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Relation between stress, time management, and academic achievement in preclinical medical education: A systematic review and meta-analysis

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Abstract:

Identifying the learners' problems is important. Besides, many factors are associated with academic failure, among which time management and stress are more important than any others based on evidence. By using a systematic review and meta-analysis, this study aims to synthesize the findings of studies about the correlation of time management and stress with academic failure to suggest a more in-depth insight into the effect of these two factors on academic failure. Four databases were searched from the inception of January 2018. Publication bias was evaluated visually using funnel plots and sized up by Egger's test. Ninety-four articles were found to be qualified for inclusion after full-text review and additional manual reference made. Of these, 8 were studies of educational interventions that were reviewed in this paper. Regarding the relation of stress and academic performance, the Funnel plot (results not shown) and Egger's test showed no publication bias in the studies ($P = 0.719$). Based on this result, the estimated pooled correlation (reverted by hyperbolic tangent transformation) between stress and academic performance was found to be -0.32 (95% confidence interval: -0.38 – -0.25). In conclusion, the review recognized a series of potentially mutable medium-to-large correlates of academic achievement, time management, and stress. It would be essential to have experimental data on how easily such self-regulatory capacities can be altered, and these interventions could help students enhance their potential, providing empirical tests for offered process models of academic achievement.

Keywords:

Academic achievement, meta-analysis, stress, systematic review, time management

Introduction

Identifying the learners' issues early and offering advice from the start is an essential investment in the training and progress of future practitioners.^[1] The National Committee on Internal Medicine (1999) has described the learner as a trainee who identifies the underlying problems that required to be addressed by a program leader or manager.^[2] Some educators have

expressed their concern about difficult learners in case they negatively affect educational programs and other students. Although studies may predict different elements, medical educators would like to be able to predict merely.^[3]

Academic failure is a problem that has turned out to be a central concern for countries in different parts of the world. In order to find the different causes of academic failure, several research projects in this field

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have been performed. Typically, students experience academic issues with academic and nonacademic characteristics, and the various combinations of reasons for academic failure result in different types of student profiles, suggesting different strategies of intervention.^[4]

The evidence indicates that when intervention techniques are applied for failed students, their performance improves in the subsequent academic year.^[5] Ahmady *et al.* indicate that failed students can be assisted in becoming successful in the classroom when appropriate intervention techniques are applied. Usually, in research concerning student learning and behavioral outcomes, certain personal attributes of the students are measured, which are then related to some outcome measure. Among these, study skills, such as time management, is one of the factors affecting academic achievement and also stress.^[6]

Personal characteristics are personality, motivation, self-concept, cognitive style, intelligence, and locus of control. Nevertheless, some environmental and contextual difficulties, which lead to unsuccessful learning, are not considered. The purpose of this study is to identify the factors related to the failure of college students.^[4]

Many factors have been related to academic failure.^[1] Ahmady *et al.* indicate that 21 factors related to academic failure in preclinical medical students, and study skill and stress is reported to be more important among other factors. We have found several studies^[7,8] that suggest time management is perhaps more important than any other study strategies.^[6]

West *et al.* (2011) show that study skills (time management) are usually powerful predictors of first-semester academic performance in medical school and other higher education disciplines.^[7] Practical time management skills are essential. Students who do not plan their time effectively run out of time before running out of the content. Relatively, few studies have investigated the joint contribution of academic performance and study skills.^[9-12]

Another reason is that medical education is inherently stressful and demanding. An ideal level of stress can increase the level of learning, while over-stress can cause health problems, leading to a decrease in students' self-esteem and failure in their academic competence. A high level of stress can affect the students' learning process in medical school negatively.^[13] Sources of stress include curriculum, personal competence, tolerance, and time outside of medical school. Increased anxiety is associated with increased depression and anxiety.^[14,15]

Knowledge about the effective size of these factors (time management and stress) can help policymakers,

managers, medical teachers, and counselors track the students' academic failure. It is essential to integrate the evidence produced through all studies to obtain useful information, help medical students, and provide directions for future studies. To the best of the authors' knowledge, this is the first systematic review and meta-analysis of the findings of studies concerning time management and stress associated with academic failure. It suggests a more in-depth insight into the effect of these two factors on the students' academic failure.

