The Future of Postgraduate Medical Education in Canada

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Abstract

The Future of Medical Education in Canada Postgraduate (FMEC PG) Project was launched in 2010 by a consortium of four organizations: the Association of Faculties of Medicine of Canada, the Collège des Médecins du Québec, the College of Family Physicians of Canada, and the Royal College of Physicians and Surgeons of Canada. The FMEC PG study set out to review the state of the Canadian postgraduate medical education (PGME) system and make recommendations for improvements and changes. The extensive process included literature reviews, commissioned papers, stakeholder interviews, international consultations, and dialogue with the public and learners. The resulting key findings and 10 recommendations, published in a report in 2012, represent the collective vision of the consortium partner organizations for PGME in Canada. Implementation of the recommendations began in 2013 and will continue beyond 2016.

In this article, the authors describe the complex process of developing the recommendations, highlight several recommendations, consider implementation processes and issues, and share lessons learned to date. They reflect on the ways in which the transformation of a very complex and complicated PGME system has required many stakeholders to work together on multiple interventions simultaneously. Notwithstanding the challenges for the participating organizations, changes have been introduced and sustainability is being forged. Throughout this process, the consortium partners and other stakeholders have continued to address the social accountability role of all physicians with respect to the public they serve.

The future of postgraduate medical education (PGME) in Canada has been under the microscope over the past decade. Many of the issues for graduate medical education (GME) in the United States are also realities for PGME in Canada; these include the number of physicians needed, the distribution of physicians, the need to balance primary care output with other specialty output, the move toward team-based care, the changes in service delivery models, the content of the curricula, the costly accreditation processes, the focus on quality and safety, and the examination of resident duty hours.[1] We need a physician workforce in Canada that will improve health outcomes for all patients in diverse settings, particularly patients who are marginalized. We also need to train this workforce while recognizing that we are already spending a large percentage of Canada's gross domestic product on health care (11% in 2014[2]).

In 2010, four organizations—the Association of Faculties of Medicine of Canada (AFMC), the Collège des Médecins du Québec (CMQ), the College of Family Physicians of Canada (CFPC), and the Royal College of Physicians and Surgeons of Canada—formed a consortium, and with $1.8 million (CAD) in financial support from Health Canada, undertook a thorough review of PGME in Canada. In 2012, we published the Future of Medical Education in Canada Postgraduate (FMEC PG) Project's 10 recommendations for change in PGME.[3] Implementation of these recommendations is ongoing across residency training programs. Our FMEC PG study has built directly on the work done in a prior, comprehensive study of undergraduate medical education (UGME) in Canada that was commissioned in 2007. That study, the Future of Medical Education in Canada MD (FMEC MD) Project,[4] built on the work of Abraham Flexner from 100 years earlier[5] and also culminated in 10 recommendations for change that are being implemented across Canadian faculties of medicine (see List 1). There are clear linkages between some of the recommendations in the two FMEC reports.

In this article, we briefly describe the complex process of developing the FMEC PG recommendations, which included literature reviews, commissioned papers, stakeholder interviews, international consultations, and dialogue with the public and learners. We highlight the resulting recommendations, which represent the four consortium partner organizations' collective vision of PGME in Canada; consider implementation processes and issues; and share lessons learned to date.

Canadian PGME Context

In Canada, all PGME is university based through 17 medical schools, which allows the 17 postgraduate deans to represent all residency programs. There are three certifying and accrediting bodies for PGME: the CFPC for family medicine, the Royal College for all other specialties, and the CMQ, which works with both the CFPC and the Royal College to accredit and certify physicians in Québec. Strong collaboration exists with other key organizations such as the Medical Council of Canada, the Federation of Medical Regulatory Authorities

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List 1
Ten Recommendations for Change in Medical Education in Canada From the Future of Medical Education in Canada MD Project[a]

1. Address individual and community needs
2. Enhance admissions processes
3. Build on the scientific basis of medicine
4. Promote prevention and public health
5. Address the hidden curriculum
6. Diversify learning contexts
7. Value generalism
8. Advance inter- and intraprofessional practice
9. Adopt a competency-based and flexible approach
10. Foster medical leadership

[a]*Source:* Adapted from "The Future of Medical Education in Canada (FMEC): A Collective Vision for MD Education."[4]

of Canada, the Canadian Medical Association, and HealthCare*CAN* (formerly the Association of Canadian Academic Healthcare Organizations).

