

Academic Outcomes and Implementation Details of Distance and In-Person Peer Mentoring Programs in Pre-Clinical Undergraduate Medical Settings: A Systematized Review

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ABSTRACT

Background: Peer mentoring may have a crucial role in the early years of medical school in terms of academic success. The aim of the current research is to review studies that have investigated the role of peer mentoring in the academic performance of undergraduate preclinical medical students.

Methods: An online search using related keywords (peer mentor as its variations with medical students and its variations) in SCOPUS, OVID, Eric, Embase, PubMed, and Web of Science with no time limit consideration was conducted on 2021/07/07. After eliminating duplicates from retrieved records, the titles and abstracts of the remaining articles were studied, and irrelevant articles were removed based on the predetermined inclusion criteria (mentees from undergraduate medical students in the preclinical phase and reporting academic performance as the outcome of the peer mentoring).

Results: Of 294 retrieved records, seven articles remained after the screening and selecting process. Two more articles were also added through hand searching, and nine papers were included in the final analysis. The selected articles were published from 2007 to 2019. Eight articles applied post-only design, and one article used an ex-post facto method. Studies implemented different kinds of peer mentoring models. In most studies, the supportive role of mentors was highlighted. Three studies reported electronic tools for mentoring interactions. Studies reported improvement in mentees' academic performance in terms of academic success indicators as well as participants' perceptions about the effectiveness of the program. The overall quality of most articles was low to moderate.

Conclusions: The results indicated that there is an improvement in students' academic performance after participating in peer mentoring programs based on both subjective and objective outcome measures. The results have implications for virtual teaching in the context that there is limited faculty time and probably less motivation for mentoring activities.

Keywords: Peer mentoring; Medical students; Systematized review; Academic performance; Preclinical phase

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Introduction

Entering medical school and completing the undergraduate program can be challenging. Even students with pre-university academic success may experience academic and personal challenges and may struggle during the early stages of an undergraduate medical program (1). Students' academic failure is recognized by criteria such as frequent absence from classes, dropout, repeating grades, and a decrease in the quality of learners' education (2). The highest rates of attrition have been reported during the preclinical phase of medical studies (3).

The preclinical phase is generally considered as a time period in undergraduate medical education from the start of the program to the beginning of the clinical phase. During this phase, topics related to normal as well as abnormal structures and functions of the human body are covered. This phase has several features that predispose it to high rates of attrition. First, medical students are abruptly faced with an increased volume of information, time pressure, and more stress as the major transition issue (4). Second, during this phase, students are mainly taught basic sciences that may be considered redundant and irrelevant by medical students (5, 6). Finally, the preclinical curriculum utilizes mostly didactic lectures with practical-oriented training (7). Although it has witnessed transition from didactic, lecture-based classroom teaching to interactive sessions such as team-based learning and flipped lectures, as well as implementation of horizontal and vertical integration, and early clinical exposure in recent decades (8), the transition was slow and the innovations were not firmly established (9). All these issues may reduce medical students' motivation and satisfaction and affect their professional identity development and eventually influence their academic performance (10).

Another concern for the preclinical phase is that students who struggle during the early phase of medical school are also more likely to be at risk during their clinical phase. It has been shown that the only significant predictor

of medical students' clinical performance was their preclinical grade point average (GPA) (11). Apart from the preclinical phase, academic failure has severe costs in terms of time and resources for students, families, medical professionals and educators, patients, and society, which makes it a prioritized topic for further investigation (12).

Interventions such as mentoring might help address academic performance improvement in medical school (13, 14). Mentoring programs may be offered before or during studies in medical school and delivered by faculty peers or both of them (15). One of the most identified mentoring approaches in medical education is the peer mentoring program (16). There is not a precise definition of peer mentoring, but it could be assumed as a relationship between students who help each other to improve their overall university competencies (17, 18). There is an increasing interest in the use of all kinds of peer mentoring for medical students because of its cost-effectiveness in terms of saving the faculty time and its benefits to both mentees and peer mentors. Steinberg (19) pointed out that the initial goals pursued by medical schools in North America in the implementation of peer mentoring are to improve the practical knowledge of the students and provide social support.

Given the potential advantages of peer mentoring in undergraduate medical programs and the increasing number of studies that report implementing these interventions, there is a need to study the outcomes and implementation details of these interventions systematically to direct the design and implementation process. In a 2018 systematic review, authors looked into all the outcomes of near-peer mentoring, in which second-year medical students mentored first-year medical students. They included five studies in their review and reported three outcomes for mentoring, consisting of "professional and personal improvement, stress decrease, and ease of transitioning." They found that the quality of the evaluation methods of the programs was low to moderate (20).

