Abstract
Over the past 50 years, the CTU has remained a core part of training for residents within internal medicine training programs. At the same time, the needs of society have changed significantly over the years, and current training needs to reflect this change. This is not a novel idea, but one that we feel requires greater attention to adequately address the needs of academic teaching hospitals across the country.

Resume
Au cours des 50 dernières années, la CTU est restée un élément essentiel de la formation des résidents dans le cadre des programmes de formation en médecine interne. Dans le même temps, les besoins de la société ont considérablement évolué au fil des ans, et la formation actuelle doit refléter ce changement. Il ne s’agit pas d’une idée nouvelle, mais d’une idée qui, selon nous, nécessite une plus grande attention afin de répondre adéquatement aux besoins des hôpitaux universitaires d’enseignement à travers le pays.

The concept of training students at the bedside is often attributed to the leadership of Dr. William Osler in the late 1800s at Johns Hopkins University. By the 1960s the Association of Canadian Medical Colleges provided further definition to the concept of training students at the bedside by developing the Clinical Teaching Unit (CTU). CTUs were defined as clinical areas where education was provided by undergraduate and graduate medical trainees through the care of patients, with graded levels of responsibility depending on their level of training. In this model, the supervising physician is jointly appointed by both the hospital and the affiliated university. At McMaster University, the main care providers for patients on the CTU across three teaching hospitals are the PGY-1 residents and medical students who report to the senior PGY-2 and PGY-3 residents. The junior learners on the team gain experience in direct patient care, including patient assessments, physical examination, and documentation. The senior members of the team develop leadership, teaching and consultancy skills. The role of direct patient care for senior learners is de-emphasized in this model.

Over the past 50 years, the CTU has remained a core part of training for residents within internal medicine training programs. At the same time, the needs of society have changed significantly over the years, and current training needs to reflect this change. This is not a novel idea, but one that we feel requires greater attention to adequately address the needs of academic teaching hospitals across the country.
Gap Analysis
At McMaster University, and many academic institutions across the country, hospitals rely upon the CTU structure to provide the majority of inpatient acute care to hospitalized patients through geographic full-time (GFT) faculty, resident trainees and medical students. The number of residents in internal medicine has climbed over the past ten years (from 336 to 437). However, patient volumes admitted to internal medicine have also been climbing: in one study there was an increase by 32.4% between 2010 and 2015. With climbing pressures to provide clinical service to growing numbers of patients at academic institutions, it is becoming an ever-greater challenge to balance the educational needs of trainees on the CTU. In 1993 a similar call was made by Maudsley et al. to critically look at our health care patterns and revise our conventional CTU training model.

Furthermore, as noted above, the majority of the CTU environments are connected to Universities. These institutions are often in large urban areas and part of tertiary care centres. This limits the internal medicine trainee from reliably accessing rural experiences. It is recognized that working within a rural practice provides contextual learning, which has an important influence on the development of relevant knowledge, skills and attitudes for trainees, and future career choices.

The CTU model is heavily focused on medical inpatients. Over the years, several medical conditions, which were previously managed in the inpatient setting, are redirected to the ambulatory setting. Also, there is now a movement towards rapid assessment clinics for internal medicine where patients are seen from the Emergency Department within 48–72 hours and there is timely access to investigations. There is a societal economic benefit to managing patients in the outpatient setting when possible. Current trainees will need to develop the skills to manage patients in the ambulatory care setting.

The traditional CTU is still an important part of core internal medicine training, however, novel changes are required for training programs to deal with some of the challenges listed above. As noted, this is not a new issue facing medical educators in 2019. This has been highlighted in prior literature dating back to 1986. Many programs across the country have made changes to their internal medicine training programs in an attempt to deal with the above-highlighted issues. Similarly, additional rotations have been built into the core internal medicine program at McMaster University to address the need for a more diverse experience and to help our trainees develop the competencies that will be required of internists in today’s clinical environment.

The Royal College of Physicians and Surgeons of Canada is leading all postgraduate training programs to transition to a competency-based medical education system entitled Competence by Design (CBD) by 2022. CBD places significant emphasis on the training context and the educational experiences trainees encounter during residency. This has provided an even greater incentive for program directors to reassess educational programming.