Family medicine is the only primary care discipline in PGME in Canada; all other disciplines are consulting disciplines. Approximately 40% of all entry-level residency positions are in family medicine, except in Québec where the proportion will soon be 55%. There are 68 specialties and subspecialties within the Royal College, which is responsible for all specialty residency training except for family medicine. Family medicine is a two-year training program, whereas Royal College specialty training programs are four to six years in length. These training periods differ from U.S. GME, where family medicine and other primary care disciplines have three-year training programs.

It is important to note that the FMEC PG project is being undertaken at a time when large changes are already happening in PGME in Canada, in the system of provision of health care, in medical knowledge, and in the understanding of education theory. As well, medical school enrollment has increased from approximately 1,500 entry-level positions in 2000 to nearly 3,000 in 2014, with a concomitant increase in the number of residency positions. Distributed campuses have been developed in communities away from medical school main campuses, and these distributed campuses have been assuming more teaching responsibilities. Tens of thousands of clinical teachers have been recruited to help with this expansion.

Overview of the FMEC PG Planning Process

There were many motivations to conduct the FMEC PG study, but the primary one was to respond to a collective sense that we could do better in educating the right number, mix, and distribution of physicians to meet the ongoing and evolving health care needs of the diverse population of Canada. The recent Institute of Medicine (IOM) report "Graduate Medical Education That Meets the Nation's Health Needs"[6] has the same ultimate goal for U.S. GME. Similarly, two recent Macy Foundation reports[7,8] have focused on U.S. GME reform.

The FMEC PG project created a comprehensive body of evidence on which to base suggestions of future changes to PGME. This project was the beginning of our journey toward improving the quality of PGME in Canada, a process for which the four consortium partner organizations, other medical and medical education organizations, and government ministries are collectively responsible—it was the start of our continuous quality improvement approach to PGME.

Developing the FMEC PG Recommendations

Methodology

A thorough literature review was conducted, and 24 papers were commissioned as part of an environmental scan that highlighted all of the critical areas in PGME.[9] We engaged a Liaison and Engagement Consulting (LEC) group, led by prominent Canadian academics from the University of Toronto, McGill University, and the University of British Columbia, to help develop the themes that would be addressed and would lead to the FMEC PG recommendations. The LEC group developed these key themes through a process of document analysis, review of the commissioned papers, and focus groups and focused interviews with medical educators across Canada. The LEC group also conducted 108 consultations with educators, regulators, learners, government officials, allied health professionals, and hospital and medical association leaders, asking them to identify personal and organizational priorities for PGME reform.

A public poll was also commissioned. This poll received 1,720 responses (through online and mail-in surveys) from Canadians who described their perceptions of physicians and health care in Canada. In addition, an analysis of international best practices in PGME, including those in the United States, was carried out by Canadian academics.

All of the information gathered was analyzed and used in an iterative and deliberate way to help us formulate the FMEC PG recommendations. Once the recommendations had been drafted, a second round of consultations took place; these included consultations with 107 individuals representing 13 key organizations and with 17 medical school roundtables (579 participants, mainly faculty). In addition, a Web-based survey of medical educators was conducted to gauge reaction to the draft recommendations. There was also an active process to engage and elicit the opinions of the CEOs of the consortium's four partner organizations. Throughout the process, every effort was made to identify the key issues for PGME.

