

## Case Study

# Management Principles to Drive the Creation of a 21st Century Medical School

Johannes Vieweg, MD,<sup>1</sup> François Sainfort, PhD,<sup>2,1</sup> Julie A. Jacko, PhD,<sup>1,2</sup> Paula S. Wales, EdD<sup>1</sup>

## Abstract

### Introduction

There are currently no data, blueprints, best practices, or financial models available to guide the creation of a new medical school. Yet, the United States is experiencing unprecedented growth of new allopathic medical schools.

### Findings

This article brings logic to the process. It converts the complexity of what is often regarded as an administrative exercise into the first published framework of management principles. Those principles were then translated into a process map and a financial optimization model. All three elements can be successfully implemented for establishing an accredited, value-driven medical education program that minimizes time from inception to implementation, and ensures sustainability over time.

### Outcomes

This case report provides a blueprint for planning and implementation of a new medical school. Outcomes include both process and optimization models, as well as valuable insights that have utility when considering a new medical school to mitigate the projected nationwide shortage of physicians.

### Keywords

undergraduate medical education; physician workforce; medical schools; organizational models; case studies

## Introduction

The United States will see a shortage of as many as 122,000 physicians by 2032, as demand for physicians continues to grow faster than supply.<sup>1</sup> Therefore, we are witnessing remarkable growth of new allopathic medical schools in the U.S. The creation of a new medical school is a highly complex, expensive and daunting task, often resulting in the formation of an Academic Medical Center (AMC) composed of a medical school, clinic(s) and hospital(s) operations.<sup>2</sup> It follows logically that they thus have enormous impact on host institutions, graduates, workforce and entire regional healthcare ecosystems. Aside from established accreditation standards, there are currently no data, blueprints, guidelines or financial models

available that can guide the creation of a new medical school and provide some degree of standardization to a highly variable and complex process. A review of the literature revealed a plethora of articles in the 1960s and 1970s about the formation of new medical schools,<sup>3-5</sup> however there is a paucity of contemporary literature addressing this topic.

## Objective

This article brings logic to the process of creating a new medical school. It converts the complexity of what is often regarded as an administrative exercise into the first published framework of management principles. Those principles are then translated into a process map and a financial optimization model. All

Author affiliations are listed at the end of this article.

Correspondence to:

Julie A. Jacko, PhD

Department of Population Health Sciences

Dr. Kiran C. Patel College of Allopathic Medicine

Nova Southeastern University

3200 South University Drive

Fort Lauderdale, FL 33328-2018

([jjacko@nova.edu](mailto:jjacko@nova.edu))

three elements can be successfully implemented for establishing an accredited, value-driven medical education program that minimizes time from inception to implementation, and ensures sustainability over time.

### Background

There is great urgency to prepare a new generation of physician leaders who are capable of innovating higher quality medical care while reducing cost. Now is a time when the newest physicians entering medicine should be leading the way to improved delivery systems and healthier populations.<sup>6</sup> In addition, technological innovations are needed that compensate for shortages of health care providers, enhance responsiveness to more demanding patients, control rather than exacerbate costs, and enhance safety and quality. Finally, the emergence of consumerism in health care is a development that enables patients to become wholly involved in their health care decisions.<sup>7</sup>

### Historical progression of the creation of new medical schools

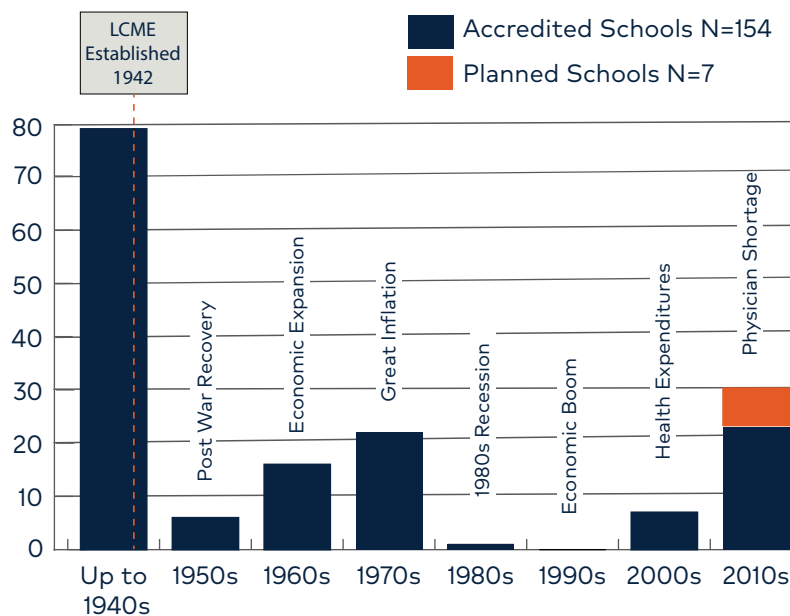
Thus, profound changes are warranted, especially in academic medicine, which has been challenged to keep pace with the rapidly evolving U.S. healthcare system. **Figure 1** shows the historical progression of the establish-

