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My Thoughts / My Surgical Practice

Re-discovering surgical innovation - An essential component of the academic surgeon



Over the past years, academic surgery has gained great relevance and significance. More than a practice, it's a culture that impacts both science and patient care. In agreement with Jain et al. the mission of academic departments of surgery is to "enhance the practice of surgery and simultaneously educate and serve the needs of their faculty, residents/fellows, medical students, patients, and community."¹

As surgeons, we have the power of changing and improving patient's lives in a unique, expeditious and delightful manner. More than a skill, it's considered an exceptional and outstanding art. Hence, based on the current definition of Dr. Scott A. LeMaire (Fig. 1)², by being academic surgeons, we become even more valuable. We aren't just impacting patient's lives but rather, we are inspiring and guiding medical students and residents through mentorship which is a gratifying and necessary process that impacts personally and professionally young generations in the long term. Mentees need guidance to fulfill goals and expectations, and as mentors, besides feeling satisfaction, by strengthening academia we learn and keep ourselves updated. Also, as academic surgeons, we become educators of future surgeons by mastering skills and imparting knowledge through our personal experience, allowing research which contributes to advances in the surgical field. Nevertheless, this original concept lacks one thing: surgical innovation. If we as academic surgeons, encourage and grant this essential factor, we allow the development of cost-effective solutions to daily surgical problems making patients the final beneficiaries of the whole process, creating a more integral practice and enhancing the impact that already exists.¹ (see Fig. 2)

According to Amalia Cochran, member of the Association of Academic Surgery, "an academic surgeon is a triple threat - clinician, educator, and researcher".¹ In order to successfully fulfill those objectives, academic surgeons should meet certain qualities, some can be mastered, and others are innate. First and foremost, enthusiasm and passion for surgery are the cornerstone of this art, followed by devotion to patient care and mentoring. Academic surgeons should also have a teaching spirit, willing to share their wisdom and expertise, to give advice and guidance to those currently on their earlier steps on the surgical journey. Finally, innovation, creativity, and going beyond the standards all characterize an academic surgeon. Willingness to find new and more advantageous ways to perform procedures and actions that can both benefit patients and contribute to the scientific field.¹

Surgeons have historically been idea generators and creative practitioners. The surgeon faces tough leadership and clinical decisions as executives in a corporation with significant impact and

consequences. Based on the Clark and Wheelwright theory most surgeons lead heavyweight teams. These teams include leaders that feel comfortable taking risks and performing independent decisions.^{2,3} The first phase of innovation is the idea generation as was described by Utterback et al. and this phase is considered the greatest weakness in the innovation process. Therefore, the idea generation is the point break where the academic surgeon must highlight with vision, flexibility, daily situation assessment, decision analysis and development of new processes. Every clinical case offers challenges to the academic surgeon that requires creativity and innovation. The academic surgeon understands patients clinical needs and may anticipate future advances and opportunities to innovate. For this reason, academic surgeons are often involved in technology development.^{4–6} Academic surgeons work like lead users (technology users whose present strong needs will become general in a marketplace months or years in the future) within the field of surgical intervention and instinctively recognize innovation opportunities.^{2,7,8}

Also, academic surgeons can recognize an innovative clinical opportunity instantly compared to corporate planning systems because they only focus on short-term accomplishments and not in senior management of unanticipated successes like new markets. Moreover, academic surgeons have the possibility, as field leaders, to promote their own innovations based on clinical outcomes. This phenomenon explains why academic surgeons have been successful in creating disruptive technology.^{2,5–7}

Although the innovator academic surgeon must be critical to new technology development and adoption. The invention of a new technology must be of interest for the general population, available and cost-effectiveness. However, if the academic surgeon wants to be successful with his innovation, he must have availability of new technologies, be in the right place to have the key intellectual interactions and academic connections necessary to have his invention noticed.^{2,6,7}

An amazing example of personality and the right support context to academic surgeons innovation is the history of the development and bringing it to practice of laparoscopic cholecystectomy by Mouret and Dubois. Dubois was an effective innovator. He was a university professor and always had interest in new surgical treatments to improve patients clinical care and actively published his results. He knew about the laparoscopy and its use in the cholecystectomy developed by Mouret and met him. Dubois studied and performed this innovative surgical procedure and incited his colleagues to learn the technique and do the same as Perissat.^{2,5,6}

