

MEDICAL EDUCATION IN REVIEW

Implementing longitudinal integrated curricula: Systematic review of barriers and facilitators

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Abstract

Purpose: The increase of longitudinal integrated curricula in medical schools worldwide represents the shift towards an outcome-oriented education. This novel model allows comprehensive student-patient interactions over time and integrates the educational content across disciplines. According to quantitative research, students, patients, doctors and communities benefit from this educational model in terms of participant satisfaction, learning outcomes and clinician recruitment. However, quantitative research does not provide detailed information on programme implementation processes. Therefore, this review aims to summarise facilitators and barriers of programme implementation reported in qualitative and mixed methods studies.

Method: The authors reviewed the literature about facilitators and barriers for the implementation of longitudinal integrated curricula in undergraduate medical education programmes. The systematic search was conducted in MEDLINE, Embase and PsycINFO on 2 December 2019. The authors used the CASP checklist for qualitative research for the critical appraisal and summarised the results across studies using thematic content analysis.

Results: The authors screened 1682 reports. Twenty studies examining 17 different curricula met the inclusion criteria. Most curricula were implemented in the United States (n = 6/17), Australia (n = 5/17) or Canada (n = 4/17). Programme implementation is facilitated and hampered by its educational components (eg continuity of supervision, safe learning environments), organisational structures (eg community involvement) and participating students' and staff' motivation and personality. The critical appraisal revealed that several studies lacked transparent documentation and adequate reflection on the researcher-participant relationship (n = 20/20), data collection instruments (n = 12/20) and recruitment strategy (n = 4/20).

Conclusions: The authors derived practical recommendations for the implementation of undergraduate, patient-centred, integrated medical curricula. Programme managers need to define and communicate common objectives with all participants. They should clarify the implementation of the objectives in all processes in a transparent

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and structured manner. Considering reporting guidelines, future studies in this field should document more transparently the methods used to gain qualitative insights and the researchers' personal involvement.

1 | INTRODUCTION

Medical schools worldwide increasingly implement longitudinal integrated curricula.^{1,2} These curricula represent a shift from input-oriented, process-based education towards a competence-based, outcome-oriented education. The 'competency construct' emerged in the 1970s and 1980s.³ Increasingly complex care situations require reflective and competent physicians: reflective of their individual role in care⁴; competent in evidence-based medicine; and competent in patient contact to ensure informed consent of the treated patient. Longitudinal integrated curricula aim to train those competencies to better prepare medical students for their future profession.

The underlying educational concepts are 'longitudinality', 'continuity' and 'integration'. Ellaway et al⁵ disambiguate these terms as follows: 'longitudinality is about the *persistence*⁶ of curriculum elements, continuity is about the *flow* between curriculum elements and integration is about the *connections* between curriculum elements'. Longitudinality, continuity and integration appear in many ways. For instance, the concept of continuity includes continuity of care, curriculum and supervision.⁷ The term integration is used to describe curriculum integration, assessment integration and learner integration of multiple levels.⁸

We illustrate the practical implementation of longitudinality, continuity and integration using the example of the German medical *reform* study courses. Medical study courses in Germany are full education programmes with a duration of 6 years ending with a practical year. *Traditional* study courses in Germany have a clear and legally defined structure. The curriculum is divided by law into three sections: basic science (eg natural sciences, medical terminology, anatomy, physiology), clinical science (eg general medicine, anaesthesiology, surgery) and clinical year. In contrast to these traditional study courses, reform study courses aim and are legally allowed to enabling curricular links between pre-clinical and clinical contents (vertical curriculum integration). Organ-centred teaching is one medium to create these links. For instance, basic and clinical content can be taught together in 'competence fields' like 'chest: heart and lungs' instead of separate subjects like 'anatomy' and 'general medicine'. Other reform elements include early and continuous patient contact, strengthened scientific education, and novel teaching and examination formats.⁹ For instance, scientific competencies may be taught in an extra longitudinal curriculum strand throughout the study course. The learning content of this strand would build on each other (continuity) and allow links to the other 'competence fields' (horizontal curriculum integration).

We define longitudinal integrated medical curricula as full medical education programmes or clerkships (as a subset of full medical education programmes) with a focus on curriculum integration and continuous student-patient interactions.

Looking into the international literature, longitudinal integrated clerkships (LICs), as a subset of longitudinal integrated curricula, fulfil these criteria. Quantitative investigations about LICs found that students, patients, doctors, organisations and communities benefit through LICs in terms of satisfaction, learning outcomes and clinician recruitment.¹⁰ LIC students at the University of California, San Francisco, rated clerkship benchmarks such as faculty teaching, adequacy of observation, feedback on performance and the overall clerkship higher than students from hybrid and block clerkship models.¹¹ Students participating in LICs achieve equivalent or even better academic results than those of clinical education in block rotations and develop more patient-centred communication skills, but have to deal with early disorientation regarding the organising of their learning.¹²

Longitudinal integrated medical education programmes placed in underserved areas are beneficial for the quality of rural health care services.¹³⁻¹⁶ The German Science Council investigated the situation of reform study courses in Germany in 2014 and drew a positive conclusion, taking into account international experiences and recommendations. Despite lacking evaluations, the German Science Council recommends to integrate competence- and patient-oriented elements into the traditional study courses.⁹ One recent study evaluating the reform study course at the Charité in Berlin found high student satisfaction rates and high self-reported preparedness for practical clerkships.¹⁷ Another recent study about the Cologne reform study course found marginal positive effects on the awareness for the field of general practice among students.¹⁸ Strengthening general practice is one aim of the medical education reform in Germany intending to address primary care shortages.¹⁹

Since quantitative research revealed many benefits, we wanted to ascertain barriers and facilitators of the implementation of longitudinal integrated medical education programmes worldwide. Our aim was to summarise barriers and facilitators in different health care and educational settings. Similar aspects reported in different settings can be transferred to other contexts. One recent narrative literature review by Brown et al (2019) investigated LIC programmes for facilitators and barriers to implementation.¹⁰ They identified students as well as tutor engagement, leadership and LIC environment as facilitators for LIC implementation and geography (potential isolation in rural areas and fragmentation due to staff turnover in urban settings), relationships, time/funding, new faculty and organisations, discomfort and student assessment (examinations) as barriers, thereby providing a useful framework of LIC implementation. However, this narrative review by Brown et al (2019) exclusively focused on LICs. This is a limitation for us, because the educational reform in Germany did not only affect

the redesign of the practical year (clerkship). It intended to transform the complete undergraduate study courses (that last at least 6 years in Germany). The second limitation of the narrative review is that its authors have not carried out a critical appraisal of included studies.