ment of new medical schools in the U.S. by decade, since the turn of the previous century.<sup>8</sup> The Liaison Committee on Medical Education (LCME) was established in 1942; the decades since have demonstrated cyclical waves of growth, including an absence of growth. In the current decade, due to documented national physician shortages, coupled with an aging population, we have witnessed unprecedented growth of new medical schools accredited by LCME.

Agile leadership, equipped with both strong academic and business acumen, will be essential to leading the bottom-up transformations necessary for the development of new medical schools. The emphasis must include better preparing students for the future of medicine. Equally important is the need for entrepreneurs and intrapreneurs to lead bottom-up efforts to rein in costs, improve quality and expand access, along with top-down policies enacted in the regulatory environment.<sup>9</sup>

### Unprecedented growth in the last decade

The significant expansion of newly accredited medical schools, particularly in populous states such as California, New Jersey, Pennsylvania, Virginia and Florida, has caused disruption in



**Figure 1.** Expansion of U.S. Allopathic Medical Schools by Decade

**Table 1.** LCME-Accredited U.S. Medical Schools with Preliminary and Provisional Accreditation Status (Initial Year 2015-2019)

Institution/Program	City, State	Accreditation Status	Initial Year
California Northstate University College of Medicine	Elk Grove, CA	Provisional	2015
CUNY School of Medicine	New York, NY	Provisional	2015
The University of Texas at Austin Dell Medical School	Austin, TX	Provisional	2015
Washington State University Elson S. Floyd College of Medicine	Spokane, WA	Provisional	2016
University of Nevada, Las Vegas School of Medicine	Las Vegas, NV	Preliminary Survey Pending	2016
The University of Texas Rio Grande Valley School of Medicine	Edinburg, TX	Preliminary Survey Pending	2015
Nova Southeastern University Dr. Kiran C. Patel College of Allopathic Medicine	Fort Lauderdale, FL	Preliminary	2017
Carle Illinois College Medicine	Urbana-Champaign, IL	Preliminary	2017
California University of Science and Medicine School of Medicine	San Bernardino, CA	Preliminary	2018
Hackensack-Meridian School of Medicine at Seton Hall University	South Orange, NJ	Preliminary	2018
TCU and UNTHSC School of Medicine	Fort Worth, TX	Preliminary	2018
Kaiser Permanente School of Medicine	Pasadena, CA	Preliminary	2019
New York University Long Island School of Medicine	Mineola, NY	Preliminary	2019

the healthcare and health education sectors, as never seen before. In the last decade, twenty-three new medical schools have received full, provisional or preliminary accreditation.<sup>8</sup> **Table 1** lists new medical schools (since 2015) with preliminary and provisional accreditation status.

A review has revealed an additional seven schools that are at various stages of the accreditation planning phase (**Table 2**). Note that for the majority, targeted preliminary accreditations are imminent (2020-2021), with two institutions' target years yet to be determined. It is recognized that hospital partnership is an essential component of the process. **Table 2** lists hospital partners for those institutions where the information was available.

### The opportunity for new medical schools

A new medical school has significant impact on its host institution, its graduates, the workforce, the region and the entire healthcare ecosystem, while also reducing national physician shortages. Those programs that develop and implement radical curricular innovations, including integrating novel technologies within the curricula, are truly training the physician of the future.

