

Driving Change for Antimicrobial Stewardship

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Disclosures

- Grant support: Pfizer Independent Grants for Learning and Change—study comparing prior approval to post-prescription review and feedback
- Consulting: Novartis—infection adjudication committee

Outline

- Technical vs. adaptive change
- Diffusion of change theory and its applications to stewardship interventions
- Behavior change and stewardship
- Characteristics of effective leaders in hospital epidemiology and antimicrobial stewardship

Technical vs. Adaptive Change

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Technical vs. Adaptive Challenges

The most common cause of failure in leadership is to treat adaptive challenges as technical problems

Technical Challenges

- Problems with a clear technical solution
- Role of the leader is to provide resources for the solution
- Example from real life: a scratch on the car door
 - Fix at the body shop

Adaptive Challenges

- Problem that require changes (often painful) in people's priorities, beliefs, habits, loyalties, role, way of thinking
 - Hard to define
- Role of the leader is to mobilize people to tackle challenges and thrive
- Example from real life: scratches on the car door recur because the person driving the car is 80 years old and does not drive well anymore
 - Can fix at the body shop but this does not solve the primary problem of persuading the driver to stop driving
 - Doing that requires the individual to recognize the problem and find creative solutions

Technical vs. Adaptive Solutions in Stewardship

Technical Solution	Adaptive Solution
Make guidelines and order sets	Empower individual prescribers to be antimicrobial stewards
Hire more pharmacists/nurses to help with stewardship activities	Foster an environment where physicians respect and value the assistance rendered by pharmacists/nurses in evaluating antimicrobial use
Employ rapid diagnostics to determine if a patient has an infection or to identify pathogens sooner	Integrate use of rapid diagnostics into clinicians practices (e.g. reassurance regarding the accuracy of the tests, assistance with interpretation)

Rapid Diagnostics Without AS

- Ability of prescribers to act on rapid tests on their own is not well documented
 - *mecA* PCR to distinguish MSSA and MRSA in blood
 - Pre-intervention period with the test vs. intervention with test and AS
 - Time to optimal therapy after test 36.6 vs. 7.7 hours
 - PNA FISH to identify CoNS
 - Pre-intervention period without test vs. intervention with just test and no AS
 - Mean duration of vancomycin use 4.15 vs. 3.51 days
 - Mean LOS 18.7 vs. 20.9 days
 - MALDI for bacteremia in the Netherlands (no MRSA or VRE)
 - MALDI in Feb/April 2010 and standard in Dec 2009/March 2010
 - No AS intervention
 - Proportion of patients on adequate therapy at 24 hours: 64% vs. 75.3%

Carver PL et al. J Antimicrob Chemother. 2008;46:2381.

Holtzman C et al. J Clin Microbiol. 2011;49:1581.

Vlek AL et al. PLOS One. 2012;7:e32589.

Rapid Diagnostics Without AS

- Assessment of PNA-FISH for Gram positive cocci in chains (identifies *E. faecalis*, enterococcus not *E. faecalis*, and strep)
- Blood cultures randomized upon arrival to lab to receive PNA-FISH or standard work-up
- Providers notified when blood cultures turned positive and in PNA-FISH arm again when results were available
- Micro techs had a script for PNA-FISH results

	PNA-FISH N = 106	Standard N = 114	P-value
Hours to appropriate therapy	21.2	21.8	0.93
Contaminant	60.1	40.8	0.32
Non-contaminant	8.1	12.0	0.47
Hours to optimal therapy	29.0	32.5	0.61

Rapid Diagnostics Without AS

- What are the issues?
 - Microbiology testing has been done the same way for 100 years
 - The “sent cultures and wait for two days while continuing broad-spectrum antibiotics” approach is very ingrained in practice
 - It is perceived as safe and allows delay in decision making in an area that many are uncomfortable with
 - We must help them transition to a new system
 - Re-teach basic microbiology
 - Hand-holding with interpretation including understanding test characteristics
 - Cheat sheets at the point of care
 - Demonstration that tests can improve care
 - Faster time to the best therapy
 - Improved outcomes—out of the hospital faster

Streptococci

Viridans group Streptococci (alpha-hemolytic streptococci)

Normal microbiota of the oral cavity and GI tract; single blood cultures growing these organisms often represent contamination or transient bacteremia

Five groups

- *S. anginosus* group (contains *S. intermedius*, *anginosus*, and *constellatus*): commonly cause abscesses; majority are Penicillin susceptible
- *S. bovis* group [contains *S. gallolyticus* subspecies *gallolyticus* (associated with colon cancer—colonoscopy mandatory, endocarditis also present in > 50% of cases) and subspecies *pasteurinus* (associated with hepatobiliary disease, endocarditis less common)]; majority are Penicillin susceptible
- *S. mitis* group (contains *S. mitis*, *oralis*, *gordonii*, and *sanguinous*): commonly cause bacteremia in neutropenic patients and endocarditis; many have Penicillin resistance
- *S. salivarius* group: less common cause of endocarditis; majority are Penicillin susceptible
- *S. mutans* group: common cause of dental caries; uncommon cause of endocarditis; majority are Penicillin susceptible

Beta-hemolytic Streptococci

All are susceptible to Penicillin

Variable rates of resistance to Clindamycin; ask the microbiology laboratory to perform susceptibility testing if you plan to use Clindamycin or macrolides for moderate to severe infections.

