

A typology of longitudinal integrated clerkships

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CONTEXT Longitudinal integrated clerkships (LICs) represent a model of the structural redesign of clinical education that is growing in the USA, Canada, Australia and South Africa. By contrast with time-limited traditional block rotations, medical students in LICs provide comprehensive care of patients and populations in continuing learning relationships over time and across disciplines and venues. The evidence base for LICs reveals transformational professional and workforce outcomes derived from a number of small institution-specific studies.

OBJECTIVES This study is the first from an international collaborative formed to study the processes and outcomes of LICs across multiple institutions in different countries. It aims to establish a baseline reference typology to inform further research in this field.

METHODS Data on all LIC and LIC-like programmes known to the members of the international Consortium of Longitudinal Integrated Clerkships were collected using a survey tool developed through a Delphi process and subsequently analysed. Data were collected from 54 programmes, 44 medical

schools, seven countries and over 15 000 student-years of LIC-like curricula.

RESULTS Wide variation in programme length, student numbers, health care settings and principal supervision was found. Three distinct typological programme clusters were identified and named according to programme length and discipline coverage: Comprehensive LICs; Blended LICs, and LIC-like Amalgamative Clerkships. Two major approaches emerged in terms of the sizes of communities and types of clinical supervision. These referred to programmes based in smaller communities with mainly family physicians or general practitioners as clinical supervisors, and those in more urban settings in which subspecialists were more prevalent.

CONCLUSIONS Three distinct LIC clusters are classified. These provide a foundational reference point for future studies on the processes and outcomes of LICs. The study also exemplifies a collaborative approach to medical education research that focuses on typology rather than on individual programme or context.

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INTRODUCTION

Longitudinal integrated clerkships (LICs) represent a transformative approach to clinical education¹ that uses continuity² and relationships³ among medical students, patients and physicians to shape the educational experience. As the number of medical schools using LICs globally has doubled in the last 5 years,⁴ this educational approach has generated considerable discussion. The LIC redesign challenges the tradition of clinical education that relies on sequential, time-limited 'block' rotations through specialty hospital departments.⁵ However, what defines an LIC is often contentious outside the LIC community as educators use the terms 'longitudinal' and 'integrated' to describe a range of educational interventions.⁶ Through this study, we seek to clarify understanding of the LIC from the accumulated perspectives of 44 schools in seven countries.

Background

Medical education leaders established LICs to address workforce, health system and public health imperatives,^{5,7–10} and to translate the sciences of learning into our clinical education models.^{2,3} In regions in which workforce shortages existed, the LIC approach enabled education leaders to deliberately design extended educational experiences in low-resource settings that would not have been possible through a traditional rotation approach. The combination of this extended immersion and the enabling of students' meaningful contributions to care in these settings is postulated to be important in encouraging students to take up careers in these underserved contexts.^{11,12}

Although some medical schools have used this approach for over 40 years, the term 'LIC' was only formally defined when interested education leaders, including those at seven LIC-oriented schools, met in Cambridge, Massachusetts, USA in 2007. This group, the international Consortium of Longitudinal Integrated Clerkships (CLIC), used an iterative process of discussion to characterise the elements of all known LIC programmes and to propose a consensus definition. Its members recognised that, despite differences in their implementation, LICs shared three common elements.¹³ These characteristics indicate that: (i) medical students participate in the comprehensive care of patients over time; (ii) medical students have continuing learning relationships with these patients' clinicians, and (iii) through these experiences, medical students meet

the majority of the academic year's core clinical competencies across multiple disciplines simultaneously.

The first element emphasises that LICs require active, authentic and ongoing student participation in patient care and that this care is not limited to a particular discipline, disease grouping or episode of care.^{14,15} The second element articulates the importance of relational learning that has emerged from research in this field and indicates that it takes time to develop such relationships with clinical supervisors.³ Both these elements may also form part of non-LIC clerkship designs, although it is difficult to be 'comprehensive' if the rotation objectives are focused on a specific disease grouping and do not allow 'time' for follow-up of patients as they progress through different stages of care, and it is challenging to establish effective 'learning relationships' with busy clinical supervisors in a short rotation.

