Microbiology and Antibiotics for the Infection Preventionist

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Disclosures

- No financial disclosures
- I disclose that I have seen David, Sharon, and Tim's presentations and they are amazing!
- They are going to teach us all we need to know about antibiotics and microbiology.
- I will attempt to create the backdrop for why this is so important right now.

CMS Hospital Conditions of Participation Final Rule- 9/30/2019

This document is scheduled to be published in the Federal Register on 09/30/2019 and available online at https://federalregister.gov/d/2019-20736, and on govinfo.gov

[Billing Code: 4120-01-P]

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Centers for Medicare & Medicaid Services

42 CFR Parts 403, 416, 418, 441, 460, 482, 483, 484, 485, 486, 488, 491, and 494

[CMS-3346-F; CMS-3334-F; CMS-3295-F]

RIN 0938-AT23

Medicare and Medicaid Programs; Regulatory Provisions to Promote Program Efficiency, Transparency, and Burden Reduction; Fire Safety Requirements for Certain Dialysis Facilities; Hospital and Critical Access Hospital (CAH) Changes to Promote Innovation, Flexibility, and Improvement in Patient Care

AGENCY: Centers for Medicare & Medicaid Services (CMS), HHS.

ACTION: Final rule.

Condition of Participation- Infection Control and Antibiotic Stewardship Programs

8. Infection prevention and control and antibiotic stewardship programs (§ 482.42)

We proposed a change to the title of this CoP to "Infection prevention and control and antibiotic stewardship programs." By adding the word "prevention" to the CoP name, our intent is to promote larger, cultural changes in hospitals such that prevention initiatives are recognized on balance with their current, traditional control efforts. And by adding "antibiotic stewardship" to the title, we would emphasize the important role that a hospital should play in combatting antimicrobial resistance through implementation of a robust stewardship program that follows nationally recognized guidelines for appropriate antibiotic use. Along with these changes, we

- "An implementation date that is six months from this final rule"
- End of March, 2020

Requirements for Hospital Antibiotic Stewardship Programs

- **CMS 2016 Proposed Hospital Conditions of Participation**
- **Requirements for antibiotic stewardship programs**

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Centers for Medicare & Medicaid Services

42 CFR Parts 482 and 485

[CMS-3295-P]

RIN 0938-AS21

Medicare and Medicaid Programs; Hospital and Critical Access Hospital (CAH) Changes to Promote Innovation, Flexibility, and Improvement in Patient Care

Critical Access Hospital Requirement

MBQIP New Required Measure

FY2018 – 2021

Antibiotic Stewardship Summary

Joint Commission Accreditation Standard

Joint Commission Requirement

New Antimicrobial Stewardship Standard

Applicable to Hospitals and Critical Access Hospitals

Effective January 1, 2017

Medication Management (MM)

Note: *An example of an educational tool that can be used for patients and families includes the Centers for Disease Control and Prevention's Get Smart document, "Viruses or Bacteria—What's got you sick? at http://www.cdc.gov/getsmart/community/downloads/getsmart-chart.pdf.*

DNV GL-Healthcare National Integrated Accreditation for Healthcare Organizations (NIAHO®) Accreditation Requirements for Hospitals: Antimicrobial Stewardship

by

Katherine Shea, PharmD, BCIDP, AAHIVE, Clinical Director- Infectious Diseases, Cardinal Health

DNV GL-Healthcare recently added a new NIAHO® accreditation requirement on antimicrobial stewardship that became effective in January 2019. This issue of *Quality Matters!* provides the standard requirements and suggestions of information to have available for surveyors to demonstrate compliance.[1] Organizations that are surveyed by other accrediting agencies, such as The Joint Commission, will find this information valuable for their antimicrobial stewardship programs.

Antimicrobial Stewardship (MM.8): The organization shall have a program in place to enhance antimicrobial stewardship, an activity that includes appropriate selection, dosing, route, and duration of antimicrobial therapy. The standard requirements (SR) are as follows:

Consequences of Any Antibiotic Exposure

- Increased risk of candidemia.
- Increased risk for *C. difficile* infection
  - 7-10 fold increased risk for up to 3 months
- Adverse drug reactions
- Disruption of normal gut bacteria.
  - Which could increase the risk of sepsis.
- Selective pressure for antibiotic resistance.

>$20B/year in health care costs

Estimated minimum number of illnesses and deaths caused annually by antibiotic resistance*:

At least

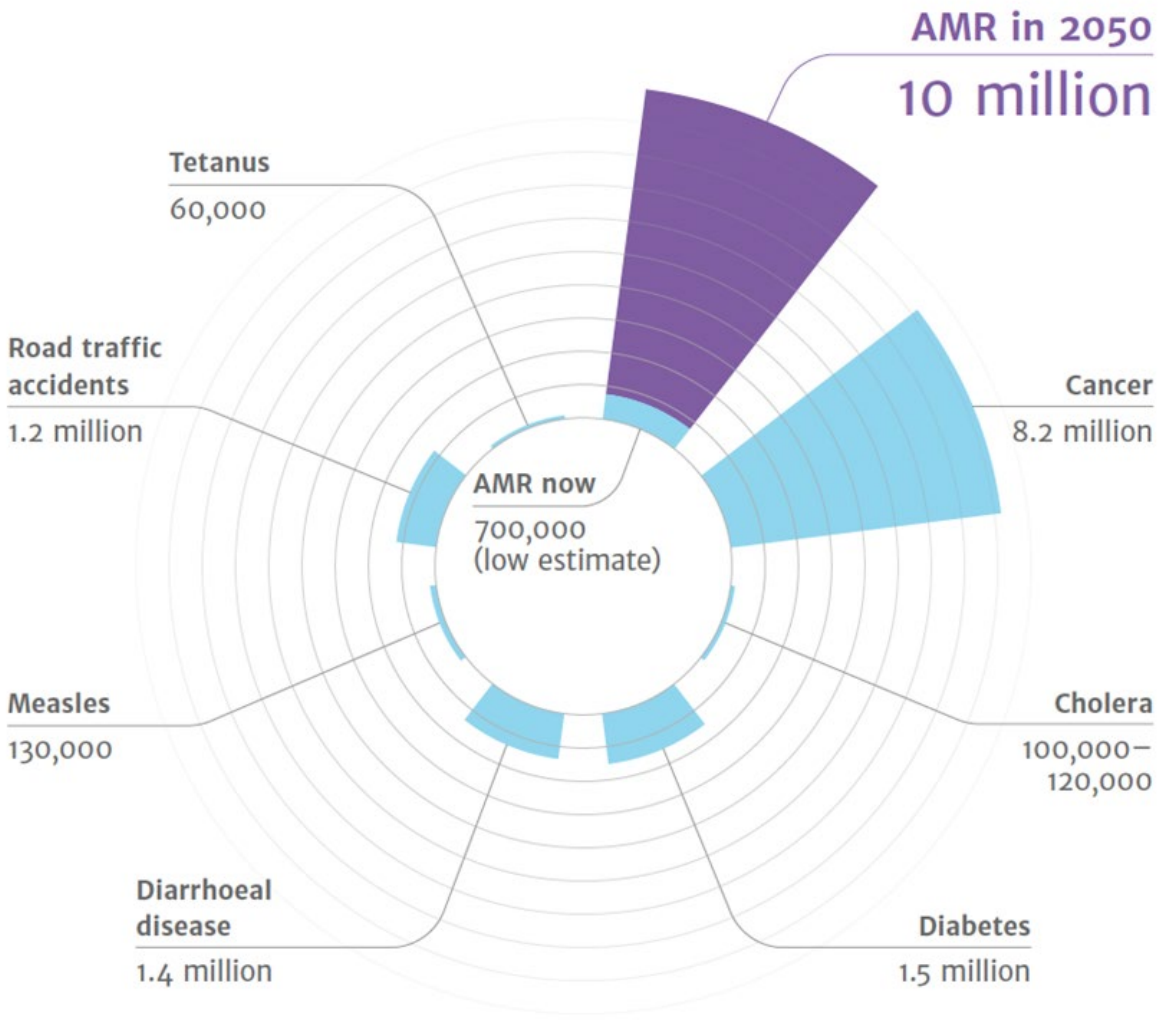
2,049,442 illnesses

23,000 deaths

*bacteria and fungus included in this report

https://www.cdc.gov/drugresistance/threat-report-2013/index.html

If We Stay On This Path: 2050 Projections for Antibiotic Resistance



Antibiotics Are Different From All Other Drugs

- Antibiotics lose their effectiveness over time- even if we use them perfectly.
- Every specialty (almost) uses them on a regular basis.
- They are a shared resource- the use of antibiotics for in one patient can compromise how they work for someone else through the spread of resistance or lead to complications for someone else through spread of *C. difficile*.