While anti-staphylococcal penicillins (Oxacillin and Nafcillin) are the agents of first choice for susceptible *S. aureus* infections, their activity against streptococci is sub-optimal

High rates of resistance to tetracyclines and TMP/SMX preclude their empiric use for infections suspected to be caused by beta-hemolytic streptococci

- *S. pyogenes* (group A strep): pharyngitis, skin and soft tissue infections including erysipelas, cellulitis, necrotizing fasciitis; Clindamycin resistance in 1.5-5.2%; macrolide resistance in 4-7%.
- *S. agalactiae* (group B strep): neonatal infections, infections of the female genital tract, skin and soft tissue infections, bacteremia; Clindamycin resistance in 16-26%; macrolide resistance in 7-32%.

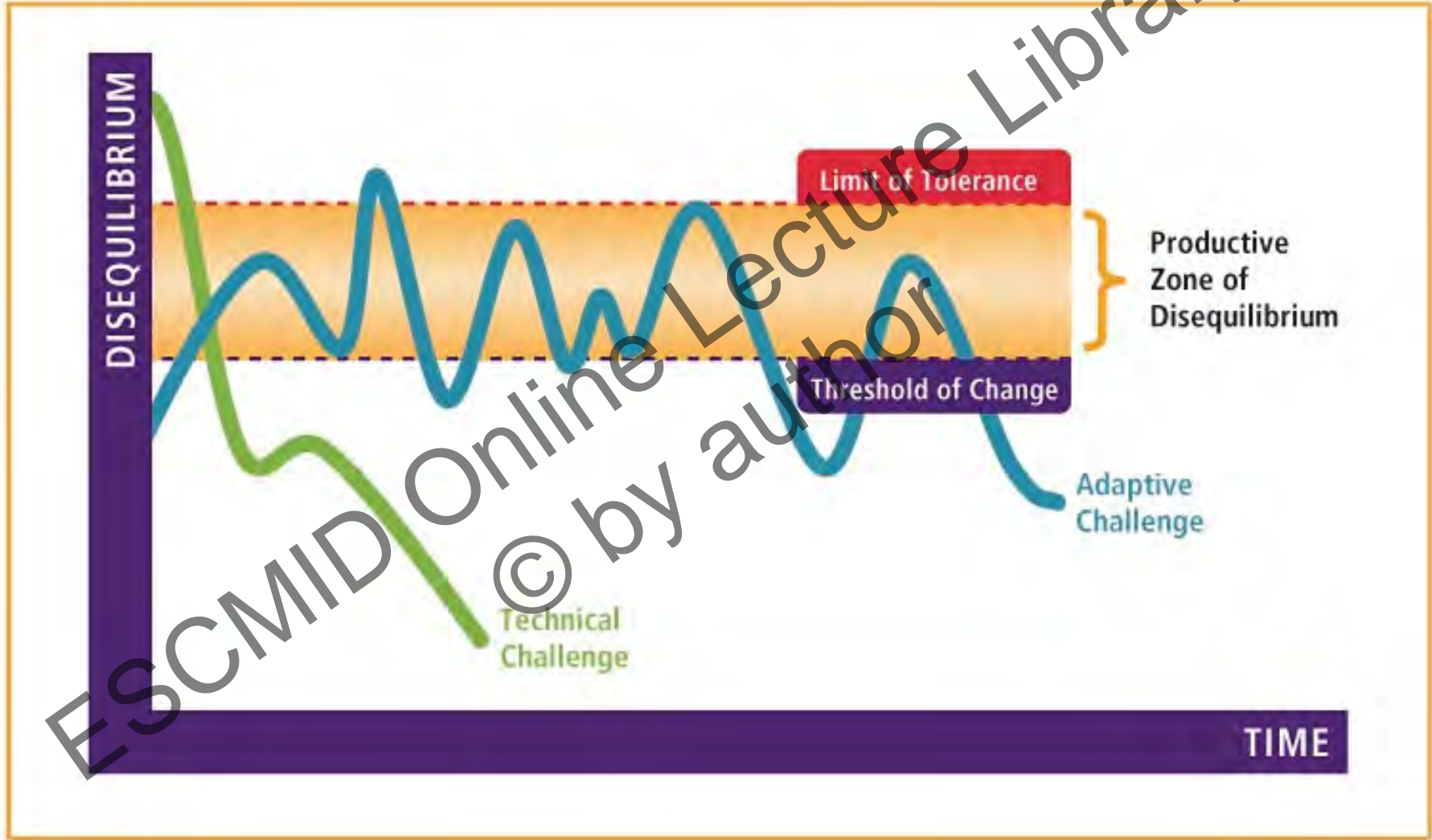
Organism	Preferred empiric therapy (% susceptible in blood at JHH)	Alternative empiric therapy if PCN allergic
MSSA	Oxacillin (100%)	Non-severe PCN allergy: Cefazolin Severe PCN allergy: Vancomycin ¹
MRSA	Vancomycin (100%)	Daptomycin
Coagulase-negative staphylococci	Single positive cultures are often a contaminant; no treatment recommended. See page 54 of the JHH Antibiotic Guidelines for information and indications for treatment. Call the microbiology lab for more information and further work up if infection suspected (5-6510).	
<i>S. lugdunensis</i>	Vancomycin (100%) ²	Oxacillin (89%) or Daptomycin
<i>E. faecalis</i>	Ampicillin (99%)	Vancomycin (89%) ¹
<i>E. faecium</i> (VRE)	Linezolid (93%) ³	Daptomycin (96.5%)
<i>E. faecium</i> (not VRE)	Vancomycin (100%) ³	Linezolid
Streptococcus spp.	Non-oncology patient: Ceftriaxone ⁴ Oncology patient: Vancomycin ⁴	Severe PCN allergy: Vancomycin ¹
<i>S. anginosus</i>	Penicillin G (100%)	Non-severe PCN allergy: Ceftriaxone Severe PCN allergy: Vancomycin ¹
<i>S. pyogenes</i> (group A strep)	Penicillin G (100%)	Non-severe PCN allergy: Cefazolin Severe PCN allergy: Vancomycin ¹
<i>S. agalactiae</i> (group B strep)	Penicillin G (100%)	Non-severe PCN allergy: Cefazolin Severe PCN allergy: Vancomycin ¹
<i>S. pneumoniae</i> (not meningitis)	Ceftriaxone (94%) ⁴	Severe PCN allergy: Vancomycin ¹
<i>S. pneumoniae</i> (meningitis)	Ceftriaxone + Vancomycin	Severe PCN allergy: Chloramphenicol + Vancomycin ¹
<i>Listeria spp.</i>	Ampicillin (100%)	Trimethoprim/sulfamethoxazole

