Institute for Healthcare Improvement

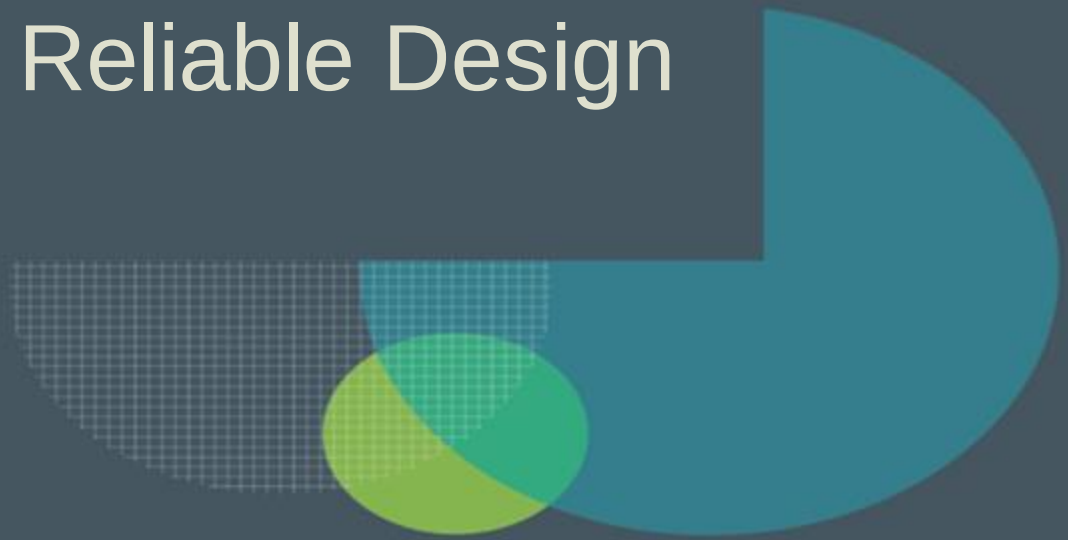
العناية المثلى دائماً
Best Care Always
مبادرة من مؤسسة حمد الطبية
An initiative by HMC

حمد
Hamad

Reliable Design and the Influence of Human Factors

Institute for Healthcare Improvement

Reliable Design



Three-level Design of Safe and Reliable Systems of Care

Prevent → Design the system to prevent failure

Identify → Design procedures and relationships to make failures visible when they do occur so that they may be intercepted before causing harm

Mitigate → Design procedures and build capabilities for fixing failures when they are identified or mitigating the harm caused by failures when they are not detected and intercepted

Earl Weiner, U of Miami
Nolan. BMJ March 2000

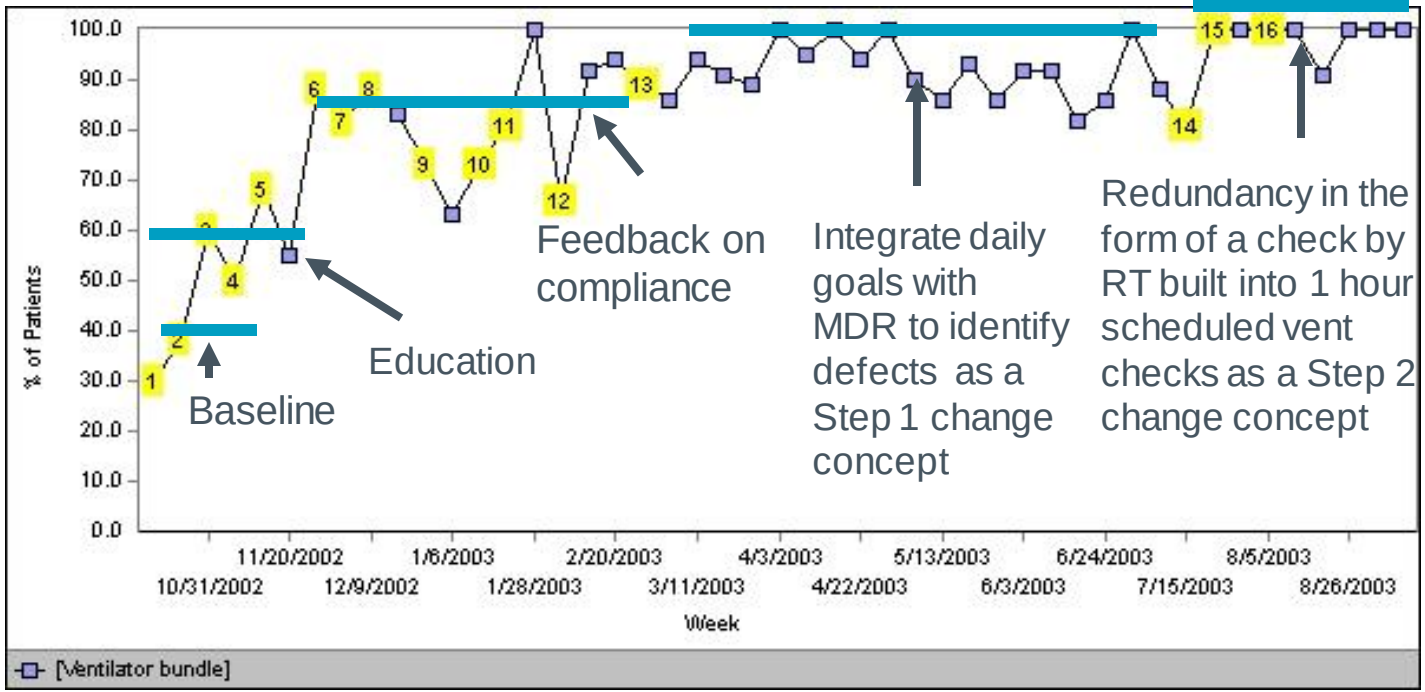
Think of a Process You Believe is Reliable