At McMaster University, we have modified our curriculum in several ways to meet the changing needs of our learners and society (Table 1). These will be described in detail below, however, to summarize we incorporated a formal Ambulatory CTU (A-CTU) to emphasize the outpatient management of medical patients. To balance teaching and patient care throughout the day, and to ensure an opportunity for direct supervision of residents during the primary assessment of new patients in the Emergency Department, we created a medical service dedicated to admitting Internal Medicine patients during the daytime. A social medicine rotation was developed to provide learners with the knowledge and skills required to care for vulnerable populations, which is not consistently captured while working on the CTU. Finally, we have incorporated a simulation curriculum to address limitations in receiving direct observation and feedback for certain clinical activities during the traditional curriculum. Our modifications at McMaster University have helped to deal with some gaps in the traditional CTU training, however, we recognize that there are no perfect solutions. This article is to serve as a platform for idea sharing between internal medicine programs across the country.

Ambulatory CTU
We have developed an Ambulatory CTU (A-CTU) located in the Boris Clinic at McMaster University, which has a similar graded structure of the traditional CTU in an ambulatory setting. In this clinical environment, medical learners manage a variety of inpatient acute care to hospitalized patients through geographic full-time (GFT) faculty, resident trainees and medical students. The number of residents in internal medicine has climbed over the past ten years (from 336 to 437). However, patient volumes admitted to internal medicine have also been climbing: in one study there was an increase by 32.4% between 2010 and 2015. With climbing pressures to provide clinical service to growing numbers of patients at academic institutions, it is becoming an ever-greater challenge to balance the educational needs of trainees on the CTU. In 1993 a similar call was made by Maudsley et al. to critically look at our health care patterns and revise our conventional CTU training model.

Furthermore, as noted above, the majority of the CTU environments are connected to Universities. These institutions are often in large urban areas and part of tertiary care centres. This limits the internal medicine trainee from reliably accessing rural experiences. It is recognized that working within a rural practice provides contextual learning, which has an important influence on the development of relevant knowledge, skills and attitudes for trainees, and future career choices.

The CTU model is heavily focused on medical inpatients. Over the years, several medical conditions, which were previously managed in the inpatient setting, are redirected to the ambulatory setting. Also, there is now a movement towards rapid assessment clinics for internal medicine where patients are seen from the Emergency Department within 48–72 hours and there is timely access to investigations. There is a societal economic benefit to managing patients in the outpatient setting when possible. Current trainees will need to develop the skills to manage patients in the ambulatory care setting.

The traditional CTU is still an important part of core internal medicine training, however, novel changes are required for training programs to deal with some of the challenges listed above. As noted, this is not a new issue facing medical educators in 2019. This has been highlighted in prior literature dating back to 1986. Many programs across the country have made changes to their internal medicine training programs in an attempt to deal with the above-highlighted issues. Similarly, additional rotations have been built into the core internal medicine program at McMaster University to address the need for a more diverse experience and to help our trainees develop the competencies that will be required of internists in today’s clinical environment.

The Royal College of Physicians and Surgeons of Canada is leading all postgraduate training programs to transition to a competency-based medical education system entitled Competence by Design (CBD) by 2022. CBD places significant emphasis on the training context and the educational experiences trainees encounter during residency. This has provided an even greater incentive for program directors to reassess educational programming.

At McMaster University, we have modified our curriculum in several ways to meet the changing needs of our learners and society (Table 1). These will be described in detail below, however, to summarize we incorporated a formal Ambulatory CTU (A-CTU) to emphasize the outpatient management of medical patients. To balance teaching and patient care throughout the day, and to ensure an opportunity for direct supervision of residents during the primary assessment of new patients in the Emergency Department, we created a medical service dedicated to admitting Internal Medicine patients during the daytime. A social medicine rotation was developed to provide learners with the knowledge and skills required to care for vulnerable populations, which is not consistently captured while working on the CTU. Finally, we have incorporated a simulation curriculum to address limitations in receiving direct observation and feedback for certain clinical activities during the traditional curriculum. Our modifications at McMaster University have helped to deal with some gaps in the traditional CTU training, however, we recognize that there are no perfect solutions. This article is to serve as a platform for idea sharing between internal medicine programs across the country.

Ambulatory CTU
We have developed an Ambulatory CTU (A-CTU) located in the Boris Clinic at McMaster University, which has a similar graded structure of the traditional CTU in an ambulatory setting. In this clinical environment, medical learners manage a variety

| Activity                                      | PGY 1 | PGY 2 | PGY 3 |
|-----------------------------------------------|-------|-------|-------|
| Traditional CTU                              | 12 weeks | 14 weeks | 4 weeks* |
| Preceptor Based Internal Medicine Team        | 4 weeks | 2 weeks |       |
| ER consultation and Follow-up team           | 4 weeks | 4 weeks |       |
| Social Medicine Rotation                      | 2-4 weeks* |       |       |

*elective
**simulation curriculum is longitudinal throughout noon rounds while on the clinical teaching unit and academic half day.
of complex medical patients in an outpatient setting referred from the Emergency Department or community care providers.

