Urban-based Longitudinal Integrated Clerkship: A scoping review

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Abstract

Background Reports about longitudinal integrated clerkship (LIC) mostly deal with rural-based LICs. Clinical clerkships usually take place in urban academic medical center (AMC). We need to explore how to implement LIC in urban AMC. Authors reviewed the existing literature focused on urban-based LIC (uLIC) to explore the features and challenges uLIC.

Method Authors adopted the scoping review framework. Research questions were: (1) What are the characteristics of uLIC studies? (2) How did medical schools implement uLICs? (3) What were the challenges when implementing uLICs? and (4) What gaps exist in uLIC research? Authors reviewed 495 studies from an initial electric database search and selected 27 articles for inclusion, and extracted relevant data and organized the demographic information and details of the uLICs for each of medical school. Authors conducted a thematic analysis on the challenges of uLIC.

Results Twenty-five papers were published in the United States. Urban-based LICs were evaluated by participants’ responses (n=13) and students’ learning outcome (n=10). One paper discussed obstacles of uLIC implementation. Fourteen papers were reported by two medical schools (Harvard Medical School, University of California San Francisco College of Medicine). The two medical schools reported student selection methods and six medical schools reported student assessment methods. Challenges related to LICs included preceptors' burden about LIC education, students’ concern about academic achievement, students’ inability to adapt to LICs, shortage of educational resources of AMC, and lack of understanding about LICs.

Conclusion Research is needed to understand the long-term outcomes of uLICs and strategies to overcome challenges. Medical schools should prepare student support systems and faculty development programs to facilitate successful implementation of uLICs. Medical schools’ and hospitals’ resources and funding should be taken into careful
consideration prior to implementing uLICs.

**Background**

Most medical schools’ clinical curriculums are rotational block clerkships (RBCs). This approach was instituted based on the assumption that it provides increased learning opportunities by offering greater diversity of experience and exposure to more disciplines. In practice, too many subspecialties result in a fragmented learning experience where students are unable to explore the whole disease spectrum [1]. Frequent block transitions cause students to struggle with their roles and responsibilities [1–3]. Moreover, close relationships between students and patients and students and preceptors are unable to develop and continue. As a result, students experience a lack of supervision and role modeling and can undergo an erosion of empathy and enthusiasm [4, 5].

The longitudinal integrated clerkship (LIC) may provide solutions to overcome the problems associated with RBCs. An LIC is a clinical curriculum with a long duration which enables the student to simultaneously experience multiple disciplines and develop and maintain continuing relationships with their preceptor and patients [6, 7]. Compared with students who undertake RBSs, Students in LICs have well-developed patient-centered communication skills and display better higher-order clinical and cognitive skills. Moreover, students in LICs take on increased responsibility with patients and report higher levels of confidence when dealing with ethical dilemmas. Continuity of student-preceptor relationships facilitates incremental knowledge acquisition and progressive feedback [6, 8, 9].

Studies about LICs are primarily focused on reporting curriculum implementation, program evaluation, and comparison of the outcomes of LIC versus RBC. Studies report LICs in rural settings in Canada, Australia, South Africa, and the United States and include a diversity of topics and report a variety of purposes related to rural-based LICs [10–14]. There are
many studies that report LICs in rural areas, but few reporting LICs in urban areas. One study by Poncelet and Hirsh et al. detailed only two medical schools which implement LICs in an academic medical center (AMC) and did not report any medical school implementing LICs in urban community hospitals [6]. There have been no extensive review articles summarizing LICs in urban setting or in AMCs alone.

This study reviewed the literature reporting LICs in urban-based medical centers to provide medical educators with guidance for the successful implementation of urban-based LICs (uLICs). Four research questions guided this scoping review:

1) What are the characteristics of uLIC studies?
2) How did medical schools implement uLICs?
3) What were the challenges when implementing uLICs?
4) What gaps exist in uLIC research?

Methods

We adopted the scoping review framework outlined by Arksey and O’Malley [15]. A scoping review is used to explore basic data to map the research of a relatively new field of interest which has not previously been comprehensively reviewed. We chose this methodology to extensively investigate the existing studies on uLICs and identify the characteristics of publications. Here, we followed Arksey and O’Malley’s scoping review framework which has the following five stages: (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data; and (5) collating, summarizing, and reporting the results. As the research questions were identified in the introduction section, the method section will begin with stage two. This study is exempt from Institutional Review Board approval.

