Educational Outcomes of the Harvard Medical School–Cambridge Integrated Clerkship: A Way Forward for Medical Education

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Abstract

Purpose

The authors report data from the Harvard Medical School–Cambridge Integrated Clerkship (CIC), a model of medical education in which students' entire third year consists of a longitudinal, integrated curriculum. The authors compare the knowledge, skills, and attitudes of students completing the CIC with those of students completing traditional third-year clerkships.

Method

The authors compared 27 students completing the first three years of the CIC (2004–2007) with 45 students completing clerkships at other Harvard teaching hospitals during the same period. At baseline, no significant between-group differences existed (Medical College Admission Test and Step 1 scores, second-year objective structured clinical examination [OSCE] performance, attitudes toward patient-centered care, and plans for future practice) in any year. The authors compared students' National Board of Medical Examiners Subject and Step 2 Clinical Knowledge scores, OSCE performance, perceptions of the learning environment, and attitudes toward patient-centeredness.

Results

CIC students performed as well as or better than their traditionally trained peers on measures of content knowledge and clinical skills. CIC students expressed higher satisfaction with the learning environment, more confidence in dealing with numerous domains of patient care, and a stronger sense of patient-centeredness.

Conclusions

CIC students are at least as well as and in several ways better prepared than their peers. CIC students also demonstrate richer perspectives on the course of illness, more insight into social determinants of illness and recovery, and increased commitment to patients. These data suggest that longitudinal integrated clerkships offer students important intellectual, professional, and personal benefits.

In this article, we report the educational outcomes of the Harvard Medical School–Cambridge Integrated Clerkship (CIC), an innovative model of medical education in which third-year medical students learn the core skills of doctoring by following a panel of patients from each of the major clinical disciplines across different venues of care.[1] We created the CIC in response to the national call to transform clinical medical education, a call based on the recognition that existing clinical training is structurally and educationally problematic.[2–10] As the 1984 Report of the Project Panel on the General Professional Education of the Physician[2] demonstrates, serious concerns about clinical education are not new, and they have been revisited repeatedly by the Association of American Medical Colleges and other leading organizations.[3–10]

We designed the CIC to address gaps in the current traditional system of block rotations. We sought to foster students' learning and satisfaction by supporting longitudinal student–patient and student–faculty relationships and by facilitating an integrated and developmental approach to learning and assessment.[1,11–17] The educational philosophy underpinning the CIC is "educational continuity"—students' direct engagement in the continuities of care, supervision, and curriculum.[11,12] We have described the basic features of the CIC in detail previously.[1]

In this article, we report on the effectiveness of the CIC and the feasibility of more widespread adoption of models of this type. We describe three years of experience with this clerkship. At the end of these three years, Harvard Medical School incorporated selected longitudinal features into clerkship experiences at their other teaching hospitals, thereby ending the opportunity for further direct comparisons of the CIC with more traditional clerkships. Nonetheless, this is the most extensive study reported to date comparing longitudinal integrated and traditional clerkships.

Method

The CIC was an educational pilot for its first three years (2004–2005, 2005–2006, and 2006–2007) with 8 students enrolling in each of years 1 and 2 and 12 students in year 3. We compared 27 CIC students (1 student left the program midyear) with a group of 45 students who completed their rotations in the traditional manner (i.e., who took seven required third-year clerkships by rotating among other Harvard teaching hospitals). The institutional review boards of Harvard Medical School and Cambridge Health Alliance considered this study exempt.

Recruitment of participants and baseline comparisons

Because more students identified the CIC as their first preference than could

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be accommodated, Harvard Medical School selected students randomly from those expressing a preference for the CIC. The comparison group was composed of students who had requested the CIC but had not been selected and were therefore doing traditional rotations. Their numbers were supplemented by other third-year volunteers doing traditional clerkships. As incentive, comparison group received credit for the equivalent of a two-week elective.

To establish whether the two groups differed at baseline, we compared both groups on a variety of measures: Medical College Admission Test scores, United States Medical Licensing Examination Step 1 scores, Harvard Medical School second-year objective structured clinical examination (OSCE) scores, Patient–Practitioner Orientation Scale (PPOS) scores, and plans for future practice. For each of the three years of data collection, we found no significant between-group differences on any of these measures. Due to the small size of the groups, it was impossible to ascertain differences within the comparison group between students not randomly selected for CIC and other volunteers.

