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Creating Sustainable Operations In Healthcare Using Lean Six Sigma

How to approach improving work practices

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President
Healthcare Science Advisors

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Executive Summary

- Why Bother Improving Healthcare Practice?
- The Importance of Understanding a Process As a Process
- Ways In Which Patient Care Misses Its Objective
- How Can Lean and Six Sigma Help?
- Case Studies in Hospital and Clinical Practice
- Making Processes Repeatable
- Summarize

Why Bother Improving Healthcare?

Journal of General Internal Medicine
pp 1–7

Vital Signs Are Still Vital: Instability on Discharge and the Risk of Post-Discharge Adverse Outcomes

Researchers evaluated vital sign instability within 24 hours of discharge, defined as: temperature ≥37.8°C, heart rate ≥100 beats per minute, respiratory rate >24 breaths per minute, systolic blood pressure ≤90 mm Hg, or oxygen saturation <90%.

They adjusted results for six factors of poor prognosis, including severity on admission, comorbidities, and hospital complications.

Almost one in five individuals included in the study (18.7%) were discharged with one or more vital sign instability.

Among those without any instabilities, 12.8% died or were readmitted within 30 days of discharge compared with 16.9% with one instability, 21.2% with two instabilities, and 26.0% with three or more instabilities (*P* < 001).

After adjusting for other factors, those with one or more instability had a 36% higher chance of death or readmission compared with those with no instabilities (risk adjusted odds ratio [AOR], 1.36; 95% CI, 1.26 - 1.48). When analyzed separately, the risk for death was more strongly associated with having one or more vital sign instability near discharge (AOR, 2.36; 95% CI, 1.97 - 2.83) than was 30-day readmission (AOR, 1.36; 95% CI, 1.26 - 1.47) compared with no instabilities.

Moreover, risk for death or readmission increased with increasing number of vital sign instabilities. The relationship was especially strong for death, which doubled, tripled, and quadrupled for each additional instability.

nand Velasco, Ruben Amarasingham,

68 Shares 509 Views

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tability on discharge and post-

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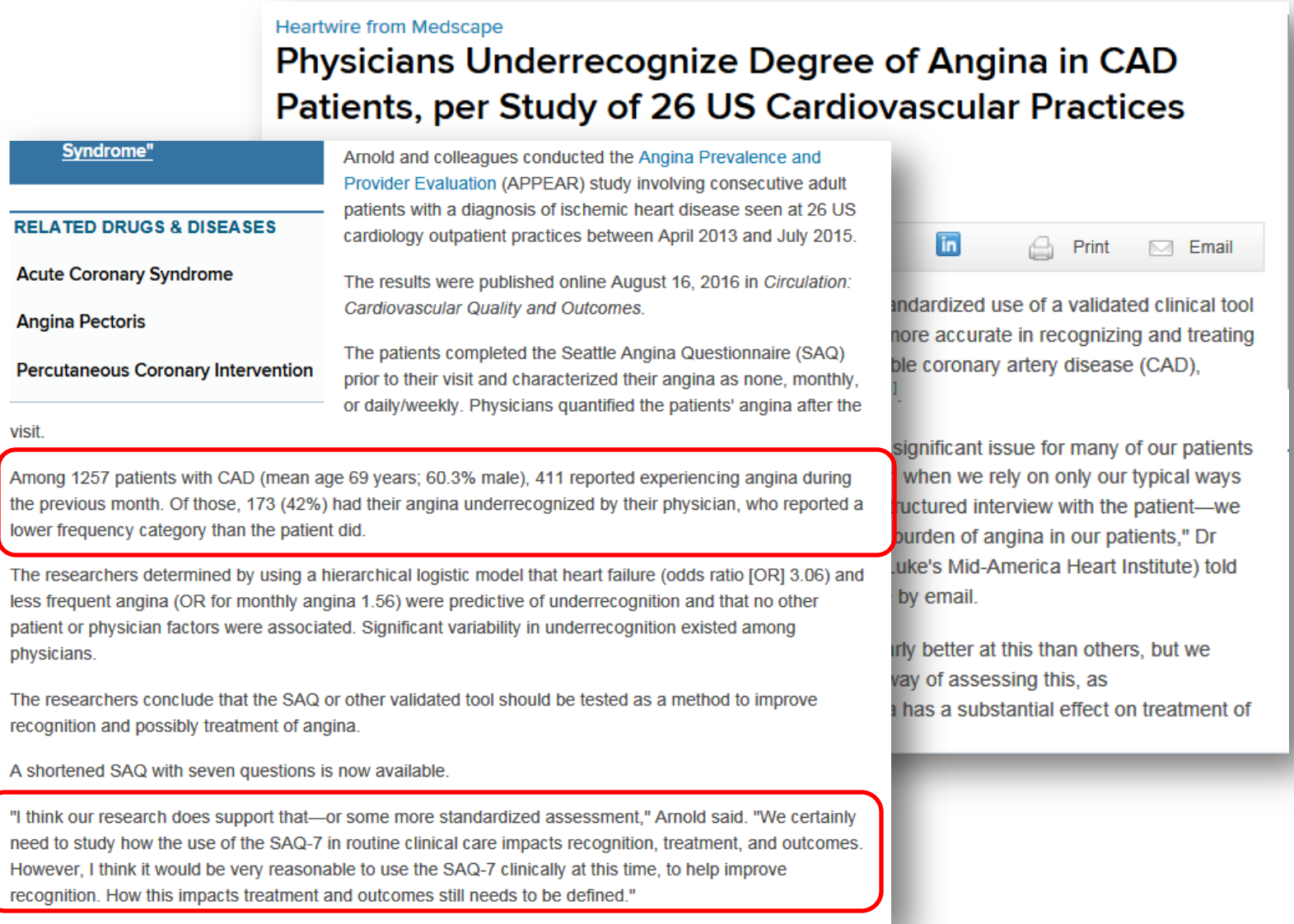
- Different isn't…