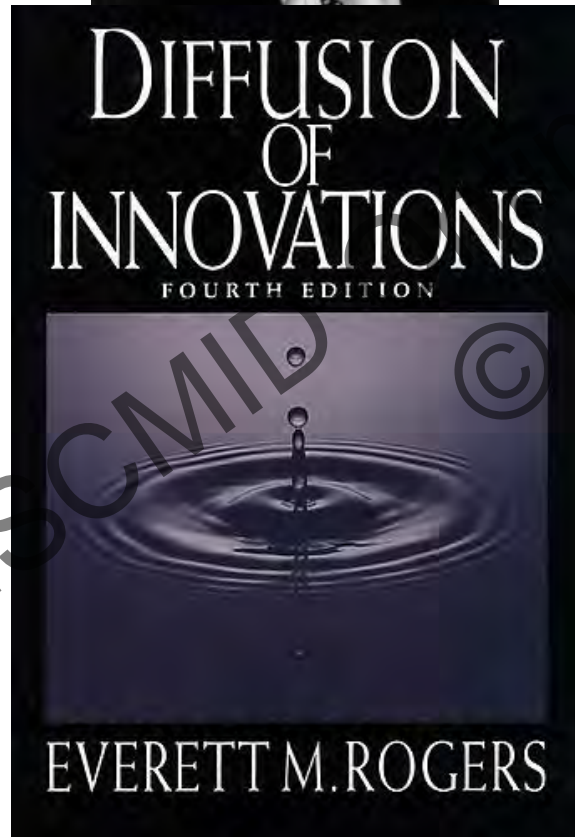
¹Consult allergy for skin testing /desensitization

²Narrow to Oxacillin if found to be susceptible

³Narrow to Ampicillin if found to be susceptible

⁴Narrow to Penicillin G if found to be susceptible





- Everett Rogers – rural sociologist (1962)
- Diffusion is “the process in which an innovation is communicated through certain channels over time among the members of a social system”