The A-CTU provides a different learning experience than a traditional outpatient clinic for several reasons. To begin, this clinic provides an opportunity for PGY3 learners to practice higher-level skills required for an academic clinician working in an outpatient practice. This includes supervising and reviewing cases with multiple learners or physician extenders (physician assistant or nurse practitioner) in the outpatient setting, triaging referrals, and following up on critical results. Similar to the traditional CTU, there is also a full allied health team present in the A-CTU, including a pharmacist, occupational therapist, and social worker. Residents learn how to collaborate with these providers in the ambulatory setting. There is a formal academic curriculum on the A-CTU. This includes a dedicated physical examination curriculum guided by PGY3 residents for the PGY1 residents and an afternoon report where interesting or challenging outpatient cases are discussed with all levels of learners. Furthermore, the A-CTU provides an opportunity to seek consultation from sub-specialty services sharing the clinic space. The Boris clinic often has General Internal Medicine, Diabetes, Dermatology, Thrombosis, Hematology, Obstetrical Medicine, Rheumatology, Respiratory and Infectious Disease clinics running concurrently. If a sub-specialty opinion would be of value, the PGY1 resident can seek formal or informal consultation from the relevant specialist. This is both encouraged and welcomed within the culture of the A-CTU. Also, there is access to an ultrasound machine and procedural equipment. Thus, similar to the CTU, learners can gain procedural or point-of-care ultrasound skills while on the A-CTU.

Preceptor-Based Senior Medical Resident Role

In addition to functioning as a senior resident on a traditional CTU, our senior residents complete a preceptor based inpatient internal medicine rotation where they work under the direct supervision of an attending physician. The one-on-one teaching experience between faculty and senior learner sets the stage for meeting targeted learning objectives and graded responsibility. We anticipate that many of our graduates will work in community-based hospital environments without formal CTUs, thus felt it was important to develop the skills to function as an independent practitioner. In the preceptor-based rotation, the senior resident is responsible for independently managing inpatients. The resident will complete all necessary clinical procedures. They are responsible for reviewing the initial consultation with the overnight admitting team, as well as bedside management and discharge planning. This rotation also allows for direct observation and feedback for the learner, which is important in our current CBD curriculum.

Consultation and Follow-Up Medical Team

The traditional CTU usually manages patients admitted overnight by the on-call team. We have found it to be a challenge to both education and clinical service for these teams to see new consults during the day. For this reason, a new hybrid daytime consultation team was developed. This team consists of a senior resident and 1–2 junior learners who admit new consultations from the Emergency department during daytime hours. The majority of patients admitted by this team are followed until discharge. To ensure this team can provide excellent clinical care and meet its educational mandate, the number of patients is capped at 15–17. Additional patients are then transferred to other clinical teams. By admitting new patients in the daytime, the learners have the opportunity to receive direct observation and feedback from the supervising attending. In addition to commenting on the history and physical examination skills, the resident will have the opportunity to receive feedback on management and resource utilization at the time of admission. This is often missed when reviewing a large number of patients in the morning. Also, by having active inpatients and admitting new patients, the learner will learn how to manage time and priorities during the day. In addition to improved education, this rotation has helped to ensure that daytime consults are seen promptly.

Social Medicine Rotation

We have identified that the CTU environment does not consistently provide trainees with the skills or knowledge required to provide optimal care to vulnerable patients, many of which have unique healthcare needs both in hospital and the community. This rotation was designed to provide a breadth of community and hospital-based learning experiences to familiarize trainees with at-risk populations (for example newcomers, inner-city populations and patients with chronic illness and disability, mental health or substance abuse disorder), the social determinants of health and available resources.