Data collection

We collected quantitative and qualitative data from each cohort of CIC students and comparison students. We assessed knowledge attainment using the National Board of Medical Examiners' (NBME) subject exams in surgery, pediatrics, obstetrics–gynecology, and psychiatry (the subject exams taken by all Harvard students) and the NBME Step 2 Clinical Knowledge exam. The comparison students took the subject exams at the end of the corresponding block rotations. The CIC students scheduled their subject exams at approximately three-week intervals during the last quarter of the year. All students took the Harvard Medical School fourth-year comprehensive exam, a nine-station OSCE, at the completion of their third year. We collected surveys of students' experiences and perceptions at the end of the year and, for the PPOS, at the beginning as well. The PPOS is a validated instrument that measures the extent to which practitioners hold patient-centered beliefs.[18,19] The Communication, Curriculum, and Culture Instrument (C3) is a validated scale that measures the extent to which students believe that they have been exposed to the hidden curriculum.[20–24] The C3 produces three subscale scores: the extent to which attendings and housestaff model patient-centered behavior, the students' personal encounters with patient-centered experiences, and students' perceived support for their patient-centered behaviors.[20,21]

Data analysis

After three years, the formal study concluded when Harvard Medical School transitioned to a new clerkship model, in which all students completed their core clinical requirements at a single site. Therefore, all data reported here compare the combined results of three years (2005–2007) of 27 CIC students and 45 comparison students, although the number of students may vary for individual comparisons because of missing data. We also computed separate year-by-year analyses for each of the measures, but we report only the combined results because the pattern of findings was remarkably similar from year to year.

All analyses using parametric data used independent t tests for cross-group comparisons and paired t tests for pre–post comparisons. For nonparametric data, we used chi-square. For each of the relevant measures, we report between-group and pre–post comparisons with aggregated three-year data. Although not reported, we computed individual year-by-year comparisons, and these findings were consistent with the cumulative results.

Results

We organize our results to address three questions that bear on the success of the CIC:

1. Were the program's structural goals achieved (i.e., were the students' experiences consistent with the CIC's aim to provide continuity with patients, continuity with faculty, and a satisfying learning environment)?
2. How well did CIC students perform on standard student assessments (i.e., were the CIC students' knowledge and clinical skills at least comparable to those of students in more traditional clerkships)?
3. Did the CIC affect students' professional attitudes and values as compared with students in traditional clerkships?

Program outcomes: Structural goals
Continuity with patients and faculty. Reflecting the emphasis on continuity of care, CIC students were far more likely than students in the comparison group to have seen patients before their initial diagnosis and decision for admission and also after discharge. In addition, CIC students were more likely to feel that they had established meaningful relationships with patients and made real differences in their patients' well-being. Reflecting the emphasis on continuity of supervision by faculty, CIC students reported that they received more feedback and mentoring from attending physicians than did the comparison students. (See Figure 1 for a graphical presentation of these findings.) For each of these structural goals, the comparison reached statistical significance (for each comparison, $P < .001$). CIC students were also more satisfied with the quality of the feedback they received: 51.8% of CIC students rating the quality of supervision in the highest two categories compared with 17.5% of the comparison students ($P = .05$).

Satisfaction with the learning environment. CIC students were more satisfied with "the atmosphere for learning" that they encountered, with 96% rating the CIC in the two highest categories compared with 43% for the comparison students ($P < .001$). The experiences of CIC and comparison students differed in other ways as well. Most notably, scores on the C3 indicated that the learning environment that students encountered in the CIC provided less exposure to the hidden curriculum. On the C3, scores on all three subscales showed significant differences: the behavior of housestaff and attendings ($P < .001$), personal experiences consistent with patient-centered actions ($P < .001$), and support for students' patient-centered behaviors ($P < .005$). At the same time, CIC students felt that their clerkship experience was more satisfying, confidence building, rewarding, humanizing, and transformational and less boring and marginalizing than did the comparison students (Table 1). Interestingly, CIC students also described

