

Manuscript Title

A typology of longitudinal integrated clerkships

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Ethical Approval.

Ethical approval was sought and obtained for this study from Flinders University, Australia, and McGill University, Canada.

ABSTRACT

A typology of longitudinal integrated clerkships

Background

Longitudinal Integrated Clerkships (LICs) are an example of an approach to medical education that has an emerging evidence base for transformational professional and workforce outcomes derived from small institution specific studies.

This study is the first from an international collaborative formed to study the outcomes of LICs across multiple institutions. We aim to establish a baseline reference typology to inform further research in this field.

Methods

We collected and analysed data on all LIC and LIC-like programs known to the members of the international Consortium of Longitudinal Integrated Clerkships (CLIC).

Results

Our data represented 54 programs, 44 medical schools, seven countries and over 15,000 student-years of LIC-like curricula. We found wide variation in program length, student numbers, health care settings and principal supervision.

We identified and named three distinct program clusters - Comprehensive LICs, Blended LICs, and LIC-like Amalgamative Clerkships.

Conclusions

We classified 3 distinct LIC clusters that also provide a foundational reference point for future studies on the outcomes of LICs.

Purpose

Longitudinal integrated clerkships (LICs) are an example of a transformative approach to clinical education (1) that uses continuity (2) and relationships (3) between medical students and their patients and teachers as guiding principles. The number of medical schools using LICs globally has doubled in the last five years (4). Despite its rapid growth and general acceptance, this educational approach has generated considerable discussion because it challenges the tradition of learning clinical medicine utilizing sequential rotations through specialty hospital departments (5). In addition, what defines a LIC is often still poorly understood outside of the LIC community, with the terms “longitudinal” and “integrated” being used for a range of educational interventions (6).

Although 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, MA, USA in 2007. This group, the international Consortium of Longitudinal Integrated Clerkships (CLIC), used an iterative process of discussion to characterize the elements of all the known LIC programs and propose a consensus definition. They recognised that, despite differences in their implementation, LICs encompassed three common elements (7):

1. Medical students participate in the comprehensive care of patients over time.
2. Medical students have continuing learning relationships with these patients’ clinicians.
3. Through these experiences, medical students meet the majority of the academic year’s core clinical competencies across multiple disciplines simultaneously.

This 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’. Norris et al published a summary in 2009 of the 17 programs known to be using this approach (4). By 2013, the meeting of CLIC had grown to involve over 230 delegates from 48 schools. In this context of rapid uptake, examining the landscape of LICs and LIC-like programs becomes critical, and serves to further clarify the original definition and current nature of LIC models.

In 2011, participants in an annual CLIC meeting in Yankton, South Dakota, initiated a process to form a collaborative research group to further investigate and explore the nature of LICs. The CLIC Research Collaborative now gathers researchers from 44 medical schools in 7 countries comprising 54 discrete programs. This study, the first from the Collaborative, undertook to describe the variability in LIC characteristics, to establish a LIC typology, and to identify other characteristics

associated with this typology classification. This study describes the dimensions of LICs and LIC-like programs across schools known to CLIC internationally in order to enhance our shared understanding of this educational model.

Method

Research Design

The Collaborative formed a Methodology Design Group (MDG) following the 2011 CLIC conference to lead the research program. The MDG met regularly via Skype and used a Delphi process to develop the survey tool (Appendix 1), seeking feedback from all Collaborative participants. Ethics approval was gained at Flinders University in Australia and McGill University in Canada.

Data Collection

Members of the Collaborative contacted people by e-mail 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 maximize response rates from participants across 4 continents, the survey team offered three options for completing the survey: online via Survey Gizmo, by phone 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. Surveyors recruited further participants from the subsequent CLIC conference and data collected by phone or Skype interview in 2014. Researchers completed all data collection between September 2013 and October 2014.

Statistical Analysis

We performed statistical analysis using SPSS (version 22) and Stata (StataCorp, Texas, USA) (version 13.1). We present numbers and percentages for categorical variables, and means and standard deviations for normally distributed continuous variables. In order to classify the types of LICs we used a qualitative review of the survey results that focused on the proportion of the academic year spent in LICs, 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 site (data not shown). The face validity assessment identified 3 broad types of LIC (see Results below). We then performed univariate analyses to assess associations between the 3 broadly defined types of LICs (termed Clusters A, B and C) 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 1 error rate of $p < 0.05$. We used all available data in the analyses and response numbers are reported in the case of missing data.

