The Use of Simulation for Medical Student Handoff Education

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Abstract
Patient handoffs are a necessary part of modern patient care in large tertiary care hospitals. Though formal training often exists for medical residents, there are few opportunities for medical students to learn this essential skill prior to residency. We propose a case-based simulation approach to teaching handoffs. We focus on small-group learning in a safe environment, autonomous decision-making, and a formative assessment through structured debriefing. Deep understanding is fostered through teaching peer collaboration and flexible medical decision-making.

Keywords: simulation, medical students, handoff

Rationale
One of the great challenges of medicine is that “at some point in the day or the week or the call cycle...physicians...must go home, and care must be handed over to someone else. This is a biologic and logistic imperative.”1 As a result, modern patient care, particularly in academic institutions, is delivered by multiple providers with varying degrees of knowledge of their patients.2 Handoffs between providers, in which control of and responsibility for a patient passes from one health professional to another, are increasing.3 There are no easy solutions: lengthy shifts have been associated with an increase in serious medical errors 4 while flawed handoffs create the potential for medical errors and serious health consequences for patients.

Many metrics have been developed to examine and improve individual handoffs. Brannen et al (2008) indicates that, at best, resident participants in a singular handoff agree on a primary diagnosis and problem list about 50% of the time.5 The use of simulated handoff experiences, checklists, and mnemonics all have been shown to

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reduce mistakes. However, although a singular handoff may be excellent, the successful secondary transmission of patient information is crucial for continued high-quality healthcare delivery. We believe studying more than one handoff at a time is important; like a game of ‘telephone,’ nuance or substance may be lost the further one is from the initial successful handoff.

Implementing structured handoff environments and focused handoff education for medical residents has been associated with a significant reduction in medical errors and preventable adverse events among hospitalized children. While handoffs among medical residents have been scrutinized in light of their lengthy work-hours, we know little about how medical students learn and execute handoffs. A 2014 study on handoff practices in undergraduate medical education reported that few medical students are taught handoff competencies in medical school. This is a significant deficiency as commonly, students in their final year are allowed to perform handoffs without any formal training. Specifically, in a national survey of clerkship directors in Internal Medicine, only 15% of clerkships had structured handoff training, however, 93% reported that sub-interns (students in their fourth year) performed handoff activities. In a survey by Arora et al., medical students reported they frequently participate in handoffs, have little formal training, and all believed they had witnessed a handoff error. The author suggests medical schools should ‘consider the appropriate level of competence for medical student participation in handoffs, and implement corresponding curricula and assessment tools to ensure medical students are effectively able to conduct handoffs.’

Simulation has been proven to effectively teach complex skills. Simulation has been shown to enhance medical education; students who participated in a simulation exercise performed better on a knowledge-based test and reported increased comfort and perceived competence in their clinical approach (Sperling, Med Ed Online 2013). Team-based training has also been proven effective in healthcare; the T-Mex (Teamwork Mini-Clinical Evaluation Exercise) focused on six collaborative competencies in healthcare through direct observation and of exercises such as discussing discharge plans and asking for help with patients. The competencies taught included supportive team relationships, self-awareness, and safe communication.

Aim
It is clear that medical students need better handoff education and there are a multitude of methods available for instruction. Good handoffs require specific skills – teamwork, clear communication, a cognitively safe environment, and a good understanding of the patient’s medical needs. Further, they are performed in complex
tertiary care training institutions and often multiple handoffs are needed over a patient’s time in the hospital. The aim of our project is to develop a structured handoff training exercise using simulation to create a patient-care environment for students to practice and observe multiple handoffs over time.

**Project Description**

Small groups of 4-6 students will meet in hour-long sessions; some will participate and others will observe. The session will be outlined as confidential and ungraded. Direct instruction will be provided to review competencies related to high-quality handoffs using the handoff elements specific to Lurie Children’s Pediatric Residents, “L-U-R-I-E-S,” as adapted from the hospital Care Transition Policy:

<table>
<thead>
<tr>
<th>LINER</th>
<th>“One-liner” with critical information about the patient. Includes two patient identifiers and chief complaint or primary diagnosis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPDATES</td>
<td>Update of events from the day including recent changes in status or plan.</td>
</tr>
<tr>
<td>RELEVANT SYSTEMS</td>
<td>Orderly review of patient problems and plan by systems, emphasizing those that are relevant to patient’s diagnosis.</td>
</tr>
<tr>
<td>IDENTIFY PROBLEMS</td>
<td>Anticipated changes in condition of patient including what may go wrong during the next interval of care.</td>
</tr>
<tr>
<td>EXPECTANT MANAGEMENT</td>
<td>Plan of action for anticipated difficulties, follow-up items for next interval of care.</td>
</tr>
<tr>
<td>SEVERITY &amp; SYNTHESIS</td>
<td>Outgoing team: shares their impression of patient’s severity. Incoming team: verbalizes understanding and asks questions.</td>
</tr>
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Two medical student colleagues will be observers during the case and between three and five will participate. The first participating student and the observing students will initially be presented with the history and physical of a simulated patient seen in the Emergency Room and admitted to the inpatient Pediatric General Medicine service. Verbal handoff from a supervising physician/educator and a simulated patient printout from an electronic medical record, similar to those used in our hospital, will be provided.

