education sciences

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Structuring Medical Education for Workforce Transformation: Continuity, Symbiosis and Longitudinal Integrated Clerkships

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Academic Editor: Nicky Hudson
Received: 1 April 2017; Accepted: 26 May 2017; Published: 2 June 2017

Abstract: Health systems worldwide are increasingly unable to meet individual and population health needs. The shortage of healthcare workers in rural and other underserved communities is compounded by inadequate primary care infrastructure and maldistribution of services. At the same time, the medical education system has not changed to address the growing mismatch between population health needs and care delivery capacity. Internationally, leaders are calling for change to address these challenges. Substantive changes are needed in medical education's stance, structure, and curricula. Educational continuity and symbiosis are two guiding principles at the center of current clinical educational redesign discourse. These principles rely on empirically-derived science to guide educational structure and improve outcomes. Educational continuity and symbiosis may improve student learning and support population health through workforce transformation. Longitudinal integrated clerkships (LICs), growing out of workforce imperatives in the 1970s, have demonstrated sustainable educational and workforce outcomes. Alongside the success of LICs, more innovation and more reaching innovation are needed. We propose restructuring clinical medical education specifically to address workforce needs and develop science-minded (rigorous, inquisitive, and innovative) and service-minded (humanistic, community-engaged, and socially accountable) graduates.

Keywords: medical education design; workforce; continuity; longitudinal integrated clerkship; symbiosis; transformation

1. The Case for Change

We are in crisis. Political, economic, socio-cultural, demographic, and health system factors jeopardize the health of individuals and populations worldwide [1,2]. Despite advances in science and technology, unprecedented socioeconomic gaps result in unequal healthcare allocation, access, and quality [3]. Healthcare costs are rising. Many of the modern advances in medicine do not reach all communities equally and disproportionately burden vulnerable populations [4]. The unequal allocation of resources may be most apparent in rural settings, home to nearly half of the world's

population [5]. One factor central to this crisis is the shortage of healthcare workers in rural and other underserved communities [6].

A key component of the physician workforce shortage is the longstanding global maldistribution of healthcare resources, exacerbated by the lack of primary care [7]. Internationally, we witness the disproportionate allocation of university and government resources to tertiary medical and surgical care. Fee-for-service out-of-pocket payment systems are creating prohibitive barriers to access for large segments of the population [1,4]. In Western health systems, shorter lengths of inpatient stay, and an aging population drive increasing outpatient volume, acuity, and demands for chronic care management [8–10]. The global primary care workforce is unable to shoulder this increasing burden.

Despite the mismatch between population health needs and care delivery capacity, the medical educational system has not changed to address this gap. Indeed, the traditional Western model of medical education is not structured to meet modern workforce needs [2,11]. In the Western system, medical students' clinical training relies on hospital-based sequential block rotations—a system created over a century ago [12]. Even as ambulatory practice makes up the vast majority of primary and specialty care delivery, students in traditional medical school curricula have limited, brief, and superficial exposure to outpatient practice. The malalignment of educational structure and clinical delivery is perhaps most evident in the traditional Western educational models, in which students lack authentic longitudinal experiences in general practice. Medical school curricula focus nearly exclusively on the diagnosis and management of acute (and often rare) disease. Students have fewer opportunities to work with patients afflicted with chronic disease and the conditions most affecting public health. In addition, students have limited work with health promotion, disease prevention, and in improving quality and safety. These educational structural issues are compounded by other factors including the rise of private medical schools that disproportionately favor affluent students from urban centers [11] and the difference in pay between specialists and generalists [13,14]. Without substantive changes in the educational stance, structure, and curricula, medical schools will be challenged to align educational outputs with workforce needs.

Medical education is undergoing intense scrutiny, and Western health education systems are beginning to heed this call [15]. Multiple new approaches exist. Education leaders advocate using the learning sciences to guide the design of educational models [16,17]. Preclinical curricula are developing new pedagogy [18]. Early clinical exposures are also increasingly common [19,20]. Clinical competency-based learning and assessment frameworks are generating significant discourse [21,22]. Whether these developments ultimately have meaningful and sustainable effects on students, patients, and the community remains an open question.

