

# King saud university' medical students research experience: a mixed–methodology study

## Abstract

King Saud University's (KSU) medical students are educated on research methodology through a mandatory course. This investigation aims to evaluate these students' research experience. This is a mixed–methodology study undertaken at the medical college KSU. Four focus groups were performed to allow an in–depth analysis of factors affecting KSU medical students' research experiences. The qualitative aspect was followed by a quantitative survey to evaluate the KSU medical college faculty's perception of undergraduate students' supervisory mission. A total of 49 participants were involved in this study. Thirty–one students participated in the qualitative part. However, only 18 faculty members responded to the online questionnaire (a response rate of 18%). The thematic analysis produced three main themes and 12 subthemes. The main themes were related to organizational factors influencing students' research experience, how they conducted research and their research outcomes. Quantitative analysis findings indicated that the majority of supervisors think that students' research weaknesses are related to the development of the research questions, statistical analysis and scientific writing. There is a need to revisit the curriculum structure of KSU medical college and minimize the interference between research and clinical education, and examinations. More emphasis should be given to providing practical training in statistics, scientific writing and supervisory experience enhancement.

**Keywords:** medical students, king saud university, mix methodology, medical education, student research, undergraduate and medical research

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Abdulaziz A Alodhayani,<sup>1</sup> Ibrahim Gosadi,<sup>2</sup>  
 Manal M Al-Daajani,<sup>1</sup> Salah Ezreqat,<sup>1</sup>  
 Houssam El-Mourad,<sup>3</sup> Firas Ghomraoui,<sup>3</sup>  
 Tahani AlShaibani<sup>3</sup>

<sup>1</sup>Department of Family and Community Medicine, College of Medicine, King Saud University, Saudi Arabia

<sup>2</sup>Prince Sattam Chair for Epidemiology and Public Health Research, Department of Family and Community Medicine, College of Medicine, King Saud University, Saudi Arabia

<sup>3</sup>College of Medicine, King Saud University, Saudi Arabia

**Correspondence:** Abdulaziz A AlOdhayani, Assistant Professor, Family & Community Medicine Department, College of Medicine, King Saud University, Riyadh–11455, Saudi Arabia, Tel +966–560566066; Email drodhayani12@yahoo.com

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## Introduction

Research education for medical students can strongly influence critical thinking skills. As future doctors, the ability of medical practitioners to evaluate and criticize the available evidence is likely to be enhanced by understanding research principles. Therefore, acquiring critical thinking skills is important subsequent positive influence on clinical practice.<sup>1</sup> The benefits of educating medical students on the principles of research at undergraduate levels are multiple. Several medical achievements such as the discovery of insulin and understanding the principles of nerve transmission were initiated at undergraduate levels.<sup>2</sup> Undergraduate students' research education aids in increasing the ability of students to publish their research projects,<sup>3,4</sup> and can significantly contribute to the overall publications at their academic institutions.<sup>5</sup> Research experience in medical schools was reported as one of the factors associated with the career achievement of academicians,<sup>6,7</sup> and as a motivation to pursue further research after medical school graduation.<sup>8,9</sup> Despite the conceived benefit of educating medical students on the principles of research, each student's research experience is likely to vary depending on the education methodology and institutional commitment. It has been argued that teaching students the importance of research, the creation of a supportive research environment for students and the provision of productive supervisory efforts are vital for the development of students' research experience.<sup>10</sup> Unsuitable research environments for students could be linked to reduced opportunities of medical students to conduct sound research projects.<sup>11</sup> The medical college at King Saud University (KSU) in Saudi Arabia incorporated a research methods course to the core courses taught to its undergraduate medical students during their third year. This incorporation was initiated in 2011 and one of the outcomes was the publication rate of students' research projects. The current statistics of the KSU medical student's publication rates indicates that only 10% of students' research projects were published in peer–reviewed journals.<sup>12</sup>