JAMA Internal Medicine | Original Investigation | LESS IS MORE

Receipt of Antibiotics in Hospitalized Patients and Risk for *Clostridium difficile* Infection in Subsequent Patients Who Occupy the Same Bed

Daniel E. Freedberg, MD, MS; Hojjat Salmasian, MD, PhD; Bevin Cohen, MPH; Julian A. Abrams, MD, MS; Elaine L. Larson, RN, PhD

- Receipt of antibiotics in prior patients was significantly associated with incident CDI in subsequent patients (log-rank $P < .01$).
- This relationship remained unchanged after adjusting for other factors known to influence risk for CDI (receipt of antibiotics by the subsequent patient, prior patient developed CDI).

JAMA Intern Med. Published online October 10, 2016.

It's a Matter of Patient Safety—It Is More than just about Antibiotic Resistance

- What if something bad happens without an antibiotic? What is the **number needed to treat**?
  - Complications to common respiratory infections are very rare
  - Over 4400 patients with colds need to be treated to prevent 1 case of pneumonia

- What if something bad happens with an antibiotic? What is the **number needed to harm**?
  - Antibiotic adverse events can be severe
    - Life-threatening allergic reactions (e.g., anaphylaxis)
    - Antibiotic-associated diarrhea (e.g., *C. difficile* infection)
    - 1 in 1000 antibiotic prescriptions leads to an ER visit for an adverse event (~200,000 estimated ER visits/year in U.S.)
  - Antibiotic adverse events have long-term consequences for chronic disease**:** disruption of microbiota and microbiome linked to chronic disease

Petersen et al. *British Medical Journal*. 2007;335(7627): 982. Shehab, et al. *Clin Infect Dis*. 2008 Sep 15;47(6):735-43. 3. Shehab et al. *JAMA 2016*:316:2115-25. *4.* Bourgeois, et al. *Pediatrics.* 2009;124(4):e744-50. 5. Vangay, et al. Cell host & microbe 2015; 17(5): 553-564.

Adverse Events from Hospital Antibiotics

- In a review of 1488 hospitalized patients given antibiotics.
- 20% of patients experienced at least 1 antibiotic-associated adverse event.
  - 4% of all patients got *C. difficile*, 6% got an MDRO infection
- 20% of non-indicated antibiotic regiments were associated with an adverse event, including 7 cases of *C. difficile*.
- Every 10 days of antibiotics was associated with a 3% increased risk of an adverse event.
- Most common in 1st 30 days:
  - GI (diarrhea, nausea, vomiting): 42%
  - Renal (>1.5 times rise in creatinine): 24%
  - Hematologic (anemia, leukopenia, thrombocytopenia): 15%

Tamma et al. JAMA Intern Med, 2017

Adverse Events from Hospital Antibiotics

- 97% of antibiotic adverse events resulted in additional testing and/or additional medical care (prolonged or new hospitalization or clinic and/or ED visit).