Locwin, B. (2014). QbD and Risk Assessment Move into the Clinical Space. *Contract Pharma.*

Under-Recognition Goes (Un)der-Reported



Heartwire from Medscape

Physicians Underrecognize Degree of Angina in CAD Patients, per Study of 26 US Cardiovascular Practices

Syndrome"

RELATED DRUGS & DISEASES

Acute Coronary Syndrome

Angina Pectoris

Percutaneous Coronary Intervention

Arnold and colleagues conducted the Angina Prevalence and Provider Evaluation (APPEAR) study involving consecutive adult patients with a diagnosis of ischemic heart disease seen at 26 US cardiology outpatient practices between April 2013 and July 2015.

The results were published online August 16, 2016 in *Circulation: Cardiovascular Quality and Outcomes*.

The patients completed the Seattle Angina Questionnaire (SAQ) prior to their visit and characterized their angina as none, monthly, or daily/weekly. Physicians quantified the patients' angina after the visit.

Among 1257 patients with CAD (mean age 69 years; 60.3% male), 411 reported experiencing angina during the previous month. Of those, 173 (42%) had their angina underrecognized by their physician, who reported a lower frequency category than the patient did.

The researchers determined by using a hierarchical logistic model that heart failure (odds ratio [OR] 3.06) and less frequent angina (OR for monthly angina 1.56) were predictive of underrecognition and that no other patient or physician factors were associated. Significant variability in underrecognition existed among physicians.

The researchers conclude that the SAQ or other validated tool should be tested as a method to improve recognition and possibly treatment of angina.

A shortened SAQ with seven questions is now available.

"I think our research does support that—or some more standardized assessment," Arnold said. "We certainly need to study how the use of the SAQ-7 in routine clinical care impacts recognition, treatment, and outcomes. However, I think it would be very reasonable to use the SAQ-7 clinically at this time, to help improve recognition. How this impacts treatment and outcomes still needs to be defined."

Print Email

andardized use of a validated clinical tool
nore accurate in recognizing and treating
ble coronary artery disease (CAD),

significant issue for many of our patients
when we rely on only our typical ways
ructured interview with the patient—we
burden of angina in our patients," Dr
Luke's Mid-America Heart Institute) told
by email.

rly better at this than others, but we
vay of assessing this, as
has a substantial effect on treatment of

Harmonization and Standards Are Designed To Protect Against Subjective Bias

Medscape Medical News

LAIV, Inactivated Flu Vaccine Offer Similar Protection

Lara C. Pullen, PhD

August 16, 2016

- Strong sample size
- Equiprotective effects
- You may hear things like – 'this inactivated flu vaccine is better than the live-virus vaccine.'
  - But depending on the populations under surveillance, there's in reality no difference

The investigators randomly assigned children to receive either LAIV or IIV by community (52 Hutterite communities participated). The primary outcome was a non-inferiority comparison of influenza rates between LAIV and IIV groups, including immunized Hutterite children (n = 1186), aged 36 months to 15 years, and 3425 community members who were not immunized. Of the children in the study, 80% were aged 6 years or older.

During the 3 year study, the mean vaccine coverage among eligible children in the LAIV group was 76.7%, and 72.4% in the IIV group.

The investigators performed intense active influenza surveillance and found that both LAIV and IIV had a similar effect on laboratory-confirmed influenza A and B viruses. Specifically, the rate of influenza virus infection was 5.3% in the LAIV group compared with 5.2% in the IIV group.