1. Identifying relevant studies

We (JY, SYP) searched the following core databases from their beginnings to the 31st of
December 2018: Pubmed, Embase, Ovid Medline, and ERIC (search strategy is attached as a supplement file). The following search keywords were combined: longitudinal, integrated, interdisciplinary, clerkship(s), integrated circuit(s), clerk(s), clerked, urban, academic medical center, tertiary hospital, community hospital, undergraduate, medical school and medical student(s). Search terms were combined using the Boolean operator “AND” and “OR” to find the most appropriate publications. In addition, we manually searched the reference lists of all selected publications to identify other publications not found on the initial database search. We did not restrict publication type, but we did target only those written in English.

2. Selecting studies

1) Inclusion and exclusion criteria

We defined uLIC as an LIC at a teaching hospital-attached medical school in an urban area. We defined a teaching hospital as a medical school and hospital located in the same city where a student could move from hospital to hospital in half a day. “Teaching hospital” referred to academic medical centers, community hospitals, tertiary medical centers, and patient centered medical home. Patient centered medical home is an approach to the delivery of primary care that is patient-centered, comprehensive, team-based, coordinated, accessible, and focused on quality and safety [16].

Prior to publication selection, the inclusion criteria were as follows: (1) publication about an LIC in an urban undergraduate medical school; and (2) format of the publication is a commentary, case report, abstract, poster, or original article. We also included publications where the LIC was not fully described, but when additional information could be obtained through the Consortium for Longitudinal Integrated Clerkships (CLIC) website [7]. We excluded review articles and publications which referred to LICs in rural areas or those not associated with medical schools. We also excluded publications dealing with
topics not related to LIC implementation, such as visit notice tools or career interest in LIC.

2) Selection of articles

The database search resulted in 495 publications. Two researchers (JY, SYP) excluded 267 duplicates and screened the title and abstract of the remaining 228 publications. The researchers excluded 171 publications because they covered other topics (n = 114), LIC was implemented in rural area (n = 32), items of the curriculum were not fully described in the publication (n = 14), or the publication was a review article (n = 7). Title and abstract screening resulted in 57 publications. We then conducted full text reviews. In the first full-text review, JY excluded 28 publications because they were not about the implementation of LICs (n = 18), LIC overlapped with other included publications (n = 4), they were review articles (n = 4), they did not cover a clinical clerkship course (n = 1), or they did not fit the LIC definition defined in the inclusion criteria (n = 1). A second full text review of the remaining 29 articles was performed by SYP. We (JY and SYP) discussed the publications and excluded a further two articles because one did not match the LIC definition used in the current study, and the other did not fully identify LIC. We also reviewed the references of the remaining 27 publications and found no additional publications to include. A total of 27 publications were finally included in this study (Fig 1).

3. Charting the data

Two researchers (JY, SYP) independently extracted data from the 27 included articles. We started the data extraction process by developing a data form. The data extraction process was carried out with three branches: (1) demographics of the publications were extracted, including authors, date of publication, country where the LIC took place, research purpose, research design, and evaluation method; (2) details of the LIC were
extracted, including medical school, hospital setting, grade of student, number of students, duration, curriculum design, disciplines involved, and student assessment; and (3) challenges of the LICs were extracted, as well as any potentially relevant information about the challenges.

We charted and sorted the extracted data by each medical school into an excel spreadsheet. If the publication did not provide enough information, we identified additional information from the CLIC website or the website of the particular medical school [7]. The researchers (JY and SYP) reached agreement about article selection and data extraction through discussion. If a consensus was not reached, a third researcher (HR) made the final decision. The quality of included articles was not assessed because quality assessment falls outside the study remit of a scoping review.

4. Collating, summarizing and reporting the results

We selected relevant publications using a flow chart (figure 1) and organized the publications’ demographic information and details of the LICs for each of medical school. Using the method described by Braun and Clarke, we conducted a thematic analysis about the challenges of the uLICs reported in the literature [17]. This approach has six phases: (1) familiarizing oneself with data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing a report.