Our medical learners are provided an elective opportunity (for either two or four weeks) to be part of this clinical service. During this rotation, the learner is paired with a faculty supervisor who provides an individualized orientation regarding expectations and an introduction to social medicine. The same supervisor will debrief with the learner weekly, review personal reflections and compile their assessments. The rotation is comprised of a combination of core and elective half-day experiences, which include (but are not limited to): inpatient addictions medicine, home visits with an internist caring for vulnerable populations, outpatient addictions medicine clinics, shelter health clinic, tuberculosis clinic, refugee health clinic, Aboriginal health clinic, pre-exposure prophylaxis clinic, needle exchange programs, shadowing addictions workers or social workers.
Integration of Simulation

In addition to direct patient care on clinical CTUs, we have integrated simulation as a core component of the clinical experience and it takes place longitudinally over the three years of core internal medicine training. It is a challenge to ensure that each learner has direct observation and feedback of all necessary clinical activities. The simulation curriculum has been designed to address these gaps. During CTU teaching sessions the residents are exposed to high fidelity acute care experiences where they are observed and coached in their medical knowledge and communication skills. This allows for a formal debrief session, which can be difficult to arrange during real acute medical situations. Also, technology for simulation-based training has improved significantly over the years such that realistic scenarios can be developed. Our simulation curriculum includes specific half-day sessions where procedures are taught and observed using partial task-trainers. We have utilized simulated patients to help with communication skills. Finally, we use simulation to provide further instruction on the physical exam technique in the cardio-respiratory system. Overall our simulation training has complimented our clinical training.

Adapting Our Educational Training in Context of Increasing Patient Care Volumes

At McMaster University, we are working to address the growing patient volume requiring admission to internal medicine through alternative care pathways from the traditional CTU. Each hospital in our University Network is addressing this slightly differently, however, thus far solutions have included the institution of a hospitalist model and development of physician-based non-traditional CTU teams supported by nurse practitioners or physician assistants. We are aware that increased volumes can affect resident education but at the same time we want to ensure that our residents are not shielded from these realities, as they will need to be prepared for independent practice. Our learners work collaboratively with each of the teams and participate on the non-traditional CTU teams as part of their training. Discussions are underway to remodel the CTU, such that it is limited to a strict number of patients and certain geographic areas of the hospital. This is being done for patient safety and to provide an environment where learners have an opportunity to maximize their learning.

Summary

The traditional CTU is important for core education in internal medicine, but as the needs of society continue to shift, a more diverse educational curriculum is important to meet the competency requirements for internal medicine residents. CBD has forced us to look closer at our training process and ensure that we are providing the appropriate breadth and depth of experience within internal medicine and attending to both the education and service demands of our academic hospitals. Over the years, we have been working to modify the internal medicine program at McMaster University to reflect the requirements our learners will need for future practice and to address gaps in the traditional CTU model. We recognize that there are many potential solutions, and anticipate that internal medicine programs across the country are similarly responding with a variety of solutions. We hope that this article will stimulate a conversation about how we can continue to rethink and modify training programs with a shared goal of meeting shifting societal needs, growing patient volumes and complexity, and new educational and curricular requirements in the era of CBD.

References

1. Golden RL, William Osler at 150: an overview of a life. JAMA 1999;282(23):2252–8.
2. Maudsley RF, The clinical teaching unit in transition. CMAJ 1993;148(9):1564–6.
3. Evans JR, Chute AL and Morley TP. The clinical teaching unit: a white paper. Can Med Assoc J 1966;95(14):720–7.
4. Canadian Resident Matching Service. R-1 match interactive data. 2018; Available at: https://www.carms.ca/data-reports/r1-data-reports/r1-match-interactive-data/.
5. Verma AA, Guo Y, Kwan JL, et al. Patient characteristics, resource use and outcomes associated with general internal medicine hospital care: the General Medicine Inpatient Initiative (GEMINI) retrospective cohort study. CMAJ Open 2017;5(4):E842–e849.
6. Curran V and Roulke J. The role of medical education in the recruitment and retention of rural physicians. Med Teach 2004;26(3):265–72.
7. Dent JA. AMEE Guide No 26: clinical teaching in ambulatory care settings: making the most of learning opportunities with outpatients. Med Teach 2005;27(4):302–15.
8. Schroeder SA, Showstack JA, and Gerbert B. Residency training in internal medicine: time for a change? Ann Intern Med 1986;104(4):554–61.
9. RCPSC. Competence by Design: Reshaping Canadian Medical Education, J.R. Frank and K.A. Harris, Editors; 2014.
10. Panju M, Kara A, Panju A, Fulford M, O’Bryne P, Haider S. An ambulatory clinical teaching unit: filling the outpatient gap in internal medicine residency training. Can J Int Med 2016;113(3):27–31
11. Wiese A, Kilty C, Bennett D. Supervised workplace learning in postgraduate training: a realist synthesis. Med Educ 2018;52:951–69.