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A systematic review

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DOI

[10.1111/medu.14607](https://doi.org/10.1111/medu.14607)

Publication date

2022

Document Version

Final published version

Published in

Medical Education

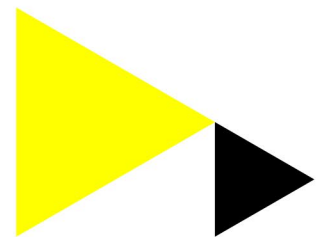
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Citation for published version (APA):

Bonnie, L. H. A., Cremers, G. R., Nasori, M., Kramer, A. W. M., & van Dijk, N. (2022). Longitudinal training models for entrusting students with independent patient care? A systematic review. *Medical Education*, 56(2), 159-169. <https://doi.org/10.1111/medu.14607>



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REVIEW ARTICLE

MEDICAL EDUCATION IN REVIEW

Longitudinal training models for entrusting students with independent patient care?: A systematic review

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Funding information

ZonMw, Grant/Award Number: 839130004

Abstract

Objective: The participation of students from both undergraduate medical education (UGME) and postgraduate medical education (PGME) in independent patient care contributes to the development of knowledge, skills and the professional identity of students. A continuing collaboration between students and their preceptor might contribute to opportunities for students to independently provide patient care. In this systematic review, we aim to evaluate whether longitudinal training models facilitate the independent practice of students and what characteristics of longitudinal training models contribute to this process.

Method: This systematic review was performed according to the PRISMA guidelines. In May 2020, we performed a search in three databases. Articles evaluating the impact of longitudinal training models on the independent practice of students from both UGME and PGME programmes were eligible for the study. A total of 68 articles were included in the study. Quality of the included studies was assessed using the Quality Assessment Tool for Studies with Diverse Designs (QATSDD).

Results: Both UGME and PGME students in longitudinal training models are more frequently allowed to provide patient care independently when compared with their block model peers, and they also feel better prepared for independent practice at the end of their training programme. Several factors related to longitudinal training models stimulate opportunities for students to work independently. The most important factors in this process are the longitudinal relationships with preceptors and with the health care team.

Conclusion: Due to the ongoing collaboration between students and their preceptor, they develop an intensive and supportive mutual relationship, allowing for the development of a safe learning environment. As a result, the professional development of students is fostered, and students gradually become part of the health care team, allowing them the opportunity to engage in independent patient care.

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1 | INTRODUCTION

Training students in undergraduate medical education (UGME) and postgraduate medical education (PGME) in the workplace, and allowing them to contribute to patient care, is essential to prepare them to become independently functioning medical professionals.¹⁻⁴ Student participation in patient care is not only important for the acquisition of knowledge and skills but also for developing other important aspects of the profession such as relationships with patients and other medical staff, professional identity, norms, values and attitudes.³ Providing patient care independently with remote supervision is essential for giving students opportunities to engage in all processes in the workplace and experience the responsibilities involved in independently providing patient care.⁴⁻⁸ Despite its known importance for learning, many students are not provided the opportunity to work independently with remote supervision.^{6,9-11}

For a preceptor to entrust a student with independent patient care is complicated, because developing a trusting physician-patient relationship is a complex process, depending on factors related to the physician, the patient and the disease.^{12,13} Development of this relationship requires investments from the physician, not only in time but also in efforts.¹³ Physicians who train students to become medical professionals will at some point need to entrust their students in providing care for their patients. This is a deliberate process in which patient safety plays an important role.¹⁴ It requires a safe and open educational relationship between the student and the preceptor, where students feel safe to show their strengths and weaknesses¹⁴ and preceptors feel safe to provide adequate feedback.¹⁵⁻¹⁷ The development of this relationship requires ongoing collaboration between students and preceptors, where they know each other both professionally and personally, and trust and respect each other.^{14,18,19} Collaboration between students and their preceptor positively influences feedback and assessment because it is based on ongoing student development in all aspects of medical care,²⁰ which is of great importance for student competency development.^{21,22} The safe learning environment¹⁴ as well as the increased quality of assessment and feedback^{21,22} arising from the longitudinal collaboration between students and their preceptor make an important contribution to the development of students into competent and independently functioning physicians.⁶