The third element is quite distinctive. Here the LIC design requires a single 'integrated' clerkship to cover the learning objectives of multiple disciplines simultaneously. To enable this to occur, the LIC educational structure relies on students developing a complex 'cohort' of patients. The cohort or 'panel' incorporates patients from all the core specialties. In an LIC, patient needs guide the student's involvement more comprehensively and continuously than discipline-based and time-based rotations permit. Students on LICs care for 'their' patients across time, across venues and across the panoply of patients' care needs.^{2,16} Although grounded in ambulatory settings, this model of educational continuity relies on ambulatory, acute and in-patient venues at once, wherever the cohort of patients' care needs arise. The LIC is designed as a whole educational experience, not as an adjunctive longitudinal experience added to the backbone of a traditional block rotation.²

The CLIC definition intentionally chose language to support inclusiveness in this new approach to clinical education, such as 'continuing learning relationships', 'over time', 'majority' and 'simultaneously', in order to emphasise the model's principles rather than to impose an obligatory structure. Using this definition, Norris *et al.*⁴ published a summary in 2009 of the 17 programmes known to be using this approach. By 2013, the CLIC meeting had grown to involve over 230 delegates from 48 schools. In this context of rapid uptake, examining the landscape of LICs and LIC-like programmes becomes critical,

and serves to further clarify the original definition and current nature of LIC models.

METHODS

Research design

The Collaborative formed a Methodology Design Group (MDG) following the 2011 CLIC conference to lead the research programme. The MDG met regularly via Skype and used a Delphi process to develop the survey tool (Appendix S1), seeking feedback from all Collaborative participants. Ethics approval was gained from Flinders University in Australia and McGill University in Canada.

Data collection

Members of the Collaborative contacted by e-mail people from all universities with representatives at the 2012 and 2013 CLIC conferences, and any others known to be considering LIC-like models, and invited them to participate in this study. To maximise response rates from participants across four continents, the survey team offered three options for completing the survey: online via Survey Gizmo; by telephone or Skype interview at a time of convenience to the respondent, or by face-to-face interview at the 2013 CLIC conference in Big Sky, Montana, USA. Surveyors recruited further participants from the subsequent CLIC conference and data collected by telephone or Skype interview in 2014. Researchers completed all data collection between September 2013 and October 2014.

Statistical analysis

We performed statistical analysis using IBM SPSS Statistics for Windows Version 22.0 (IBM Corp., Armonk, NY, USA) and STATA Version 13.1 (Stata-Corp LP, College Station, TX, USA). We present numbers and percentages for categorical variables, and means and standard deviations (SDs) for normally distributed continuous variables. In order to classify types of LIC, we used a qualitative review of the survey results that focused on the proportion of the academic year spent in the LIC, the length of the LIC and the number of disciplines taught within the LIC. We supported this assessment with a k-means cluster analysis of the percentage of time spent in rural locations, the number of disciplines taught, and the size of the smallest and largest LIC sites (data not shown).

The face validity assessment identified three broad types of LIC (see Results). We then performed univariate analyses to assess associations between the three broadly defined types of LIC (termed Clusters A, B and C, respectively) and student and supervisor demographics using analysis of variance (ANOVA) for continuous variables and Fisher's exact test for categorical variables. We assessed significance for each test using a two-tailed type I error rate at $p < 0.05$. We used all available data in the analyses. Response numbers are reported in cases of missing data.

Data mapping

To provide a visual representation of the data, we mapped the geographic locations of the medical schools running LIC programmes using ARCGIS Version 10.2.1 (ESRI [Environmental Systems Research Institute], Inc., Redlands, CA, USA) and the World Geodetic System (WGS) 1984 World Mercator coordinate system. The geographic latitude and longitude coordinates for each school were based on the centroid of their respective postcodes or zipcodes. We obtained US-based school geocodes using US zipcode data for 2006 (Tele Atlas North America, Inc., Lebanon, NH, USA) and the remaining geocodes using the latitude and longitude for postcodes individually entered into Google Earth.