Teaching research methodology at the KSU medical college is composed of several steps. Firstly, theoretical education is conducted during the first term of the academic year. Secondly, students are required to form small teams and select supervising professors. Each team produces a research proposal and pursues ethical approval by the end of the first semester. Thirdly, data collection and processing, reporting the study findings and the submission of a manuscript to be evaluated by the local faculty is completed by the end of the second semester of the third year. The complexity of the method used to educate KSU's medical students on the principles of research is mainly based on theoretical education, practical training and their supervisory mission. The low publication rate of KSU medical students' research reports could be a proxy measure indicating the presence of factors influencing the overall research experience. This investigation aims to evaluate the KSU medical students' research experiences. Assuming a variation of factors influencing students' research experience between different educational institutions, a qualitative approach was chosen to perform an in–depth analysis of factors affecting research experiences. To increase the value of the current investigation, the qualitative aspect was followed by a quantitative survey to evaluate the KSU medical college faculty's perception of undergraduate students' supervisory mission and methods of enhancement.

## Methodology

### Study settings

This is a mixed–methodology study that was undertaken at the medical college KSU between April and September 2015. All of the study participants were medical students and faculty members who were involved in supervising students' research projects. All of the participants were above 18 at the time of recruitment. Ethical approval to conduct the study was provided by the ethical committee of the College of Medicine at King Saud University, Riyadh, Saudi Arabia.

## Qualitative approach

The approximate number of medical students registered at the college of medicine in 2014/2015 was 1400, the majority of whom are involved with both curricular and extracurricular research activities. Approaching medical students was made via collaboration with the Students Research Support Unit (SRSU), where a convenient sample of medical students was recruited. To enrich the collected data about students' research experiences, recruitment was performed in a manner to ensure the involvement of students who had a history of publication compared to those who did not attempt to publish their research projects. Students who were not involved in any research activities were excluded. Issues raised during focus group discussion were mainly related to factors that are likely to influence students' research experience and were mainly driven from the findings of other similar studies. These issues were related to the students' research environment, research training, time restrictions and mentorship. Further issues related to research and dissemination difficulties were discussed, highlighting the experiences of those who attempted to publish their findings. Four different focus groups were conducted. Due to cultural restrictions, male and female focus groups were conducted separately. Additionally, female students' focus groups were facilitated by a female researcher and, similarly, male focus groups were facilitated by a male researcher. Focus group discussions were facilitated via MD (female) and SE (male), who were postgraduate public health students at KSU with postgraduate training in qualitative research. No independent observer was invited to attend the focus group discussions.

There was no prior relationship established between participating students and the focus group facilitators. Audio recording was performed for all focus group discussions and this was augmented via handwritten notes. The handwritten notes were taken by FG (male) and TS (female), who are final year medical students. Each focus group contained between 7 and 10 students and lasted between 1 and 2 hours. No transcripts were provided to the students asking for additional comments. However, a summary of the focus group discussion was reviewed by the end of each discussion. Data saturation was not discussed with the students. Focus group discussions were conducted in Arabic. Transcripts were firstly produced in Arabic via HM (male), who is a final year medical student. Translation of manuscripts to English was performed via IG (male), who is an assistant professor at KSU's college of medicine; he is a native Arabic speaker but is

also fluent in English. Coding was performed by IG using Open Code 4.0 software. Line-by-line coding was conducted by reading all responses. A thematic approach was used to analyse the data. Similar codes were gathered within major themes and further subthemes were developed to indicate the issues influencing KSU medical students' research experiences. Selected quotations were used as examples of particular students' responses.

## Quantitative approach

As the thematic analysis indicated the importance of mentorship on influencing students' research experience, a quantitative investigation was conducted to assess supervisors' opinions about students' research activities. During the 2014/2015 academic year, the number of faculty members in the college of medicine was approximately 400 professors, though only about 100 were involved with students' research activities. Identification of supervisors was accomplished with the assistance of SRSU. Approaching professors was established via sending a survey link using the SRSU supervisors' database. Google forms were used to record supervisors' responses and a reminder was sent to them a month after the initial approach. A semi-structured questionnaire was developed via AO (male), an assistant professor at the college of medicine, to measure supervisors' research experience. The components of the questionnaire were mostly related to issues concerning supervisory experience, areas of strengths and weaknesses of students' research, and factors that are likely to enhance supervisory experience. SPSS software version 22 (IBM Corp, Armonk, NY, USA) was used to calculate means, standard deviations and the proportions of study variables.