Guiding principles

The 10 FMEC PG recommendations for reforming PGME have a sound basis in four guiding principles that are felt to be of central importance to Canada's future medical education system:

1. Align physicians' learning around the health and well-being of patients and communities
2. Ensure patient safety and quality patient care
3. Value, model, and integrate interprofessionalism and intraprofessionalism into resident learning and practice
4. Integrate state-of-the-art technology[3]

Embedded in these principles is the key notion of social accountability, a perspective that has been endorsed by all Canadian faculties of medicine[10] and other major medical education organizations. Additionally, there is a commitment to model and practice in a supportive, interprofessional manner. Patient safety, aligned to the quality

of care provided to patients, is an essential area that all the leading medical organizations in Canada need to continue to address.

Result

The work described above resulted in the 2012 publication of the FMEC PG report "A Collective Vision for Postgraduate Medical Education in Canada,"[3] which includes our 10 recommendations for change (see Table 1).

Implementing the FMEC PG Recommendations

We are currently in the process of implementing the 10 FMEC PG recommendations. The implementation, which began in 2013 and will continue beyond 2016, is at different stages depending on the nature of the recommendation. Each of the 10 recommendations has one or more key transformative action items that, if implemented, would achieve substantial change (see Table 1). Many of the recommendations also have additional action items that are being addressed.

To move forward with implementation, in 2013 we approached Health Canada for additional funding support. Although health is a provincial responsibility in Canada (with the federal government providing some transfer payments to the provinces and looking after certain populations such as Aboriginal persons and the prison populations), Health Canada agreed to provide funding of approximately $1 million (CAD) over three years to help implement three recommendations: the recommendations on transitions (no. 5), governance (no. 9), and alignment of accreditation (no. 10). The other recommendations are being implemented with support from relevant organizations and from individuals. An FMEC PG project management team is funded by the four consortium partners, and a project lead (N.B.) was hired through the Health Canada grant.

Once the FMEC PG report was released, we created a Strategic Implementation Group (SIG) that includes representatives of all the major medical and learner

Table 1

The Future of Medical Education in Canada Postgraduate Project: Ten Recommendations With Key Transformative Actions[a]

Recommendations	Key action items
1. Ensure the right mix, distribution, and number of physicians to meet societal needs	Create a national approach, founded on robust data, to establish and adjust the number and type of specialty positions needed in Canadian residency programs in order to meet societal needs. Establish a national plan to address the training and sustainability of clinician scientists.
2. Cultivate social accountability through experience in diverse learning and work environments	Provide all residents with diverse learning environments that include varied practice settings and expose them to a range of service delivery models.
3. Create positive and supportive learning and work environments	Provide residents with adequate opportunities to learn and work in environments that foster respect among professions and are reflective of an interprofessional and intraprofessional, collaborative, patient-centered approach to care.
4. Integrate competency-based curricula in postgraduate programs	Develop and implement competency-based training programs.
5. Ensure effective integration and transitions along the educational continuum	Develop smoother and more effective transitions from medical school to residency and from PGME into clinical practice: a. Review and redesign current practices and systems (e.g., the entry-into-residency process). b. Link the individual learner competencies developed in MD training with the educational objectives set for the resident. c. Review the timing of national examinations. d. Develop strategies to increase flexibility to switch disciplines while in training or when reentering residency training.
6. Implement effective assessment systems	Provide residents with regular and adequate formative feedback from multiple sources on both their individual and team performance, including the identification of strengths and challenges, to support progressive attainment of competence along the learning continuum.
7. Develop, support, and recognize clinical teachers	Develop a national strategy for faculty development and CPD that is accessible, comprehensive, and supports the spectrum of clinical teaching activities, including the teaching, assessment, and role modeling of CanMEDS and CanMEDS-FM roles.
8. Foster leadership development	Develop, in close collaboration with UGME programs, a national core leadership curriculum for all residents that is focused on professional responsibilities, self-awareness, providing and receiving feedback, conflict resolution, change management, and working as part of a team as a leader, facilitator, or team member.
9. Establish effective collaborative governance in PGME	Identify organizations that have decision-making authority in PGME and define roles that could better streamline and enhance their collaboration through the study of governance models and the implementation of the one that promotes the greatest efficiency and effectiveness.
10. Align accreditation standards	Facilitate and enable a more integrated PGME system by aligning accreditation standards and processes across the continuum of learning in the UGME, PGME, and CPD environments.