- Name the process
- Define what you mean by reliable
- What do you think makes the process reliable?

Examples of Reliable Processes

- Airline industry
- Automobiles
- Starbucks
- McDonald’s
- Nuclear Submarines
- Others…..

Example of a Run Chart Showing Implementing the VAP Bundle



(Baptist Memorial, Memphis)

Why Are Processes Not Reliable?

- Individual Autonomy
- Focus on benchmark performance
- Over-reliance on training, vigilance and hard work
- Expecting that a having a policy will result in improved reliability

The Reliability Design Strategy

- Prevent initial failure using intent, simplification and standardization
- Identify defects (using redundancy) and mitigate
- Measure and then communicate learning from defects back into the design process

IHI Reliable Design Methodology

- Start small- subset/segment of the population
- Visualize the steps in the process using a high-level flow diagram
- Identify the defects in each step
- Lead with the change concepts of simplification and standardization
- Develop a ‘back-up plan’ or redundancy
- Test-test-test
- Measure-measure-measure

Start Small

- Experience tells us that not all situations are the same
- One standardized process will not work for all
- Design a process to deliver reliable care for a group that is easiest to work with
- Learn from that group and spread to others

Step 1- Let's Identify a Problem

- Select subset or segment of population
- Select process you want to make more reliable
- Develop a high level flow diagram
- Identify defects in each step
- Select which defect you will fix first
- State your reliability goal
  - At least 95% reliable

Selecting a Subset/Segment

Characteristics:

- Easy to identify
- Willing participants
- Can learn how to design for other subsets
- High enough volume to be able to test daily or every other day
- “If we cannot make our process reliable for this group, what are our chances with other groups?”

