

# Patient Safety: Applying Industrial Quality Models in Healthcare Settings

*Tempora mutantur,  
nos et mutamur in illis*

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Quality problems are everywhere. Between the health care we have and the care we could have lies not just a gap, but a chasm. The frustration level of both patients and clinicians has never been higher. Health care today harms too frequently and routinely fails to deliver its potential benefits.

*Crossing the Quality Chasm*  
*Institute of Medicine, 2001*

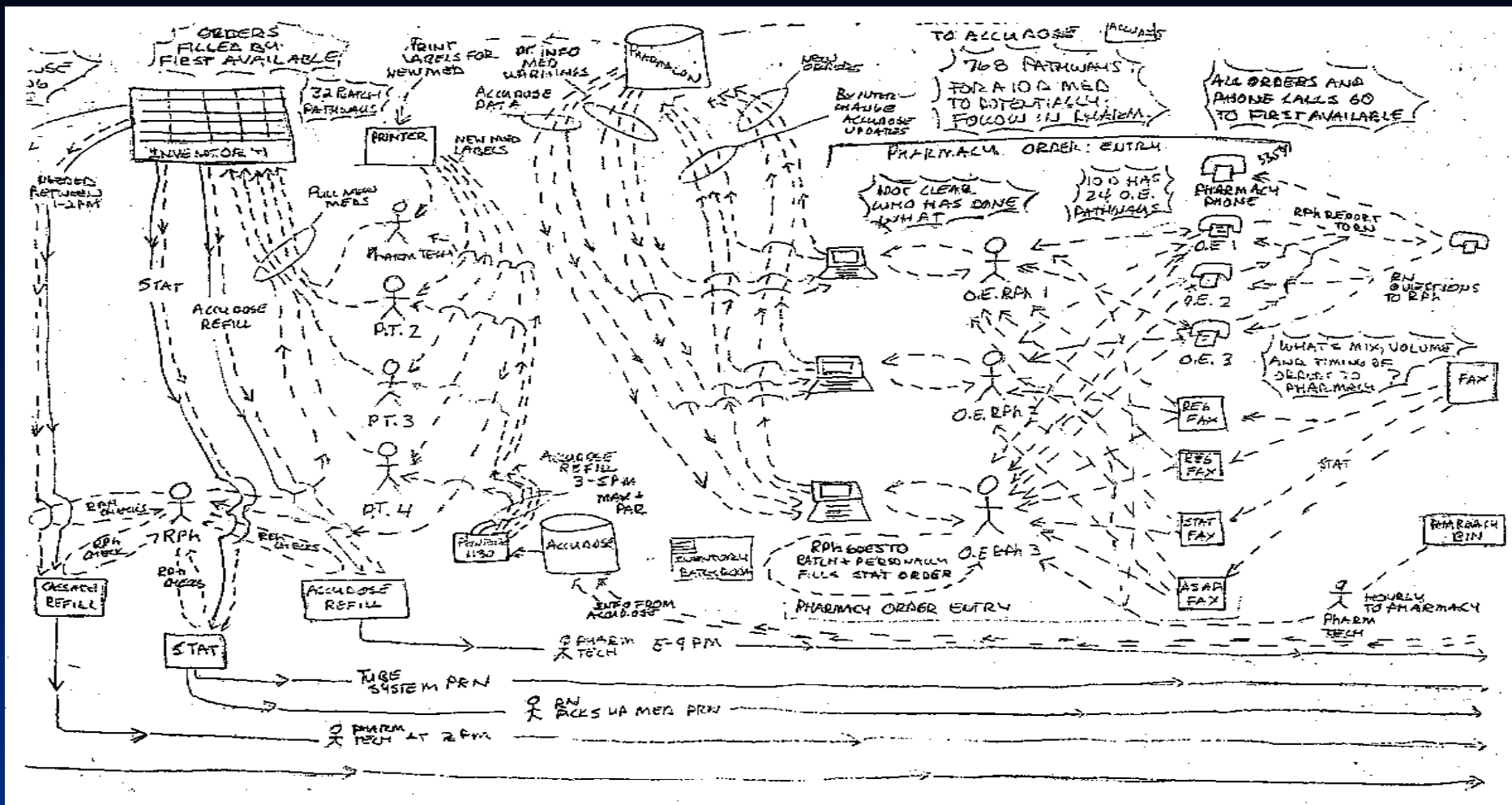
# Contemporary Healthcare

Stacey, R.D. 1996



**CHAOS!**

# Chaos in Healthcare!



Flow diagram for medication delivery to an intensive care unit

# Patient Safety is...

- Healthcare without unintended harm, free from errors and near misses
- A surrogate term for healthcare quality
- An organizing principle to motivate healthcare quality improvements
- An extremely compelling “tag line” that has effectively engaged consumers, healthcare organizations, purchasers, and decision makers
- A critical public health issue for infectious diseases clinicians and CDC!

