University Library

A gateway to Melbourne's research publications

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:
Worley, P;Couper, I;Strasser, R;Graves, L;Cummings, BA;Woodman, R;Stagg, P;Hirsh, D

Title:
A typology of longitudinal integrated clerkships

Date:
2016-09-01

Citation:
Worley, P., Couper, I., Strasser, R., Graves, L., Cummings, B. A., Woodman, R., Stagg, P. & Hirsh, D. (2016). A typology of longitudinal integrated clerkships. Medical Education, 50 (9), pp.922-932. https://doi.org/10.1111/medu.13084.

Persistent Link:
https://hdl.handle.net/11343/291654

Received Date : 01-Sep-2015
Revised Date : 04-Mar-2016
Accepted Date : 14-Mar-2016
Article type : Research Papers

Author Manuscript

Manuscript Title

A typology of longitudinal integrated clerkships

Paul Worley, Ian Couper, Roger Strasser, Lisa Graves, Beth-Ann Cummings, Richard Woodman, Pamela Stagg, David Hirsh and the Consortium of Longitudinal Integrated Clerkships (CLIC) Research Collaborative*

ABSTRACT

A typology of longitudinal integrated clerkships

Background

Longitudinal integrated clerkships (LICs) are a model of structural redesign of clinical education **growing in the United States, Canada, Australia, and South Africa. In contrast to 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.

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/medu.13084

This article is protected by copyright. All rights reserved

The evidence base for LICs reveals transformational professional and workforce outcomes derived from a number of small institution-specific studies.

This study is the first from an international collaborative formed to study the processes and outcomes of LICs across multiple institutions in different countries. 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), using a survey tool developed through a Delphi process.

Results

We collected data from 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 typological program clusters according to program length and discipline coverage - Comprehensive LICs, Blended LICs, and LIC-like Amalgamative Clerkships.

Two major approaches emerged in terms of size of communities and types of clinical supervision--programs based in smaller communities with mainly Family Physicians/General Practitioners as clinical supervisors and those in more urban settings where sub-specialists are more prevalent.

Conclusions

We classified 3 distinct LIC clusters that 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 focusing on typology rather than on individual program or context.

Author Manuscript

This article is protected by copyright. All rights reserved

Purpose

Longitudinal integrated clerkships (LICs) are a transformative approach to clinical education (1) that uses continuity (2) and relationships (3) among medical students, patients and physicians to shape the educational experience. While the number of medical schools using LICs globally has doubled in the last five 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 of the LIC community as educators use the terms 'longitudinal' and 'integrated' for a range of educational interventions (6). Through this study, we seek to clarify the understanding of the LIC from the accumulated perspectives of forty four schools in seven countries.

Background

Medical education leaders established Longitudinal Integrated Clerkships (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 where workforce shortages existed, the LIC approach enabled educational 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 enabling 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, 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 (13):

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 article is protected by copyright. All rights reserved

Author Manuscript

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 don't 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 students' involvement—more comprehensively and continuously than discipline-based and time-based rotations permit. LIC students 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 inpatient venues at once—wherever the cohort patients' care needs arise. LICs are designed as whole educational experiences—not adjunctive longitudinal experiences added on to the backbone of traditional block rotations (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 emphasize the model's principles rather than imposing an obligatory structure. Using this definition, 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.

Author Manuscript

This article is protected by copyright. All rights reserved

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 S1), 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

This article is protected by copyright. All rights reserved

Author Manuscript

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 S2). 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.

This article is protected by copyright. All rights reserved
Author Manuscript

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 S1 online).

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 1).

Insert Figure 1. Year LIC Commenced

This article is protected by copyright. All rights reserved

Author Manuscript

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 (See figure S1 online).

Clinical Supervision

This article is protected by copyright. All rights reserved

Author Manuscript

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

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 54 programs in 44 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.

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.

This article is protected by copyright. All rights reserved

Author Manuscript

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.

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 (17), in the USA this innovation has moved from the innovators stage to the

This article is protected by copyright. All rights reserved

Author Manuscript

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 (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 '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

This article is protected by copyright. All rights reserved

Author Manuscript

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 (20-34); however, as each program differs in context and structure, 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 programs in new geographical 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 our medical education. Our typology study has found that many programs share core characteristics, suggesting the possibility that researchers can 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 generalizing this to other similar programs (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

This article is protected by copyright. All rights reserved

Author Manuscript

accompany clinical delivery and health systems transformation (1,5,7,10). The CLIC Research Collaborative sees this future program of research as both an important opportunity and a critical responsibility.