Data Mapping

To provide a visual representation of the data, we mapped the geographical location of the medical schools using an LIC program by using ArcGIS software (version 10.2.1) and the WGS 1984 World Mercator coordinate system. The geographic latitude and longitude coordinates for each school were based on the centroid of their respective postcodes/ZIP-codes. We obtained US based school geocodes using US Zip Code data (Tele Atlas North America, Inc., 2006) 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 characterization of the data, and the commentary on this analysis included the views of the entire CLIC Research Collaborative.

Results

Fifty-four distinct programs from 44 medical schools responded to the survey (see Appendix 2). These programs 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 programs 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 of a clerkship for it to be included as an LIC program. However, the third criterion does specify that the students "meet the *majority of the year's* core clinical competencies" through the program.

Among programs submitting data, their clerkships' length 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 program length and discipline coverage.

Insert Table 1. LIC Clusters

Programs in Cluster A functioned as extended rotations that covered more than one, but not the majority, of disciplines for the year. Programs 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. Programs in Cluster C comprised either the entire year's study or had very short orientation programs 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 programs that cover an entire academic year are actually shorter than Cluster B programs that require complementary discipline-specific rotations to complete the academic year's study.

Table 2 describes the univariate associations among the 3 clusters and each of the survey demographic questions.

Insert Table 2. LIC Program Characteristics

Geographic location

Programs of Cluster C dominated in Australia, Canada and the US, while in other countries including Norway, South Africa and the UK, Cluster A was more prevalent ($p=0.01$). Although the data derive from seven countries, only two programs that meet all three current CLIC criteria were outside the three countries of the USA, Australia and Canada (See Figure 1 below).

Insert Figure 1. GIS location of LIC programs by cluster and student numbers

Student entry into the Medical Education Program

There were significant associations among cluster types and the type of entry provided as well as the length of the medical education program as a whole. There is a mix of high school entry and graduate entry medical education programs that have incorporated LICs. Due to the geographic clustering of the medical schools in North America and Australasia, 85% (46/54) of the programs have graduate-entry admissions pathways and 83% (45/54) are 4-year programs (Table 2). There was no difference in the student intake numbers into Year 1 of the medical education program across clusters ($p=0.43$) which varied from 36 to 305 with a mean (SD) of 160(67) students.

Beginnings

The first LIC type program commenced in 1971. The number of medical schools with LIC programs globally has expanded exponentially in the last ten years (Figure 2).

Insert Figure 2. Year LIC Commenced

Community Size and Locations

We asked the 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/community. We included the capital city as a separate category due to 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 31/45 (69%) of Cluster B and C programs continue to incorporate communities of less than 25,000 population, with nine (20%) being based exclusively in communities this size or less. Currently, 24% (8/34) of Cluster C programs reside in urban centres with a population over 100,000 people.

Number of distinct LIC-like programs in each school

The majority (38/44 or 86%) of the medical schools in the study have only one LIC or LIC-like program. Four universities have multiple distinct Cluster B and C programs, and two medical schools have a Cluster A program as well as a Cluster C program.

The majority of LICs occur in the penultimate year of the medical program, which tends to be the first core clinical immersion (i.e. clerkship) year. However, this varies according to cluster with Cluster B and C programs more likely to occur in the penultimate year than Cluster A programs ($p=0.001$) (Table 2).

Number of students in the programs

The size of individual Cluster B or C programs varied from 2 to 85 students per year, while cluster A programs had between 10 and 240 students per year. In 34/45 (76%) LICs in Cluster B or C, the size of the program represented less than 20% of the full class. However, there are now four schools where all students undertake a Cluster B or C program (Figure 1).

Clinical Supervision

Whilst in the shorter integrated Cluster A rotations, the allocated clinical supervisors were predominately Family Medicine (FM) physicians, in the longer programs, there appear to be two

distinct types – programs which allocate predominately FM supervisors, and programs which allocate predominately other specialist supervisors (Table 3).

