



# A Novel Improvement Science Curriculum for Pre-Clinical Medical Students: First Year of a Student-Led Initiative

Sherry Liang, BA<sup>1</sup>; Reem Hasan, MD, PhD<sup>1</sup>; Christopher Terndrup, MD<sup>1</sup>; Sherril Gelmon, DrPH<sup>2</sup>; Matthew DiVeronica, MD<sup>1</sup>  
Oregon Health & Science University School of Medicine<sup>1</sup>; Oregon Health & Science University and Portland State University School of Public Health<sup>2</sup>

## Aim

The aim of this medical-student led initiative at Oregon Health & Science University (OHSU) is to:

- design and implement a novel improvement science curriculum for pre-clinical medical students to identify problems in clinical workflows and systematically address these issues through a team-based improvement project
- create assessment tools tailored to the level of pre-clinical medical students to evaluate knowledge, skills, and attitude towards improvement work
- identify barriers to implementation and sustainability for teaching improvement to pre-clinical medical students

## Background

- To respond to the current needs of the healthcare system, undergraduate medical education must adequately prepare trainees to participate in improvement of the health systems in which they work. Ideally, improvement training should be longitudinal, interprofessional, and team-based.<sup>1</sup>
- The learning experience of improvement should also be a combination of didactic and project-based work.<sup>2</sup> The Institute for Healthcare Improvement (IHI) Open School Quality Improvement Practicum course has been successfully utilized to have students complete clinical improvement projects.<sup>3</sup> While most curricula have targeted students in clerkships, there is opportunity for effective training of pre-clinical medical students under the conditions described above.

## Intervention

An IHI Open School medical student leader designed and led a curriculum utilizing the IHI Open School QI Practicum course for preclinical medical students to experientially learn improvement in a longitudinal, interprofessional, and team-based setting.



Figure 1. First cohort of learners with medical student curriculum lead

## Program Description

Students participated in eight in-person sessions over six months to complete the IHI Open School QI Practicum course. Sessions included didactics, group activities, and project work in the clinic.

The curriculum was piloted with seven students in a novel preceptorship program at OHSU known as the Student Navigator Project (SNaP), where students act as patient navigators and medical assistants in a primary care clinic for 18 months. Learners completed the improvement project as a team, identifying an area of improvement based on their own experience working in the clinic.

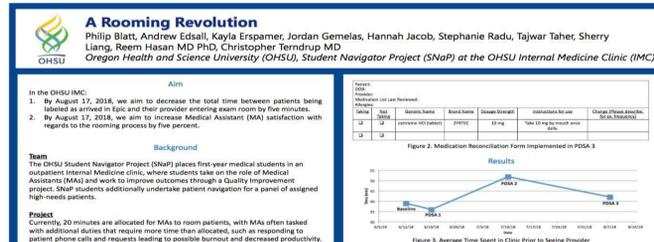


Figure 2. Students created a poster to present their clinical improvement project at conferences

## Summary of Results

Baseline assessments revealed limited improvement knowledge and skills. Six out of seven students reported having no prior experience in quality improvement.

**Knowledge:** All seven students had improved scores on the knowledge test with an average improvement of 5 out of 17 points.

**Attitude:** Students overall reported a positive attitude and comfort towards doing improvement work.

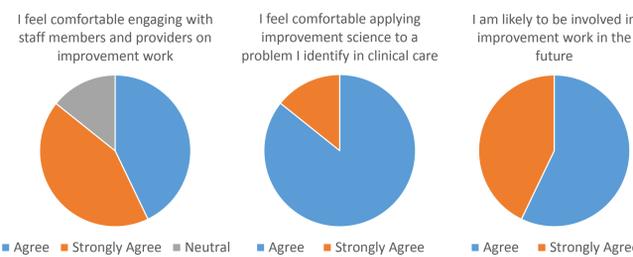
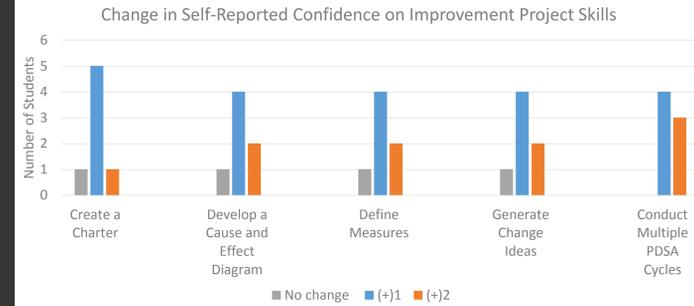


Figure 3. Post-curriculum student responses to attitude towards improvement, comfort with applying improvement science in clinical settings, and likelihood of future improvement work involvement

## Summary of Results (Cont.)

**Skills:** Majority of students reported increased confidence in implementing the stages of an improvement project.



Graph 1. Summary of change in self-reported confidence. A (+)1 change was "not confident at all" to "somewhat confident" or "somewhat confident" to "very confident." A (+)2 change was "not confident at all" to "very confident."