Abbreviations: PGME indicates postgraduate medical education; CPD, continuing professional development; FM, family medicine; UGME, undergraduate medical education.

[a]*Source:* Adapted from The Future of Medical Education in Canada Postgraduate Project, "A Collective Vision for Postgraduate Medical Education in Canada."[3]

organizations in Canada as well as government representatives. A Management Committee—consisting of representatives of the four consortium partners plus a medical school dean, a UGME dean, and a PGME dean—manages the implementation activities on a day-to-day basis and reports to the SIG. It has been essential to have all these key medical educators engaged in all decision making related to implementation.

For most of the recommendations, the SIG has established working groups with designated leaders from academic medicine. Medical students and residents are also included in the working groups. Each working group was asked to create a project charter, based on the recommendation's action items, with deliverables and timelines. These project charters were reviewed by the SIG, and there is ongoing feedback between the Management Committee and the working groups to ensure that the charter objectives are being followed and timelines are being respected.

Below, we highlight the implementation activities underway for several of the recommendations. More details about implementation activities for all the recommendations can be found on the FMEC PG Web site.[11]

Recommendation 1: Physician mix, distribution, and number

Recommendation 1 is as follows:

> In the context of an evolving healthcare system, the PGME system must continuously adjust its training programs to produce the right mix, distribution, and number of generalist and specialist physicians—including clinician scientists, educators, and leaders—to serve and be accountable to the Canadian population. Working in partnership with all healthcare providers and stakeholders, physicians must address the diverse health and wellness needs of individuals and communities throughout Canada.[3]

To spearhead the implementation of this recommendation, we established a multi-stakeholder task force—the Physician Resource Planning Task Force—cochaired by the president and CEO of AFMC and a representative from one provincial government. This task force is building a physician planning tool that will generate physician supply scenarios to account for different specialty mixes, track physician migration across jurisdictions, provide interprovincial comparisons, and make projections for both rural and urban communities. The ultimate goal is to adjust the training supply (numbers and disciplines) in relation to need.

All residency positions in Canada are funded by governments—the vast majority by provincial governments and a few by the federal government. These positions exist in tertiary care teaching hospitals as well as in many smaller community hospitals and other community-based health care settings. Implementing this recommendation will ultimately require a dialogue between provincial governments and medical schools to adjust the training positions to meet community needs. This dialogue may well challenge some long-held practices in which residency positions have been allocated for many reasons, including the assignment to services that are dependent on residents to meet patient care needs. Additionally, implementation of this recommendation should help medical students and residents make career choices that will lead to jobs and meaningful careers.

Recommendations 4 and 6: Competency-based medical education

Recommendation 4 focuses on bringing competency-based medical education (CBME) into all residency training programs. The CFPC and the Royal College are both undertaking major initiatives to move toward a CBME model. The CFPC's Triple C competency-based curriculum[12] is being rolled out in all 17 departments of family medicine in Canada. It is based on the CanMEDS–Family Medicine framework and the evaluation objectives in family medicine. There are three components of Triple C: comprehensive education and patient care, continuity of education and patient care, and centered in family medicine. The Royal College's Competence by Design[13] program is being implemented in a number of early adopter disciplines. Competence by Design is a multiyear initiative to implement a CBME approach to residency education and specialty practice in Canada. It is based on determining what competencies and assessment tools are required to meet patient needs and sets the appropriate curriculum for residents.

In parallel with the rollout of CBME, both the CFPC and the Royal College are developing expanded toolboxes of formative and summative assessment programs, which are essential for the successful implementation of CBME. The development of these toolboxes addresses recommendation 6 on implementing effective assessment systems.