Following these phases, we (JY, SYP) re-read the data to become more familiar with and more deeply immersed in the content. We searched for patterns and meanings and exchanged ideas about points of interest in the articles. We then generated codes manually using a Microsoft Excel spreadsheet by converting the initial list of ideas about challenge into allocated codes (i.e. “insufficient number of preceptors”). Each coded idea was written on a post-it note (one idea per post-it). The notes were checked to ensure that each idea was represented and there were no duplicates. The post-its were then stuck to a
wall and discussed and clustered until meaningful themes and subthemes emerged. The process was repeated until all ideas had their own cluster. The final themes were then defined and named.

Results

1. Demographics of articles

The author, year of publication, country, medical school, study purpose, and evaluation method of the 27 publications are summarized in Table 1. Publications were published between 1997 and 2017. Of the 27 papers, only three papers were published before 2009. Most of the papers (n = 25, 92.59%) were published in the United States, and two papers (n = 2, 7.40%) were published in Australia. Eight publications were from Harvard Medical School, six were from the University of California San Francisco College of Medicine, three were from the University of Colorado Denver School of Medicine, and two were from Flinders University. The other schools reported one study each. There was one article in which multiple medical schools were jointly involved.

Study purposes were as follows: program evaluation (n = 13; 48.15%), comparison of the effectiveness of LIC vs. RBC (n = 11; 40.74%), report about experiences of LIC implementation (n = 2; 7.41%), and identification of challenges of LIC implementation (n = 1; 3.70%). Of the 13 program evaluations, 11 evaluated participants’ reactions to uLICs (Kirkpatrick model level 1), one evaluated learning outcomes (Kirkpatrick model level 2), and one evaluated both students’ reactions to LIC and learning outcomes.

2. The characteristics of implementing uLICs

The characteristics of implementing uLICs are summarized in Table 2.

1) Medical school and teaching hospital setting

We identified the 12 medical schools that reported uLIC implementation. A search of medical schools’ websites added a further four medical schools to the list, for a total of 16
medical schools. Ten medical schools conducted uLICs at urban community-based hospitals, five at tertiary medical centers, and one at a patient centered medical home.

2) Students

Longitudinal integrated clerkships were implemented in the third year of the curriculum at all medical schools except one, where it was implemented in the second year. The number of students in each group ranged from 3–29. One school implemented uLIC for all students and fifteen medical schools implemented uLIC in a portion of their student body only. There was a trend of gradually increasing the number of students participating in uLICs from a small number of pilots. Two medical schools reported that they selected students for participation randomly from among candidate students. Fourteen medical schools did not indicate their method of student selection.

3) Duration

The duration of uLICs varied from eight weeks to one year. One-year curriculums were most common (n = 13, 81.25 %). Two medical schools implemented LICs which were under 12 weeks duration.

4) Curriculum design and involved disciplines

Many medical schools did not report their curriculum design in detail. Two medical schools implemented LICs and RBCs in parallel streams. Four medical schools required students to experience both LICs and RBCs. Among them, two medical schools had LICs for short durations. Most medical schools reported uLICs which were based in ambulatory clinics. Three medical schools described a curriculum which was divided into inpatient and outpatient components. Six medical schools scheduled students to visit clinics for half a day, at the same time, once per week. Between three and nine disciplines were included in each of the LICs. The most common discipline included was internal medicine, followed by pediatrics, and then surgery.
5) Assessment

Six medical schools reported their assessment methods but few schools had assessment methods specifically for assessing uLIC students. Three medical schools assessed students using the shelf examination used by the National Board Medical Examiners or Objective Structured Clinical Examination to evaluate uLICs or compared their outcomes with RBCs. One medical school assessed students based on the preceptors’ observation. No publications reported assessment criteria or items in detail.

3. The challenges of urban based LICs

Five themes, and 24 subthemes were derived from the 57 codes (Table 3).

1) Preceptors’ burden about LIC education

There were 13 codes under the theme “preceptors' concerns about LIC.” The subthemes derived from these codes were as follows: Preceptors felt that LIC education was a burden [18, 22, 23, 34, 36]; LICs prevented preceptors from doing clinical work [23, 29, 34, 36]; preceptors felt that their reward was too small compared to the time and effort they input [23, 27, 38]; and preceptors had difficulties with student assessment [29, 44].

2) Students’ concern about academic achievement

There were 18 codes under the theme “students’ complaints about LICs.” Subthemes derived from these codes were as follows: students complained that they learned nothing from their preceptors [18, 22, 27, 39]; students were afraid about not receiving feedback on their performances midway through the semester [23]; students were concerned about their end-of-semester assessment [19, 20, 23]; and students had difficulties in their independent learning [26].