Insert Table 3: Percentage of supervisors who are family medicine specialists

Programs that allocated predominately FM supervisors were more likely to be the programs that included small communities of less than 10,000 people. Whilst 84% of programs with predominately FM supervisors included small communities, only 18% of programs with predominately other specialists as clinical supervisors included small communities ($p < 0.001$) (Table 4).

Insert Table 4: Association between size of teaching sites and proportion of family medicine clinical supervisors

Discussion

The report of the Lancet Commission on Education of Health Professionals for the 21st Century clearly articulated the need for radical reform of medical education to serve societal needs better (1). Medical education leaders established Longitudinal Integrated Clerkships (LICs) to address workforce, health system, and public health imperatives (5,8,9,10,11) and to translate the sciences of learning into our clinical education models (2,3). Our study demonstrates the diversity of approaches to this transformative model of clinical education across seven countries.

Through this study, we identified three major clusters of programs. The 45 programs in 37 schools in Clusters B and C meet the current CLIC criteria for LICs. The first cluster, Cluster A, comprised shorter clerkships that combine learning from a number of disciplines, and are longer than the usual rotations in their year, but do not meet the ‘majority’ criterion in the CLIC definition in regards to both curriculum time and curriculum content. We propose that these programs not be referred to as LICs, but rather be referred to 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 utilize 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, delivered as an integrated program, and thus incorporate only limited brief inpatient discipline-specific immersive experiences.

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

1. Programs based around Family Medicine (FM) settings that include small communities of less than 10,000 people, have a larger number of sites where students are based (see definition of site in Table 2), and predominately engage Family Physicians as clinical supervisors
2. Programs based in more urban settings with hospitals and clinics where sub-specialists are prevalent, have fewer sites with predominately non-FM clinicians as clinical supervisors

It is unclear from this study whether this divide is just a logical consequence of the healthcare organization where 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 is due to FM physicians being the predominant specialty practicing 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 program.

Thus, a 5-category typology of programs that utilize LIC principles emerges from these data (Table 5).

Insert Table 5. LIC Typology

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

This study has documented the rapid growth in the use of Longitudinal Integrated Clerkships internationally, with a more than doubling of known programs in the 5 years since the 2009 Norris

review (4). In 2013/14, approximately 1000 students undertook A, B, and C-type LICs in 46 programs in 38 different schools, in seven countries on four continental regions, predominately in the penultimate year of the medical education program, and with a median clerkship length of 40 weeks.

It would appear from these data, that, whilst in Europe and Africa the use of LICs is still confined to a group of early innovators (12), in the USA this innovation has moved from the innovators stage to the early adopters stage (18/141 = 13% of MD granting medical schools), well into the early majority stage in Canada (8/17 = 47%), and to the cusp of the late majority stage in Australia (9/18 = 50%).

LICs are a growing innovation in both the established and newest medical schools. More established schools chose to pilot starting with a small percentage of their cohort undertaking LICs, and 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 programs. The Consortium is still predominately 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 programs that are no longer active. The authors are aware of two pioneering programs that have since ceased – the 1993 Cambridge Community Clinical Course at Cambridge University in the UK (13) and the 1974 Upper Peninsula Program at Michigan State University in the USA (14).

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 'program' 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 explanations necessary during the data collection process by interview. This suggests that multi-institutional data collected by survey across different countries may suffer from inconsistent interpretation by the respondents.

This study has demonstrated both the common elements and the diversity of these LIC implementations. The diversity raises critical questions. For instance, in regards to pedagogy, the following are proposed, amongst others. What are the relative contributions of longitudinality and

integration to the observed outcomes? Are there differences in student outcomes from LICs where the supervisors are predominately Family Medicine physicians? What disciplines are most commonly included and excluded from LICs? What is integration, how is it operationalized, how can it be best quantified, and could 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, the generalizable student, teacher and community outcomes, and the pitfalls that education planners need to avoid?

In regards to the sociology of medical education, we suggest the following questions are relevant. Why is the LIC approach predominately 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 is 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 could be a suitable approach for schools in the developing world? Why are most schools only offering the LIC approach to 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 above (15-29). Through the Collaborative, with the aid of this typology, we have the possibility to examine these important questions with the alternative approach of large multi-centre studies similar to those used in clinical trials research and thus create a complementary evidence base for the contribution of medical education to health services and clinical practice. Further, it allows for the future possibility of developing a tool or identifying a phenomenon in one type of clerkship (e.g. Type B – Blended Clerkship) and validating this or generalizing this to other similar programs (i.e. another Blended Clerkship).