So far, most UGME and PGME programmes work with short rotations with multiple preceptors.^{15,23} If a longitudinal workplace training model really improves medical education, major curricular transformation of both programmes may be required.^{6,18} However, a structured overview of the influence of longitudinal training models on the independent practice of students is lacking. The aim of this study was to provide a structured systematic synthesis of available literature concerning the influence of longitudinal training models on the independent practice of UGME and PGME students.

With this systematic review, we aim to answer the following questions:

1. Do longitudinal training models facilitate the independent practice of UGME and PGME students during the course of their training programme?
2. What characteristics of longitudinal training models contribute to the independent practice of UGME and PGME students?

2 | METHODS

Several terms are used for describing longitudinal training models. UGME programmes are often described as longitudinal clerkships, longitudinal integrated clerkships or extended placement. For PGME programmes, terms like ambulatory long block, longitudinal scheduling or continuity clinic are used. We have chosen to use the term longitudinal model/programme as an umbrella term in this review. Whenever distinction is needed between UGME and PGME longitudinal training models or students, this is indicated. Otherwise, they are referred to as training programmes or students.

Besides various terms, there are also multiple formats for longitudinal training, both in UGME²⁴⁻²⁷ and in PGME.²⁷⁻²⁹ Generally, UGME longitudinal training models consist of an attachment over several months in a hospital, primary care or community setting, integrated across core clinical disciplines. During this attachment, the student is assigned to one set of faculty members and one group of patients,^{24,27} and the student learns to provide comprehensive care for patients over time and across various disciplines and settings.²⁵ PGME longitudinal training models are available in various forms, ranging from a weekly experience during 1 year of the training programme, to a full year (or more) in an ambulatory clinic, with a permanent team of faculty members,^{28,30} where students learn to provide care to a fixed group of patients. Variations in models are common.

2.1 | Design

For this systematic review, we evaluated longitudinal training models of workplace-based learning, involving a continuing relationship between students and their patients and preceptor. This review was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines.³¹ The review protocol is available upon request.

2.2 | Search strategy

We performed a search in PubMed/MEDLINE, ERIC and EMBASE on 15 May 2020, combining terms for 'medical education', 'trainee', 'student' and 'longitudinal'. The full search strategies are provided in Appendix A.

In addition to the articles selected from the original search strategy, we expanded the search using forward and backward citation searching of the included articles and contacted experts in the field of longitudinal training for any ongoing or recently published studies.

2.3 | Study selection

2.3.1 | Inclusion criteria

We aimed to include all original research articles that evaluate aspects of the impact of a longitudinal training model on the independent practice of students. Within the longitudinal training model, there should be student continuity with patients and with their preceptor for at least 6 months.¹⁴ Outcome measures eligible for this study were as follows:

- Degree of independent practice of trainees
- Preparedness for independent practice
- Factors related to longitudinal training models contributing to or hindering the independent practice of students

Both quantitative and qualitative design studies, in all languages and from every time-point or region, were eligible for inclusion.

2.3.2 | Exclusion criteria

Studies that evaluated aspects of longitudinal training models but did not provide data on outcomes related to independent practice were excluded. As a result, studies that evaluated patient perspectives, described the development and implementation of a longitudinal training model, or only provide the results of assessment programmes in longitudinal training models were excluded. Longitudinal courses that were not executed in the workplace were excluded. Studies evaluating expectations of students or preceptors towards working in a longitudinal training model were excluded. As this study focuses on independent practice of UGME and PGME students, studies focusing on other professions (e.g. pharmacy, midwifery and nursing) were excluded.