## Conclusions

A curriculum utilizing the IHI Open School QI Practicum course for pre-clinical medical students to apply their newfound knowledge to a clinical improvement project can be both feasible and effective in building learner competence and confidence in healthcare improvement. Key elements to success included:

- A longitudinal clinical experience (such as SNaP) that authentically integrates students into clinical workflows and promotes strong student camaraderie
- Experienced faculty and students available to reinforce improvement concepts and help students navigate the challenges of conducting improvement work
- Adequate buy-in from clinical sites to promote student-led projects

## Next Steps: 2018-2019

The curriculum will be expanded to 10 medical students with a second clinical site added. To assess the curriculum's longitudinal impact, the first cohort will be surveyed on their behaviors towards improvement work during clerkships.

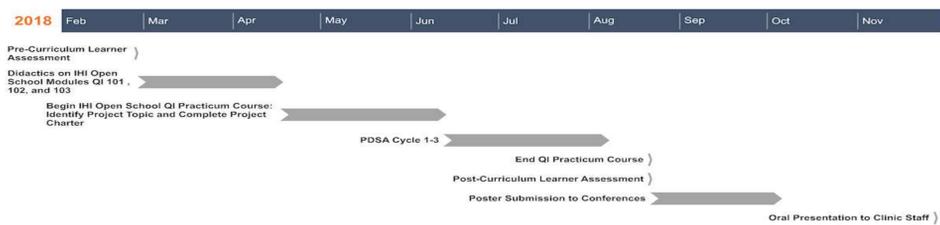
## References

1. Berwick DM, Finkelstein JA. "Preparing Medical Students for the Continual Improvement of Health and Health Care: Abraham Flexner and the New 'Public Interest.'" Academic Medicine. 2010.
2. Armstrong G, Headrick L, Madigosky W, Ogrinc G. "Designing Education to Improve Care." The Joint Commission Journal on Quality and Patient Safety. 2012.
3. Madigosky W, Deitz G, Fink L. "IHI Open School Faculty Guide: Best Practices for Curriculum Integration." Institute for Healthcare Improvement. 2017.

For more information, contact Sherry Liang at [liansh@ohsu.edu](mailto:liansh@ohsu.edu)

## About the Curriculum

### Curriculum Roadmap



### Pre-Post Improvement Knowledge Test

A 17-point knowledge test was created based on the key objectives of the IHI Open School modules QI 101, 102, and 103.

1. An aim statement should include the following:
  - a. Measurable numeric goals, specific time frame, and team members
  - b. Costs, measurable numeric goals, and specific time frame
  - c. Measurable numeric goals, specific time frame, and the population or system affected
  - d. The population or system affected, team members, and measurable numeric goals
2. Which of the following questions is not part of The Model for Improvement?
  - a. How will we know that a change is an improvement?
  - b. What changes can we make that will result in improvement?
  - c. Which stakeholders are most impacted by this change?
  - d. What are we trying to accomplish?
3. A hospital is aiming to reduce the incidence of ventilator-associated pneumonia (VAP) by 20 percent within five months in the ICU. Choose the best example of a process measure relating to this aim.
  - a. Number of days on mechanical ventilation in the ICU
  - b. Percentage of patients with ventilator-associated pneumonia
  - c. Readmission of ventilated patients to the ICU who then require mechanical ventilation
  - d. Average percentage of hospital beds occupied in the ICU in a given week
4. According to the Institute for Healthcare Improvement, which of the following is the best advice when measuring for improvement?
  - a. Focus on collecting data for one measure at a time
  - b. Use quantitative and qualitative data
  - c. Set aside as much time as possible for data collection
  - d. Choose one team member to collect the data to ensure reliability
5. Match each quality improvement tool to its correct description.
 