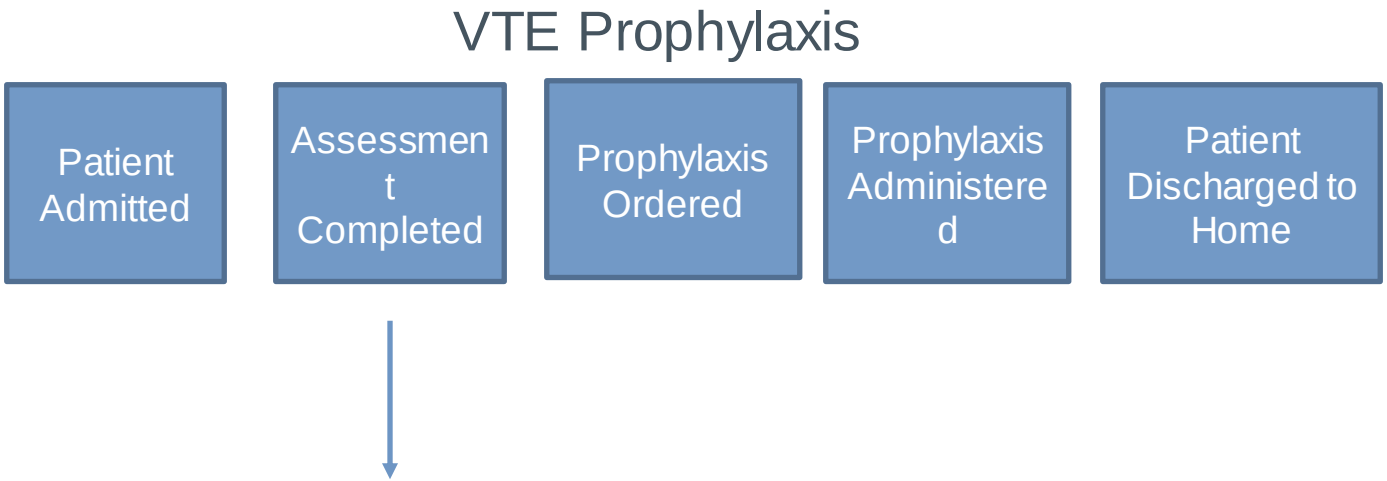
Subset for the Ventilator Care Bundle

- Patients in ICU-9
- Dr. Mohammad’s patients
- Patients on the South side of the ICU
- Medical ICU with two willing doctors

Create a High Level Flow Diagram

- Select a process you wish to make reliable
- Outline 4-5 steps in the process - no more!
- Pick the step where the most number or most severe failures occur
- Start by making that step reliable

Example of High Level Diagram



Aim: At least 95% of the patients will be assessed

What is your goal?

- At least 95% reliability for the process for non – catastrophic processes
- Why not 100%?
- Process must be capable and reliable
- Process must be linked to outcome

Step 2

- Use standardization to ensure reliability in the step you have chosen

Why Standardize?

- Reduces variation
- Easier to fix a defect when one occurs
- Makes it easier to train
- Makes it easier to assess competency
- Supports care we expect our patients receive

What would you standardize?

- With your neighbor, decide what you standardize in the step, ‘Complete VTE Assessment’

Standardize the Process: Complete the Following

- Who
- What
- When
- Where
- How
- With what

Step 3: Develop a Back Up Plan

- Very difficult to reach 100% every time with only one step
- Allowing for 80% reliability in first step gives opportunity to design more freely
- You may achieve 95% or better with only first step-but is it sustainable?
- You should have a safeguard/backup plan in place

Examples of Backup Plan

- CHF and pharmacist check
- Call to patient after discharge
- Checkout after primary care visit
- Visual marker for head of bed elevation

Measurement

- Needed to determine reliability of processes
- Sampling is useful
- Measurement alone does not result in improvement

How to Help Your Teams

- Start with segmentation, flow diagram and standardization
- Standardization must achieve at least 80% before moving on
- If reliability not improving consider testing some other steps
- Use the following grids to coach teams

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Human Factors and Reliability

Human Error

1. Errors are common
2. The causes of errors are known
3. Many errors are caused by activities that rely on weak aspects of cognition
4. Systems failures are the “root causes” of most errors

Lucian Leape, “Error in Medicine” *JAMA*, 1994

Human Factors

- Human Factors focus on human beings and their interaction with each other, products, equipment, procedures, and the environment.
- Human Factors leverage what we know about human behavior, abilities, limitations, and other characteristics to ensure safer, more reliable outcomes.
- Example: how doors open, color coding aprons in ICU.

Our Focus

- Understanding the ‘violations’ of human factors principles that set us up for errors
- Determining what to do to address these violations

Error-Producing Conditions

- Unfamiliarity with task x17
- Shortage of time x11
- Poor communication x10
- Information overload x6
- Misperception of risk (drift) x4
- Inadequate procedures / workflow x3

These are compounded by “human factors violations” such as fatigue, stress, work environment (e.g., psychologically unsafe environment), interruptions and distractions, and ambiguity regarding roles and responsibilities.

Human Factors Violations: Drivers of Human Error

- Fatigue
- Lack of sleep
- Shift work
- Boredom, frustration
- Fear
- Stress
- Reliance on memory
- Reliance on vigilance
- Injury or Illness

- Interruptions & distractions
- Noise
- Heat
- Clutter
- Motion
- Lighting
- Unnatural workflow
- Procedures or devices designed in an accident prone fashion

Specific Error Reduction Strategies to be Used in Reliable Design

- Use visual controls
- Avoid reliance on memory
- Simplify and Standardize
- Use constraints/forcing functions
- Use protocols and checklists
- Improve access to information
- Automate carefully
- Reduce interruptions and distractions
- Take advantage of habits and patterns
- Promote effective team functioning

Strategy: Use Visual Controls

Stove A

Which dial turns on the burner?