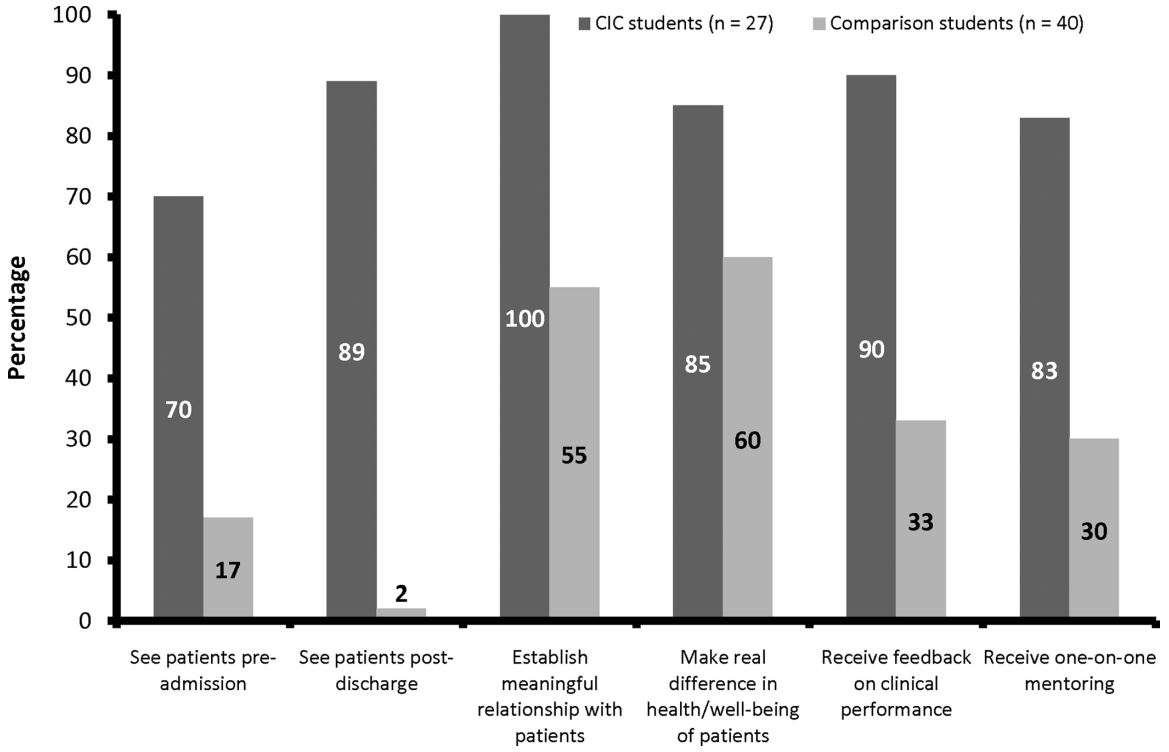

Figure 1 Comparison of how well 27 Cambridge Integrated Clerkship (CIC) students and 40 traditionally trained comparison students felt they met the structural goals of engaging continuity of care (following patients before admission and after discharge), having meaningful engagements with patients, making a difference in patients' health or well-being, and maintaining continuity of supervision (amount of feedback and mentoring by faculty). The bars show the percentage of students who said that they had "often" or "very often" engaged in the activities or received the feedback and mentoring. For all goals, $P < .001$. Harvard Medical School, 2004–2007.

their experience as more hectic and stressful (and equally frustrating).

Program outcomes: Student assessment

Knowledge and clinical skills. On specific NBME subject exams, an examination of the scores failed to indicate systematic differences according to the time of year when the exams were taken by the comparison students. Therefore, we compared the mean scores of all CIC students with those of all comparison students regardless of the academic quarter of the testing. CIC students performed as well as or better than the comparison students on the NBME subject exams taken by all Harvard Medical School students (surgery, obstetrics–gynecology, pediatrics, and psychiatry).

Table 1

Students' Descriptions of Their Learning Environments, Comparing 27 Cambridge Integrated Clerkship (CIC) Students and 40 Students in a Comparison Group, Harvard Medical School, 2004–2007*

Students' descriptions of clerkship	27 CIC students	40 comparison students	*P* value
Satisfying	5.41	4.67	<.005
Confidence building	4.96	3.87	<.005
Rewarding	5.78	4.77	<.001
Humanizing	5.44	3.88	<.001
Transformational	5.44	4.62	<.01
Boring	1.44	1.90	<.05
Marginalizing	1.89	3.43	<.001
Hectic	5.37	4.65	<.005
Stressful	5.26	4.62	<.005
Frustrating	3.63	3.75	.709

*Using a six-point Likert scale (1 = "describes it not at all" and 6 = "describes it perfectly"), students responded at year's end to the question, "At this point, how well would you say that the following adjectives describe your clerkship experience?"

Step 2 Clinical Knowledge scores were higher for the CIC students, but not significantly so. On the Harvard fourth-year OSCE, CIC students significantly outscored the comparison group. CIC students' scores were higher on five of the six skills scores computed across stations, with the communications scores reaching marginal significance ($P = .07$) and the history-taking scores significantly higher ($P = .03$). See Table 2 for specific data about these findings.

Professional attitudes and values. Our assessment of students' professional attitudes and values looked at three areas: patient-centeredness, preparation for practice, and career choice. Regarding patient-centeredness (Figure 2), the mean PPOS scores of CIC and comparison

Table 2

Mean Scores on Tests of Knowledge and Clinical Skills, Comparing 27 Cambridge Integrated Clerkship (CIC) Students With 45 Students in a Comparison Group, Harvard Medical School, 2004–2007

Assessment measure	27 CIC students	45 comparison students	*P* value
National Board of Medical Examiners subject exams*			
Obstetrics–gynecology	73.70	71.73	.377
Pediatrics	80.62	74.79	<.01
Surgery	76.85	73.33	.099
Psychiatry	80.22	71.86	<.05
Harvard Medical School Comprehensive Objective Structured Clinical Exam†	68.13	64.34	<.05
National Board of Medical Examiners Step II Clinical Knowledge Exam*	240.63	234.14	.232

*Actual scores.
† Percent correct.

students were similar at the beginning of the year. At year's end, scores had increased in CIC students but declined in the comparison group, marking a significant difference ($P = .011$). End-of-year surveys suggested that CIC students felt better prepared than their peers in a number of important, patient-centered elements of care, including being truly caring with patients, dealing with ethical dilemmas, and involving patients and families in decision making (Table 3).