At the same time, we are witnessing a growing movement to address workforce challenges through medical educational redesign [15,23,24]. Even as there is no single solution to the crisis of workforce shortages and maldistribution, educational leaders recognize that transforming clinical education offers particular promise [2,17,23–29]. Educational continuity has emerged as an organizing principle to guide educational design [24,28,29]. One prominent example of educational continuity is the clinical education model known as a longitudinal integrated clerkship (LIC). The LIC structure does not rely on traditional specialty-specific inpatient block rotations for students' core clinical learning; LICs are a restructuring of the core clinical year such that medical students "(1) participate in the comprehensive care of patients over time, (2) participate in continuing learning relationships with these patients' clinicians, and (3) meet the majority of the year's core clinical competencies, across multiple disciplines simultaneously through these experiences" [23,28]. The LIC model has emerged as one method of clinical education delivery that connects the sciences of learning, students' educational needs, care delivery transformation, and workforce and population imperatives [28,29]. LICs and their connection to educational continuity are described in detail elsewhere [23,24,28,29]. Historically, LICs arose to address the chronic physician shortage in underserved rural regions and to foster primary care workforce retention [23,28,30]. Over time, the LIC literature has demonstrated the

benefits for students' learning [28–30], students' humanism [23,31–34], patients [29,35,36] and their communities [17,20,23,28,29,37].

Despite a compelling case for educational transformation and ample evidence of the benefit of LICs among other progressive educational models, opportunities for restructuring education are not yet fully realized. This review seeks to provide an educational framework, successful examples, and evidence in the literature to guide international education leaders in addressing the imperatives for change.

2. Guiding Educational Principles

In The Lancet Commission Report, Frenk et al. outline the model of "*transformative* education" [2]. The authors describe a shift from the goal of knowledge and professional credentials acquisition to a model of competency-driven, interdependent, team-based community health with the needs of the population at the core [2]. Grounding education in social accountability and community [38] also upholds the business principle of "design thinking" that starts with listening to, and empathy for, recipients of innovation [39]. In this section, we outline two educational principles that begin with learners, patients, and populations as the primary drivers of educational design.

2.1. Educational Continuity

Educational continuity [24] is an organizing framework that underpins educational design and arises from the sciences of learning [28,29,40,41]. Educational continuity restructures relationships across a series of intra- and interpersonal interactions. In medicine, educational continuity includes continuity of the care of the patient, continuity of the curriculum, and continuity of supervision. Of course, other continuities exist, including continuity with one's inter-professional teammates, *continuity* with one's peers, and continuity with one's community or "place" [42]. Continuity with one's own core values (the motivations that bring students to seek careers in medicine) and the core values of the profession are also fundamental for students; unfortunately, students' "continuity of idealism" is at risk under the influences of the hidden curriculum [32]. In particular, longitudinal connections with preceptors and mentors are key to building a supportive learning environment for students. Ideally, longitudinal relationships with patients and teachers also prevent the erosion of students' values [32]. In such longitudinal relational models, students have meaningful roles on an inter-professional care team *over time* preventing the risk of objectification of others [43] that comes with transient social relationships [44]. Indeed, the success of the model is predicated on the integrity and strength of the learner-patient, learner-teacher, and learner-community relationships *over time*.

2.2. Symbiosis

A second guiding principle is educational symbiosis, the notion that medical students learn in, and must negotiate, a series of bidirectional and mutually beneficial relationships [10]. This model places the student as a center node within four axes of relationships: personal-professional; clinician-patient; university-health service; and government-community [10]. Within the personal-professional relationship axis, the student must merge her personal values with her emerging professional values. Within the second relationship axis, students must learn to negotiate their relationships with and on behalf of clinicians and patients. The third relationship axis describes students navigating the interplay between the university and the health system in which the student is learning. Students who learn in nations with government-based health care systems or at institutions with strong public health missions must also learn to navigate a fourth axis—the relationship between the government and community goals for healthcare delivery. These four relationship axes influence students' professional identity formation [45]. These relationships also serve as integral elements of educational design that leaders use to create educational structures. It appears that far beyond pedagogy, restructuring relationships may more deeply influence professional orientation, skills,

and outcomes—and hereby, educational structure may be the critical force to address society's workforce needs [23,28,29,31,34,45].

