Review Article

A Systematic Review of Studies on General Medicine Comprehensive Exams in Iran

Tahereh Changiz[1], Fariba Asgari[2*], Nikoo Yamani[3]

[1]Ph.D. in Pharmacology, Full Professor, Department of Medical Education, Medical Education Research Center, Isfahan University of Medical Sciences, Isfahan, Iran.
[2]Ph.D. Candidate in Medical Education, Department of Medical Education, Medical Education Research Center, Isfahan University of Medical Sciences, Isfahan, Iran.
Department of Nursing Management, Faculty of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, Iran
[3]Associate Professor, Department of Medical Education, Isfahan University of Medical Sciences, Isfahan, Iran.

ABSTRACT

Introduction: Evaluation is one of the most important stages of education system. Student exams may be used both for student assessment and program evaluation. Given the significance of general medicine exams, the present study systematically reviews studies conducted on these exams in Iran in 2016.**Methods** : Available documents were systematically reviewed and their information was collected. Using documents available in scientific databases such as IranMedex, SID, Magiran, Medlib, PubMed, Google Scholar, ERIC by appropriate keywords (doctor, general practitioner, student, graduate, trainee, intern, exam, general sciences, pre-internship, skill and medical), 59 studies conducted on general medicine exams until March 2015 were extracted; of these studies, 10 studies which were available in full text and met the least research quality were selected for the review. **Results**: Out of 10 studies reviewed, 7 studies evaluated the effective factors on results of general medicine exams and 3 studies analyzed the results of these exams. Meanwhile, results of those 7 studies showed that low GPA, delay in passing the basic sciences and age at the time of admission to the university are effective factors on results of exams. Results of three studies analyzing exams showed that genetics and radiology gained the highest and parasitology, orthopedics and physiology gained the lowest average percentage of scaled relative ratings. In analysis of 40 exams during a 20-year period, 65.8% students were passed the exams in the first trial. However, 99.6% of participants continued their education after few trials. **Conclusion**: The factors such as length of stay in medical school and grand point average of students are predicating comprehensive exam results in all the reviewed studies. Therefore, these factors can be considered as effective factors on results of general medicine exams. Also the results may support the importance of national comprehensive exams as a reliable tool in fostering quality in education.

Keywords: exam, basic sciences, pre-internship, general medicine

INTRODUCTION

Trainees are products of educational systems. Educational systems employ human and physical resources to provide educational program by spending cost and time. In an education system, learners which are input to the system are influenced by the educational process and considered as output of the system. In fact, educational processes determine characteristics of educational systems [1]. Evaluation of the educational process is an important step to determine success of the educational system

in carrying out educational tasks to determine both cost-effectiveness and consistency of the educational program with educational goals and standards. Evaluation is one of the most important stages of the educational system. Exams are the best instrument for evaluation; exam is defined as a systematic method to measure a sample of behavior [2]. In the higher education system of Iran, medical education is currently a responsibility of the Ministry of Health, Treatment and Medical Education. In this education system, medical students who could successfully pass the basic medical sciences exam are qualified for subsequent periods. General medical education is consisted of four courses including basic sciences, pathophysiology, apprenticeship and internship. Basic medical sciences exam is held at the end of the first course; students who successfully pass this exam will continue their education in higher courses (pathophysiology, apprenticeship and internship). They will receive general medicine certificate if they are successful in the last course [3].

Due to the significance of medicine, each organization has developed standards for the exams which show overall orientation of the exams to monitor realization of educational goals. For example, one exam strategy defined by General Medical Council (GMC) in 2009 is as follows:

- Over the curriculum, outcomes of graduates should be evaluated appropriately to ensure that only students who earn these outcomes are allowed to graduate [4].

In the United States of America, medical students have to pass several exams as a part of the educational process to receive graduation certificate and permission to practice [5]. In Iran, the course of basic medical sciences underlies academic achievement and precise understanding of subsequent courses of general medicine. Basic medical sciences exam as one of the most important exams evaluating the students is held at the end of the first course of general medical education [6-7]. Pre-internship exam is held at the end of apprenticeship provided that the students pass the coursesof clinical training phase and submit their thesis. In case of getting acceptable score in this exam, the students will start the internship and will receive the general medicine diploma [8,1]. Studies conducted on medical sciences exams indicate various problems. These studies addressed limited area of the factors associated with success such as age, gender, grades and scores in the exams.

Therefore, it seems essential to review the literature systematically and comprehensively to draw a general and generalizable conclusion. Systematic reviews are a type of secondary research reviewing the evidence found on a specific issue and drawing conclusions systematically and scientifically from the relevant studies [9]. Therefore, this study systematically reviews studies conducted on general medicine exams held in Iran until March 2016 to provide coherent and effective data for decision makers and take essential steps in order to improve quality of medical education with proper planning and fair distribution of resources.