Recommendation 5: Transitions

Recommendation 5 relates to ensuring effective transitions along the educational continuum. The transitions from medical student to resident and then from resident to practicing physician are difficult, and they often are not managed with enough explicit attention to patient safety and regard for learner issues. The aim of this recommendation is to improve these transitions and provide learners with more skills to handle the changes. The implementation initiatives include the development of exiting entrustable professional activities (EPAs) for all medical students. (EPAs are units of professional practice, defined as tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence.[14]) Other initiatives include improved and more transparent PGME admission processes, discipline-specific post-Match "boot camps" for students, and consideration of a reconfiguration of the entry into residency (numbers and types of entry-level disciplines).

Recommendation 9: Effective, collaborative governance

Recommendation 9 is related to governance of PGME and is intended to facilitate transformative change. As is documented in the IOM report on GME,[6] decision making related to governance and financing in PGME is both complex and complicated. To respond to this recommendation, the Governance Working Group commissioned a study of collaborative governance models. Agreement has been reached on the terms of reference for a new PGME Governing Council, which will make collective recommendations for ratification by the council members' organizations. We are in the process of testing the model for its effectiveness and efficiency and are drawing up a memorandum of understanding between all council members.

Recommendation 10: Aligning Accreditation Standards

Recommendation 10 aims at aligning accreditation processes and standards across the learning continuum from

UGME to PGME and into professional practice. While the alignment of accreditation processes requires some compromises, the alignment of standards requires even more compromises. These issues are being dealt with head on by all of the UGME, PGME, and continuous professional development accrediting bodies in Canada. The even bigger challenge that we are struggling with is developing meaningful outcomes measures that test the effectiveness of our medical training rather than mainly measure processes.

Identifying Outcomes and Developing Performance Indicators

One of the key issues that needs to be addressed by all of the working groups is how to identify outcomes and develop performance indicators. There is a range of expected outcomes—time frames (short, intermediate, and long range), levels (local, regional, and national), and outcome chain (satisfaction, learning, behavior, and results)—and all 10 recommendations will have to be linked to the overall aim of the FMEC PG project a number of years downstream. There are clear outcomes for some recommendations, such as the alignment of accreditation processes across the educational continuum, the development and implementation of a PGME Governing Council, the development of clear and transparent admission requirements for all PGME programs, and the implementation of CBME in all disciplines. For other recommendations, however, no clear outcomes have yet been articulated; all of the working groups have been advised that this is an essential part of their work. Planning is under way for a sustainability summit in 2015–2016—with participation by the working group chairs, SIG members, and representatives of all the SIG member organizations—to decide collectively how the work coming out of this project can be internalized and lead to the cultural and learning environment changes that we see as essential. It will be critical that the 17 faculties of medicine and the 4 consortium partners in particular be prepared to support the decisions coming out of the summit.

The impact of implementing these recommendations at the institutional (university) level is likely dependent to some degree on the institution's local learning culture, its organizational readiness, its organizational values, and the adequacy of its resources.

Lessons Learned to Date

As described above, the success of the FMEC PG project will be measured in many ways, including the development of more rational health human resource planning in Canada, the introduction of CBME in all disciplines, the alignment of accreditation processes and standards across the continuum, and the institution of a PGME Governing Council to lead a collaborative governance and decision-making process. The substantial progress of the implementation to date can be credited to many factors.

One key factor relates to the inclusive and extensive consultation process used in both the development and the implementation processes. As implementation has continued, we have stepped back and reflected on our process. Ours is a process of transformation within a complex adaptive system. For the purposes of this article and to guide the PGME Governing Council that we are forming, we are defining complex adaptive systems as "dynamic systems that adapt *in* and evolve *with* a changing environment"[15] and consist of heterogeneous, interactive "adaptive agents" functioning as a whole within a set of defined rules.[16] It is critical to highlight that we are attempting to introduce multiple interventions in the system simultaneously and at different points. This is not an easy task. Furthermore, in a complex adaptive system, small inputs can lead to large changes, and there may be unexpected consequences of any action taken. Change will come about with interventions at many levels and not simply from a top-down approach.