3) Students’ inability to adapt to LIC

The code “students’ inability to adapt to LIC” had the following subthemes: faculty had difficulty selecting students for participation in LICs [38]; students could not adjust to LICs
students abandoned LICs [18]; faculty had difficulty identifying students with problems early [22]; student support systems did not work during their LICs [22].

4) Shortage of educational resources of AMC

There were 19 codes under the theme “shortage of educational resources of AMC.” Subthemes derived from these codes were as follows: shortage of administrative staff to assist with LIC implementation [23, 35, 37]; inadequate preceptors to teach students in LICs [18, 23, 35]; students were unable to meet various types of patients because of their preceptors’ subspecialties [23, 35]; limited space in hospitals for LIC [22, 23, 29, 38, 40, 41]; LICs required significant financial resources [23, 27, 37]; and students’ schedules it were complicated to make [18, 23, 25, 35]; and students had to move long distances on a tight schedule [18, 23].

5) Lack of understanding about LIC

There were nine codes under the theme “lack of understanding about LIC.” Subthemes derived from these codes were as follows: no one with in-depth knowledge about LICs [37]; students were unable to understand the purpose of LICs [20]; participants had difficulties comprehending the advantages of LICs [35]; and participants were doubtful about the cost effectiveness of LICs [35, 37].

Discussion

This study reviewed existing uLIC studies to provide guidance for the successful implementation of uLICs. Specific challenges to uLIC reported in the literature are as follows: student support systems did not work well when the students had problems; students were dissatisfied with the structure LICs and RBCs in parallel streams; there were difficulties considering both medical schools and teaching hospitals in schedule management; participants (student, preceptor and education administrators) lacked an
understanding about the complex process of implementing LICs; and preceptors did not know how to teach and assess students. Publications did not identify the following processes: how to select students for participation in uLICs, how to assess students in uLIC-RBC parallel streams at the same hospital, how to develop and implement appropriate student schedules, or how to recruit preceptors for uLICs. To fill the gaps of in the research about uLICs implementation of uLIC across the entire student population may be one way to address students’ complaints and manage problems related to student selection to assessment. However, this would require significant funding, administrative support, a large number of preceptors and a large hospital which would be practically prohibitive with the situation of each medical school and teaching hospital. Thus, inevitably LICs will initially need to be implemented among a small number of students. In order to select students to participate in uLICs effectively, educators should not only consider students’ grades, but should also ensure students fully understand the goals and learning processes. After the LIC has commenced, educators must stay heavily involved in the program to maintain and manage students’ and preceptors’ satisfaction as well as optimal outcomes. Assessment methods should be specifically designed for students in uLICs and deliver feedback in a timely manner. Assessment methods must be different from those of students in parallel RBCs. Schedule management is at the core of the successful practical implementation of uLICs. Urban-based LICs should include the number of disciplines which can be comfortably managed by the administrators with particular attention focused on the management students’ schedules. Faculty development about LICs is necessary to facilitate recruitment of preceptors and provide instruction to preceptors about how to teach and assess students, how to anticipate what problems students may have, and how to discuss with students what they need. Preceptors should be provided with time and financial reward for
faculty development.

We make the following recommendations: (1) uLIC should be implemented among a small number of students; (2) student selection should be appropriate and student support systems should work in a timely manner; (3) fewer disciplines should be included for effective schedule management; (4) medical schools should provide time and financial reward for faculty development related to uLIC.

Recommendations for Future Research

The publications in this study primarily focused on program evaluation and comparing LICs with RBCs. According to the Kirkpatrick model, uLICs should be evaluated by learner behavior and result [49]. To do so, uLIC students must be the subjects of longitudinal research. Ideally, the knowledge and skills of post-graduate trainees who participated in uLICs should be observed, and patient outcomes should be assessed. This kind of study would be advantageous because it would help educational directors make decisions about whether to implement uLICs, or whether to continue current uLICs.

Investigation of strategies to overcome the challenges identified in this study should continue. The challenges mentioned in 27 publications were sometimes not specific to uLICs. The context of the thematically analyzed codes was only speculated by the researchers so we cannot be certain we clearly understood their true meaning and what the actual problems were. Moreover, we could not identify specific solutions to the problems identified. Therefore, to find strategies to overcome challenges specific to uLICs, future studies should focus on identifying the real problems of each participant and the practical shortage of specific resources in their context.