MATERIALS AND METHODS

This study systematically reviewed all published articles related to comprehensive exams (basic medical sciences and pre-internship) of general medicine in Iran. Initially, the question and search strategy were determined. The question was: "what factors are related to the results of comprehensive exams held in Iran?". Literature search strategy was based on agreement of two researchers, included a combination of Farsi synonyms for keywords as presented in table 1. The articles were searched by web-based electronic and manual search (to complement findings).

included doctor, general practitioner, student, graduate, trainee, intern, exam, basic medical sciences ,pre-internship and medical. The published studies on general medicine exams held by universities of medical sciences until March 2016 were extracted for the review. Articles which were available in full text were analyzed. The articles were extracted by web-based electronic and manual search(to complement findings).

A) Electronic search: The available databases including PubMed Medline, Google Scholar, ERIC Irandoc, Iranmedex, magiran, Medlib, SID and Namamatn were used. Two independent researchers searched the relevant databases to find articles published in 2000-2015 (Table 1).

B) B) Manual Search: to increase accuracy of manual search, titles of articles were extracted from electronic archives of Persian medical education journals including Iranian Journal of Medical Education, Strides in Development of Medical Education, Education Strategies in Medical Sciences, Journal of Medical Education Development, Horizons of Medical Education Development, and Research in Medical Education.

Table 1: search strategy based on keywords to extract articles on general medicine comprehensive exams

English keywords
Medical student or Intern or Stager or Extern or General practitioner or General and Physicians or Graduated medicine or medicine AND [Iran OR Farsi OR Persian]
Comprehensive exams or Basic sciences exam or Pre internship exam AND [Iran OR Farsi OR Persian]
Medical sciences
Systematic AND review AND [Iran OR Farsi OR Persian]
Situation AND education AND Iran OR Farsi OR Persian

Available evidence about general medicine exams was summarized in the form of tables and diagrams. Figure 1 shows screening and selection of articles for final analysis.
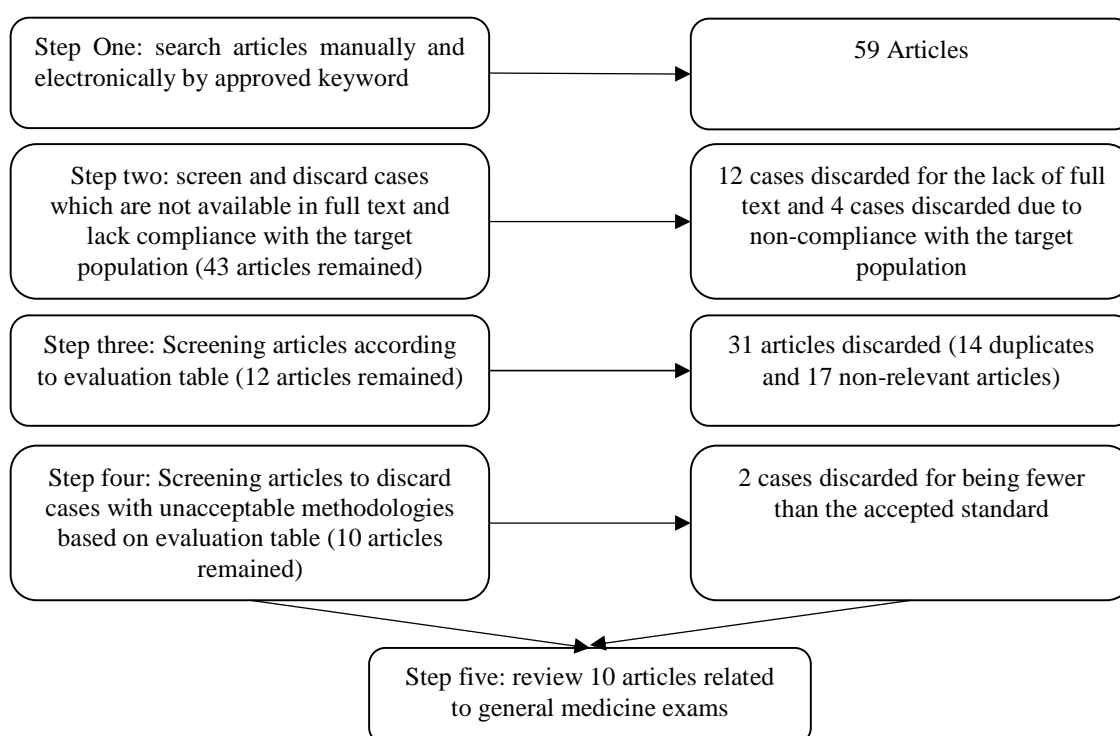
Step One: search articles manually and electronically by approved keyword → 59 Articles