Writing on large system change in health care, Best et al[17] emphasize the role of focused and distributed leadership and the need for engagement of all physicians. The inclusion of learners (both medical students and residents) has been critical to our process. However, although we have strong and focused leadership, we probably do not have enough distributed leadership to connect with the grassroots—the learners and the educators. We have communication tools that, again, allow us to reach those most involved with the project, but our reach is not wide enough. We will be engaging a communications expert in 2015–2016 to help with communication to preceptors, educators, and learners so that we can ensure that there is widespread buy-in and understanding of the changes.

Another perspective that has shaped our way forward is the National Health Service Institute for Innovation and Improvement report "Leading Large Scale Change: A Practical Guide."[18] The report describes 10 key principles of large-scale change. The first principle describes the key idea in the large-scale change process: "movement towards a new vision that is better and fundamentally different from the status quo." The other principles are all key to success, aimed at "transforming mindsets, leading to inherently sustainable change."

The biggest challenge in implementing most of the FMEC PG recommendations has been bringing organizations with discrete mandates, decision-making structures, and perceived areas of responsibility together to work toward common goals. Implementing our collective vision requires tact, cooperation, and compromise. The consortium partners have succeeded beyond our expectations in gaining the confidence of all the stakeholder organizations so that we can make decisions that benefit our PGME system. As decisions near finalization and each SIG member organization has to appropriately endorse decisions through its own process, there is the risk of pullback as these decisions may have impacts on organizations' perceived mandates. Having said that, we cannot emphasize enough how much this project and its implementation strategies have done for collaborative decision making in PGME in Canada. Organizations are sharing their plans and goals, decisions are being made within a broader context, and no issues are being left off the table.

We are aiming for transformative and sustainable change, not simply the completion of a project. However, funding to support the implementation of some of the recommendations is time limited and will not be sufficient. We require an ongoing commitment of financial and human resources if we are to truly reach the vision laid out in the 10 recommendations.

The impact on partners' financial and human resources is significant and presents a challenge as we move forward with implementation activities that will take years and, by necessity, will need to involve external partners, especially health care organizations and governments.

Harking back to the nature of this project—working toward large-scale change in a complex adaptive system—it is apparent that the coordination of implementation activities continues to be a major challenge. There is an ongoing need not only to align all of the project implementation activities with one another but also to align these activities with the many ongoing activities and initiatives of the consortium partner organizations.

Conclusion

The FMEC PG project has enabled stakeholder organizations to come together to develop a collective vision for PGME in Canada. Implementing this vision for PGME, as well as the FMEC MD project's vision for UGME, has resulted in collective action to improve medical education and promote physicians' social accountability roles with respect to the public in Canada. By reforming the continuum of medical education from end to end, we will continue to ensure the capacity of our physicians to meet the needs of Canadians, now and in the future.