Attributes of Innovations that Help Spread

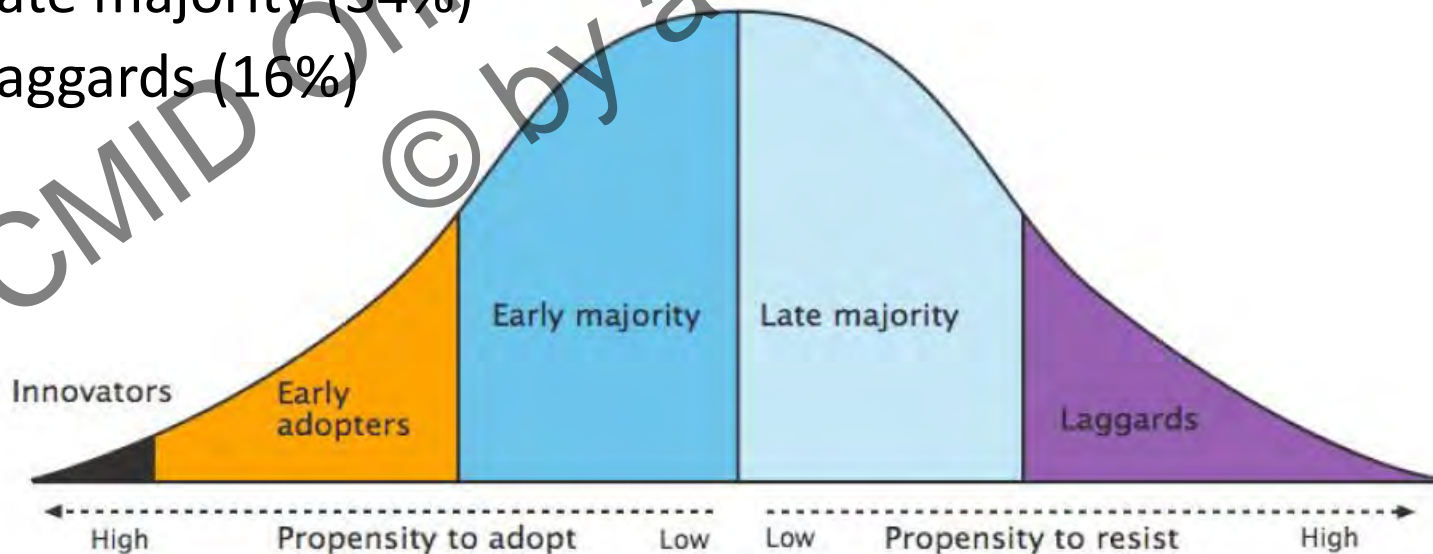
- **Relative advantage**
 - Is it better than what we already have according to the users (not you)?
- **Compatibility**
 - Is it consistent with existing values and practices?
- **Simplicity/ease of use**
 - Is it easy to understand/adopt?
- **Trialability**
 - Can the innovation be experimented with on a limited basis?
- **Observability**
 - Can users see the results of the innovation?

Diffusion of Innovation

- Categories of adopters

- Innovators (2.5%)
- Early adopters (13.5%)
- Early majority (34%)
- Late majority (34%)
- Laggards (16%)

The diffusion curve generally takes off after 10-20% adoption



Appendix C. Checklist for Building a Written Physician Engagement Plan Using the IHI Framework for Engaging Physicians in Quality and Safety



Innovation Series 2007

Engaging Physicians in a Shared Quality Agenda

6. Adopt an Engaging Style:

- 6.1 Involve physicians from the beginning
- 6.2 Work with the real leaders, early adopters
- 6.3 Choose messages and messengers carefully
- 6.4 Make physician involvement visible
- 6.5 Build trust within each quality initiative
- 6.6 Communicate candidly, often
- 6.7 Value physicians' time with your time

5. Show Courage:

- 5.1 Provide backup all the way to the board

4. Use "Engaging" Improvement Methods:

- 4.1 Standardize what is standardizable, no more
- 4.2 Generate light, not heat, with data (use data sensibly)
- 4.3 Make the right thing easy to try
- 4.4 Make the right thing easy to do

1. Discover Common Purpose:

- 1.1 Improve patient outcomes
- 1.2 Reduce hassles and wasted time
- 1.3 Understand the organization's culture
- 1.4 Understand the legal opportunities and barriers

2. Reframe Values and Beliefs:

- 2.1 Make physicians partners, not customers
- 2.2 Promote both system and individual responsibility for quality

3. Segment the Engagement Plan:

- 3.1 Use the 20/80 rule
- 3.2 Identify and activate champions
- 3.3 Educate and inform structural leaders
- 3.4 Develop project management skills
- 3.5 Identify and work with "laggards"

Engaging Physicians in Quality and Safety

An Intervention to Improve Management of Community Acquired Pneumonia

- We studied the unintended consequences of core measures related to initiation of antibiotics for CAP for patients admitted to the hospital
 - Misdiagnosis of CAP occurred in $\sim 1/4$ of cases
 - Duration of therapy median was 10 days
 - Duplicate antibiotics were frequently given within first 24 hours
 - Therapy was not narrowed based on micro data
- This was despite having long-standing guidelines for diagnosis and treatment of CAP

An Intervention to Improve Management of CAP

Inclusion Criteria	≥ 18 years old, diagnosed with CAP, admitted to inpatient medicine service
Exclusion Criteria	Residents of a long-term care facility Diagnosed of cystic fibrosis Admission for a lower respiratory tract infection within the previous 30 days
Measured Outcomes	Duration of antibiotic therapy Percentage of cases where microbiology results were used to narrow therapy Percentage of patients receiving duplicate therapy within 24 hours Percentage of 30 day readmission Percentage of <i>C. difficile</i> events

An Intervention to Improve Management of CAP

- Understand chances of behavior change
 - Survey of CAP prescribing practices for medicine housestaff and 4th year medical students
 - Was there a difference between what they think they do and what they actually do?
- Engage the prescribers in the process
 - Survey
 - Forced them to think about their practice and how they make decisions
 - Bribery—10\$ gift card for participation
 - Presentation of existing data on CAP duration of therapy
 - Feedback of baseline data
 - Request for concerns and opinions about management at a group meeting
 - A 4th year medical student who was staying at Hopkins for residency was part of the intervention team
 - Good investment

An Intervention to Improve Management of CAP

- Make the change easy
 - More specific guidelines
 - Guidelines at the point of care
 - Written
 - Prompting and specific recommendations by the team's pharmacist and the stewardship program
- Feedback of success
 - Positive reinforcement

Survey

- Surveyed medicine house-staff and 4th year medical students
 - 17 questions were designed to assess their knowledge and beliefs regarding management of CAP
 - \$10 gift cards were given to those who completed survey
- 55% (138/251) response rate

What is the most common duration of therapy that you use for CAP?