A more recent example of academic surgical innovation is Dr

The Academic Surgeon

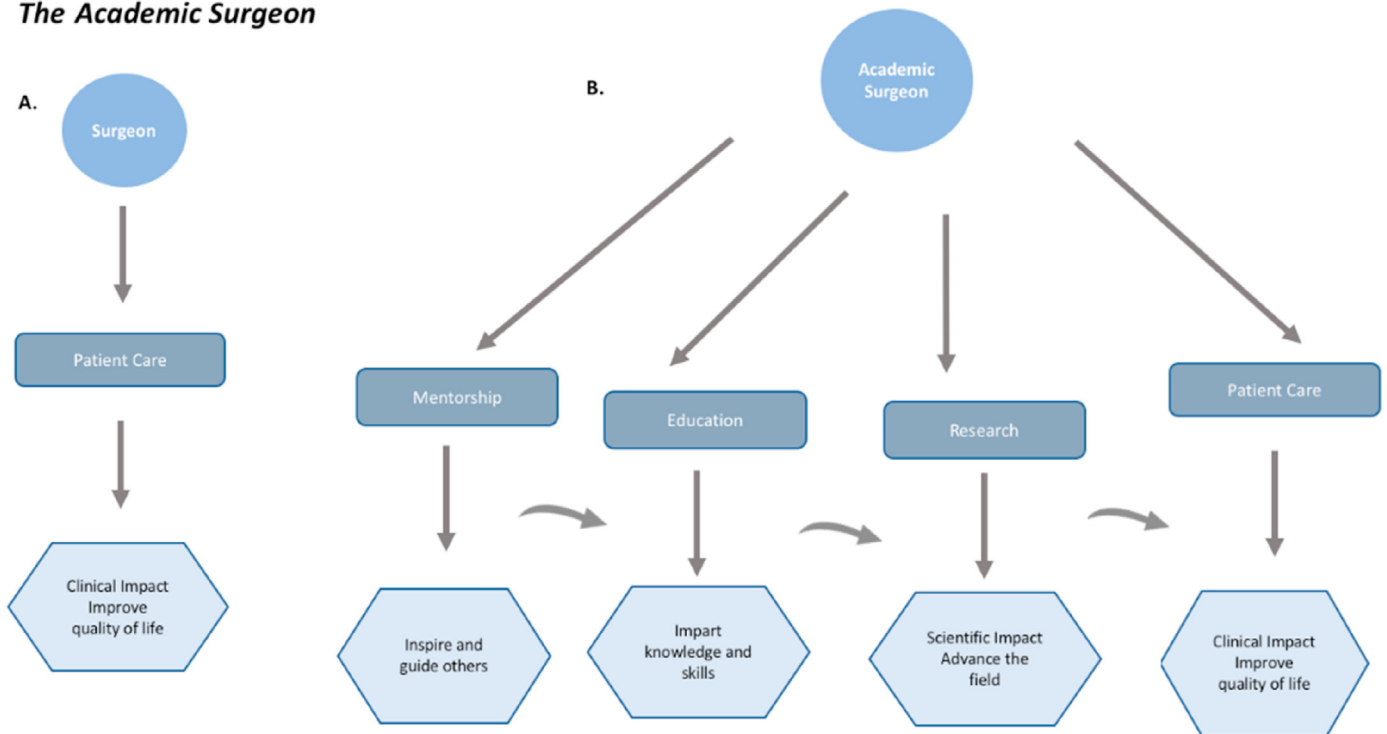


Fig. 1. Original definition of the academic surgeon by Dr. Scott A. LeMaire. [Success in Academic Surgery] Herbert Chen, Lillian S. Kao (eds.) - Success in Academic Surgery (2017, Springer International Publishing) - libgen.lc.pdf).²

Carla Pugh, professor of Surgery at Stanford University School of Medicine and the Director of the Technology Enabled Clinical Improvement (T.E.C.I.) Center. She was the first surgeon in the United States to obtain a PhD in Education with the goal of using technology to change the face of medical and surgical education. Her research involves the use of simulation and advanced engineering technologies to develop new approaches for assessing and defining competency in clinical procedural skills. Almost two hundred medical schools are using one of her sensor enabled training tools for their students and trainees Dr. Pugh holds three patents on the use of sensor and data acquisition technology to measure and characterize hands-on clinical skills. Her work has received numerous awards from medical and engineering organizations. In 2011 Dr. Pugh received the Presidential Early Career Award for Scientists and Engineers from President Barak Obama at the White House.^{5–8}