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 (1,5,8,11). The CLIC Research Collaborative sees this future program of research as both an important opportunity and a critical responsibility.

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Appendix 1. Sample questions from survey tool

Does your medical course accept students direct from high school i.e. undergraduate entry, or require completion of a bachelor degree i.e. graduate entry?

- Undergraduate
- Graduate entry
- Both

This question is for USA accredited medical programs only

Does your institution award an Allopathic or Osteopathic degree?

- Allopathic
- Osteopathic

What is the total number of weeks of study required in your medical course?

What is the total number of years of study required in your medical course?

- 1
- 2
- 3
- 4
- 5
- 6

In this academic year how many students will you/have you admitted to Year 1 of your medical course ?

Please describe the key elements of your clerkship program

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What year did this Clerkship Program commence with students? i.e. The Flinders University Parallel Rural Community Curriculum commenced in 1997 (YYYY)

How many clerkship sites are in your program ie a discrete community, town, villages, neighbourhood?

How many clerkship sites do you classify as rural?

What is the largest population size of your clerkships sites?

- City >250,000
- Major urban centre i.e. >100,000- 250,000
- Regional City or large town >25,000-100,000
- Smaller town 10,000-25,000
- Small community <10,000

What is the smallest population size of your clerkships sites?

- City >250,000
- Major urban centre i.e. >100,000- 250,000
- Regional City or large town >25,000-100,000
- Smaller town 10,000-25,000
- Small community <10,000

What is the total length in weeks of the Clerkship Program?

How many weeks of the Clerkship Program are undertaken in a rural area?

In which year of the medical program is the Clinical Clerkship Program situated?

In this academic year how many students will undertake a Clerkship Program?

In this academic year how many students who will undertake a Clerkship Program have a rural background (as defined by your institution)?

In this academic year how many male students will undertake a Clerkship Program?

What percentage of your clinical supervisors in the Clerkship Program are family physicians / GPs?

< 25%

25% - 50%

51% - 75%

> 75%

What is the name of your Clerkship Program e. g. Parallel Rural Community Curriculum?

If you have more than one clerkship program, can you please provide contact details of the person who would be best able to complete the survey for their program and answer the interview questions?

Appendix 2. Contributing CLIC Research Collaborative programs

Cluster A

James Cook University	Australia	Integrated Rural Placement
Queens University	Canada	Integrated Delivery of Medical Education in the Community
UiT The Arctic University of Norway	Norway	Rural Practice Placement
University of Witwatersrand	South Africa	Integrated Primary Care Block
Keele School of Medicine	UK	GP student assistantship
University of Exeter	UK	POBLE Population based learning
Columbia University	USA	Bronx VA Integrated Clerkship
University of Colorado	USA	Integrated Longitudinal Medical Clerkship (ILMC)
University of Wisconsin	USA	Wisconsin Academy for Rural Medicine (WARM)

Cluster B – Family Medicine

Flinders University	Australia	NT Community Based Medical Education (CBME)
University of Melbourne	Australia	Extended Rural Cohort
University of Illinois	USA	Rural student physician program (RSPP)
University of North Dakota	USA	Rural Opportunities in Medical Education (ROME)
University of Washington	USA	WWAMI Rural Integrated Training Experience (WRITE)
University of Minnesota	USA	Metropolitan Physician Associate Program (MetroPAP)
University of Minnesota	USA	Rural Physician Associate Program (RPAP)
The University of Alabama	USA	Tuscaloosa Longitudinal Community Curriculum TLC ²

Cluster B – Other Specialties

Duke University	USA	Primary Care Leadership Tract
Flinders University	Australia	Onkaparinga Clinical Education Program (OCEP)
University of California San Francisco	USA	Fresno LIC