Authors

Corresponding Author:

Professor Paul Worley

Contact Information

Address: Dean of Medicine
Flinders University
GPO Box 2100, Adelaide SA, 5001, Australia

Email: paul.worley@flinders.edu.au

Phone: +61 8 8204 4160

Fax: +61 8 8204 5845

Mobile: +61 419 829 137

Contributors: Paul Worley, Ian Couper, Roger Strasser, Lisa Graves, Beth-Ann Cummings, Richard Woodman, Pamela Stagg, David Hirsh & the CLIC Research Collaborative*

In addition to the named authors the following are members of the CLIC Research Collaborative: Kenny Bahn, Amanda Barnard, Maggie Bartlett, Kathleen Brooks, Gilles Brousseau, David Campbell, Narelle Campbell, Hoffie Conradie, Byron Crouse, Dawn DeWitt, Michael Douglas, Jay Erickson, Deb Fearon, David Garne, Jennene Greenhill, Lori Hansen, Alex Harding, Bill Heddle, Wes Jackson, May-Lill Johansen, Deborah Jones, Scott Kitchener, Scott Knutson, Jill Konkin. Sarah Mahoney, Helen Malcolm, Lindsay Mazotti, Bridget O'Brien, Daryl Pedler, Bruce Peyser, William Pieratt, Denese Playford, Ann Poncelet, Leonard Reeves, Duplain Rejean, Torsten Risor, Lambert Schuwirth, Barbara Sheline, Branko Sijnja, Ruth Stewart, Sarah Strasser, Robert Trowbridge, Richard Van Wylick, Lucie Walters, Henry Weil, Sarah Wood, Lea Yerby

Note on authorship

All authors are claimed to have met the ICMJE criteria for authorship of this article. All were involved in the iterative process of conceptualising the research during face to face meetings held for this purpose during annual CLIC meetings in 2011 and 2012. All authors were then involved in analysing the data during

This article is protected by copyright. All rights reserved

Author Manuscript

face to face meetings held for this purpose at the 2013 and 2014 CLIC meetings. After each of the whole authorship meetings, a small group took the consensus away to work on in between the meetings through email and Skype. The original text was drafted by PW, then revised by the named eight authors before critical input and revisions were received from all 55 authors. The final text emerged from the input of all authors and was signed off by all.

Acknowledgements: none

Funding: there is no funding source for this research. The LIC programs on which the research is based are funded through multiple sources globally.

Conflicts of interest: All authors have employment or academic affiliation with the programs on which this research is based. We do not consider these interests have had any material impact on the research.

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

References

1. Frenk J, Chen L Bhutto Z et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet.* 2010; 376:1923-1958
2. Hirsh D, Ogur B, Thibault G, Cox M. New models of clinical clerkships: 'continuity' as an organizing principle for clinical education reform. *N Engl J Med.* 2007; 356(8):858–66
3. Worley P. Relationships: a new way to analyse community-based medical education? (Part 1). *Educ Health*. 2002;15(2):117–28
4. Norris TE, Schaad DC, De Witt D, Ogur B, Hunt D. 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(7):902–7
5. Strasser R, Hirsh D. Longitudinal integrated clerkships: transforming medical education worldwide? *Med Educ.* 2011; 45:436–7
6. Brauer DG & Ferguson KJ The integrated curriculum in medical education: AMEE Guide No. 96, *Medical Teacher.* 2015; 37(4):312-322
7. Hirsh D, Worley P. Better learning, better doctors, better community: how transforming education can help repair society. *Med Educ.* 2013;47(8):842-848
8. Greenhill J, Poncelet A. Transformative learning through longitudinal integrated clerkships. *Med Educ.* 2013; 47(4):336-339
9. Walters L, Greenhill J, Richards J et al. Outcomes of longitudinal integrated clinical placements for students, clinicians and society. *Med Educ.* 2012; 46(11):1028-1041

