

# Patient Safety with Six Sigma, Lean, or Theory of Constraints

*Joseph L. Quetsch*

## Abstract

Understanding between healthcare clinicians and engineers is facilitated by presenting three improvement methods compared with Patient Safety. The methods discussed are Six Sigma ( $6\sigma$ ), Lean, and Theory of Constraints (TOC). Patient Safety is a dominant paradigm in healthcare today. Effective organizations will first adopt a proven method for improvement, and then apply tools correctly with understanding.

Improvement methods are contrasted along aspects including 1. original purpose 2. implicit goals 3. focus of attention and effort 4. social values 5. size and types of problems approached 6. characteristics of the organization to use the method and 7. typical tools and artifacts.

The handout is a table with columns {Six Sigma, Lean, Theory of Constraints, Patient Safety}, and rows {each aspect enumerated 1-7 above}. The presentation will highlight similarities and differences using healthcare examples. The reader will have a framework useful for quickly informing a healthcare improvement team at the point of selecting an approach or considering a tool.

## Introduction

A typical request of the engineer from a healthcare client is to show a tool, perhaps without context or method. Healthcare clients may be impatient with process improvement engineers, or vice versa, while incompatible paradigms are not well recognized.

Opportunities in problem form may be approached successfully by more than one method and proven methods are rarely mutually exclusive. In practice, professionals “borrow” techniques from other methods or solve each part of a project with the appropriate approach for that component. When the team comes down to applying a tool, the team may be more successful where the assumptions contained in the tool are understood. Tool use is action, action occurs in context, thus proven tools were proven in context. Random use of tools without regard to the method within which the tool evolved may be random behavior.

This presentation contrasts four paradigms for improving healthcare. A detailed understanding of each method or detailed understanding of American healthcare today is beyond the scope of this presentation. The audience is assumed to be generally aware of the approaches discussed and familiar with problems in healthcare.

## Methods

This presentation is a synthesis of well known practices and publications. There is ample anecdotal evidence in the literature and amongst practitioners of process improvement that each of the systematic methods of improvement yields desirable results efficiently for correct healthcare opportunities. The presenter is unaware of randomized controlled research comparing improvement systems in healthcare.

## Discussion

Requesting a tool for a quick and easy repair of a process may be a symptom of misunderstanding. The request may reveal an assumption that correct things are happening correctly and just need a little tweak. As healthcare practitioners are reluctant to treat only symptoms and eager to intervene at root cause or at intermediate mechanisms, so engineers are reluctant to treat apparent symptoms and eager to know the root source and intermediate determinants of behavior for the relevant process.

### *Common ground*

Each improvement method is a way of seeing the world. Each method determines perception initially and the pursuit of evidence. Each method has a style of hypothesis formation and a preference for hypothesis testing (Kuhn, 1996). We have skipped the arguments that “Results are determined by process” and only by process. We here axiomatically know that to improve results we must improve process. We agree on a sufficiently broad notion of process as some set of the determinants of the result. The methods discussed here are ways of understanding processes.

Not all clinicians understand or agree with the engineers’ notion of process. Some good faith improvement efforts have been harmful. Clinicians have learned that some bad faith attempts to take control or money came wrapped as improvements. Our laws or customs do not restrict who can pretend to be an improvement expert. Besides actually being competent at one or more proven methods, we must successfully communicate an understanding of our engineering sciences. We may not desire an identical view of some phenomenon, but we desire to comprehend the other professionals’ perception.

Myths about improvement sciences abound. Improvers are often believed by other improvers to have blinders or lack common sense. Few scientists abandon common sense. While the descriptions below discuss only special strengths of a method, the reader should not infer the absence of other views within a method. For example, Six sigma people are perfectly capable of improvement without statistics, and every type uses some statistics. All methods include coaching and personal growth. All methods value community and non-profit social values. This paper intends to contrast the methods.

Successful improvers are adept at defining the problem or opportunity in helpful ways. Helpful for developing understanding of the problem and achieving the opportunity. The same problem, perhaps even equivalent notions of understanding, might be expressed in 6-sigma as  $Y = F(X_1, X_2, X_3 \dots)$ , in Lean as 5 Whys, in TOC as drum-buffer-rope and in Patient Safety as FMEA (Failure Mode and Effects Analysis).