Cluster C – Family Medicine

Australian National University	Australia	Rural Stream Integrated Year
Deakin University	Australia	IMMERSe
Flinders University	Australia	Parallel Rural Community Curriculum
Griffith University	Australia	RMED LongLook Program
Monash University	Australia	Gippsland Regional Integrated Community Curriculum
University of Adelaide	Australia	Rural Clinical Program
University of Western Australia	Australia	Rural Clinical School WA
University of Wollongong	Australia	Phase 3 Longitudinal Integrated Clinical Placement Program
Dalhousie University	Canada	Dalhousie LIC Program
Northern Ontario School of Medicine	Canada	Comprehensive Community Clerkship (CCC)
University of Alberta	Canada	Integrated Community Clerkship
University of Calgary	Canada	UCLIC
University of Montreal	Canada	ELI
University of Saskatchewan	Canada	Prince Albert Program
University of Otago	New Zealand	Rural Medical Immersion Program (RMIP)
Stellenbosch University	South Africa	Ukwanda Rural Clinical School Longitudinal Integrated Model
Commonwealth Medical College	USA	Year 3 LIC

Cluster C – Other Specialties

Flinders University	Australia	Alice Springs LIFT
Flinders University	Australia	LIFT (Longitudinal Integrated Flinders Training)
McGill University	Canada	Gatineau Integrated Clerkship
University of British Columbia	Canada	Integrated Community Clerkships (ICC)
Columbia University	USA	Columbia-Bassett Program
Florida Atlantic University	USA	Year 3 LICs
Harvard Medical School	USA	The Cambridge Integrated Clerkship
Indiana University	USA	BLIC (Bloomington Longitudinal Integrated Curriculum)
Medical College of Georgia	USA	Georgia Northwest Campus
Texas A & M Medical School	USA	A & M Integrated Medicine (AIM)
Tufts University	USA	Maine Medical Centre Program
University of California San Francisco	USA	Kaiser KLIC
University of California San Francisco	USA	PISCES
University of Colorado	USA	Denver Health LIC
University of North Carolina	USA	Asheville Integrated Clinical Clerkship
University of North Dakota	USA	Minot integrated longitudinal experience (MILE)
University of South Dakota	USA	Yankton Ambulatory Program