Pareto Chart	To identify a cause-and-effect relationship between two variables
Run/Control Chart	To identify the "vital few" factors that have the largest contribution to a given effect
Scatter Diagram	To plot data over time in order to determine whether a change is leading to improvement
Driver Diagram	To visually display a team's theory of what factors are important influencers on a project aim
6. Which of the following describes Deming's Theory of Profound Knowledge?
  - a. Cost, Theory of Knowledge, Variation, Psychology
  - b. Theory of Knowledge, Psychology, Variation, Appreciation of a System
  - c. Variation, Appreciation of a System, Psychology, Creative Thinking
  - d. Psychology, Theory of Knowledge, Appreciation of a System, Cost
7. An improvement team is having difficulty determining what changes they can test to improve wait times in the cardiology clinic. Choose the best answer for an organizational tool that could help the team address this challenge.
  - a. Cause and Effect Diagram
  - b. Root Cause Analysis
  - c. Control Chart
  - d. Scatter Diagram
8. To reduce hospital costs, an inpatient team is working to shorten patients' length of stay in their unit. A team member suggests adding a measure to make sure the interventions do not increase readmission rates. What type of measure is this describing?
  - a. Outcome
  - b. Covariate
  - c. Balancing
  - d. Process
9. A provider hypothesizes that asking her diabetic patients to plan a visit for glucose management could decrease the incidence of diabetic complications. Her first patient is interested. To see if this approach should be expanded, choose the best answer for the next step to take.
  - a. Tell other providers in her pod to ask their diabetic patients the same question
  - b. Ask the next five patients the same question and set up a visit for those who say yes
  - c. Send a MyChart message to all diabetic patients asking this question
  - d. Try another intervention with the next diabetic patient
10. The Triple Aim for health system improvement includes the following:
  - a. Lower costs, better individual care, workforce wellness
  - b. Workforce wellness, better individual care, healthier populations
  - c. Healthier populations, workforce wellness, lower costs
  - d. Better individual care, healthier populations, lower costs
11. Write in order the four stages of testing a change for improvement.
 

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_

### Learning Objectives

- Understand the critical role of improvement science in examining health systems
- Describe the key elements of the Model for Improvement
- Implement a clinical improvement project by completing a charter, developing a cause and effect diagram, conducting multiple PDSA cycles, creating a run chart, and creating a summary report
- Disseminate improvement work in scholarly venues through posters and oral presentations
- Reflect on the role of medical students in improving quality and safety in healthcare

### Post Participation Survey on Self-Perceived Knowledge, Skills, and Attitude

Learners self-assessed change in confidence on understanding improvement concepts and executing an improvement project.

Check the box indicating your level of confidence in understanding each concept. Each row should have two checked boxes.	Prior to participating in the SNaP Improvement Curriculum			Now		
	Not confident at all	Somewhat confident	Very confident	Not confident at all	Somewhat confident	Very confident
The elements of the Model for Improvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Frameworks for improving health and healthcare, such as the IHI Triple Aim and the Institute of Medicine's Six Quality Aims	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deming's Theory of Profound Knowledge as a framework for examining systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
An aim statement and its key components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The definition and significance of each type of measure, including outcome, process, and balancing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A PDSA cycle and its components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvement tools and when to use each, such as a cause and effect diagram, driver diagram, flow chart, histogram, pareto chart, run chart, and scatter diagram	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The differences between measurement for research and measurement for improvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Check the box indicating your level of confidence in being able to perform each skill. Each row should have two checked boxes.	Prior to participating in the SNaP Improvement Curriculum			Now		
	Not confident at all	Somewhat confident	Very confident	Not confident at all	Somewhat confident	Very confident
Identify key stakeholders based on the improvement need	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Create a charter to describe an improvement project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Create a flow chart to describe a process as it currently operates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Create a cause and effect diagram to understand causal factors to an outcome	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Create a driver diagram to depict what influences a project's aim	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Define measures, including operational definitions, for an improvement project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generate change ideas through various approaches, such as improvement tools, literature review, change concepts, creative thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Establish a prediction and data collection plan for the "plan" phase of PDSA cycles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test a change idea for the "do" phase of PDSA cycles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compare actual findings to a prediction, and display data on a run chart or other tools for the "study" phase of PDSA cycles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Determine whether to abandon, adopt, or adapt a change idea during the "act" phase of PDSA cycles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate to what extent you agree or disagree with each statement.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel comfortable applying my improvement knowledge and skills to a problem that I identify in clinical care.	<input type="checkbox"/>				
I feel comfortable engaging with staff members and providers on improvement work.	<input type="checkbox"/>				
Gaining improvement knowledge and skills is an important part of pre-clinical training.	<input type="checkbox"/>				
Developing and implementing an improvement project is an important part of pre-clinical training.	<input type="checkbox"/>				
I am likely to be involved in improvement work in the future.	<input type="checkbox"/>				
It is important for medical students to participate in improvement work.	<input type="checkbox"/>				
Leading improvement work is part of being a practicing physician.	<input type="checkbox"/>				