How to prioritize resources and strategies on control of MDRO

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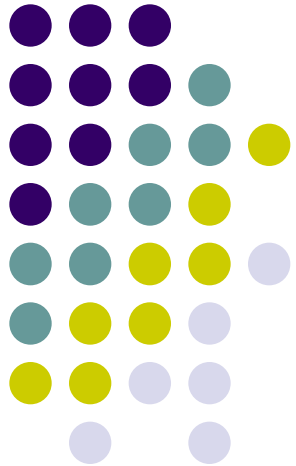

Preliminary questions

- What is a MDRO?
- Do I have a MDRO problem?
- Which should I focus on?
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Definition of MDRO

- Resistance to 2 or more antimicrobial classes
- "ESKAPE" pathogens
  - ***E****nterococcus faecium*: VRE
  - ***S****taphylococcus aureus*: MRSA
  - ***K****lebsiella pneumoniae:* ESBL, KPC, NDM-1
  - ***A****cinetobacter baumanni*: MD-ACBA, carbapenemase producers
  - ***P****seudomonas aeruginosa*: MD-PAE
  - ***E****nterobacter* spp: AMP-C
- SGH – any organism that is susceptible to none or only 1 antimicrobial tested in full panel
- Set your definition!

Preliminary questions

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Surveillance database

- Review database
  - Infection Control
  - Microbiology Laboratory

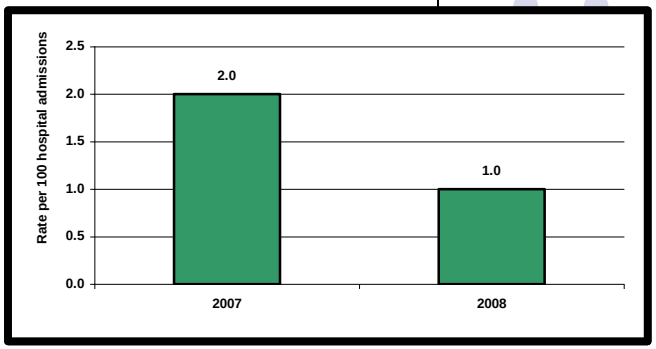
- MDRO burden
  - Stratification by location, organisms
    - JCR MDRO toolkit
      - http://www.jcrinc.com/MDRO-Toolkit/

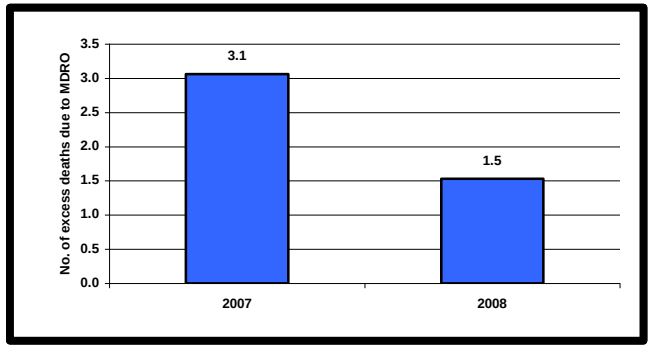
MDRO Burden Calculator

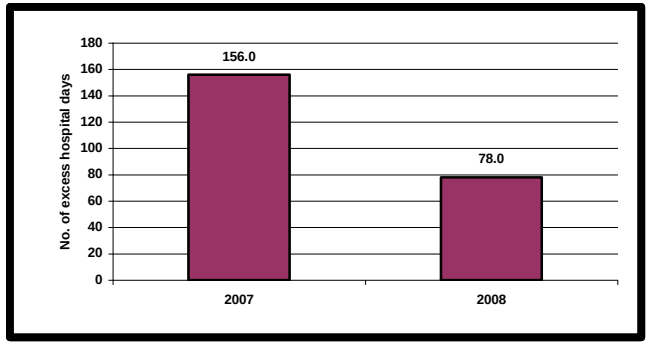
Patient Population for Analysis	**Medical Intensive Care Unit**
MDRO Infection for Analysis	**MRSA bloodstream infection**

Time Periods for Analysis	**2007**	**2008**
A. Number of non-duplicate isolates of specific pathogen of interest	40	20
B. Number of non-duplicate isolates of pathogen resistant to specific antibiotic of interest	30	15
C. Proportion of resistant isolates representing true infection (%)	100.0	100.0
D. Number of admissions	1500	1500
E. Inpatient mortality (%)	5.1	5.1
F. Average length of stay	6.5	6.5
G. Average cost per hospital day	$6,200	$6,200
H. Proportional increased risk of death associated with infection with resistant pathogen	2.0	2.0
I. Proportional estimated increased length of stay associated with resistance	1.8	1.8

Reporting Period	**2007**	**2008**	**Change**
Proportion of isolates that were MDROs	**75.0%**	**75.0%**	**0.0%**
Rate of MDROs per 100 admissions	**2.00**	**1.00**	**-1.00**
No. of excess deaths due to MDRO	**3.06**	**1.53**	**-1.53**
No. of excess hospital days due to MDRO	**156.0**	**78.0**	**-78.00**
Costs associated with excess hospital days	**$967,200**	**$483,600**	**-$483,600**

