A Novel Approach to Curricular Review Through a “Lean” Lens

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Categories: Curriculum Evaluation/Quality Assurance/Accreditation

Abstract

It has been well acknowledged that undergraduate medical curricula need to shift in order to meet the future needs of society, governments, and students. However, change is difficult given the complexity of the undergraduate medical education system. Few systematic approaches to curricular review and change have been documented in the literature.

"Lean", a way of thinking and analysis, has been traditionally used by production industries to derive greater value from fewer resources, thereby minimizing inefficiencies. By adopting a lean lens and applying it to medical education, the authors offer a novel way of characterizing the inefficiencies in undergraduate medical curricula. Inefficiencies are varied and include curricular deficits, overproduction, inventory redundancy, and idle time.

Further reflection suggests that these inefficiencies are the consequence of poor information management and communication between administrators and faculty and missed opportunities for consolidation of topics or assessments. Addressing these root causes would yield measurable benefits, including the creation of time for pursuit of personalized learning and enhanced student wellness. Other students and institutions may wish to leverage this approach to identify and address similar inefficiencies within their own curricula.

Keywords: Medical education; undergraduate; curriculum review; quality improvement

Introduction

With the tremendous growth in medical information, the rise of artificial intelligence and deep learning, and increasing emphasis on health systems science, the future landscape of medicine continues to shift. While experts have called for adaptations to the way we train physicians and proposed new domains of knowledge and skills in response, little is known about how to conduct systematic curricular reviews to facilitate these changes (Prasad, 2013). However, novel approaches to curricular review and reform are slowly emerging to guide institutions. Hsih et al describe a learner-centred model of pre-clinical curriculum review through the Student Curriculum Review Team
(SCRT) (Hsih et al., 2015). The SRCT uses a three-step process involving the collection and review of course evaluation data, the generation of solutions through a "Town Hall" format, and the implementation of changes via course director meetings (Hsih et al., 2015).

Applying Lean Methodology to Undergraduate Medical Education

Building on these efforts, we believe that an approach commonly used for continuous quality improvement by production industries, "Lean," could be applied systematically to identify examples of strengths and opportunities for improvement in undergraduate medical education (UME). Lean refers to a way of thinking that focuses on minimizing "waste" and maximizing "value" (McKay and Peters, 2015). Value can be "expressed in terms of a specific product or service at a specific price," while waste refers to any component of the production process that does not contribute value (e.g., wasted material, time, human effort, etc.) (Scoville, 2014). Medical schools, like other corporate enterprises, produce a service, a three- or four-year general medical degree, through multiple "production" processes (e.g., pre-clerkship, clerkship). During these processes, different types of inefficiencies arise.

One commonly encountered inefficiency in production industries is defects in output (e.g., non-functioning or faulty goods). In UME, defects can be conceptualized as deficits in the curriculum that result in gaps in attitudes, knowledge, or skills. In the setting of competency-based curricula, one example of a curricular deficit is a learning event (e.g., lecture, small group session) without specific learning objectives. Indeed, clear and published learning objectives are critical to the effectiveness of any learning event, and the lack of objectives makes it difficult to distill the salient points that must be carried forward in training. Furthermore, clarity with respect to learning objectives is essential to the assessment of teaching effectiveness and the provision of valid feedback.

Overproduction – producing what is unnecessary or producing what is necessary in unnecessary amounts – is another inefficiency in lean nomenclature. It can be conceptualized in terms of duplication of content within the medical curriculum or teaching outdated materials or skills. In addition to being intrinsically wasteful of resources, duplications also create the potential for ambiguity around diagnosis, investigations, or management, depending on the lens or expertise of the clinician-teacher.

Maintaining excessive amounts of supplies or materials for any length of time, also known as inventory redundancy, is a challenge faced by UME when supplies or materials are thought of as learning resources. Various practice guidelines, presentations, handouts, podcasts, and videos may be provided for single learning events, making it difficult for students to determine what to use or review. For example, multiple chapters of more than one textbook being assigned for a single hour-long lecture can make it challenging for students to find the time to accomplish the requisite readings. Lengthy readings may also undermine the value of lectures if the same material is being covered in class (a form of overproduction).

Idle time is another inefficiency frequently encountered in both production industries and UME. We think of it as the time spent on learning events, assessments or clinical duties of questionable value. For example, over the course of clerkship, a significant amount of time may be spent on assessments and projects of uncertain value not directly related to the clinical rotation being undertaken. With all the demands of a clinical rotation, including preparing for end-of-block exams, students are typically unable to delve deeply into these selected topics and do the minimum to achieve satisfactory performance. For those students who strive for and achieve exceptional performance, their assignments often still fall below the threshold for academic publication. Such projects often duplicate efforts in pre-clerkship, thus unnecessarily increasing curricular density.
Motion inefficiencies occur when there is unnecessary movement or movement that is done too quickly or slowly between steps within a given process. In UME, it occurs when clerks move too quickly through some rotations without enough time to apply basic knowledge or acquire technical skills. It also occurs when, due to high volumes of clinical activity, students are able to log all of the mandatory presentations early in the rotation and then "coast." We have observed the latter occurring particularly in Psychiatry. Conversely, due to variable clinical volumes and presentations, acquisition of requisite clinical encounters and technical skills can be much more difficult in areas like Emergency Medicine and Anesthesia.