2.4 | Screening process

The results from the searches in each database were pooled, and duplicates were removed. The first 300 titles and abstracts of the acquired articles were screened by four researchers (LB, GC, NvD and MN) in order to ensure concordance with the inclusion and exclusion criteria. Next, the titles and abstracts of the remaining articles were screened by two researchers (LB and GC, MN or NvD) independently. The included full texts were assessed for inclusion and exclusion criteria by two reviewers independently (LB and GC). If consensus about inclusion or exclusion of an article could not be reached, NvD was consulted to reach consensus.

The screening process was done using the Rayyan application.³²

2.5 | Quality assessment

The assessment of the methodological quality of the included articles was performed by two researchers independently (LB and GC). In case of disagreement, a third researcher (NvD) was consulted.

Because we included quantitative, qualitative and mixed-method studies in this systematic review, we used the Quality Assessment Tool for Studies with Diverse Designs (QATSDD) to assess the methodological quality of the included papers.³³ Although initially developed for the assessment of the methodological quality of studies in health services research,³³ the tool has also been used in medical education research reviews^{34–37} and has shown to be feasible and produce good inter-rater reliability.³³

The QATSDD consists of 16 items rated on a 4-point scale (0–3). Scores can range from 0 to 42 for quantitative and qualitative studies and from 0 to 48 for mixed-method studies. The higher the score on the QATSDD, the better the methodological quality of the study.³³ The quality of the included studies is reported with the outcomes.

2.6 | Data extraction

Data extraction was carried out by LB using a predefined extraction form and checked by a second researcher (GC). For all included articles, the authors, year of publication, country of study, level (UGME or PGME), medical specialty (if applicable) and format of the longitudinal model were extracted. Relevant outcome measures for students or preceptors, related to the degree of independent functioning during the attachment and perceived preparedness for practice, and factors within the longitudinal model that support or hinder independent practice, were extracted to answer our research question. Any disagreement was resolved through discussion between the two researchers, supervised by a third researcher (NvD).

3 | RESULTS

The initial search and additional screening retrieved 19,642 articles. After screening for duplicates, 6339 articles were removed. The titles and abstracts of 13,303 articles were screened for eligibility, 13,199 articles were excluded. Of the 104 remaining articles, the full text articles were reviewed, and 68 articles adhered to all elements of the selection criteria and were included. Figure 1 shows the PRISMA diagram for the inclusion of studies.

Table S1 lists all the studies included in the systematic review, including information regarding the training programme, methodological background and QATSDD score. The majority of the studies (77.9%, $N = 53$) described research performed in UGME longitudinal training models, the perspectives of students (72.1%, $N = 49$) and used a qualitative methodology (44.1%, $N = 30$). The mean QATSDD scores were 25.8/42 for qualitative studies, 20.1/42 for quantitative studies and 25.9/48 for mixed-method-studies.

Table S2 contains a summary of the results of the included articles for UGME training models. Table S3 contains a summary of the included articles for PGME training models.

Although the contexts of the articles differed (UGME vs. PGME), and the perspectives of the papers varied (students vs. preceptors), the factors from both contexts and perspectives corresponded