Figure 1. GIS location of LIC programs by cluster and student numbers

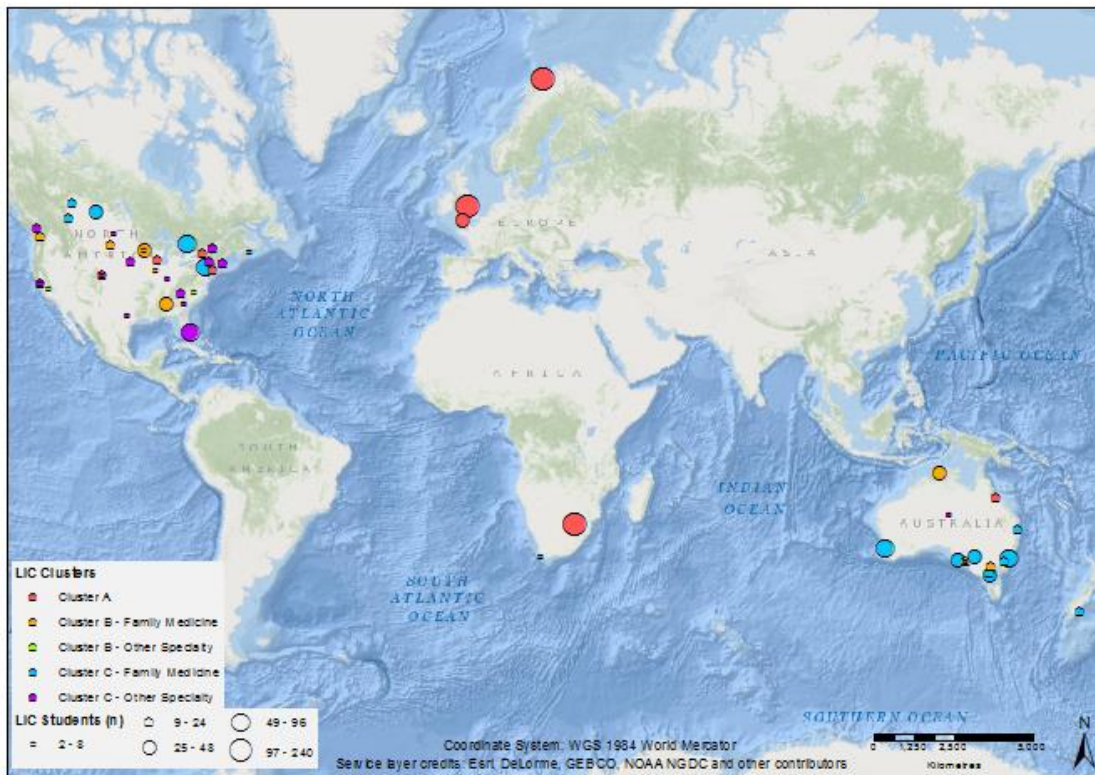


Figure 2. Year LIC Commenced

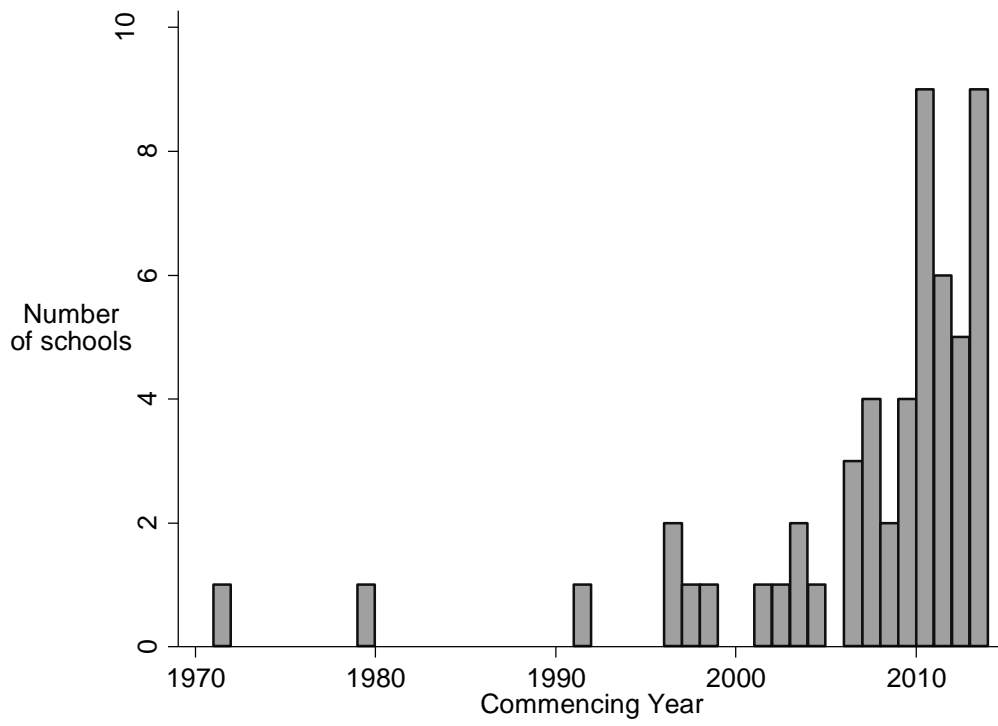


Table 1. LIC Clusters

Cluster	Proportion of Academic Year	Median (Range) in weeks	Number of programs
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