Preparation for practice. In end-of-year surveys, CIC students felt less well prepared than their peers to practice in the hospital setting, but more prepared to practice in the ambulatory setting. They felt better prepared than their peers in understanding how the health care system works, having the knowledge base necessary to be competent practitioners, knowing their strengths and limitations, dealing with ambiguity, and engaging in self-reflection. They also felt better prepared to understand how the social context affects patient care and to work with patients from diverse backgrounds and at different stages of the life cycle. There were no significant differences in the feelings of the two groups about their ability to practice evidence-based medicine. See Table 3 for specific details about these findings.

Career choice. CIC students' expectations for future career choices (as expressed in time spent in practice, research, and education) were not significantly different from the comparison students either at the beginning or at the end of the clerkship year. Students' reports of future career goals revealed no systematic differences from their traditional peers, with most CIC students seeking specialty, academic, and research career paths. CIC students have been successful in matching in the residency programs of their choice, with all students reporting having received their first or second choice of program—the vast majority their first choice.

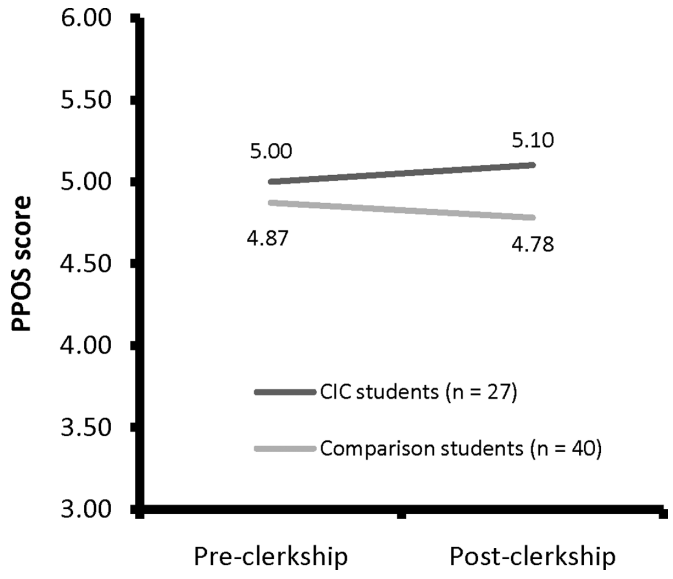

Figure 2 Comparison of pre- and postclerkship mean scores of 27 Cambridge Integrated Clerkship (CIC) students and 40 traditionally trained comparison students on the Patient–Practitioner Orientation Scale (PPOS), which measures patient-centeredness on a six-point scale. For the preclerkship scores, $P = .239$; for the postclerkship scores, $P = .011$. Harvard Medical School, 2004–2007.

Conclusions

In its design, the CIC adhered to principles derived from the learning sciences with the goals of improving students' learning, professional development, and satisfaction.[16,17,25–34] The program's structural pillars support an environment in which continuity of care and supervision drive student learning.[11,12] These "continuities" support a highly relational learning model that relies on patient–student, faculty–student, student–student, and student–society relationships to facilitate professional growth.[11–16] This educational lattice of effective student engagements has been termed "symbiotic."[35,36] The CIC appears to be both effective in reaching these goals and feasible for more widespread implementation.

Effectiveness

Traditional clerkships provide students with limited opportunities to participate

Table 3

Assessment of Students' Preparation for Practice, Comparing 27 Cambridge Integrated Clerkship (CIC) Students With 40 Students in a Comparison Group, Harvard Medical School, 2004–2007*

Topical areas of students' preparedness	27 CIC students	40 comparison students	*P* value
To practice in the hospital setting	4.63	5.07	<.05
To practice in the ambulatory setting	5.89	4.22	<.001
To have the knowledge base necessary to be a competent practitioner	5.11	4.47	<.005
To be truly caring in dealing with patients	5.93	5.07	<.001
To deal with ethical dilemmas	5.33	4.17	<.001
To know your strengths and limitations	5.44	4.85	<.05
To deal with patient problems that do not have clear answers	5.48	4.55	<.001
To be a self-reflective practitioner	5.70	4.62	<.001
To see how the social context affects patients and their problems	5.89	4.67	<.001
To involve patients in decision making	5.59	4.55	<.001
To relate well to a diverse patient population	5.96	4.72	<.001
To relate to people at different stages of the life cycle	5.74	5.07	<.005
To understand how the health care system works	5.26	4.07	<.001
To practice evidence-based medicine	4.89	4.97	.739

*Using a six-point Likert scale (1 = "prepared me very poorly" and 6 = "prepared me very well"), students responded at year's end to a question on how well they felt prepared for practice.

in establishing a preliminary diagnosis and following diagnostic and therapeutic plans or to know patients as people or as part of a family or community. Seeing "undifferentiated" patients prior to admission to the hospital and following them after discharge provides just this opportunity. By following patients across care venues, CIC students observe the natural history of illness and the results of therapeutic interventions.

