

Ops Series: Lean Six Sigma

Kraftin E. Schreyer, MD CMQ FAAEM



Welcome back to part two of the Ops Series on Lean Six Sigma! This issue, we're taking a deep

dive into Six Sigma, discussing other process improvement tools used in both lean and Six Sigma, and summarizing the intersection between the two performance improvement methodologies.

What is Six Sigma?

Six Sigma is a performance improvement methodology that uses both qualitative and quantitative tools to improve processes through a reduction in variation and removal of defects. The concepts behind Six Sigma can be traced as far back as the late 1700s, when the normal curve was introduced by Carl Friedrich Gauss. Then, around 1920, Walter Shewhart demonstrated that the point at which a process required correction fell three sigma (aka standard deviations) from the mean on a normal curve. The term "Six Sigma" was coined by Bill Smith, an engineer for Motorola, and has come to be synonymous with process improvement through reduction in defects and variation. Statistically, six-sigma signifies that a process is so invariable, only 3.4 defects are generated per one million process runs. Visually, this translates to a very, very narrow bell curve. Six Sigma has been used in the emergency department to reduce wait times and overcrowding, improve patient turnaround times, and increase revenue.

What is a defect?

In Six Sigma, a defect is a failure of a process or product. Defects are a key part of the Six Sigma methodology, because the existence of a defect indicates a problem that needs to be solved.

How does Six Sigma achieve reductions in variation and defects?

Six Sigma is notoriously statistically rigorous. The approach used in Six Sigma is known as DMAIC: Define, Measure, Analyze, Improve, Control. Different performance improvement tools can be used for each step in the DMAIC process.

Define: The first step is to define the problem that will be the focus of the Six Sigma improvement. Problems can be identified using a value stream map (remember that from part I?) and feedback from those involved with the process and/or customers of the end product. Defining the problem is more than just giving it a name – it involves the creation of a project charter that outlines the scope of the project and provides clear direction for future steps.

Process Improvement tool: Value Stream Map

A value stream map is a visual display of all steps in a specific process and how they relate to the final product. For each step in the process, time, materials, and information are quantified.

Both value-added and non-value-added steps are then identified and the time for each is totaled.

Measure: Once the problem has been defined, the process itself must be measured. Baseline data should be collected on the capability of the process (how well the process performs as it should) and the frequency and magnitude of problems within the process. These measurements provide reference data on variation and defects within the process.

Process Improvement tool: Pareto chart

A pareto chart is an ordered bar chart with a superimposed line graph that is used to identify the "vital few," which are the 20% of causes that lead to 80% of the consequences. On a pareto chart, the ordered bars represent the frequency of contributing factors, and the line represents the cumulative percentage of those factors.

>>

“Six Sigma has been used in the emergency department to reduce wait times and overcrowding, improve patient turnaround times, and increase revenue.”



Analyze: Defects and variation must next be analyzed, to determine the underlying causes of each. Unless the true root cause of variability or a defect is identified, further work cannot be done to correct future iterations of the process.

Process Improvement tools: Root Cause Analysis, Failure Mode, and Effect Analysis
Root cause analyses are reactionary tools used to break down processes into the most basic components and identify those that contributed to an adverse outcome. In contrast, failure mode and effect analyses are prospective tools used to identify potential failure points in a process that has yet to be implemented.

Improve: Process performance is improved by addressing and eliminating the root causes of defects and variation. During the improvement phase, process changes are piloted, and data is collected to ensure change is being made in the process and outcomes.

Process Improvement tool: Kaizen Event

A Kaizen event is a brief, focused, performance improvement cycle that evaluates for rapid change. Both strong leadership and adequate planning are required for a successful Kaizen event.

Control: The final phase focuses on sustainability of the process improvements. Both a plan for monitoring the process and a plan for responding to slippage should be created.

Process Improvement tools: Control Chart, Quality Control Plan

Control charts are line graphs that assess process variation over time, with respect to upper and lower control limits. Quality control plans are outlined in one or more documents, and specify each aspect of the control process, including objectives, allocation of responsibilities and resources, standards to be applied, measurement definitions, auditing tools, and procedures for change and modification.

What is Lean Six Sigma?

Lean Six Sigma is a powerful combination of the two performance improvement methodologies, lean and Six Sigma. In addition to reducing waste, defects, and variability in a process, Lean Six Sigma provides a framework for performance optimization. By employing complementary process improvement tools used in both Lean and Six Sigma, the combination of the two methodologies has been shown to be the optimal way of improving process effectiveness and efficiency.

Lean Six Sigma has been used to improve patient flow in many emergency departments around the world. Hopefully the basic knowledge shared in this brief introductory series can pave the way for you to do the same! ●

“By employing complementary process improvement tools used in both Lean and Six Sigma, the combination of the two methodologies has been shown to be the optimal way of improving process effectiveness and efficiency.”



References

1. Furterer, S. Applying lean six sigma methods to reduce length of stay in a hospital's emergency department. *Qual Engin.* 2018. <https://doi.org/10.1080/08982112.2018.1464657>
2. Hall J, Scott T. *Lean Six Sigma: A Beginner's Guide to Understanding and Practicing Lean Six Sigma.* 2016.
3. Hussein, NA, Abdelmaguid TF, Tawfik BS, Ahmed NGS. Mitigating overcrowding in emergency departments using six sigma and simulation: a case study in Egypt. *Oper Res Healthcare.* 2017. <https://doi.org/10.1016/j.orhc.2017.06.003>
4. Maniago E, Ardolic B, Peana J. ED Patient Flow: Utilizing the Six Sigma Approach to Reduce Emergency Department Overcrowding. *Annals Emerg Med.* 2005. <https://doi.org/10.1016/j.annemergmed.2005.06.034>
5. Tuttle, Kevin. Improving ED Wait Times at North Shore University Hospital. 2003. <https://www.isixsigma.com/new-to-six-sigma/dmaic/improving-ed-wait-times-north-shore-university-hospital/>