



## Factors related to academic failure in preclinical medical education: A systematic review

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### Abstract

**Introduction:** Identifying the learners' problems early enough and providing advice from the beginning is definitely an important investment in the training and progress of future practitioners. The current review aimed at examining factors related to academic failure of the preclinical medical students.

**Methods:** The study was carried out as a systematic search of publications in the following databases published from January 1987 to January 2018: PubMed, Web of Knowledge, Educational Resources, Information Center and Scopus. No language limitation was set for searching the resources. As a comprehensive search, the following keywords were used for the abstract, title and keyword sections: academic performance, academic failure, academic achievement, drop out, academic engagement, learning disorder, medical student, struggle student and problem learner. A valid tool (STROBE) was used to determine the quality of the articles.

**Results:** Most articles discussed personal causes, 7 discussed learning style, 7 discussed personality traits, 6 discussed motivational strategies and self-efficacy, 4 discussed quality of sleep, 4 discussed the effect of stress, 9 discussed demographic factors, 3 discussed physical activity, 1 discussed coping strategies, 2 discussed class attendance and 4 discussed study strategy. Twenty-five articles described instructional design cause, 3 described teaching strategies, 2 described course assessments, 1 described the course structure, 3 described critical thinking, 3 described blended learning, 13 described predictive courses, 14 described admission tests, 1 described the learning environment, 2 described curriculum planning and 3 described the pre-matriculation program.

**Conclusion:** Medical teachers often do not know which students are problem learners or what causes academic failure. The goal of this systematic review was to determine the origin of problems in learning to identify problem learners. The results indicates that managers, policymakers, instructors and counselors can monitor student academic achievement by careful planning of instructional design, attention to an educational environment, use of active teaching methods, continuous assessment of students and consideration of personal factors.

**Keywords:** Academic failure, Medical student, Medical education

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## Introduction

Medical teachers often work with students who have problems. Some of these students have knowledge deficits while others have attitude or behavioral problems (1). Sometimes, it is hard to understand if a learner is presenting with a problem. Distinguishing learner issues early and giving guidance from the beginning is an essential investment in the training and growth of potential practitioners. It will also help clinical educators, program directors and faculty developers (2).

The National Board of Internal Medicine (1999) has described the problem student as a trainee who reveals substantial problems that need the treatment of a program director or senior resident. Van, *et al.* (1998) describes a problem student as one with affective, cognitive, structural, and interpersonal problems (3). Therefore, the problem student is a learner who does not meet the objectives of the training program due to a substantial problem with knowledge, attitude or skill (4).

Studies revealing on the prevalence of problem students are limited (5, 6). The rates vary from 5.8% around a 4-year period in a psychiatry program (6) to 9.1% around a 25-year period in a family medicine program (7). The absolute problems determined by educators were inefficient medical knowledge (48%), bad clinical judgment (44%) and inadequate use of time (44%) (2). Another study provides insufficient knowledge, attitudinal problems, interpersonal conflict, psychological illness, family tension and material abuse (7).

It is hard to recognize a struggle student. Improved counseling and supervision might impose economic costs on the resources of both the program and the faculty. Some medical teachers are worried that a troublesome learner may have a negative effect on educational programs and classmates. Medical educators would like to be able to predict who will become a problem learner, but studies predict different factors (8).

The reasons underlying the continuous scientific investigation of this phenomenon are based on the complexity of the factors involved (1, 2). The different definitions of academic success and failure (2, 3) make systematic comparison of research results difficult. There is rarely one single reason that determines why a student will leave or stay in a program (8, 9). They seem to be the product of complex interactions between individual student factors and institutional and professional factors (1, 2). Unfortunately, studies on academic success or failure have not been

consistent with regard to the different factors (1, 9). To identify students at risk of academic failure, the factors associated with it must be identified. A comprehensive and systematic investment of the academic failure literature to date has not focused on the factors that affect problem learners.

The current study focused on preclinical dropouts because previous studies have revealed that half of all medical dropouts were first year dropouts and that the factors influencing first year dropouts differed from those for later dropouts (9, 10). By identifying the problem learner in the preclinical phase, academic failure can be prevented in the clinical phase, which is important for identifying and preventing the problem learner.