Therefore, our aim was to conduct a systematic review of the evidence regarding barriers and facilitators of implemented *full* longitudinal integrated medical curricula and LICs in studies with a qualitative design. We focused on the latter, because qualitative research gains deeper insights in processes and individual assessments than stand-alone quantitative research designs do.²⁰

2 | METHOD

We conducted a systematic review based on the method described in the Cochrane Handbook for Systematic Reviews of interventions²¹ and the PRISMA reporting standards.²²

2.1 | Inclusion criteria

We systematically searched for qualitative or mixed methods designed studies that examined barriers or facilitators of fully implemented longitudinal medical education programmes and clerkships after predefined criteria.²³

We set a minimum programme length of 6 months to ensure its longitudinality. Recent reviews used a minimum length of 6 months as well.^{12,23} We restricted our search to undergraduate programmes. We registered a review protocol in advance²⁴ and needed to modify it during initial screenings and the development of the search strategy. Originally, we planned to investigate qualitative and mixed methods studies that primarily dealt with rural longitudinal integrated curricula in the early implementation phase. In the course of the development of the search strategy and the identification of key publications, we found that most studies did not distinguish clearly between early implementation and established practice. Therefore, we included all implemented programmes regardless of implementation stage. As this is the first systematic review examining barriers and facilitators of longitudinal curricula, we also removed the rural focus because we wanted to evaluate barriers and facilitators of these programmes in general, before focusing on location. Therefore, we extended the review question to implemented longitudinal integrated curricula independent of urban or rural settlement. Appendix S1 lists all inclusion and exclusion criteria.

2.2 | Search strategy

We searched in the electronic bibliographic databases MEDLINE, Embase (both via Ovid) and PsycINFO (via EBSCOhost). FW developed the search string that consists of several keywords and MeSH

terms (see Appendix S2). In addition, we conducted a hand search. This included the screening of reference lists of included studies (backward screening) and a forward search of studies that cite one or more of the studies originally included. Initially, we included qualitative or mixed methods studies in English or German language published until 4 March 2019. FW and HH updated the search on 2 December 2019.

DK and LH independently screened titles, abstracts and full texts. They resolved discrepancies by consulting another reviewer (FW or HH). FW and HH independently screened the references found through backward and forward screening.

2.3 | Critical appraisal

For critical appraisal, we used the CASP (Critical Appraisal Skills Programme) Checklist that includes a set of 10 items²⁵:

1. Was there a clear statement of the aims of the research?
2. Is a qualitative methodology appropriate?
3. Was the research design appropriate to address the aims of the research?
4. Was the recruitment strategy appropriate to the aims of the research?
5. Was the data collected in a way that addressed the research issue?
6. Has the relationship between researcher and participants been adequately considered?
7. Have ethical issues been taken into consideration?
8. Was the data analysis sufficiently rigorous?
9. Is there a clear statement of findings?
10. How valuable is the research?

Response options are 'Yes', 'No' and 'Can't Tell'. We made decisions based on criteria listed in Appendix S3 that we derived from the 'hint' section of the CASP²⁵ publication. We used the category 'can't tell' when not enough information in the report was given to decide whether the respective criterion has been adequately justified.

HH performed the critical appraisal and FW assessed and approved its results. We documented the comprehensive critical appraisal including justifications for each decision with MS Excel. The comprehensive table can be requested from the authors.

2.4 | Data extraction

We used a qualitative approach to explore why the examined programmes worked or did not work.²⁶

As illustrated in the results of Table 1, we extracted the following study characteristics: research aim, data collection method, programme location (country), number of study participants, setting and length of programme. HH extracted data; FW proofed the extraction.

Using 5 exemplary studies,²⁷⁻³¹ FW and HH independently extracted quotes containing barriers and facilitators of programme implementation to define which parts could be extracted as those. HH did the ongoing extraction, checked by FW. In case of ambiguities, we discussed those until we reached consensus.

To identify barriers and facilitators of LICs, we used a mixture of deductive and inductive coding, according to Mayring.³² Deductive coding is used when an initial structure of the material is warranted by the research question or theoretical knowledge of the field. Inductive coding is used when no further structure is known beforehand. Facilitators and barriers were the overarching categories used to answer the research question. Deductively, we defined an element found within the quotes as barrier or facilitator when, in addition to the quoted experience of the respondent, the impact on the programme was clearly characterised (eg 'medical students who did engage with their clinical supervisors and contributed positively to the busy workloads, motivated some clinicians').³³ We used inductively coded elements to develop new categories and expand or refine existing ones. For instance, we paraphrased 'That's another bugbear. We don't have any discussions about patients'³⁴ as 'no opportunity for discussions about patients', thus expanding the sub-category 'learning environment'. We also kept judgemental quotes from the original text to illustrate participants' individual opinions by using in vivo codes, for instance, 'young, unmotivated, difficult students'.³⁴

FW and HH collected all extracted quotes with its coding, category and type of respondent with MS Excel. The table can be requested from the authors.

3 | RESULTS

Our initial and updated search yielded 1,682 reports for title and abstract screening (see Appendix S4). Following completion of screening, we included 18 study reports^{27-31,33-45} from the initial and 2 study reports^{46,47} from the updated search in the systematic review. We identified 7 of these 20 study reports by database search and 13 by hand search. The references of 42 reports excluded during full-text screening are listed in Appendix S5.