This review was only focused on first-year medical students and reported studies that used second-year students as mentors for first-year students as mentees. Although the first year is a critical year for medical students in terms of transition issues (21), the preclinical phase seems like a big challenge for those students for the sake of its specific characteristics. Furthermore, albeit near-peer has been demonstrated to be beneficial to medical students, preclinical students may take more advantage of clinical mentors in terms of increasing motivation and interest in studying as they understand the relevance and importance of basic science topics. Given the potential benefits of peer mentoring during the pre-clinical phase of medical school, the current study intended to collect, combine, and interpret the best evidence regarding peer mentoring implementation details and outcomes in terms of academic performance of medical students during this pre-clinical phase. The results of this study can guide medical teachers and educators to design and implement such cost-benefit mentoring programs for improving students' academic performance.

Methods

The current study is a systematized review. In these types of reviews, researchers try to use elements of systematic reviews as much as possible, but it cannot be claimed that a complete systematic review has been conducted. What has been identified, methodological limitations, and uncertainty about the results in reviewed studies are discussed and investigated in systematized reviews (22).

Study selection flow was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (23). Firstly, the research questions were formulated based on SPICES, which is one of the research question formats used in the review studies in the health service field. The SPICE letters stand for Setting, Perspective, Intervention, Comparison, and Evaluation, respectively.

All of these components are not necessarily applicable for all studies (24). For instance, educational interventions usually lack comparison groups due to the limitations. Thus, the C component is generally removed from the SPICE. Accordingly, the research question was formulated as follows: What is the role of peer mentoring (intervention) in the academic performance (evaluation) of medical students (perspective) and its implementation details in the preclinical phase (setting)?

Inclusion and Exclusion Criteria

Based on the formulated question, inclusion criteria were identified as the following: recruiting peer mentors among undergraduate and postgraduate medical learners without any limitations in the academic year; selecting mentees from undergraduate medical students in the preclinical phase; and finally, reporting academic performance as the outcome of the peer mentoring. Hence, those studies that have utilized peer teaching or recruited mentees from the postgraduate or clinical phases of undergraduate medical programs were excluded from the study. Based on the research question and inclusion criteria, all types of reviews, studies with mentees in clinical phase or postgraduate medical students, and studies where peer mentors only had a teaching role were removed from the search results. The review studies were removed from the results responding to the research question to have interventions that reported the peer mentoring program and its academic outcomes.

Search Strategy

SCOPUS, OVID, Eric, Embase, PubMed, and the Web of Science are common and available data sources containing health professions education studies. Peer mentors (peer counsellor, peer support, and peer advisor as variations) and medical students (undergraduate medical students as variations) and their combinations of two main concepts were searched (See Table 1 and also [Appendix 1](#)). These key words were

Table 1: Keywords and their variations to search the databases

Concept numbers	Keyword	Keyword variation(s)
1	Peer mentor*	OR peer counselor* OR peer support* OR peer advisor*
2	Medical student*	OR undergraduate medical student*

selected based on the previous related research and the expertise of the authors in the context of mentoring. Databases were searched in the English language. No time limitation was considered to retrieve more studies. The search process took place on May 16, 2020. Searching was first done with high sensitivity and then in a specific form; broad searching with minimum limitations was performed first to estimate the extent of the literature, and then a search string was provided with more specific keywords, operators, and filters dedicated to each database.

Study Selection Process

Repeated articles were removed (n=158) and then the titles and abstracts of 136 remaining articles were studied, considering inclusion criteria. The full text of the remaining articles from the previous phase (n=19) was studied, and unrelated articles were removed. Eventually, nine studies were entered for final analysis. The study selection process was performed by ZZ and then checked by RG.

Quality Assessment of the Studies

The rest of the articles were critically appraised based on QUESTS criteria. QUESTS refers to criteria that Harden et al. (2000) introduced to identify the best evidence-based medical education. It includes quality, utility, extent, strength, target, and setting. The quality of the evidence was investigated regarding three dimensions of design, implementation, and data analysis; each dimension was given a score from 1 to 5, based on the extent to which researchers agree on the appropriateness of each dimension (1. absolutely disagree to 5. absolutely agree). The utility of evidence (to what extent can the method be transferred and adopted without modification) was identified based on a 4-point Likert scale. The

range of evidence was evaluated along two dimensions: study type and data collection tool(s) (25). To explore the strength of studies, the scale offered by Ahmadi Kia and Shirazi (26) was utilized through a 4-point Likert scale as follows: 1. There was no discernible point/it was not statistically significant. 2. The findings are ambiguous, but it seems that there is a procedure to follow. 3. Maybe the discussion and conclusion parts can be based on the findings. 4. The findings are clear, and it is mostly possible that they are correct.