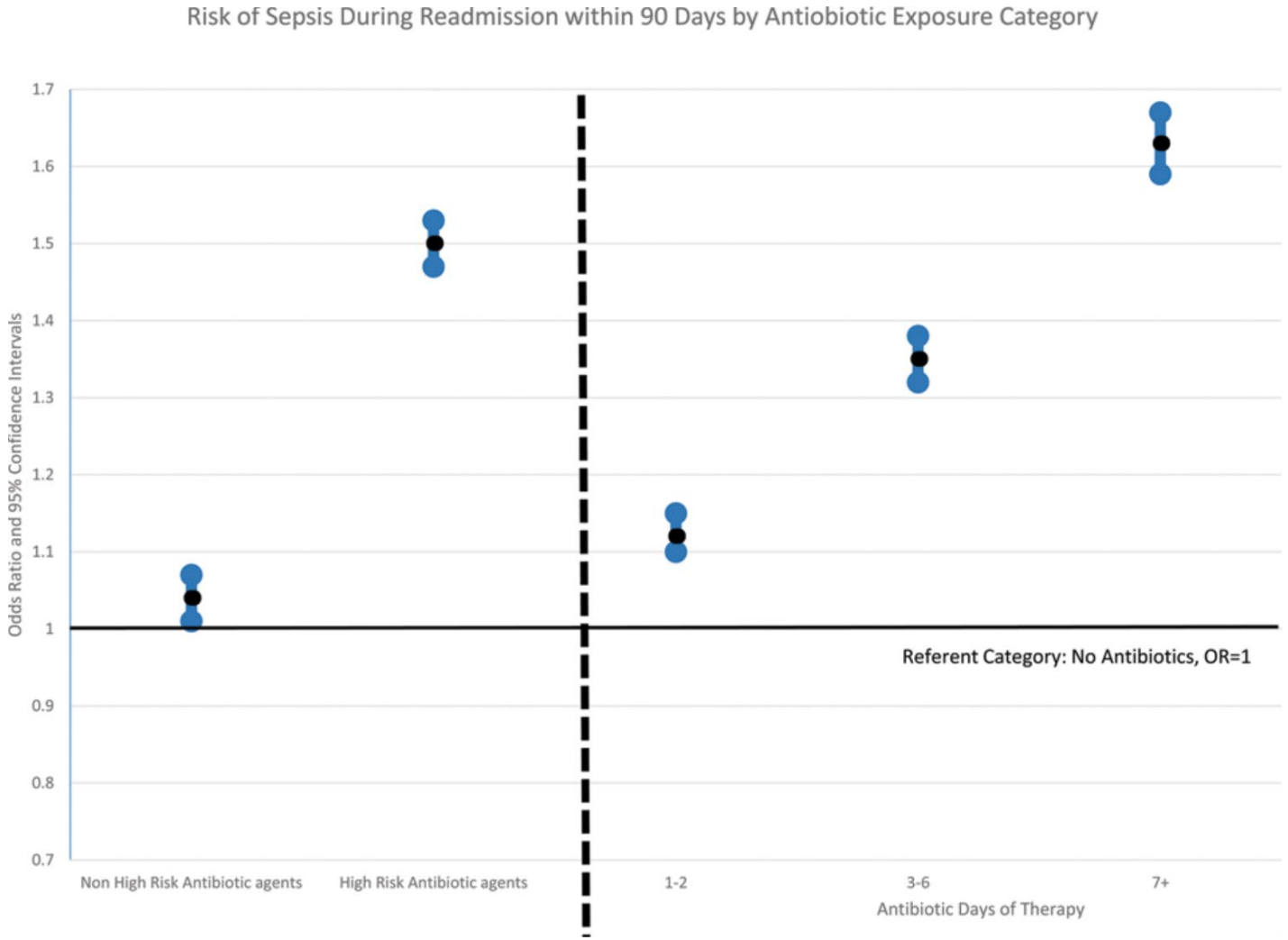
Clinical Infectious Diseases

MAJOR ARTICLE

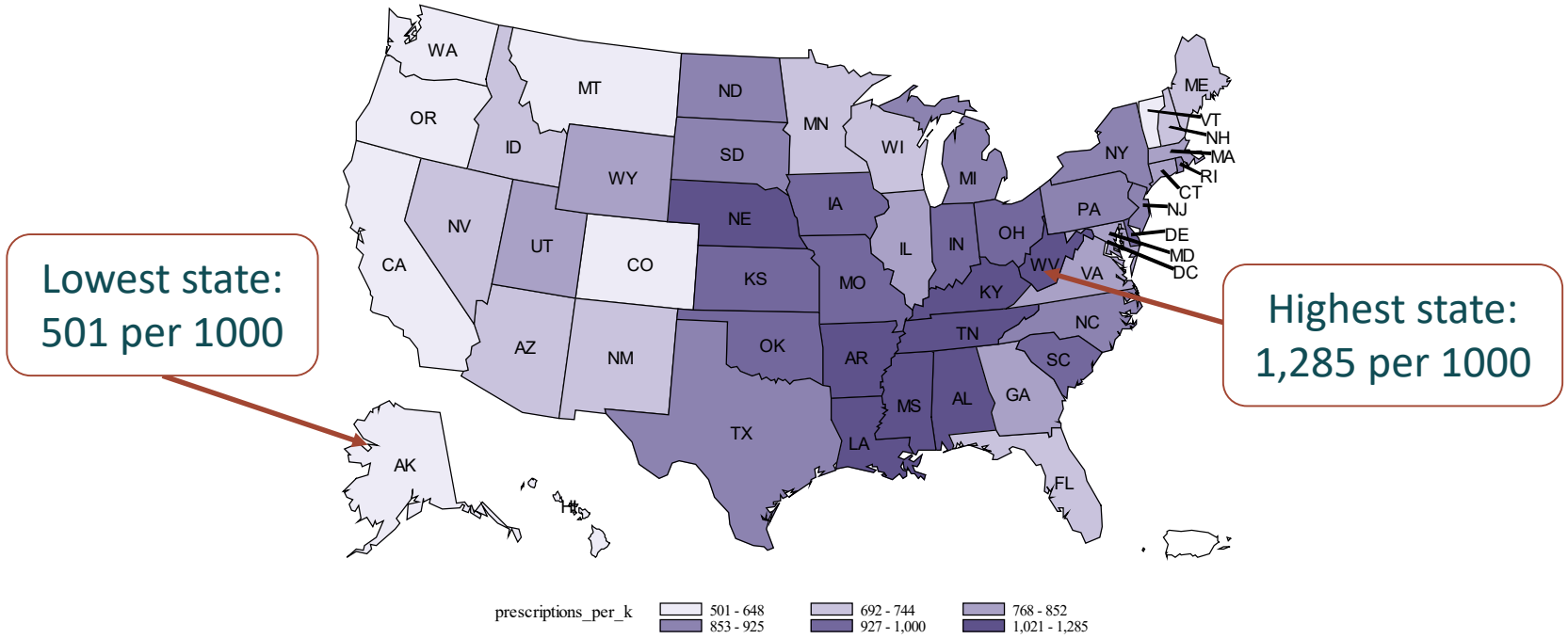
Risk of Subsequent Sepsis Within 90 Days After a Hospital Stay by Type of Antibiotic Exposure

James Baggs, John A. Jernigan, Alison Laufer Halpin, Lauren Epstein, Kelly M. Hatfield, and L. Clifford McDonald

Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia



Community Antibiotic Prescribing Rates per 1000 Population — United States, 2014



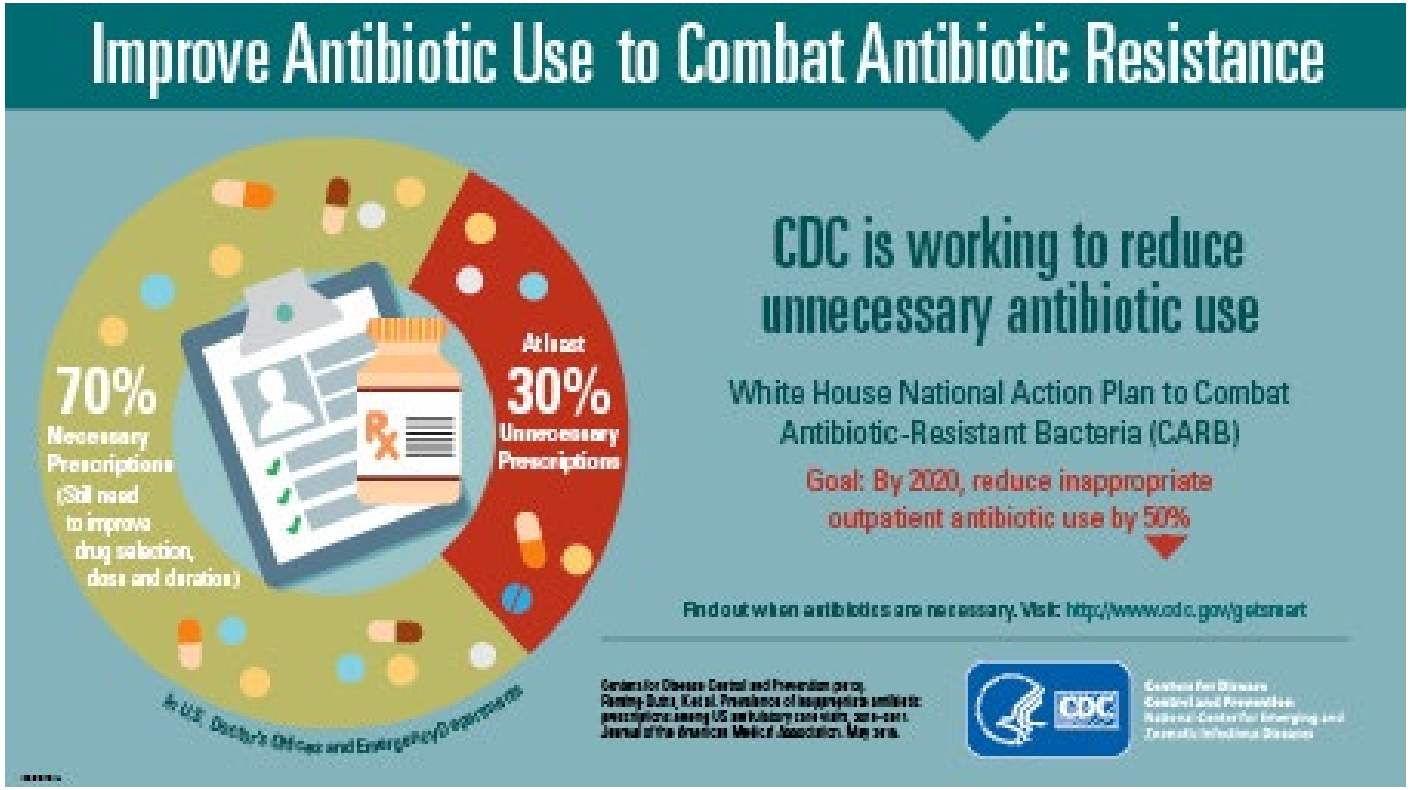
Data: IMS Health Xponent
http://www.cdc.gov/getsmart/community/programs-measurement/measuring-antibiotic-prescribing.html

JAMA Internal Medicine | Original Investigation

Estimating National Trends in Inpatient Antibiotic Use Among US Hospitals From 2006 to 2012

James Baggs, PhD; Scott K. Fridkin, MD, MPH; Lori A. Pollack, MD, MPH; Arjun Srinivasan, MD, MPH; John A. Jernigan, MD, MS

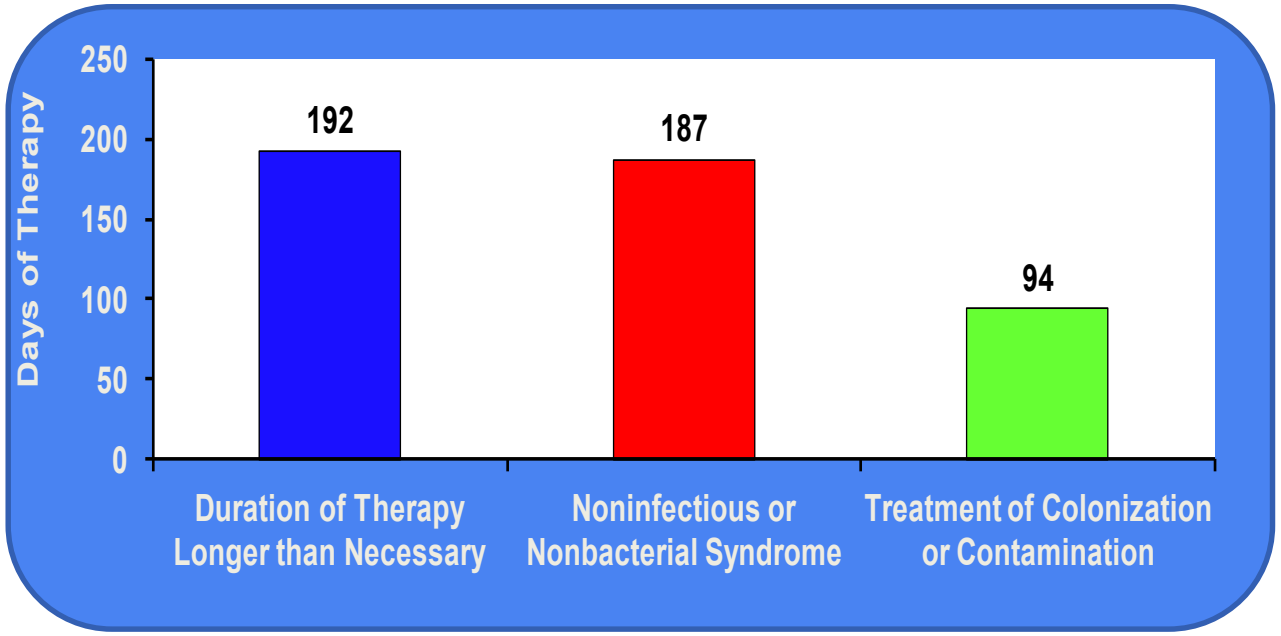
- 55.1% of patients got at least 1 dose.
- Overall use was 755 DOT/1000 patient days
- Use did not vary by bed size.
- Non-teaching hospitals had higher use than teaching.
- Use of many classes went up:
- Vancomycin (32%), beta-lactam/inhibitor (26%), 3rd/4th generation cephalosporins (12%)
- Biggest increase in carbapenem use: 37%.