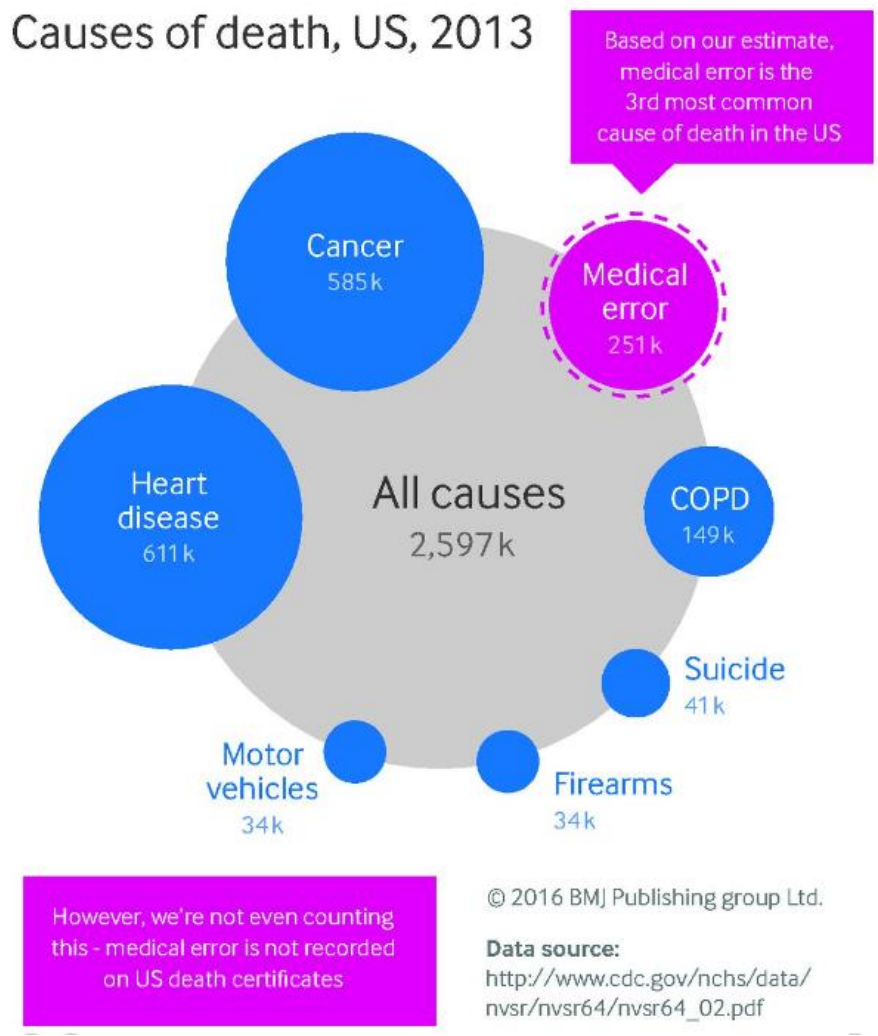
Deaths Due to Medical Error

- And finally…

Medical Errors Are No. 3 Cau
Deaths, Researchers Say

May 3, 2016 · 6:31 PM ET
Heard on Morning Edition

MARSHALL ALLEN | OLGA PIERCE



l errors should rank as
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about 150,000 deaths.

mplications that go
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nificant part, that's
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ors and poor judgment

- In *no other* high level of defects (esp y) acceptable!
- *e.g.*, airline travel - context

Enter Lean and Six Sigma

- Complementary methods
  - One doesn't need to exist at the expense of the other
- Lean tools to surface and eliminate defects
  - Value stream mapping
  - Deep understanding of 'flow' and 'rework' – what are your rates of each?
  - Root cause analysis (RCA)
  - Daily improvement
- Six Sigma tools help you quantify your performance repeatably as well as test hypotheses

Sounds Great!... So Why 'Wouldn't' This Work?

- Cultural barriers
- Self-propagating and –reinforcing systems
- 'Clinical practice inertia'

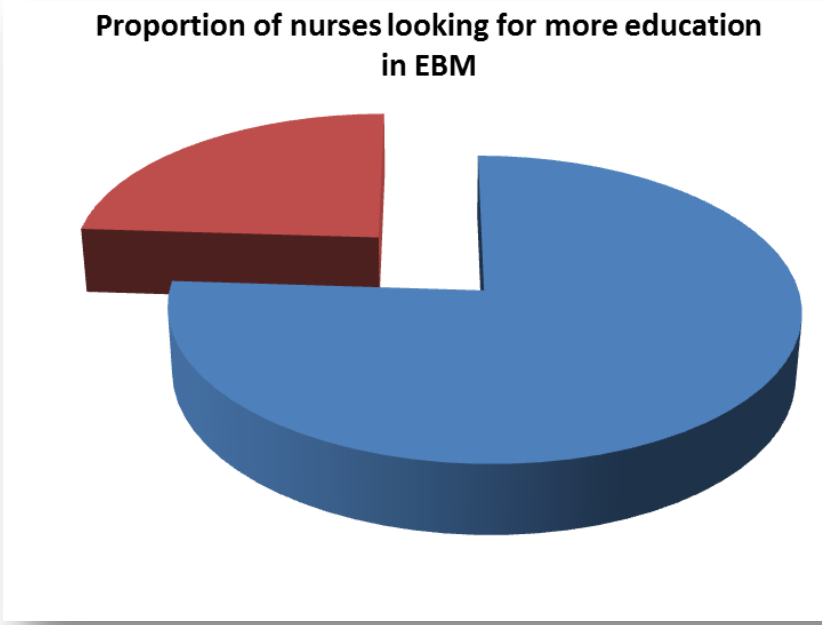
> "The absence of a proven effective framework for implementing clinical practice change has resulted in a patchwork of interventions in ambulatory and acute care medicine. There is an increasing appreciation that interventions should be undertaken only after careful, theory-based examination of the source and strength of the evidence, the organizational and professional context in which the change will be made, and the availability of facilitating methods."

- Hospitals, clinics, and other healthcare organizations have a **tremendous influence on the practicing patterns** of their staff and the outcomes of the patients they service
- This takes place largely through organizational cultural influences (localized practicing patterns), as well as the systematized processes that are in place within each individual organization

Reference: Weinert & Mann (2008). "The Science of Implementation: Changing the Practice of Critical Care," in *Current Opinions in Critical Care.*

The Good News On The Behavioral Front

- 76.2 percent
- *n* = 1,015
- healthcare practitioners wanted more education and skills-building in evidence-based practice



- The barriers most-frequently standing in the way of evidence-based practice were:
  - leaders
  - politics
  - organizational cultures

- Those who had been practicing in medicine the longest tended to be most resistant to evidence-based practice.