3. LICs—Restructuring Education for Workforce Transformation

LICs serve as an example of an educational model grounded in educational continuity and symbiosis. Educational leaders created the first LICs to address rural health care workforce shortages. The first known LIC, the Rural Physician Associate Program (RPAP) of the University of Minnesota (UMN), has trained over 1300 students since its initiation in 1971 [46]. Students at the Minneapolis UMN campus apply to participate in the yearlong rural immersion program. To complete the requirements of their core clinical year, student participants pair with a preceptor and learn longitudinally in rural community health centers and hospitals. Students live in the community for the duration of the program. In 1991, the University of South Dakota created a rural LIC with similar workforce goals; the results of the program were so successful that in 2013, institutional leaders restructured the core year for the entire institution as an LIC. In 1997 in Australia, Flinders University School of Medicine (FUSM) created an extensive network of LIC opportunities called the Parallel Rural Community Curriculum (PRCC). Participants in these programs also live and learn in rural and remote communities throughout underserved Australian regions [47]. Multiple schools in Australia now use the model, including the University of Wollongong, which uses the model for its entire class, specifically to foster rural workforce retention [48].

The literature demonstrates that these workforce-oriented LIC programs provide "hands on" experience for students, exposing them to a wider range of common illness and more regular contact with patients over time compared to their colleagues in tertiary care settings [47,49–52]. Students report multiple benefits of the rural LICs including high teacher-to-student ratio [49], broad exposure to various patients over time, and deep student-patient relationships [20]. Students also describe the benefits of the longitudinal learner-centered teaching environment in which familiarity and trust develop, allowing for developmentally aligned supervision, nurturing guidance, autonomy, and escalating independence [19,33,49]. These factors lead to increased clinical confidence [30,49]. Students report high satisfaction with their education in these rural and community settings and with their emerging professional identity [53]. Preceptors also find meaning in the relationships they develop with students in the longitudinal model; as the learner-patient dyads and learner-teacher dyads mature, preceptors gain confidence in the student's growing clinical skills and gradually transition aspects of patient care from the preceptor to the student [45]. Preceptors also describe *reduced* time pressure because of the growing student independence, and more satisfaction in their professional lives [34]. The literature suggests that these student-preceptor longitudinal relationships create time for trust, increasingly important in our competency-based education frameworks [54].

Among other programs, and over substantial time, the UMN and Flinders LIC programs have continued to demonstrate that graduates are more likely to practice primary care, to practice in rural communities, or both when compared to students in traditional programs [15,29–31,34,49,55,56]. Analysis of the PRCC cohorts shows over four times the number of PRCC graduates remaining to practice in rural communities compared to those who graduate from the tertiary hospital-based program [46]. Primary care workforce numbers are similarly encouraging [31]. We know of no other structure of clinical education that generates workforce outcomes so successfully.

In multiple countries, leaders now create whole schools using the LIC educational structure to create workforce outcomes. For example, in 2001, the Provincial Government of Ontario, Canada, established a new medical school in Northern Ontario (NOSM) with an explicit mission of social accountability and a mandate to contribute to improve the health of the people and communities of Northern Ontario [37]. The institutional leaders deliberately designed structures, processes, and content to expand access to medical education and access to health care in the remote, rural, underserved, Aboriginal, and Francophone communities [37]. The third year of the NOSM curriculum is an immersive longitudinal community-based experience known as the Comprehensive Community

Clerkship (CCC). This mandatory LIC places students to live and learn in 12 large rural or small urban communities outside Sudbury and Thunder Bay for the full academic year. NOSM has developed a distinctive model of medical education known as distributed community engaged learning (DCEL). This model blends its core LIC structure with pillars of current medical education discourse including case-based learning, community-based medical education, and electronic distance education. Benefits of the program are clear and reaching, with increased economic activity, a larger school budget, and increased recruitment and retention of a diverse healthcare workforce [57]. Perhaps most critically, there is also a growing sense of empowerment among community participants and development of "community capacity and opportunities for innovation and growth [38]."

4. Going Forward

Communities worldwide are suffering because of workforce shortages. This crisis of medical access for rural populations is also occurring in less remote, but also vulnerable, urban population centers. To address workforce shortages, we, the international medical education community, must develop new educational goals, structures, processes, leadership, and funding mechanisms. In the interest of all members of society, we should aim deliberately and explicitly to attract, select, nurture, promote, and retain physicians and other healthcare workers from and for underserved communities. We will also need to support these physicians and other healthcare workers fully. This vision will require attention at all levels including pre-university education, universities, governments, funders, healthcare delivery institutions, employers, program applicants, and the public. Together, those who benefit from and contribute to the medical education system will need to embrace a mission of developing service-minded (humanistic, community-engaged, and socially accountable) and science-minded (rigorous, inquisitive, and innovative) graduates.

Thoughtfully designed educational interventions exist, but more innovation and more reaching innovation are needed [17]. Historically, efforts have included recruiting students from rural areas and changes to admission processes. Pre-medical pipeline programs can attract and nurture undergraduate and secondary school students interested in careers in the health sciences. More recently, "authentic inter-professional learning" experiences offer important opportunities at all levels of medical education and are integrated into many clinical settings [17].