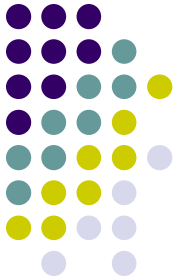






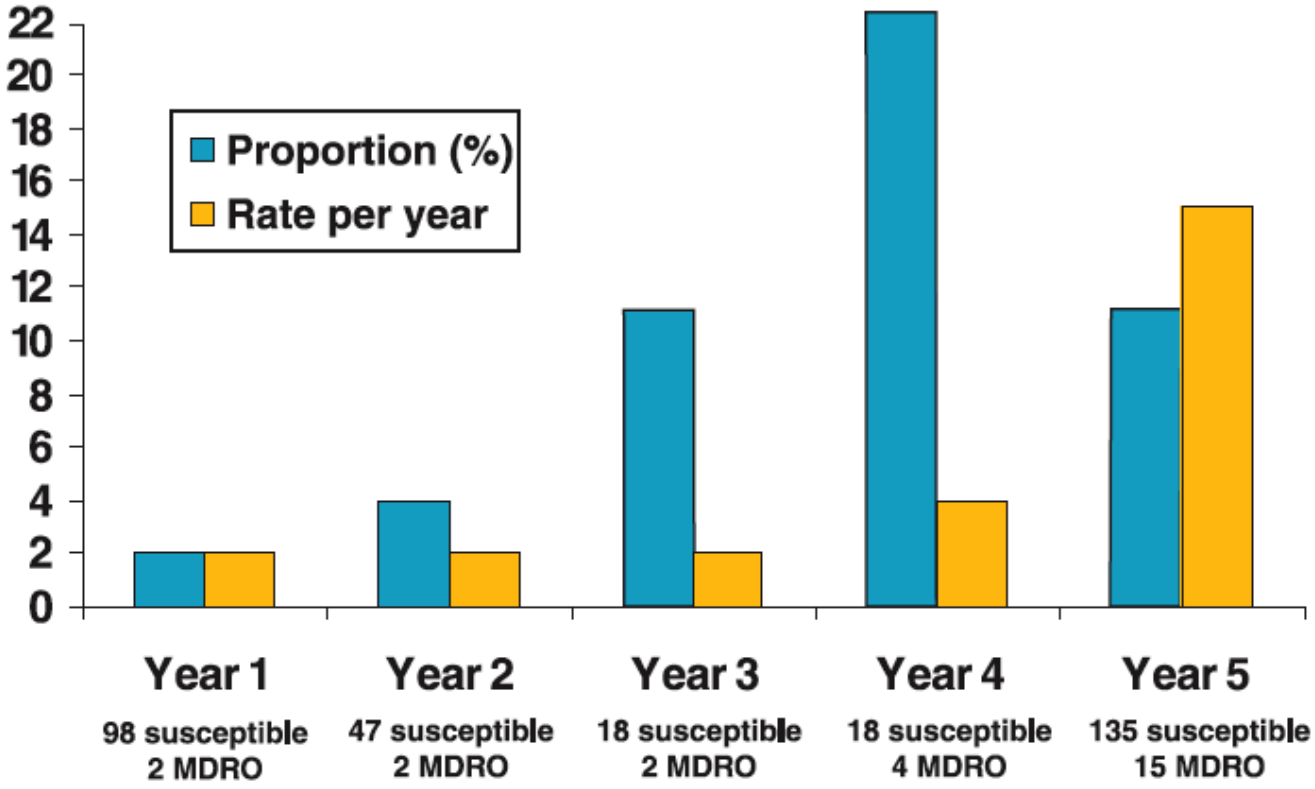
Source: JCR MDRO Toolkit

Assessing the burden of a MDRO infection



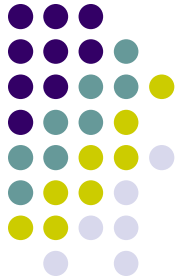
- The overall clinical impact of MDROs is determined by 2 factors:
  - The overall frequency of MDRO infections at the institution
    - Based on the number of bacterial isolates that are resistant to antibiotics, divided by the total number of bacterial isolates (proportion)
    - Based on the absolute number of MDRO specimens in a population per unit of time (incidence)
  - The increased risk of morbidity and mortality for a given patient that is attributable to the MDRO

Proportion vs rates



Adapted from Schwaber M.J., De-Medina T., Carmeli Y.: Epidemiological interpretation of antibiotic resistance studies–What are we missing? *Nat Rev Microbiol* 2:979–983, Dec. 2004.

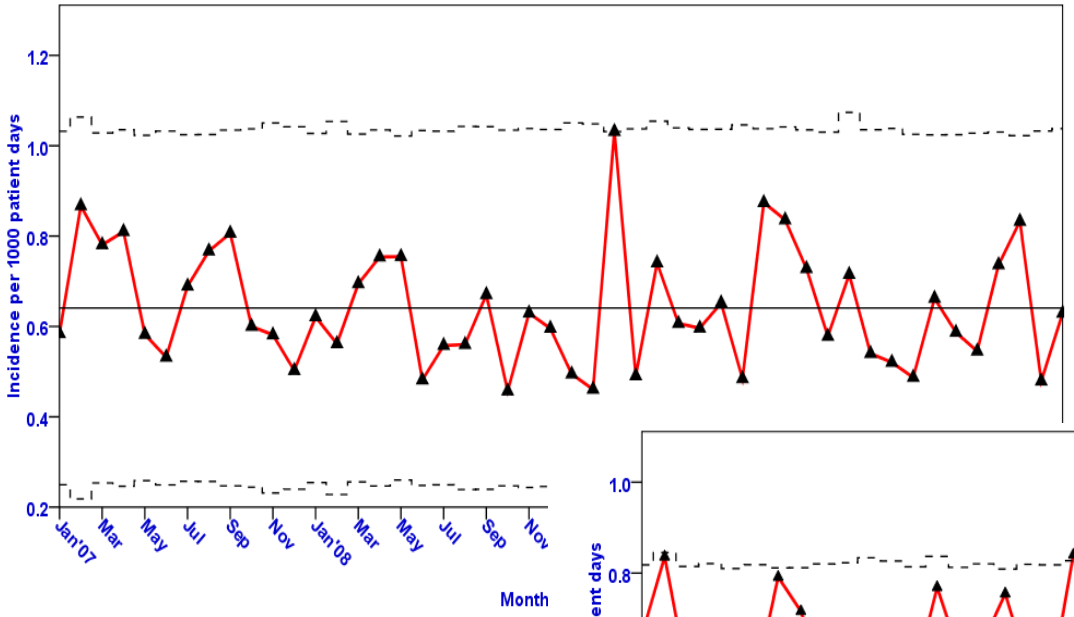
Using your Infection Control surveillance database