The participating student will be asked to review his or her patient case and choose several medical management options based on real-time evolving clinical changes, parent concerns, or nurse requests. Based on their decision, the student will
be presented with a written update of their patient and then be asked to handoff the patient, now with new clinical information, to another colleague who has been waiting in another room.

The second colleague will again make a small medical management decision, receive a written update on their patient, and hand off the patient again. Three total handoffs will be completed. It is hoped that a dynamic and evolving scenario will replicate the challenges of autonomous decision-making and nuances of medical handoff techniques. Handoff skills, not medical decision-making, will be the primary learning objective of the case.

**Learning Objectives**

I. Novice learners will acquire effective, structured hand-off practices to facilitate continuity of care and patient safety.

William Perry suggests “concentrating on content leaves students uncritical.” Our handoff exercise eliminates the teaching of medical content. Students will be given all the information about their patient including their diagnosis and management plan. They will be asked to focus on prioritizing information and communicating with peers.

II. Students will learn autonomous medical decision-making in a dynamic simulated patient care environment which is intellectually safe for all levels of learners.

Motivated students who enjoy their work are the most effective learners. In an article on “Improving Student Motivation,” it is suggested that learning is better when students experience success, are given ownership over a decision, have creativity, and are learning novel, surprising, unusual content that is relevant to their daily life. Further, students must be in an ‘emotionally literate environment’ where they feel comfortable in themselves and with others. We believe the novel learning environment of simulation coupled with autonomous medical decision-making will facilitate student engagement and comfort.

III. Students will apply higher-level thinking about patient care and encourage self-reflection using a structured debriefing exercise.

Handoffs are an example of a ‘threshold concept’ in medicine. A threshold concept is defined as a certain concept central to the mastery of a subject. In order for safe patient care, doctors must be comfortable passing along information about patients. In the handoff process, nuances are often revealed about patient care, and
safety concerns become evident. In learning to give a good handoff, students must make refined decisions about what information is fundamental to share about a patient. This involves a significant conceptual shift which is often irreversible once mastered. Learning a threshold concept will require our students to tolerate some amount of confusion and uncertainty.14

Our exercise will foster deep understanding. Entwistle suggests that students who are deep learners look for patterns, check evidence, and examine logic.15 Further, Bloom’s Revised Taxonomy describes the highest levels of learning to be “applying,” “creating,” “evaluating,” and “analyzing.”16 In a medical training institutions, “RIME” (Reporter-Interpreter-Manager-Educator) is another standard of hierarchical learning to describe the evolution of a medical student from basic understanding to advanced application.17 To effectively participate in our handoff exercise, students will need a deep understanding of the material such that they can manipulate and apply the information correctly when giving a handoff.

Teaching Methods

Part I: Pediatric Clinic, Wednesday @ 3pm
Chief Complaint: Limp
HPI: Olivia is a 2 year old with limp for two days and refusal to walk since this morning. Her parents think that her left leg is bothering her. Yesterday she would walk slowly with a limp to get around, but today, she has refused to walk since this morning. She has had normal PO intake and no fevers. She and her 6 year old brother both had an upper respiratory infection about 2 weeks ago. There is no history of rash, vomiting, or diarrhea. Parents report no recent trauma. Olivia has not traveled anywhere recently or had any ill exposures.
ROS: All systems reviewed and negative except as noted in the HPI.
Past Medical/Surgical History: NSVD full-term. No medical problems. No surgeries
Medications: None
Allergies: NKDA
Social History: Lives at home with mom, dad, brother, and 2 cats. She does not attend daycare or preschool.
Family History: Maternal grandmother with SLE.
Immunizations: UTD
Development: No concerns.
Physical Exam:
VS: T 37.9 (R) HR 124 RR 24 BP 92/54 pO2 100% on RA
Gen: Happy and playful while sitting on her parent’s lap, non-toxic
HEENT: normal
Neck: Supple, no LAD
CV: RRR, normal S1/S2, no murmurs
Resp: CTA bilaterally, good expansion and aeration
Abd: soft, non-tender, non-distended, normal bowel sounds
GU: Tanner I female
Extremities: Holds both legs straight while supine. Resists LLE exam and difficult to assess tenderness to palpation; however, there appears to be full passive ROM
Neuro: Normal reflexes. Sensation appears intact. If forced, will bear weight transiently on left leg.
Skin: No rash.
Labs: WBC: 11,200 with 54% neutrophils and 46% lymphocytes; hgb: 12.4 g/L; Plt count: 357,000. CRP: 1.8 mg/dL; ESR: 28 mm/hr
Impression: Transient Synovitis
Please sign out the patient to the covering physician taking nighttime call for your practice.