Stove B

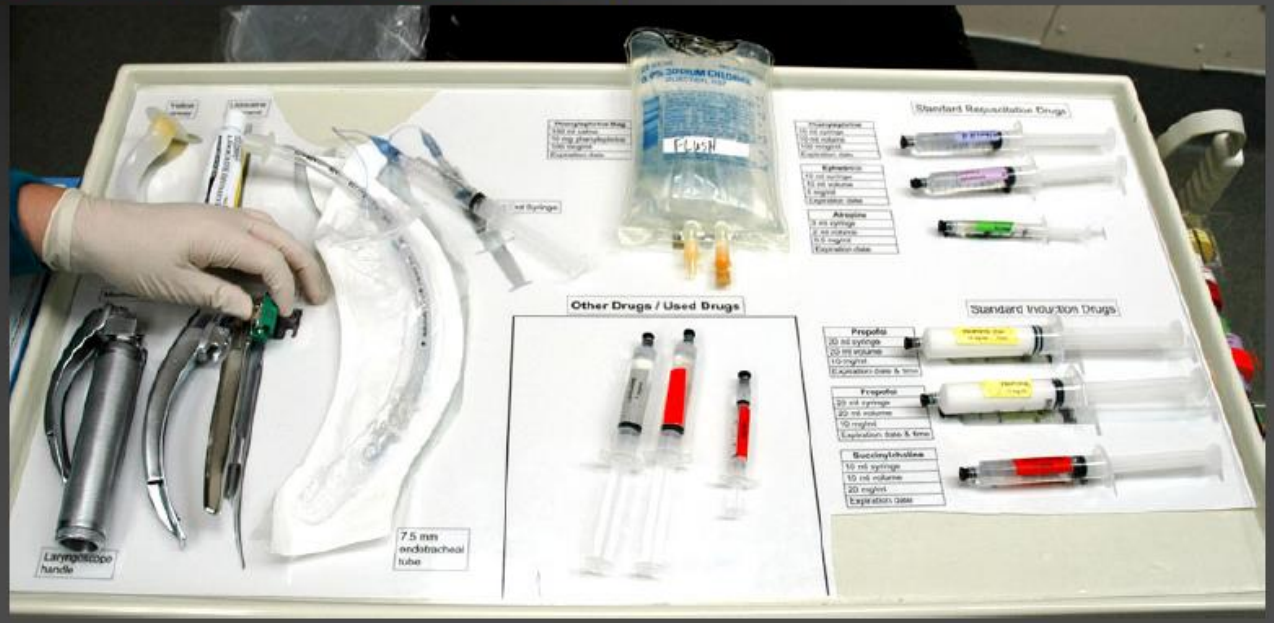
June 28, 2004

Visual Control for Safety

TEAM MEDICINE VIRGINIA MASON

5S Anesthesia “Shadow Board” - Before

Visual Control for Safety



5S Anesthesia Shadow Board - After

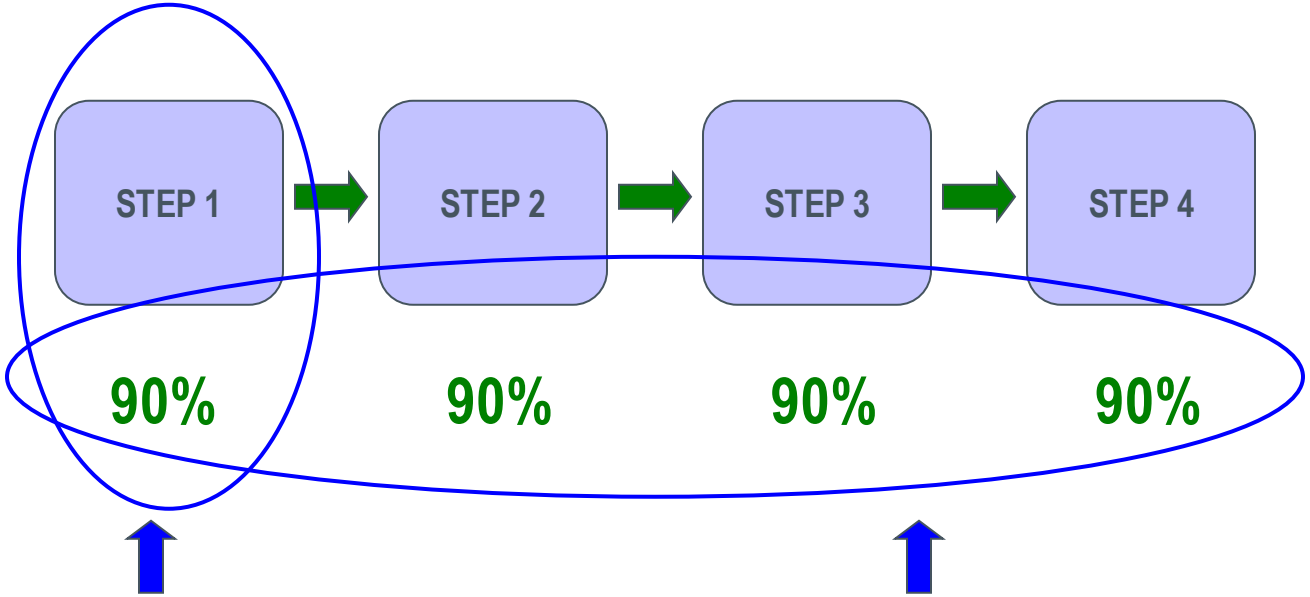
Strategy: Avoid Reliance on Memory

- Computerized drug-drug interaction checking
  - Drug information databases
  - Customized drug rules
- Preprinted orders
  - Chemotherapy order form
  - Pain management order forms
- Star$$$

Strategy: Simplify

- Formulary restrictions
  - Remove items
  - Eliminate therapeutic duplications
  - Limit availability
- Heparin weight based protocol
  - Simplifies ordering process
  - Provides comprehensive orders
- Reduce number of handoffs, number of steps in a process

Why Simplify Workflow?



Strategy: Use Constraints/Forcing Functions

- Concentrated KCl vials
  - Remove KCl from all inpatient units
- Connectors that prevent IV administration of enteral products
- Computer prompt: “Proceed Y or No?”
- And of course, In-N-Out Burger (can’t lose the tray in the trash!)

Strategy: Use Protocols and Checklists

- Checklists
  - Reminders of every step in the process
  - NOT rigid molds for non-thinking behavior
  - Pilot checklists: includes method to designate where stopped if interrupted