Data interpretation

The MDG viewed the collected data and then presented preliminary analyses to the study participants to check for credibility. Subsequently, the MDG presented the preliminary results at plenary sessions of the 2013 and 2014 CLIC conferences, allowing the broader Collaborative to provide input into the interpretation of the results. The MDG led further descriptive analysis and characterisation of the data; the commentary on this analysis included the views of the entire CLIC Research Collaborative.

RESULTS

Representatives of 54 distinct programmes at 44 medical schools responded to the survey (Appendix S2). These programmes represented over 15 000 student-years of LIC-like clerkships. Six universities offered two or more distinctly different LIC models within their curricula.

Length of clerkship, discipline coverage and definition of cluster typology

All programmes in the study met the first two CLIC criteria for an LIC, namely that students participate in the comprehensive care of patients over time and have continuing learning relationships with these patients' clinicians. The 2007 CLIC definition is silent on the absolute length required of a clerkship for it to be included as an LIC programme. However, the third criterion does specify that the students 'meet the *majority of the year's* core clinical competencies' through the programme.

Among programmes submitting data, the lengths of clerkships varied from 6 to 54 weeks. We reviewed the data and by consensus delineated three clusters based on the educational criteria in the 2007 CLIC definition. Table 1 shows the three clusters according to programme length and discipline coverage.

Programmes in Cluster A functioned as extended rotations that covered more than one, but not the majority, of disciplines for the year. Programmes in Cluster B covered all or the majority of disciplines in that year, but utilised complementary discipline-specific rotations to complete the year's study. Programmes in Cluster C comprised either the entire year's study or had very short orientation programmes for individual disciplines followed by a full academic year covering all disciplines simultaneously. As the length of the academic year varied considerably amongst the schools in this study (32–54 weeks), some Cluster C programmes that covered an entire academic year were actually shorter than Cluster B programmes that required complementary discipline-specific rotations to complete the academic year's study.

Table 2 describes the univariate associations among the three clusters and each of the demographic items surveyed.

Table 1 Longitudinal integrated clerkship clusters

Cluster	Proportion of academic year	Weeks, median (range)	Programmes, n
A	< 50%	12 (6–18)	9
B	50–90%	28 (20–38)	11
C	90–100%	42 (32–54)	34
	Total	40 (6–54)	54

Geographic location

Programmes in Cluster C dominated in Australia, Canada and the USA, whereas in other countries, including Norway, South Africa and the UK, Cluster A was more prevalent ($p = 0.01$). Although the data were derived from seven countries, only two programmes that met all three current CLIC criteria were outside the three countries of the USA, Australia and Canada (Fig. S1).

Student entry into the medical education programme

There were significant associations among cluster types and type of entry provided, as well as the length of the medical education programme as a whole. A mix of post-high school entry and graduate-entry medical education programmes had incorporated LICs. Because of the geographic clustering of the medical schools in North America and Australasia, 85% (46/54) of the programmes had graduate-entry admissions pathways and 83% (45/54) were 4-year programmes (Table 2). There was no difference in student intake numbers into Year 1 of the medical education programme across clusters ($p = 0.43$). These varied from 36 to 305 students (mean \pm SD: 160 ± 67 students).

Beginnings

The first LIC-type programme commenced in 1971. The global number of medical schools with LIC programmes has expanded exponentially in the last 10 years (Fig. 1).

Community size and locations

We asked participating schools to describe the different communities in which they based their LICs, noting that they may use multiple clinics or hospitals within each site or community. We included the capital city as a separate category in view of the perception of civic power inherent in some such cities, independent of actual population. Historically, many of the early LICs focused on expanding clinical education into rural and regional centres and 31 of 45 (69%) Cluster B and C programmes continued to incorporate communities with populations of $< 25\,000$. Nine (20%) such programmes were based exclusively in communities of this size or smaller. Eight of 34 (24%) Cluster C programmes resided in urban centres with populations of over 100 000 people.