**Strategies for Change**

Certain strategies for change become apparent in reviewing these inefficiencies. First, information flow between the educators and administrators who design the curriculum and the faculty who deliver it must be optimized. Teaching faculty must be aware of what has been taught previously, and what is planned downstream in the curriculum. Better communication will minimize both deficits and overproduction. Developing a user-friendly information management platform that tracks the curriculum and that can be used to orient faculty is crucial to overcoming this challenge. The adoption of such technology and data-driven approaches are currently underway. For example, Lee Kong Chian School of Medicine in Singapore developed a Curriculum Explorer (CLUE) tool to facilitate granular searches and mapping exercises and to enable viewers to navigate through each year of the curriculum via multiple paths (Canning* et al., 2017).

Secondly, unnecessary assignments should be avoided. To maximize value in this area, we advise consolidating assessments with common themes. Independent clerkship research assignments, for example, could be replaced with a longitudinal systematic review projects in which clerks are partnered with faculty members to generate a research question, develop and execute a search strategy, quantitatively or qualitatively analyze the findings, and prepare and submit a manuscript. Parallel processing of such an initiative during clinical rotations would not only meet the "scholar" competency of most accrediting bodies, but students would benefit from the exposure to research and a potential publication.

If our system of educating future physicians is to be truly competency-based, addressing motion inefficiencies is critical, specifically ensuring that medical trainees have the prerequisite knowledge before individual rotations and before beginning residency. This approach may require programs to eschew the traditional four or six-week block system in favour of allocating time based on the number of clinical presentations contained within a specific block (e.g., Family Medicine, Surgery, etc.). Applying this idea to our aforementioned example would mean shortening the Psychiatry block and perhaps extending the Emergency Medicine rotation.

**Limitations of Lean Methodology in Curricular Review**

While too many redundancies in a system are inefficient, some may be valuable. They can serve as mechanisms to protect against system failure. In the context of medical curricula, those failures include a lack of or "under teaching" of a particular topic or low scores on post-graduation standardized examinations. In this way, perhaps what we consider to be deficits, overproduction, idle time, or motion inefficiencies in the curriculum are really checks and balances.

We also recognize that lean is an approach for analyzing production industries and that we have constructed a number of assumptions in order to be able to apply it to medical education. While a medical curriculum can be
likened to a complex assembly line with the final product being a degree, UME is quite distinct from other production industries in that customers (i.e. students) interact with the product as it is being developed. Students' medical school experiences are shaped by interactions with patients and colleagues, unique clinical placements, faculty engaged, and extracurricular activities undertaken. These are inputs that are beyond the control of the curricular assembly line and, as such, the final degree will never be homogeneous. Similarly, we assume that as customers we all have the same notions of "value." However, given that value is a complex construct with multiple subjective (e.g., quality) and objective (e.g., cost) dimensions, pinning down a single definition that applies broadly is difficult.

Conclusion

We have adapted lean thinking to highlight examples of inefficiencies in UME and reflect on the opportunities for improvement. In addition to creating time for topics that are currently underrepresented, a "leaner" curriculum would give students more opportunities to focus on personalized learning plans, scholarly work, and their own wellness, thereby adding value to their medical education. While this approach has limitations, we hope that our colleagues at other institutions find it helpful in identifying opportunities for improvement within their curricula and making changes to enhance medical student life and learning.

Take Home Messages

- Lean methodology refers to a way of thinking that focuses on minimizing "waste" and maximizing "value."
- Lean can be adapted to conduct systematic curricular reviews to identify gaps, duplication of content, and other inefficiencies in undergraduate medical education.
- A lean approach to minimize these types of inefficiencies may be one way of optimizing the available time in undergraduate medical curricula.

Notes On Contributors

Akshay is a fourth-year medical student at Queen's University. Prior to beginning his medical training, he worked as a project coordinator for a children's mental health and developmental services agency in Toronto. His research interests lie at the intersection of informatics, advanced analytics, medical education and family medicine.

Gray is a fourth-year medical student at Queen’s University. He completed a Master of Science degree in neuroscience and a Bachelor of Science in psychology and biology prior to medical school. He is passionate about leveraging his experiences to help medical students discover creative ways of using their medical degree.

Dr. Anthony Sanfilippo is the Associate Dean of the School of Medicine at Queen's University. He also holds a teaching position with Queen's University as a Professor of Medicine and Cardiology. He maintains clinical and research interests in echocardiography and plays active roles in undergraduate medical education.

Acknowledgements

None.
Bibliography/References


Appendices

None.

Declarations

The author has declared that there are no conflicts of interest.

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Ethics Statement

Ethics approval was not required for this personal view/opinion piece.

External Funding

This paper has not had any External Funding

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