Through 27 publications and four websites, we identified different uLIC programs at 16 medical schools. Most publications were from the United States and two were from Australia. Because we searched for English articles only, we did not include data from
studies not published in English. Above all, there are only a few medical schools with teaching hospitals that are well-funded and scalable for LIC implementation. Urban-based LIC implementation characteristics in this study are not applicable to medical school in Korea without modification. Future research is required to observe the nature of uLICs in diverse countries, including Asian countries.

Conclusions

Medical schools should prepare student support systems and faculty development programs to facilitate the successful implementation of uLICs. Medical schools’ and hospitals’ resources and funding should be taken into careful consideration prior to implementing uLICs. More research is needed to report long-term outcomes and strategies for overcoming challenges associated with uLIC in various contexts.

Declarations

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Abbreviation

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Ethics approval and consent to participate

This study was exempt from IRB review of Dong-A university on the 3rd July 2019.

Consent for publication
Not applicable.

Competing interests

The authors declare that they have no competing interest.

Authors’ contributions

HR JY designed the research with conception. JY and SYP collected the data and JY, SYP, and HR analyzed and interpreted the data. JY initially drafted the manuscript and JY, SYP and HR revised it critically. All authors read and approved the final manuscript.

RBC: Rotational Block Clerkship

LIC: Longitudinal Integrated Clerkship

uLIC: urban-based LIC

AMC: Academic Medical Center

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Tables

Table 1. Demographics of articles
| Author | Year | Country | School | Study purpose | Evaluation method |
|--------|------|---------|--------|---------------|------------------|
| 1 Yonke A., et al. [18] | 1997 | USA | Chicago college of Medicine, University of Illinois. | To evaluate program | Feedback conference |
| 2 Yu M., et al. [19] | 1997 | USA | Charles R. Drew University of medicine and science. | To evaluate program | Student’s response survey |
| 3 Peters AS., et al. [20] | 2005 | USA | Harvard Medical School. | To evaluate program | Student written report |
| 4 Hansen L., et al. [21] | 2009 | USA | Sanford school of Medicine, University of South Dakota. | To compare effectiveness of LIC and RBC | NBME subject exam scores |
| 5 Shaffer K., et al. [22] | 2009 | USA | Harvard Medical School. | To compare effectiveness of LIC and RBC | OSCE, Final exam scores, Choice of specialty |
| 6 Poncelet A., et al. [23] | 2011 | USA | University of California San Francisco, College of Medicine. | To compare effectiveness of LIC and RBC | NBME subject exam scores, SP (Standardized patient) exam, Student’s response survey |
| 7 Ghosh A., et al. [24] | 2012 | USA | Harvard Medical School. | To evaluate program | Student’s response survey |
| 8 Griswold T., et al. [25] | 2012 | USA | Harvard Medical School. | To compare effectiveness of LIC and RBC | OSCE, NBME subject exam scores, Student written report, Observed clinical work |
| 9 Haspel RL., et al. [26] | 2012 | USA | Harvard Medical School. | To evaluate program | Student’s response survey |
| 10 Hirsh D., et al. | 2012 | USA | Harvard Medical School. | To compare effectiveness | Admission Test scores |
| No. | Authors                          | Year | Country | Institution                               | Methods                                    | Goals                                                                 |
|-----|----------------------------------|------|---------|-------------------------------------------|--------------------------------------------|----------------------------------------------------------------------|
| 11  | Mazotti LA., et al. [28]          | 2012 | USA     | University of California San Francisco, College of Medicine | To report experience of implementation | NBME subject scores, USMLE Step 1 OSCE, PPOS                          |
| 12  | Meah YS., et al. [29]             | 2012 | USA     | Mount Sinai School of Medicine, New York. | To evaluate program | BSCO, RIME                                                            |
| 13  | O'Brien, BC., et al. [30]         | 2012 | USA     | University of California San Francisco, College of Medicine | To compare effectiveness of LIC and RBC | Observational sampling                                                |
| 14  | Henschen, BL., et al. [31]        | 2013 | USA     | Northwestern University Feinberg School of Medicine | To evaluate program | Student’s response survey Feedback conference                          |
| 15  | Suri A., et al. [32]              | 2013 | USA     | Harvard Medical School                     | To evaluate program | Feedback conference                                                    |
| 16  | Teherani A., et al. [33]          | 2013 | USA     | University of California San Francisco, College of Medicine | To compare effectiveness of LIC and RBC | USMLE Step 2 Feedback conference
|     |                                  |      |         |                                           | To identify perception difference of LIC and RBC | Focus group interview                                                 |
| 17  | Banh K., et al. [34]              | 2014 | USA     | University of California San Francisco, College of Medicine | To evaluate program | Student’s response survey Patient’s response survey                   |
| 18  | Heddle W., et al. [35]            | 2014 | Australia | School of medicine, Flinders University. | To identify challenges of LIC implementation | Feedback conference                                                   |
|   | First Name, Last Name, et al. | Year | Country | Institution | Study Objective | Methodology |
|---|-------------------------------|------|---------|--------------|----------------|-------------|
| 19 | Melo J., et al. [36] | 2014 | USA | John A. Burns School of Medicine, University of Hawaii | To compare effectiveness of LIC and RBC | NBME subject exam scores |
| 20 | Poncelet, AN., et al. [37] | 2014 | USA | University of California San Francisco, College of Medicine | To compare effectiveness of LIC and RBC | NBME subject exam scores |
| 21 | George P., et al. [38] | 2015 | USA | Warren Alpert Medical School of Brown University | To report experience of implementation | |
| 22 | Mahoney S., et al. [39] | 2016 | Australia | School of medicine, Flinders University | To compare effectiveness of LIC and RBC | OSCE |
| 23 | O'Brien BC., et al. [40] | 2016 | USA | University of California San Francisco College of Medicine; Harvard Medical School; Sanford school of Medicine, University of South Dakota | To identify perception difference of LIC and RBC | Interview of students & preceptors |
| 24 | Ari M., et al. [41] | 2017 | USA | University of Colorado School of Medicine | To evaluate program | Student written report, Focus group interview |
| 25 | Diuguid-Gerber J., et al. [42] | 2017 | USA | College of Physicians and Surgeons, Columbia University | To evaluate program | Feedback session |
| 26 | Felder-Heim C., et al. [43] | 2017 | USA | University of Colorado School of Medicine | To evaluate program | Student’s response survey |
| 27 | Snow SC., et al. [44] | 2017 | USA | University of Colorado School of Medicine | To evaluate program | Preceptor’s response survey |