## Results

### Participants' characteristics

A total of 49 participants were involved in this study; their characteristics are explained in table 1-2. Thirty-one students participated in the qualitative part of this study. However, only 18 faculty members responded to the online questionnaire (a response rate of 18%). The majority of students who participated in the study were third years; hence, the participation of students registered in the subsequent years was limited due to their clinical training. The majority of faculty members who responded were males, which is likely to represent the overall distribution of gender in KSU's faculty of medicine.

**Table 1** Participants' Characteristics

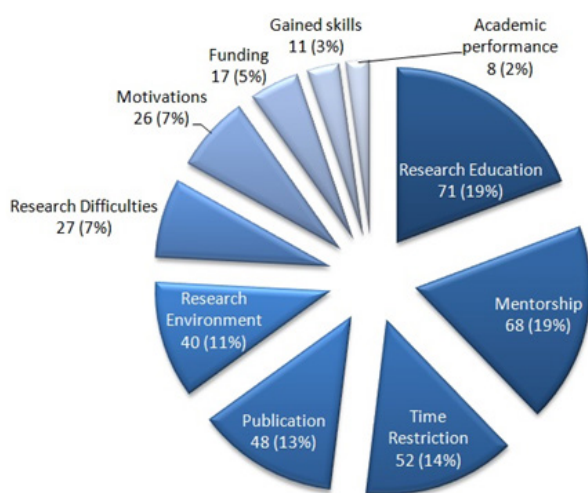
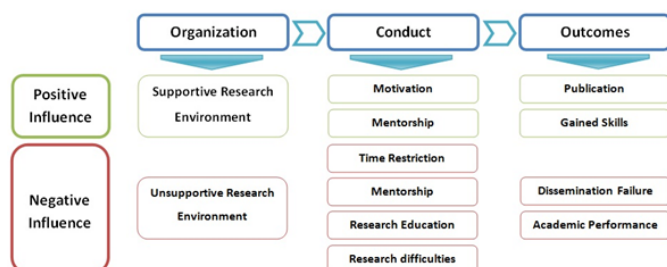
Students: N=31		Professors: N=18	
Age: Mean (SD)	22 (1)	Age: Mean (SD)	45.5 (8.6)
Gender: Frequency (Proportion)	Males: 14 (45.2)	Gender: Frequency (Proportion)	Males: 15(83.3)
	Females: 17 (54.8)		Females: 3(16.7)
Year of study: Frequency (Proportion)	Third year: 16 (51.6)	Academic Rank: Frequency (Proportion)	Assistant Professor: 9(50)
	Fourth year: 8 (25.8)		Associate Professor: 4(22.2)
	Fifth year: 7 (22.6)		Professor: 5(27.8)
	Yes: 15 (48.4)		No Publications: 8(44.4)
Publication in peer-reviewed journals: Frequency (Proportion)	No:16 (51.6)	Number of published supervised students' reports: Frequency (Proportion)	Single Publication: 3(16.7)
			Two publications: 4(22.2)
			Three Publications: 3(16.7)

**Table 2** Supervisors' perceptions of factors and how this would enhance their supervisory experiences

Factors that would Positively Influence Students' Supervisory Experiences	Frequency
Provision of financial incentives for supervision	12
Provision of research assistants	11
Provision of research budget	11
Reduction of administrative work	9
Provision of research administrative support	9
Provision of specific training for supervisors	6
Reduction of teaching work	5
Reduction of clinical work	3
Recognition and awarding of preeminent supervisors	1

## Findings of qualitative analysis

The data analysis produced 368 codes; their distribution and frequency are illustrated in figure 1. The thematic analysis produced three main themes and 12 subthemes. The main themes were related to organizational factors influencing students' research experience, the conduct of research and research outcomes. Furthermore, the subthemes were divided into factors with a positive or negative influence on the students' research experience (Figure 2). A description of the factors influencing students' research experience is stated below.