New medical schools, unlike established medical schools, are relatively unencumbered by organizational inertia and legacy processes and systems. While they are frequently populated by experienced faculty and personnel from established schools, anecdotal evidence from newer medical schools established in the last

**Table 2.** U.S. Institutions at Various Stages of the Accreditation Planning Process

Institution	State	Hospital Partner	Target Date for Preliminary Accreditation	Reference
Charles Drew University	CA	Cedar Sinai/UCLA	October 2021	<a href="https://lasentinel.net/charles-r-drew-university-launches-plans-for-independent-four-year-medical-education-program-and-community-health-worker-academy-with-1-3-million-in-grants-from-cedars-sinai.html">https://lasentinel.net/charles-r-drew-university-launches-plans-for-independent-four-year-medical-education-program-and-community-health-worker-academy-with-1-3-million-in-grants-from-cedars-sinai.html</a>
Keck Graduate Institute (The Claremont Colleges)	CA	TBD	October 2021	<a href="https://www.kgi.edu/news/keck-graduate-institute-announces-plans-for-new-medical-school/">https://www.kgi.edu/news/keck-graduate-institute-announces-plans-for-new-medical-school/</a>
George Mason University	VA	TBD	October 2021	<a href="https://wtop.com/business-finance/2019/06/george-mason-university-to-consider-adding-a-medical-school/">https://wtop.com/business-finance/2019/06/george-mason-university-to-consider-adding-a-medical-school/</a>
Marist College	NY	Nuvance Health	July 2021	<a href="https://wrrv.com/marist-college-health-quest-creating-medical-school/">https://wrrv.com/marist-college-health-quest-creating-medical-school/</a>
University of Houston	TX	HCA Healthcare	October 2020	<a href="https://www.texastribune.org/2019/05/02/university-houston-medical-school-gets-approval-texas-legislature/">https://www.texastribune.org/2019/05/02/university-houston-medical-school-gets-approval-texas-legislature/</a>
Wake Forest University	NC	Atrium Health	TBD	<a href="https://www.charlotteobserver.com/news/business/article229060864.html">https://www.charlotteobserver.com/news/business/article229060864.html</a>
College of Henricopolis School of Medicine	VA	TBD	TBD	None available

two decades indicates that the organizational ecosystem is inhibited by fewer encumbrances in new schools. Thus, new schools have the opportunity to dramatically innovate medical education. This can be achieved through curricula producing better learning outcomes, the strategic use of technology, novel organizational structure, the timing and sequencing of learning, the use of innovative pedagogy and the reorganization of clinical training. The new schools have the advantage of learning from educational experiments of the past, as well as using new and future technology to supplement traditional pedagogical techniques. Recognition of changing models of care de-

livery, new skill sets necessary for clinicians, rapidly advancing medical science and the need to restore trust, all call for radically new ways of training future physicians. Over the next decade, the new medical schools will catalyze change throughout the entire educational system. They will have a tremendous impact on health care delivery, the healthcare system, and the economy as a whole. Therefore, a newly accredited medical school can be a transformational academic asset within the ecosystem of a university. It affords significant prestige, which tends to grow, catalyzing biomedical research, fostering increased community interest and philanthropy, and enhancing recognition

and the ranking of the parent university on national and global scales.

### **Challenges and disruptions of new medical schools**

Although the long-term benefits for establishing new medical schools are well-defined, the addition of such programs within universities can pose formidable challenges and disruptions. These are attributable to the cultural, academic, strategic and fiscal impact of the new school within the overall existing framework of the university. Moreover, aside from traditional accreditation standards, there is no available “blueprint” or “best practice model” that guides the creation of a fully accredited medical school pursuing the triple aims of academic medicine – education, research and clinical care. Finally, there are no established or published business models to achieve the fiscal sustainability of new medical schools without substantive hospital or government subsidies. Reflecting on the lack of generalizable management principles guiding this extraordinarily challenging task toward value enhancement, some institutions proposed a discovery-driven planning process. This has involved reverse engineering desired outcomes related to curriculum and facilities development, based on a set of core values. However, such models lack a generalizable blueprint and are limited to institutions with specific institutional settings and missions.<sup>10</sup>

When an institution is considering starting a new medical school, the matter is traditionally addressed through the facilitation of an outside expert charged to develop, without bias, the institutional feasibility study. This is regarded as a first step in defining the prospective new medical school’s distinctive identity, and is the product of a multifactorial formula incorporating institutional priorities, assets, strategic goals, regional circumstances, as well as political and social considerations. The feasibility study further includes initial financial projections to estimate cost and revenue throughout the institutional planning stage and the ensuing accreditation phases, which conclude with the graduation of the inaugural student class.