Krickpatrick's four-level model (1: reaction, 2: learning, 3: behavior, 4: results) was also used to investigate the target level (27). Finally, the results were analyzed and interpreted.

Data Extraction

Implementation details of programs have been described considering the peer mentoring model, platforms of implementation, and the duties of mentors. The types of peer mentoring models were analyzed based on the classification of Andrew et al.: "pre-entry peer mentoring, one-to-one peer mentoring at transition, one-to-group peer mentoring at transition, one-to-one longer-term peer mentoring, one-to-group longer-term peer mentoring, partnership-led peer mentoring, and group peer mentoring" (18). Platforms of implementation were described in two categories: in-person and distance. The duties of mentors were also examined in terms of their supportive and/or teaching roles.

The academic outcomes of participants were described based on the objectivity of reported outcomes. Academic performance indicators such as course grade, GPA, pass/fail rate, and exam results were assumed as objective academic outcomes, while self-reported academic performance was considered subjective academic outcomes.

Results

Initially, 294 records were retrieved from the electronic search of various databases. After removing duplications, 136 articles remained. Through title and abstract screening, 19 articles fulfilled the inclusion criteria. Nine studies entered the analysis phase after reading the articles' full text and hand searching. The selection process has been shown in Figure 1.

The highest frequency of the final articles was related to the SCOPUS database (30%), PubMed (20%), and ERIC and WOS databases, each accounting for 10% of the

selected articles. Twenty percent of the articles were included in the study by hand searching of retrieved articles' references and also in relevant journals. Selected articles published between 2007 and 2019. Eight studies utilized post-only design, and one article used ex-post facto methodology. Most of the studies used questionnaires as a tool to assess participants' perceptions of the academic performance of mentees. Two articles had good quality, and the rest had moderate to poor quality. The details of the critical appraisal of articles based on QUESTS and the studies' descriptions and results have been presented in Table 2.