Building upon deliberate admissions practices and student supports, enrichment programs, new pedagogy, and new curricular offerings, we argue for a powerful, and perhaps necessary, complementary approach—educational restructuring. We offer one example with longstanding and robust outcomes—workforce-oriented LIC models [28,29,31,34]. LICs animate the principles of educational continuity and educational symbiosis to unleash perhaps the most effective formative force of all—relationships.

In workforce-oriented LICs models, students learn in and engage communities and have meaningful relationships with, and roles on behalf of, patients, teachers, and the community itself. Duty and commitment drive students' learning [17,33]. Some LICs go further, connecting structural redesign of clinical education to other workforce-oriented training. For example, in the United States, prominent universities create LICs to address critical societal needs. Duke University's LIC is a core component of its "Primary Care Leadership Track"—a program which gives interested students the opportunity to focus on primary care throughout the four years of medical school [58]. The program's aim is to create a cohort of students who are service-minded and prepared for primary care practice and leadership [58]. Columbia University has a longstanding, successful rural community LIC with longitudinal leadership and management training at its core [59,60]. The University of California, San Francisco (UCSF) has an array of LICs to serve important institutional and societal missions. One UCSF LIC serves patients in urban San Francisco [61], another LIC resides in Kaiser—a nationally renowned health system committed to advancing quality, safety, and care delivery redesign [62]. Yet another UCSF LIC serves the rural needs of Fresno, California [63]. Other US institutions,

alongside schools in Canada, Northern Europe, South Africa, and Australia are continuing to innovate and develop new LICs to advance student and population needs.

No educational model is without limitations. Like other clinical educational models, LICs depend on quality of instructors, an effective program of faculty development, ensuring consistency across educational venues, and support for busy educators with an array of other non-educational responsibilities. With the longitudinal design, LICs pose important considerations due to time-in-relationship among participants. Program leaders must monitor student-student and student-faculty relationships to ensure students' educational and professional outcomes and ongoing faculty satisfaction and success. Educational quality requires close oversight due to fixed instructor assignment (i.e., the risks associated with apprenticeship models). Even as the longitudinal and integrated design closely adheres to the sciences of learning [40,41] and provides important benefits for students [28,29,34,64] this structure may add additional stress to learners [64] who learn multiple disciplines simultaneously. Nonetheless, considering the widespread success of LICs, we propose that more than pedagogy, educational *structure* matters, educational *location* matters, and that *time in meaningful roles and relationships* matters; all these educational forces can have critical impacts on learners, patients, and communities at once.

5. Conclusions

There are barriers to change in medicine and medical education. There are barriers rooted in societal and governmental practices and policies. There are barriers that prioritize subspecialty training over primary care fields through allocation of resources. There are barriers such as the longstanding adherence to the "100-plus-year reign" [17] of the traditional inpatient block rotation model of medical education. This model continues to dominate the educational landscape, and there is resistance to change in spite of advances in educational science and in spite of data.

But as we've learned, resistance to change can inspire the most creative responses. Leaders in medical education across the world are asking questions and challenging the norms that have been in place for over a century. We are seeing a culture shift, an embrace of service-minded and science-minded innovation, bolstered by committed university and government-based medical education systems internationally.

Health affects all people in all communities and not just those who can afford care or those who by luck or circumstance find themselves in high resource, high density areas. We believe that the relationship between the community-in-need and the person(s) tasked with providing care is fundamental and transcendent. Indeed, if healthcare can be distilled to this precious human engagement, then the goal of medical education must be to preserve, nurture, and honor it assiduously. And students must train in exactly this way—not just with heuristics, but with meaningful and authentic roles in care-giving *over time* with the patients, teachers, and communities they seek (and need) to serve. This understanding of the heart of healthcare must compel our existing medical education systems to transform and return to social accountability. We can ensure students learn the right science, in the right ways, with the right role models, in the right places, with the right mission. Because relationships are so powerful as a force for transforming learners, we need to actively restructure education to create the right relationships [59,64,65]. Along with the other tried and true techniques that benefit workforce outcomes, we affirm the profound value of educational restructuring.

Author Contributions: Nora Y. Osman, Alev Atalay, Arundhati Ghosh, Yamini Saravanan, Bianca Shagrin, Tara Singh and David A. Hirsh conceived of, contributed to, wrote and edited the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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