



## Early clinical exposure program in learning renal physiology

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> Abstract

**Introduction:** Teaching renal physiology for undergraduate medical students in an understandable way using methods which improve their deep learning has always been a problem. In this study, Early Clinical Exposure (ECE) was used in teaching renal physiology for the second year medical students in Shiraz Medical School. This article aims to introduce and develop this program and also measure the attitude of medical students toward ECE in learning renal physiology.

**Methods:** This is a mixed method study conducted on 120 second year undergraduate students. After performing the course, both qualitative and quantitative methods were used for measuring the viewpoints of the students. In the qualitative part, 10 high rank medical students were selected. These students participated in brain storming sessions to express their opinion about the program based on the strengths and weaknesses. For trustworthiness of the qualitative part, member check and peer check were done. In the quantitative part, a researcher-made questionnaire was used based on the objectives of the program in a 4 point Likert scale. The validity of questionnaire was determined by medical education experts and reliability was determined after a pilot study.

**Results:** Based on the results of the quantitative part of the study, 98 percent of the students stated that the ECE program was generally a useful program. In the qualitative part, the students' comments were obtained. The benefits of the program were summarized in 4 main themes. These themes are "understanding of renal physiology", "Integration of basic and clinical knowledge", "Improvement of attitude toward importance of physiology", and "encouragement to study". In response to the questions about negative aspects of this program in qualitative part, the two main themes were insufficient time and large group size.

**Conclusion:** Students reported that ECE was useful, but they stated that they needed to have more encounter with patients and more hospital teaching. The results also reveal that this ECE program is an excellent approach to strengthen learning in a difficult subject like renal physiology. This approach is adjustable to other basic science topics and subjects as well.

**Keywords:** Early clinical exposure; Integration; Learning

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## Introduction

Becoming a physician is a difficult process, and the early years of undergraduate medical education can have a significant effect on this process. Besides, with the move toward the reforms of medical curriculum in recent years, there have been emergent attempts to make some occasions for integration of pre-clinical and clinical phases and Early Clinical Exposure programs (ECE) (1).

In recent years, the importance of ECE has increasingly been highlighted by medical education experts (2). ECE is defined as patient contact in a clinical environment in pre-clinical period that improves learning (3).

The objectives of ECE are to improve the medical students' attitude toward basic sciences and clinical skill training, foster deep learning in pre-clerkship setting, encourage the professional interest (4).

A systematic review about ECE revealed that it can improve self-awareness, and make students happier with their medical education curriculum and self confidence in meeting the patients. ECE can motivate them and reduce the stress of meeting patients. It exposes the students to clinician role models, reinforces the students' learning, and helps them learn about how clinicians and the healthcare system can take care of the patients. It can strengthen learning of basic sciences, biomedical and social sciences and educational objectives that cannot be learned from textbooks. ECE can also help the teachers, healthcare providers and patients (3).

An overview about ECE in undergraduate medical curriculum in Europe showed that ECE had been suggested as a method for educating undergraduate medical students, and is applied in basic medical teaching in numerous countries in Europe, with a variation of objectives, educational strategies, and evaluation methods (5).

Some ECE programs are designed based on specific objectives in linking basic science and clinical science in of the form of vertical integration, while others are designed for focusing on social aspects and meaning of diseases and communication skills (6, 7).

One of the disciplines in basic science that is highly related to clinical medicine is physiology. A basic science, like physiology, should be well-educated as an applicable subject, for use in the clinical setting. Acquisition of a massive amount of knowledge could not permanently mean that the student will be capable of relating that knowledge in a clinical situation for patient care. Perfect knowledge of physiology will be a perfect acceptance of its clinical correlations, and will

consequently lead to a comprehensive clinical practice and patient care. Therefore, physiology would be well understood, remembered and practically used if educated in a clinically arranged setting (8).

Teaching renal physiology to undergraduate medical students so that it is understandable and also improves their deep learning has always been a problem. Therefore, in this study ECE was used in teaching renal physiology to the second year medical students in Shiraz Medical School.

This study was carried out to introduce and develop this program and also measure the attitude of medical students toward ECE in learning renal physiology.

## Methods

This is a mixed method study conducted on 120 second year undergraduate students. At first, the course plan of renal physiology was studied by a nephrologist and a physiologists in a 2 month period, and discussion about including ECE was made by these experts. The topics selected by the above-mentioned experts were "Acid Base Balance" and "Water and electrolytes". In the beginning of the class, the introduction of these topics was presented by a physiologist. In this part, the aim of the course and ECE program was explained to the students. Then, the students were divided into 12 groups, each group containing 10 medical students. Each group was directed by a last year medical student as a tutor. The tutors had experience about the topics and small group activities. These groups of students attended the hospital to the nephrology ward and obtained the history of patients and observed the physical examination that was done by a nephrologist with assistance of a last year medical student for each group. The third section was done in the class and a nephrologist answered the students' questions about real patients in the large group discussion. At the last section, the students were asked to answer the clinical scenarios based on their knowledge in the basic science renal physiology and their hospital experience. A sample of questions is mentioned below.