The complexity and implications of this issue can provide a pivotal approach with which managers, policymakers, instructors and counselors can monitor student academic failure. It is a priority to synthesize the evidence developed through high-quality studies to obtain useful information to reduce failure and promote success of medical students and to provide directions for future research. This systematic review describes the factors related to the problem learner in a preclinical medical career.

## Methods

The present systematic review intends to determine the causes of academic failure in preclinical medical students.

The databases from January 1987 to January 2018 were searched because the outset of this topic, i.e. problem learner, was in 1987 in PubMed, Web of Knowledge (Thomson Reuters), Educational Resources and Information Center (ERIC) and Scopus.

An expert in systematic reviews developed a comprehensive and systematic search strategy using keywords about problem learners and the unique functions associated with each database searched (medical subject headings [MeSH], truncation symbols and Boolean operators). The reference lists of included articles were reviewed to identify other articles meeting the inclusion criteria. The ontological search was for keywords related to the problem learner. Those chosen were: academic performance, academic failure, academic achievement, drop out, academic engagement, learning disorder, medical student, struggling student, problem learner (Table 1).

Two independent researchers applied the inclusion criteria (see: Study eligibility) to the database hits by first reviewing each study title and abstract. The full text of the study was subsequently reviewed if the study appeared to

**Table 1:** Search strategies for different databases

<p><b>Pubmed:</b> ("academic performance"[MeSH Terms] OR academic performance [Text Word] OR "academic performance" OR "performance, academic" OR "performance, academic" OR "academic test performance" OR "academic test performance" OR "performance, academic test" OR "test performance, academic" OR "academic test scores" OR "academic test score" OR "score, academic test" OR "test scores, academic" OR "educational test scores" OR "educational test score" OR "score, educational test" OR "scores, educational test" OR "test score, educational" OR "test scores, educational" OR "educational test performance" OR "educational test performances" OR "performance, educational test" OR "performances, educational test" OR "test performance, educational" OR "test performance, educational") OR ("academic failure" OR "failure, academic" OR "failure, academic" OR "academic failure"[MeSH Terms] OR academic failure [Text Word]) OR ("academic success" OR "success, academic" OR "success, academic" OR "academic achievement" OR "academic achievements" OR "achievement, academic" OR "achievements, academic" OR "academic success" [MeSH Terms] OR academic achievement [Text Word]) OR (drop out) OR (academic [All Fields] AND engagement [All Fields] OR "academic successes" OR "success, academic" OR "successes, academic" OR "academic achievement" OR "academic achievements" OR "achievement, academic" OR "achievements, academic") OR ("learning disorders"[MeSH Terms] OR learning disorder [Text Word]) AND ("students, medical" [MeSH Terms] OR medical student [Text Word] OR "medical students" OR "student, medical" OR "medical student" OR problem learner)</p> <p><b>Scopus:</b> (TITLE-ABS-KEY (academic AND performance)) OR (TITLE-ABS-KEY (academic AND performances)) OR (TITLE-ABS-KEY (academic AND test AND performance)) OR (TITLE-ABS-KEY (academic AND test AND performances)) OR (TITLE-ABS-KEY (performance AND academic AND test)) OR (TITLE-ABS-KEY (educational AND test AND score*)) OR (TITLE-ABS-KEY (educational AND test AND performance)) OR (TITLE-ABS-KEY (performances AND educational AND test)) OR (TITLE-ABS-KEY (test AND performance AND educational)) OR (TITLE-ABS-KEY (academic AND failures)) OR (TITLE-ABS-KEY (academic AND successes)) OR (TITLE-ABS-KEY (academic AND achievement)) OR (TITLE-ABS-KEY (academic AND success)) OR (TITLE-ABS-KEY (drop AND out)) OR (TITLE-ABS-KEY (academic AND engagement)) OR (TITLE-ABS-KEY (academic AND successes)) OR (TITLE-ABS-KEY (academic AND achievement)) OR (TITLE-ABS-KEY (learning AND disorder*)) OR (TITLE-ABS-KEY (academic AND performance)) OR (TITLE-ABS-KEY (educational AND development)) OR (TITLE-ABS-KEY (academic AND achievement)) AND (TITLE-ABS-KEY (medical AND student*)) OR (TITLE-ABS-KEY (problem AND learner)) OR (TITLE-ABS-KEY (medical AND college AND student)) OR (TITLE-ABS-KEY (medical AND undergraduate AND student))</p> <p><b>ISI:</b> (TS = (academic performance) OR TS = (academic failure) OR TS = (academic successes) OR TS = (academic achievement) OR TS = (academic engagement) OR TS = (drop out) OR TS = (learning disorder)) AND (TS = (medical student) OR TS = (problem learner))</p> <p><b>ERIC:</b> ((academic performance) OR (academic failure) OR (academic success) OR (academic achievement) OR (academic engagement) OR (drop out) OR (learning disorder)) AND ((medical student) OR (problem learner))</p>
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meet the selection criteria or if there was any doubt regarding eligibility. A third independent researcher resolved any disagreements. Hand searching was also carried out in the Medical Teacher and Medical Education journals. Reference lists of all papers meeting the quality criteria were reviewed to identify and select the relevant papers. The most prominent authors were contacted with a request for gray literature: conference proceedings, unpublished studies, internal reports, etc., and the data was included in the study.