	MS4	Intern	2 nd yr	3 rd yr
5 days	12%	17%	35%	11%
7 days	49%	74%	60%	78%
10 days	33%	9%	5%	11%
14 days	6%	0%	0%	0%

What is the minimum duration that you use for CAP?

	MS4	Intern	2 nd yr	3 rd yr
3 days	11%	0%	5%	7%
5 days	52%	52%	77%	60%
7 days	33%	44%	18%	19%
10 days	3%	4%	0%	0%

What would you change a patient with CAP and sputum growing penicillin susceptible *S. pneumo*?

	MS4	Intern	2 nd yr	3 rd yr
Continue CTX/azithro	9%	0%	14%	4%
Change to po moxi	6%	0%	4%	6%
Change to po amox	46%	40%	27%	56%
Change to po PCN	24%	22%	14%	19%
Change to po amox/clav	15%	39%	32%	19%

Thoughts About Results

- Housestaff answers on the survey were more consistent with recommendations than their actual practice, both in duration of therapy and narrowing of therapy
- We felt that this indicated that our interventions would be accepted

Recommended Duration of Therapy Before the Intervention Period

Pathogen-specific treatments and duration

- Susceptibility results should be considered when choosing an agent
- *S. pneumoniae*: IV: penicillin G OR cefuroxime OR ceftriaxone; PO: amoxicillin OR cefpodoxime OR azithromycin. Treatment for 5–10 days based on clinical stability
- *L. pneumophila*: Azithromycin for 7–10 days OR Moxifloxacin for 10–21 days
- *H. influenzae*: doxycycline OR amoxicillin/clavulanate OR cefuroxime are preferred. Other options include ceftriaxone OR cefpodoxime OR moxifloxacin. Treat for 5–10 days.

Updated Recommendations on Duration of Therapy

Therapy can be stopped after the patient is:

- Afebrile for 48–72 hours and
- Has no more than one of the following signs and symptoms: HR > 100 beats/min, RR > 24 breaths/min, BP < 90 mmHg, O₂ sat < 90%, altered mental status

Suggested duration of therapy based on patient specific factors:

- **5 days:** Patient without immunocompromise or structural lung disease
- **7 days:** Patients with moderate immunocompromise and/or structural lung disease
- **10–14 days:** Patients with poor clinical response, who received initial inappropriate therapy, or who are significantly immunocompromised

Discussed with infectious disease division

Updated Recommendations on Narrowing Therapy

Pathogen-specific and step-down therapy	
Organism	Preferred therapy
<i>S. pneumoniae</i> PCN susceptible	Penicillin G 1 million units IV Q6H OR Amoxicillin 500 mg PO TID
<i>S. pneumoniae</i> PCN intermediate or urine antigen positive	Penicillin G 1 million units IV Q6H OR Amoxicillin 1 g PO TID
<i>S. pneumoniae</i> PCN resistant, cephalosporin susceptible	Ceftriaxone 1 g IV Q24 OR Cefpodoxime 200 mg PO BID
<i>H. influenzae</i> non-beta-lactamase producing (Ampicillin susceptible)	Ampicillin 1 g IV Q6H OR Amoxicillin 500 mg PO TID

Results

- Patients characteristics were similar between the two periods

	Baseline N=56	Intervention N=63	P-value
Median duration of therapy	10 days	7 days	<0.001
Excess antibiotic days	241	93	<0.001
Median excess duration of therapy	4 days	1 day	
Duplicate therapy within 24 hours	90%	55%	
Narrowing of therapy	19%	67%	
Length of stay, median, days	4 days	5 days	
30-day readmissions, No (%)	9 (14.5)	5 (7.7)	0.22
<i>C. difficile</i> infections, No (%)	3 (4.8)	1 (1.5)	0.28

Follow Up

- When we presented the data that the median course of therapy was 7 days after the intervention, one house officer said:
 - “If you wanted us to use 5 days, you should have told us to give 3 days of therapy; we always add on two days to make ourselves feel better”
- So we did . . .
- Several years later, the debate has shifted among the medicine housestaff to whether to give 3 vs. 5 vs. 7 days

Behavior Change and Prescribers

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The Biggest Error We Make in Trying to Change Behavior

Assuming knowledge changes behavior

- Our instinct to create change (esp. in medicine)

