# Simulation Curriculum Can Improve Medical Student Assessment and Management of Acute Coronary Syndrome During a Clinical Practice Exam

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**Abstract:** *Background:* It has been noted that increased focus on learning acute care skills is needed in undergraduate medical curricula. This study investigated whether a simulation-based curriculum improved a senior medical student's ability to manage acute coronary syndrome as measured during a clinical performance examination (CPX). The authors hypothesized that simulation training would improve overall performance when compared with targeted didactics or historical controls. *Methods:* All 4th-year medical students (n = 291) over 2 years at the authors' institution were included in this study. In the 3rd year of medical school, the "control" group received no intervention, the "didactic" group received a targeted didactic curriculum, and the "simulation" group participated in small group simulation training and the didactic curriculum. For intergroup comparison on the CPX, the authors calculated the percentage of correct actions completed by the student. Data are presented as mean ± standard deviation with significance defined as $P < 0.05$. *Results:* There was a significant improvement in overall performance with simulation versus both didactics and control ($P < 0.001$). Performance on the physical examination component was significantly better in simulation versus both didactics and control, as was for diagnosis: simulation versus both didactics and control ($P < 0.02$ for all comparisons). *Conclusions:* Simulation training had a modest impact on overall CPX performance in the management of a simulated acute coronary syndrome. Additional studies are needed to evaluate how to further improve curricula regarding unstable patients.

**Key Indexing Terms:** Medical student; Simulation; Deliberate practice; Curriculum; Acute coronary syndrome. **[Am J Med Sci 2014;347 (6):452–456.]**

Each year in the United States, millions of patients are hospitalized for medical conditions requiring urgent assessment and treatment such as acute coronary syndrome (ACS).[1–4] Best-practice guidelines have been published for proper patient assessment and management for ACS and other acute illnesses.[5–10] Adherence to these guidelines dramatically improves patient outcomes.[1,4,7,11–15] However, an equally large amount of research has shown that overall adherence to guidelines by physicians is poor.[7,16–25]

Some sources have recently reported that little training is included in the most medical school curricula to prepare future interns for the care of unstable patients.[26,27] Several studies have demonstrated that simulation-based medical education (SBME) can improve performance in the management of unstable patients immediately after training.[28–30] Accordingly, our institution sought to improve the training of its students for the management of acute medical conditions. One part of this curricular expansion was to teach students how to assess acute chest pain and manage ACS. We undertook this study to investigate whether this new simulation-based curriculum improved the senior medical student's ability to properly manage a standardized patient (SP) presenting with ACS. Our hypothesis was that SBME combined with a targeted didactic curriculum would improve student adherence to published guidelines for the assessment and management of simulated ACS several months after initial training, when compared with both the exposure to the targeted didactic curriculum alone and historical controls.

## METHODS

The Medical University of South Carolina Institutional Review Board reviewed this study protocol and waived the need for Institutional Review Board approval.

Students who participated in the Internal Medicine 3rd-year Clerkship in the 1st half of year 1 were considered the "Control" group. This group received no curricular intervention. We instituted a targeted didactic curriculum during the midpoint of year 1 during the Clerkship. This group of students was the "didactic" group whose targeted didactic curriculum included 2 hours of lectures entitled "The Approach to the Unstable Patient," when on the Clerkship. The content of the didactic curriculum covered the initial assessment, differential diagnosis and management of a patient presenting with acute chest pain including the proper initial management steps of ACS. In the 2nd year of the study, the "simulation" group participated in small group simulation training in addition to the targeted didactic curriculum.