# Goals of Healthcare

- Appropriate treatment
- Short length of stay / efficient resource utilization
- Low mortality in hospital and after
- Best possible functional status
- Patient satisfaction
- Healthcare provider satisfaction

# Healthcare Safety!



# 7 Healthcare Safety Challenges

*In 5 years:*

- Reduce targeted catheter-associated adverse events by 50%
- Reduce targeted surgical adverse events by 50%
- Reduce targeted antimicrobial-resistant bacterial infections by 50%

## **7 Healthcare Safety Challenges**

*In 5 years:*

- Reduce mortality and hospitalizations due to respiratory infections among long term care patients by 50%
- Eliminate microbiology laboratory errors leading to adverse patient outcomes
- Eliminate occupational needle injuries among healthcare personnel
- Achieve 100% compliance with ACIP guidelines for immunization of healthcare personnel

# Strategies for Improving Healthcare Safety

## Goal: Prevent Catheter Infections

- Benchmarking / Continuous Quality Improvement



# Benchmarking for Quality Improvement

Site	Hospital A Infection Rate*	NNIS Benchmarks (percentile)				
		10%	25%	50%	75%	90%
UTI	7.2	1.3	3.0	5.1	7.1	9.6
BSI	8.0	1.0	2.4	4.6	6.3	7.9
VAP	3.8	3.4	6.5	10.1	13.4	17.5

\* Rate = # infections per 1000 device-days

UTI = urinary catheter-associated infection  
BSI = central catheter-associated bloodstream infection  
VAP = ventilator-associated pneumonia



# *Quality Promotion / Infection Prevention* **Cycle for Success**

***Is there an important problem?***

*Compare local rates to NNIS benchmarks*

***Do the changes work?***

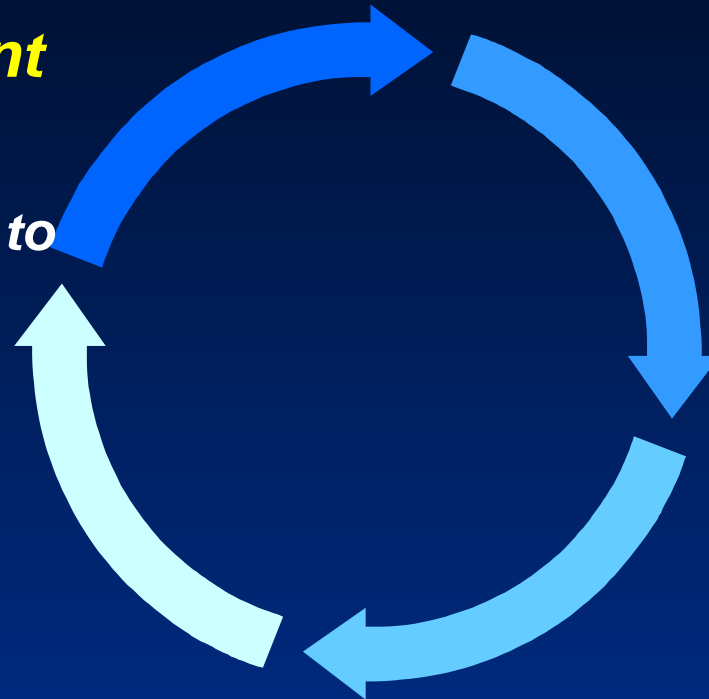
*Monitor progress toward improvement*

***Why? What?***

*Multi-disciplinary committees*

***How to affect change?***

*Education  
Feedback  
Decision support*



*A Decade of Progress:*  
**Hospital-onset Infection Rates in Intensive  
 Care Units Decline (NNIS Hospitals)**

<u>Type of ICU</u>	<u>Percent Decline in Rate</u>		
	<u>BSI*</u>	<u>VAP*</u>	<u>UTI*</u>
coronary	43%	42%	40%
medical	44%	56%	46%
surgical	31%	38%	30%
pediatric	32%	26%	59%