**Part II – Thursday @ 3am**
Over the next 12 hours, Olivia has had what appears to be worsening pain and she has developed a fever as high as 103 F. today. You are the overnight physician and are concerned about a septic arthritis. You decide to send her to the Emergency Room and call ahead to tell the covering physician about her. Please handoff the patient to the Emergency Room physician.

**Part III – Thursday at 11am**
You are the ED physician. You note Olivia to be a non-toxic, but fussy child who appears very uncomfortable. Olivia has a T of 38.9 (R), blood pressure of 115/70 and HR to 130. She prefers to hold her leg flexed and externally rotated. She has obvious tenderness on both active and passive movement of her left hip and persistent refusal to walk. You order A CBC, ESR, and CRP ordered; results are notable for WBC 15,500, hgb. of 118 g/L, and a platelet count of 400,000. The differential is N78, B8, L14. Her CRP is 5.1 mg/dL and the ESR is 52 mm/hr. The XR is read as slight widening of joint space; clinical correlation suggested. You feel she needs to be admitted for IV antibiotics and treatment of a possible septic joint. Please call the inpatient pediatric admitting team and handoff the patient.

**Part IV – Thursday at 8pm**
You are the inpatient pediatric team. After a few doses of IV Clindamycin, you are concerned that Olivia’s pain is not better. She is still refusing to walk. Her temperature has been > 38.0 all day today and is not improving. She has been drinking ok, but does not have much of an appetite. Her current exam is notable for a temperature of 38.1, HR 140, BP 110/65, and continued refusal to move her LLE, with preference for flexion and external rotation. You do not note any cellulitis or erythoderma surrounding her hip. You decide to consult Orthopedics for possible
surgery. Please call the covering Orthopedic resident on-call for the consult and handoff the patient. Ortho is consulted and finds her exam and labs concerning for septic arthritis. She is made NPO tonight in anticipation of OR in the early morning and you are asked to start IV antibiotics. When you leave in the morning, Olivia is in the OR. Please sign out your patient to the daytime covering Pediatric resident. Include any issues you may foresee post-operatively.

Part V – Tuesday at 10am
You have taken care of Olivia for several days in the hospital. Olivia has completed OR drainage of her joint, has had many doses of IV antibiotics and pain medication. Her drain has been removed and the wound culture grew Staph Aureus. She is now pain-free and her fevers have resolved. She is walking easily. She will go home with a PICC line for antibiotics (Clindamycin for 4 weeks, arranged with a home-health agency called HomeCare) and has follow-up with Ortho and ID. You write her discharge summary and call her Pediatrician. Please handoff the patient to the outpatient pediatrician.

Assessment
A debriefing exercise on handoff skills and a discussion will follow the exercise. Specifically, topics to be addressed include communicating a patient’s primary problem, acuity, and providing contingency plans for concerning situations. Take-home learning points via self-reflection from observers and participants will be encouraged. Leaders of the debriefing exercise will be faculty or residents. Data suggests that either type of physician is as effective in debriefing medical students in a mannequin-based simulation experience.17

Leaders will be trained in leading an effective discussion as outlined by the Stanford University Center for Teaching and Learning. We will encourage leaders to decentralize the discussion towards the students, stop and pause frequently, and avoid focusing on medical content. We will review that teaching is a dialogue with a two-way conceptual exchange and that the teacher is not there to deliver content, rather to engage students in acquiring their own learning. Each session will have a student “reader,” “leader,” and “scribe.” The discussion will be framed around the following three questions:

Opening: Was anything confusing or surprising to you?

Exercise: Think-Pair-Share: what were some strengths and weaknesses you noticed in the handoffs today?

Closing: What is one big question or big idea you will take away from today?
Project Evaluation

We reviewed a session with a small group of 11 medical students in their final year. This initial pilot session focused much more on medical decision-making and clinical content than the hand off. Students were much more concerned with making ‘correct’ decisions and getting successful ‘answers’ to the case instead of giving effective handoffs. They also reported confusion on details such as exact timeline of events, choice of antibiotics, and logistics of hospital discharge. These details were clarified and clinical information was adjusted to be more transparent. We are still in the process of testing the sessions and debriefing questions on medical students during their clerkship and data is forthcoming. Our design process is a good example of an “assessment cycle:” we have redefined learning objectives, gathered evidence, and identified gaps to make decisions and changes to our curriculum.

Reflections:

It is stimulating and exciting to be a Searle Fellow. Collaborating on a teaching project with others from varying disciplines has broadened my awareness of teaching and learning across the university and strengthened my skills as an educator. Though I hoped a simulation exercise could teach handoffs, I didn’t know how to effectively apply principles of higher learning in small groups.

I have learned teaching is learner-driven. Both students and teachers know how to operate within a top-down, content-driven approach that rewards strategic learning. However, if we allow students to “own” their learning and reflect on their learning style, they will thrive. Teachers should be comfortable leveraging student collaboration and giving up control over the classroom to foster higher-level learning. This requires both learners and educators to become comfortable with more ‘uncertain’ learning environments. Perhaps the most important lesson is that in environments of successful teaching and learning, students have as much to offer as their teachers.

References:


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