Table 2: LIC program characteristics

	Cluster			p-value ¹
	A (n=9)	B (n=11)	C (n=34)	
Country, n (%)				
Australia/New Zealand	1 (6.7)	3 (20.0)	11 (73.3)	
Canada	1 (11.1)	0 (0.0)	8 (88.9)	
Norway/SA/UK	4 (80.0)	0 (0.0)	1 (20.0)	
USA	3 (12.0)	8 (32.0)	14 (56.0)	0.01
Entry				
Undergraduate	4 (50.0)	0 (0.0)	4 (50.0)	
Graduate	4 (10)	9 (22.5)	27 (67.5)	
Both	1 (16.7)	2 (33.3)	3 (50.0)	0.058
Medical course duration (years)				
3	0 (0.0)	0 (0.0)	1 (100.0)	
4	5 (11.1)	11 (24.4)	29 (64.4)	
5	2 (100.0)	0 (0.0)	0 (0.0)	
6	2 (33.3)	0 (0.0)	4 (66.7)	0.029
Number of 1 st year students, mean ± SD	161±49	184±75	153±68	0.435
Year that the LIC commenced				
1971-1999	1 (14.3)	4 (57.1)	2 (28.6)	
2000-2005	0 (0.0)	0 (0.0)	5 (100.0)	
2006-2010	5 (22.7)	6 (27.3)	11 (50.0)	
2011-2014	3 (15.0)	1 (5.0)	16 (80.0)	0.04
Population of smallest site				
Capital city	1 (11.0)	0 (0.0)	4 (11.8)	
>100,000	0 (0.0)	1 (9.1)	4 (11.8)	
25-100,000	0 (0.0)	0 (0.0)	5 (14.7)	
10-25,000	0 (0.0)	2 (18.2)	3 (8.8)	
<10,000	8 (88.9)	8 (72.7)	18 (52.9)	0.51
Number of sites, mean(±SD) (note that 'site' refers to a community/town and there may be multiple practices or hospitals used in a single 'site')	22.8±31.8	12.0±12.0	6.8±6.1	0.02
Year of course				
Final	4 (44.4)	0 (0.0)	2 (5.9)	
Penultimate	3 (33.3)	11 (100.0)	32 (94.1)	
Other	2 (22.2)	0 (0.0)	0 (0.0)	<0.001
Number of students in LIC				
Mean ± SD	64.7±79.1	17.1±11.2	24.2±22.9	0.01
Range	10-240	2-32	4-85	
Mean proportion of total students (%)	49.3±25.3	36.0±22.2	33.4±26.6	0.36

¹ For comparison between clusters. Obtained from Fishers Exact test for categorical variables and ANOVA for continuous variables.

Table 3: Percentage of supervisors who are family medicine specialists

	Cluster			p-value ¹
	A (n=8)	B (n=10)	C (n=31)	
Percentage of supervisors as family medicine specialists				
<25%	1 (12.5)	1 (10.0)	13 (41.9)	
25-50%	0 (0.0)	1 (10.0)	1 (3.2)	
51-75%	1 (12.5)	0 (0.0)	3 (9.7)	
>75%	6 (75.0)	8 (80.0)	14 (45.2)	0.06

¹ For comparison between clusters. Obtained from Fishers exact test.

Table 4: Association between size of teaching sites and proportion of family medicine clinical supervisors

	Size of smallest teaching site			p-value ¹
	Urban (> 100k) (n=10) N (%)	Regional (10k- 100k) (n=9) N (%)	Rural (<10k) (n=30) N (%)	
% of clinical supervisors that are family medicine specialists				
<25%	8 (53.3)	5 (33.3)	2 (13.3)	
25-50%	0 (0.0)	1 (50.0)	1(50.0)	
51-75%	1 (25.0)	0 (0.0)	3 (75.0)	
>75%	1 (3.6)	3 (10.7)	24 (85.7)	<0.001

¹ For comparison between clusters. Obtained from Fisher's exact test.

Table 5. LIC Typology

LIC Program Typology			
Program Type	Program Characteristics	Setting Sub-type	Sub-type Characteristics
Amalgamative Clerkship	<ol style="list-style-type: none"> 1. Less than 20 weeks (<50% of the duration of the academic year) 2. Two or more, but <50% of disciplines covered 3. Treated as a one of many rotations in a rotation based course 4. Any of the last three years of the degree program 	Community	<ol style="list-style-type: none"> 1. Median 11 sites, usually including small rural communities 2. Usually a family medicine focus
Blended LIC	<ol style="list-style-type: none"> 1. 50-89% of the duration of the academic year 2. All or majority of disciplines covered 3. Linked complementary rotations external to the LIC to complete the academic year 4. Usually in penultimate year 	Family Medicine	<ol style="list-style-type: none"> 1. Median 9 sites, usually including small rural communities; 2. Predominately FM supervisors
		Other Specialties	<ol style="list-style-type: none"> 1. Median 2 sites, usually include large urban communities 2. Predominately non-FM supervisors
Comprehensive LIC	<ol style="list-style-type: none"> 1. Full duration of the clinical academic year (90-100%) 2. All disciplines covered 3. Limited brief inpatient discipline specific immersive experiences within the LIC 4. Usually in penultimate year 	Family Medicine	<ol style="list-style-type: none"> 1. Median 9 sites, usually including small rural communities 2. Predominately FM supervisors
		Other Specialties	<ol style="list-style-type: none"> 1. Median 1 site, usually including large urban communities 2. Predominately non-FM supervisors