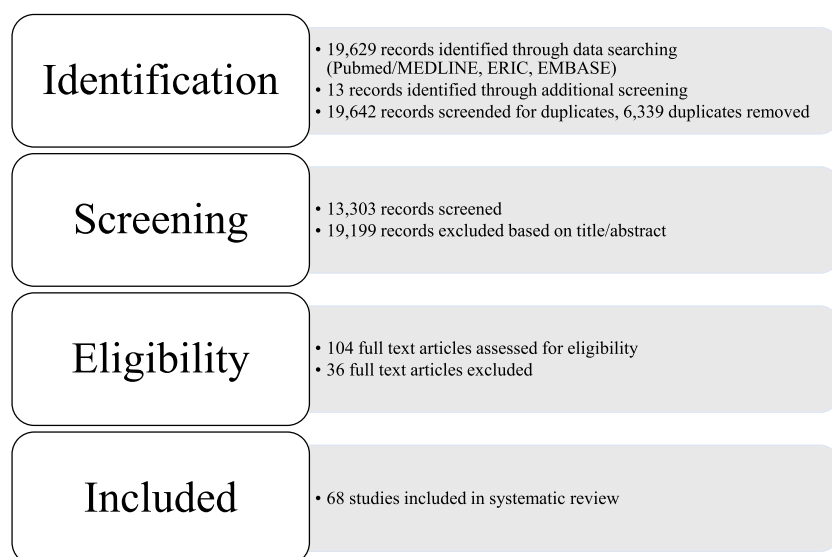


FIGURE 1 The PRISMA diagram for the inclusion of studies [Color figure can be viewed at wileyonlinelibrary.com]

closely. We have therefore described the results as being from one context. When results could be specifically attributed to a single context or perspective, we have mentioned this.

3.1 | Independent practice

The levels of responsibility taken on by both UGME^{38–40} and PGME⁴¹ students gradually increased during their longitudinal training experience. UGME students reported that they spent significantly more time on and were significantly more actively involved in direct patient care within authentic roles compared with their block colleagues and were already providing patient care alone from early in the year.^{42–44} At the end of the longitudinal rotation, UGME students were able to carry out a full consultation, in many cases independently, including history taking, physical examination, diagnosis making, creating a management plan, and patient education.^{20,45,46}

PGME students also noticed an increase in their independence and an evolution of the supervision by their preceptor from direct supervision towards a more supportive role. PGME students provided care to uncomplicated patients independently or with minimal supervision from their preceptor from halfway through their training programme.^{41,47}

During their longitudinal programme, students assumed the role of a physician,^{39,48–52} experiencing ownership of patients.^{50–55} Some students even felt they were the primary physician for their patients,^{56,57} increasing their sense of responsibility for patient care.^{40,50} Students felt that the responsibilities they bore for independently providing patient care were adequate for their level of training.^{45,56–58} Both students^{39,48,49} and preceptors^{59,60} thought that a longitudinal training model provided a more realistic view of working as a doctor, when compared with a block training model.

Both UGME and PGME students in longitudinal training models felt better prepared for independent practice than their block model colleagues.^{38,52,61–69} This preparedness related not only to clinical

skills but also to factors like dealing with ethical dilemmas, influence of social context on patient care, patient diversity, health system, and personal and professional development.^{69,70,71}

Preceptors recognised students' readiness for independent practice in their capability to make proposals for improving health care quality and for influencing health care policies and procedures.⁷² UGME graduates who completed a longitudinal programme had similar ratings to block model colleagues for clinical acumen and human sensitivity, but their overall performance was rated (much) stronger.⁷³ PGME students from longitudinal models felt best prepared for independent practice with regard to their interviewing skills, patient interactions, physical examination, factual knowledge, reporting and working in a health care team.⁷⁴

3.2 | Factors influencing the opportunities for independent practice

We identified three factors specifically related to longitudinal training models, which directly or indirectly influence opportunities for students to provide patient care independently.

3.2.1 | Longitudinal relationship with patients

Longitudinal contact between students and patients, frequently across various health care settings, helped to build a strong and continuing professional relationship between students and patients,^{40,42,45,51,53,65,69,75–82} contributing to both student learning and patient care.^{38–40,45,47–50,52–55,57,65,69,75,76,78,82–87} As students were involved in all aspects of patient care over time,⁵⁵ these experiences contributed to professional identity formation^{51,52,75} and to competence development,^{22,75} which supported preceptors in their decision to entrust students with independent patient care.^{46,72,73}