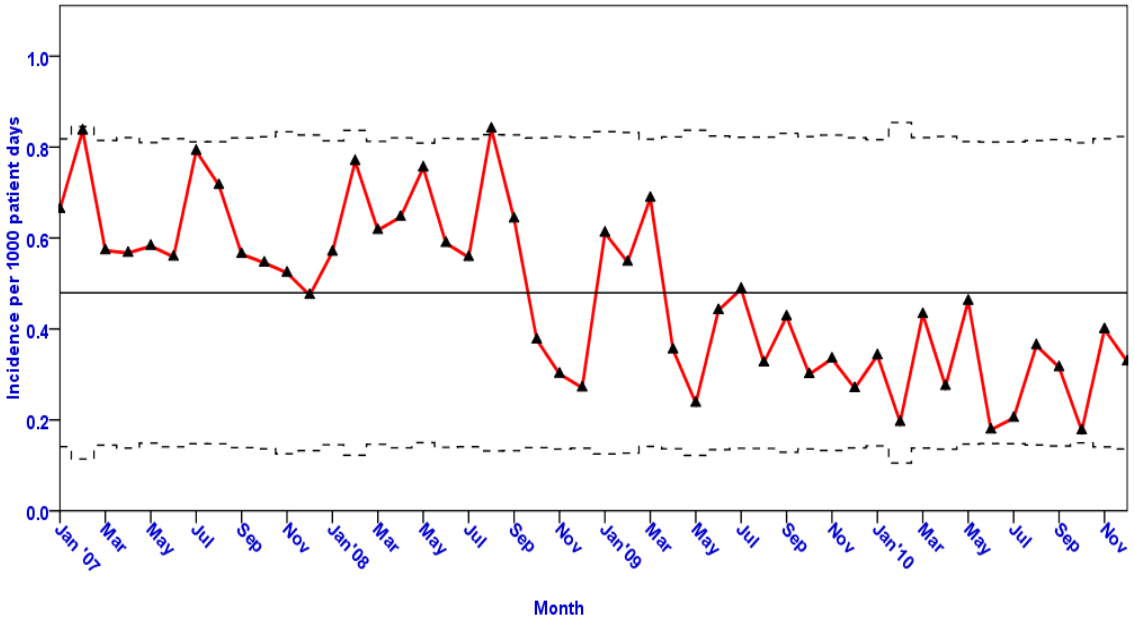


- Look for performance over time
  - Line charts
  - Run charts
  - Control charts

- Determine if there is a significant change over time
  - Special Cause Variation in contrast to Random Variation
  - Quality tools – statistical process control (SPC) charts

SPC charts (minimum of 25 data points) – looking for shifts, trend





Preliminary questions

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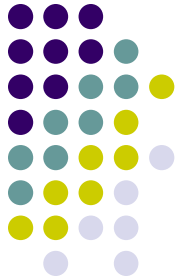
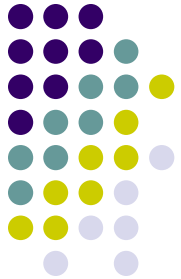
Analysis of data from Microbiology Lab, IC surveillance



- WHAT - By organism
  - MRSA
  - ESBL, etc

- WHERE - By location
  - High volume, high risk
  - Focus efforts in high risk areas e.g. ICUs

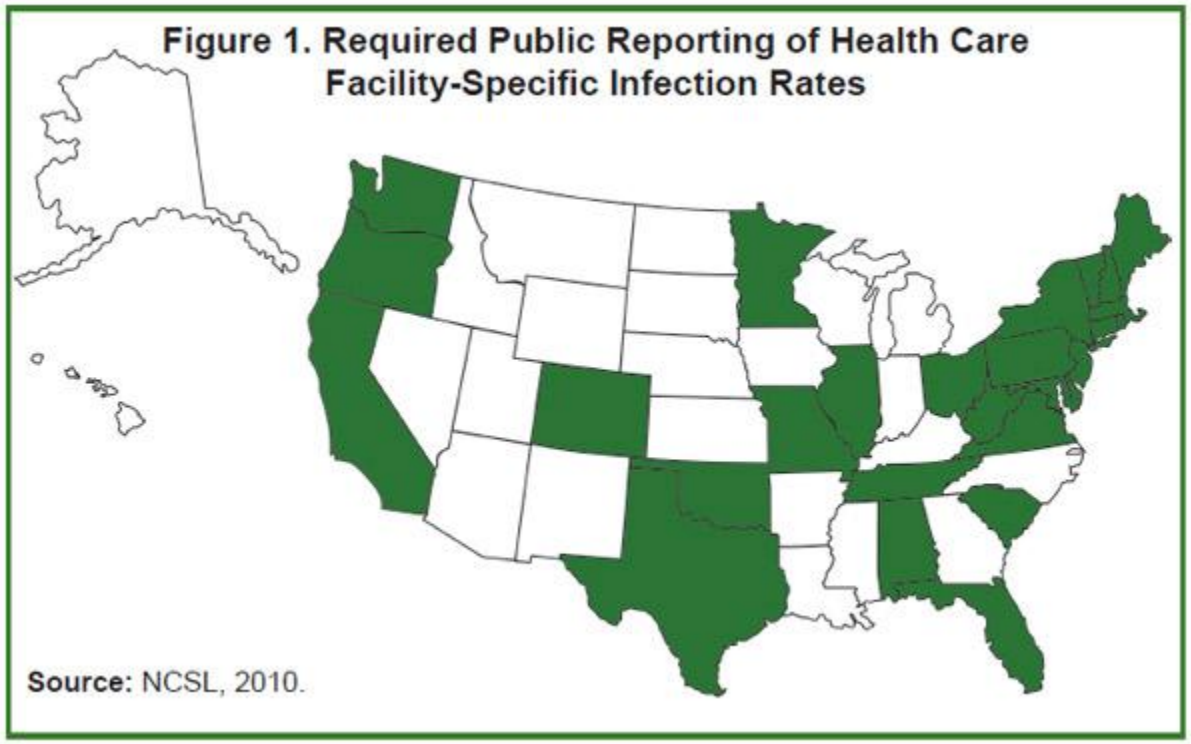
Key components in MDRO program – which do I choose to do? (HOWs)