The studies that met the inclusion criteria were selected. Table 2 shows the inclusion and exclusion criteria of the systematic review. A second generation search of the list of papers was performed by searching (reference lists of the included studies) and forward tracing (as cited by Scopus and Google Scholar). The corresponding authors were contacted for additional information or full-text requests.

### Quality assessment

The quality of the included studies was evaluated by two researchers using standardized critical appraisal tools using STROBE guidelines. STROBE was selected because most of the

studies were observational; hence, many elements of CONSORT did not apply and because the STROBE guidelines have been endorsed by over 100 journals (<http://www.strobe-statement.org>) (11-14).

Most articles (57 articles) were of high-quality (15-22) and 32 were of medium-quality (8-14). No low-quality papers were included. All the papers were compared using the following categories: title and abstract, introduction, methods, results, discussion, data collection methods, and other information. A total of 22 items were considered relevant: the article title and abstract (1 item), introduction (2 items), methods (8 items), results (5 items), discussion sections (4 items), and other information (1 item). Eighteen items were common to all three designs and four were design unique with various versions for all or selection of an item. For many items (asterisk), information was presented with independently for case and control groups in case-control studies, or exposed and unexposed groups in cohort and cross-sectional studies. The most commonly met indicators were analysis of the results and conclusions of data. On many occasions, the data collection method was not clear due to insufficient data, although the data gathering method was

**Table 2:** Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Population	Medical student	Other health promotion
Subject	Causes of failure undergraduate medical program	
Study design	Case study, cohort, cross-sectional	Secondary research
Language	No limitation	
Time	1987-2018	

reliable and valid for the research question and context (Table 3).

Disagreements were resolved by discussion with a third independent researcher. Scores were calculated using the appropriate tool. The researchers extracted the following data using a purpose-built, standardized data-extraction tool:

- Personal effective factors, learning style, demographic, personality trait, stress, quality of sleep, study strategies, self-efficacy, critical thinking, curriculum (teaching strategies, environment, admissions test)

- Type of study
- Definition of academic achievement
- Measurement method

Agreement between the researchers on the methodological quality of the studies was established as the percentage of agreement and the Kappa statistic. Frequency tables were used to summarize the study characteristics. The details of the causes leading to problem learning were summarized. Statistical integration of the data was not possible as there was no consistency in the areas of effective factors, designs employed or measures of effectiveness assessed. The synthesis of findings was integrated by narrative structured to address the objectives of the review.

## Results

### Summary of study characteristics

#### Number of studies

The search identified 6305 abstracts and 480 articles were selected for further review. The final review included 90 articles. The majority of articles [80] were identified from electronic databases and the balance [10] was identified

from reference lists. The articles were most likely on medical education and medical teachers (Figure 1).

#### Source of studies

The majority of studies [31] were carried out in Asia, followed by Europe [24] and the USA [24], Australia [7] and South Africa [4].

#### Type of design

The majority design in the articles was cross-sectional, following by cohort and case control (Table 4).

#### Aims of studies

The aim of the studies was to report on the causes of academic failure in preclinical medical courses (Table 4).

#### Definition of academic failure

Using the articles obtained in the data extraction phase, the definition of academic failure in Jiraporncharoen (2015) was less than 3 out of 5 [32], in Shantakumar (2017) was below 60% [97] and in Abdulghani (2012) was less than 3.75 out of 5 (14). Other articles defined it as failing to pass the test.