Table 2 Programme characteristics of longitudinal integrated clerkships (LICs)

	Cluster			p-Value*
	A (n = 9)	B (n = 11)	C (n = 34)	
Programmes, n (%)				
Australia/New Zealand	1 (11.1)	3 (27.3)	11 (32.4)	
Canada	1 (11.1)	0	8 (23.5)	
Norway/South Africa/UK	4 (44.4)	0	1 (2.9)	
USA	3 (33.3)	8 (72.7)	14 (41.2)	0.010
Entry, n (%)				
Undergraduate	4 (44.4)	0	4 (11.8)	
Graduate	4 (44.4)	9 (81.8)	27 (79.4)	
Both	1 (11.1)	2 (18.2)	3 (8.8)	0.058
Medical course duration, n (%)				
3 years	0	0	1 (2.9)	
4 years	5 (55.5)	11 (100)	29 (85.3)	
5 years	2 (22.2)	0	0	
6 years	2 (22.2)	0	4 (11.8)	0.029
Year 1 students, mean ± SD	161 ± 49	184 ± 75	153 ± 68	0.435
Year LIC commenced, n (%)				
1971–1999	1 (11.1)	4 (36.4)	2 (5.9)	
2000–2005	0	0	5 (14.7)	
2006–2010	5 (55.5)	6 (54.5)	11 (32.4)	
2011–2014	3 (33.3)	1 (9.1)	16 (47.1)	0.040
Population of smallest site, n (%)				
Capital city	1 (11.1)	0	4 (11.8)	
> 100 000	0	1 (9.1)	4 (11.8)	
25 000–100 000	0	0	5 (14.7)	
10 000–25 000	0	2 (18.2)	3 (8.8)	
< 10 000	8 (88.9)	8 (72.7)	18 (52.9)	0.510
Number of sites, [†] mean ± SD	22.8 ± 31.8	12.0 ± 12.0	6.8 ± 6.1	0.020
Year of course, n (%)				
Final	4 (44.4)	0	2 (5.9)	
Penultimate	3 (33.3)	11 (100)	32 (94.1)	
Other	2 (22.2)	0	0	< 0.001
Students in LIC, mean ± SD	64.7 ± 79.1	17.1 ± 11.2	24.2 ± 22.9	0.010
Students in LIC, range	10–240	2–32	4–85	
Proportion of all students, %, mean ± SD	49.3 ± 25.3	36.0 ± 22.2	33.4 ± 26.6	0.360

* Comparison between clusters; Fisher's exact test for categorical variables and ANOVA for continuous variables

[†] 'Site' refers to a community or town; a single 'site' may include multiple practices or hospitals

SD = standard deviation

Number of distinct LIC-like programmes in each school

The majority (38/44, 86%) of the medical schools in the study ran only one LIC or LIC-like programme. Four universities had multiple distinct Cluster B and

C programmes, and two medical schools ran a Cluster A programme as well as a Cluster C programme.

The majority of LICs occurred in the penultimate year of the medical programme, which tends to be