3.2.2 | Longitudinal relationship with preceptor

Longitudinal contact between students and their preceptor led to more intensive, supporting and collaborative professional and personal relationships.^{22,40,44,48,50,52,53,59,79,88,89} Preceptors in longitudinal programmes actively invested in the relationships with their students by being friendly, welcoming, taking interest in students as people and by adapting the clinic to the students' learning needs.⁶⁰ As a result of these relationships, trust of preceptors in students could develop, leading to the entrustment of independent patient care,^{59,85} allowing students autonomy in providing patient care and performing procedures.^{59,66,89} As preceptors and their students started working together,⁹⁰ the students gradually became part of the health care team.^{85,91}

As a result of the positive relationship between students and their preceptor,^{22,60} students in longitudinal models were more satisfied with the learning environment compared with block model students,^{42,69,77,86} describing their learning environment as safe and supportive.^{22,51,63} The safe learning environment allowed students to make mistakes, indicate their limitations in providing patient care, and receive and process feedback from their preceptor.^{22,51} This provided students in longitudinal models with additional opportunities for learning in the workplace compared with students in block models,^{22,86} as there were repeated opportunities for undertaking procedures and acquiring clinical skills within a supervised and safe environment.⁵⁵ The safe learning environment made preceptors more comfortable in providing constructive feedback.⁶⁰ Preceptors perceived the assessment process for students to be more meaningful when compared with block models.^{46,92} This led to an improvement in the quality of supervision^{48,58,69,83,84,92–94} and feedback for students in longitudinal models when compared with block models.^{22,42,69,75,77,83,92} Student supervision in longitudinal models progressed towards mentoring and role modelling, and fostering the professional development of students.^{46,48,50,54,58,66,76,77,84,85,90,93,95}

Students and preceptors formed partnerships in patient care and in learning.^{60,88,96} As a result, preceptors provided students with frequent and immediate feedback on their functioning.^{22,40,82,88} As preceptors witnessed student development over time, preceptors gained insight into their students' learning styles, interests, and strengths and limitations.^{46,90,95} This provided opportunities for individual approaches to learning,^{22,39,46,48,51,52} allowing preceptors to encourage and enable students to step outside their comfort zone and set and meet learning goals that go beyond the usual level of the clerkship.^{53,60} Students, as a result, consistently built on what they had learned before.⁸⁵ Learning continued to develop as new learning goals emerged from experiences in the workplace.^{22,40,51,52,60,93}

Preceptors also influenced the student–patient relationship. Entrustment of independent patient care to students enhanced their opportunities for independent practice, allowing them to develop more intensive student–patient relationships.⁸⁵ Preceptors facilitated ongoing student–patient relationships by scheduling patients on the day the student was present, taking students on inpatient hospital rounds, involving students in ongoing care for patients, or encouraging students to make home visits.^{48,78,80}

Potential threats to workplace-based learning in longitudinal rotations, like limited dedicated time available for teaching⁹¹ and the impact of students on clinical load, patient flow, and preceptor working hours and income,^{46,97–100} did not seem to differ from block rotation models.⁹⁷ A potential disadvantage of a longitudinal relationship with only one preceptor, as presented in one study, was insufficient teaching skills of the preceptor negatively influencing the longitudinal training experience of students.⁸⁵ Two studies found that students who collaborated intensively with only one preceptor over an extended period of time, with limited exposure to other practitioners, were faced with a less rich learning experience.^{95,101} Additionally, in another study, students wondered whether feedback and assessment might be biased by the intensive relationships they had developed with their preceptor. Although seldom reported, students valued the visits from faculty staff from their training institute for assessment purposes for this reason.²² The above mentioned concerns were, however, usually overcome, because students became part of the entire health care team during their longitudinal rotation,^{44,53,54,70,80,82,85,91} and they considered the other members of the health care team to be teachers as well.^{53,54}