This article is protected by copyright. All rights reserved

Author Manuscript

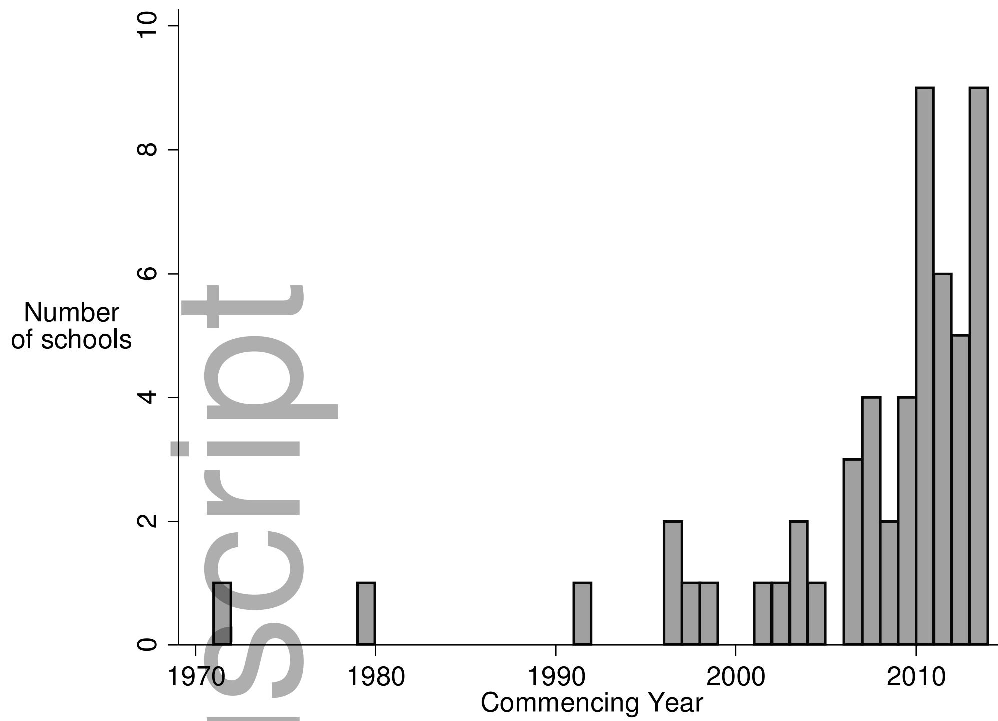
10. Hirsh D, Walters L, Poncelet AN. Better learning, better doctors, better delivery system: Possibilities from a case study of longitudinal integrated clerkships. *Med Teacher.* 2012; 34(7): 548-54.
11. Worley PS, Prideaux DJ, Strasser RP, Silagy CA, Magarey JA. Why we should teach undergraduate medical students in rural communities. *Medical Journal of Australia* 2000; 172(12):615-7.
12. Denz-Penhey H, Shannon S, Murdoch CJ, Newbury JW. Do benefits accrue from longer rotations for students in Rural Clinical Schools*? Rural Remote Health. 2005; 5: 414.* Available at http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=414 (Accessed 24 Feb 2016)
13. Consortium of Longitudinal Integrated Clerkships (CLIC). Available from http://www.clicmeded.com/ (Accessed 11th Oct 2014)
14. Prideaux D, Worley P & Bligh J. Symbiosis: a new model of clinical education. *The Clinical Teacher*, 2007; 4: 209-212.
15. Newman FM, Marks HM & Gamoran A. Authentic Pedagogy and Student Performance. *American Journal of Education*, 1996; 104 (August): 280-312.)
16. Worley P, Prideaux D, Strasser R, Magarey A, March R. Empirical evidence for symbiosis medical education: a comparative analysis of community and tertiary-based programs. *Medical Education* 2006; 40:109-116.
17. Rogers, E. M. *Diffusion of innovations*. New York: Free Press 1962
18. Oswald N, Jones S, Date J, Hinds D. Long-term community-based attachments: the Cambridge course. *Med Educ.* 1995; 28(1):72-76
19. Brazeau NK, Potts MJ, Hickner JM. The Upper Peninsula Program: a successful model for increasing primary care physicians in rural areas. *Family Medicine.* 1990; 22(5):350-355
20. Thistlethwaite JE, Bartle E, Chong AIL, Dick M-L, King D, Mahoney S, Papinczak T, Tucker G. A review of longitudinal community and hospital placements in medical education: BEME Guide No. 26. *Medical Teacher.* 2013; 35:e1340-e1364
21. Worley P*,* Esterman A*,* Prideaux D*.* Cohort study of examination performance of undergraduate medical students learning in community settings*. BMJ.* 2004*;*328*:*207–9
22. Hirsh D, Gaufberg E, Ogur B, Cohen P, Krupat E, Cox M, Pelletier S, Bor D. Educational outcomes of the Harvard Medical School-Cambridge Integrated clerkship: a way forward for medical education. *Acad Med.* 2012; 87(5):643-650.
23. Halaas GW. The Rural Physician Associate Program: successful outcomes in primary care and rural practice. *Rural and Remote Health* 5: 453. (Online) 2005. Available from: http://www.rrh.org.au (Accessed 30th Nov 2015)
This article is protected by copyright. All rights reserved
Author Manuscript