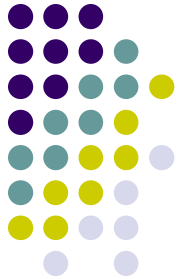
- Surveillance
- Active screening for carriers
- Contact Precautions
- Decolonization

Quality – its influence and impact

- **California**, **Colorado**, **Illinois**, **Missouri**, **New York**, **Oklahoma**, **Pennsylvania**, **South Carolina**, **Tennessee**, **Vermont**, **Virginia** and **West Virginia**, require their facilities to report directly to the NHSN.



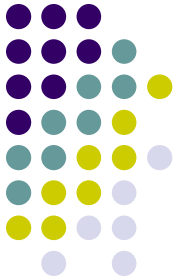
West Virginia Medical Institute MRSA Change Strategy



- Keyword **– transformational change**
  - Alters the culture of the institution by changing underlying institutional assumptions, behaviors, processes and products
  - Is deep and pervasive and affects the whole institution
  - Is intentional
  - Is continuous
  - Occurs over time
  - Requires that you set a clear performance agenda
  - Requires that quality and safety be part of the core business processes of the organization
  - Ensures quality and safety initiatives are driven by the strategic plan
  - Requires that departments have a clear map of how to implement the agenda

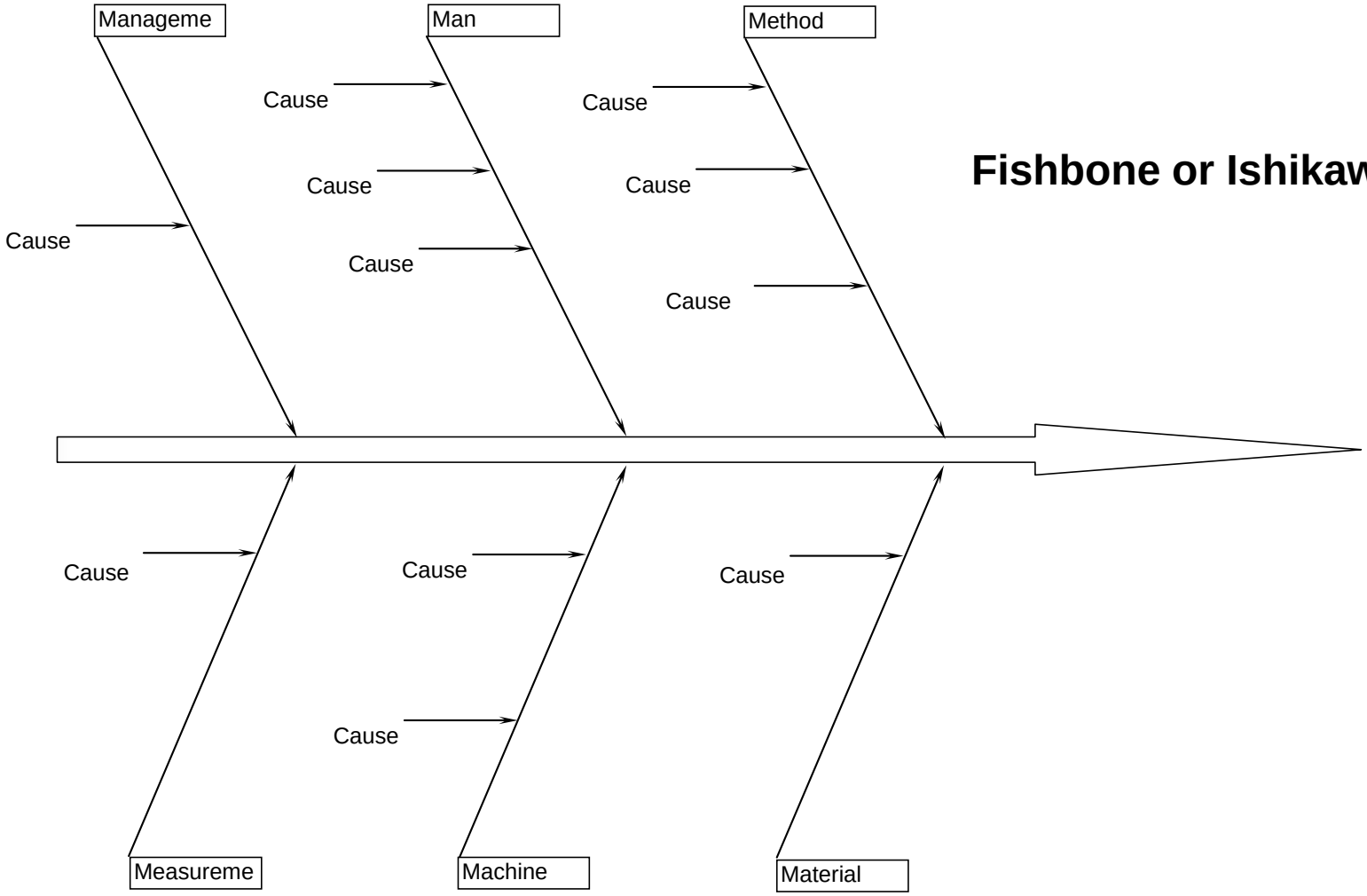
- Example - use HFMEA or fishbone analysis to identify and prioritize failures in Contact Precautions protocol