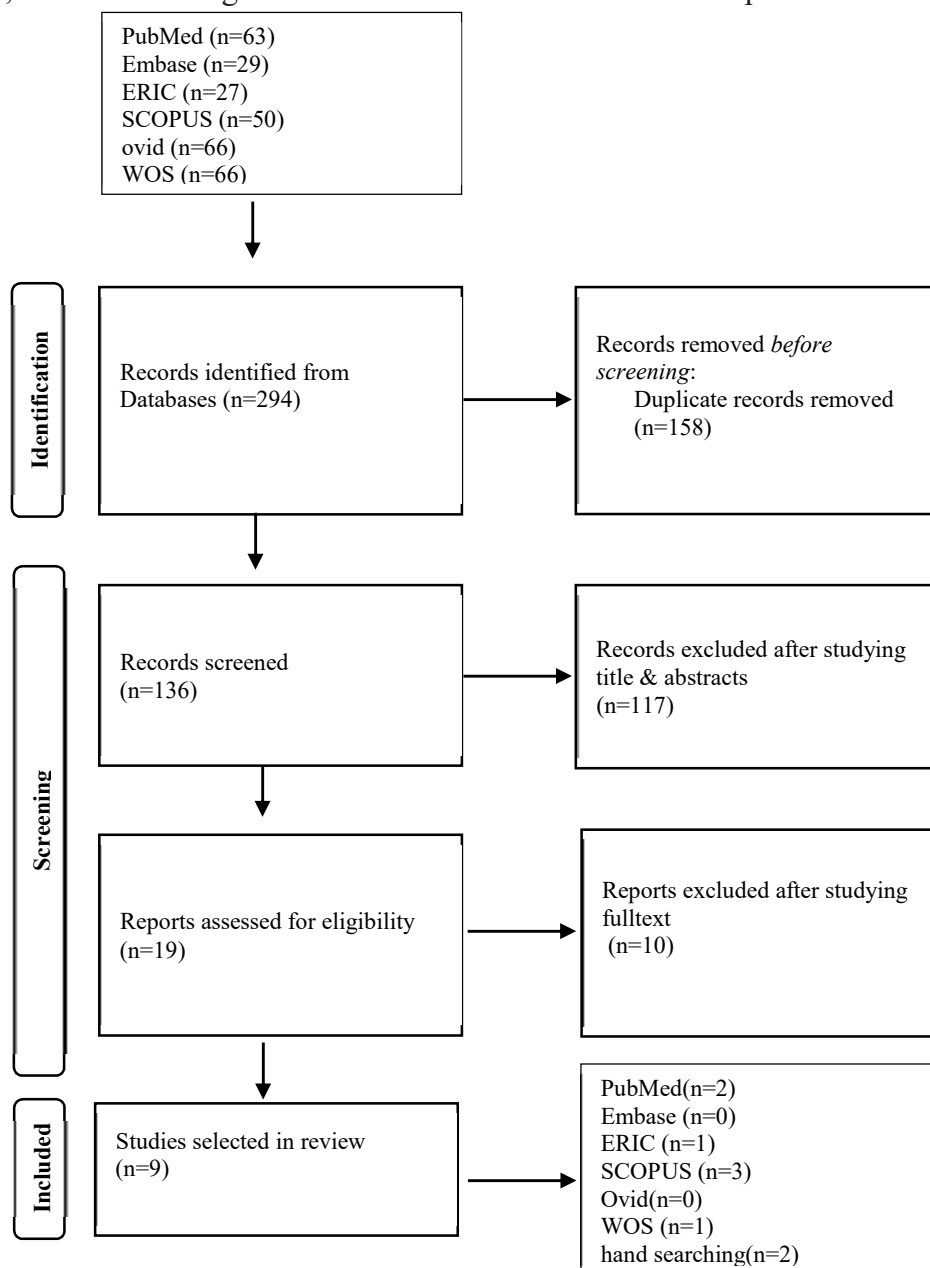


Figure 1: Search and study selection flow based on PRISMA (23)

Table2 : QUESTS results

Num- bers	Author(s)	Database	Country/ Year	Setting/ Aim of study	Target	Extent		Strength		Quality (1 to 5)		Utility (1 to 4)
						Study design	Instrument(s)	(1 to 4)	De- sign	Imple- ment	Anal- ysis	
1	Benedict J. Page, Ansie Loots & Don F. du Toit	Eric	South Africa 2007	Describing the six-year experience of Stellenbosch University in using a peer tutor/mentor	Academic status (dropout -pass/fail)	2	Document review	2	3	3	3	3
2	Muhamad Saiful Bahri Yusoff et al.	WOS	Malaysia 2010	Assessing the perception and attitude of medical students in the first and second years towards the group peer mentoring program	Students' perception	3	Questionnaire	3	3	4	5	4
3	Satendra Singh et al.	Pubmed	India 2014	Evaluation of a peer mentoring program consisting of faculty and peer mentors for first-year medical students	Participants' Perception (Faculties, mentors, mentees)	2	questionnaire	2	3	3	3	4
4*	Bahaa Aba Alkhalil	Hand searching	Saudi Arabia 2015	Determining the model of peer mentoring program activities (two groups: peer mentoring group and peer mentoring with clinical teaching group)	Students' perception learning	4	Multiple-choice test at the end of the course + logbook, questionnaire, interview, and focus group	4	5	5	5	4

Num- bers	Author(s)	Database	Country/ Year	Setting/ Aim of study	Target	Extent		Quality (1 to 5)		Utility (1 to 4)	
						Study design	Instrument(s)	Strength (1 to 4)	De- sign ment ysis		
5	Daniel Huhn et al.	Hand searching	Germany 2015	1. Determining the model of peer mentoring program activities (two groups: peer mentoring group and peer mentoring with clinical teaching group) 2. A comparison of the effects of program activities on students' grades 3. Determining the perception of mentees	Students' perception 1	Posttest only (qualitative & quantitative data)	Questionnaire and semi structured interview	2	3	3	4
6	Eric J Tanenbaum et al.	Scopus	2016	Determining the perception of mentees	Students' perception and USMLE grade (learning) 1,2	Posttest only	Questionnaire	3	3	4	4
7*	Parya Abdolalizadeh et al.	Scopus	Iran 2017	Investigating the usefulness of peer mentoring programs for exam preparation in first-year international medical students	Participants' perception (mentees, mentors) 1	Posttest only (qualitative data)	Focus group	4	5	5	4