24. Worley P, Martin A, Prideaux D, Woodman R, Worley E, Lowe M. Vocational career paths of graduate entry medical students at Flinders University: a comparison of rural, remote and tertiary tracks. *Med J Aust.* 2008; 188(3):177–8
25. Gaufberg E, Hirsh D, Krupat E, Ogur B, Pettetier S, Reiff D, Bor D. Into the future: patient centredness endures in longitudinal integrated clerkship graduates. *Med Educ.* 2014; 48:572-582
26. Walters L, Prideaux D, Worley P, Greenhill J. Demonstrating the value of longitudinal integrated placements to general practice preceptors. *Med Educ.* 2011; 45(5);455-463
27. Eley D, Brooks KD, Zinc T, Cloninger C. Toward a global understanding of students who participate in rural primary care longitudinal integrated clerkships: considering personality across two continents. *J Rural Health.* 2014; 30(2):164-174
28. O'Brien BC, Poncelet AN, Hansen L, Hirsh DA, Ogur B, Alexander EK, Krupat E, Hauer KE: Students' workplace learning in two clerkship models: a multi-site observational study. *Med Educ.* 2012; 46:613–624
29. Hauer KE, Hirsh D, Ma I, Hansen L, Ogur B, Poncelet AN, Alexander EK, O'Brien B: The role of role: learning in longitudinal integrated and traditional block clerkships. *Med Educ.* 2012; 46: 698–710.
30. Hauer KE, O'Brien B, Hansen L, Hirsh D, Ma I, Ogur B, Poncelet AN, Alexander EK, Teherani A. More Is Better: Students Describe Successful and Unsuccessful Experiences With Teachers Differently in Brief and Longitudinal Relationships. *Acad Med.* 2012; 87(10):1389-96
31. Poncelet AN, Wamsley M, Hauer KE, Lai C, Becker T, O'Brien B. Patient views of continuity relationships with medical students. *Med Teach*. 2013; 35(6):465-71
32. Hudson JN, Knight PJ, Weston, KM. Patient perceptions of innovative longitudinal integrated clerkships based in regional, rural and remote primary care: a qualitative study. *BMC Family Practice.* 2012; 13:72 Available from http://www.biomedcentral.com/1471-2296/13/72 (Accessed 30 Nov 2015)
33. Voss M, Coetsee F, Conradie H, van Schalkwyk S. We have to flap our wings or fall to the ground. The experiences of medical students on a longitudinal clinical model. *African Journal of Health Professions Education.* 2015 (in press)
34. Couper I, Worley P, Strasser R. Rural longitudinal integrated clerkships: lessons learned from two programs on different continents. *Rural and Remote Health* 11: 1665. (Online), 2011 Available from: www.rrh.org.au (Accessed 30 Nov 2015)

Figure 1. Year LIC Commenced

This article is protected by copyright. All rights reserved

Author Manuscript



Author Manuscript

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			
	A (n=9)	**B (n=11)**	**C (n=34)**	**p-value[1]**
Country, n (%)				

This article is protected by copyright. All rights reserved

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 1st 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

This article is protected by copyright. All rights reserved

Author Manuscript

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			
	A (n=8)	**B (n=10)**	**C (n=31)**	**p-value[1]**
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.

Author Manuscript

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

	Size of smallest teaching site		
	Urban	Regional	Rural

This article is protected by copyright. All rights reserved

	(> 100k) (n=10) N (%)	(10k- 100k) (n=9) N (%)	(<10k) (n=30) N (%)	p-value[1]
% 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.

Author Manuscript

Table 5. LIC Typology

LIC Program Typology			
Program Type	**Program Characteristics**	**Setting Sub-type**	**Sub-type Characteristics**
Amalgamative Clerkship	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	1. Median 11 sites, usually including small rural communities 2. Usually a family medicine focus

This article is protected by copyright. All rights reserved

Blended LIC	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	1. Median 9 sites, usually including small rural communities; 2. Predominately FM supervisors
		Other Specialties	1. Median 2 sites, usually include large urban communities 2. Predominately non-FM supervisors
Comprehensive LIC	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	1. Median 9 sites, usually including small rural communities 2. Predominately FM supervisors

Author Manuscript

This article is protected by copyright. All rights reserved