Successful improvers are adept at discovery and measure. Systematic methods provide styles for generating hypothesis and testing. Methods tend to define problems such that the tools work there. Methods also tend to define the project management within which tools are used.

### ***Pigeonholes***

The reader may wish to explore Table 1 before or after the following remarks. Table 1 title: High-Level Side-by-Side Comparison of Dominant Improvement Styles.

Six sigma chooses to see the world through statistics. Six sigma is far more than statistics, but reject a statistical view of your world and you must reject Six sigma. Statistics are an amazingly powerful way to see what human eyes were not designed to detect. Much of 20<sup>th</sup> century science confirms the utility of statistical approaches. Few scientists reject statistics, but many prefer more tangible methods. To be content with Six sigma requires faith as well as competence in statistics. Six sigma may have a tendency to ignore what does not fit a solvable statistical function. Six sigma is associated with an inclusive calculation of return on investment, prescribed team composition and prescribed behaviors. Viewing the world through mathematical functions is both rigorous and curious. (Pyzdek, 2003)

Lean chooses to see the world with human eyes directly on the unfiltered, possibly undistorted process. Lean observes directly rather than via functions or reports. Humans unconstrained by functions or filters may have fewer blinders for the first looks, but the need to see and communicate scientifically requires disciplined use of checklists and the inclusion of measure and category before the view is considered adequate. Statistics are used for hypothesis testing. Lean may have a tendency to ignore what is not apparent to direct observation. Disciplined adherence to established Lean practices may keep the

effort scientific and the Lean method reproducible (Womack & Jones, 2003).

Theory of Constraints (TOC) chooses to see the world through accountants' reports designed to show real operations, before accounting games begin. (Corbett, 1996) Throughput accounting directly opposes creative accounting. Traditional tax or finance or cost accounts remain necessary but only throughput accounting is used to support operations. Throughput accounting judges local management decisions according to impact upon global cash flow by following the logical consequences of a management decision through each downstream process all the way to the global cash flow (Goldratt, 2004). Then the accountant logically backward-chains from global cash flow to assign a dollar value to the local management decision. TOC attempts to maintain cause and effect relationships throughout the enterprise, exposing the costs of local optimization. The name 'theory of constraints' derives from the aspect that once the steps are known, only the bottlenecks receive management attention or investment. TOC's narrow focus on throughput and bottleneck may make TOC less threatening compared to other improvement methods. Patient throughput or health status can be improved using the same thinking TOC has developed for global cash flow. Clinicians and line managers may use throughput accounting to illustrate the wisdom of decisions not supported by arbitrary or creative accounting.

Patient safety chooses to see the world through errors. (Institute of Medicine (U.S.). Committee on Quality of Health Care in America., 2001) Viewing the world through errors presents several hazards or hurdles for process engineers. If errors are defined as exceptions, then looking at the errors is not looking at the ordinary routine processes. If errors are defined by a final end result, then there are many plausible processes and no method for replacing the black box generating final results. If errors are defined as deviation from a professional standard, then resources may be consumed validating the abstract standard or quibbling over the deviation. Viewing the world through errors may be inconsistent with viewing the processes that are routinely producing desired correct results. The view through an error may impair perception of a need for process redesign if a patch remedy looks good for that error. (U.S.). Committee on Quality of Health Care in America., 2001)

Patient safety makes good use of a scientific body of knowledge specializing in aspects of systems leading to failure or errors. Patient safety practitioners who use the safety science tools for more than diagnosis or discovery are likely to apply Six sigma or Lean methods while engineering replacement systems. TOC arguments may serve to internally sell the new safer systems. Other patient safety practitioners may remain in a comfort zone of professional traditions and keep original processes with a safety patch.