Using quality tools to understand the problem



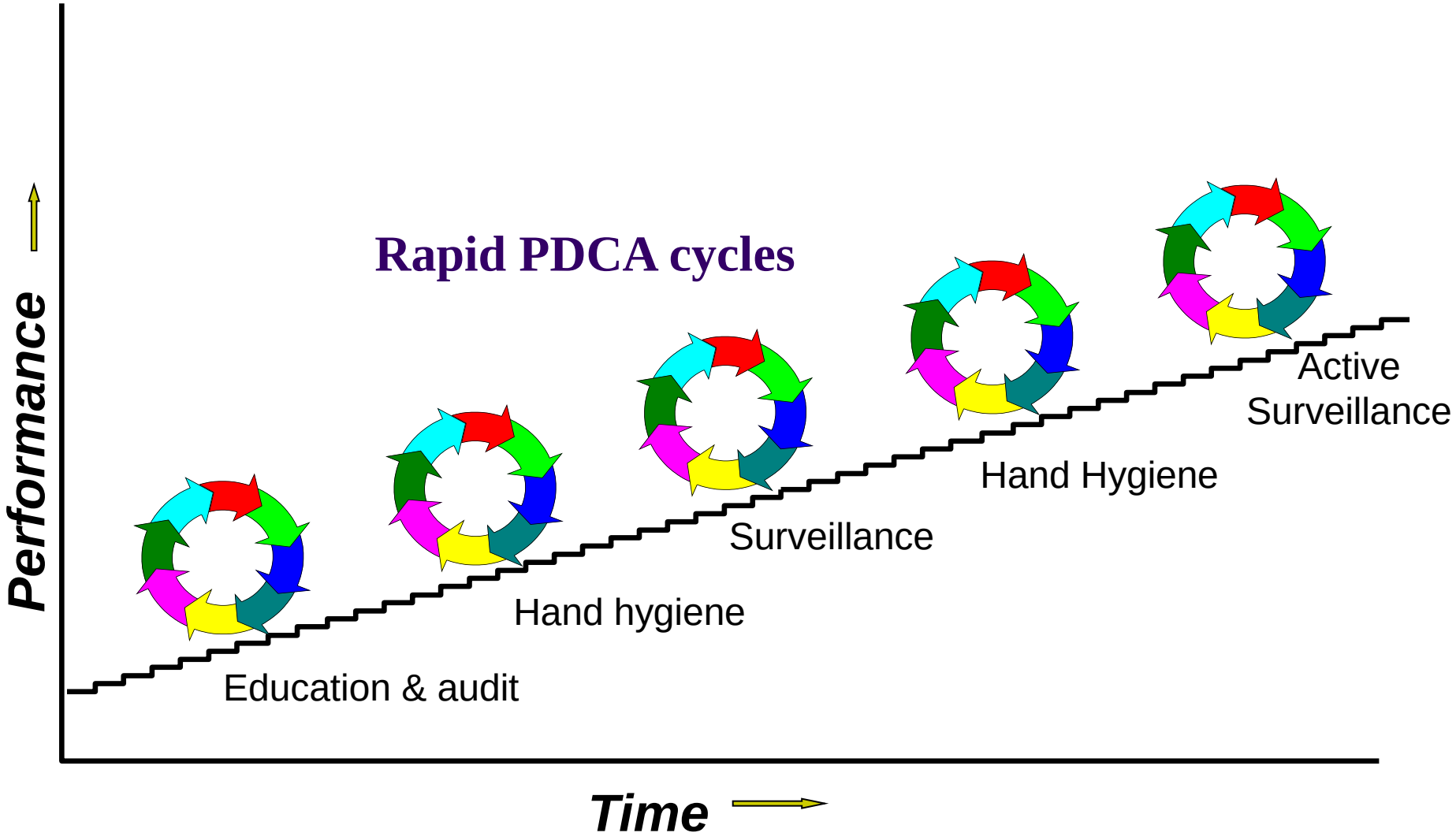
- Fishbone or Ishikawa diagram
  - Quick overview of causes and effects
- Healthcare Failure Mode and Effects Analysis (HFMEA)
  - Detailed analysis of each process steps and sectors
- Approach
  - PDCA (IHI Bundle implementation)
  - LEAN

4Ps (Policies, Procedures, People, Plant/Technology) or 6Ms (Machines, Methods, Materials, Measurements, Mother Nature / Environment, Manpower / People



Fishbone or Ishikawa diagram

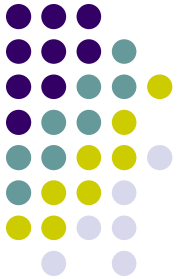
QI projects using PDCA achieve incremental improvement