Previous research demonstrates that longitudinal experiences generate rich benefits for learning.[17,37] Continuity of care also provides the opportunity for reflection on the primacy of the doctor–patient relationship. It is surely not coincidental that 100% of the CIC students in three successive cohorts reported that they were often or very often able to establish meaningful relationships with their patients, a rate almost twice that of their peers in traditional clerkships. It is likewise noteworthy that CIC students reported significantly more frequently than their peers that they had made a real difference in the health or well-being of patients.

Students in traditional clerkships also have limited opportunities to develop meaningful relationships with faculty preceptors. We intentionally created an educational structure to support a functional "community of practice" wherein students learn by directly comanaging patients with faculty and other members of the interprofessional team.[16,28] Students have multiple iterative interactions with experienced practitioners and receive serial, developmentally aligned coaching and assessment.[16,17,28,33] Enhanced role modeling and mentoring authenticate the students' participation.[16,26–28,33] We designed the CIC specifically with these considerations in mind. Compared with their peers, CIC students receive far more of their supervision and mentoring from faculty preceptors, and CIC students rate the quality of feedback higher than students in traditional clerkships.

CIC students describe their clerkship experience very differently, characterizing it as more humanizing (even transformational) and less marginalizing than do their peers in more traditional clerkships. Strikingly, these strongly positive perceptions exist in the face of an experience that is described as both more hectic and more stressful than the traditional clerkship. The CIC's relatively flexible structure requires that students organize their schedules and negotiate more competing duties than peers in traditional clerkships. It is also possible that students' daily demands feel more "real" and urgent as they attempt to satisfy patients' expectations of them. In essence, CIC students must be able to organize their learning tasks simultaneously with the immediacy of being real caregivers and colleagues—goals reasonably described as being both satisfying and transformative and hectic and stressful.

CIC students also view themselves as better prepared than their peers in many important elements of professional identity formation: to be truly caring in dealing with patients, to be able to deal with ethical dilemmas, to involve patients and families in decision making, to relate well to a diverse patient population, to relate to people at different stages of the life cycle, and to see how the social context affects patients and their problems.

Although this study does not address the underlying reasons for these differences, it is likely that the central emphases of the CIC on patients' welfare and on the learning environment are important factors. Although not different at the beginning, by the end of the clerkship CIC students scored higher than their peers on a validated instrument for assessing patient-centeredness. In addition, in terms of faculty role modeling, observation, and support of

patient-centered behavior, CIC students felt less exposed to the negative effects of the hidden curriculum than their peers.[22–24] Thus, rather than experiencing the "ethical erosion" so typical of traditional clerkships,[13,18,38–40] the CIC seems to reinforce students' humanistic patient-centered values.

Some argue that the lack of discipline-based immersion in longitudinal integrated clerkships could impair knowledge accrual; however, when compared with traditionally trained peers at Harvard Medical School, CIC students perform as well or better on measures of content knowledge and clinical skills. Moreover, the experience seems to strengthen skills critical for lifelong learning and safe and effective clinical practice, as CIC students felt better prepared to be self-reflective, to know their own strengths and limitations, and to deal with ambiguity.

In summary, CIC students are at least as well prepared as, and in several important ways better prepared than, their peers to enter advanced clerkships and electives. At the very least, we believe that CIC students bring with them a richer perspective on the course of illness, more insight into the social determinants of illness and recovery, and an increased commitment to patients that will motivate ongoing learning and patient advocacy.[37]

Study limitations

The limitations of this study include its small size, relatively short time frame during which formal comparisons could be made, and its testing at a single institution. In addition, even though we found no discernible differences between CIC students and the comparison group at baseline, the potential exists that the study cohort somehow differed on other unmeasured characteristics. In response, we can only emphasize that our results were consistent across multiple cohorts and multiple measures over time. In addition, we note that the CIC is ongoing, now about to begin its ninth year, and has continued to fully meet its programmatic goals.

Another limitation is that reports of beliefs and abilities are not objective assessments of competency and that students' self-assessments may not ultimately predict their actual behaviors in residency or independent practice. However, it is reassuring that all graduates of the program reported receiving their first or second choice of residency program and that anecdotal reports are highly affirming and have not revealed any problems. Although some published data suggest that students in longitudinal integrated clerkships develop greater retention of content knowledge,[1,41] it remains unknown whether graduates of the program sustain the changes described.