A common belief in patient safety circles is that no prescriptive method is necessary- improvement will emerge from sharing ideas. Idea sharing as a method is consistent with a view of healthcare as a complex adaptive system that is best managed without prescriptive control (Zimmerman, Lindberg, & Plsek, 2001). Patient safety does not require a particular view of process or provide a method for pursuing improvement. A systematic, coherent, guiding scientific paradigm for improvement may someday emerge from the patient safety movement.

### Summary

Problems and opportunities should be addressed with a scientific method, which incidentally uses tools. Use of tools out of context may be random behavior.

Each method is derived from its own view of the world. Given that view, the tools and hypothesis and behaviors make sense and yield consistent results.

Improvement methods were contrasted to facilitate selection. High level characteristics of the methods were presented as rough concepts to facilitate matching the organization and the opportunity with a method. A table compares side by side aspects of the methods.

### Citations:

- Corbett, T. (1996). *Throughput Accounting*.
- Goldratt, E. M. (2004). *The goal : a process of ongoing improvement* (3rd ed.). Burlington, VT: Gower.
- Institute of Medicine (U.S.). Committee on Quality of Health Care in America. (2001). *Crossing the quality chasm : a new health system for the 21st century*. Washington, D.C.: National Academy Press.
- Kuhn, T. S. (1996). *The structure of scientific revolutions* (3rd ed.). Chicago, IL: University of Chicago Press.
- Pyzdek, T. (2003). *The Six Sigma handbook : a complete guide for green belts, black belts, and managers at all levels* (Rev. and expanded ed.). New York: McGraw-Hill.
- Womack, J. P., & Jones, D. T. (2003). *Lean thinking : banish waste and create wealth in your corporation* (1st Free Press ed.). New York: Free Press.

Zimmerman, B., Lindberg, C., & Plsek, P. (2001). *Edgework: insights from complexity science for health care leaders* (second ed.). Irving TX: VHA.

### Biographical Sketch

Joseph L. Quetsch MD, BS Computer Science, is principal of Care Process Remodel Associates, LLC, assisting healthcare organizations to change efficiently and correctly using mainstream sciences.

Next page is Table 1: High-Level Side-by-Side Comparison of Dominant Improvement Styles, which is the handout for the presentation.

## High-Level Side-by-Side Comparison of Dominant Improvement Styles

Quetsch JL, Society for Health Systems, Orlando, February 18 2007

Label:	6-sigma	Lean	Theory of Constraints	Patient Safety	
1 Original Purpose	Maximize reliability	Maximize value	Maximize profit	Minimize bad results	1
2 Goal or Theme	Eliminate variation	Eliminate waste	Reality accounting	Eliminate error	2
3 Focus of effort	Statistical correlation	Process visibility	Optimal pace	Peer review	3
4 Social Values	Uniformity in all things.	Adapt to do more with same resources.	Maximize return on investment	Judgment, autonomy and teamwork	4
	Statisticians drive	Grass roots driven	Throughput accountants drive	Care professionals drive	
	Adhere to the defined, best process	decreed Agree to perform the current best common process	Think through implications, follow to real cash flow consequences	Adhere to professions, each profession knows best practice	
	customer voice factored in, statistician judges value	customer is only judge, value is what will customer pay?	global cash flow shows value.	no uniform measure of value. Measures are typically ratio indicators, actuarial risk, quality of life.	
5 Types of Problem	Statistically tractable problems (large counts of similar items)	Whatever is discovered, visibility enables common sense.	Optimization. Each local unit optimized for global result.	Incident reports, surveillance	5
	Large problems, prefer \$500k	No contribution is too small.	Single minded focus on the current constraint	Politically correct problems	
6 Organizational fit	Large organizations, central control style, operations chiefs make decisions	Any size organization, delegated control, line mangers make decisions	Any size organization, central view for global information, accountants make decisions	Any size organization, healthcare professionals control, decisions emerge	6
7 Typical artifacts	Statistical graphs, control loops	Value stream maps, project schedules	Stories, metaphor, chains of reason, chains of producers	Policy statements, inspection reports	7
<b>Label:</b>	<b>6-sigma</b>	<b>Lean</b>	<b>Theory of Constraints</b>	<b>Patient Safety</b>	