Melnyk et al. (2012). The state of evidence-based practice in US nurses: critical implications for nurse leaders and educators. *Journal of Nursing Administration*.

Case Studies

- Hand-washing – clinical practice
- ER wait times

Handwashing

- Inter-hospital contamination rates can be modeled in-part by hand-washing practices

Infection Control and Hospital Epidemiology

INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY

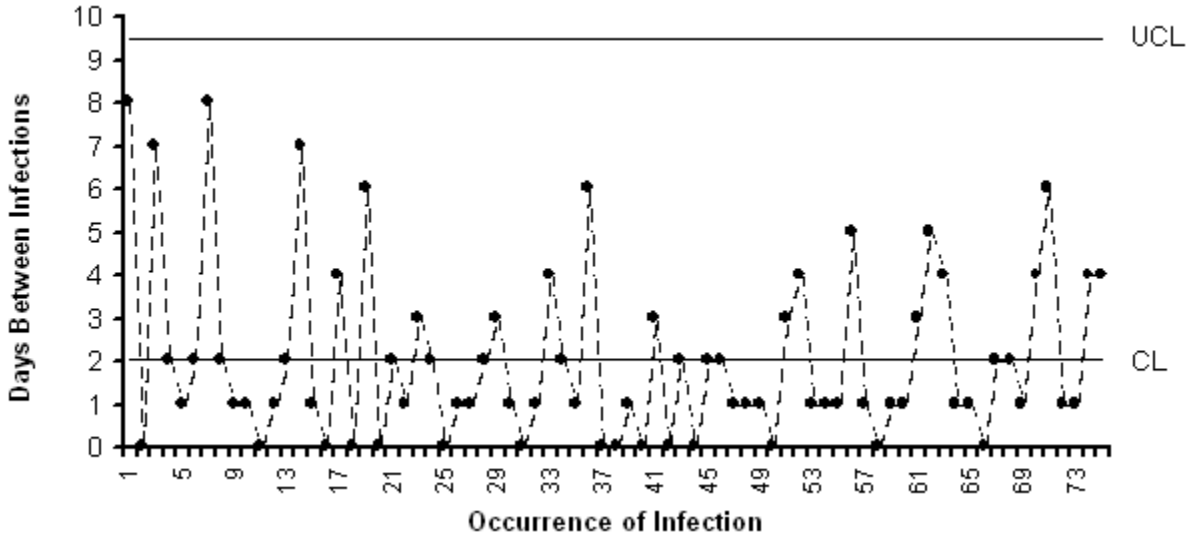
J Saudi Heart Assoc. 2013 Jul; 25(3): 203–208. PMCID: PMC3809478
Published online 2013 May 9. doi: 10.1016/j.jsha.2013.04.003

Physician 'defiance' towards hand hygiene compliance: Is there a theory–practice–ethics gap?

Manfred Mortell,[a] Hanan H. Balkhy,[b] Elias B. Tannous,[b] and Mei Thiee Jong[c]

Author information ▶ Article notes ▶ Copyright and License information ▶

Abstract Go to:



ı D. Graham, PhD; Katrina Sullivan, a Roth, MD; Karen Stockton, MHSc;

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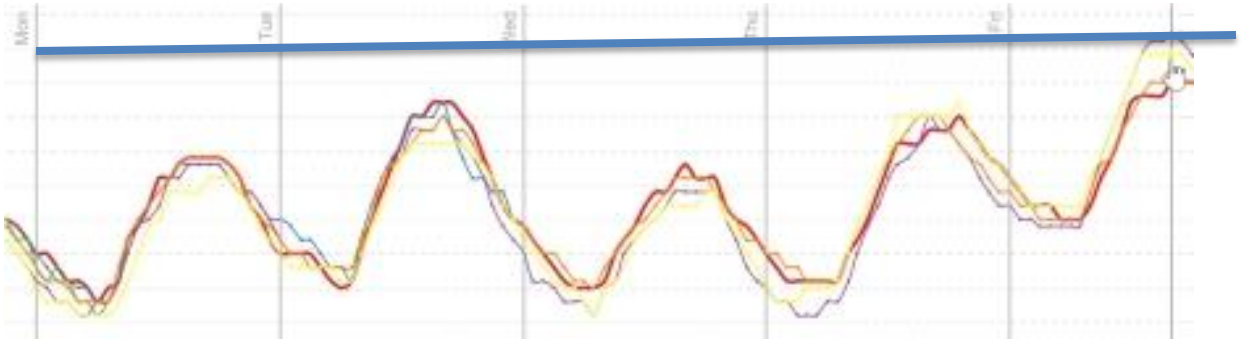
nts A total of 42 staff physicians and residents in
edicine and surgery.