In this study, we did not address which features of the CIC most influence students' development. The longitudinal, integrated design makes it impossible to separate the influences of patients and teachers. Indeed, we believe that both sets of relationships are crucial for appropriate professional identity formation. Independent effects ascribable to the context and nature of the Cambridge Health Alliance, where our students spend the year, might also have an important influence. It is possible that an environment permeated by social advocacy has a seminal influence on professional identify formation. Perhaps so, but if this is the case, these data invite the need to rethink the kinds of environments to which we expose learners.

Feasibility

Longitudinal clerkships with similar features to the CIC have existed worldwide for 40 years, and the number of such programs is growing rapidly.[1,42–52] Longitudinal integrated clerkships are succeeding in large tertiary hospitals[50–52] and at schools with primary care missions.[42–48,51] The model has proved feasible in urban settings[1,49–52] and in rural and remote settings.[42–48,51] Some institutions have demonstrated that an entire class can participate.[48] The model has importantly influenced The Future of Medical Education in Canada: A Collective Vision for MD Education[53] and the Carnegie Foundation's Educating Physicians: A Call for Reform of Medical School and Residency.[54] To support the growth of the model and advance scholarship, medical education leaders have formed the International Consortium of Longitudinal Integrated Clerkships, which has met—and grown in size—annually since 2007.[43,51]

Despite these successes, resistance to more widespread adoption of longitudinal, integrated clerkship models continues. We believe this article begins to fill this gap, if only with short-term outcome metrics. Further study is needed to ascertain whether students' attitudes and skills are so powerfully ingrained as to be maintained in postgraduate training and beyond. To address this question, we are currently studying graduates of the program, and the initial data look promising.

Another consideration is cost. Given that the CIC relies on faculty educators rather than residents, how financially realistic is this model? At Harvard Medical School, the CIC receives the same per-student reimbursement as more traditional clerkship sites, and the program's cost is at the lower end of the range described in the literature.[55] Nonetheless, it remains to be determined whether faculty-intensive models of this type can support the education of a class of hundreds at schools now relying largely on tertiary care hospitals for clinical training and (subsidized) residents for medical student teaching.

For large classes, students might be apportioned into functional units (e.g., "pods" of 8–12 learners) to improve ease of scheduling while still reaping the benefits of the model: small-group student "learning communities" with close faculty oversight, a developmental approach to curriculum and assessment, and relationship-centered learning.[16] Mechanisms to schedule and track longitudinal patients are robust,[56] but methods to develop and reward faculty merit more innovation. Nonetheless, even as institutions possess the resources to support this model, ingrained culture may prove to be the greatest hurdle to overcome.

Some have suggested that the model requires highly self-motivated, well-organized student learners and "may not be for everyone." Naturally, this question invites consideration as to whether the traditional model is "for everyone" or whether any model could be. More important, this critique encourages us to consider what attributes of learners we seek to engage when creating educational structures. In this case, do we not wish for medical students to be highly self-motivated, well organized,

and able to integrate complex themes from multiple perspectives in real time?[17,34,37]

In addition, our experience is that our students receive more direct oversight and guidance than students in the traditional model, and we have been successful in identifying and assisting students who have had learning and other issues that merited identification and assistance. Areas of further study will be to determine which facets of the program make it stressful and hectic and to what degree these impede or facilitate students' learning and development. Similarly, we have yet to determine which factors most support learning and development and how we might best enhance these features.

In conclusion, we reflect on the century since Abraham Flexner's review of the medical schools of the United States and Canada. With regard to clinical training of medical students, the basic structure of the CIC reveals nothing more than a return to the first two key principles that Flexner[57] espoused:

> To sample a school on its clinical side, one makes in the first place straight for its medical clinic, seeking to learn the number of patients available for teaching, the variety of conditions that they illustrate, and the hospital regulations in so far, at least, as they determine (1) continuity of service on the part of the teachers of medicine, (2) the closeness that the student may follow the individual patients….

The need to idealize the training of medical students remains as critical now as it was then. The CIC is a model of medical education deliberately designed to place the patient continuously at the center of the student's interest and the student and the patient together continuously at the center of the teacher's interest. Educational structures in which the core student experience derives from following cohorts of patients longitudinally and cooperatively with faculty are feasible and conform well to Hippocratic, Flexnerian, and other sacred traditions of medicine. The model of longitudinal integrated education also closely adheres to core principles described in diverse academic literatures making up the learning sciences. Our data demonstrate that the CIC serves to foster students' learning, to advance students' professionalism, to harness the hidden curriculum, and to stem ethical erosion. It may, in fact, transform learners and teachers, the systems in which they work, and, ultimately, the care of their patients.[58] Through "educational continuity"[11] and meaningful relationships with patients and preceptors, this model may also inspire students' idealism about the future of the profession.

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Ethical approval: The institutional review boards of Harvard Medical School and Cambridge Health Alliance considered this study exempt.