3.1 | Study characteristics

The included studies ($n = 20$) examined 17 different curricula at 14 different universities. The curricula were carried out in the United States ($n = 6/17$),^{28,30,40-42,44} Australia ($n = 5/17$),^{33,34,36,37,39,46} Canada ($n = 4/17$),^{31,35,36,38,47} UK ($n = 1/17$)²⁷ and South Africa ($n = 1/17$).^{29,43,44} Fifteen of 17 programmes are internships with a length between 8 months^{36,38} and 1 year.^{29-31,33,34,36-39,40,42-47} The other 2 programmes are curricula with a duration of 4³⁵ or 5 years.⁴¹ Most programmes ($n = 11/17$)^{27-29,31,33,34,36-39,41,43,44,46} cooperate with medical care institutions in rural areas, where the students carry out their practical training. The number of persons

interviewed in the studies ranged from 6 to 132 participants, most studies interviewing students ($n = 14/20$).^{27,30,31,34-38,40,41,43-46} One study report included in this review examined patient perspectives, reporting solely positive results.³⁹ Individual interviews were used as a survey method in 17 of 20 studies.^{27-31,33-39,42-46} Table 1 lists all extracted study characteristics.

3.2 | Barriers and facilitators for the implementation of longitudinal integrated curricula

We allocated emerging quotes to 7 main categories: education, organisation, relationships, students, tutors and staff, the overall new model and others. The categories 'education' and 'organisation' contain several sub-categories. Table 2 provides an overview of all extracted barriers and facilitators.

3.2.1 | Education—integrated curriculum

On the one hand, programme participants valued the flexibility and openness of the curriculum in the integrated model that allows new learning opportunities.^{29-31,43,44,47} On the other hand, some students and educators were uncertain about the learning objectives.^{36,40,43}

3.2.2 | Education—Learning environment

Programme participants valued learning environments welcoming students^{27,33}; allowing discussions about patient care³³; providing a supportive, friendly atmosphere^{44,46}; and offering a space 'safe' for open and nonjudgemental dialogue³⁵ and for mistakes.³⁰ Students valued continuity of relationship,³⁶ setting³¹ and with peers.^{30,40}

3.2.3 | Education—Mentoring/Continuity of supervision

Whereas a tutor, supervisor or role model mainly focuses on promoting and supporting a student's professional skills, a mentor is in an ongoing relationship with a mentee and actively supports the mentee in personal and career questions.^{48,49} Mentoring is explicitly mentioned as facilitator in 2 studies.^{36,37} Students and preceptors report positive experiences through continuous supervision^{27,33} and preceptorship.^{30,31,41,42,45} One study investigating patient perspectives found that patient respect for doctors was enhanced by the quality of preceptorship they provided to students.³⁹ Supervisor guidance helped students in the learning process.³³ Sporadically, concerns arose that working with only one preceptor might limit the learning experiences.^{37,41,42} Tutors mentioned the burden of responsibility, inter alia, the

TABLE 1 Study characteristics

Author	Intervention	Country	Participants	Method	Programme length	Programme setting
Bartlett et al 2019 ²⁷	Rurally based LIC (University of Dundee)	UK	7 students, 21 GP tutors, 2 regional tutors, 2 directors of medical education, 5 University of Dundee faculty	Focus groups, semi-structured interviews, reflective audio-diaries	40 wk	Practices in 2 rural areas
Beatlie et al, 2019 ⁴⁶	LIC at Deakin's Rural Community Clinical School	Australia	15 programme participants (5 general practice supervisors, 2 practice managers, 5 medical students, 3 general practice registrars)	Semi-structured, in-depth interviews	1 y	Rural general practices
Bing-you et al 2014 ²⁸	Rurally based LIC (Tufts University School of Medicine)	USA	9 physician leaders (interviews); rural LIC preceptors (survey)	Semi-structured interviews, online survey	9 mo	5 rural hospitals
Boudreau et al 2014 ³⁵	physician apprenticeship course (McGill University)	Canada	24 students, 3 teachers	Document reviews, semi-structured interviews, focus groups, observations of PA group meetings, questionnaires	4 y	First 18 mo: 'first year patient' (patient's home and clinic visits), next 6 mo: clinical site attachments without direct responsibility; later: clerkship
Connolly et al 2014 ³³	Rurally based LIC (Monash University East Gippsland Regional Clinical School)	Australia	15 senior medical and nursing staff	Individual and group-structured interviews	1 y	2 rural hospitals
Couper & Worley 2010 ³⁷	Rurally based LIC (Flinders University)	Australia	Interviews: 15 university-based staff, 38 clinicians, 20 managers, 10 administrators, 4 community representatives; 45 students in 6 focus groups	Focus groups, individual interviews	1 y	General practices and regional or district hospitals
Couper et al 2011 ³⁶	2 rurally based LICs: Flinders and Northern Ontario School of Medicine (NOSM)	Australia/ Canada	Flinders: see above (Couper & Worley, 2010); NOSM: 39 interviews, 7 students in focus groups	Focus groups, individual interviews	1 y; 8 mo	See above (Couper & Worley, 2010); many health service facilities in large rural or small urban areas
Denz-penhey & Murdoch 2009 ³⁴	Rurally based LIC (Rural Clinical School of Western Australia)	Australia	60 students, 27 academic staff, 15 administrative staff	Interviews	1 y	Students were 250-2500 km away from their tertiary training site in communities varying in size from about 4000 to 50 000
De Villiers et al 2018 ²⁹	Rurally based LIC (Stellenbosch University)	South Africa	6 young family physicians (experience 0-3 y)	Semi-structured interviews	1 y	Rural district hospitals
Dube et al 2015 ³⁸	Rurally based LIC (Northern Ontario School of Medicine)	Canada	12 students	Face-to-face interviews, Skype interviews, 'walking interviews'	8 mo	Large rural or small urban community hospitals
Hudson et al 2012 ³⁹	rurally based LIC (University of Wollongong)	Australia	13 patients	Semi-structured interviews	1 y	General practices in regional, rural and remote health care settings

(Continues)

TABLE 1 (Continued)