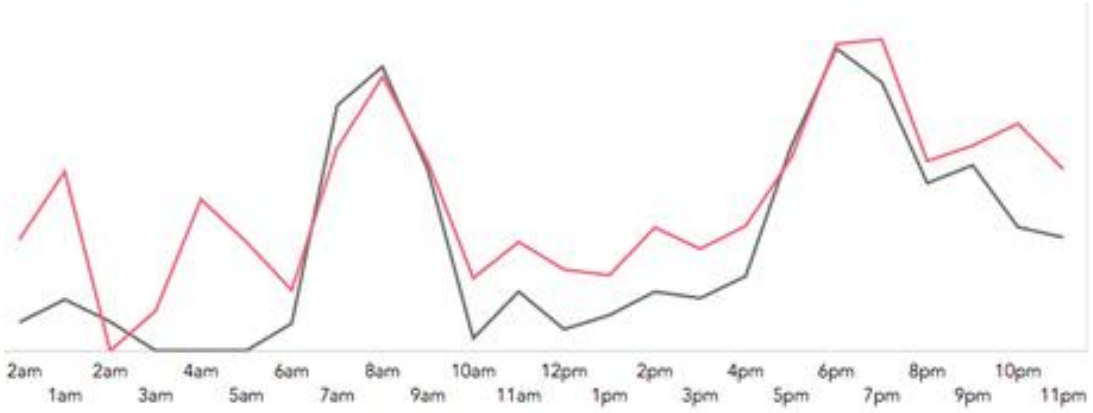
Repeatability Begets Sustainability

- Staffing based on actual performance data can lead to
  - Actual performance!
- Sustainability of interventions and new modes of working – it needs to be repeatable!
- If your days of the week look like this:



- Why should headcount look like this?

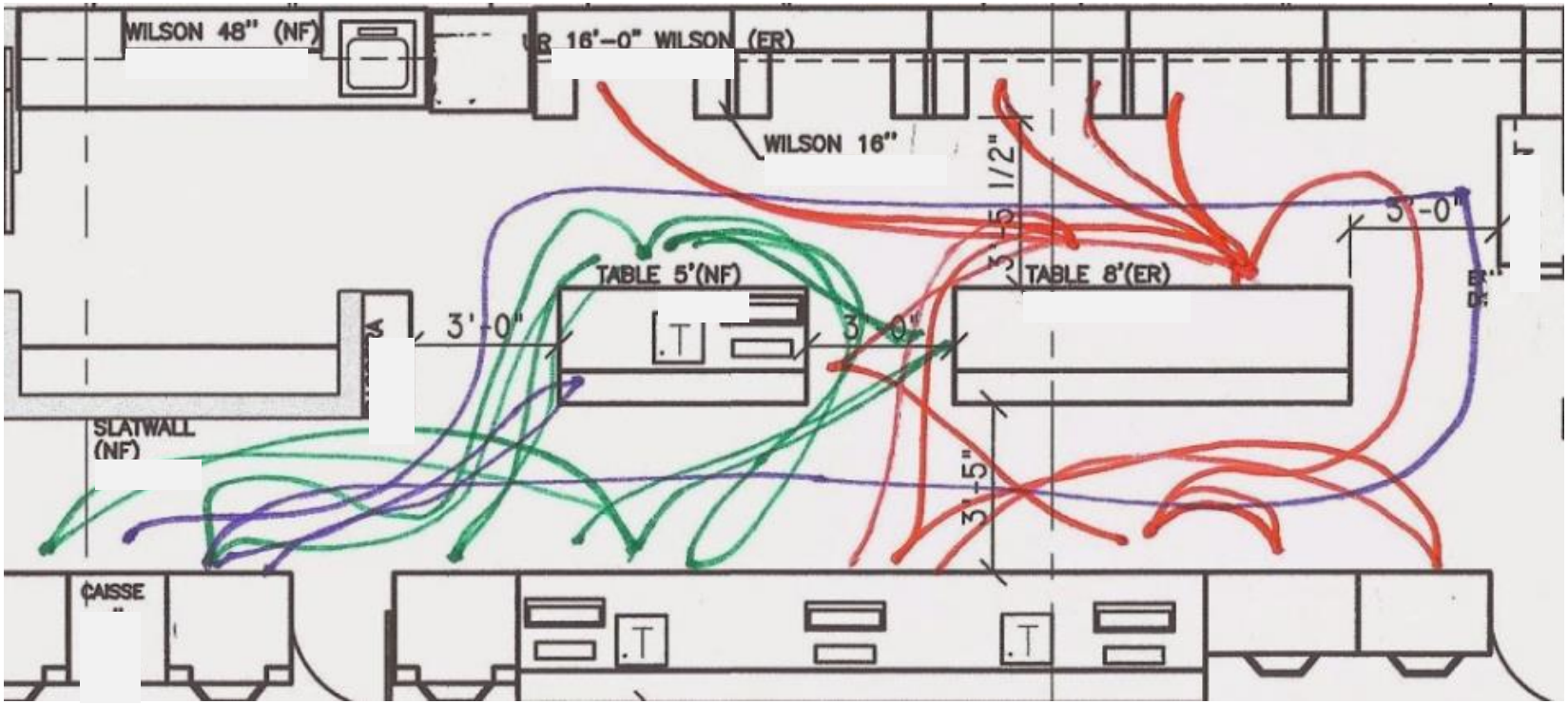
- Even time of day will have variability to it that you can *plan* for



- Heijunka

Think Your Organization's Flow Doesn't Include Waste?

- Think again!