BSI = central line-associated bloodstream infection rate  
 VAP= ventilator-associated pneumonia rate  
 UTI = catheter-associated urinary tract infection rate

*CDC NNIS System, 1990-1999*



# Strategies for Improving Healthcare Safety

## Goal: Prevent Catheter Infections

- Benchmarking / Continuous Quality Improvement
- Root Cause Review / Analysis

# Root Causes Review\* of Fatal Catheter-associated Bacteremia: Delay in Treatment

- Work processes / timeline
  - fever noted / MD alerted / patient evaluated
  - tests ordered / tests performed / results available
  - results reviewed / treatments ordered / administered
- Communication / supervision channels
  - nurse / houseofficers / attending / consultants
- Structural issues / competing priorities
  - staffing / census
  - hours on call / consecutive shifts worked



# Strategies for Improving Healthcare Safety

## Goal: Prevent Catheter Infections

- Benchmarking / Continuous Quality Improvement
- Root Cause Review / Analysis
- Six Sigma Analysis

# What is Six Sigma ?

...3.4 defects per million process opportunities

...A business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimize waste and resources while increasing customer satisfaction

*M Harry & R Schroeder: Six Sigma; 2000*

...the most important initiative GE has ever undertaken.

*Jack Welch, General Electric*

# What is Six Sigma Breakthrough Strategy?

- Measurement: data collection and reporting
- Analysis: statistical evaluation of process data
- Improvement: re-design, change processes
- Control: continuous process monitoring

# Six Sigma Strategy

- Focus: persistent (endemic) problems, not just sporadic (epidemic) problems
  - Hidden problems; “ton of feathers”
  - Evade attention
  - Erode quality
  - “Ton of feathers”
- Most quality problems are persistent!



# Benchmarking for Quality Improvement

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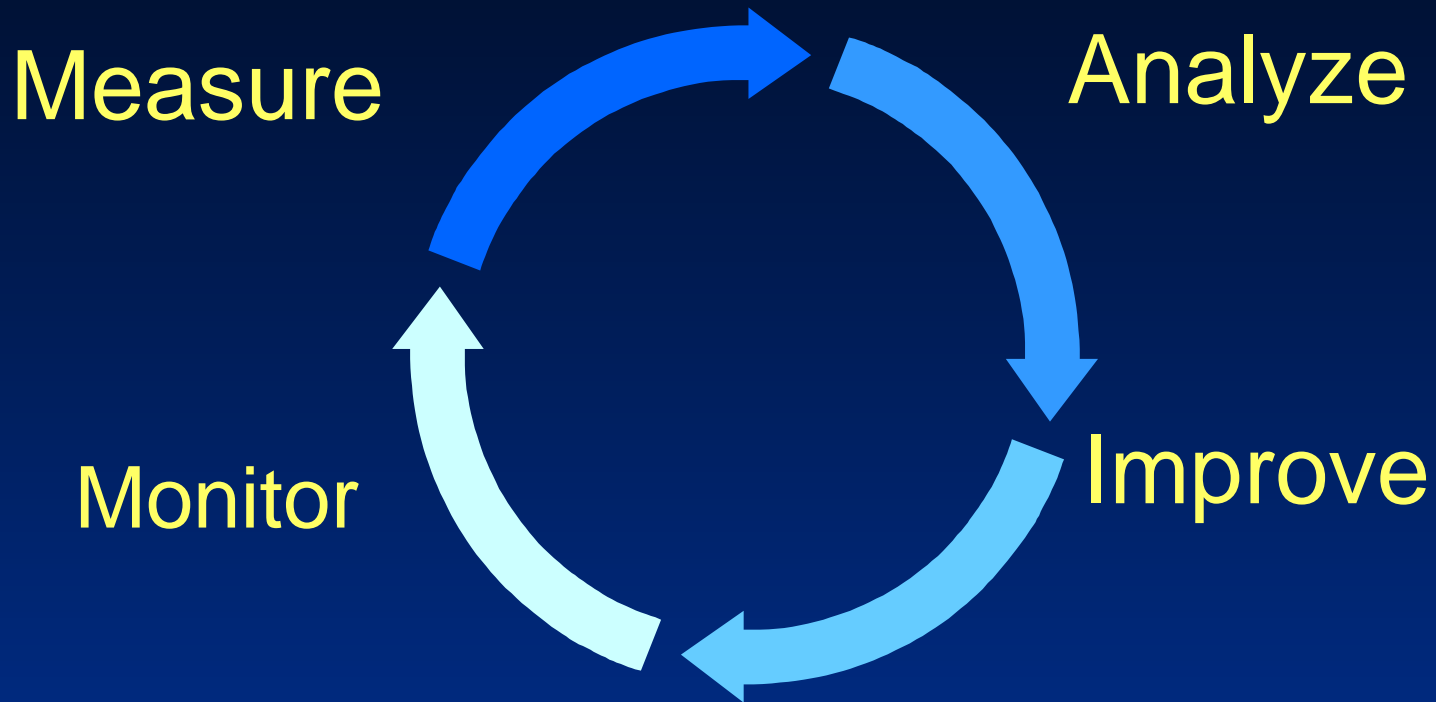
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# *Six Sigma: Breakthrough* Catheter Infection Prevention