Num- bers	Author(s)	Database	Country/	Setting	Target	Extent		Strength (1 to 4)	Quality (1 to 5)		Utility (1 to 4)
						Instrument(s)	Study design		De- sign	Imple- ment ysis	
8	Sean E. Scott et al.	Scopus	USA	2018	Investigating students' perception and their study habits that are related to USMLE-step1 success	Students' perception	Questionnaire	2	3	3	4
9	Samuel J. Altonji et al.	PubMed	USA	2019	Discovering the perception of peer mentors and mentees at Tehran University of Medical Sciences from the dual peer mentoring program	Students' perception and satisfaction	Questionnaire	3	2	3	4

* Good quality study

In the following, each of the nine articles was analyzed based on the types of peer mentoring models, the duties of peer mentors, and the expected outcomes regarding academic performance.

Peer Mentoring Model

Studies have described and administered different kinds of peer mentoring models. Singh et al. (28) used the cascade model of peer mentoring. This model considers several levels of mentors for students. Generally, one faculty member is considered the supervisor of one or more higher-level peer mentors. In some cases, lower-level mentors are also present, and their activities are supervised by higher-level peer mentors. Abdolalizadeh et al. utilized dual peer mentoring, in which two or more peer mentors are responsible for counselling a group of students. In group peer mentoring, a group of students help each other with various psychological, social, and educational issues (29). The rest of the articles are used one by one or in small groups for peer mentoring. In these models, only one mentor gets the responsibility of providing counselling to a student or group of students. In addition, the mentoring platforms in all studies were in-person, and in three of them (28, 30, 31), virtual and electronic tools such as websites, email, mobile apps, and telephone were also available for mentoring interactions.

The Duties of Peer Mentors

In most studies, the supportive role of mentors was more highlighted. (28, 29, 32-36) In 2 studies (30, 31), peer mentors were involved in teaching activities in addition to their supportive role.

Academic Outcomes

Included studies reported academic performance outcomes at different levels (Table 3). All studies pointed to the improvement of medical students' academic performance after implementing a peer mentoring program. Performance was investigated using academic success

Table 3: Summary of findings

Num- bers	Title/ Author(S)/ Date	Summary of related findings
1	"Perspectives on a South African tutor/mentor program: The Stellenbosch University experience" Page et al. 2007	Negative indicators such as failing and dropping out have declined since the mentoring program, of which peer mentoring has been a part and have been replaced by positive indicators such as passing.
2	"Evaluation of medical students' perception towards the BigSib Programme in the School of Medical Sciences, USM" Yusoff et al. 2010	46.2% of students believed that this program helped them in their studies. More than 50% of students believed that this program had been effective in improving their soft skills and professional skills. 45.9% of students believed that this program was successful.
3	"Near-peer mentoring to complement faculty mentoring of first-year medical students in India" Singh et al. 2014	Of 74 mentees, in response to the open-ended question "benefits of peer mentoring?", 74 believed that the program helped their education. 65.88% of the mentees thought that this program was useful.
4	"Near-peer-assisted learning (NPAL) in undergraduate medical students and their perception of having medical interns as their near peer teacher" Aba Alkhail. 2015	The end-of-course grades of students who had peer mentoring with clinical teaching were significantly higher than the grades of students whose mentors had only a counseling role (not significant). More than half of the students were satisfied with the mentoring and clinical teaching program of the interns and acknowledged that this program had been useful in improving their knowledge and skills.
5	"Voluntary peer-led exam preparation course for international first year students: Tutees' perceptions" Huhn. et al. 2015	In general, first-year international medical students believed that the peer mentoring program was helpful in preparing them for the exams.
6	"An Effective Evidence-Based Student Run Near-Peer Support Group for the USMLE Step 1 Exam" Eric J Tanenbaum1et al. 2016	64.3 of the students believed that the program helped them select the appropriate material for studying. 53.4 of the respondents agreed the program helped them organize their preparation for the USMLE-step 1. Improved students' USMLE-step1 grades compared to previous years.
7	"Dual peer mentoring program for undergraduate medical students: exploring the perceptions of mentors and mentees" Abdolzadeh. 2017	Main categories: "Mentees' support" and "mentoring as a program" and "mentors' development." "Mentees' support" themes: positive relationship, academic support, and psychosocial support. Most mentees believed that peer mentors, by enhancing their awareness of different study methods, would guide them in choosing the appropriate study method and lead to better performance on their tests.
8	"The Rising Physicians Program: A Novel Approach for Mentoring Medical Students" Sean E. Scott et al. 2018	8 students said it was very useful; 7 students said it was useful; one said it was not useful at all; and 10 students were neutral about the effectiveness of peer mentoring on their academic performance.
9	"Perceived Benefits of a Peer Mentoring Program for First-Year Medical Students" Samuel J. Altonji et al. 2019	The students' agreement with the academic benefits of the program was 2.96 and 2.65 (studying more effectively and performing on examinations better, respectively).