Author	Intervention	Country	Participants	Method	Programme length	Programme setting
Latessa et al 2017 ³⁰	2 LIC programmes (Harvard Medical School and University of North Carolina School of Medicine)	USA	10 interviews with graduate students each programme; survey: 20 UNC, 40 HMS	Electronic survey, semi-structured, telephone interviews	1 y	Harvard: urban hospitals; UNC: mission hospitals and community physician's private practices
Mihalynuk et al 2008 ³¹	Rurally based LIC (University of British Columbia)	Canada	12 students	Semi-structured interviews, focus groups	1 y	Family practitioners
Poncelet et al 2011 ⁴⁰	LIC (University of California)	USA	23 students	Written surveys and focus groups at the middle and end of the year	1 y	Tertiary care academic medical centre: several hospitals (in-patient and ambulatory settings)
Rodríguez et al 2019 ⁴⁷	Longitudinal family medicine experience (McGill University)	Canada	43 preceptors	Focus groups	1 y	Preceptors of community clinics, health care centres, family medicine academic teaching units, emergency rooms, nursing homes
Sokal-gutierrez et al 2015 ⁴¹	Full medical education programme (University of California)	USA	11 focus groups: 4 students each; questionnaire for students, faculty and staff (no number of participants)	Focus groups, online survey	5 y	Underserved hospitals and clinics
Teherani et al 2009 ⁴²	LIC (University of California)	USA	27 preceptors	Semi-structured interviews	1 y	Clinical preceptors (no further information about the setting)
Von Pressentin et al 2016 ⁴³	Rurally based LIC (Stellenbosch University)	South Africa	2 medical students, 6 clinician educators, the RCS academic director and the lead clinician educator	Participatory action research approach (focus group, individual interviews, group meetings)	1 y	Rural district hospitals
Voss et al 2015 ⁴⁴	Rurally based LIC (Stellenbosch University)	South Africa	13 students	Interviews	1 y	Rural district hospitals
Wamsley et al 2009 ⁴⁵	Longitudinal out-patient attachment (University of California)	USA	12 students	Semi-structured interviews	1 y	Out-patient attachment at subspecialty clinic

TABLE 2 Barriers and facilitators

Category	Subcategory	Barriers	Facilitators
Education	<i>Integrated curriculum</i>	Lack of flexibility in the student programme ³⁶ Lack of standardisation of teaching input and quality ³⁶ flexibility of choice: no range of options available ³⁶ learning contents simultaneously ⁴⁰ unstructured work, open curriculum ²⁹ uncertainty regarding the required learning outcomes ⁴³ less didactic VI (vertically integrated) approach ⁴⁶	Flexible daily schedules ³⁰ integrated curriculum ^{30,31,43} programme flexibility ³¹ Flexibility in an integrated programme ⁴⁴ Integrated learning and student assessment ⁴³ Unstructured work, open curriculum ²⁹ A resource outlining the learning objectives for different levels of learners, associated with different topics ⁴⁶ a more focused statement of course learning objectives ⁴⁷ Flexibility when scheduling the sessions ⁴⁷ Vertically integrated tutorial formats ⁴⁶
	<i>Learning environment</i>	No opportunity for discussions about patients ³⁴ Unanswered questions ⁴⁴ Nursing staff were using students as cleaners and messengers ³⁴ Lack of structure in the learning environment ⁴³	Safe learning environment ^{30,35} Companionship, interaction with young enthusiastic people and the opportunity to engage in meaningful discussion about patient care ³³ Learning opportunities: corridor discussions, bedside team discussions ³³ Continuity of relationship ³⁶ Continuity of setting ³¹ opportunity becoming part of a medical community ³⁰ continuity with peers ^{30,40} supportive learning environment offering group learning sessions ⁴⁶ collegiality ⁴⁶ supportive community of patients ⁴⁶ discussions and community-based activities ⁴¹
	<i>Mentoring/ Continuity of supervision</i>	The longitudinal preceptorship limited their ability to experience a variety of health care settings and communities ⁴¹ Working with one preceptor might limit the students' exposure to other clinicians' perspectives in that discipline ⁴² Burden of responsibility for tutors ²⁷ The need to grade exposure in order to prevent the students being overwhelmed ²⁷ Role modelling (not enough teamwork) ³⁷ Compulsion to build intimate relationships to students ³⁵	Mentoring ^{36,37} Long-term supervision ³³ Supervisor guidance ³³ Quality of preceptorship provided by doctors ³⁹ continuous preceptorship ^{30,42,45} continuity to primary care providers ³¹ 2-y longitudinal clinical preceptorship ⁴¹ Continuity of educational supervision ²⁷ Possibility of switching the preceptor during the course ⁴⁷ opportunities for personal support ³⁵ Role modelling ^{41,45}
	<i>Patient integration (students take on responsibility for patients and gain real experiences)</i>	Dependence on patient opportunities ⁴² Lack of continuity with patients ⁴⁵ Feelings of ineptitude and vulnerability in fulfilling the expectations for this new clinical role ³⁸ Moments of burnout related to doubts about patient management ³⁸ Lack of responsibility for patient care ⁴⁵	Patient continuity ^{27,29-31,36,40,44,45} Undifferentiated patients as the basis for learning ^{29,37} Patient involvement in the LIC ³⁷ Patients willingly/patient integration ³⁹ Patient integration in care (open conversations) ³⁹ Consultations involving the student and doctor ³⁹ Parallel consulting model ³⁹ variety of patients ³¹ Patient portfolio method ⁴³ Seeing many patients ⁴⁴ Continuity of care ^{33,39,43} Real clinical experiences ^{30,38} learning clinical approaches ⁴⁴ Seeing a caseload relevant to practice ⁴⁴ Feeling part of the practice team with a useful contribution to make to patient care ²⁷ Students taking on responsibilities for patient care ^{35-37,42,45} Community-based experiences ⁴¹

(Continues)

TABLE 2 (Continued)