In 2000 the Stanford University introduced the first biodesign innovation process as a constantly evolving innovation teaching methodology for developing medical technologies and delivering them to patients. This program was developed to improve surgical innovation among academic surgeons, detailing the clinical unmet need before any solution is considered. The teaching process combines a small number of theoretical lectures with intensely mentored, project-based teaching. The fellowship was named as the Stanford Biodesign Innovation fellowship and consists of a 10-month, fulltime, innovation teaching program with 12 fellows with diverse backgrounds per year. Wall et al. measured the career focus, leadership trajectory, and productivity of 114 Biodesign Innovation Fellowship alumni based on survey data and public career information compared to finalists interviewed but not selected. The 60% of alumni are employed in health technology vs 35% of finalists interviewed but not selected. The 72% of alumni hold managerial or higher positions compared to 48% of the finalist group. On technology translation, more than 440,000 patients have been

reached with technologies developed directly out of the Biodesign Innovation Fellowship, with another 1,000,000+ aided by solutions initiated by alumni after their training. This study confirms the positive impact of the fellowship program. Since then, many design-oriented educational programs have been initiated.^{6–8}

Surgical innovation depends on creativity and initiative to progress, developing a unique culture of continuous innovation. There are no accepted definitions for surgical innovation but can be defined as the introduction of new concepts, technologies, techniques, approaches, processes, politics or combinations with each other and the application of it. Many surgical innovations presuppose some form of research but not all research leads to innovation. The main limitation for surgical innovation is the transition from theoretical ideas to use in humans. This limitation is related to 3 major barriers: the role of market forces and economic limitations, ethical considerations of innovative surgery, and the conflicts of interest associated with the use of surgical innovations. Surgical innovations must be cost-effective and justifiable from an economic point of view. One example of it is robotic surgery that is a surgical innovation but needs a high level of expertise and has elevated costs that have limited its widespread use. On the other side in latinamerica the main problem for the development of surgical innovation is the lack of government economic politics to support and funding this process of creation of new solutions to old and new surgical problems. Surgical innovations could cause increased mortality and morbidity and patient harm. Therefore, ethical considerations are related to avoiding patient harm and promoting the patient's autonomy, providing them with information about the risks and benefits of the innovation to choose between the standard of care or novel treatments. Nevertheless, patients can also be harmed given the invasive nature of surgery and anesthesia. A famous example of ethics in surgical innovation was the treatment of uterine leiomyomas using a laparoscopic power morcellator that generated a higher risk of disease dissemination and peritoneal