3.2.3 | Longitudinal relationship with health care team

Small health care teams and the longer periods in one clinic,^{44,53,54,70,80,82,91} as well as a positive relationship between the student and the preceptor,^{85,91} allowed students to form mature relationships with other members of the health care team and thereby became a part of the team. Once included in the health care team, students were allowed to take on more responsibilities and more complex roles in providing independent patient care.^{44,82} Additionally, the supportive environment within the health care team stimulated students to take on the responsibilities and complex roles.^{44,82}

4 | DISCUSSION

Both UGME and PGME students in longitudinal training models are involved in authentic roles in providing patient care, more frequently than their block training model peers. They are intensively supervised by their preceptor and the health care team in order to gradually entrust them with the independent provision of patient care. They are more frequently allowed to provide patient care independently compared to their block model peers, and they also feel better prepared for independent practice at the end of their training programme. The longitudinal relationship between students and their preceptor and the health care team, respectively, allows for the gradual entrustment of independent patient care to students, based on the students' professional development.

Longitudinal rotation systems seem to make a strong contribution to the development of an 'educational alliance', in which preceptors and students work on student development together, using a mutual

understanding of performance standards, negotiated action plans and opportunities to work on feedback in practice.⁹⁹ An 'authentic and committed educational relationship' is a key aspect of the educational alliance.⁹⁹ This is also seen in longitudinal rotation models in which both students and preceptors note that their mutual relationship is stronger and more intense in comparison with block rotation models,^{22,40,44,48,50,52,53,59,79,88,89} allowing them to form a partnership in student learning.^{60,88,96} The strong and intense mutual relationship allows for the development of a safe learning environment.^{22,60} The safe learning environment is not only important for students to be able to show their strengths and weaknesses without compromising patient care¹⁴ but also for preceptors to provide their students with sincere and constructive feedback⁶⁰ and to safely entrust the patients to their students.^{20,103} The improved feedback due to the educational alliance, together with the sound overview of student development as a result of the ongoing cooperation between preceptors and their students, provide for learner-tailored learning experiences, specifically adapted to the needs of the student.

The strong and intense mutual relationship between students and their preceptor that arises as a result of their ongoing collaboration also allows preceptors to develop trust in their students.^{59,85} Preceptors have to trust their students in order to (gradually) entrust them with independent patient care.^{14,16,20,104–107} These findings support earlier research on the development of the trust relationship between preceptors and students, showing that the trust relationship develops more easily in a longitudinal training model compared with a block training model.¹⁴ Entrustment of patient care is not solely based on the opinion of the preceptor, as the health care team also plays a role in entrusting students with patient care.^{44,82} As a result of the longitudinal relationship between students and their preceptor,^{22,40,44,48,50,52,53,79,88,89} and students and the health care team,^{44,53,54,70,80,91} patient care can be gradually entrusted to students, based on their professional development.^{44,59,82,85}

The health care team also plays an important role in student learning and development. In longitudinal rotation systems, students work with a health care team for a longer period of time, which enhances the inclusion of students in the health care team.^{44,53,54,70,80,82,91} Being part of the health care team allows students to take on increasingly complex roles in the provision of patient care.^{44,82} However, the relationship between preceptors and students also plays a significant role in this process, because students have to be supported by their preceptor in order to participate in the health care team.^{85,91,108} Lave and Wenger also state that participation within a health care team allows students to participate in all aspects of health care provision, not only providing individual patient care but also providing care as a health care team, therefore making an important contribution to the professional development of students.^{105,106} This has also been recognised by students and preceptors in longitudinal models,^{22,46,51,52,55,72,75} creating awareness among students about their future role as a physician,⁵⁵ and thereby providing an extra dimension to the professional development of students and their preparation for independent practice.

The inclusion of the student in the health care team provides additional perspectives for student feedback, assessment and learning. Health care team members can provide additional information for the feedback and assessment of students, by means of multisource feedback from all members of the health care team, leading to a broad assessment for trainees in all areas, that even goes beyond the content of the medical profession.¹⁰⁷ As students also consider other members of the health care team to be their teachers,^{53,54} these health care team members can provide students with additional and more diverse learning opportunities and role modelling.^{95,109} As a result, the professional development of students may be further stimulated.