Analyze → Think → Change

- More effective way to create change

See → Feel → Change

The St. Lucia Parrot



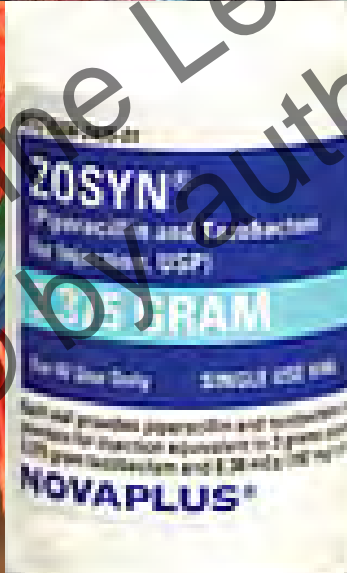
The St. Lucia Parrot Intervention

- Paul Butler was a newly graduated English biologist who became interested in the parrot problem
- Rather than focus on the science of conservation, which was not of interest to the islanders, he focused on marketing the parrot
 - Marketing campaign to make the bird as a symbol of this newly independent island nation.
 - St. Lucia declared the parrot its national bird, set aside forest reserves, and harshly penalized hunters. Pop songs celebrated the parrot, and ministers praised it from their pulpits.
- St. Lucia parrot population “has clawed its way back to 600 or 700,” Butler estimates.



http://www.ssireview.org/articles/entry/the_cultural_touch/www.stanfordepnl.com

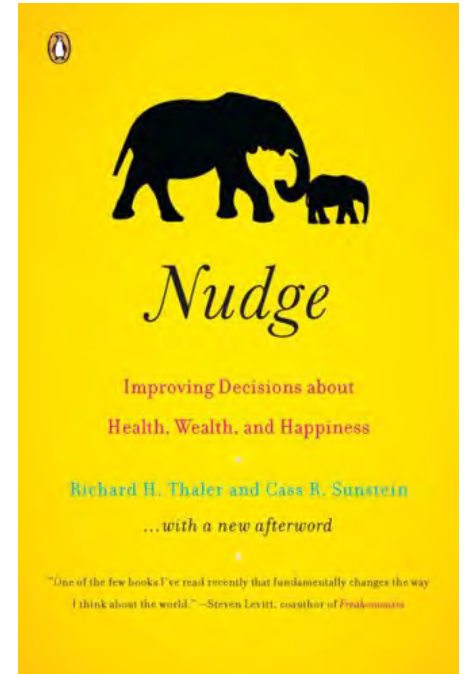
Switch by Dan and Chip Heath



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Choice Architecture

- Concept from Richard Thaler
- Idea that decisions are made on the basis of how information is presented
- Can we “nudge” prescribers to make the right choice?
 - Preserves sense of **prescriber autonomy**
 - Order of antibiotic choices on an order set



How would you get from Paddington Station to Bond Street Station?



(a) Schematic Tube Map
(Source: London Underground)



(b) Geographical Map
(Source: Simon Clarke)

- 30% of riders choose to go via Notting Hill Gate, even though it is significantly longer and slower

Antibiotic Nudging

- 14 clinicians (11 MD, 3 NP)
- 7 randomized to post a signed commitment letter to use antibiotics appropriately in their exam rooms
- 954 adults with ARI
- ICD-9 codes for antibiotic appropriate and antibiotic inappropriate diagnoses assessed

Antibiotics, like penicillin, fight infections due to bacteria that can cause some serious illnesses. But these medicines can cause side effects like skin rashes, diarrhea, or yeast infections. If your symptoms are from a virus and not from bacteria, you won't get better with an antibiotic, and you could still get these bad side effects. How can you help? Carefully follow your doctor's instructions. . . .Your health is very important to us. As your doctors, we promise to treat your illness in the best way possible. We are also dedicated to avoid prescribing antibiotics when they are likely to do more harm than good.

	Poster		Control	
	Baseline	Final	Baseline	Final
Inappropriate prescribing percentage	43.5	33.7	42.8	52.7
Absolute percentage change	-9.8		9.9	
Difference between poster and control	-19.7			

No evidence of diagnostic shift away from antibiotic-inappropriate diagnostic codes

- Why successful?
 - “People place a high value on consistency and follow through with their public commitments to avoid disapproval by their peers”
 - Public commitment causes people to identify the behavior with their self image which may enhance personal dedication to perform it

Characteristics of Effective Leaders

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Factors Associated With Successful Leadership

- In depth survey of 14 hospitals regarding roles of personnel in HAI prevention activities using qualitative methods
- Four key behaviors of leaders who successfully implemented HAI prevention practices
 - Nurturing a culture of clinical excellence and effectively communicating it to staff
 - Overcoming barriers of resistance from people or processes that prevent effectiveness
 - Acting as inspirational role models
 - Thinking strategically while acting locally

Four Key Behaviors

- **Nurturing a culture of clinical excellence and effectively communicating it to staff**
- Overcoming barriers of resistance from people or processes that prevent effectiveness
- Acting as inspirational role models
- Thinking strategically while acting locally

Nurturing a Culture of Clinical Excellence

- Culture

- Culture is the collection of values, beliefs and assumptions that guides behaviors¹