Worksheet for Process Step 3F5: Result Misread by Tech

HFMEA Step 4- Hazard Analysis										HFMEA Step 5- Identify Actions and Outcomes				
			Scoring			Decision Tree Analysis								
Failure Mode: First evaluate failure mode before determining potential causes	**Potential Causes**		Severity	Probability	Hazard Score	Single Point Weakness?	Existing Control Measure?	Detectable?	Proceed?	**Action Type (Control, Accept, Eliminate) or Rationale for Stopping**	**Action**	**Outcome Measure**	Person Responsible	Management Concurrence
3F5 Result misread by tech	→		Moderate	Frequent	8	→	N	N	Yes					
	3F5a	Tech fatigue	Moderate	Occasional	6	Y	N	N	Yes	Control	Have a second tech confirm and initial readings when double shifts are worked	Review record every 2 weeks following double shifts. 100% compliance is expected.	Lab Supervisor	Yes
	3F5b	Too busy and distracted	Moderate	Frequent	8	→	N	N	Yes	Control	Control access to the lab and dedicate a single phone line for all incoming calls.	Redesigned lab and phone system.	Facilities Engineering	Yes
	3F5c	Poor lighting	Moderate	Remote	2	N	N	Y	Stop	Lighting condition is obvious to user, second source is also provided.				
	3F5d	Confusing readout on PSA instrument	Moderate	Frequent	8	→	N	N	Yes	Eliminate	Purchase new equipment	New equipment in place by XX/XX/XX	Supply Supervisor	Yes

Example: HFMEA for MRSA reduction (Utah Hospitals & Health Systems Association)



Failure Mode	Cause of Failure	Like-lihood of failure	Potential Effects of Failure	Severity	Probability of Dectection	Risk Profile Number	Actions to Reduce Causes of Failure
Is line indicated?	Central access not essential	4	Increase risk for infection	6	4	96	1. Use peripheral access instead if sufficient 2. Use oral nutrition when able to take po 3. Conversion to po antimicrobials when good oral bioavailability and able to take po 4.Evaluate need for parental medications, continued antimicrobials
Location where inserted	Inserted in the field or emergency department	4	Increase risk for infection	6	2	48	Prefer insertion of central line in ICU where possible
Location where inserted	Inserted in the field or emergency department	4	Increase risk for infection	6	2	48	Removal of central lines placed under emergency conditions as soon as possible and no longer than 48 hours
Choice of insertion site	Insertion of line at femoral site in adult patients	4	Increase risk for infection	6	2	48	1. Line insertion in adult patients using SC site by trained, experienced clinician 2. Use of bedside ultrasound to decrease risk of mechanical complications with insertion at SC site.
Choice of insertion site	Insertion of line at IJ site	6	Increase risk for infection	4	2	48	1. Line insertion in adult patients using SC site by trained, experienced clinician 2. Use of bedside ultrasound to decrease risk of mechanical complications with insertion at SC site
Selection of catheter type	Prolonged catheterization anticipated	3	Increase risk for infection	5	5	75	Use of catheter impregnated with antimicrobial or antiseptic agents in high risk adults
Selection of catheter type	Insertion of catheter with more lumens than needed	4	Increase risk for infection	3	1	12	Use a CVC with the minimum number of ports or lumens essential for management
Selection of catheter type	Multiple choices of catheter types	5	Increase risk for infection	5	6	150	Limit the number of choices of catheter types, standardize. Encourage selection of fewer number of lumens where feasible.

Abstract

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Quality/Process Improvement/Adverse Outcomes

Use of failure mode and effect analysis (FMEA) to improve active surveillance for methicillin-resistant *Staphylococcus aureus* (MRSA) at a university-affiliated medical center

S. Monti, J. Jefferson, L. Mermel, S. Parenteau, S. Kenyon and B. Cifelli

Rhode Island Hospital, Providence, Rhode Island

Abstract ID 54565
Tuesday, June 21. Available online 9 June 2005.

BACKGROUND: Failure mode effects analysis (FMEA) is a procedure that helps to identify each vulnerable step of a process to determine how these vulnerabilities affect the desired outcome. An FMEA ranks and prioritizes the possible causes of failures and facilitates the development of prevention strategies. As a result of a root cause analysis, our hospital's patient safety committee selected "Early Identification and Timely Isolation of Patients with MRSA" for FMEA.

OBJECTIVES: To use FMEA to identify potential failures in the process of admission screening of high-risk patients thus delaying early identification and timely isolation of patients colonized or infected with MRSA.

METHODS: Using the hospital's MRSA policy, a multidisciplinary team met to review the admission screening process of patients through all hospital admission sites: pre-admission testing (PAT) for same-day surgical patients, emergency department (ED), and admitting department. High-risk patients, as determined by a positive response to a screening questionnaire, have an automatic "screening alert" message printed on the nursing station printer of the receiving unit. The screening alert results in the entry of an order for a nares culture to rule out MRSA. Upon receiving a positive screening culture result, the patient is placed on contact precautions.

RESULTS: The three highest-scoring potential failure modes identified were 1) staff compliance with standard precautions pending positive culture results; 2) delay in screening of patients admitted via the ED; and 3) no reliable process for communication of high-risk or positive MRSA history status by PAT staff to a surgeon, operating room, or infection control (IC) department. Additional potential failure modes included: ED physician-dependent orders for private rooms for isolation patients; delays in obtaining screening cultures for ED holding unit patients; unreliable and inconsistent communication between AD, nursing staff of admitting units, and IC staff; and a 2- to 3-day lag time from culture collection to results availability.

CONCLUSIONS: The FMEA process was extremely useful for understanding and analyzing the complex process of screening high-risk admissions for multidrug-resistant pathogens. The process facilitated communication among the various departments that resulted in the identification of creative and sustainable solutions.