#### Causes of academic failure

Most articles referred to personal causes. Seven articles referred to learning style, seven to personality traits, six to motivational strategies and self-efficacy, four to quality of sleep, four to effect of stress, nine to demographic factors, three to physical activity, one to coping strategies, two to class attendance and four to

**Table 3:** Quality of studies included

Items on checklist	Details	Indicator met	Indicator not met
Title and abstract	Study design, providing the abstract with an informative and balanced summary	42	47
Introduction	Scientific background and rationale, specific objectives	44	45
Methods	Key elements of study design, setting, participants, variables, data sources/measurement*, bias, study size, quantitative variables, statistical methods	21	68
Results	Participants*, descriptive data*, outcome data*, main results, other analyses	52	37
Discussion	Key results, limitations, interpretation, generalizability	49	40
Other information	Funding	10	79

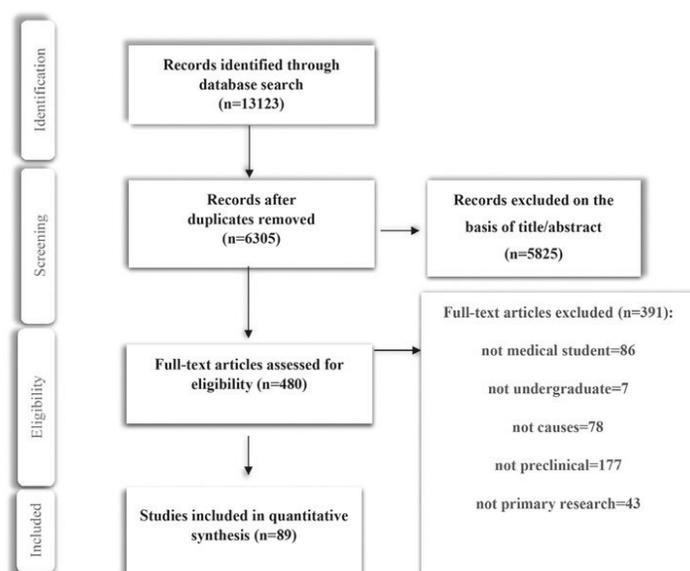


Figure 1: Study flowchart demonstrates the inclusion-exclusion process

**Table 4: Causes and design of articles**

Total number of articles and reference number(s)			R (Pearson)	
Type of design	Cross sectional (N=48)	9,10,13-58.		
	Cohort (N=25)	59-83		
	Case control (N=17)	84-99		
Causes of academic failure	Instructional design	Teaching strategies	68,90,99	
		In course assessment	87,89	
		Structure of course	96	
		Critical thinking	33,38,48	
		Blended learning	88,93,94	
		Predictive courses	9,10,18,24,27,49,59,62,64,65,73,79,85	Chemistry (r=0.35) Physics (r=0.19) Anatomy (r=0.66) Physiology (r=0.52) Biochemistry (r=0.65)
	Personal causes	Learning style	13,26,31,32,36,39,54	
		Personality trait	19,22,25,30,40,75,86	
		Motivation strategy	23,28,29,42,72,83	
		Self-efficacy	25,34,41,50,78,84	R=0.19
		Quality of sleep	14,15,17,97	
		Effect of stress	37,51,67,80	R=-0.3
		Demographic factors	18,20,66,69,70,71,82,83,92	
		Physical activity	44,53,76	
		Coping strategies	46	
Admission test	Class attendance	35,43		
	Study strategies	56,58,67,73	R=0.4	
	Learning environment	16,21,42,45,57,60,61,71,74,75,77,82,91,96		
	Curriculum planning	55		
	Pre-matriculation program	63,81		
		47,52,98		

study strategies (Table 2). Twenty-five articles described instructional design cause, three teaching strategies, two course assessment, one structure of course, three critical thinking, three blended learning, and 13 predictive courses (Table 2). Fourteen articles described admission tests, one learning environment, two curriculum planning and three pre-matriculation programs. A more detailed overview of the synthesis of the research evidence is provided below. The findings were synthesized into six categories and 17 subcategories.

### *Instructional design*

#### *Teaching strategies*

Koles (2010) found that TBL enhances mastery of course content. Students in the lowest academic quartile may benefit more than the highest quartile students from TBL strategy (68). Williams (2017) confirmed that academic performance improves with a self-directed teaching approach (99). Rashid-Doubell, *et al.* found that ARS (audience response system) did not improve academic performance in a preclinical course, but students reported that the use of clickers during lectures provided a more interactive learning environment, increased student participation, promoted active-learning and helped students identify gaps in knowledge (90). Three articles used quality assessment and the power of the evidence to indicate that the use of active strategies can prevent a problem learner.