# Strategies for Improving Healthcare Safety

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- Six Sigma Analysis
- Toyota Production System

# TPS Goals

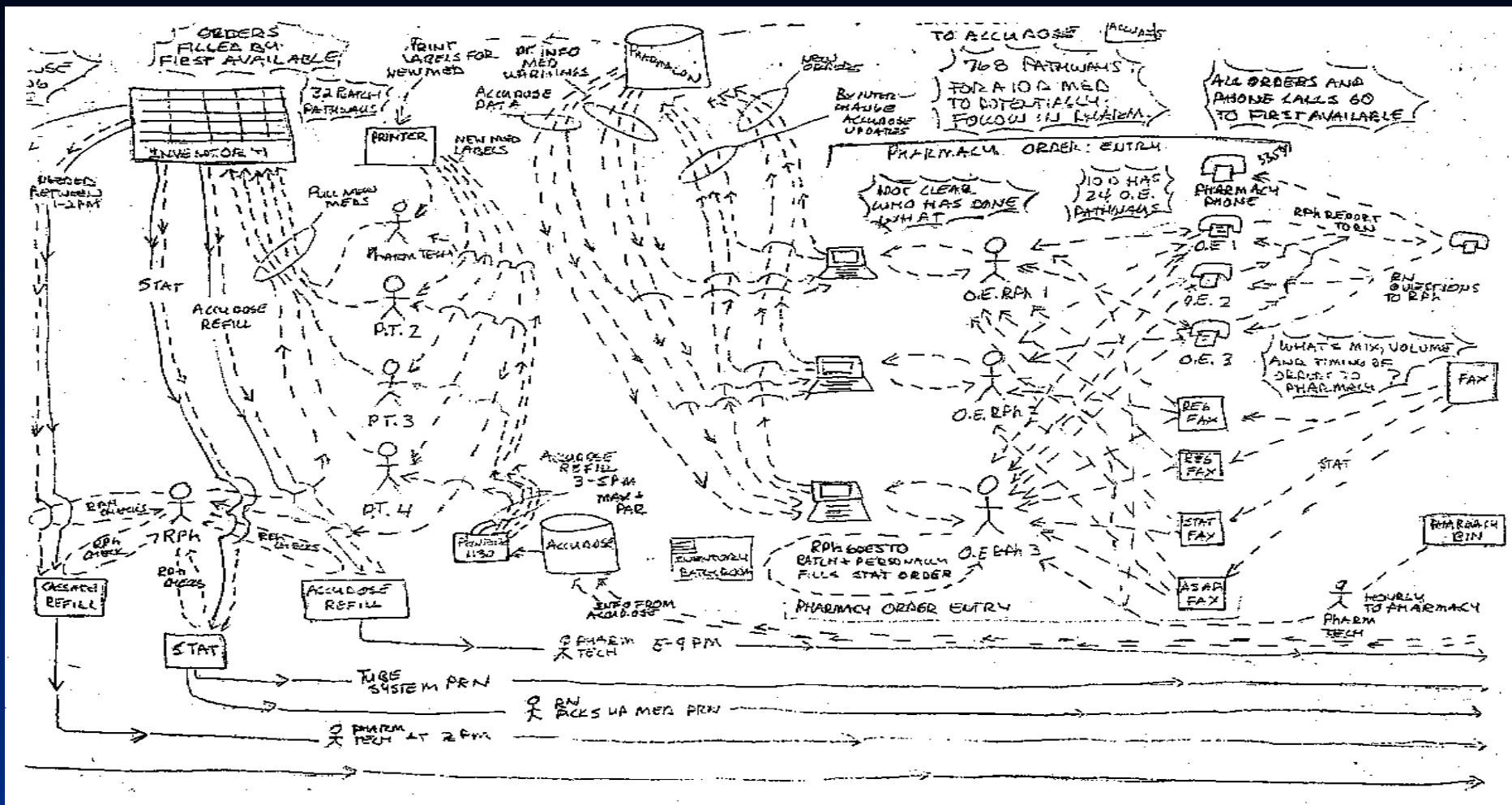
- Quantity control: adapt to daily and monthly fluctuations in demand in terms of quantities and variety
- Quality assurance: assures that each process will supply only good units to the subsequent processes
- Respect-for-humanity: cultivated while utilizing human resources to attain cost and quality objectives.