47 million unnecessary antibiotic prescriptions per year

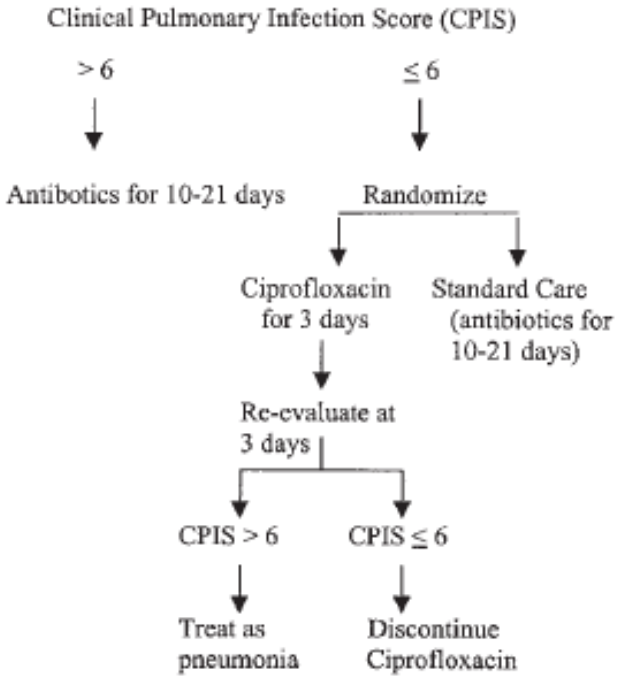
Most Common Reasons for Unnecessary Days of Therapy

576 (30%) of 1941 days of antimicrobial therapy deemed unnecessary



Hecker MT et al. *Arch Intern Med*. 2003;163:972-978.

Antibiotic Stewardship and Decreased Risk of Resistant Infections

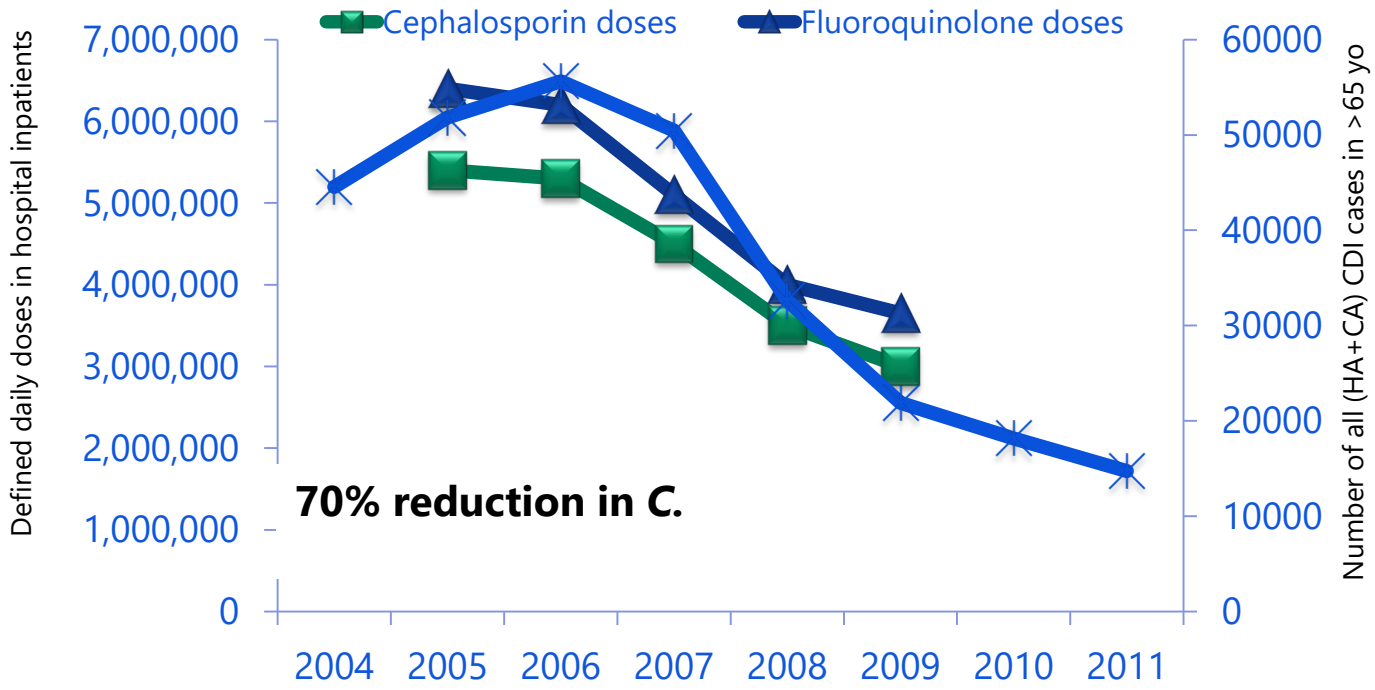


	Cipro	Standard
Antibiotic duration	3 days	10 days
LOS ICU	9 days	15 days
Antibiotic resistance/ superinfection	14%	38%

Study terminated early because attending physicians began to treat standard care group with 3 days of therapy

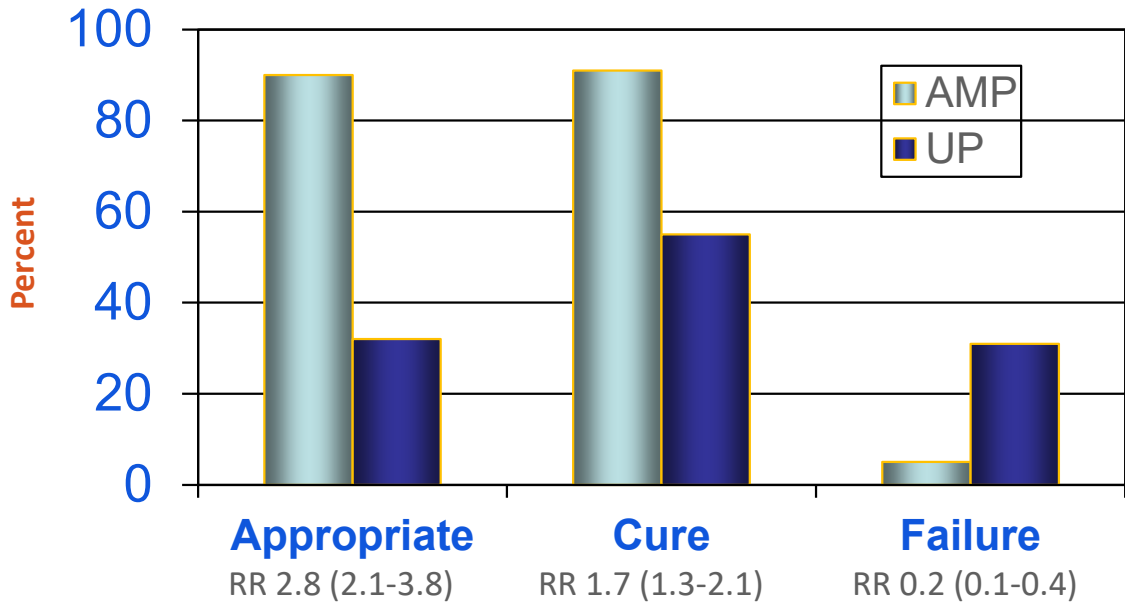
Singh N et al. *Am J Respir Crit Care Med*. 2000;162:505-11.