#### *Course assessment*

Poljicanin (2009) found that daily quizzes were associated with better academic success in an anatomy course (87). Pratten (2014) also confirmed that short frequent objective-led summative assessments of individuals in a group context can effectively increase individual active engagement and improve academic achievement (89). Two articles were found in which the power of evidence showed that formative evaluation can prevent the problem learner.

#### *Structure of course*

Salopek (2009) found that the type of temporal delivery of a basic course in a medical curriculum is not a major determinant of student academic courses when delivered in alternating temporal blocks or when spread over the academic year (95). One article addressed this subject, which was not sufficient for comment and there was need for an original article.

#### *Critical thinking*

Joshi (2012) found a positive correlation

between emotional intelligence and academic performance in undergraduate medical students (33). Lee (2016) showed that critical thinking may be a meaningful factor for predicting academic achievement. He investigated the effect of multiple mini-interviews as a predictor of academic achievement. The results showed that critical thinking skills predicted academic success during the preclinical years of medical education (38). Scott (1994) confirmed that critical thinking skills were moderately predictive of academic success during the preclinical years of medical education (48). Three articles addressed the topics of critical thinking and quality assessment and the power of evidence and showed that fostering critical thinking in medical students could avert the development of a problem learner.

#### *Blended learning*

Popovic (2018) found that Moodle accompanied by lectures increased the interest of students, attendance at face-to-face lectures and formative and summative scores (88). Romanov (2007) confirmed that lectures with eLearning materials have a positive correlation with academic achievement (93). Sajid (2016) highlighted blended learning as helpful for exam preparation and concept clarification, but did not find a significant increase in academic performance of students taught using this method (94). The three articles about blended learning, according to quality assessment and the power of evidence showed that using blended learning was one element for preventing problem learners.

#### *Predictive courses*

Six articles indicated that biology was the best predictor of optimal academic performance in preclinical medical students (9,18,59,64,73,85), nine articles indicated chemistry and physics (9,10,24,27,59,62,64,73,85), five articles highlighted mathematics (27,59,62,64,85) and one article cited anatomy, physiology and biochemistry (85). Three articles highlighted the importance of the first semester (65,79), one article high school grade (18) and two articles previous university (18,70). Thirteen articles addressed this subject and the power of evidence showed that students with high grades in biology, chemistry and physics were less likely to drop out of medical school.

Based on the results, score in chemistry showed a relatively stronger and significant relationship with the MBBS professional examinations compared with other science subjects. The correlation was significant ( $r=0.35$ ); for physics it was not significant at all ( $r=0.19$ ).

Positive correlations were found between the premedical year grade point average (pre-MD GPA) and anatomy, physiology, and biochemistry scores ( $R=0.664, 0.521, \text{ and } 0.653$ ).

#### *Pre-matriculation program*

Schneid (2018) found that pre-matriculation programs could help students to succeed in the first year of medical school (47). Strayhorn (1999) indicated that summer premedical programs were suitable for determining whether participants would be able to handle the academic rigors of medical school (52). Tucker (2008) confirmed this finding (98). Three articles showed that a power of evidence pre-matriculation program could prevent a medical student from dropping out.

#### *Personal causes*

##### *Learning style*

Two studies found that assimilators received significantly higher grades in theoretical examinations than the other groups (13,26), one study highlighted convergent style (13), another study highlighted a sensing-intuitive learning style (31), another indicated a reflective learning style (32), another cited competition (36) and two studies reported no correlation between learning style and academic achievement (39,54). Seven articles on this subject showed that quality assessment, assimilators and sensing-intuitive learning style have positive correlations with preventing academic failure in preclinical medical students.

##### *Personality traits*

Bhagat (2016) found a significant correlation between academic achievement and negative emotionality (19), but Guntern (2017) showed that emotional stability predicts perceived pre-clinical academic achievement (25). One article showed no correlation (22) and two showed that conscientiousness style predicted pre-clinical academic achievement (25,40), another cited agreeableness (30) and one cited extraversion (25). Seven articles found, according to the power of evidence, that emotional stability, conscientiousness and agreeable personality have correlation with academic achievement.