Category	Subcategory	Barriers	Facilitators
	<i>Student examination formats (integration of assessment)</i>	<p>Disjuncture evident between clinical practice and assessment requirements³⁶</p> <p>Student's anxiety about examinations²⁹</p> <p>Pressure of summative examinations³⁸</p> <p>Difficulties in linking examination content to patient experiences³¹</p> <p>All grades at the end of the year⁴⁰</p> <p>Final examination at the tertiary teaching hospital as a huge source of tension⁴³</p> <p>Concerns about parity with learning at the teaching hospital and the implications for what they would be asked during the examinations⁴⁴</p> <p>Worried that they had not seen the 'weird and wonderful' cases they assumed they would be given during the examinations⁴⁴</p> <p>The patient log as a method for course evaluation⁴⁷</p>	<p>Post-examinations³¹</p> <p>appropriate course evaluation strategies such as the use of a case report to be submitted at the end of the course⁴⁷</p>
	<i>Teaching elements</i>	Lack of rural postgraduate training opportunities ³⁶	<p>'reality check' of experiences³⁵</p> <p>interprofessional education³³</p> <p>team work³⁶</p> <p>postgraduate training opportunities³⁷</p> <p>videoconference teaching sessions³¹</p>
	<i>Training sites</i>	<p>General practice as teaching location for a whole academic year²⁷</p> <p>Gaps in paediatrics and psychiatry at some sites³⁶</p> <p>Subspecialised clinics^{40,45}</p> <p>LIC doesn't suit to several specialties⁴²</p> <p>Lack of specialist contact³⁶</p> <p>Lack of exposure to specialties³⁶</p> <p>Limited patient diversity in subspecialised practices⁴²</p> <p>Difficult access to secondary care services²⁷</p>	<p>Learning in different clinical environments³⁸</p> <p>using multiple sites³⁷</p>
Organisation	<i>Administration</i>	<p>Administrative matters²⁷</p> <p>administrative burden, workload²⁸</p> <p>Administrative issues (academic days, the evaluations, changes and cancelling of examinations)⁴⁴</p>	-
	<i>Communication, Common vision and Stakeholder involvement</i>	<p>Defining mission and policies⁴¹</p> <p>Communication³⁶</p> <p>Lack of awareness of the LIC within the local medical communities²⁷</p> <p>Clinicians' lack of awareness of the LIC²⁷</p> <p>Insufficient understanding and awareness of the LIC at the teaching sites⁴⁴</p>	<p>Common vision^{36,37}</p> <p>appreciative hospitals³⁶</p> <p>Community involvement^{36,37,39}</p> <p>Strong partnerships³⁷</p> <p>University support for teaching sites³⁷</p> <p>Relationship with university³⁷</p>
	<i>Resources</i>	<p>Finances^{27,41}</p> <p>Fear of productivity losses²⁸</p> <p>Fear of negative financial impact on the hospital²⁸</p> <p>Distance from resources (eg the library)³⁶</p> <p>Physical resource constraints³⁶</p> <p>Human resource constraints³⁶</p> <p>Financial burden for some students³⁶</p> <p>Availability of library books³⁴</p> <p>Shortage of clinical rooms³⁴</p> <p>Time constraints⁴⁶</p> <p>Financial constraints⁴⁶</p>	-

(Continues)

TABLE 2 (Continued)

Category	Subcategory	Barriers	Facilitators
	<i>Time for teaching</i>	Concerns about managing the workload of teaching ²⁷ Time for teaching in an already pressured environment ²⁷ Lack of teaching capacity ²⁷ Difficulties with time pressures when trying to complete a clinical load and teach students at the same time ³³ Students did slow down patient care ³³ Availability of dedicated time for teaching is a scarce commodity ²⁹ Due to the low-resource settings in which they practiced medicine, their clinical preceptors were very busy and stressed ⁴¹ Most preceptors felt that teaching LIC students required more time than TC students ⁴² Lack of time to adequately plan sessions ⁴⁶	-
	<i>Staff support</i>	Not enough locally placed support for tutors ²⁷ Securing adequate staff/faculty support was a concern ⁴¹	Annual faculty development retreat ³⁶ Familiarising doctors with study guides, patient-related portfolios ⁴³ Receiving peer-to-peer feedback ⁴⁷
	<i>Student workload</i>	Students were felt to be too busy ³⁶ 'We are getting almost 18 h, way too much' ³⁴ Competing obligations during their busy schedules ³⁸ Extra workload particularly given the time pressures of their medical curriculum and master's degree courses and research ⁴¹ Difficult to balance clinical time with study time ⁴⁴	-
	<i>Technical issues</i>	Variable Internet connectivity ²⁷ Navigating a complex website to upload assessment reports ²⁷ Technology not adequate yet ³⁶ Problems evident with Virtual Academic Rounds ³⁶ Reliance on Internet communication technology ³⁶ Some planned online tutorials could not be provided for technical reasons ⁴⁴	—
	<i>Others</i>	Waiting times for non-urgent care ²⁷ Need for travelling for tutorials and examinations ⁴⁴ Lack of doctor control over scheduling ⁴⁵ Absence of evaluation processes ⁴⁶ Having to acquit the reporting requirements for multiple levels of learners, who belong to different training bodies ⁴⁶ Competing needs within the practice (sometimes sessions were conducted with no predetermined topic or learning objectives) ⁴⁶	Marketing efforts ²⁸ feedback implementation ³⁴ clear allocation for supervision ⁴³ tutors' scheduling patients for students ⁴⁵ site selection process crucial—matching students to sites ³⁶ using patient feedback ⁴⁶
Relationships		Managing relationship boundaries ²⁷ difficult student-staff relation ³⁴ Differing expectations between students and specialists ⁴⁴ Coordinators' lack of awareness of students' problems ³⁴ Difficult relationships with Students ⁴⁷	Patient-student-preceptor relationship ³⁹ Doctor-patient relationship ³⁹ Positive relationships with staff members ⁴⁴ Role clarification ⁴³ Clarification of mutual student-preceptor expectations from the beginning of the relationship ⁴⁷

(Continues)

TABLE 2 (Continued)