Unfortunately, feasibility studies for new medical schools are developed by a small cadre of

experts that provide best estimates of the prospective medical school’s future. Curricular and economic design, hospital affiliations and other factors greatly impact the overall economic model. Therefore, in most institutional settings, there are major differences between projected and actual costs during the medical school’s startup phase. This often causes tensions among institutional and medical school leadership, especially once the new medical school’s curricular design, staffing resources and business model have been developed by founding leadership, so that form can follow function.

### **Case Report in Innovation, Quality, Value and Agility: NSU MD**

Nova Southeastern University (NSU), a private, not-for-profit institution, located in Fort Lauderdale, Florida, successfully planned (starting in 2016), initiated (2017), and rapidly received preliminary accreditation (2018) for a new medical school awarding the MD degree. With a distinct vision for medical innovation, NSU MD has kept total costs at a lower level than estimated by experts, while ensuring that quality metrics have been met or exceeded. For example, the charter class of students recently completed the first year of NSU MD’s progressive, case-based program, performing above the national average on six of the seven National Board of Medical Examiners exams. They performed at the national average on the seventh.

This programmatic success in the area of quality is in part attributable to NSU MD’s innovative approach to medical education, which enhances core principles,<sup>6</sup> including the training of physicians on the science of health delivery and their role within the health system. The curriculum uniquely addresses health care finances and how to be responsible stewards of health care costs, preparing physicians to effectively lead teams of healthcare professionals. It also supports flexible pathways for physician training and assessing the competencies students acquire before and during medical school as well as readiness for residency training.

Lowering costs during the planning and initial accreditation phases was the result of NSU’s

centralized, shared resources model and a strong collaboration with the H. Wayne Huizenga College of Business and Entrepreneurship (HCBE) at NSU. This partnership enabled the implementation of management and process flow optimization strategies within the medical school. Moreover, these business tactics and a strong partnership model with hospital and regional partners contributed to the final economic model, putting the new medical school on a track toward rapid fiscal sustainability.

The intentional reduction of costs to produce better value was a key achievement in the operationalization of the business strategies employed. Cost is contingent on time and tactics and is also a function of regional factors. Time is a frequently overlooked expense dimension, with the cost-to-wait dramatically underestimated. In fact, the carrying costs of overhead while waiting to plan, initiate or receive preliminary accreditation can be substantial. The more time it takes an organization, the higher those costs will be. In addition, an institution's ability to move forward through the process is contingent on LCME's capacity to review it at any given time. If the capacity is not available, the time to preliminary accreditation is longer and the costs associated with carrying the overhead increase. In addition, it is not unreasonable to expect LCME policy changes over time. The sooner an institution plans, initiates and receives preliminary accreditation, the less the risk of unanticipated policy changes adding time, and hence expense, to the process.

Agility was also a key differentiator for NSU MD while planning, initiating and ultimately receiving preliminary accreditation. This agility mindset permeated its culture at every level, enabling the College to outpace typical institutional speeds while keeping costs to a minimum and reinvesting those cost savings to produce a higher quality program. Quality indicators that correspond to program metrics such as student recruitment, retention, performance on national standardized exams, curriculum, pedagogy, faculty-student ratios and graduation rates demonstrated that these tactics increased the value of the system overall.

## Findings and Outcomes

### Key management principles discovered and implemented

From the NSU experience, the authors have detailed ten key management principles that were essential to meeting NSU MD's financial plan. They are independent of the specific mission and curriculum chosen by the institution, thereby providing critical advice to anyone contemplating a similar challenge, or looking to improve ongoing operations. The ten key management principles are shown in **Table 3**. Not only have they been successfully used, but they are highly recommended, as they can dramatically impact a new medical school's triple aims of education, research and clinical care.