##### *Motivation strategies*

Five articles showed a correlation (23,28,29,72,83) and one article showed no correlation (42). Five articles showed significant but moderate relationships between academic performance and the motivation strategies subsumed within the categories of task value and self-efficacy for learning performance. The

power of evidence of the six articles suggests that motivational strategies have a positive correlation with academic achievement.

##### *Self-efficacy*

Four articles showed a correlation (25,41,50,78) and one article showed no correlation (34). Based on the power of evidence, five articles showed a relationship between self-efficacy and academic performance. The results indicated positive a correlation between self-efficacy and academic achievement ( $r=0.19$ ).

##### *Quality of sleep*

According to the power of evidence, all four articles about the effect of sleep on academic achievement confirm sleep deprivation is negatively associated with academic performance in medical students (14,15,17,97).

##### *Effect of stress*

According to the power of evidence, all four articles about the effect of stress on academic achievement confirmed that higher levels of stress were associated with poor academic performance (37,51,67,80). The result showed there was moderate negative (-0.3) and significant correlation between academic performance and stress.

##### *Demographic factors*

The three studies showed different results. Bastias (2000) and Mann (2010) found a significant correlation between academic failure and being native (18,70), but Malau-Aduli (2017) showed Indigenous status had strong risk factors associated with academic difficulty (69). One article indicated lower socioeconomic status and parental marital problems were important factors (20). Another one indicated being the first in the family (FIF) to go to university was important (69), two highlighted parental education had a positive correlation with academic failure (71,83), another found a significantly higher risk for dropout was in the students above 21 years of age at university (91) and one study showed that minorities had a positive correlation with academic success (82). According to the power of evidence, demographic factors such as parental education, FIF and being over 21 years of age correlated with dropping out by the preclinical medical students.

##### *Physical activity*

Two studies showed physical activity and recreation increased students' focus and could help them to succeed academically (44,76). One

study indicated that a high body mass index in female medical students impaired academic performance (53). According to the power of evidence, physical activity had a positive correlation with academic performance.

#### *Coping strategies*

Schiller (2018) stated that coping strategies were unrelated to preclinical academic performance (46). One article addressed this subject, so it was not possible to determine a result about this subject. It requires more original research.

#### *Class attendance*

Two studies highlighted class attendance during teaching sessions as having a direct impact on examination results. Students with poor attendance were at risk of failure of examinations (35, 43). This is in line with the power of evidence.

#### *Study strategies*

The power of evidence suggests from all four articles confirmed the effect of study strategies on academic achievement. Study strategies are positively associated with academic performance in medical students (56,58,67,73). The results showed time management had moderate correlation (0.3) with academic performance

#### *Admission test*

Of 13 articles indicating that the MCAT score was a strong predictor of medical school performance, two indicated the multifaceted selection process. They suggest that, in addition to measuring of academic variables, the measuring of ethical and interpersonal attributes might help in selection of applicants with the greatest potential to succeed in medical education (16,96). One article showed no correlation between admission test score and academic failure (61). Three articles indicated medical college admission tests or student undergraduate grade-point average or both could identify individual students who were academically at risk (21,45,77). According to the power of evidence, multifaceted selection procedure seemed to be predictive of academic achievement.

#### *Learning environment*

Wayne (2013) found that a positively perceived learning environment added to better academic performance (55). There was only one study in this regard; thus, no definite conclusion can be made about the positive perception of the learning environment and academic achievement.

#### *Curriculum planning*

Iputo (2005) showed that the adoption of PBL/CBE curriculum had a positive impact on the dropout rate (63). Another study indicated that extended course duration had a correlation with academic achievement (81). According to the power of evidence, attention to curriculum planning can reduce the attrition rate

#### **Discussion**

This was the first systematic review to examine the causes of academic failure in preclinical medical students. This systematic review identified 89 studies and several conclusions could be drawn from the results. The framework for problem learners indicates that when teachers first suspect a challenge, they should ask themselves three questions in order to confirm their suspicions: What's the problem? Whose problem is it? Is it a problem that can be changed (2).

In this systematic review, the causes of academic failure were distinguished and categorized for the learner, teacher and system. The causes for the learner are personal, the causes for the teacher are factors relevant to instructional design and the causes for the system are admission tests, learning environment, curriculum planning and pre-matriculation program.