# Muda

- Waste of time
- Waste of overuse
- Waste from transporting
- Waste of over processing
- Waste of inventory
- Excess motion of operators and workers
- Waste from scrap and rework. Human under utilization
- Improper use of computers
- Working to the wrong metrics

# Chaos in Healthcare!

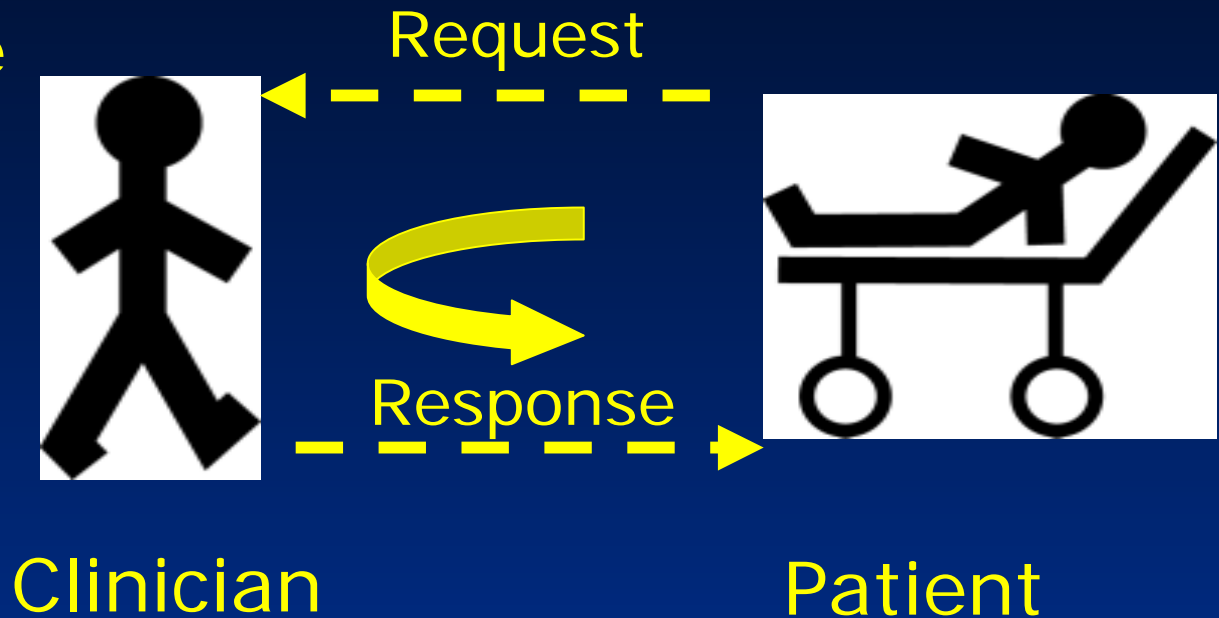


Flow diagram for medication delivery to an intensive care unit

# TPS: Promoting Patient Safety

## The Goals:

- Error-free care
- 1:1 contact
- No waste
- Immediate response
- Safety



# Pittsburgh Regional Health Initiative

- **A community coalition:**
  - 31 hospitals / 4 insurance plans / all major healthcare purchasers
  - State Attorney General
- **United by a common mission:**
  - Providing patients what they need when they need it without waste or error
- **Perfection – “Zero” Goals:**
  - Zero medication errors
  - Zero hospital-acquired infections
  - Perfect clinical outcomes: Invasive cardiac procedures, hip and knee replacement surgery, depression, c-sections, diabetes

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Systems must

*Times change,  
and ~~we~~ change with them too*

Owen's Epigrammata, 1615