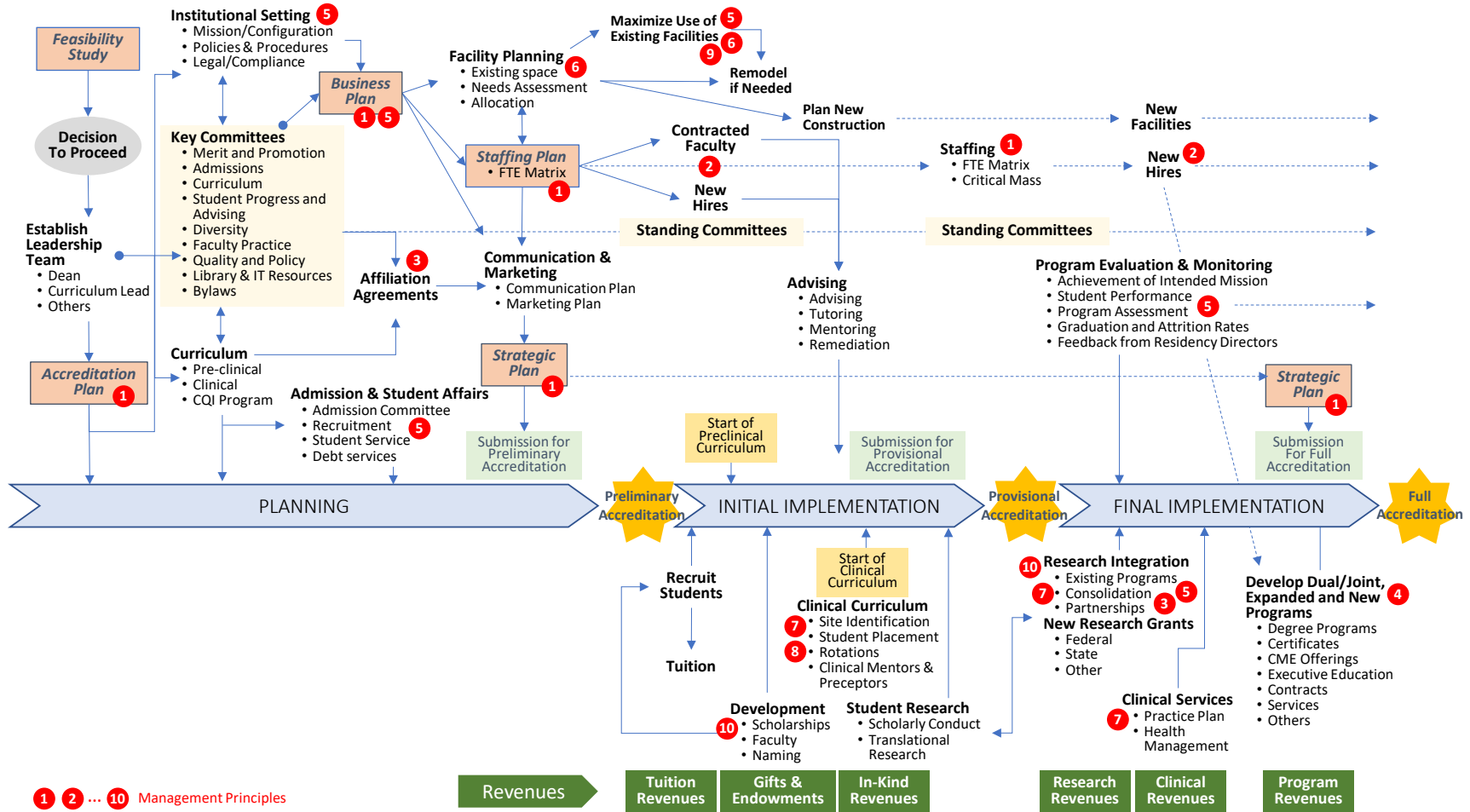
### Process map

The model in **Figure 2** depicts the entire, multifaceted planning and implementation process. From the original feasibility study to full accreditation, it depicts the steps required to create a new medical school that is capable of achieving fiscal sustainability, while also achieving the highest standards of quality. It shows three major phases—planning, initial and final implementation—as well as key milestones that need to be achieved throughout the process. At the bottom of the figure, sources of revenue are identified. The model also frames the ten key management principles from **Table 3** (numbered in the figure from 1 to 10) providing context for their utility.