A 69 year old man was admitted in the surgical ward. 2 days after admission, he suddenly developed cardiorespiratory arrest. Cardio-pulmonary Resuscitation was done for him and he was intubated and he was under respirator; the sample of Arterial Blood Gas showed the following result:

PH: 6.85, PCO<sub>2</sub>:82 mmHg, PO<sub>2</sub>:214mmhg, HCO<sub>3</sub>:14mmol/l, Anion gap: 24, Lactate: 12mmol/l

Please determine the changes of these parameters in this patient:

- 1- Intracellular and extracellular water and electrolyte
- 2- The serum level of Anti Diuretic Hormone (ADH), Atrial Natriuretic Peptide and Aldosterone
- 3- Urinary Sodium Excretion
- 4- Urine osmolarity

For measuring the viewpoints of the students about this ECE, both qualitative and quantitative methods were used. In the qualitative part, 10 high rank medical students were selected through extreme case sampling method (9). These students participated in brain storming sessions to express their opinion about the program based on the strengths and weaknesses of the program and recommendation for similar programs for the future. All of the sessions were recorded and major themes mentioned. For trustworthiness of the qualitative part, member check and peer

check was done. In the quantitative part, a researcher made questionnaire was used based on the objectives of the program in a 4 point Likert scale. The validity of the questionnaire was determined by medical education experts and reliability was determined after a pilot study ( $r=0.81$ ). The students' grades in summative physiology exam were used as a measure of achieving the objectives of the ECE.

**Results**

All of the students filled out the questionnaires. Based on the results of quantitative part of the study, 98 percent of the students stated that the ECE program was generally a useful program (Figure 1). The results of other questions are shown in Table 1.