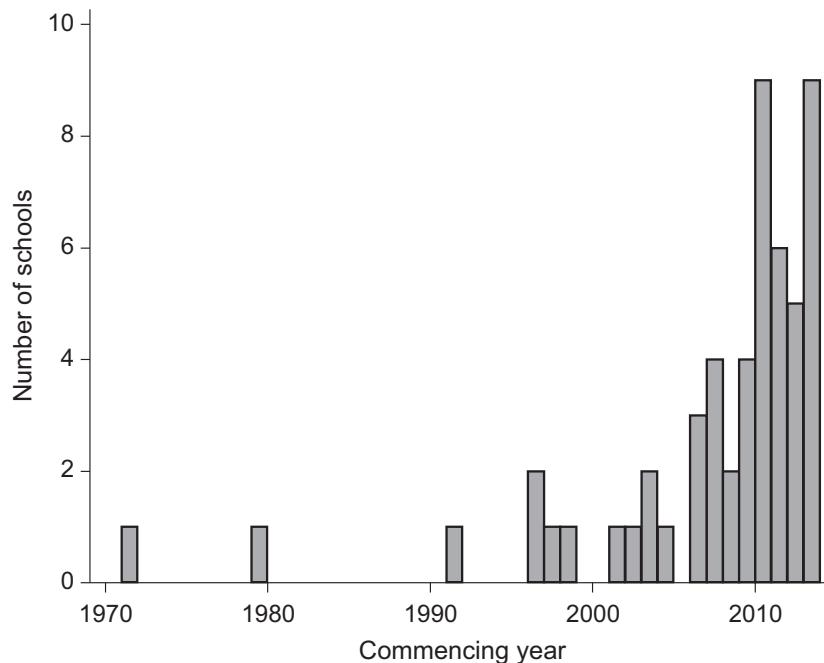


Figure 1 Years in which longitudinal integrated clerkships commenced

the first core clinical immersion (i.e. clerkship) year. However, this varied according to cluster: Cluster B and C programmes were more likely than Cluster A programmes to occur in the penultimate year ($p = 0.001$) (Table 2).

Number of students in the programmes

The size of individual Cluster B or C programmes varied from two to 85 students per year, while Cluster A programmes included between 10 and 240 students per year. In 34 of 45 (76%) LICs in Clusters B and C, the size of the programme represented $< 20\%$ of the full class. However, in four schools all students undertook a Cluster B or C programme (Fig. S1).

Clinical supervision

Whereas allocated clinical supervisors in the shorter integrated Cluster A rotations were predominantly family medicine (FM) physicians, the longer programmes appeared to be of two distinct types: programmes which allocated predominantly FM supervisors, and programmes which allocated predominantly other specialist supervisors (Table 3).

Programmes that allocated predominantly FM supervisors were more likely to be programmes based in small communities of fewer than 10 000 people. Whereas 84% of programmes with predominantly FM supervisors included small communities,

Table 3 Percentage of supervisors who are family medicine (FM) specialists

Supervisors as FM specialists	Cluster, n (%)			p-Value*	
	A (n = 8)	B (n = 10)	C (n = 31)		
< 25%	1 (12.5)	1 (10.0)	13 (41.9)		
25–50%	0	1 (10.0)	1 (3.2)		
51–75%	1 (12.5)	0	3 (9.7)		
> 75%	6 (75.0)	8 (80.0)	14 (45.2)	0.060	

* Comparison between clusters; Fisher's exact test

only 18% of programmes with predominantly other specialists as clinical supervisors were based in small communities ($p < 0.001$) (Table 4).

DISCUSSION

This study has documented the rapid growth in the use of LICs internationally, which more than doubled in the 5 years subsequent to the 2009 review published by Norris *et al.*⁴ In 2013/2014, approximately 1000 students undertook A, B and C-type LICs in 54 programmes in 44 different schools, in seven countries on four continental regions,

Table 4 Association between size of teaching site and proportion of family medicine (FM) clinical supervisors

Supervisors as FM specialists	Smallest teaching site, n (%)			p-Value*
	Urban (> 100 000) (n = 10)	Regional (10 000–100 000) (n = 9)	Rural (< 10 000) (n = 30)	
< 25%	8 (80.0)	5 (55.5)	2 (6.7)	
25–50%	0	1 (11.1)	1 (3.3)	
51–75%	1 (10.0)	0	3 (10.0)	
> 75%	1 (10.0)	3 (33.3)	24 (80.0)	< 0.001

* Comparison between clusters; Fisher's exact test

predominantly in the penultimate year of the medical education programme, and with a median clerkship length of 40 weeks.

Through this study, we have identified three major clusters of programmes. The 45 programmes in 37 schools in Clusters B and C met the current CLIC criteria for LICs. The first cluster, Cluster A, comprised shorter clerkships that combined learning from a number of disciplines, and were longer than the usual rotations in their year, but did not meet the 'majority' criterion in the CLIC definition in regard to either curriculum time or curriculum content. We propose that these programmes should not be referred to as LICs, but should rather be described as 'Amalgamative Clerkships' (ACs).

