Patient Safety Tip of the Week

November 6, 2012

Using LEAN to Improve Stroke Care

For over 15 years we have had an effective treatment for acute ischemic stroke (thrombolytic therapy with tPA) but this must be given within a very narrow time window to be both efficacious and safe. That time window had been 3 hours from time of onset of the first symptoms or signs of stroke but now has been extended in some circumstances to 4.5 hours or longer (IST-3 2012). The sooner a patient can be given tPA the better the chance he/she will not have a residual neurological deficit. Nevertheless, it has proven challenging first to get patients into the hospital within that time frame and then get all the necessary procedures and tasks done within that narrow window. Nationwide, only 3.7% to 5.2% of patients potentially eligible for thrombolytic therapy actually get it (Adeoye 2011). Numerous barriers have contributed to our suboptimal performance.

We faced many of the same challenges many years ago when we first began using thrombolytic therapy for acute MI patients. The improvement in acute MI patients also is better the sooner thrombolytic therapy is administered. The first protocols back then required cardiologist involvement in the decision to proceed and then there were delays due to storage and preparation of the thrombolytic agents. Then we finally said "hey, emergency physicians know how to read EKG's and have good clinical judgment" and we also addressed the pharmacy bottlenecks. As a result we were able to re-engineer our protocols so that today's target of door-to-needle times of less than 30 minutes is very doable in most ER's.

So how do we re-engineer our policies and procedures for stroke care to allow more patients with acute ischemic stroke to receive thrombolytic therapy during that short window? The stroke team at Washington University and Barnes-Jewish Hospital in St. Louis has the answers. They applied the **LEAN/Toyota Production System approach** to streamline the processes and achieved a dramatic reduction in the door-to-needle time for thrombolytic therapy in acute ischemic stroke patients (Ford 2012). Though they were a designated stroke center and had a stroke team that was promptly activated, their door-to-needle time for thrombolytic therapy averaged 58 minutes

They brought together a team not just of doctors and nurses but everyone involved in care of the patient, from the pre-hospital crews to the clerical and registration staff, and

radiology technologists. They began with the well-known LEAN technique of **value stream mapping**. Their team flowcharted all the processes involved (for process flow, information flow and patient flow) and identified both steps that added no value and steps that were taking place serially that could be done in parallel. Value stream maps for both the **current state** and the **future state** were developed.

Some of the barriers and bottlenecks included delays in getting the imaging studies done and read by the radiologist, getting lab work results promptly, getting an accurate history about the time of onset of symptoms and signs (often from witnesses at the patient's home or other site), and getting the history and physical and neurological evaluation done promptly.

Their biggest bottleneck was related to imaging requirements. Among non-value-added steps they noted that patients were often moved from one room to another location (eg. to the CT or MRI suite) then back again. So they developed a change in flow so that the **patient is brought directly to the radiology suite by the ambulance crew**. That sort of thinking is a crucial step in getting away from our old "That's the way we've always done it" thinking or our thinking that "We can't send them there. What if they are not stable?" Well the Barnes/Washington University team obviously was able to address the patient safety issue and incorporated this into their measurement strategy. Their results were pretty dramatic. In a table presented by this group at the International Stroke Conference 2012 (Panagos 2012) the average time from door to head CT scan completed dropped from 25 minutes down to 8 minutes.

Their other major **bottleneck was getting required lab results** (INR, platelet count, glucose level) back in a reasonable time (Panagos 2012). On average it was taking 33 minutes for those tests to come back. So they initiated point-of-care (POC) testing for INR and glucose levels, effectively alleviating their second big bottleneck.

They also **identified clinical activities that could be performed simultaneously rather than one after the other**. For example, the neurologist and the emergency physician could both do parts of their evaluations at the same time. Similarly, one nurse could get together needed medications while another nurse started an IV.

To get an accurate assessment of the time of onset of symptoms or signs of stroke they assigned a social worker to make contact with family or other pertinent witnesses. A great way to make use of all the valuable members of your healthcare team and free up others to do the things they do best!

With the new re-engineered system in place they **reduced the door-to-needle time from an average of 58 minutes down to 37 minutes**. And the percentage of patients who received tPA during the "golden hour" (the first 60 minutes after onset of stroke symptoms and signs) increased from 52% to 78%. And all this was accomplished without an increase in unwanted side effects or complications of treatment.