Materials and Methods

This systematic review was carried out following PRISMA guidelines.^[16]

Search strategy

PubMed, Web of Knowledge Educational Resources, and Information Center, and Scopus databases were searched.

Using the search No., time limitation was set for searching the resources. For comprehensiveness of the search, the following keywords were used in the abstract, title, and keyword sections: "academic performance" and "academic failure" or "academic achievement" and "drop out;" "medical student" and "struggle student;" "time management" and "stress." Hand searching was also done in Medical Teacher and Medical Education journals. Furthermore, reference lists of many articles were reviewed to identify the relevant papers. The most celebrated authors in this area were contacted for "gray literature:" conference proceedings, unpublished studies, and internal reports. The obtained data were included in the study. The inclusion criteria for the articles were as follows: being a correlation between study skill and stress with academic performance, observational study design, preclinical medical students, without any language, or time limitation from January 1987 to January 2018.

Inclusion and exclusion criteria

The exclusion criteria for the search were being secondary research or not being a preclinical medical student. All the databases were searched by one reviewer, and Endnote X8 was applied for data management. The articles were imported into Endnote X8 to remove the duplicate data before importing the data into Excel. The imported data were the list of authors, titles, journals, and years of publication. Two team members (N Kh and SA) screened the titles and abstracts to determine the potentially relevant articles. The full-text version of the study was then reviewed if the study met the selection criteria or if there was any doubt concerning the study's eligibility. Furthermore, a third independent researcher was requested to resolve any disagreements.

Quality assessment

The study quality was rated on STROBE guidelines. Over 100 journals have endorsed STROBE guidelines (<http://www.strobe-statement.org>).^[17-20] Studies were rated for each of the following: title and abstract, introduction, methods, results, discussion, data collection methods, and other information. This yielded a quality rating with a range from 8 to 22.

Data extraction and analysis

As several different variables were tested in each article, thus the article names were repeated. Studies were coded according to author (publication year), effective factors in academic performance, measurement method, type of R, type of analysis, location, and type of study [Table 1]. Two reviewers extracted data from the included articles. They compared extractions and resolved differences through discussion or with a third nonauthors.

Analysis

This meta-analysis was conducted via Stata 15.0 software (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC). As the distribution of the correlation was highly skewed, the inverse hyperbolic tangent transformation ($z = \text{tanh}^{-1}(\rho) = 1/2 \ln((\rho + 1)/(\rho - 1))$) was applied. All the calculations were based on the transformed values. The Cochran's Q test and The I^2 statistic were used to assess and characterize the extent of the heterogeneity, respectively. I^2 -50% was indicated as considerable heterogeneity. Given the high heterogeneity of the data, the random-effects model was used. We used hyperbolic tangent transformation ($\rho = \text{tanh}(z) = [e^{2z} - 1] / [e^{2z} + 1]$) to change the pooled estimates (and its 95%

confidence intervals [CI]) to the pooled correlation. All the individual studies results were reported with 95% CIs and demonstrated in a forest plot. Publication bias was evaluated visually using funnel plots and sized up by Egger's test. A $P < 0.05$ was statistically significant.

Results

The study selection initial database searches retrieved 13,123 articles. After exclusion of duplicate references, conference abstracts, screening titles and abstracts, 6305 articles were selected for further review (title and abstract). A total of 100 articles were found eligible for inclusion after full-text review and additional manual reference screening. Five articles, including the studies of educational interventions, were reviewed in this paper [Figure 1].

Study characteristics

Study setting and populations

Most of the studies were completed in Europe (50%), 2 (25%) USA, and 2 (25%) Asia.

Type of design

The majority design in the articles was prospective, followed by correlational [Table 1].

Aims of studies

The purpose of the studies was to report the effect level of the study skill (time management) and stress on academic performance.