Previous presentations: Some of this material, in a variety of formats, has been presented at medical-school-based conferences, at the Gold Foundation Biennial Meeting in Chicago, Illinois, in 2008, and at the Association of American Medical Colleges annual meeting in Denver, Colorado, in 2011. Some of the preliminary data accompanied the original program description, published in Academic Medicine in 2007.

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References

1 Ogur B, Hirsh D, Krupat E, Bor D. The Harvard Medical School–Cambridge Integrated Clerkship: An innovative model of clinical education. Acad Med. 2007;82:397–404.
2 Physicians for the twenty-first century. Report of the project panel on the general professional education of the physician and college preparation for medicine. J Med Educ. 1984;59:1–208.
3 Ludmerer KM. Learner-centered medical education. N Engl J Med. 2004;351:1163–1164.
4 Christakis NA. The similarity and frequency of proposals to reform US medical education: Constant concerns. JAMA. 1995;274:706–711.
5 Educating Doctors to Provide High-Quality Medical Care: A Vision for Medical Education in the United States. Washington, DC: Association of American Medical Colleges; 2004.
6 Weinberger S, Whitcomb M. The clinical education of medical students: Report on Millennium Conferences I and II. Shapiro Institute for Education and Research, Harvard Medical School and Beth Israel Deaconess Medical Center. Washington, DC: Association of American Medical Colleges; 2001.
7 Nutter D, Whitcomb M. The AAMC Project on the Clinical Education of Medical