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ORIGINAL ARTICLE

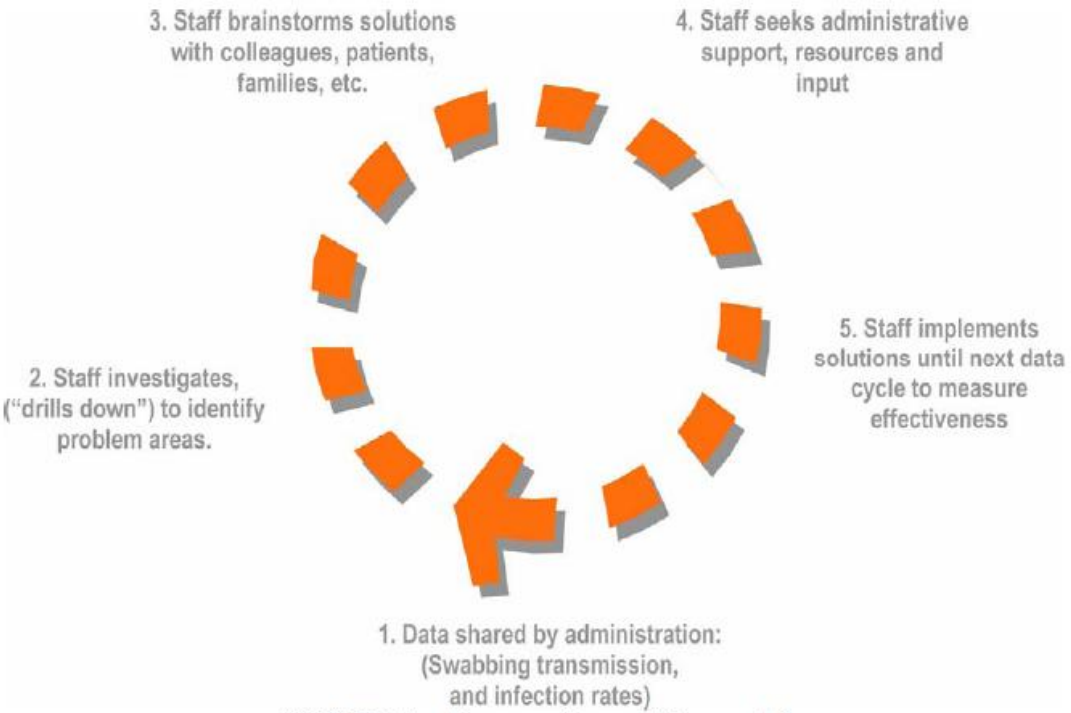
Implementation of an Industrial Systems-Engineering Approach to Reduce the Incidence of Methicillin-Resistant *Staphylococcus aureus* Infection

Robert R. Muder, MD; Candace Cunningham, RN; Ellesha McCray RN, MBA; Cheryl Squier, RN; Peter Perreiah, MBA; Rajiv Jain, MD; Ronda L. Sinkowitz-Cochran, MPH; John A. Jernigan, MD

TABLE 1. Rates of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infection in Study Units During the Study Period

Study unit, fiscal year	No. of patient-days	No. of MRSA infections		MRSA infection rate[a]
		All	Surgical site infections	
Unit A				
2000	6,691	12	9	1.79
2001	6,205	8	8	1.28
2002	6,794	10	8	1.47
2003	7,332	4	4	0.55
2004	7,882	3	3	0.38
2005	9,020	4	1	0.44
2006	8,494	4	2	0.47
Unit B				
2002	3,105	12	2	3.86
2003	3,131	22	6	7.03
2004	3,177	6	0	1.89
2005	3,325	6	1	1.80
2006	3,159	1	0	0.32

[a] No. of MRSA infections per 1,000 patient-days.



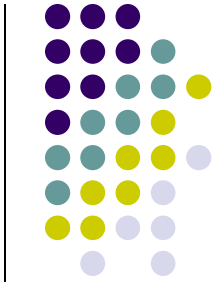
VAPHS' data-driven problem solving model

LEAN in healthcare

- LEAN thinking includes:
  - Specifying value as action steps
  - Sequencing value-created actions
  - Creating interruption-proof sequences
  - Focus on demand rather than supply sequenced operations
  - Focus on seeking ever more effective performance through learning

- LEAN tools
  - Value stream mapping
  - Use of Takt time and customer focus using pull systems
  - Time measurement techniques and cycle time observation
  - 5S for a work area
  - Development of Poka Yokes
  - Identifying Waste and elimination techniques
  - Development of Work cells
  - Creating a visual workplace

Effective implementation

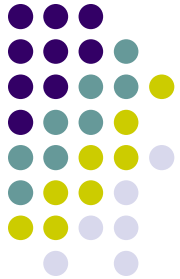


- Requires culture of improvement in organization
  - PDCA
  - LEAN
  - Six Sigma
- Leadership’s support
  - Release resources
- Coaches / facilitators

Reality check

- Infection Control issues
  - Many other issues besides MDRO
    - Sharps
    - Construction and renovation
    - Employee health
- How many ICPs do you have in your hospital team?
  - What is the ratio?
  - Can they cope?

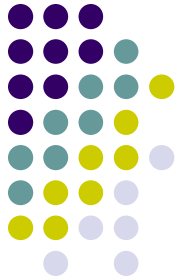
Use the IC Risk Assessment Matrix in IC Program Planning



- Perform the Risk Assessment
  - Assemble the team e.g. IC Committee
  - Provide a draft form
  - Guide discussion and debate
  - Reach consensus and select highest priorities
  - Present the priorities to leadership for support and approval

- Done in budgeting exercise to plan for resources and confirmed before fiscal year