Regarding the relation of stress and academic performance, the Egger' test and Funnel plot (results not shown) indicated that there was no publication

Table 1: Data extraction of articles related to study skill (time management) and stress

ID	Author (publication year)	Effective factors in academic performance	Measurement method	Type of R	Type of analysis	Location	Type of study
1	Kleijn (1994)	Study habits	SMART	$R=0.4$	multiple regression analysis	Amsterdam	Prospective
2	Kleijn (1994)	Anxiety	Dutch adaptation of Spielberger test anxiety inventory	$R=-0.3$	Pearson correlation	Amsterdam	Prospective
3	Kleijn (1994)	Anxiety	Dutch adaptation of Spielberger Test Anxiety Inventory	$R=-0.57$	Pearson correlation	Amsterdam	Prospective
4	Kleijn (1994)	Anxiety	Dutch adaptation of Spielberger Test Anxiety Inventory	$R=-0.32$	Pearson correlation	Amsterdam	Prospective
5	West (2011)	Study strategies	Learning and study strategies inventory (LASSI)	$B=0.32$	regression	Texas	Correlational
6	West (2011)	Study strategies	Learning and study strategies inventory (LASSI)	$B=0.43$	regression	Texas	Correlational
7	Kumar (2014)	Effect of stress	Semi-structured Performa and stress scale	$R=0.17$	Pearson correlation coefficient	India	Correlational
8	Sohail (2013)	Stress	Researcher-made	$R=-0.58$	Spearman	Lahore	Correlational
9	Stewart (1999)	Stress	State trait-anxiety inventory	$R=-0.16$	Pearson	Hong Kong	Prospective longitudinal

SMART=Study management and academic results test

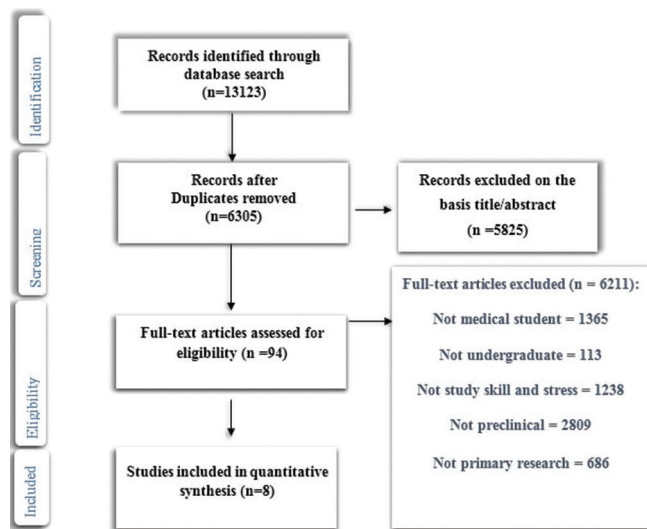


Figure 1: Study flowchart demonstrates the inclusion-exclusion process

bias in the studies ($P = 0.719$). The same was obtained when we evaluated the relation of the study skill (time management) and academic performance, not statistically significant ($P = 0.833$).

The individual studies transformed between stress and academic performance were shown in a forest plot [Figure 2]; based on this result, pulled correlation (result from hyperbolic tangent transformation) between stress and academic performance was found to be -0.32 (95% CI $[-0.38, -0.25]$).

The individual studies transformed between study skill (time management) and academic performance were demonstrated in a forest plot [Figure 3]; based on this result, pulled correlation (result from hyperbolic tangent transformation) between stress and academic performance was found to be 0.39 (95% CI $[0.29, 0.47]$).

Discussion

To the authors' knowledge, this is the first systematic review and meta-analysis of the evidence concerning the effect of study skill (time management) and stress on academic performance.

Overall, with this review, we found medium to high-quality evidence from a modest number of studies, suggesting that study skills (time management) and stress significantly affect academic achievement: study skill (time management) (ES: 0.39) and stress (ES: -0.32).

However, research suggests that study skills (time management) are also significant factors affecting academic achievement in medical schools.^[8,21-25]

Study skills are one of the more reliable predictors of first-semester total grades.^[7] The predictive strength of