This process map reflects actual structured sets of activities performed by NSU MD that transformed measurable inputs into outputs, along with key performance indicators. The process flow, as depicted, defines the sequence and interactions of related process steps, activities and tasks that comprise the entire planning and implementation process, from feasibility study to full accreditation. The Founding Dean and his team anticipated organizing the experience into a structured process, a priori. The structure, principles and optimization that emerged were not derived retrospectively after reflection on the experience, but rather they were fully derived during the planning phase, leading up to Provisional Accreditation, as shown in **Figure 2**. NSU MD views its process to be a strategic asset of the organization.

**Table 3.** Ten Key Management Principles

Principles	Impact Areas	Financial Implications
1. Developed and utilized a comprehensive financial optimization and prediction model for planning, accreditation and sustainability over time that includes optimization of time required and reinvestment of savings for purposes of improving quality.	Strategic Analytics	Optimized resource allocation over the entire 6-10-year process.
2. Adopted Just-In-Time approaches to faculty and staff hiring.	Personnel	Minimized personnel lead time costs.
3. Implemented a licensing model with other university colleges, centers and institutes to secure program faculty.	Personnel	Minimized costs associated with program faculty lines.
4. Leveraged faculty effort through the delivery of pipeline or post-baccalaureate programs.	Personnel	Created new streams of revenue with existing faculty lines and by optimizing utilization of personnel.
5. Implemented lean and six sigma methodologies to optimize resource management and consolidate through acquisition and mergers of other programs with the medical school.	Resources Management and Program Consolidation	Streamlined operations, eliminated waste and minimized institutional overhead.
6. Maximized shared resources (student services/simulation/library/testing).	Program Services	Eliminated unnecessary duplication and minimized ancillary costs.
7. Developed and established strategic internal and external contractual partnerships.	Partnerships	Optimized synergistic activities and minimized risk and exposure.
8. Obtained in-kind revenue from hospital partners.	Partnerships	Reduced costs for services provided through hospital partners, and provided a stable platform for clinical care.
9. Initially utilized and re-purposed existing campus facility and space resources until funds are secured for major capital investment.	Facilities	Minimized initial investment in facilities.
10. Developed and implemented a fiscal sustainability model that includes aligning research product with a campaign that links donor interests with specific disease entities.	Sustainability	Complemented the initial tuition-based business model with other significant sources of revenue, ensuring the fiscal health of both the education and research enterprises.



**Figure 2.** Process Flow Strategies from Feasibility to Full Accreditation for the Formation of a New Medical School



Managed optimally, the process as defined has delivered a clear, competitive advantage. Schools that anticipate undertaking the launch of a new MD program can use this map to assist in defining process boundaries, ownership, responsibilities, internal controls, effectiveness measures and work standards for compliance, consistency and performance.

### Modeling approach

As shown in the process map, a major starting point for the planning of a medical school is to decide on the nature and structure of the curriculum. Curricular design decisions then lead to major subsequent resources requirements including, but not limited to, staffing (faculty and staff), facilities, postgraduate training, hospital affiliations and research requirements. These requirements evolve over time, during initial and final implementation phases (see **Figure 2**), and can be met in several different ways. For example, one can decide to hire new faculty or leverage existing faculty from other schools/colleges on a part-time basis. Similarly, existing university resources (simulation facility, student services, etc.) can be shared or (re)created as part of the new medical school. Hospital affiliation agreements can be negotiated to offer in-kind revenue and other savings. Faculty can be leveraged to deliver additional revenue-generating programs beyond the MD curriculum.

Specific curricular design decisions drive resource requirements that can be met in different ways. Hence, we developed a comprehensive financial spreadsheet model that incorporates costs and revenues associated with different resourcing configurations. The model was populated with cost data specific to NSU and the local and regional community, thereby allowing us to project reliable cost estimates and systematically analyze different configurations for achieving the mission over time at minimum overall cost.