Category	Subcategory	Barriers	Facilitators
Student characteristics and selection procedures		<p>Non-engaged students³³</p> <p>Problematic students³⁶</p> <p>Young, unmotivated, difficult students³⁴</p> <p>unreliable students (late, rude)³⁴</p> <p>Issues with peers (house cleaning etc)³⁴</p> <p>Weak students⁴²</p> <p>Disruptive or unengaged learners⁴⁶</p> <p>Unequal opportunities for students to participate in the programme⁴¹</p> <p>Fear of wrong student matching²⁸</p>	<p>Students bringing knowledge to their tutors and practice staff²⁷</p> <p>Students' contemporary knowledge³⁹</p> <p>Student input for supervisors (feedback)³³</p> <p>Active student participation²⁸</p> <p>Engaged students³³</p> <p>Student self-directedness^{38,43,44}</p> <p>Enthusiastic, inspiring, and stimulating students²⁹</p> <p>Inquisitive students²⁸</p> <p>Students' possibility of transformation³⁵</p> <p>Well prepared students for work and responsible for their own learning²⁹</p> <p>Different learning styles required for such a programme and the fact that it may not suit everyone was an important positive theme³⁶</p> <p>Transparency in the selection process³⁶</p> <p>Student selection was mentioned as an important issue³⁷</p> <p>Observant and diligent students⁴⁷</p>
Tutors and staff		<p>A few midwives were not so enthusiastic at calling students into their delivery suite³³</p> <p>Physicians' uncertainty (learning outcomes, latest knowledge)²⁹</p> <p>Staff blaming students³⁴</p> <p>staff patronising students³⁴</p> <p>Tutors don't feeling well equipped for academic teaching⁴³</p> <p>More senior learner who were not open and transparent within the group⁴⁶</p>	<p>Supportive and enthusiastic health staff²⁷</p> <p>Clinicians who were willing to share their clinical knowledge³³</p> <p>Other staff participation in teaching²⁹</p> <p>Physicians providing guidance for participants³⁸</p> <p>Supporting guidance for students⁴³</p>
The overall new model		<p>Newness of educational method²⁷</p> <p>Knowledge and understanding of the LIC²⁷</p> <p>Scepticism and discomfort with a new model²⁸</p> <p>Lack of standardisation (approaches and conformity)³⁶</p> <p>Student disorientation due to the new model³⁸</p> <p>Lack of structure^{31,43,44}</p> <p>adapting to the LIC model⁴³</p> <p>Clarifying how the programme would function⁴¹</p> <p>Students not knowing what to know⁴⁴</p>	<p>Learning opportunities of the new model^{27,34,38}</p> <p>hoped benefits on recruitment²⁷</p> <p>Potential impact of the new model²⁷</p> <p>Teaching opportunities at hospitals (attract physicians)²⁸</p> <p>Having the LIC students on-site²⁸</p> <p>Decrease of recruitment costs (because the LIC attracts physicians interested in teaching)²⁸</p> <p>Lack of standardisation (outcomes and autonomy)³⁶</p> <p>Helping to train the future medical workforce (preceptor motivation)⁴⁶</p> <p>Contact with students (preceptor motivation)⁴⁷</p> <p>enjoying teaching (preceptor motivation)⁴⁷</p> <p>Motivation to give something back (preceptor motivation)⁴⁷</p> <p>Having a sense of duty or obligation (preceptor motivation)⁴⁷</p> <p>promoting family medicine (preceptor motivation)⁴⁷</p> <p>Improving medical education (preceptor motivation)⁴⁷</p> <p>Potential of the new model (preceptor motivation)⁴⁷</p>
Others		<p>Social isolation^{27,36}</p> <p>accountability (vs. Learning experiences)³³</p> <p>Lack of academic and social support for students³⁶</p> <p>Social disruption³⁶</p> <p>Heterogeneous students³⁴</p> <p>Infrequent return patients, patients from long distance⁴²</p>	<p>Being known in the local community²⁷</p>

need to calculate the student workload to prevent them from overload, as barrier.²⁷

3.2.4 | Education—Continuity of care (students take on responsibility for patients and gain real experiences)

Programme participants appreciated patient integration. Students and patients benefited from continuous care delivered by students.^{27,29-31,33,36,37,39,40,43-45} Students took on responsibilities for patients and gained real clinical experiences,^{27,30,35-38,42,44,45} that was an important learning experience allowing for insights into their future role as doctors and a better understanding of patient perspectives. However, this new clinical role challenged students, personally and professionally.³⁸

3.2.5 | Education—Student examination formats (integration of assessment)

Student examinations emerged as barrier,^{31,36,44,47} because of the difficulty to linking required curricular content to patient and clinical experience. This discrepancy frightened and stressed students.^{29,38,40,43}

3.2.6 | Education—Teaching elements

Students appreciated 'reality checks' of experiences in meetings,³⁵ videoconference sessions delivered from the main campus³¹ and team work.³⁶ Supervising staff valued interprofessional education that fostered friendships and led to more respect for each disciplines knowledge and skill base.³³ Postgraduate training opportunities at training sites supported successful programme implementation in one programme.³⁷ A lack of rural postgraduate training opportunities was seen as a risk to the workforce agenda.³⁶

3.2.7 | Education—Training sites

Depending on the programme, students carried out their practical training at different training sites such as subspecialised or general practices. Subspecialised clinics limited patient diversity and student experiences.^{40,42,45} Other barriers reported are lacking specialist contact³⁶ and difficult access to secondary care services.²⁷ Students valued the selection of multiple sites.^{37,38}

3.2.8 | Organisation—Administration

Students and site coordinators noted administrative matters and burden during programme implementation.^{27,28,44}

3.2.9 | Organisation—Communication, Common vision and Stakeholder involvement

A clear recognition of a common vision³⁷ unifying service and education facilitates programme implementation.³⁶ Students and tutors reported a lack of awareness of the programme within the local medical communities as a barrier.^{27,44} Facilitators for programme implementation are community involvement,^{36,37,39} appreciative hospitals,³⁶ strong partnerships and university support for training sites.³⁷

3.2.10 | Organisation—Resources

Several programme participants mentioned problems with physical (finances, clinical rooms, library books) and human resources (time constraints).^{27,28,34,36,41,46}