We propose that Cluster B be referred to as 'Blended LICs', comprising LICs that incorporate all or the majority of disciplines, but utilise complementary discipline-specific rotations to complete the academic year.

We propose that Cluster C be referred to as 'Comprehensive LICs', comprising LICs that incorporate all the year's disciplines as their core, are delivered as integrated programmes, and thus incorporate only limited brief in-patient, discipline-specific immersive experiences.

This study also reveals some variation in approaches in terms of the sizes of communities and types of clinical supervision. Two major approaches emerge from the data.

The first approach is apparent in programmes based around FM settings that include small communities

of fewer than 10 000 people, have a larger number of sites at which students are based (see definition of site in Table 2), and predominantly engage family physicians as clinical supervisors.

The second approach is evident in programmes that are based in more urban settings with hospitals and clinics at which subspecialists are prevalent, operate at fewer sites and use predominantly non-FM clinicians as clinical supervisors.

It is unclear from this study whether this divide is simply a logical consequence of the context of the health care organisation in which the medical school is based, whether there are educational or strategic rationales for this, or whether it may reflect the culture of the medical school. However, it is likely that the association between FM supervision and the use of small communities can be attributed to the fact that FM physicians represent the predominant specialty practising in these small communities.

Amalgamative Clerkships focus upon the first approach, whereas Blended and Comprehensive LICs use both approaches. There is no apparent preference for these approaches on the basis of the country of the programme.

Thus, a five-category typology of programmes that utilise LIC principles emerges from these data (Table 5).

This typology reflects the historical trajectory of the LIC innovation. The early adopters were rural and family medicine-based, and this innovation has now diffused to urban and tertiary centre sites. The

Table 5 Longitudinal integrated clerkship (LIC) typology

LIC programme typology				
Programme type	Programme characteristics		Setting subtype	Subtype characteristics
Amalgamative clerkship	1	< 20 weeks (< 50% of duration of academic year)	Community	1 Median: 11 sites, usually including small rural communities
	2	Two or more but < 50% of disciplines covered		2 Usually an FM focus
	3	Treated as one of many rotations in a rotation-based course		
	4	Any of the last 3 years of the degree programme		
Blended LIC	1	50–89% of duration of academic year	FM	1 Median: nine sites, usually including small rural communities
	2	All or majority of disciplines covered		2 Predominantly FM supervisors
	3	Linked complementary rotations external to LIC to complete the academic year	Other specialties	1 Median: two sites, usually including large urban communities
	4	Usually in penultimate year		2 Predominantly non-FM supervisors
Comprehensive LIC	1	Full duration of clinical academic year (90–100%)	FM	1 Median: nine sites, usually including small rural communities
	2	All disciplines covered		2 Predominantly FM supervisors
	3	Limited brief in-patient discipline-specific immersive experiences within LIC	Other specialties	1 Median: one site, usually including a large urban community
	4	Usually in penultimate year		2 Predominantly non-FM supervisors

FM = family medicine

linkage between rural settings and FM supervision in this typology probably reflects the reality that, in Canada, the USA and Australia, the majority of doctors practising in rural areas are family physicians.

It would appear from these data, that, whereas in Europe and Africa the use of LICs is still confined to a group of early innovators,¹⁷ in the USA this innovation has moved from the innovators stage to the early adopters stage (18 of 141 [13%] MD-granting medical schools), well into the early majority stage in Canada (eight of 17 [47%] schools), and to the cusp of the late majority stage in Australia (nine of 18 [50%] schools).

The LIC represents a growing innovation in both the established and newest medical schools. More established schools chose to pilot the LIC and started by allowing a small percentage of their cohorts to undertake LICs, whereas four newer schools have decided this is the best approach for their entire school cohort. Four schools have more than one approach to the LIC model, possibly reflecting variations in the clinical contexts in which their students learn.