For example, given the curriculum design and specific choices made regarding how to deliver the curriculum (such as the faculty-to-student ratio, team/problem-based pedagogical approach), there are a number of possible options regarding how to set up and allocate the workload of existing and newly hired faculty members over time. Our objective was to find the mix of part-time existing faculty and new hires that would minimize the cost of delivering

the educational services specified in the chosen curriculum over a set period of time (the first four years). This is commonly referred to as a staffing and scheduling optimization problem.<sup>11</sup> While this can be done in a spreadsheet model through a series of “what-if” analyses, the problem can also be formulated as a “mixed integer linear programming” model<sup>12</sup> and can be systematically solved using the Solver algorithm in a spreadsheet program such as Microsoft Excel. While a novel application in this particular context, this type of optimization model has been successfully used for just-in time production planning, workforce scheduling and many other problems.<sup>11</sup> One advantage of this approach is that the model can be updated, augmented and refined over time, although such models can rapidly become quite complex.

### Discussion

The creation of a new allopathic medical school within a university setting has often been characterized as one of the most complex and unpredictable tasks in an academic environment, often causing disruption, anxiety and stress within institutions and leading to, not surprisingly, a high turnover rate among faculty and founding deans. Unfortunately, there has historically been an absence of transparency when defining the journey from initiation to accreditation to successful implementation to fiscal sustainability over time. It has not been documented, to-date, what obstacles inevitably appear and it is not known what effective processes, approaches and models have been discovered that can accelerate achieving the mission.

In this manuscript, we seek to convey our experiences, processes, approaches and models deployed during the planning and creation phase of a new allopathic medical school in the populous South Florida region. We utilized financial optimization modeling, incorporating revenue and expense data, to yield a value-based economic design, in which deliberate cost savings in mission critical domains were re-invested in a higher quality educational product. Moreover, we used process flow analysis<sup>13</sup> to identify distinct cost drivers that could be averted in a value-based and “lean” academic environment, giving serious consideration to the impact and interaction of this new economic model as it relates to other programs and services (**Figure 2**). As a potential limitation, the described

workflows, processes and tactics can vary considerably among institutions, due to variances in institutional settings and priorities, clinical affiliations, financial prowess and regional considerations.

Creating a more predictable and reproducible accreditation process and developing a sustainable undergraduate education model<sup>14,15</sup> have become major strategic priorities for applicant institutions and accreditation agencies alike. Although the institutional feasibility study is a first step to define a future business model of the new school within the overall context of the university, these early forecasts rely on historic and institutional projections to estimate cost, but do not represent a balanced, non-tuition-driven financial model that demonstrates the long-term sustainability of the new venture. In order to develop an economically viable model, new medical schools must show a diversified income portfolio and, most importantly, demonstrate integration with affiliated hospital, community and other partners through agreements aligned with the missions of education, research and clinical care. Thus, securing affiliations with one (academic-medical-center-type accreditation) or several (community-type accreditation model) hospital partners and defining a reciprocal value system that would derive from such partnership(s) has become the top priority when a new medical school is considered. Areas of mutual interest may entail joint programs along the educational continuum, partnerships in the field of population health, data sciences, medical technologies or other projects.

This article makes important observations when considering a deliberate approach applied to the design of value-driven medical schools seeking to reduce cost, enhance quality and optimize educational, research and health outcomes. It further suggests that institutions of higher education considering the creation and development of new medical schools, or those seeking to dramatically improve current operations, should regard such challenges as opportunities to fundamentally transform the economic design of the educational and healthcare system through the application of “lean” methodologies and targeted re-investment of cost savings to yield a higher quality product. The real-time identification, enumeration and

re-allocation of cost savings during the accreditation phase within the cost domains of staff and faculty recruitment, facilities development and resource management are designed to enable a value-based economic design. Thus, giving the school a unique opportunity to build its curriculum, facilities and priorities from the ground up. It is our conjecture, that value, as measured by health outcomes per dollar expended, should be the focus of every actor in modern healthcare.<sup>16</sup>

We acknowledge that developing an innovative and sustainable economic model must be balanced with the constraints of meeting licensing and accreditation requirements. The most influential oversight body overseeing the accreditation of programs leading to the degree of Medical Doctor (MD) in the United States and Canada is LCME, jointly sponsored by the Association of American Medical Colleges (AAMC) and the American Medical Association (AMA). Fortunately, the planning and accreditation process involves frequent and productive communications with LCME to assure adherence to their 12 accreditation standards in the face of innovation, while transitioning from the planning stage to applicant and candidate status.