NBME National Board of Medical Examiners
OSCE Objective Structured Clinical Examination
SP Standardized Patient
Table 2. The characteristics of implementing urban-based LICs

| Medical school       | Setting    | Grade of student | No of student | duration | Design    | Disciplines           | Assessments |
|----------------------|------------|------------------|---------------|----------|-----------|-----------------------|-------------|
| Harvard Medical      | Community  | 2                | 8–12          | 1yr      | LIC and RBC| IM, Ped, Neu, Psy, GS | NBME s      |
| School                                                                 | Based Hospital                                      | Parallel Streams | OB/GYN Exams, Clinical Mid-Year Assessment Involving All Specialties |
|-----------------------------------------------------------------------|-----------------------------------------------------|------------------|---------------------------------------------------------------------|
| University of California San Francisco College of Medicine            | Tertiary Medical Center                             | 3                | 9~16 1yr LIC and RBC parallel streams FM, IM, Neu, Psy              |
| University of Colorado School of Medicine, Denver                     | Community based hospital                            | 3                | 8 1yr Inpatients shortly & Outpatient (remainder of year) GS, IM, Neu, OB/GYN, Ped, Psy |
| Sanford School of Medicine, University of South Dakota                | Community based hospital                            | 3                | 21 1yr Ambulatory setting IM, Ped, Psy OB/GYN, GS                  |
| School of Medicine, Flinders University                                | Community based hospital                            | 3                | 23 Ped, IM, OB/GYN, Psy, GS, General Practice, EM                  |
| John A. Burns School of Medicine, University of Hawaii                | Community based hospital                            | 3                | 28 6 months Ambulatory setting FM, IM, OB/GYN, Ped, Psy, GS        |
| Warren Alpert                                                         | Community                                            | 3                | 24 1yr Inpatients( FM, GS, IM, OB/GYN, Subject                |
| Medical School | Based Hospital | Tertiary | Outpatient (32wks) & Elective (4wks) | Neur, Ped, Psy | OS | Dir | Obsr |
|----------------|----------------|---------|-------------------------------------|---------------|----|-----|------|
| Medical School of Brown University | Based hospital | 12wks | Both LIC and RBC in a year | Primary care, IM, Orthopedics, Urology |
| College of Physicians and Surgeons, Columbia University | Tertiary medical center | 4 | Both LIC and RBC in a year | Primary care, IM, Orthopedics, Urology |
| Northwestern University Feinberg School of Medicine | Community based hospital (PCMH) | 1yr | Both LIC and RBC in a year | Primary care, IM, Orthopedics, Urology |
| Mount Sinai School of Medicine | Tertiary medical center | 12wks | Both LIC and RBC in a year | Primary care, IM, Orthopedics, Urology |
| Chicago college of Medicine, University of Illinois | Tertiary medical center | 1yr | Ambulatory setting (half a day every week in preceptor’s office) | Primary care, IM, Orthopedics, Urology |
| Charles R. Drew University of medicine and science, Los Angeles | Community based hospital | 30wks | Ambulatory setting (half a day every week in preceptor’s office) | Primary care, IM, Orthopedics, Urology |
| Duke University School of Medicine | Tertiary medical center | 1yr | Inpatient (4 month) & Outpatient (8 months) | Primary care, IM, Orthopedics, Urology |
| Institution                                                                 | Location                  | Type                          | Duration | Block Type | Specialties                                                                 |
|---------------------------------------------------------------------------|---------------------------|-------------------------------|----------|------------|-----------------------------------------------------------------------------|
| Geisinger Commonwealth School of Medicine                                 |                           | Community based hospital      |          |            | Med, FM, Ped, GS, OB/GYN, Psy                                               |
| The University of Alabama School of Medicine, Tuscaloosa Campus           |                           | Community based hospital      | 1 yr     | Both LIC   | and RBC in a year                                                           |
| University of North Carolina School of Medicine                           |                           | Community based hospital      | 4        | Inpatient & Outpatient           | GS, IM, Psy, Ped, Neu, OB/GYN, EM, FM, Psy                                 |