The new component of the Academic Surgeon

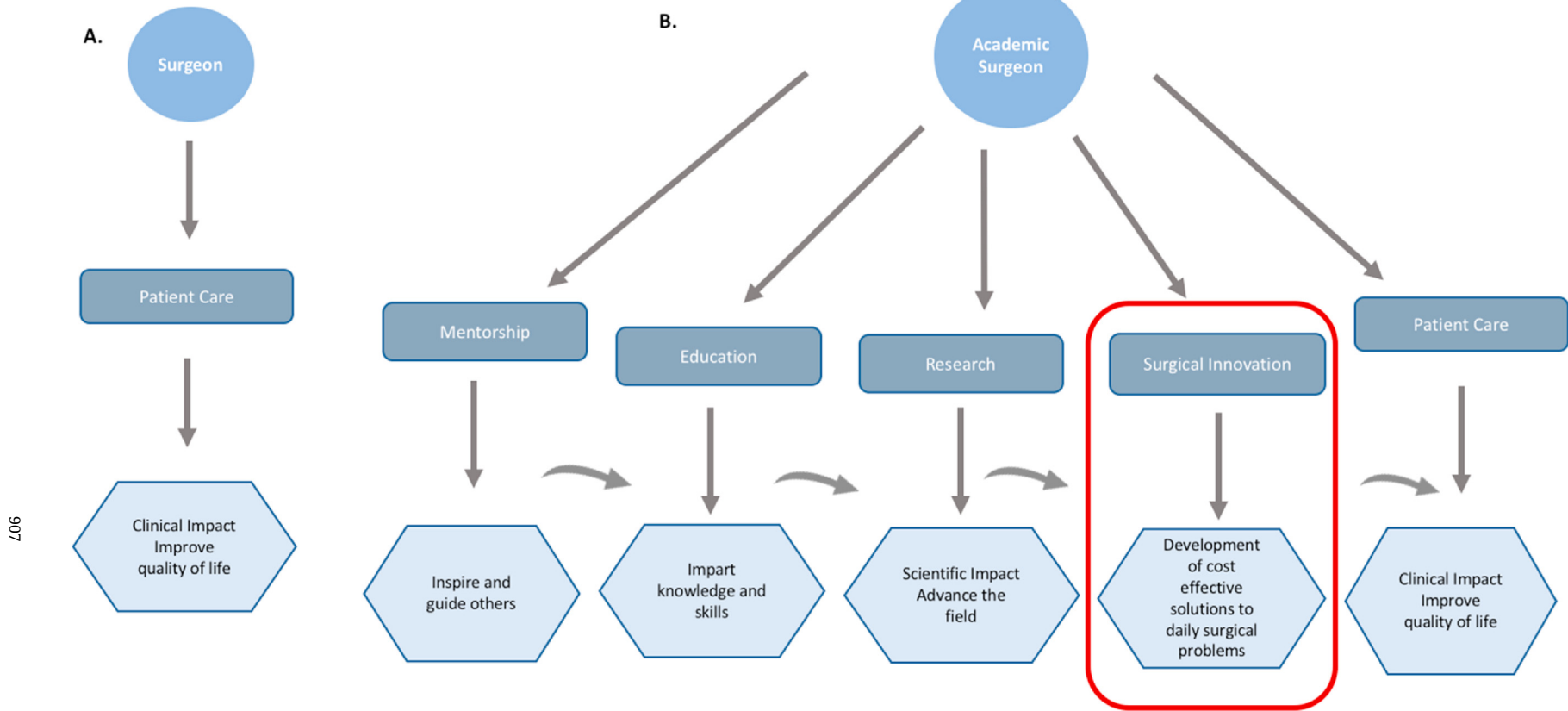


Fig. 2. Surgical Innovation: the new component to enhance the impact of academic surgeons. (Based on original figure taken by [Success in Academic Surgery] Herbert Chen, Lillian S. Kao (eds.) - Success in Academic Surgery (2017, Springer International Publishing) - libgen.lc.pdf).²

carcinomatosis. The final barrier to surgical innovation are the potential conflicts of interest affecting decision making that could result in surgeons pursuing innovations despite risks to patients due to economic gain. All information about funds and surgeons roles must be disclosed. Moreover, data related to positive and negative outcomes and methods used to assess the safety and efficacy of the innovation have to be reported. The other great issue to perform surgical innovation in latinamerica is the absence or minimum mentorship and programs for the formation of the future surgical innovators^{6–8}

The academic innovative surgeons do not have a specific phenotype. Any surgeon could be an innovator and a key point to improve surgical innovation is the diversity of surgeons. Diversity allows to have multiple points of view about the same surgical problem and achieve the best innovative solution. Dr **Heather Logghe** is the perfect example of it. She started the viral movement #ILookLikeASurgeon to show the evolving and diverse image of the XXI century surgeon, a hashtag that reached over one hundred million people on Twitter since October 2015. Dr Logghe was inspired by the #ILookLikeAnEngineer campaign. In 2017 the campaign was selected as the cover of The New Yorker magazine.⁹

After all the benefits mentioned above, surgical innovation is not reserved only for academic surgeons and must be considered not only in the new surgical device's development but also in preoperative, intraoperative and postoperative patients care. Surgical innovation is present in many actual surgical topics as the improvement of virtual care, artificial intelligence, machine learning, safety and quality improvement, new methods of surgical education, simulation, rural surgical care, resource-limited and austere environments surgery and global surgery.^{6,7} It has been demonstrated that being an academic surgeon is a gratifying and fulfilling duty. Impacting not only patients but colleagues, fellows, residents and medical students as well as becoming a recognized investigator capable of changing the course of surgical future is more than worth it and rewarding. At last, surgical innovation is the missing piece of the puzzle to fulfill the academic surgeon.⁹

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