Often overlooked is early linking of research to the institutional planning and implementation processes. This eventually enables an organization, whose plans, policies and decisions are informed by a rich core of valid institutional data and a sophisticated understanding of the meaning of those data, to achieve institutional advancement and effectiveness.

We advocate a philosophy of a “science of institutional planning” that fosters new knowledge, allows new policies and better decision making through the reporting and analysis of institutional data. This philosophy not only impacts the planning or building process of a new medical school, but also allows transformation of community health and the region’s overall economy.<sup>17</sup>

## **Conflicts of Interest**

The authors declare they have no conflicts of interest.

## Author Affiliations

1. Dr. Kiran C. Patel College of Allopathic Medicine, Nova Southeastern University
2. H. Wayne Huizenga College of Business and Entrepreneurship, Nova Southeastern University

## References

1. Association of American Medical Colleges (AAMC). Physician Supply and Demand - A 15-Year Outlook: Key Findings, 2019. <https://www.aamc.org/system/files/2019-08/physician-supply-demand-15-year-outlook-key-findings.pdf>. Accessed April 25, 2019.
2. Johnston SC. Academic Medical Centers: Too Large for Their Own Health? *JAMA*. 2019;322(3):203–204. <https://doi.org/10.1001/jama.2019.6834>
3. Moy, RH. Do We Really Need More New Medical Schools? *JAMA*. 1971;218(4):570–570. <https://doi.org/10.1001/jama.1971.03190170048010>
4. Penrod, KE. New Medical Schools: Can They Be Established Quickly at Less Expense? *JAMA*. 1971;218(4):571–573. <https://doi.org/10.1001/jama.1971.03190170049011>
5. Brooks, GL. A New Medical School's Expectations of the University, *JAMA*. 1965;194(12):1291–1294. <https://doi.org/10.1001/jama.194.12.1291>
6. Skochelak SE, Stack SJ. Creating the Medical Schools of the Future. *Acad Med*. 2017;92(1):16–19. <https://doi.org/10.1097/ACM.0000000000001160>
7. Schimpff, SC. Disruptive Changes Are Coming to the Delivery of Medical Care. Harvard Business Review online. <https://hbr.org/2010/04/disruptive-changes-are-coming>. April 23, 2010. Accessed April 19, 2019.
8. Liaison Committee on Medical Education (LCME). Accredited MD Programs in the United States. <http://lcme.org/directory/accredited-u-s-programs/>. Updated February 12, 2020. Accessed April 23, 2019.
9. Govindarajan V, Ramamurti R. Transforming Health Care from the Ground Up, *Harv Bus Rev*. July-August 2018:96–104.
10. Allen, J. Creating a New Medical School From the Ground Up. <https://www.tradelineinc.com/reports/2017-3/creating-a-new-medical-school-ground>. Published March 22, 2017. Accessed July 19, 2019.
11. Brandeau ML, Sainfort F, Pierskalla WP, eds. *Operations Research and Health Care: Handbook of Methods and Applications*. Boston, MA: Kluwer Academic Publishers; 2004. <https://doi.org/10.1007/b106574>
12. Chen DS, Batson RG, Dang Y. *Applied Integer Programming: Modeling and Solution*. Hoboken, NJ: John Wiley & Sons, Inc; 2010.
13. Sharp A, McDermott P. *Workflow Modeling: Tools for Process Improvement and Application Development*. Boston, MA: Artech House; 2001.
14. Hedrick JS, Cottrell S, Stark, D et al. A review of continuous quality improvement processes at ten medical schools. *Med Sci Educ*. 2019;29:285. <https://doi.org/10.1007/s40670-019-00694-5>
15. Irby DM, Cooke M, O'Brien BC. Calls for reform of medical education by the Carnegie Foundation for the advancement of teaching: 1910 and 2010. *Acad Med*. 2010;85:220–7. <https://doi.org/10.1097/ACM.0b013e3181c88449>
16. Porter ME, Weisberg EO. *Redefining Healthcare: Creating Value-Based Competition on Results*. Harvard Business School Press, Boston, MA, 2006.
17. Brown E, Woollcott J. Economic Impact of AAMC Medical Schools and Teaching Hospitals. Association of American Medical Colleges, March 2018. Available at <https://www.aamc.org/download/488250/data/executive-summary.pdf>.