3.2.11 | Organisation—Staff support

Insufficient staff support complicates programme implementation.^{27,41} The Northern Ontario School of Medicine implemented an annual faculty development retreat that helped supervising doctors.³⁶ In another programme, preceptors appreciated the opportunity of peer-to-peer feedback.⁴⁷

3.2.12 | Organisation—Time for teaching and Student workload

Students as well as tutors reported time constraints. Students felt too busy^{34,36,41} and had difficulties serving all obligations.^{38,44} Teaching staff mentioned the additional time required for teaching as barrier in 6 studies.^{27,29,33,41,42,46}

3.2.13 | Organisation—Technical issues

Three studies reported technical problems: variable Internet connectivity and problems with website navigation²⁷; inadequate technology, problems with virtual academic rounds and the reliance on Internet communication technology in general³⁶; and general technical problems that hampered the provision of some online tutorials.⁴⁴

3.2.14 | Relationships

Relationship boundaries between students and teaching staff occurred in several programmes.^{27,34,44,47} Clarifying mutual expectations from the beginning improved the relationship.^{43,47} Good student-preceptor relationships promoted patient and student participation.^{39,44}

3.2.15 | Student characteristics and selection procedures

Self-directed^{38,43,44} and active^{28,29,33,47} students bringing up-to-date knowledge to and giving feedback to their tutors^{27,33,39} facilitate programme implementation. Longitudinal integrated clerkships may not suit everyone.³⁶ Supervisors recommended that only students who wanted to participate actively in the programme should be accepted.³³ Selection of students, thus, is an essential programme component.³⁷ Students mentioned the need for transparency within this selection process.³⁶

3.2.16 | Tutors and staff

Supportive and enthusiastic health care staff²⁷ that is willing to share clinical knowledge³³ and provides guidance^{38,43} facilitates programme implementation.

3.2.17 | The overall new model (longitudinality, continuity and integration as the underlying educational concepts)

The learning and teaching opportunities of the novel model attracted students and tutors.^{27,28,34,38,47} Tutors were enthusiastic about the potential impact on clinician recruitment.^{27,28,46,47} But, the lack of structure created student anxieties and insecurities,³¹ disorientation³⁸ and challenges.⁴³ The lack of structure facilitated clinical learning, but was more problematic to academic learning.⁴⁴

3.2.18 | Others

Social isolation hampered implementation of 3 programmes reported in 2 studies.^{27,36} At Flinders University, social isolation was tackled by implementing weekly student face-to-face meetings.³⁶ One study raised the discussion about the accountability responsibilities versus learning experiences for students: How can the decision for less-experienced students taking on patient care as a learning experience be justified, as opposed to the more experienced clinician taking over patient care?³³ One programme reported a lack of academic and social student support.³⁶ A LIC in Western Australia taught students from 2 different universities with different medical curricula together. The common teaching dissatisfied the students who differed clinical experiences and expertise.³⁴ Preceptors mentioned that infrequent return of patients hampered student participation in longitudinal care with the same patient.⁴²

3.3 | Critical appraisal

All study reports (n = 20) include a clear statement of the aims of the research (Item 1 of the CASP checklist), a justification

for a qualitative methodology (Item 2) and the chosen research design (Item 3) and consider ethical issues (Item 7). In 4 studies,^{33,36,37,40} no sampling strategy (Item 4) is described. Eight study reports^{28,30,38,39,42,45-47} provide complete information about data collection (Item 5). The relationship between researcher and participants (Item 6) is not mentioned in 3 study reports^{33,35,44} and none critically examined the researchers' influence on the formulation of the research question and the data collection process. Four reports^{27,36,37,40} do not fully document the data analysis process (Item 8). Most study reports included clear statements of their findings (Item 9) (n = 17)^{28-31,33-36,38,39,41-47} and is valuable for research (Item 10) (n = 14).^{27-30,34-36,38-41,45-47}

Authors of 17 studies reported on the financing or potential conflicts of interests.^{27,29-31,34-36,38-47} Three studies neither reported on the financing nor on potential conflicts of interests.^{28,33,37}

Appendix S6 gives an overview of the results of the critical appraisal.

4 | DISCUSSION

This study provides the first systematic review of barriers and facilitators in longitudinal integrated medical education programmes including a critical appraisal of included studies. We identified barriers and facilitators in several different curricula with different duration, implemented into different educational settings and health care systems, and therefore derived elements transferable to other longitudinal integrated medical curricula.

4.1 | Principal findings

Identified **barriers** are the *student examination formats* that mismatched the less structured way of teaching in longitudinal integrated curricula.^{31,36,44,47} *Subspecialised clinics with limited patient diversity* decreased the variety of student experiences.^{40,42,45} *Administrative issues*^{27,28,44} and *workload of teaching*^{27,29,33,41,42,46} complicated implementation, as well as the *lack of awareness of the programme* within the local medical communities.^{27,44} The *lack of structure and objectives* within the programme unsettled tutors and students.^{31,38,41,43,44,46} *High student workload*^{34,36,38,41,44} and problems with the *technical infrastructure*^{27,36,44} dissatisfied programme participants. *Social isolation* posed a problem in rural student placements.^{27,36}

Identified **facilitators** are *continuity of supervision*^{27,30,31,33,36,37,41,42,45} and the provision of *safe and friendly learning environments*.^{27,30,33,35,44-46} *Continuity of patient care* enabled students to early take up responsibilities and to gain real clinical experience.^{27,30,33,35-39,42-45} Nevertheless, this new clinical role also challenged students.³⁸ *Communicating a common vision*^{36,37} and *involving communities* supported the implementation.^{36,37,39} *Staff requested support*^{36,43,47} to eliminate uncertainties with the

novel concept..^{29,43} Transparent *student selection procedures* were useful³⁷ and may attract engaged students. *Self-directed*,^{38,43,44} *active*,^{28,29,33,47} *knowledgeable and attentive*^{27,33,39} students facilitated programme implementation.