Step two: screen and discard cases which are not available in full text and lack compliance with the target population (43 articles remained) → 12 cases discarded for the lack of full text and 4 cases discarded due to non-compliance with the target population

Step three: Screening articles according to evaluation table (12 articles remained) → 31 articles discarded (14 duplicates and 17 non-relevant articles)

Step four: Screening articles to discard cases with unacceptable methodologies based on evaluation table (10 articles remained) → 2 cases discarded for being fewer than the accepted standard

Step five: review 10 articles related to general medicine exams

Figure 1: Screening and selection process of articles related to general medicine exams

RESULTS

Out of 59 articles extracted by the initial search, finally, 10 reliable articles remained for the analysis. By searching international databases, 3 articles in English were extracted of which two articles were excluded because of their qualitative method and one article was excluded because its target population was not medical students. Therefore, all analyzed articles were in Persian.

Medical universities of authors' affiliation included Zahedan University of Medical Sciences for 3 articles (11-13), Kashan University of Medical Sciences for 2 articles (8,14), Tehran University of Medical Sciences for 1 article (7), Qazvin University of Medical Sciences for 1 article (10), Lorestan University of Medical Sciences for 1 article 1 (6), Kermanshah University of Medical Sciences for 1 article (15), and Babol University of Medical Sciences for 1 article (1).

Structurally, the published articles were dealing with one of the two main issues:

- Finding effective factors on results of comprehensive exams: in 8 articles (16,13,12,11, 10,8,7,6)
- Analysis of results of basic sciences and pre-internship exams in 3 articles (1,10,12),

Results of 11 articles on results of general medicine exams are listed in Table 2.

DISCUSSION AND CONCLUSION

According to systematic review of the articles on comprehensive exams, these studies were conducted in two areas. Most studies addressed the effective factors on results of general medicine exams; however, many of these studies also addressed the exam results (6,7,10-13,16). Higher number of studies on basic medical sciences exam can be explained by its fundamental role in students' achievement in general medicine . effective factors on result of the exams. However, some of these studies only addressed effective factors on basic medical sciences exam [6,7,10-13,16] and some others addressed these factors in pre-internship exam [13], while some studies addressed the effect of these factors in both exams [1,14] These studies reported age, high school GPA, duration and mean score of the basic medical sciences courses as the most important effective factors on result of basic medical sciences exam [10-16,6,7]. One of the studies did not consider age as an effective factor. This can be explained by the fact that the majority of students aged 20.1±3.04 years. Age distribution was low in this population; otherwise, results of other studies showed that people with lower age had better academic achievement [14]. In all studies reviewed, it was observed that high school GPA of students was significantly correlated with their average scores in the basic sciences courses. Moreover, there was a relatively good direct relationship between basic sciences comprehensive exam score and GPA; the higher the GPA, the higher the score of basic sciences comprehensive exam [10-13,16,6,7]. Bastias reported GPA as an important indicator to predict academic performance of students in the first three years of medical school [17].Iramaneerat and Frischschlager supported the predictive role of high school performance in academic achievement of medical students [19-20]. Duration and mean of scores basic sciences course was another factor noted in all articles. Delay in passing the basic sciences courses increased potential to failure in the basic medical sciences

exam. By eliminating the confounding effect of other factors, multivariate logistic regression showed that only effect of basic medical sciences score was significant; in other words, every 1 point increase in mean score of basic science courses reduced the potential failure in the exam by 69% (14). All the studies reviewed suggest significant role of basic sciences mean score [11,10,12,13,16,6,7].

One study reported a significant inverse relationship between the number of semesters passed in basic sciences stage and results of the exams; result of the basic sciences exam improved as duration of the basic sciences stage was reduced (P = 0.31) [6].In a similar study, duration of basic sciences courses was associated with results of the exam [7]. Little is known about predictors of success or failure in pre-internship exam. One study reported basic sciences exam score as a valid instrument for predicting the result of pre-internship exam (12). Some also pointed out the necessity to consider mean score of basic sciences courses due to the close relationship between these two scores (8). This correlation may be interpreted as a reflection of students' general aptitude. However, other less explored underlying factors cannot be ruled out.