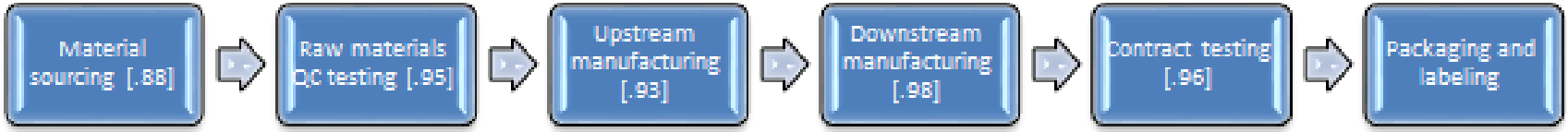
- This equates to progression of patient disability, disorder, or mortality

Quality by Design is your roadmap

To ensure:

- that you have everything packed
- that your trip is planned as expected

- The outcomes of your processes shouldn't be left to chance!



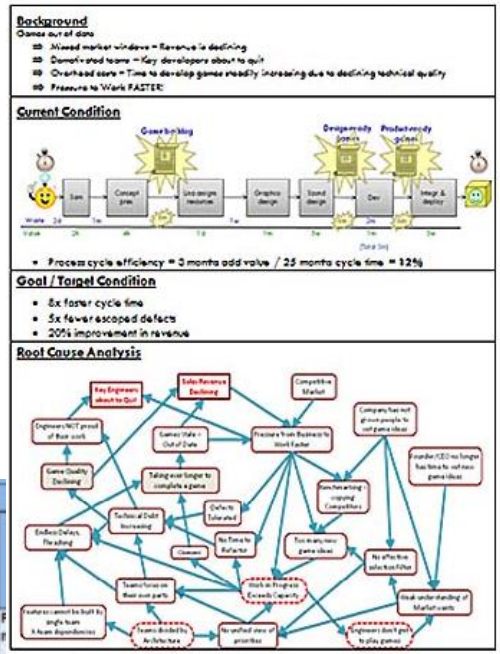
ER Wait Times

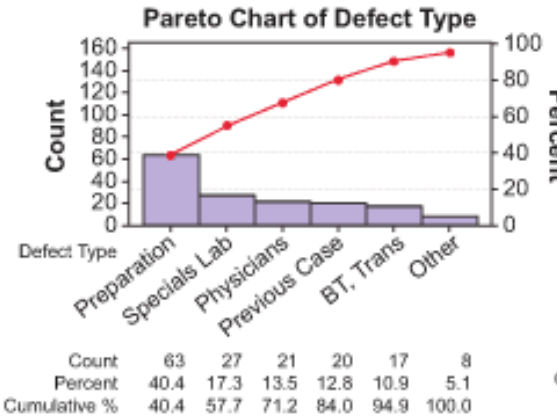
reducing ca
why you'll s
!

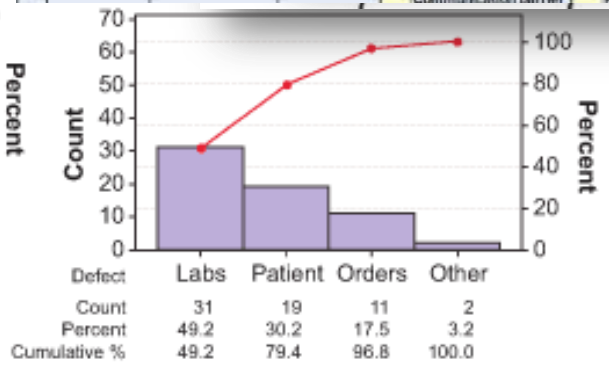
- I've worked with 2 of these hospitals, and do you think they're alone now? No! check this out:
- Patients want to be choosy consumers and have their time valued

Root Cause Analysis

- A3
- 5 Whys
- Fishbone diagram
- Fault Tree Analysis
- FMEA



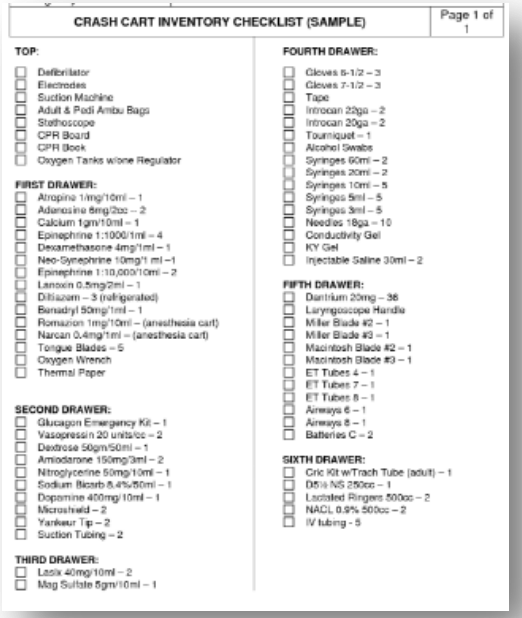




Ultimately, *your* data should guide your operational performance improvement

Other Considerations

- Crash cart for flu season
  - if you're going to have to walk between the office, vial storage, and patient screening room for 89% of your appointments during flu season (Sep-Feb), why wouldn't you plan for it?
  - Look at *your* data
  - Get a checklist, put it to use!