#### *Teacher issues*

Teachers may label a medical student as a problem because he/she cannot fulfill the role that should be fulfilled (1). Teachers also enter medical school with specific expectations and experiences, all of which can lead to problems. Teachers should try to carefully assess to what extent they are contributing to the identified problem. One item related to the teacher is teaching strategies. If a teacher fails to use active teaching or a student-centered method, it may not be possible to identify gaps in student knowledge that will affect academic achievement. Formative evaluation in the form of daily quizzes was associated with better academic.

Success in the medical courses affects student success in the first two years of medical school by fostering critical thinking through effective teaching and evaluation. Limited use of problem solving methods, class discussions, questions and answers, and other methods of fostering thinking skill as well as the lack of encouragement of students to seek solutions by themselves prevent the growth of critical thinking in medical students. The use of evaluation methods based on memorization of a large amount of theoretical information is inapplicable and leads to learning

without thinking and reasoning. This may cause academic failure.

Blended learning and flipped classrooms improve student learning and the lack of it may cause academic failure. Predictive courses indicate that students who scored high grades in biology, chemistry and physics were less likely to drop out of medical school. Those for whom prior achievement are likely to experience a downwardly biased indicator of future potential. This is a warning for teachers for early identification of a problem learner. Only one article on structure showed no correlation, but this cannot be confirmed with such a small sample size. More original articles are required. If medical teachers pay more attention to such variables as teaching strategies, student evaluation and curriculum planning, they are more likely to prevent academic failure.

#### *Learner issues*

In addition to gaps in knowledge, attitudes or skills, learner problems can include learning style, personality traits, lack of motivation and self-efficacy, quality of sleep, stress, demographic factors, physical activity, coping strategy, class attendance and study strategy. In consequence, students should be encouraged to be flexible in their own learning styles in order to be able to engage successfully in varying teaching methods across the curriculum. Teachers also should be motivated to provide a variety of teaching materials and resources to suit different learning styles. Faculty members must pay attention to differences in personality traits among students and use teaching methods that address the individual differences of students. They should guide these students to study based on their personal differences and try to coordinate these styles.

Student motivation may be an important determinant of academic achievement. Students must be taught how to regulate their learning behavior, receive sufficient instruction and obtain support from teachers. There is need for curricular/extracurricular education and counseling about healthy sleep patterns, effective stress management, and increased level of social literacy about problems related to the social status of families. Counseling and guidance services can help to prevent and identify problem learners and can encourage physical activity, monitor attendance in class and participation in the learning process and organize study skills.

#### *System issues*

System problems are often difficult to identify and can include admission tests,

learning environment, curriculum planning and pre-matriculation program. Multifaceted selection procedures seem to be predictive of academic achievement. The sole use of test scores without interviews (non-academic performance) increase dropout rates. The perceived learning environment can improve academic performance, but the lack of enough articles requires additional primary research.

PBL curriculum has a positive impact on students from disadvantaged educational backgrounds to reduce attrition rates. Longer medical curriculum, and block/modular subject structure were associated with better academic outcomes and lower attrition; thus, curriculum planning can reduce the attrition rate. Grades on examinations in pre-matriculation programs have the potential to help identify students who are at risk of failing.

The results of this systematic review should be taken in the context of a specific cultural and educational environment. In American universities, the emphasis is more student-centered. In Iran, the teaching method is teacher-centered and the result is a lack of creativity and inventiveness by the students. The infrastructure (e.g. educational facilities) should be improved. Textbooks and educational content should be dynamic, collaborative and low-volume, instead of a large number of students in the classroom with a non-cooperative and heavy educational content. In Iran, student acceptance is based on quotas (konkour), but universities in America and the West consider skills such as intelligence and talent and how to communicate and interact with friends when they enter the university. There is a cultural difference between Iranian and foreign students.

#### **Conclusion**

Medical teachers often cannot identify a problem learner and the causes of academic failure. The goal of this systematic review was to determine the reason behind the failure of a problem learner. The results suggested that managers, policymakers, instructors and counselors can monitor student academic achievement with careful planning for instructional design, educational environment, the use of active teaching methods and continuous assessment of students and consideration of personal factors.

#### *Strengths and weaknesses*

One limitation of the study was the lack of meta-analysis; however, a meta-analysis was not possible because of the different study designs, measurement tools and the nature of the results

reported. But there was strength in our review because there was no language limitation and a checklist of 22 quality indices.

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