Impact of Reductions in Antibiotic Prescribing on C. difficile in England



Ashiru-Oredope et al. J Antimicrob Chemother 2012; 67 Suppl 1: i51–i63
Wilcox MH et al. Clinical Infectious Diseases 2012;55(8):1056–63
http://www.hpa.org.uk/web/HPAweb&Page&HPAwebAutoListName/Page/1179745282388

Clinical Outcomes Better with Antimicrobial Stewardship Program



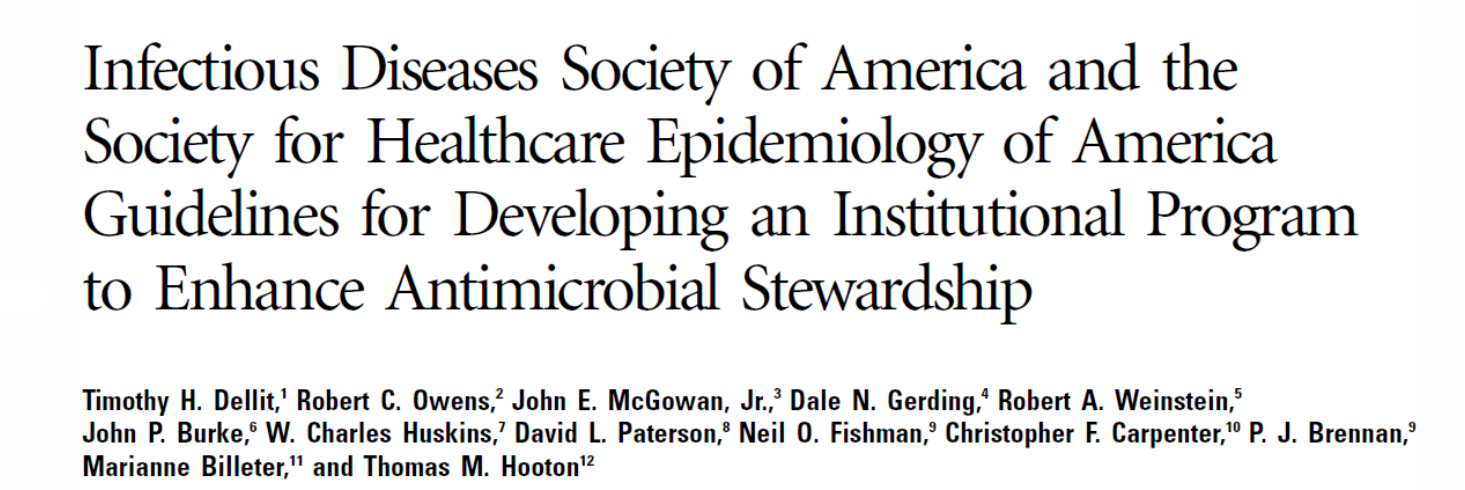
Fishman N. *Am J Med.* 2006;119:S53.

AMP = Antibiotic Management Program
UP = Usual Practice

A Challenge From Dr. Frieden

- What stewardship program can you recommend that could be implemented in ANY hospital?
- How will you know if people are following your recommendation?

A Challenge With Broad Implementation



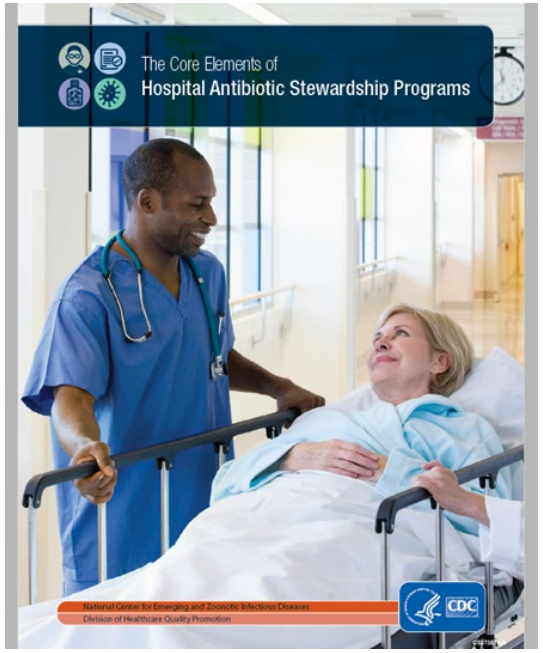
Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

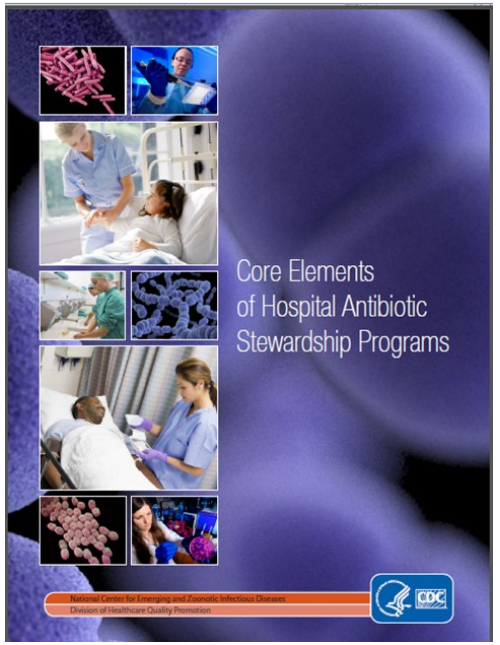
Timothy H. Dellit,[1] Robert C. Owens,[2] John E. McGowan, Jr.,[3] Dale N. Gerding,[4] Robert A. Weinstein,[5] John P. Burke,[6] W. Charles Huskins,[7] David L. Paterson,[8] Neil O. Fishman,[9] Christopher F. Carpenter,[10] P. J. Brennan,[9] Marianne Billeter,[11] and Thomas M. Hooton[12]

- Guidelines recommended programs that were led by ID physicians and pharmacists.
- Excellent model for larger hospitals.
- Not feasible in many hospitals.

“Core Elements of Antibiotic Stewardship”

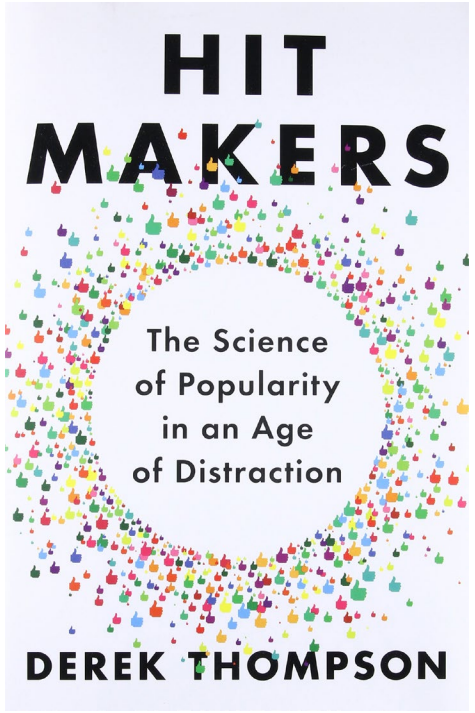
- Leadership commitment from administration
- Single leader responsible for outcomes
- Single pharmacy leader
- Antibiotic use tracking
- Regular reporting on antibiotic use and resistance
- Educating providers on use and resistance
- Specific improvement interventions





Familiarity Trumps Innovation

- The “Core Elements” approach was new.
- There is nothing new in the core elements.
- That might be why people liked it.