CRASH CART INVENTORY CHECKLIST (SAMPLE) Page 1 of 1

TOP:
- ☐ Defibrillator
- ☐ Electrodes
- ☐ Suction Machine
- ☐ Adult & Pedi Ambu Bags
- ☐ Stethoscope
- ☐ CPR Board
- ☐ CPR Book
- ☐ Oxygen Tanks w/one Regulator

FIRST DRAWER:
- ☐ Atropine 1/mg/10ml – 1
- ☐ Adenosine 6mg/2cc – 2
- ☐ Calcium 1gm/10ml – 1
- ☐ Epinephrine 1:1000/1ml – 4
- ☐ Dexamethasone 4mg/1ml – 1
- ☐ Neo-Synephrine 10mg/1 ml –1
- ☐ Epinephrine 1:10,000/10ml – 2
- ☐ Lanoxin 0.5mg/2ml – 1
- ☐ Diltiazem – 3 (refrigerated)
- ☐ Benadryl 50mg/1ml – 1
- ☐ Romazicon 1mg/10ml – (anesthesia cart)
- ☐ Narcan 0.4mg/1ml – (anesthesia cart)
- ☐ Tongue Blades – 5
- ☐ Oxygen Wrench
- ☐ Thermal Paper

SECOND DRAWER:
- ☐ Glucagon Emergency Kit – 1
- ☐ Vasopressin 20 units/cc – 2
- ☐ Dextrose 50gm/50ml – 1
- ☐ Amiodarone 150mg/3ml – 2
- ☐ Nitroglycerine 50mg/10ml – 1
- ☐ Sodium Bicarb 8.4%/50ml – 1
- ☐ Dopamine 400mg/10ml – 1
- ☐ Microshield – 2
- ☐ Yankeur Tip – 2
- ☐ Suction Tubing – 2

THIRD DRAWER:
- ☐ Lasix 40mg/10ml – 2
- ☐ Mag Sulfate 5gm/10ml – 1

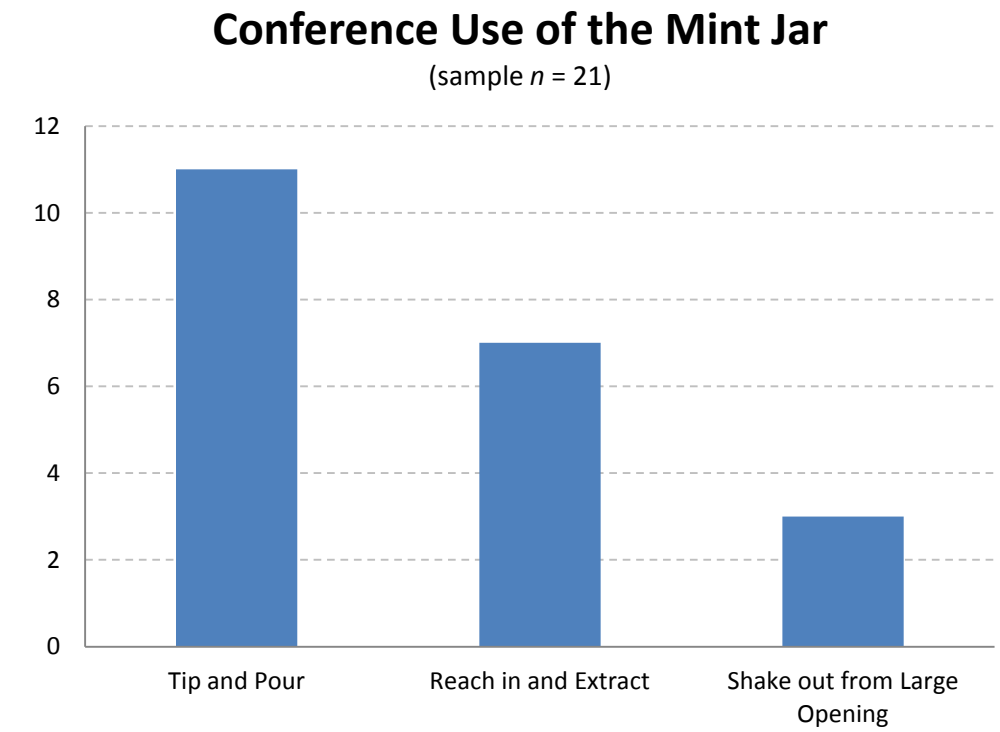
FOURTH DRAWER:
- ☐ Gloves 6-1/2 – 3
- ☐ Gloves 7-1/2 – 3
- ☐ Tape
- ☐ Introcan 22ga – 2
- ☐ Introcan 20ga – 2
- ☐ Tourniquet – 1
- ☐ Alcohol Swabs
- ☐ Syringes 60ml – 2
- ☐ Syringes 20ml – 2
- ☐ Syringes 10ml – 5
- ☐ Syringes 5ml – 5
- ☐ Syringes 3ml – 5
- ☐ Needles 18ga – 10
- ☐ Conductivity Gel
- ☐ KY Gel
- ☐ Injectable Saline 30ml – 2

FIFTH DRAWER:
- ☐ Diazepam 20mg – 36
- ☐ Laryngoscope Handle
- ☐ Miller Blade #2 – 1
- ☐ Miller Blade #3 – 1
- ☐ Macintosh Blade #2 – 1
- ☐ Macintosh Blade #3 – 1
- ☐ ET Tubes 4 – 1
- ☐ ET Tubes 7 – 1
- ☐ ET Tubes 8 – 1
- ☐ Airways 6 – 1
- ☐ Airways 8 – 1
- ☐ Batteries C – 2

SIXTH DRAWER:
- ☐ Cric Kit w/Trach Tube (adult) – 1
- ☐ D5½ NS 250cc – 1
- ☐ Lactated Ringers 500cc – 2
- ☐ NACL 0.9% 500cc – 2
- ☐ IV tubing - 5

Repeatability, Repeatability, Repeatability

- Does this look familiar?
- So few options… so much variation



Observational data collected by Ben Locwin 18Aug16, Boston, MA

Ultimately, Make It Sustainable!