indicators as well as mentees' perceptions. Tanenbaum et al. (36) used the USMLE-step 1 test score as an indicator of academic performance, whereas Page et al. (32) and Yusoff et al. (31) used students' pass/fail rate and GPA as objective academic outcome measures. Other studies only reported subjective academic performance measures, students' attitudes toward improving study skills, exam performance, and personal development.

Discussion

This research was a systematized review study with the aim of collecting the best evidence regarding the role of peer mentoring in undergraduate medical students' academic performance. We conducted a systematic electronic search based on the considered keywords. Finally, nine articles met all the inclusion criteria and were analyzed. Based on QUESTS criteria, quality evaluation of obtained articles revealed that three articles had good quality and the others had moderate to weak quality.

Retrieved studies described and administered different types of peer mentoring programs. Budge (2006) stated that the best peer mentoring model is the one that matches the purposes of the program, resources, and context of the study (37). Despite the existence of differences in peer mentoring models (18), none of the studies have compared the effectiveness of different models. More studies need to be conducted to compare the various models of peer mentoring programs for medical students.

Three studies reported virtual platforms and electronic tools such as websites, email, mobile apps, and telephones for further mentoring interactions. This finding highlights that peer mentoring can be used in distance education settings to purposefully provide a context for students to interact more with each other. Also, in distance education, these strategies could be as effective as face-to-face methods for students' academic and mental support (38).

In most studies, the supportive role of

mentors was more highlighted. Peer mentors can have three main functions: mental and emotional support, professional development, and role modelling (18). The earlier definition of peer mentoring refers to the hierarchal nature of mentoring, which considers the peer mentor as the one with better performance and higher educational years than mentees. However, new definitions highlighted the helping nature of mentors and considered that the mentor and mentee can be at the same level.

What is important here is the difference between peer mentoring and peer teaching. Most of the articles that were removed from this review included those in which the peer only had the role of teaching. Thus, it is suggested to consider clear responsibilities for peer mentors and pay attention to the main concept of "mentor," including the helping nature of their role in the studies of this field.

The results of the investigated studies indicate that there is an improvement in students' academic performance after participating in peer mentoring programs. This finding is consistent with the Pethrick et al. study results, which conducted a systematic review on peer mentoring programs in a medical residency context and reported participants' academic improvement in studies that evaluated the academic outcomes of peer mentoring programs (39). This result shows that struggling students in particular can benefit from peer mentoring programs to relieve their academic failure.

The results of most reviewed studies were limited to reporting the self-perceptions of mentees regarding their academic performance. There were only three articles that evaluated the academic outcomes using objective indicators such as pass/fail rate and course grade (35-37). Future studies are needed to focus on more rigorous outcome measures in order to support the subjective measures of academic outcome.

This review has limitations. Despite the existence of various studies in the peer mentoring field, the number of firm and quality studies is really low because these programs have been mostly performed

in developing designs and suffer from inappropriate educational design or experimental methodology. Therefore, the result of this review should be interpreted with caution.

Conclusion

Reviewed studies presented various models of peer mentoring, mostly with in-person interaction between mentors and mentees. The results of this study, which were obtained using the best evidence, showed that peer mentoring improved the academic performance of medical students using self-reported and objective measures of academic performance. The results have implications for distance learning as well as in-person education so that students can learn mutually from each other in the context that there is limited faculty time and probably less motivation for mentoring activities.

Ethical Considerations

This study was approved by the Research Ethics Committee of the Tehran University of Medical Sciences, Tehran, Iran. Approval ID: IR.TUMS.MEDICINE.REC.1398.377.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author on request.

Authors' Contributions

ZZ contributed to the study design, retrieving articles, analysis and interpretation of data and drafting of the manuscript. RG contributed to the study design, checked the search strategy and retrieving process, participated in the analysis and interpretation of data and drafting the manuscript. Both authors (ZZ, RG) approved the final paper for submission.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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