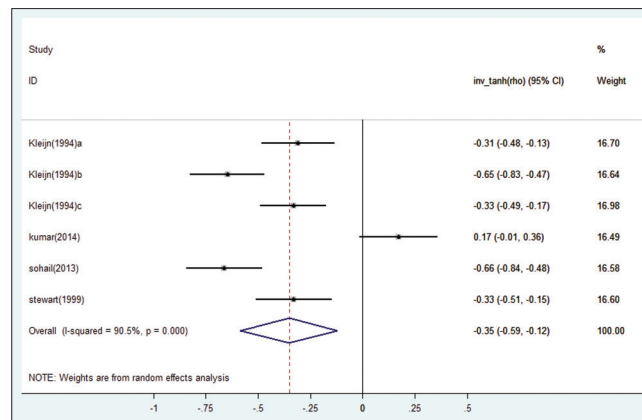


Figure 2: Correlation between stress and academic failure

first-semester final average is accounted for by scores on time management,

Teaching time management rules, such as preventing postponement, previewing data, reviewing material shortly right after presented, prioritizing items, handling study periods, reviewing repeatedly, and making time for other commitments, is an essential component.^[26]

For instance, sometimes, students procrastinate studying material they have problem with or do not see the applicability of. In this instance, seminars or counseling, which concentrate on arranging these projects for one's optimum time of day such that it will be simpler to focus on the material and reduce procrastination, may be offered.^[27]

Time management aims to improve the nature of activities that require a limited time. The inability to use time in the learning process is the main problem for the students. Previous studies have shown that the excessive intensity of courses affects productivity negatively. In this situation, medical students, who have to cope with an intensive training curriculum, may inevitably but efficiently make the most of their time. To succeed in the education process, medical students must set goals for their education and plan for appropriate academic progress. They, therefore, have to follow course schedules, be prepared for examinations, and use the time available for other activities.^[28]

Another significant issue is that there is a substantial increase in stress levels during study times, in the 1st year in particular.^[29] Perceived stress is a key factor in discriminating among students with low versus high academic performance.^[30] First-year students face different challenges that can be seen as potential stressors. They have to get familiar with a new environment, get into contact with other students, choose their lectures and seminars, participate in extracurricular activities, and manage their first tests. Another source of students'

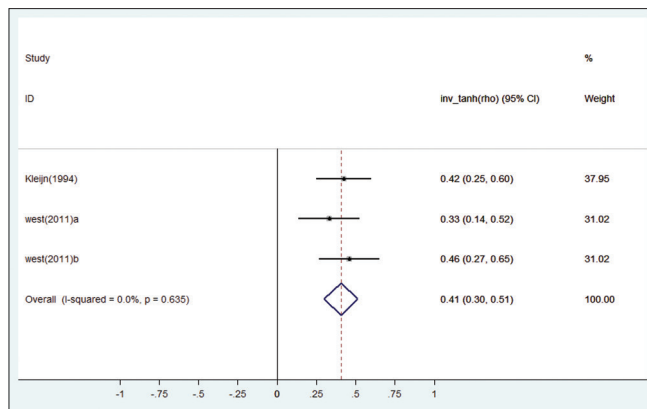


Figure 3: Correlation between study skill (time management) and academic failure

perceived stress is time-related demands, such as an increasing workload, time pressure, and regulation of their self-study.^[31]

Pfeiffer notes that too much stress is negatively associated with students' readiness, focus, and performance, while positive stress helps the student achieve maximum performance.^[32] It should also be recommended that this situation is the first exam in which students are exposed to a significant amount of integrated curriculum. Often, students are suggested by their seniors to pursue an education in the coming years; thus, they can lower the stress levels, control stress in a better way, and enhance their academic performance.

Managing self-efficacy, flexibility, and social support also are related to academic achievement; thus, intervening to enhance self-efficacy, resilience, and social support may lessen the perception that stress is affecting performance.

Limitations

The limitation of this review is that statistically significant time management and stress have not been reported in all studies.

Conclusions

This review of 31 years of research on the correlation of stress, time management, and academic failure has been devoted to the understanding of the effect of time management and stress on academic achievement of medical students. This systematic review and meta-analysis are the first in the field. We wish that this work provides a base for more focused research and intervention. Finally, our review and others have identified a series of potentially modifiable medium-to-large correlates of academic achievement, time management and stress in particular. It would be worthwhile to have experimental data on how easily such self-regulatory capacities can be altered, as well as for whom, over what period, and to what extent do such

changes to be effective academic performance. These interventions could help students develop their potential and would provide empirical tests for proposed process models of academic achievement.

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Conflicts of interest

There are no conflicts of interest.

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