



## Simulation and education

## Comparison of two teaching methods for cardiac arrhythmia interpretation among nursing students<sup>☆</sup>



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## ABSTRACT

**Aim:** The aim of this study was to compare the six-stage method (SSM) for instructing primary cardiac arrhythmias interpretation to students without basic electrocardiogram (ECG) knowledge with a descriptive teaching method in a single educational intervention.

**Methods:** This is a randomized trial. Following a brief instructional session, undergraduate nursing students, assigned to group A (SSM) and group B (descriptive teaching method), undertook a written test in cardiac rhythm recognition, immediately after the educational intervention (initial exam). Participants were also examined with an unannounced retention test (final exam), one month after instruction. Altogether 134 students completed the study. Interpretation accuracy for each cardiac arrhythmia was assessed.

**Results:** Mean score at the initial exam was  $8.71 \pm 1.285$  for group A and  $8.74 \pm 1.303$  for group B. Mean score at the final exam was  $8.25 \pm 1.46$  for group A vs  $7.84 \pm 1.44$  for group B. Overall results showed that the SSM was equally effective with the descriptive teaching method. The study showed that in each group bradyarrhythmias were identified correctly by more students than tachyarrhythmias. No significant difference between the two teaching methods was seen for any specific cardiac arrhythmia.

**Conclusions:** The SSM effectively develops staff competency for interpreting common cardiac arrhythmias in students without ECG knowledge. More research is needed to support this conclusion and the method's effectiveness must be evaluated if being implemented to trainee groups with preexisting basic ECG interpretation knowledge.

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### 1. Introduction

Effective and early recognition of cardiac arrhythmias during cardiac rhythm monitoring of critically ill patients and cardiac arrest victims may be crucial and beneficial to identify changes in cardiac status, assess response to treatment and diagnosis.<sup>1–3</sup> In the 2010 guidelines of the European Resuscitation Council (ERC) for cardiopulmonary resuscitation (CPR), emphasis is given in the early recognition of high risk patients for cardiac arrest, highlighting the importance of early identification of life-threatening cardiac arrhythmias by medical or nursing staff before the patient becomes symptomatic.<sup>4–6</sup>

Accuracy of cardiac rhythm interpretation improves with intermittent educational interventions.<sup>1,7</sup> Lecture can be used for teaching cardiac rhythm disorders interpretation to healthcare professionals.<sup>1,8,9</sup> Moreover, instruction of cardiac rhythm recognition is critical during Advanced Life Support (ALS) training and recommendations for education in CPR suggest evaluation of any educational intervention to ensure that learners acquire and retain knowledge and skills.<sup>10</sup> Further research is needed to develop and evaluate ideal time-effective teaching methods for cardiac rhythm interpretation.<sup>9,11</sup> The six-stage method (SSM)<sup>12,13</sup> is an alternative to a lecture-based teaching method, in which cardiac arrhythmias are introduced using ECG pattern description. The SSM has been approved by the ERC and is being used in ALS courses.<sup>13</sup> The method provides a structured rhythm analysis and the questions are easy to remember, which may lead to higher skill retention.<sup>12</sup> Furthermore, the method allows accurate analysis and description of a rhythm, sufficient to dictate safe and effective clinical management of an arrhythmia, without the need to give it a specific name.

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The aim of the present study was to assess and compare two teaching methods of primary cardiac arrhythmia interpretation with a single educational intervention to students with no prior training in electrocardiogram (ECG) and cardiac rhythm interpretation. We compared the SSM with the descriptive teaching method and investigated the effectiveness of both methods immediately after the educational intervention and a month later, by examining skill retention.

## 2. Methods

### 2.1. Participant recruitment

Third-year undergraduate nursing students of the University of Athens were included in the study. The participants had not followed any didactic session about cardiac rhythm monitoring and electrocardiography before participating in the study. Students who were already working as staff nurses or did not appear on date of the instruction were excluded from the study. The study population consisted of 185 students of the overall 234 students who were attending the academic year. The students that participated were highly motivated to learn how to recognize cardiac arrhythmias and are considered to constitute a 'virgin' population regarding their ECG knowledge level.

### 2.2. Design of the study

This educational study took place within the academic course of "Internal Medicine I" on the fifth semester (winter 2011/2012) after obtaining Institute's Committee Ethics approval (Institutional reference number: 2160/22-7-2011). Attendance at these lectures was mandatory and all students had been informed about their voluntary participation in a comparative study of two cardiac arrhythmia interpretation teaching methods and that their score performance would not affect their final course's score. The students were not told which teaching method they would be receiving. The exam's written assessment sheets were anonymous and participants used only their student identification numbers (SID). The study consisted of two parts, an initial instruction and assessment and a final assessment a month later. The initial instruction and exam took place at the University of Athens, Faculty of Nursing on December 15, 2011 and the final exam on January 19, 2012.