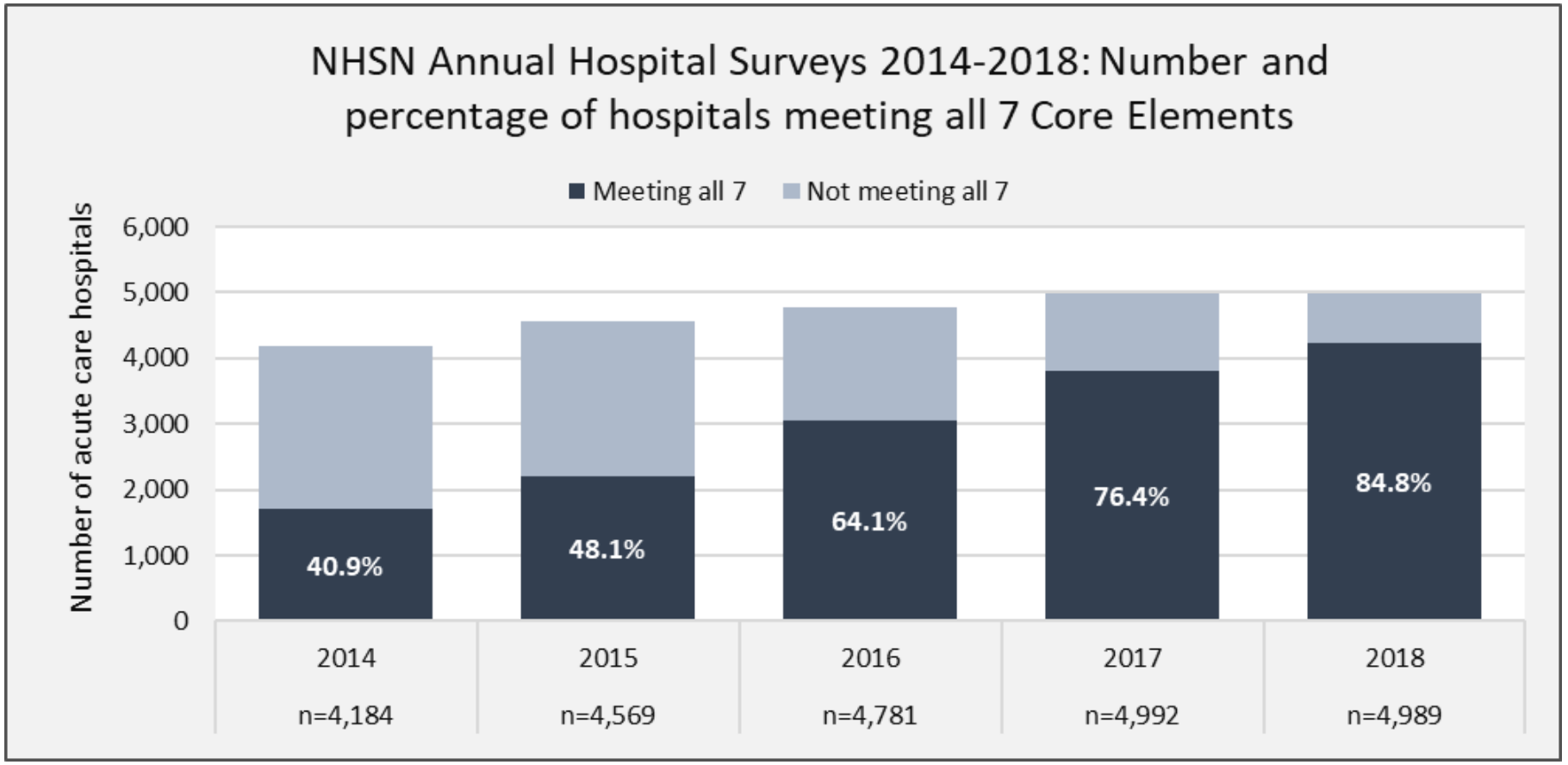
Derek Thompson, *Hitmakers*

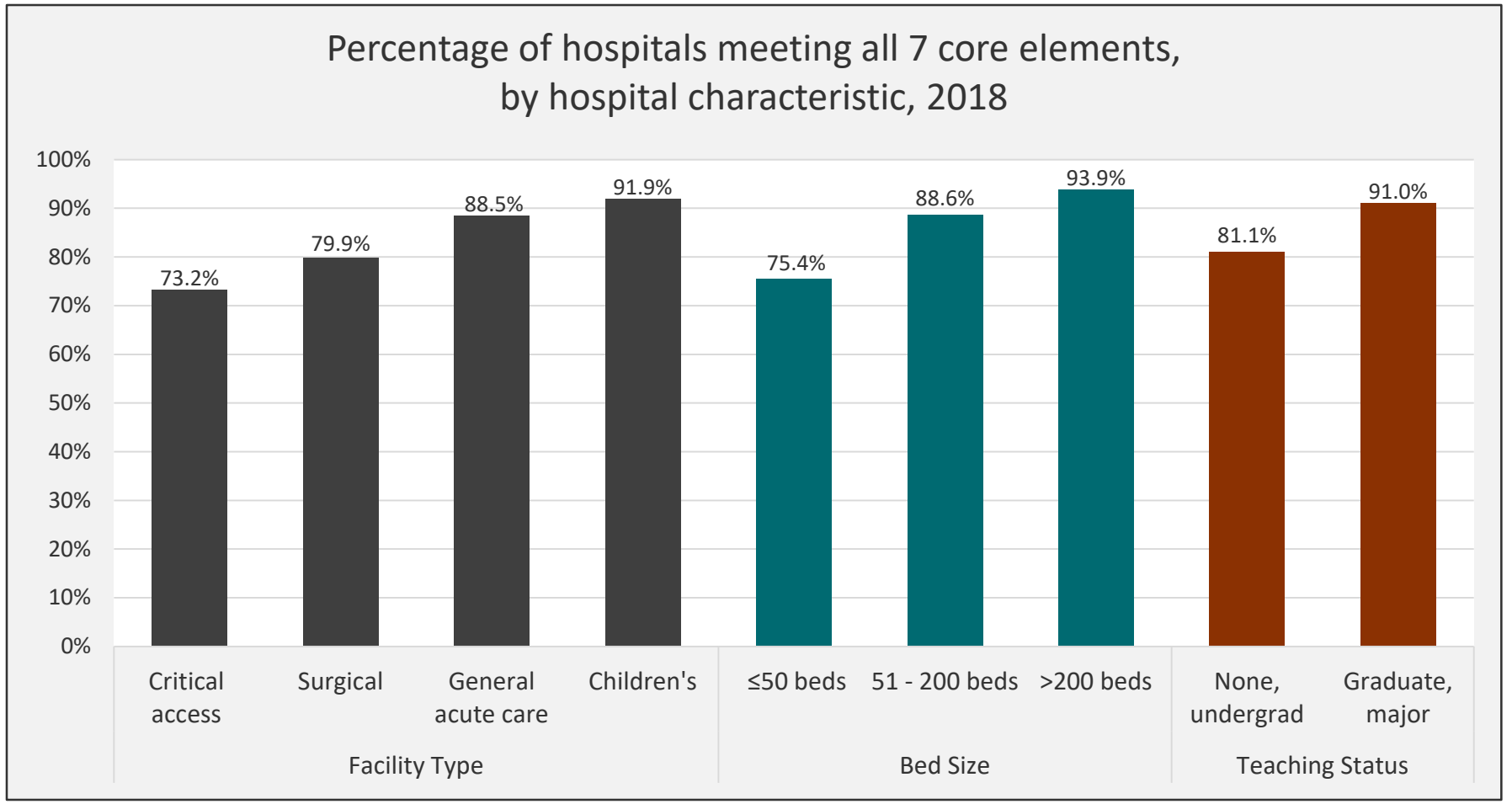
Top Grossing Films of the 2010s

- ***Star Wars: Episode VII - The Force Awakens (2015)***
- ***Black Panther (2018)***
- ***Avengers: Infinity War (2018)***
- ***Jurassic World (2015)***
- ***Marvel's The Avengers (2012)***
- ***Star Wars: Episode VIII - The Last Jedi (2017)***
- ***Incredibles 2 (2018)***
- ***Rogue One: A Star Wars Story (2016)***
- *Beauty and the Beast (2017)*
- ***Finding Dory (2016)***