We administer the clinical performance examination (CPX) in the 1st quarter of the senior year of medical school at our institution. All 4th-year medical students (n = 291) who took an 8-station CPX over the 2-year period were included (n = 144 and n = 147 for years 1 and 2 of testing, respectively). The standard 7-station CPX was administered along with an added 8th station that included the unstable patient (ACS, specifically acute ST-elevation myocardial infarction [STEMI]). Student performance on the ACS station was not

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TABLE 1. Grading checklist for acute coronary syndrome station

| Item | Assessment |
|---|---|
| 1 | Performed hand hygiene |
| 2 | Introduced self to patient |
| 3 | Assessed level of consciousness (alertness/orientation: person, place, time, etc) |
| 4 | Acquired history of present illness (asked questions about chest pain—where, how long, how bad, etc?) |
| 5 | Acquired medical history (do you have medical problems for which you see a doctor?) |
| 6 | Acquired surgical history (have you had surgery? When?) |
| 7 | Acquired family Hx (does anyone in your family have heart disease; other health problems?) |
| 8 | Acquired social Hx (alcohol, tobacco, illicit drugs) |
| 9 | Asked about allergies (allergies to foods or medications?) |
| 10 | Asked about current medications |
| 11 | Asked about last dose of sildenafil (Viagra) |
| **Item** | **Physical examination (including obtaining vital signs)** |
| 12 | Applied bedside ECG |
| 13 | Confirmed patent IV in place or requested IV placement (is there a working IV?) |
| 14 | Placed pulse oximeter |
| 15 | Applied BP cuff |
| 16 | Checked temperature |
| 17 | Checked BP in both arms |
| 18 | Auscultated heart (must auscultate in 4 points on chest and over carotids) |
| 19 | Auscultated lungs (credit for >3 lung fields on each side) |
| 20 | Auscultated abdomen (credit for >2 areas of auscultation + palpation and "does this hurt?" or any pain?) |
| 21 | Examined extremities (credit for checking pulses in both arms and checked for edema in legs) |
| 22 | Examined patient's neck |
| **Item** | **Differential diagnosis** |
| 23 | Listed correct DDX (acute coronary [acute MI, heart attack, STEMI], pulmonary embolus, pericarditis, esophageal rupture (Boerhaave's syndrome), aortic dissection, pneumothorax) |
| **Item** | **Laboratories and tests** |
| 24 | Ordered 12-lead ECG |
| 25 | Ordered portable chest x-ray (CXR) |
| 26 | Ordered correct laboratories (BMP, CBC, cardiac enzymes, LFTs, Coags [PT, PTT, INR], d-dimer) |
| **Item** | **Diagnosis** |
| 27 | Correctly diagnosed "anterior-lateral STEMI" |
| 28 | Correctly assessed CXR—no acute cardiopulmonary problem/normal aorta/no air in mediastinum/no pericardial effusion |
| 29 | Correctly assessed laboratories (need to mention elevated troponin and Glc) |
| **Item** | **Management** |
| 30 | Placed supplemental oxygen (NC if $SaO_2 > 90\%$, FM if $SaO_2 < 90\%$; must titrate for $SaO_2 > 94\%$) |
| 31 | Ordered immediate cardiology consult |
| 32 | Requested/mentioned to activate cath laboratory |
| 33 | Ordered nitroglycerin (sublingual, paste or infusion) |
| 34 | Ordered aspirin (325 mg)—verbalized that patient is to chew this |
| 35 | Ordered heparin bolus and infusion (okay to unknown dose) |
| 36 | Participant stated that it was safe to give heparin b/c CXR normal and BP equal in both arms |
| 37 | Ordered Plavix (clopidogrel load), 300–600 mg by mouth |
| 38 | Ordered Lipitor or simvastatin (80 mg by mouth) |
| 39 | Ordered Lopressor (metoprolol) (5 mg IV) |
| 40 | Ordered bolus 1 L normal saline or lactated Ringer's solution |
| 41 | Ordered Mucomyst (600 mg by mouth)to be given immediately |
| 42 | Requested monitor for transport to cath laboratory |

ECG, echocardiography; BP, blood pressure; BMP, basic metabolic panel; CBC, complete blood count; LFT, liver function test; PT, prothrombin time; PTT, partial thromboplastin time; INR, international normalized ratio; IV, intervenous; NC, nasal canula; FM, face mask.