**Figure 1** Frequency (proportions) of reported factors influencing students' research experiences.**Figure 2** Main themes and subthemes summarising the factors influencing KSU medical students' research experiences.

## Research environment

Students' perceptions about the KSU research environment can be summarized into supportive and unsupportive factors. A supportive research environment was mostly related to the availability of

research chairs, access to funding through certain research chairs, the availability of a library and literature access, and the availability of professors interested in students' research. However, students do acknowledge that, despite the presence of a supportive research environment, the students' research experiences do vary, as explained in the following quote:

"I think that there are many opportunities to do research. However, I think there is a variation in the extent to which a student can do competent research."

Several factors aided in the creation of an unsupportive research environment for KSU's medical students. Lack of research coordination influenced students' orientation on the available research opportunities. This was manifested on several levels.

Some students indicated difficulties in identification and approaching suitable supervisors. The students thought that this could be solved through appropriate coordination between college professors and students, as indicated in these quotes:

"The college should have a research coordinator for students. Such a person is needed to facilitate the students' access to the researchers who are available to supervise us."

"I think the college environment is not supportive when students need to do research. Students do not know how to access the supervising doctors. The doctors do not know what the objectives of the research process are."

In addition, students thought that the lack of coordination between clinical and laboratory facilities in the university hospital and academic affairs in the college of medicine created an unfavorable research experience augmented by violations of their rights, as explained in the following quotes:

"We faced difficulty when we needed to collect data from the university hospital nursing staff as they required permission from their department directors. It is not practical to seek approval from every director in the teaching hospital. The ethical approval given by the research ethics committee in the college should be sufficient to convince the nursing staff to facilitate our research process."

"Some doctors are added to the research investigator list simply because they facilitate access for us to collect data either by providing laboratory investigations or connecting students with clinical staff. I think this practice is unethical as the doctor of concern gets his name added to the author list even without being involved with the research itself."

Another hindrance was related to cultural issues. Due to cultural restrictions practiced in Saudi Arabia students were not able to collect data from the opposite gender. For example, male students

thought that their difficulty in accessing female subjects for data collection would affect the quality of studies and reduce publishing opportunities. However, students thought it is possible to solve this issue, as indicated in this quote:

“Difficulty in accessing female students needed for data collection is a cultural issue. However, it can be solved by administrative or secretarial assistance.”

## Motivation

There are several factors that motivated KSU medical students to engage in research. Some students' interest in research was mostly based on increasing their chances of their research being published and having better future career opportunities as doctors and researchers. The following quotes illustrate students' perceptions about their undergraduate research motivation and future clinical practice:

“I got more interested in learning about research as it is very important for the advancement of medical care and the construction of management guidelines.”

“I think this course is crucial as it explains why it is important to understand evidence-based medicine practice. I think students should be aware about the importance of research early in their medical training and I do not think it is wise to delay this course further than the third year.”

Although some students explained that their interest was due to several reasons, some reported that they only engaged in research activities because it was mandatory. It can be clearly seen that some students' motivation to perform research is not moved by a scientific or clinical practice basis. The following quotes suggest that it can be useful to engage the students in a mandatory research course:

“I think having to do research on a mandatory basis is good practice as many students would not have done research if it was optional.”

## Education and time restrictions

Research education and time restrictions jointly had the biggest influence on students' curricular research experiences. Firstly, teaching a research course to KSU medical students during third year created several difficulties. These difficulties are related to teaching other clinical disciplines during the third year, which limited the time available for the students to understand and practice their research. The following quotes indicate how the timing of the course affected their research experiences:

“I think if we were taught research principles in the second year that would give us more chance to perform more research and gain more experience instead of delaying the research course to the third year.”

“As the third year is very busy, we put our main effort into becoming well educated about taking a medical history and doing physical examinations. I gave less attention to learning or doing appropriate research.”