4.1 | Limitations

A major limitation within this systematic review is the lack of definition for longitudinal training models, which has been recognised previously by Thistlethwaite et al.²⁷ Even though Worley et al.²⁵ provided a typology of longitudinal integrated clerkships, there are multiple formats for longitudinal training models in use,^{24–29} and the duration of placement ranged from a few weeks^{50,62,79,85,86} to several years.^{41,42,45,49,74,77,89,93,111} Although we acknowledge the positive impact of longitudinal training models on students' opportunities to work independently, we cannot tell which format or duration is most appropriate in achieving these goals. This also holds true for the fact that many studies were conducted in a rural area, so it is not possible to say whether the results relate to the longitudinal training model or to the rural environment. Future research could benefit from identifying which formats, context and/or duration of longitudinal training models best prepare students in UGME and PGME programmes for independently providing safe and high-quality health care. In fact, it may be well that a uniform format for longitudinal rotations is not useful due to the wide variation in health care context around the world, so that variation in the design of longitudinal rotations is needed to provide students with the best possible experience, tailored to the local health care setting. Currently, the Consortium of Longitudinal Integrated Clerkships (CLIC, clicmeded.com) provides an overview of available literature relevant for longitudinal rotations and help when planning on using longitudinal rotations.

Another limitation extends to medical education research in general, as the literature search was hampered by the lack of definition and the poor coding of medical education-related papers within databases. As a result, in shaping the search strategy, we were forced to use broad search terms to find all relevant articles, resulting in an extensive list of search results.

Furthermore, there is a risk of outcome reporting bias and publication bias. Positive results of medical education interventions are more likely to be shared and published than studies that report negative or non-significant results,¹¹² which may result in an overly positive perception of longitudinal training models.⁸⁷ As trial registers or prepublished protocols are generally not available for these types of

studies, we were unable to rule out a reporting bias or publication bias within this systematic review, even though we specifically searched for neutral or negative outcomes or aspects of longitudinal training models. Although we cannot rule out a certain amount of bias within this systematic review, our aim was to present the results as transparently as possible by reporting the methods and results according to the PRISMA standards of quality.³¹

At last, the quality of the reported studies was highly variable, with studies scoring either very high or very low on the QATSDD. In total, 26 of the included 68 studies had QATSDD scores of half or less than half of the maximum QATSDD scores. Despite the varying quality, we chose to include all studies in our systematic review in order to be able to provide the most complete picture possible on the influence of longitudinal rotation models on opportunities for independent practice for students, and not risking the chance of losing any relevant information. Future research could help to further improve the quality of evidence on longitudinal training models.

5 | CONCLUSION

We have strong indications that longitudinal rotation models make an important contribution to the opportunities for students in both UGME and PGME programmes to participate in authentic roles in providing patient care, and being allowed to provide patient care independently. As a result, students are better prepared for their future careers as independently functioning physicians who are able to deliver high-quality patient care. The longitudinal relationship between students and their patients, their preceptor(s) and the health care team are factors that contribute specifically to the opportunities of independent practice for students. Due to the ongoing collaboration between students and their preceptor, they develop an intensive and supportive mutual relationship, allowing for the development of a safe learning environment and safe patient care. Because of the safe learning environment, the professional development of students is fostered, and they are gradually entrusted with independent patient care, based on their professional development. The longitudinal relationship with the health care team allows for the inclusion of students in the health care team, resulting in students participating in all aspects of patient care. Additionally, the health care team can make an important contribution to the professional development of students. Once students are entrusted to provide patient care, they are able to develop longitudinal relationships with their patients, which further stimulates the professional development of the student and allows for further entrustment of patient care.

