. 236–8, 8 1 1985. [PubMed: 4016631]

8. Longhurst CA, Pageler NM, Palma JP et al. Early experiences of accredited clinical informatics fellowships. *J AM Med Inform Assoc* 2016; 23:829–834. [PubMed: 27206458]
9. Gardner RM, Overhage JM, Steen EB et al. Core Content for the Subspecialty of Clinical Informatics. *J AM Med Inform Assoc*. 2009 4: 16(2): 153–156. [PubMed: 19074296]
10. The American Board of Preventive Medicine Has Obtained Approval from the American Board of Medical Specialties' (ABMS) to Offer Surgical Residents Mid-Residency Training Programs in Clinical Informatics (MRTP). <https://www.theabpm.org/2019/03/19/the-american-board-of-preventive-medicine-has-obtained-approval-from-the-american-board-of-medical-specialties-abms-to-offer-surgical-residents-mid-residency-training-programs-in-clinical-informat/> Last updated: Mar 19, 2019 Accessed on May 13, 2019.
11. Singer JS, Cheng EM, Baldwin K, et al. The UCLA Health Resident Informaticist Progra, – A Novel Cinical Informatics Training Program. *JAMIA* 2017 1; 24(4): 832–840. [PubMed: 28115427]
12. NLM's University-based Biomedical Informatics and Data Science Research Traininnng Programs. <https://www.nlm.nih.gov/ep/GrantTrainInstitute.html>. Last updated: Nov 6 2018 Accessed on Dec 27 2018.
13. Fridsma DB. Health informatics: a required skill for 21st century clinicians. *BMJ*. 2018 7; 362:k3043. [PubMed: 30002063]