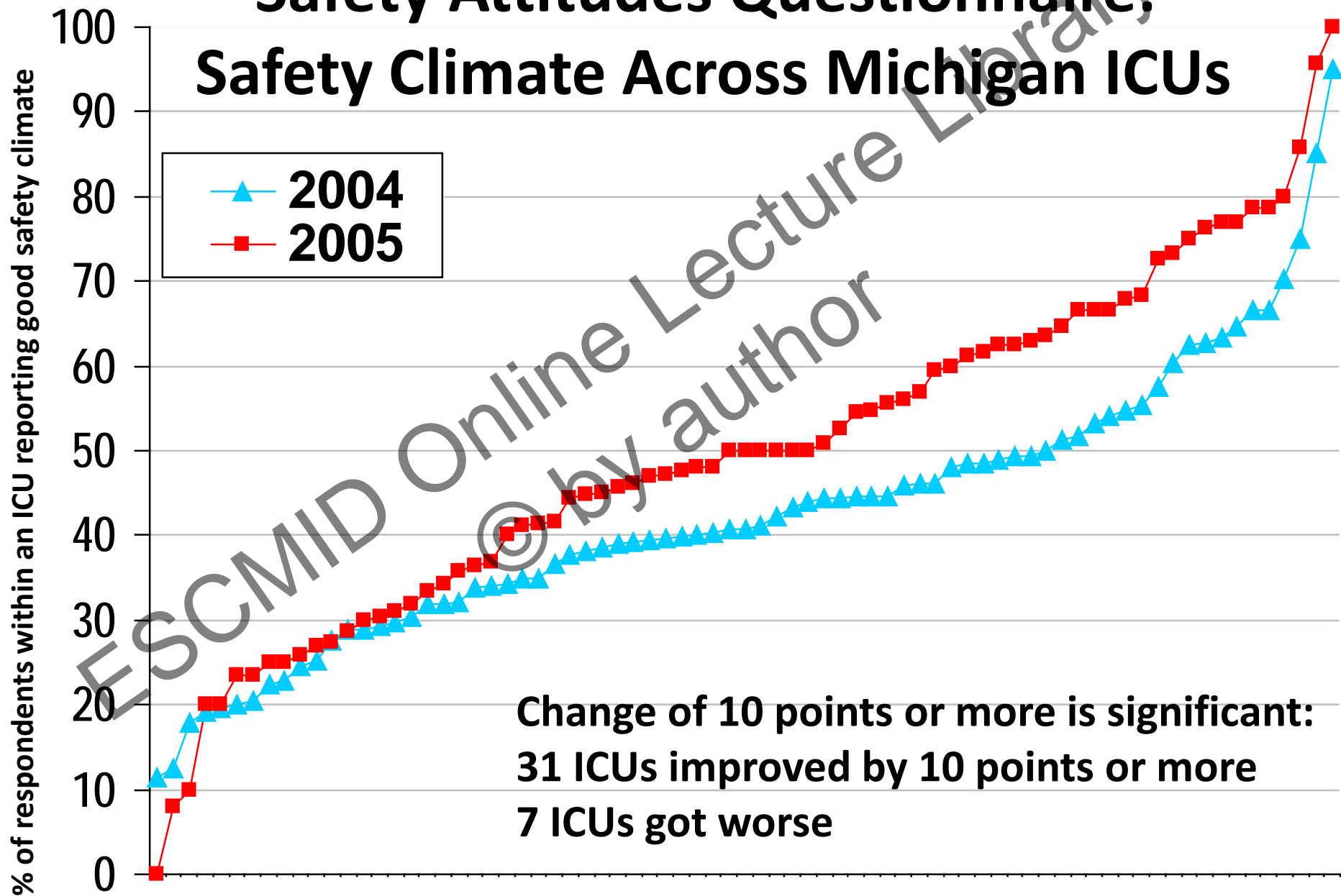
- An organization's pattern of response to problems and opportunities²