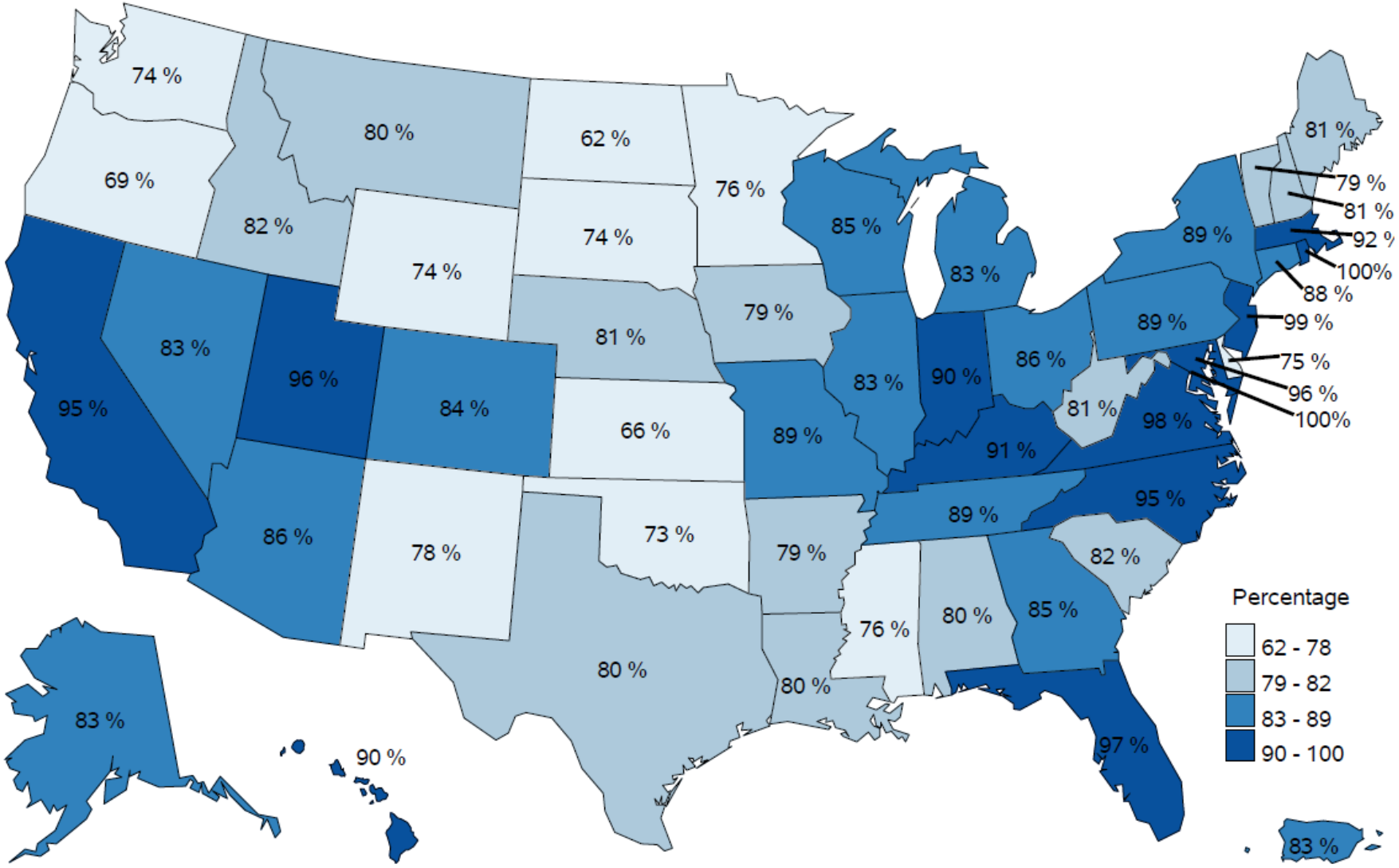
http://www.filmsite.org/boxoffice2.html

CDC Learns From Hollywood . . .


NHSN Annual Hospital Surveys 2014-2018: Number and percentage of hospitals meeting all 7 Core Elements
Meeting all 7
Not meeting all 7
Number of acute care hospitals
6,000
5,000
4,000
3,000
2,000
1,000
0
40.9%
48.1%
64.1%
76.4%
84.8%
2014
n=4,184
2015
n=4,569
2016
n=4,781
2017
n=4,992
2018
n=4,989


Percentage of hospitals meeting all 7 core elements, by hospital characteristic, 2018
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
73.2%
79.9%
88.5%
91.9%
75.4%
88.6%
93.9%
81.1%
91.0%
Critical access
Surgical
General acute care
Children's
≤50 beds
51 - 200 beds
>200 beds
None, undergrad
Graduate, major
Facility Type
Bed Size
Teaching Status

Percentage of Acute Care Hospitals, Per State, Meeting all 7 Core Elements, 2018



What's Next For The Hospital Core Elements

- A lot has changed since 2014.
- The 2019 update of the Core Elements tries to reflect:
  - Growth in use measurement
  - New data on interventions
- Will be released in late November for US Antibiotics Awareness Week.

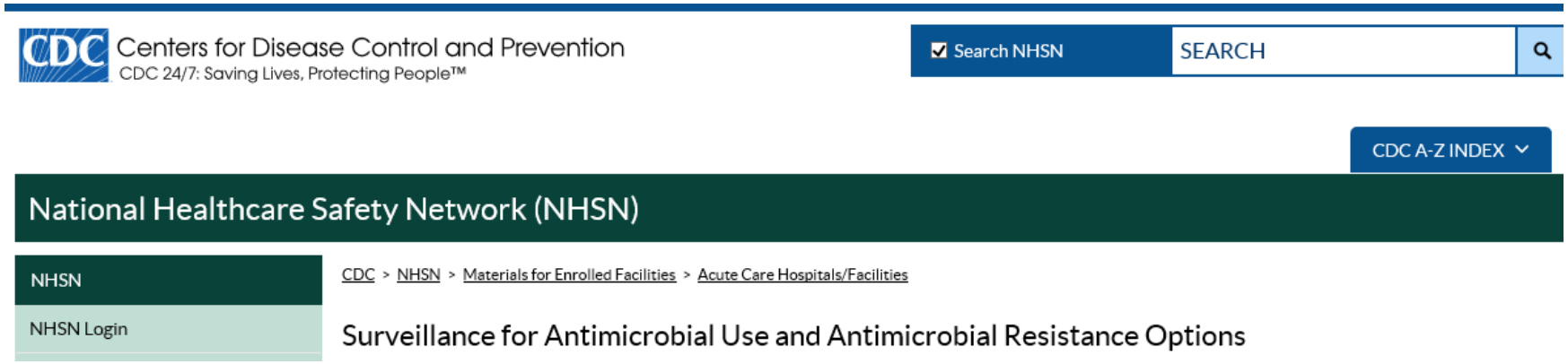
Advancing Measurement of Hospital Antibiotic Use- Lessons Learned from Infection Prevention

- "Since we do not possess an inherent ability to judge the value of something in isolation, we determine value by comparing and contrasting one thing to another."
- Would you intervene aggressively on carbapenem use that's dropping by 5% per year?
- Would you intervene aggressively on carbapenem use that's dropping by 5% per year, but that was three times higher than in other hospitals like yours?
  - "Knowing that our use is higher than others, rather than just thinking that it is, helps us when we talk to providers and has pushed us to do more."

http://www.uxmatters.com/mt/archives/2011/01/the-power-of-comparison-how-it-affects-decision-making.php

National Healthcare Safety Network (NHSN) Antibiotic Use (AU) Option - 2012

- Allows hospitals to electronically submit data on antibiotic use and patient days to create antibiotic use rates at the unit and hospital level.
- Developed with extensive input from stewardship experts.
  - Top ask: “We need benchmarks for antibiotic use!”
- Most people involved in stewardship have not worked with NHSN before and need training and guidance from Ips.



Standardized Antimicrobial Administration Ratio (SAAR)

- A ratio of actual use to predicted use.
- Predicted use is modeled based on all data submitted and used to create risk adjustment factors (e.g. number of ICU beds in the hospital).
- Endorsed by The National Quality Forum in 2016.
- Similar to the standardized infection ratio (SIR).

Out Of One, Many

- “A single measure of total antibiotic use in my hospital will be useless in helping me look for places to improve”

Standardized Antimicrobial Administration Ratio (SAAR)

- SAARs for different groups of antibiotics.
- SAARs for adult and pediatric locations.
- SAARs for ICU and non-ICU locations.
- SAARs can be calculated at the individual unit level.

- 25 adult and 15 pediatric SAARs

Standardized Antimicrobial Administration Ratio (SAAR) Evolution

- **2014** baseline SAAR models were developed using AU Option data from:
  - 77 acute care hospitals (350 adult and 33 pediatric locations)
- **2017** baseline SAAR models were developed using AU Option data from:
  - Adult models: 449 acute care hospitals, 2156 locations
  - Pediatric models: 109 acute care hospitals, 170 locations
- The larger sample size in 2017 enabled:
  - Inclusion of new location types in SAAR models
  - Adult and pediatric patient populations to be modeled separately
  - Increased precision of SAAR model estimates