Our identified facilitators and barriers support the results of a narrative review by Brown et al¹⁰ Among others, they identified integration of assessment (examinations) as a barrier as well. Medical education programmes use a wide range of assessment tools.⁵⁰ Programme initiators, who are designing a longitudinal integrated curriculum, need to discuss right from the development stage on, which assessment tools would best capture the intended student outcomes. Norcini & McKinley⁵¹ provide and discuss examples of performance-based assessments such as simulation (eg standardised patients or computer-based simulations) and work-based assessments (eg case-based discussion or direct observation of procedural skills). Programme initiators should also consider the use of formative assessment tools such as continuous feedback for students from tutors and patients.⁵²

Workload of teaching is a barrier reported in literature elsewhere.^{7,10} But an investigation about supervisor perceptions on the clinical productivity of rural, longitudinal integrated student placements suggests a financial 'turning point' after 1-2 months.⁵³ From this point on, students can take on more responsibilities and therefore reduce the doctors' workloads. Still, especially at the beginning of the programme, preceptors face a high teaching workload and need support. They request clear learning objectives and assessment criteria and wish for opportunities for professional development.⁵⁴ A questionnaire survey among German GPs identified the following most important facilitators: long-term scheduling, availability of teaching materials and equate financial compensation; and barriers: time restraints and decreased productivity.⁵⁵

Mentoring and continuous supervision support the programme implementation. Literature about mentoring programmes in medical education has shown several benefits: increased research productivity, improved medical school performance, positive effects on retention and recruitment of trainees, high participant satisfaction, and promotion as well as retaining of women in academic medicine.^{48,56-58}

Motivated students facilitate programme implementation. A qualitative study of O'Brien et al⁵⁹ concluded that 'the ideal medical student in longitudinal integrated clerkships' is a proactive and self-directed learner who engages with and advocates for patients. The less structured curriculum may not suit each student's personality. This could explain the contradictory results regarding the integrated curriculum. Some participants prefer flexibility, some more structure. Student selection procedures might address that problem by discussing the applicants' suitability. Programme managers are responsible communicating the objectives of the programme appropriately. Thus, students are aware of the requirements and are able to decide whether the programme suits them and not being overwhelmed. Supervisors and mentors might raise student motivation by providing friendly learning environments, respecting student interests and involving the students in decisions.

4.2 | Critical appraisal

The critical appraisal revealed that included studies lack a reflection of the researcher-interviewer relationship. This could have caused confirmation bias, as programme initiators tend to seek positive results. A possible dependency between interviewee and interviewer may influence the interviewee's response behaviour (especially in the case of students as interviewees and their possible future examiners as interviewers). Due to a lack of documentation, we cannot exclude that the survey instruments used in the included studies and the formulation of the research question might have caused a certain response behaviour of the respondents (question-order and wording bias). Participation in time-intensive surveys might be biased towards highly motivated programme participants with a positive attitude towards the programme. This review supports once again the need for clear and complete reporting of qualitative research.^{60,61} Despite the limitations described above, we consider the included studies to be meaningful, as both barriers and facilitators were described, therefore adding to the richness of the findings.²⁶

4.3 | Strengths and limitations

We used a clear and replicable method (database search, hand search, independent screening by 2 reviewers) to select appropriate studies that answer the research question. We recorded and justified changes made to the study design in a review protocol.²⁴ To reflect the current state of research, we updated the search on 2 December 2019. One reviewer extracted data and carried out the critical appraisal checked by a second one and using a standardised checklist (CASP checklist for qualitative research).²⁵ We found 13 studies via hand search. However, already included references appeared more and more frequently during the comprehensive hand search (backward and forward screening) that indicates a sufficient coverage of the literature on the topic. We coded quotes found in the included studies using Mayring's qualitative content analysis, which is, by nature, a subjective method. However, we limited coder bias due to individual perceptions by using 2 coders who resolved their disparities in discussions.

Our lacking contact to people involved in the implementation of LICs limited our access to further relevant literature. The systematic approach minimised bias but lacked a deeper understanding of complex implementation processes. However, our aim was to derive general recommendations and to critically appraise the existing literature. Programme initiators must discuss the transferability of the recommendations considering their individual contextual conditions.²⁶

5 | CONCLUSIONS

We systematically examined 20 study reports for barriers and facilitators of programme implementation from the perspective of students, doctors, other medical staff and patients, administrative and scientific staff.

Those responsible of longitudinal integrated medical curricula should create a balance between standardisation and flexibility within the curriculum, offering clear objectives but also elective modules. It is important to build safe learning environments enabling discussions about patients and continuous student-supervisor relationships. Training sites (practices and hospitals) should offer a certain patient diversity providing the opportunity for diverse medical experiences. Assessment tools (examinations) must adequately measure students' competencies acquired in patient contact and interdisciplinary teaching. We recommend to involving the community and communicating a common vision with clear objectives. Involvement and clear communication is essential to convince stakeholders and participants of the novel educational model and motivate them for active contribution. Transparent student selection procedures and supportive training opportunities for teaching staff facilitate programme implementation. The use of virtual courses has to consider the individual technical infrastructure and acceptance of those involved in the programme. Programme managers should be aware of the potential risk for student isolation in rural areas both socially and materially (eg Internet, literature).

Future research should investigate the broader patient perspective, as only one of the studies included in this review investigated patient perspectives and found only facilitators. Interviewing patients who may have had negative experiences within this novel educational model could help to identify further barriers for programme implementation. We recommend considering and transparently reporting on the researcher-participant relationship, the sampling strategy and data collection tools in future studies in this field.

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CONFLICT OF INTEREST

None.

AUTHOR CONTRIBUTION

HH undertook the screening, critical appraisal, data extraction, evidence synthesis and editing. LH and DK undertook the screening and contributed to the evidence synthesis and editing. FW derived the search strategy, undertook the screening and contributed to the critical appraisal, data extraction, evidence synthesis and editing. JS and FW developed the study design together and made a substantial contribution to the execution of the study and the final manuscript. JS contributed to the evidence synthesis and editing. All authors read and approved the final version of the manuscript.

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Not applicable.

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None.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.