- *The way we do things around here!*

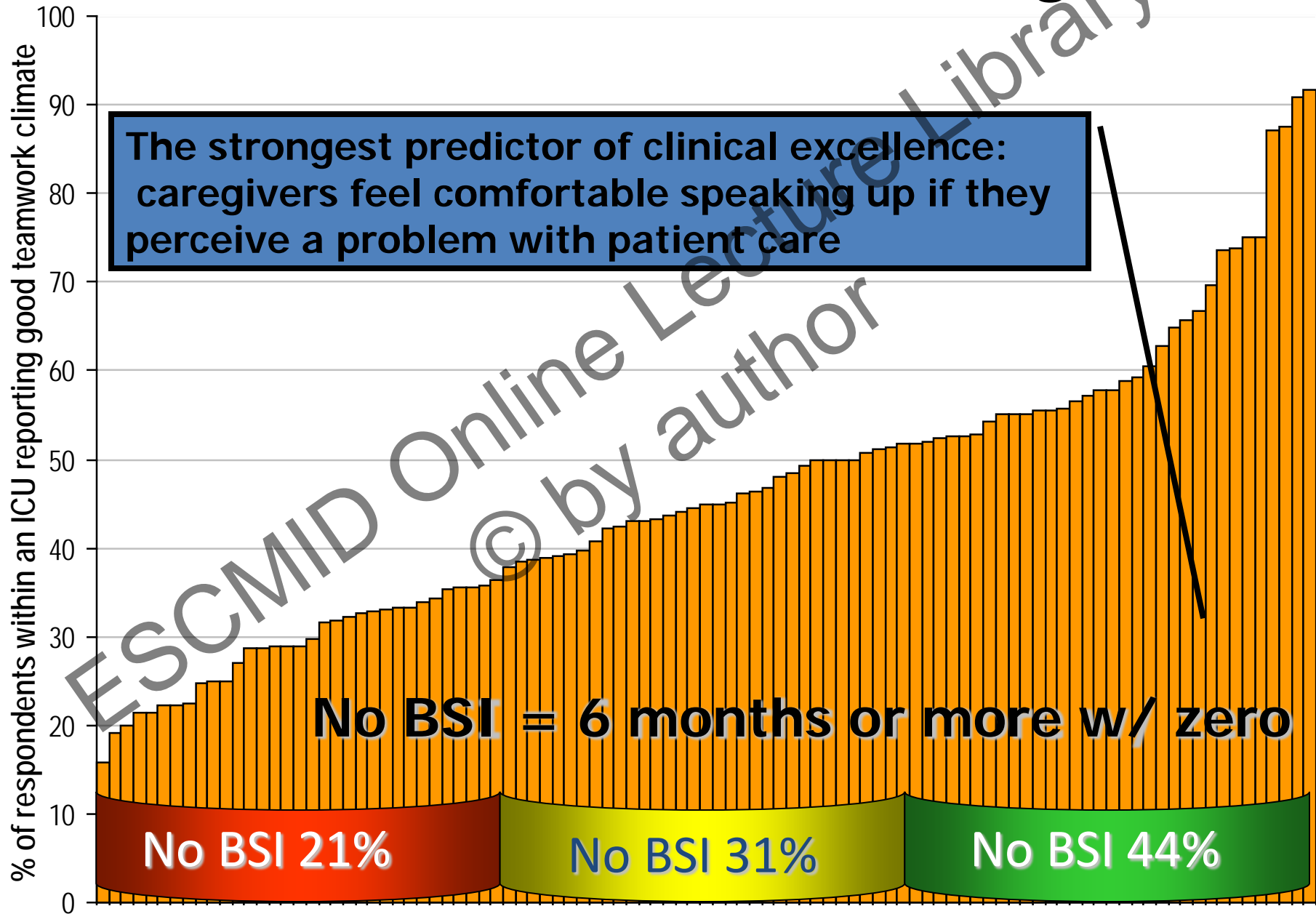
1. Pronovost. *Qual Saf Health Care* 2003;12:405-10

2. Westrum. *Qual Saf Health Care* 2004;13(Suppl II):ii22-ii27

Safety Attitudes Questionnaire: Safety Climate Across Michigan ICUs



Teamwork Climate Across Michigan ICUs



The strongest predictor of clinical excellence: caregivers feel comfortable speaking up if they perceive a problem with patient care

No BSI = 6 months or more w/ zero

No BSI 21%

No BSI 31%

No BSI 44%

Four Key Behaviors

- Nurturing a culture of clinical excellence and effectively communicating it to staff
- **Overcoming barriers of resistance from people or processes that prevent effectiveness**
- Acting as inspirational role models
- Thinking strategically while acting locally

Overcoming Barriers of Resistance

- Focus on overcoming barriers rather than complaining about how the system will not allow change
- Deal directly with resistant staff or process issues

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Examples of Barriers

- “Active resisters”
 - Hospital personnel who vigorously and openly oppose change in practice
- How to manage
 - Data feedback
 - Effective championing by an engaged and respected change agent that can speak the language of the staff they are guiding
 - Get them on the team

Examples of Barriers

- “Organization constipators”
 - Mid- to high- level executives who prevent or delay actions without active resistance
- How to manage
 - Include early in group discussions
 - Work around
 - Terminate employment and replace with someone more effective

Four Key Behaviors

- Nurturing a culture of clinical excellence and effectively communicating it to staff
- Overcoming barriers of resistance from people or processes that prevent effectiveness
- **Acting as inspirational role models**
- Thinking strategically while acting locally

Acting as Inspirational Role Models

- Leadership of stewardship team should
 - Model good prescribing behavior
 - Compliment good prescribing behavior
 - Engage role models from other specialties
 - Develop new leaders
 - Market program successes with enthusiasm

Four Key Behaviors

- Nurturing a culture of clinical excellence and effectively communicating it to staff
- Overcoming barriers of resistance from people or processes that prevent effectiveness
- Acting as inspirational role models
- **Thinking strategically while acting locally**

Thinking Strategically While Acting Locally

- Plan ahead and leave few things to chance
- Get relevant parties on your side before critical votes occur or decisions are made
- Use your influence to make things happen

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Conclusions

- Change is hard
- Change requires ACTIVE intervention
- Ability to bring about change requires
 - Recognition and management of what people need to adapt to new ideas
 - Different for different personalities
 - Recognition and management of the emotions behind change
 - Good tools to make things easier
 - Strong leadership

Never doubt that a small group of thoughtful committed citizens can change the world. Indeed, it's the only thing that ever has.

Margaret Meade

It is amazing what you can accomplish if you do not care who gets the credit.

Harry Truman