Our July 2012 What's New in the Patient Safety World column "Another LEAN Success Story" noted a tool we have not previously commented on – the **swim lane diagram** (Green 2010). Such a diagram plots workflows as they may typically occur in silos and gives you a good picture of what workflows are often going on in parallel. Arrows between lanes can show where the processes in one "lane" can impact the flow in another "lane". It is thus helpful in showing you how such workflows can give rise to bottlenecks in other "swim lanes". You can easily see how swim lane diagrams could help you determine what steps are now being done serially that could better be done in parallel.

Our Patient Safety Tips of the Week October 11, 2011 "LEAN in the Lab" and May 1, 2012 "More LEAN Successes" highlighted some of the successful applications of LEAN thinking in improving workflows in the lab, emergency department, OR, etc. LEAN, borrowed largely from Taiichi Ohno and Kiichiro Toyoda and the Toyota Production System, is both a performance improvement tool and a unique culture. And our July 2012 What's New in the Patient Safety World column "Another LEAN Success Story" highlighted another LEAN success story making a significant improvement in OR turnover time (TOT) and turnaround time (TAT).

The Barnes Jewish/Washington University group also note another important offshoot of the LEAN/TPS implementation: development of teamwork and enduring relationships. One of the key principles of LEAN/TPS is that everyone involved is important and they all have ideas that are valuable. These principles have led to many improvements now in a variety of industries. Healthcare just happens to be one of the late adopters.

Kudos to the team at Barnes Jewish/Washington University for a job well done and for sharing their successes with the rest of us!

See our previous columns on LEAN/Toyota Production System for good references and resources to get you started learning about how LEAN can help transform your work:

October 11, 2011	"LEAN in the Lab"
May 1, 2012	"More LEAN Successes"
July 2012	"Another LEAN Success Story"

References:

The IST-3 collaborative group. The benefits and harms of intravenous thrombolysis with recombinant tissue plasminogen activator within 6 h of acute ischaemic stroke (the third international stroke trial [IST-3]): a randomised controlled trial. The Lancet 2012; 379(9834): 2352 - 2363, 23 June 2012

http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2812%2960768-5/abstract

Adeoye O, Hornung R, Khatri P, Kleindorfer D. Recombinant Tissue-Type Plasminogen Activator Use for Ischemic Stroke in the United States: A Doubling of Treatment Rates Over the Course of 5 Years. Stroke. 2011; 42: 1952-1955
http://stroke.ahajournals.org/content/42/7/1952.full.pdf+html

Ford AL, Williams JA, Spencer M, McCammon C, Khoury N, Sampson T, Panagos P, Lee J-M. Reducing door-to-needle times using Toyota's lean manufacturing principles and value stream analysis. To be published in Stroke as per press release by Purdy MC. Stroke patients benefit from carmaker's efficiency. (Washington University press release) October 18, 2012
https://news.wustl.edu/news/Pages/24442.aspx

Ford AL, Williams JA, Spencer M, McCammon C, Khoury N, Sampson TR, Panagos P, Lee J-M. Reducing Door-to-Needle Times Using Toyota's Lean Manufacturing Principles and Value Stream Analysis.
Stroke 2012; first published on November 8 2012
http://stroke.ahajournals.org/content/early/2012/11/08/STROKEAHA.112.670687.abstract

Panagos P, Ford A, Williams J, Khoury N, Sampson T, McCammon C, Lee J-M. Applying Toyota Lean Manufacturing Principles to Stroke Care: Accelerating Door-to-Needle Times. AHA (American Heart Association) International Stroke Conference 2012. February 2012 (ISC 2012 New Orleans)
http://conference-cast.com/aha/media/AHA2012ISC_7/A26/3497/3497.pdf

Green B. How to Create a Swim Lane Diagram. The Lean Logistics Blog. September 1, 2010
http://leanlogisticsblog.leancor.com/2010/09/01/how-to-create-a-swim-lane-diagram/

Healthcare Consulting
www.patientsafetysolutions.com

http://www.patientsafetysolutions.com/

Home

Tip of the Week Archive

What's New in the Patient Safety World Archive