This systematic review also addressed the studies analyzing the results of basic sciences and pre-internship exams [1,10,12]. Medical exams are measures to evaluate medical students; their results are simultaneously used for evaluating and ranking the performance of medical universities [1]. One of the reviewed studies indicated no agreement between these two exams in ranking the university among other universities of medical sciences (6). This finding means that each of the two exams shows a different feature of university, so that students may be treated differently in basic medical sciences stage and clerkship stage [6]. In a study analyzing results of medical exams held in 10 years, genetics and radiology gained the highest average of the relative ratings in basic medical sciences and pre-internship exams, respectively. Moreover, parasitology and orthopedics had the lowest average of the relative ratings. However, these findings were not consistent with results of other studies [1].

Table 2: Summary of the most details related to articles on general medicine exams

Reference	Year	Location	type of study	Sample size	Exam		Result
					Basic sciences	Pre internship	
1	2013	Babol	Descriptive	Results of 10 years of basic science and pre internship exam	*	*	Genetics and radiology gained the highest and parasitology and orthopedics gained the lowest percentage average of the scaled relative ratings in basic medical sciences and pre-internship exams.
8	2012	Kashan	Descriptive and Cross-sectional	533 records of medical graduates	-	*	The most important risk factor for failure in pre-internship exam is delay in passing the basic sciences and low score of basic sciences course. Basic science scores, duration of basic sciences, score of training course and GPA are the most important predictive factors for scores of pre-internship exam.
14	2011	Kashan	Descriptive ad Cross-sectional	305 graduates since 1986 until 2003	*	-	Failure in the basic sciences exam resulted from delay in passing the basic sciences course, low GPA and score of basic sciences course, older age at the time of admission. Based on multivariate linear regression, the most important factor was score of basic sciences ($R^2 = 0.55$).
7	2011	Tehran	Descriptive and Cross-sectional	153 medical students	*	-	GPA and score of basic sciences course were important.
6	2009	Lorestan	Descriptive analytic		*	-	Syllabus, final score, importance of teaching a lesson in basic science course, level of interest in the course, importance of the course in the exam.
15	2004	Kermanshah	Descriptive analytic	Rating of Kermanshah University of Medical Sciences in 25 basic sciences exams and 20 pre-internship exams during 1990-2002	*	*	No agreement between these two exams in ranking the university among other universities of medical sciences; that is, these two exams evaluate two different aspects of the university and they cannot be replaced in evaluation of the university
10	2001	Qazvin	Descriptive Cross-sectional	Results of 12th to 24th basic sciences exams	*	-	mean admission of students was 84.80% in different courses, ranging from 77.8% to 93.9%
13	2003	Zahedan	Descriptive analytic	99 medical students	-	*	Age in both courses, scores of basic sciences and pre-internship exams and mean of degrees were significantly different.
11	2002	Zahedan	Cohort	206 students participating in 21th to 24th basic	*	-	Marital status, age, length and mean of basic science course and score of microbiology, parasitology

				sciences exams		and physiology due to high and significant relative risks are the most important factors.
12	2011	Zahedan	Descriptive analytic	Results of basic sciences exams in 1987 to 2008	*	almost all medical students passed the exam based on the usual quorum to time of the study and discarding the specialized courses

In most studies, scores of microbiology and parasitology are the predictive factors of exam results. Since the level of success in each course in every university as regard to total score of basic science exam is related to different factors such as course presentation, number of faculty members and students and etc. it seems that this matter should be considered specifically and in order to promote the quality of teaching, practices such as internal meeting.

Obviously, most studies addressed the effective factors on scores and results of pre-internship and basic sciences exams. These factors were numerous in different courses and yet very similar for both exams. One of these factors was academic record particularly score of basic medical sciences, pathophysiology and clinical courses; several studies supported the relationship between the mean scores of basic sciences and results of basic sciences exams, as well as the relationship between the grand point average in basic sciences, pathophysiology and clerkship stages and results of pre-internship exam. Students who obtained higher averages in these stages gained better results in the exams. In the reviewed studies, time spent in each stage correlated with the exam results. Those who passed the basic sciences, pathophysiology and clerkship stages in normal time gained better results in the exams than people who passed these stages in longer time. This may imply that results of comprehensive exams can be considered as a global summary of student performance at academic tasks.

Since most studies support the correlation between the previous performance of students and comprehensive exam results, it may be concluded that these national exams are reliable tools to be used for quality assurance and improvement in medical schools.

The current systematic review combined results of research evidence in order to check the status of general medicine exams. According to the results, majority of the studies were limited to one university. It seems that results of these limited studies cannot precisely respond to demands of stakeholders, managers and planners of medical education. Policymakers and planners are recommended to invest in new research based on previous studies by integrating methodologies in a larger scale in order to use their results.

This study was not exempt from personal errors; despite the massive search manually and electronically in two stages, a number of articles which did not recorded electronically or published in non-scientific journals or published in an unavailable issue might have been excluded from the review.

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