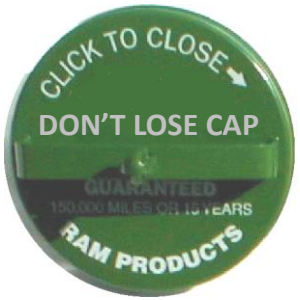
- Your level of improvement will determine the level of adherence and sustainability!
- Have it be systematized, automated, proceduralized, etc. for continued enforcement

Not All Countermeasures Are Equal

- **Design countermeasures are best, long-term**
  - Upgrade or redesign
  - Issue eliminated 100%

- **Process countermeasures are good, mid-term**
  - Add detection, warning, or other process controls, etc.
  - Change the process in a way that's hard to casually reverse

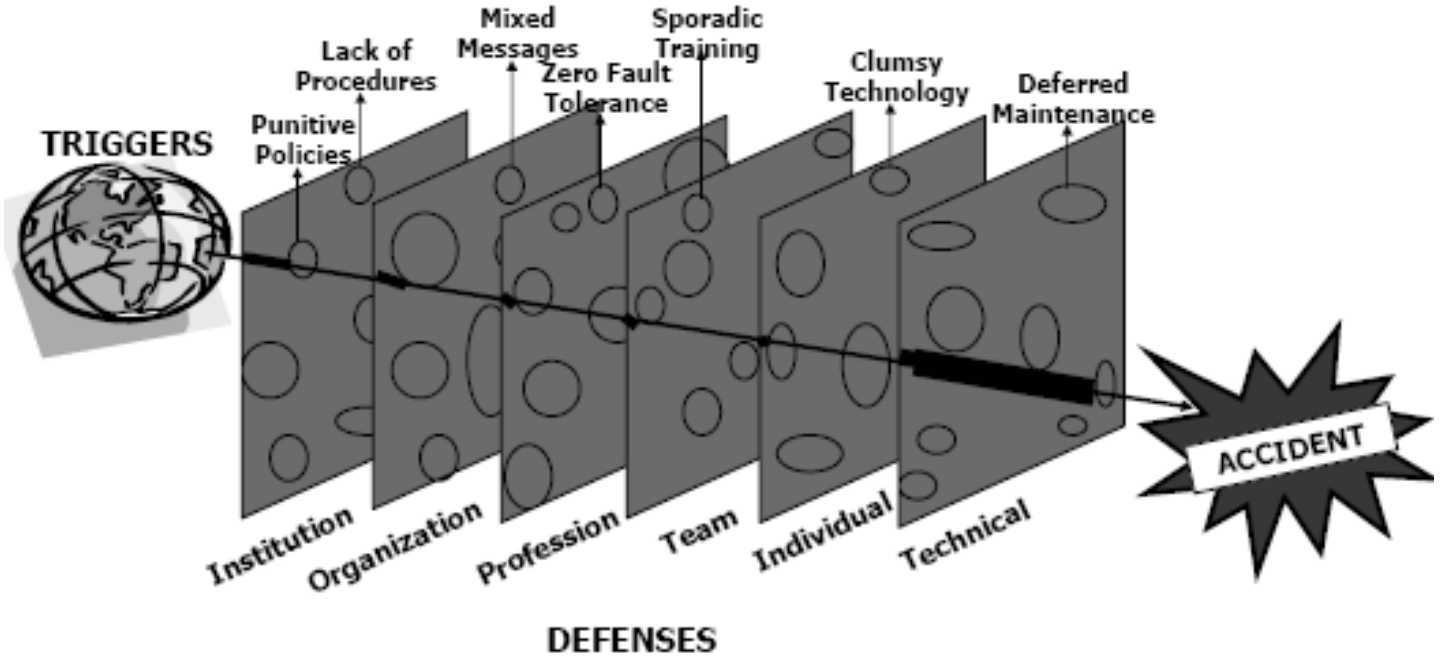
- **Human countermeasures are ok, but only as a short-term corrective action**
  - Clarify process description, awareness training, etc.
  - Use these countermeasure to contain the problem, buy time



Each countermeasure type has a different purpose and effect

The Swiss-Cheese Model of Causation

- **Each of our organizational structures provides some level of defense**
- **Each of these layers of accident prevention has holes or gaps**
- **With some probability (RTY), tortuous path exists for error to occur**



Reference: Reason, J. (1990). *Human error*. Cambridge University Press.

How many holes do you have?

Summary of Learning

- Healthcare represents a very consequential industry to get right
- *Every* process will have defects – but to get better you need to change the processes!
- Quality Risk Management allows you to focus on what *actually* matters most (hint: not the rest)
- 'Hidden factory' makes improving the future a challenge!
- Effective solutions need to be replicated (harmonized, not standardized) where possible
- You are the architects of your organizations' future state!

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