In the qualitative part, the students' comments

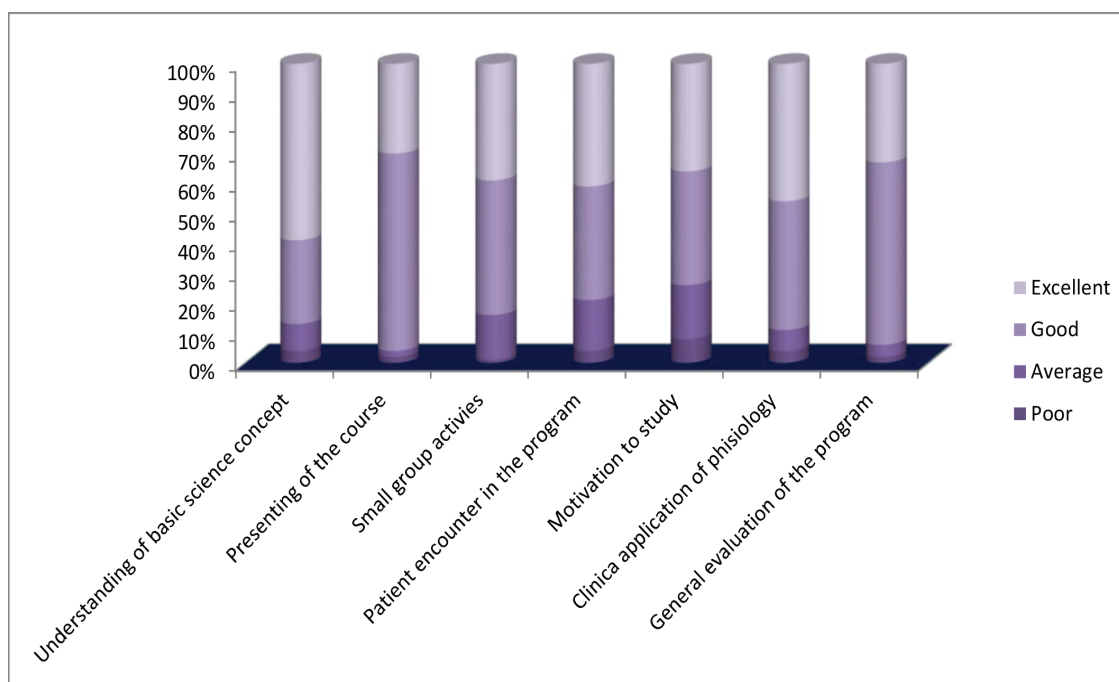


Figure 1: Students' viewpoints about ECE program in renal physiology

Understanding of renal physiology	<p>"helped us develop a better understanding of the subject of renal physiology"</p> <p>"visiting the patients facilitated the understanding of the physiology deeper"</p> <p>"we could know well instead of just remembering the concepts"</p> <p>"made the concepts clear"</p>
Integration of basic and clinical knowledge	<p>"We could relate what we saw with what we had studied"</p> <p>"It was a very good topic where we could integrate our basic science knowledge with clinical concepts"</p> <p>"We understood how to relate physiology with patients' symptoms"</p> <p>"Acts as connection between basic and clinical discipline"</p>
Improvement of attitude toward importance of physiology	<p>"was interesting and gives us the view about the importance of physiology"</p> <p>"It is exciting to get the things we read in our references"</p>
Encouragement to study	<p>"I saw really that I am a physician; therefore, I should study hard"</p> <p>"seeing the patients encouraged us to study more about physiology"</p> <p>"I really got interested in my basic sciences textbooks after seeing the patients"</p> <p>Makes us conscious that we are going to become actual doctors and innocent patients have come from reserved places believing us. I will study hard</p>

were obtained; as shown in Table 1, the benefits of the program are summarized in 4 main themes. These themes are “understanding of renal physiology”, “Integration of basic and clinical knowledge”, “Improvement of attitude toward importance of physiology”, and “encouragement to study”(Table 1).

In response to questions about negative aspects of this program in the qualitative part, the two main themes were insufficient time and large group size.

Some of the students' recommendation are listed below:

*“The number of students in each group was too large per patient.”*

*“The hospital group is big and not all of us got a chance to visit the patients appropriately.”*

*“The time for going to hospital was short and the clinician was demonstrating entirely and then, we didn't time to practice by ourselves.”*

*“Sometimes other students from other groups moved toward our group; then, our group would be too big.”*

Recommendation about improving the ECE program in future included having smaller groups for visiting the patients, increasing the frequency of hospital visits and the number of visiting patients.

## Discussion

ECE arose an opportunity to familiarize the students with the perception of diseases early in their undergraduate medical education curriculum. It also assisted in integration of basic sciences with clinical sciences (10).

The students' viewpoints about the ECE program in renal physiology showed that ECE was a valuable educational experience for them. It seems likely that these results were obtained because ECE encouraged the students to understand the application of renal physiology concepts in clinical problem-solving and to use it in their future practice as a physician. Dahle et al. suggested that vertically integrated curriculum could lead to a better acceptance of biomedical principles (11).

The results of other ECE articles showed similar results (3, 6, 7, 12).

Another noticeable finding of the present study was that the ECE program activated the students' concern in being a physician. It seems that seeing the hospital environment and having relationship with physicians, nurses and patients encouraged them and prepared an opportunity for them to think about their future career as a medical doctor. These results indicated that the program familiarized the students with the physicians' roles and tasks they must do in their

future profession. Other studies reported similar findings (13, 14).

Synchronization of ECE and an organ system like the renal system in this study was reported to be useful by the students. It may be due to the complex nature of renal physiology. A survey of the internal medicine subspecialty fellowship program showed that those who did not select nephrology fellowship reported that the care of patients with renal disease is “too complicated”. 33% of the respondents believed that renal physiology was the most difficult course in their undergraduate medical education, with acid-base balance and electrolyte imbalance named as the most difficult themes to learn (15).

Another study about the students' attitude about renal physiology showed that there was a need for curriculum redesign in renal physiology and teaching this important course using interactive methods (16).

One of the problems of early clinical learning reported in this study was that students had limited opportunities for visiting the patients during the clinical sections. The students ascertained that the large number of patients and one clinical teacher during clinical sections is not perfect and students don't have a chance to have enough contact with patients.

Sometimes, the clinical tutor spent too much time on explaining, so the students did not have enough time for discussion. It was clear that the large number of students was a major constraint for students to participate in discussions. Other studies reported similar problems (17-19). Some studies recommended 8 or fewer students for each early clinical exposure session (18). However, due to the high number of medical students and our available resources including busy clinical faculties, the ratio between the students and faculty members was not appropriate in our setting and should be considered in future programs.

Research about curriculum redesign is one of the medical education research priorities in Eastern Mediterranean Region and Iran (20, 21). The strength of the present study as mentioned earlier is that this study defined a curriculum redesign model for an important topic like renal physiology. Our previous studies about ECE showed similar results (22, 23).

The limitation of this is that it was done based on the students' viewpoints and we could not measure the real outcome of the program. Besides, the duration of the program was short. In future studies, a longer duration, especially for hospital activities, would let the students see more patients and it would lead to better achievement of the objectives.



## Conclusion

Our study showed a quantitative and qualitative summary of renal physiology ECE in our country. We have designed ECE from the beginning carefully and have renewed the renal physiology curriculum to the degree possible. Students reported ECE to be useful, but they recommended that we should have more encounters to the patients and receive more hospital teaching. The results also revealed that this ECE program was an excellent approach to strengthen learning in a difficult course like renal physiology. This approach is adjustable to other basic science topics and subjects as well.

**Conflict of Interest:** None declared.

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