ACKNOWLEDGEMENTS

This publication was written as a part of the project 'The use of Entrustable Professional Activities in Assessment in General Practice Specialty Training' (project number 839130004), that has received fundings from the 'Netherlands Organisation for Health Research and Development' (ZonMW).

CONFLICT OF INTEREST

To the best of our knowledge, no conflicts of interest, financial or other, exists.

AUTHOR CONTRIBUTION

L.H.A. Bonnie Contributions to the conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content and approval of the version to be published. G.R. Cremers Contributions to the acquisition of data, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content and approval of the version to be published. M. Nasori Contributions to the conception and design of the study, acquisition of data, drafting the article and revising it critically for important intellectual content and approval of the version to be published. Prof. Dr. A.W.M. Kramer Contributions to the conception and design of the study, drafting the article and revising it critically for important intellectual content and approval of the version to be published. Prof. Dr. N. van Dijk Contributions to the conception and design of the study, acquisition of data, drafting the article and revising it critically for important intellectual content and approval of the version to be published.

FUNDING

None.

ETHICAL APPROVAL

Since this study was a literature review, we did not obtain ethical approval for this study.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

How to cite this article: Bonnie LHA, Cremers GR, Nasori M, Kramer AWM, van Dijk N. Longitudinal training models for entrusting students with independent patient care?: A systematic review. *Med Educ*. 2022;56(2):159-169. doi: 10.1111/medu.14607

APPENDIX A: FULL SEARCH STRATEGIES FOR PUBMED/MEDLINE, ERIC AND EMBASE

Search strategy used in PubMed/MEDLINE on May 15th 2020

	Search terms	No. of articles
#1	Education, Medical[MeSH] OR Education, Medical, Graduate[MeSH] OR Education, Medical, Undergraduate[MeSH]	164,031
#2	Internship and Residency[MeSH] OR Clinical Clerkship[MeSH] OR Curriculum [MeSH]	127,856
#3	Students, Medical[MeSH] OR Clerk[tiab] OR Clerks[tiab]	34,846

Search strategy used in PubMed/MEDLINE on May 15th 2020

	Search terms	No. of articles
#4	Intern[tiab] OR Interns[tiab] OR Resident [tiab] OR Residents[tiab] OR Trainee[tiab] OR Trainees[tiab]	176,190
#5	#3 OR #4	207,219
#6	#1 OR #2 OR #5	371,354
#7	Longitudinal[tiab] OR Continuity[tiab]	277,785
#8	#6 AND #7	7193

Search strategy used in ERIC (OVID) on May 15th 2020 (ERIC 1965 to March 2020)

	Search terms	No. of articles
#1	(Medical education OR undergraduate medical education OR postgraduate medical education OR graduate medical education).ti,ab,id.	2716
#2	(Internship* OR Clerkship* OR Curriculum).ti,ab,id.	146,655
#3	(Medical student* OR Clerk OR Clerks).ti,ab,id.	4011
#4	(Intern OR Interns OR Resident OR Residents OR Trainee OR Trainees).ti,ab,id.	20,935
#5	#3 OR #4	24,613
#6	#1 OR #2 OR #5	169,228
#7	(Longitudinal OR Continuity).ti,ab,id.	32,007
#8	#6 AND #7	2482

Search strategy used in EMBASE (OVID) on May 15th 2020

	Search terms	No. of articles
#1	(Medical education OR undergraduate medical education OR postgraduate medical education OR graduate medical education).ti,ab,kw.	54,638
#2	(Internship* OR Clerkship* OR Curriculum).ti,ab,kw.	66,567
#3	(Medical student* OR Clerk OR Clerks).ti,ab,kw.	55,670
#4	(Intern OR Interns OR Resident OR Residents OR Trainee OR Trainees).ti,ab,kw.	244,378
#5	#3 OR #4	289,551
#6	#1 OR #2 OR #5	363,556
#7	(Longitudinal OR Continuity).ti,ab,kw.	387,458
#8	#6 AND #7	9954