**Online Appendix for Manuscript titled “Lean Based Redesign of Multidisciplinary Rounds on General Medicine Service”**

**Appendix 1.** Use of Lean management to redesign our multidisciplinary rounds

We leveraged three key Lean techniques to redesign our multidisciplinary rounds (MDR): (1) Value stream management (VSM), (2) Rapid process improvement workshops (RPIW), and (3) Active daily management (ADM).

*Technique 1*: VSM is a tool that helps organizations visualize a process, identify problems within the process, and provide directions for transforming it.1 Once the current state is documented, a future state is created. The future state improves on the gaps highlighted in the current state, and redesigns new processes towards a target condition. When applied to a healthcare setting, VSM is used to map the patient’s journey.2

In our study, we used VSM to map the journey of our general medicine patients from the Emergency Department (ED) to inpatient admission, through the patient’s stay in the hospital, to discharge from our hospital. We also used VSM to redesign our five general medicine teaching service teams into a multidisciplinary team comprised of a case manager, social worker, pharmacist, attending physician, respiratory therapist, rehabilitation services, clinical nutritionist, unit charge nurse, and bedside nurse.

*Technique 2*: Once an improvement plan is formed as a final step in the VSM process, it calls for multiple RPIW’s to be conducted over several months.3 RPIW is a multi-day working session staffed by frontline representatives and leaders from all the involved disciplines. It is an intense study of the current processes, and a rapid prototyping and iteration of improved processes. Each workshop is guided by the future state map created by leadership in the initial value stream session, and has associated quantitative and qualitative targets the team is expected to achieve.

In our study, we conducted RPIW to develop the workflows from ED through discharge for general medicine patients, and created standard work on how the multidisciplinary team would work together.

*Technique 3*: ADM is an integral component of Lean management system, and is key to sustaining newly developed processes established through improvement projects.4 While frontline staff develop solutions to address pressing problems, leaders support the staff by being present at the workplace to observe the changes that were implemented (known as 'gemba').

In our study, the leaders agreed on ADM activities that would follow implementation of the workflows to support sustainability. Specifically, they agreed on the amount of time they would spend at gemba to observe the new MDR workflows, provide any feedback and coaching, engage staff, and build their capacity to problem solve.

**Appendix 2.** Sensitivity analysis for primary and secondary outcomes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Outcomes** | **Pre-period (N=1770)** | **Post-period (N=1987)** | **Absolute difference (95% CI)** | **P-value for differences** |
| Mean length of stay (days) | 4.67 | 4.76 | 0.09 (-0.21 to 0.40) | 0.536 |
| Mean length of stay (Case mix index adjusted days) | - | - | 0.04 (-0.22 to 0.29) | 0.780 |
| Discharges before noon (n,%) | 138 (7.8%) | 220 (11.1%) | 3.3% (1.4 to 5.1) | <0.001 |
| Estimated discharge date recorded on our electronic health record within 24 hours of admission (n,%) | 487 (27.5%) | 821 (41.3%) | 13.8% (10.8 to 16.8) | <0.001 |

**REFERENCES**

1. Meyers FE, Stewart JR. *Motion and Time Study for Lean Manufacturing*. 3rd ed. Upper Saddle River, NJ: Prentice Hall; 2001.

2. Rother M, Shook J, Womack J, Jones D. *Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA*. Spi. Lean Enterprise Institute; 1999.

3. Woodward-Hagg, H Woodbridge P. *RPIW Participant Fieldbook: Guide to the Rapid Process Improvement Workshop.* System VPAH.

4. James B, Soria N. *How to Run Your Own Clinical Quality Improvement Training Program*.