Students. Washington, DC: Association of American Medical Colleges; 2002.
8 Whitcomb M. Redesigning clinical education: A major challenge for academic health centers. Acad Med. 2005;80:615–616.
9 Institute of Medicine. Health Professions Education: A Bridge to Quality. Washington, DC: National Academy Press; 2001.
10 Commonwealth Fund Task Force on Academic Health Centers. Training Tomorrow's Doctors: The Medical Education Mission of Academic Health Centers. New York, NY: Commonwealth Fund; 2002.
11 Hirsh DA, Ogur B, Thibault GE, Cox M. New models of clinical clerkships: "Continuity" as an organizing principle for clinical education reform. N Engl J Med. 2007;356:858–866.
12 Irby D. Educational continuity in clinical clerkships. N Engl J Med. 2007;356:856–857.
13 Christakis DA, Feudtner C. Temporary matters: The ethical consequences of transient social relationships in medical training. JAMA. 1997;278:739–743.
14 Charon R. A model for empathy, reflection, profession, and trust. JAMA. 2001;286:1897–1902.
15 Haidet P, Stein HF. The role of the student–teacher relationship in the formation of physicians: The hidden curriculum as process. J Gen Intern Med. 2006;21(1 suppl):S16–S20.
16 Lave J, Wenger E. Situated Learning: Legitimate Peripheral Participation. Cambridge, UK: University of Cambridge Press; 1991.
17 Rohrer D, Pashler H. Recent research on human learning challenges conventional instructional strategies. Educ Res. 2010;39:406–412.
18 Haidet P, Dains JE, Paterniti DA, et al. Medical student attitudes toward the doctor–patient relationship. Med Educ. 2002;36:568–574.
19 Krupat E, Hiam CM, Fleming MZ, Freeman P. Patient-centeredness and its correlates among first year medical students. Int J Psychiatry Med. 1999;29:347–356.
20 Haidet P, Kelly PA, Chou C; Communication, Curriculum, and Culture Study Group. Characterizing the patient-centeredness of hidden curricula in medical schools: Development and validation of a new measure. Acad Med. 2005;80:44–50.
21 Haidet P, Kelly PA, Bentley S, et al. Not the same everywhere. Patient-centered learning environments at nine medical schools. J Gen Intern Med. 2006;21:405–409.
22 Hafferty FW. Beyond curriculum reform: Confronting medicine's hidden curriculum. Acad Med. 1998;73:403–407.
23 Hafferty FW, Franks R. The hidden curriculum, ethics teaching, and the structure of medical education. Acad Med. 1994;69:861–871.
24 Hundert EM, Hafferty F, Christakis D. Characteristics of the informal curriculum and trainees' ethical choices. Acad Med. 1996;71:624–633.
25 Bransford JD, Brown AL, Cocking RR. How People Learn: Brain, Mind, Experience, and School. Washington, DC: National Academy Press; 1999.
26 Bleakley A. Broadening conceptions of learning in medical education: The message of teamworking. Med Educ. 2006;40:150–157.
27 Billett S. Constituting the workplace curriculum. J Curriculum Stud. 2006;38:31–48.
28 Dornan T, Boshuizen H, King N, Scherpbier A. Experience-based learning: A model linking the processes and outcomes of medical students' workplace learning. Med Educ. 2007;41:84–91.
29 Armstrong E, Mackey M, Spear S. Medical education as a process management problem. Acad Med. 2004;79:721–728.
30 Kolb DA. Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs, NJ: Prentice Hall; 1984.
31 Knowles MS. The Modern Practice of Adult Education: From Pedagogy to Andragogy. 2nd ed. New York, NY: Cambridge Books; 1980.
32 Schön DA. Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions. San Francisco, Calif: Jossey-Bass; 1987.
33 Bandura A. Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, NJ: Prentice Hall; 1986.
34 Bereiter C, Scardamalia M. Surpassing Ourselves: An Inquiry Into the Nature and Implications of Expertise. La Salle, Ill: Open Court; 1993.
35 Worley P, Prideaux D, Strasser R, Magarey A, March R. Empirical evidence for symbiotic medical education: A comparative analysis of community and tertiary-based programmes. Med Educ. 2006;40:109–116.
36 Prideaux D, Worley P, Bligh J. Symbiosis: A new model for clinical education. Clin Teach. 2007;4:209–212.
37 Ogur B, Hirsh D. Learning through longitudinal patient care—Narratives from the Harvard Medical School–Cambridge Integrated Clerkship. Acad Med. 2009;84:844–850.
38 Feudtner C, Christakis DA, Christakis NA. Do clinical clerks suffer ethical erosion? Students' perceptions of their ethical environment and personal development. Acad Med. 1994;69:670–679.
39 Christakis DA, Feudtner C. Ethics in a short white coat: The ethical dilemmas that medical students confront. Acad Med. 1993;68:249–254.
40 Feudtner C, Christakis DA. Making the rounds. The ethical development of medical students in the context of clinical rotations. Hastings Cent Rep. 1994;24:6–12.
41 Hansen L, Simanton E. Comparison of third-year student performance in a twelve-month longitudinal ambulatory program with performance in traditional clerkship curriculum. S D Med. 2009;62:315–317.
42 Verby JE. The Minnesota Rural Physician Associate Program for medical students. J Med Educ. 1988;63:427–437.
43 Norris TE, Schaad DC, DeWitt D, Ogur B, Hunt DD, for the Consortium of Longitudinal Integrated Clerkships. Longitudinal integrated clerkships for medical students: An innovation adopted by medical schools in Australia, Canada, South Africa, and the United States. Acad Med. 2009;84:902–907.
44 Hansen LA, Talley RC. South Dakota's third-year program of integrated clerkships in ambulatory-care settings. Acad Med. 1992;67:817–819.
45 Worley P, Silagy C, Prideaux D, Newble D, Jones A. The parallel rural community curriculum: An integrated clinical curriculum based in rural general practice. Med Educ. 2000;34:558–565.
46 Anderson AS, Martell JV. Comparing sequential clerkships and a longitudinal clerkship for third-year medical students. Acad Med. 1994;69:418–419.
47 Schauer RW, Schieve D. Performance of medical students in a nontraditional rural clinical program, 1998–99 through 2003–04. Acad Med. 2006;81:603–607.
48 Tesson G, Hudson G, Strasser R, Hunt D, eds. The Making of the Northern Ontario School of Medicine: A Case Study in the History of Medical Education. Montreal, Quebec, Canada: McGill-Queens University Press; 2009.
49 Oswald N, Alderson T, Jones S. Evaluating primary care as a base for medical education: The report of the Cambridge community-based clinical course. Med Educ. 2001;35:782–788.
50 Teherani A, O'Brien BC, Masters DE, Poncelet AN, Robertson PA, Hauer KE. Burden, responsibility, and reward: Preceptor experiences with the continuity of teaching in a longitudinal integrated clerkship. Acad Med. 2009;84(10 suppl):S50–S53.
51 Strasser R, Hirsh D. Longitudinal integrated clerkships: Transforming medical education worldwide? Med Educ. 2011;45:436–437.
52 Poncelet A, Bokser S, Calton B, et al. Development of a longitudinal integrated clerkship at an academic medical center. Med Educ Online. April 4, 2011;16.
53 Association of Faculties of Medicine of Canada. The Future of Medical Education in Canada: A Collective Vision for MD Education. www.afmc.ca/fmec. Accessed February 15, 2012.
54 Cooke M, Irby DM, O'Brien BC. Educating Physicians: A Call for Reform of Medical School and Residency. San Francisco, Calif: Jossey-Bass–Carnegie Foundation for the Advancement of Teaching; 2010.
55 Jones RF, Korn D. On the cost of educating a medical student. Acad Med. 1997;72:200–210.
56 Carter S. Automating Healthcare. http://automatinghealthcare.com/Clerkship.shtml. Accessed February 15, 2012.
57 Flexner A. Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching. Bulletin Number Four. New York, NY: Arno Press Inc.; 1972.
58 Berwick DM, Finkelstein JA. Preparing medical students for the continual improvement of health and health care: Abraham Flexner and the new "public interest." Acad Med. 2010;85(9 suppl):S56–S65.