Secondly, allowing sufficient time to understand practical statistical applications was critical to the students' research experiences. Furthermore, some students might have required more time to actually understand the statistical concepts. The following quotes explain how the difficulty in understanding statistical principles and practical training were important contributors to the students' experiences:

“One of the reasons which affected our ability to understand biostatistics was the fact that the course tutors assumed that we had a basic knowledge about it before the course, which was not true.”

“The course organizers did not allow sufficient time for practical SPSS training. Given that we are studying several courses simultaneously; it was very difficult to concentrate on the research course. We were lucky to have our supervising professor working with another biostatistician, who helped us with our data analysis.”

“The timing of the biostatistics lesson was two weeks before the final exams. Many of our colleagues were forced to skip these sessions to study for the final exams.”

Finally, it seems that the taught research course was not successful in educating KSU medical students about importance of research. This could have subsequently affected the quality of research conducted, which is partially supported by the witnessed low dissemination rate of the students. The following quotes highlight how their interest in research was actually enhanced after course completion rather than at the beginning of the course:

“Some of the lectures on the research methodology course seemed unnecessary. We were educated on several unpractical points, which made the course very difficult to understand and it seemed a waste of time. This made us less attentive toward doing research in the future. However, once we started doing research on our own, outside the course frame, we were able to do better research and even had the findings published.”

“Unfortunately, we only realized the importance of research once we had finished the research course. We had no intention of performing appropriate research or getting the findings published. I only understood the importance of research once the course was completed.”

## Research difficulties

When students were asked to indicate which part of their research they thought was most difficult to conduct, their responses were related to the difficulty in the formulation of research questions and objectives, securing ethical approval and their lack of statistical analysis skills. This forced them to consult external biostatisticians on certain occasions and secure ethical approval. These issues can be strongly influenced by research education and mentorship, as indicated in the following quote:

“I think it is difficult to clearly state the research question and objectives. Not clearly stating the research objectives led us to realize that some of the needed information was not collected when we had finished the data collection.”

## Dissemination

Dissemination of the students' research findings had a positive influence on their research experiences. However, failure to disseminate had a negative influence and the students indicated that almost no education was provided about dissemination methods, either through the submission of abstracts to conferences or the submission of manuscripts for peer-reviewed journals, as indicated in the following quotes:

“We did not know how to publish our findings and what mechanism to follow. We tried our luck, but we got rejected twice. Repeated rejections forced us to produce 7 versions of our manuscript. This was mainly due to lack of supervisory guidance.”

“I did not have sufficient knowledge about the differences between journals. I later realized that there are local and international journals. I think if you ask the students about the impact factors no one would know.”



It appears that dissemination opportunities are mostly influenced by students' motivation and the encouragement of supervising professors, as indicated in the following quote:

"Our supervising doctor gave us information about submitting to different journals. It was a good experience. However, it took us a while to understand the process of submitting a manuscript."

### Gained skills

Despite several factors that negatively influenced KSU medical students' research experiences, a mandatory research course might have enhanced their ability to conduct future research independently, as indicated in the following quotes:

"Completion of the research course enabled me to acquire sufficient knowledge to perform research independently."

"Before taking the research course, I had the belief that doing research was an impossible mission. However, once I got oriented about the research I got more confident about doing it."

### Academic performance

When the students were asked whether taking a mandatory research course during the third year could have affected their academic performance, several students indicated that research conduction and data collection forced some students to skip many lectures related other courses. Similarly, due to the difficulty of having supervisory meetings, some were forced to skip lectures to attend them. Having to collect data from external locations outside KSU appears to augment this issue. The following quote explain students' perceptions of interference between learning about research and other clinical disciplines:

"I noticed that we spent a long time on research conduction. I think this time should be better spent studying medicine. Sometimes I spend more time on data collection than actual study of other courses. I think this course has a negative impact on my academic performance."