The blanks were not found in the papers or on the web sites.

LIC Longitudinal integrated clerkship
RBC Rotational Block Clerkship
IM Internal Medicine
GS General Surgery
OB/GYN obstetrics-gynecology
FM family medicine, Rad radiology
RM Rehabilitation Medicine
EM Emergency Medicine
Ped pediatrics
Neu neurology
Psy psychiatry
Table 3. Thematic analysis of challenges in LIC implementation.

| Theme                          | Subtheme                                                                 | Reference(s) |
|--------------------------------|--------------------------------------------------------------------------|--------------|
| Preceptors’ burden of LIC education | Preceptors felt that LIC education was a burden.                          | 18,22,23     |
|                                | LICs prevented preceptors from doing clinical work.                       | 23,29,34     |
|                                | Preceptors felt that their reward was too small compared to the time and effort they input. | 23,27,38     |
|                                | Assessment of LIC students is another burden.                              | 29,44        |
| Students’ concern about academic achievement | Students complained that they learned nothing from their preceptors.       | 18,22,27     |
|                                | Students were afraid about not receiving feedback on their performances midway through the semester. | 23          |
|                                | Students were concerned about their end-of-semester assessment.            | 19,20,23     |
|                                | Students had difficulties in their independent learning.                   | 26           |
| Students’ inability to adapt to LIC | Faculty had difficulty selecting students for participation in LICs     | 38           |
| Shortage of educational resources of AMC | Shortage of administrative staff to assist with LIC implementation | 23,35,37 |
|----------------------------------------|---------------------------------------------------------------|--------|
|                                        | Inadequate preceptors to teach students in LICs              | 18,23,35 |
|                                        | Students were unable to meet various types of patients because of their preceptors’ subspecialties. | 23,35 |
| Limited space in hospitals for LIC     |                                                               | 22,23,29,31 |
| LICs required significant financial resources. |                                                               | 23,27,37 |
| Students had to move long distances on a tight schedule. |                                                               | 18,23 |
| Students’ schedules it were complicated to make. |                                                               | 18,23,25,31 |
| Lack of understanding about LIC        | No one with in-depth knowledge about LICs                     | 37 |
|                                        | Students were unable to understand the purpose of LICs        | 20 |
|                                        | Participants had difficulties comprehending the advantages of LICs | 35 |
|                                        | Participants were doubtful about the cost effectiveness of LICs | 35,37 |

**Figures**
Figure 1

Flow chart