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References

1 National Steering Committee on Resident Duty Hours. Fatigue, Risk and Excellence: Towards a Pan-Canadian Consensus on Resident Duty Hours. Ottawa, Ontario, Canada: Royal College of Physicians and Surgeons of Canada; 2013.
2 Canadian Institute for Health Information. Spending. https://www.cihi.ca//en/spending-and-health-workforce/spending. Accessed May 7, 2014.
3 Association of Faculties of Medicine of Canada, Collège des Médecins du Québec, College of Family Physicians of Canada, Royal College of Physicians and Surgeons of Canada. The Future of Medical Education in Canada. A Collective Vision for Postgraduate Medical Education in Canada. 2012. http://www.afmc.ca/future-of-medical-education-in-canada/postgraduate-project/pdf/FMEC_PG_Final-Report_EN.pdf. Accessed May 7, 2015.
4 Association of Faculties of Medicine of Canada. The Future of Medical Education in Canada: A Collective Vision for MD Education. 2010. https://www.afmc.ca/future-of-medical-education-in-canada/medical-doctor-project/pdf/collective_vision.pdf. Accessed May 7, 2011.
5 Busing N, Slade S, Rosenfield J, Gold I, Maskill S. In the spirit of Flexner: Working toward a collective vision for the future of medical education in Canada. Acad Med. 2010;85:340–348.
6 Institute of Medicine. Graduate Medical Education That Meets the Nation's Health Needs. Washington, DC: National Academies Press; 2014.
7 Weinstein D, chair. Ensuring an effective physician workforce for the United States: Recommendations for Graduate Medical Education to Meet the Needs of the Public. The Content and Format of GME [conference proceedings]. New York, NY: Josiah Macy Jr. Foundation; November 2011. http://www.macyfoundation.org/docs/macy_pubs/JMF_GME_Conference2_Monograph(2).pdf. Accessed May 7, 2015.
8 Johns MME, chair. Ensuring an Effective Physician Workforce for America: Recommendations for an Accountable Graduate Medical Education System [conference proceedings]. New York, NY: Josiah Macy Jr. Foundation; 2010. http://www.macyfoundation.org/docs/macy_pubs/Effective_Physician_Workforce_Conf_Book.pdf. Accessed May 7, 2015.
9 The Future of Medical Education in Canada Postgraduate Project. Activities: Environmental scan. Published 2011. https://www.afmc.ca/future-of-medical-education-in-canada/postgraduate-project/activities-environmental.php. Accessed May 7, 2015.
10 Health Canada. Social Accountability: A Vision for Canadian Medical Schools. Ottawa, Ontario, Canada: Health Canada; 2001. https://www.afmc.ca/pdf/pdf_sa_vision_canadian_medical_schools_en.pdf. Accessed May 7, 2015.
11 The Future of Medical Education in Canada Postgraduate Project. http://www.afmc.ca/future-of-medical-education-in-canada/postgraduate-project/index.php. Accessed May 7, 2015.
12 Tannenbaum D, Kerr J, Konkin J, et al. Triple C Competency-Based Curriculum. Report of the Working Group on Postgraduate Curriculum Review–Part 1. Mississauga, Ontario, Canada: College of Family Physicians of Canada; 2011. http://www.cfpc.ca/uploadedfiles/education/_pdfs/wgcr_triplec_report_english_final_18mar11.pdf. Accessed May 7, 2015.
13 Royal College of Physicians and Surgeons. Competence by Design: Reshaping Canadian Medical Education. March 2014. http://www.royalcollege.ca/portal/page/portal/rc/common/documents/educational_initiatives/rc_competency-by-design_ebook_e.pdf. Accessed May 7, 2014
14 Ten Cate O. Nuts and bolts of entrustable professional activities. J Grad Med Educ. 2013;5:157–158.
15 Chan S. Complex adaptive systems. Massachusetts Institute of Technology ESD.83 Research Seminar in Engineering Systems. October 31, 2001/November 6, 2001. http://web.mit.edu/esd.83/www/notebook/Complex%20Adaptive%20Systems.pdf. Accessed May 7, 2015.
16 Ahmed E, Elgazzar AS, Hegazi AS. An overview of complex adaptive systems. Mansoura J Math. June 28, 2005. http://arxiv.org/pdf/nlin.AO/0506059.pdf. Accessed May 7, 2015.
17 Best A, Greenhalgh T, Lewis S, Saul JE, Carroll S, Bitz J. Large-system transformation in health care: A realist review. Milbank Q. 2012;90:421–456.
18 Bevin H, Plsek P, Winstanley L; NHS Academy for Large Scale Change. Part 1. Leading Large Scale Change: A Practical Guide. Leeds, UK: NHS Institute for Innovation and Improvement; 2013. http://www.nhsiq.nhs.uk/8530.aspx. Accessed May 7, 2015.