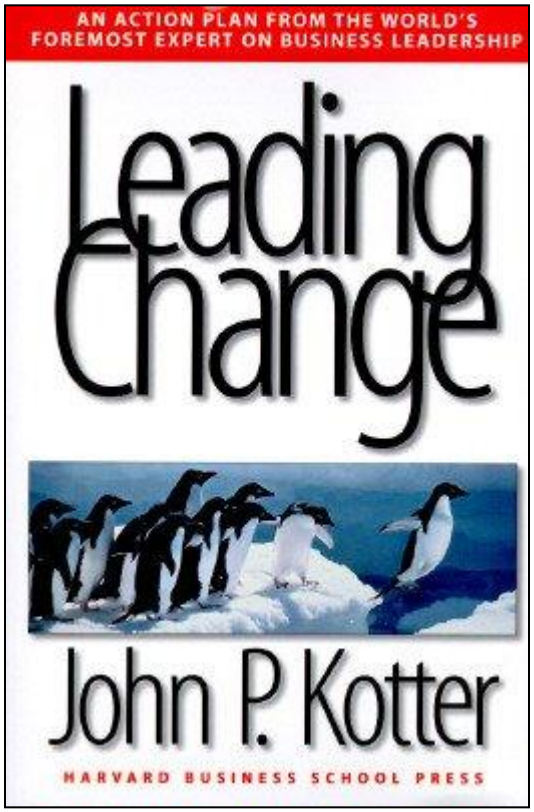
Core components in MDRO control program



- Risk Assessment
  - Evaluate clinical and economic consequences of MDRO in organization
- Performance Assessment
  - Monitoring compliance to hand hygiene, isolation precautions
- Antibiotic stewardship program
  - Monitor trends in resistance and prescribing practices
- Transmission control
  - Hand hygiene, equipment and environment hygiene
- Education
  - Leadership, staffs, patients

Aim for successful programs

- Are we ready?
- Change management



Kotter's model

- **Increase urgency**
  - Examine the situation and competitive realities
  - Identify and discuss crisis, potential crisis, or major opportunities
  - Provide evidence from outside the organization that change is necessary
- **Build the Guidance Team**
  - Assemble a group with enough power to lead the change effort
  - Attract key change leaders by showing enthusiasm and commitment
  - Encourage the group to work together as a team
- **Get the Vision Right**
  - Create a vision to help direct the change effort
  - Develop strategies for achieving that vision
- **Communicate for Buy-in**
  - Build alignment and engagement through stories
  - Use every vehicle possible to communicate the new vision and strategies
  - Keep communication simple and heartfelt
  - Teach new behaviors by the example of the guiding coalition

Kotter's model

- **Empowering Action**
  - Remove obstacles to the change
  - Change systems and / or structures that work against the vision
- **Create short term wins**
  - Plan for and achieve visible performance improvements
  - Recognize and reward those involved in bringing the improvements to life
- **Do Not Let Up**
  - Plan for and create visible performance improvements
  - Recognize and reward personnel involved in the improvements
  - Reinforce the behaviours shown that led to the improvements
- **Make Change Stick**
  - Articulate the connections between the new behaviors and corporate success

Prioritizing projects

Project	Fit with organization mission/goals	High risk to staff or patients	High volume	Related to a standard required for accreditation	Related to a law/government regulation	Related to National / International Patient Safety Goal	Complaints from patients/staff	Tracer / measurement shown deficiency	Identified as a problem in literature	Needed resources to address problem	Potential future cost savings if implemented	Project Payback Period	Priority Score (Max = 108; Min = 12)
	1 = Low 3 = Medium 9 = High	1 = No/Very low risk 3 = Moderate risk 9 = High risk	1 = Low volume 3 = Moderate Volume 9 = High Volume	1 = Low or not related 3 = Moderately related 9 = Directly related; element of performa	1 = Low or not related 3 = Moderately related 9 = Directly related	1 = Low or not related 3 = Moderately related 9 = Directly related	1 = None 3 = Few 9 = Several	1 = None 3 = Mild 9 = Strong effect	1 = None 3 = Somewhat, inconclusive 9 = Strong evidence	1 = Low or few 3 = Moderate resources 9 = Large amount	1 = Slim to none 3 = Moderate potential 9 = Large potential	1= More than 18 months 3 = 6 to 18 months 9 = Less Than 6 months	
Example	9	3	3	9	1	9	3	9	1	1	9	3	60
Project 1													0
Project 2													0
Project 3													0
Project 4													0

Source: JCR MDRO Toolkit

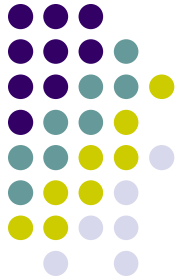
Assessing Structures and Systems for Change

Instructions: The project team discusses each category of system/structure capability and assigns a capability rating and the degree of control the team has over it.
Low capability systems and structures with a high degree of control are your greatest opportunities for building capacity. The team may add additional categories as needed.

		How capable is the system or structure in supporting this project?						What control does the team have over this system or structure?		
		High		Med	Low		N/A	Direct	Indirect	None
		5	4	3	2	1				
Leadership	Does leadership clearly and consistently communicate support for this project?									
Physicians	Are physicians engaged in quality and safety? Are they actively supporting this project?									
Staff	Are staff engaged in safety and quality? Do they understand their role, and have the time and resources to execute their role?									
Development	Do we effectively assess and build staff competence?									
Measures	Do we track performance and use the evidence to make decisions?									
Rewards	Do we recognize and reward desired behavior?									
Organization Design	Is the unit structured to support change; Does reporting, hierarchy and strategy drive change?									
Information Systems	Do the IT systems support access to information?									
Resource Allocation	Are the necessary resources allocated, budgeted or provided?									
Learning / Knowledge Transfer	Are there systems to support learning and the sharing of knowledge across unit boundaries?									

Source: JCR MDRO Toolkit

Aim for sustained programs



- Top common causes for failure of sustainability
  - Lack of consistent leadership attention
    - Use BSC or dashboard for senior leadership
  - Project results not embedded with frontline staff
    - Share regularly with process owners
  - No specific plan to sustain the improvement
    - Review and plan annually
  - Improvement priorities keep changing
    - Have a mid-term plan
  - Too many projects to sustain them all
    - Risk stratify and prioritize

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THANK YOU