### Findings of the quantitative analysis

Since only 18% of the approached professors responded, it is possible to argue that genuine interest in students' research could have influenced professors' motivation to respond to the survey. This is further augmented by the fact that only 10% of KSU medical students' research reports were published in peer-reviewed journals and the majority of supervisors who did not succeed in publishing students' research projects did not respond to the survey. Among the 18 professors who responded to the questionnaire, 10 reported the publication of students' research-related articles; and seven succeeded in publishing more than one.

When the responding supervisors were asked to report areas of students' research strengths and weaknesses, most of the supervisors indicated that the ability of the students to collect data was one of the major strength areas. However, they indicated that development of research questions was one of the weakness areas. This might justify why some supervisors would select research questions for the students despite their interest, as indicated in the students' quotes.

### Discussion

This mixed-methodology study aimed to evaluate KSU medical students' research experiences through focus groups and questioning faculty members involved in student's research using a constructed questionnaire. The main themes summarizing the factors influencing students' research experiences were related to their research

environment, the factors influencing research conduct and those related to research outcomes. The quantitative findings summarized supervisors' perceptions about the major areas of research strength and weakness and their perception of the factors that would influence their supervisory mission.

The current study indicated the importance of mandatory research courses in increasing students' awareness about the importance of research for clinical practice. A study conducted in Pakistan involving postgraduate medical trainees indicated that limited research interest was mostly driven by poor research training and education.<sup>13</sup> Nonetheless, Metcalfe suggests that educating medical students on the principles of research without appropriate organisation can have adverse effects via interference with students' curricular progress and the distraction of faculty members from their own clinical and research responsibilities.<sup>2</sup> This is further influenced by the fact that students do tend to prioritise their learning interests based on the immediate expected academic gains, especially if a mandatory research activity interferes with examinations.<sup>14</sup>

It is possible to argue that if, medical students are forced to prioritise their learning needs in a manner leading to low emphasis on another mandatory educational course, this could indicate a failure of the academic institution to provide competent curricular organisation. As indicated in the current study, factors related to the timing of the research course, limited time given for practical training, and interference with examinations hampered KSU medical students' ability to learn research principles. Evidently, appropriate organisations could enhance medical students' research experiences, as reported by Stagnaro-Green, where the creation of a Students Research Opportunities Office at Mount Sinai School of Medicine increased the student's participation in research simply through an organisation of mentorships, research activities and financial assistance for research and dissemination opportunities.<sup>15</sup>

The success of medical students' research education could be measured through publications and presentations. As teaching research principles for medical students vary depending on the institutions, several studies reported different student's publication patterns.<sup>3,4,12,16</sup> Quality of mentorship, research teaching and the organisation itself is likely to affect students' dissemination opportunities. A survey which involved British medical students from seven medical schools reported that only 11% of the respondents stated that they were knowledgeable about publication methods and 92% admitted that they could not have submitted their research reports without the support of research supervisors.<sup>11</sup>

The findings of this study indicate the need to perform several organizational initiatives. There is a need to revisit the curriculum structure of KSU's medical college and minimise the interference between research and clinical education, and examinations. More emphasis should be given to providing practical training in statistics and scientific writing. Additionally, a specific system should be developed to enhance supervisory experience through the regulation of teaching, clinical and administrative loads, and the provision of specific researching training and assistance to the involved supervisors.

This study has several areas of strengths and weaknesses. It benefited from rich data, which was collected using a qualitative approach in order to evaluate students' research experiences. Furthermore, the findings of the qualitative part facilitated the production of a questionnaire that enabled the examination of specific issues involved with mentorship. The main limitation of this study was the low response rate of the approached supervisors. There is a minor possibility that this low response rate might reflect the overall

KSU medical faculty's genuine interest in students' research, as only a minority shared their supervisory experience. Additionally, the findings of the quantitative section are supported by several main issues, indicated by students' quotes.

## Conclusion

Evaluation of KSU medical students' research experience and an evaluation of their mentorship experience indicated several areas of improvement. Better organisation of research education, improvement of students' supervisory mission, and specific research and writing training are required to enhance the students' research experiences and their faculty could be more helpful their research activities and also participate more than 18% in the quality part survey.

## Competing Interests

The author(s) declare that they have no competing interests.

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