This study has limitations. It is a single snapshot in a time of rapid growth, and probably underestimates the actual prevalence of LIC programmes. The Consortium is still predominantly a phenomenon of the English-speaking world. There may be similar approaches of which the Consortium is not aware. The methodology of this study also excluded LIC programmes that are no longer active. The authors are aware of two pioneering programmes that have since ceased: the 1993 Cambridge Community Clinical Course at Cambridge University in the UK,¹⁸ and the 1974 Upper Peninsula Program at Michigan State University in the USA.¹⁹

In addition, the study demonstrates the difficulty in finding a common language to describe aspects of medical education. What is a 'course' in one school is a 'topic' or a 'paper' in another, and a 'programme' in yet another. Terms such as 'preceptor', 'supervisor', 'clerkship', 'rotation', 'curriculum' and 'faculty' also have quite different meanings in different institutions and nations. This study used piloting of the survey tool to inform the definition of terms as clearly as possible, but the researchers still found it necessary to give explanations during the

data collection process by interview. This suggests that multi-institutional data collected by survey across different countries may suffer from inconsistent interpretation across respondents.

This study has demonstrated both the common elements and the diversity of these LIC implementations. The diversity raises critical questions. For instance, with regard to pedagogy, the following questions, among others, are proposed. What are the relative contributions of longitudinality and integration to the observed outcomes? Are there differences in student outcomes between LICs in which supervisors are and are not predominantly FM physicians? What disciplines are most commonly included and excluded from LICs? What is integration, how is it operationalised, how can it be best quantified, and might there be different impacts for different degrees of integration? How much time is needed to achieve the longitudinal or other goals of LICs? How can we best study the other LIC definitional elements of 'continuing learning relationships' and 'comprehensive care of patients over time'? What are the pedagogical mechanisms inherent in LICs? What are the generalisable student, teacher and community outcomes? What pitfalls do education planners need to avoid?

With regard to the sociology of medical education, we suggest the following questions are relevant. Why is the LIC approach predominantly a North American and Australasian phenomenon? Has the term 'LIC' become a 'branding' of the broader principles of integration and relationship-based education? What is the impact on the utility of the term 'LIC', and similar educational 'brands', when schools adjust the defined model to fit their local contexts? What are the cost-effectiveness and sustainability of the approaches and how can cost-effectiveness include not just programmatic but institutional, patient, population and system outcomes? What is the cross-cultural applicability of the LIC model? Does the successful implementation of LICs in small communities in the developed world suggest this might be a suitable approach for schools in the developing world? Why do most schools offer the LIC approach to only a small proportion of their students? What forces or constituencies are constraining clinical education innovation?

There is accumulating evidence from small studies relating to these questions.^{20–34} However, as each programme differs in context and structure, the

findings of small studies prove difficult to generalise. The context-specificity of these studies perpetuates a cycle wherein scholars create further small studies to replicate findings in new programmes in new geographic or educational settings. The scale of these studies makes outcome attribution very difficult. This is an important concern for governments, health services and funders of medical education. Our typology study has found that many programmes share core characteristics, which suggests it may be possible for researchers to assess processes and outcomes across multiple schools rather than solely within single schools. This approach will increase study power and generalisability within specific typologies and may shorten the time required for researchers to answer the important questions in education and care delivery.

Well-designed small studies will remain important in medical education research. Nonetheless, an expanded and cross-institutional evidence base allows for the possibility of identifying a phenomenon in one clerkship (e.g. a given type B blended clerkship) and validating this or generalising it to other similar programmes (i.e. another type B blended clerkship). Although this study deals with a particular educational intervention, our success in establishing an international research collaborative raises the possibility that multicentre studies may also be feasible in other areas of medical education research.

Medical education is part of the medical profession's social contract with society. We believe that translating the sciences of learning into improved educational models should underpin and accompany clinical delivery and health systems transformation.^{1,5,7,10} The CLIC Research Collaborative sees this future programme of research as both an important opportunity and a critical responsibility.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Sample questions from survey tool.

Appendix S2. Contributing CLIC Research Collaborative programs.

Figure S1. GIS location of LIC programs by cluster and student numbers.

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