  - Anesthesia Machine Checklist

Strategy: Improve Access to Information

- Include “Indication” with orders
- Drug information sources
  - Determine ease of use
- Useable procedures
- Improving adherence to prescribed care plan

Strategy: Automate Carefully

- Errors multiply if input is incorrect
- Automated dispensing machines
- Computerized physician order entry

Strategy: Reduce Interruptions and Distractions

Daily Mail, Friday, October 13, 2006

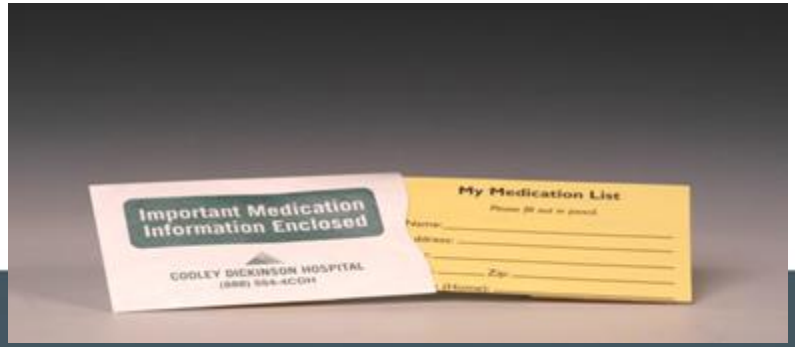
It's a jumble out there

With all those signs, you might miss the speed camera

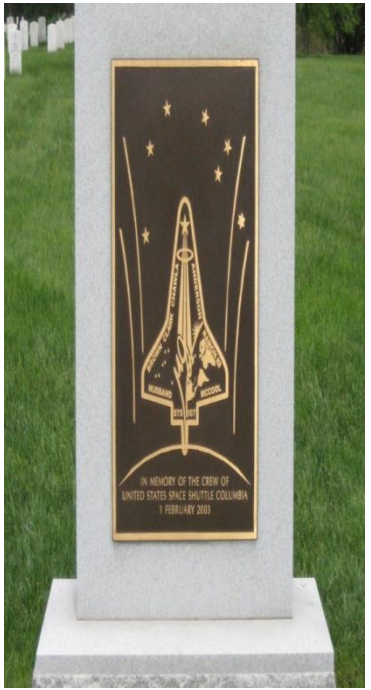
Bewildering: A learner approaches the line of signs in South-West London, which are enough to confuse and distract the most experienced driver

Strategy: Take Advantage of Habits and Patterns

- Hand hygiene
- Appointment reminder card - questions
- Patient medication list
  - Sleeve to hold insurance card and medication list



Strategy: Promote Effective Team Functioning



What Can You Do?

- Conduct a human factors task analysis:
  - Are processes standardized?
  - Is there ready access to information?
  - Are redundancies and reminders in place?
  - How many interruptions are there during the work shift?
  - How complex are the tasks or instructions?