The students were randomized and assigned anonymously, based on their SID, to a group with odd SIDs (group A) and a group with even SIDs (group B). Students of group A were taught cardiac arrhythmia interpretation using the SSM and group B using a descriptive teaching method. All students were instructed with a single educational intervention in two separate sessions, one for each group, on the same date. Firstly, students of group A were instructed and examined and subsequently students of group B. No study preparation material was given to the students. As all students were attending the same academic semester, the chosen target group of the study consisted of students homogeneous regarding their educational level about cardiac rhythm analysis and so, no pretest was performed before the instructional session.

Group A was initially given a 20-min introductory lecture by the main investigator, in which basic ECG principles and cardiac rhythm disorders were briefly explained, using the SSM (used in ALS courses), where cardiac rhythm recognition is achieved through answering specific questions.<sup>13</sup> Afterwards, all students were randomly selected and divided into subgroups of 10–15 students each, who were taught cardiac arrhythmia interpretation for 15 min by seven ALS Course Instructors interactively with focused discussion. Enlarged ECGs with various cardiac rhythms were used for that purpose and the instructors used the SSM for teaching

rhythm recognition. Students were taught to identify ventricular fibrillation by pattern recognition at stage 1. The full structured analysis was used to assess the rest of the cardiac arrhythmias associated with cardiac arrest and the peri-arrest period.

Group B was instructed in arrhythmia interpretation using a descriptive teaching method. Again, students were initially given a different 20-min introductory lecture by the same instructor, with a brief explanation of basic ECG principles, sinus rhythm and cardiac rhythm disorders based on the descriptive strategy, by analyzing their relevant characteristics. After the lecture, students were randomly selected and divided into subgroups of 10–15 students each, who were instructed for another 15 min interactively in rhythm recognition by the same seven ALS instructors. The instructors used the same enlarged ECGs and introduced all cardiac arrhythmias by discussing interactively specific features of each arrhythmia. Students were taught how to identify ventricular fibrillation patterns, recognize P waves and QRS complexes, estimate heart rate and rhythm regularity. Cardiac rhythm interpretation was based primarily on pattern recognition.

The cardiac rhythms used for instruction were identical for both methods and students were taught to recognize ventricular fibrillation (VF), ventricular tachycardia (VT), asystole (A), sinus rhythm (SR), sinus tachycardia (STachy), sinus bradycardia (SBrady), supraventricular tachycardia (SVT), atrial fibrillation (AF), atrioventricular block 2nd degree-Mobitz II (AVBlock2nd) and 3rd degree (AVBlock3rd). All instructors who participated in the study were properly prepared with faculty meetings prior to the study, in which purpose of the study and the two methods were exactly discussed and studied, in order for them to use the SSM for all students in group A and the descriptive teaching method for all students in group B. In this study, we chose to add the small-group teaching method for both student groups after the initial lectures to ensure active participation of the students, since cardiac arrhythmia interpretation is a complex practical skill and small group teaching is likely to increase student performance compared with lectures.<sup>11,14,15</sup>

The material supporting both lectures had been given to an expert team of a total of twelve ALS Course Instructors and Directors for content improvement and it was also sent to local resuscitation authorities (people with multiple publications on resuscitation, who are part of the ERC ALS working group or International Course Committees) to ensure it was of a high standard and accurate content.

Immediately after each instructional session, participants undertook a standardized written multiple choice test in cardiac rhythm interpretation (initial exam). There was a 10-min maximum time allowance, the students were under constant supervision and no assistance was provided. The examination sheet included 10 cardiac rhythms with four possible answers for each rhythm and one of them is correct. The time limit of 1 min for each cardiac rhythm was considered to be sufficient, since the students were instructed in emergency rhythm recognition.<sup>2,6</sup> Only the taught cardiac arrhythmias were used for assessment and the students had to recognize VF, VT, A, SR, STachy, SBrady, SVT, AF, AVBlock2nd and AVBlock3rd. The written test was exactly the same for both groups and the test score varied from 0 to 10 for each student, depending on the correct identified cardiac rhythms. Participants were also asked general information about their age and sex.

The students were asked to participate in an unannounced reexamination in cardiac arrhythmia identification one month after the teaching session (final exam), using the same assessment sheet that was used at the initial exam. Purpose of the final exam was to assess skill retention in general and with each method. Participants were given no study material after the initial teaching in order to

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