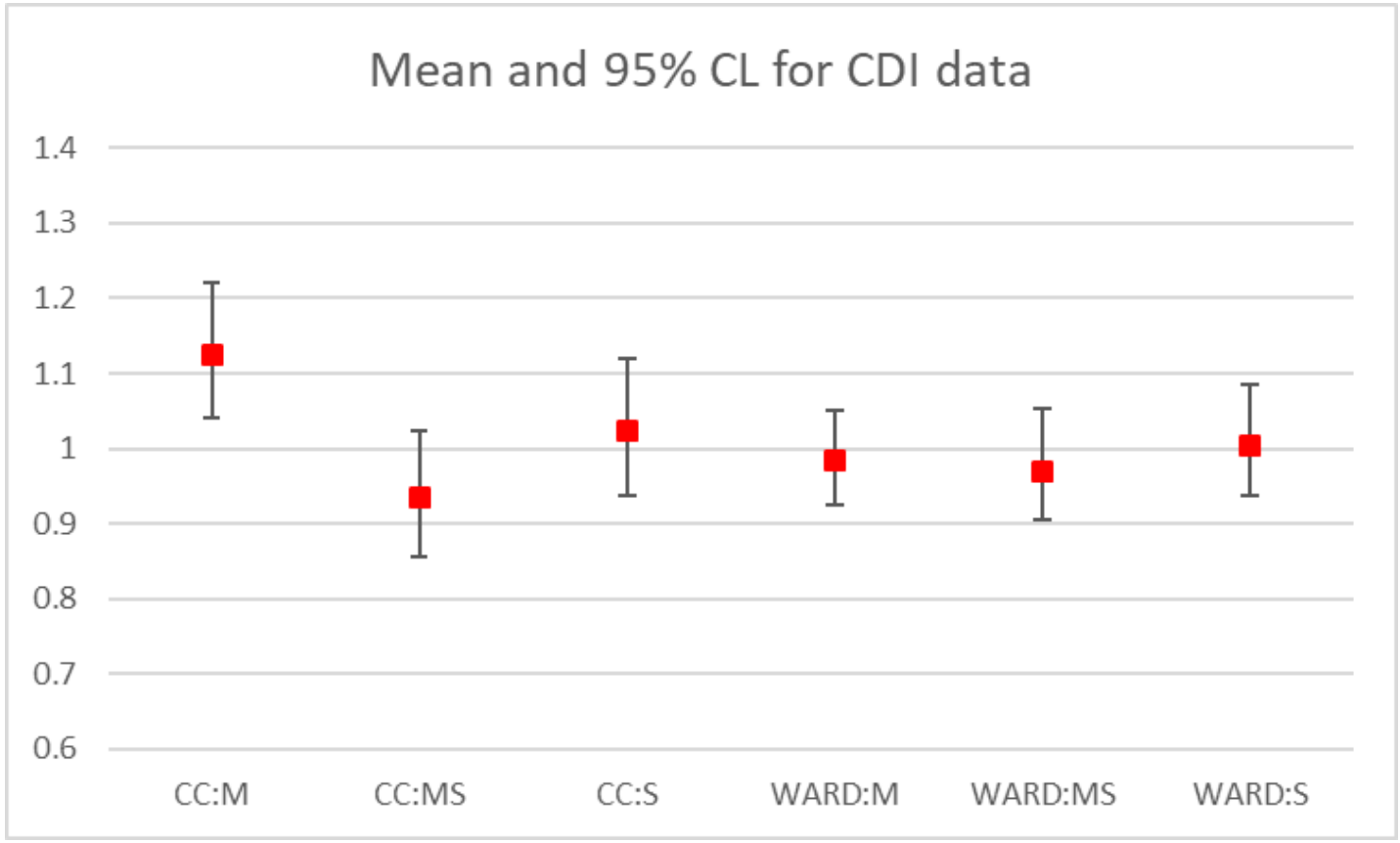
Facility Distributions

SAAR Distributions for facilities by Agent Class N=1182																	
ICUs	mean	min	1%	5%	10%	20%	25%	30%	40%	median	60%	70%	75%	80%	90%	95%	99%	max
All	1.00	0.03	0.31	0.70	0.77	0.85	0.88	0.91	0.95	0.99	1.03	1.09	1.11	1.15	1.25	1.34	1.59	3.25
BSCA	0.97	0.00	0.15	0.50	0.64	0.76	0.79	0.83	0.90	0.95	1.02	1.09	1.14	1.18	1.32	1.46	1.88	3.87
BSHO	1.01	0.00	0.07	0.43	0.56	0.72	0.78	0.83	0.91	1.00	1.09	1.17	1.22	1.28	1.45	1.60	2.18	4.88
CDI	1.00	0.00	0.17	0.55	0.66	0.76	0.80	0.84	0.90	0.97	1.05	1.12	1.17	1.22	1.37	1.49	1.88	3.95
COMP	1.02	0.00	0.20	0.61	0.69	0.80	0.83	0.86	0.94	0.99	1.05	1.13	1.18	1.23	1.41	1.59	1.89	2.88
FUNGAL	0.94	0.00	0.00	0.24	0.38	0.52	0.58	0.63	0.73	0.85	0.96	1.07	1.15	1.26	1.63	1.94	3.12	4.40
GramP	0.96	0.00	0.08	0.46	0.58	0.70	0.74	0.79	0.86	0.94	1.02	1.10	1.15	1.20	1.39	1.53	2.04	3.83
NSBL	1.06	0.01	0.17	0.43	0.53	0.69	0.74	0.80	0.89	0.99	1.10	1.22	1.28	1.37	1.65	1.98	2.68	4.82

Some Interesting Points

- Most pooled mean values are around 1.
- ~25% of locations are using an excess of 20% or more antibiotics than predicted across all locations types and agent classes.
- More wards than critical care units have SAARs significantly greater than 1, though medical critical care units have generally higher percentages greater than 1 than other ICU types.
- Antifungal agents have the lowest median but the widest range of SAARs.
- Medical Critical Care Units had a particularly high distribution for the CDI agent class.

Distributions of SAARs for Agents Posing Highest Risks for C. difficile



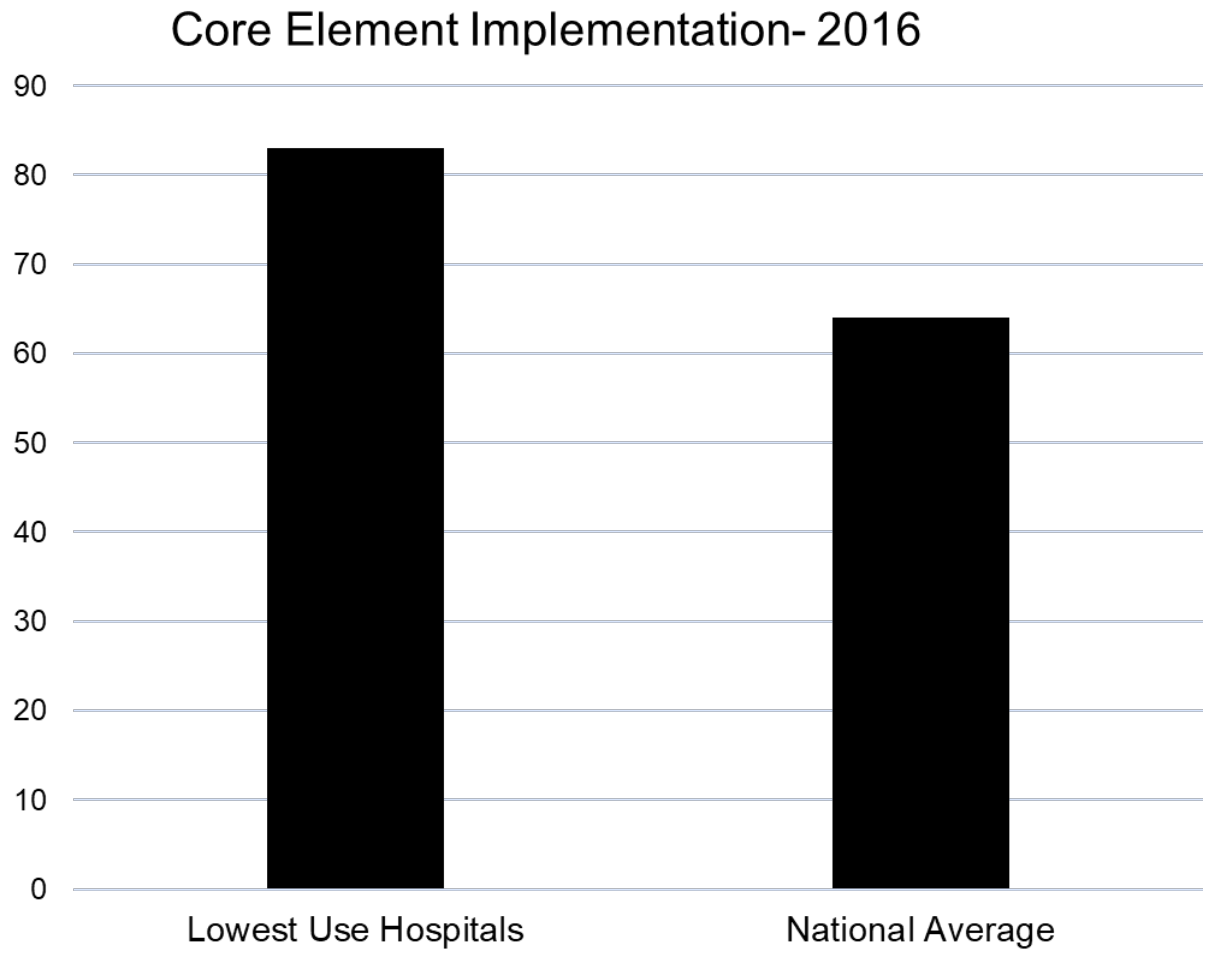
Critical Care Medical

Challenges With A Benchmark Measure of Antibiotic Use

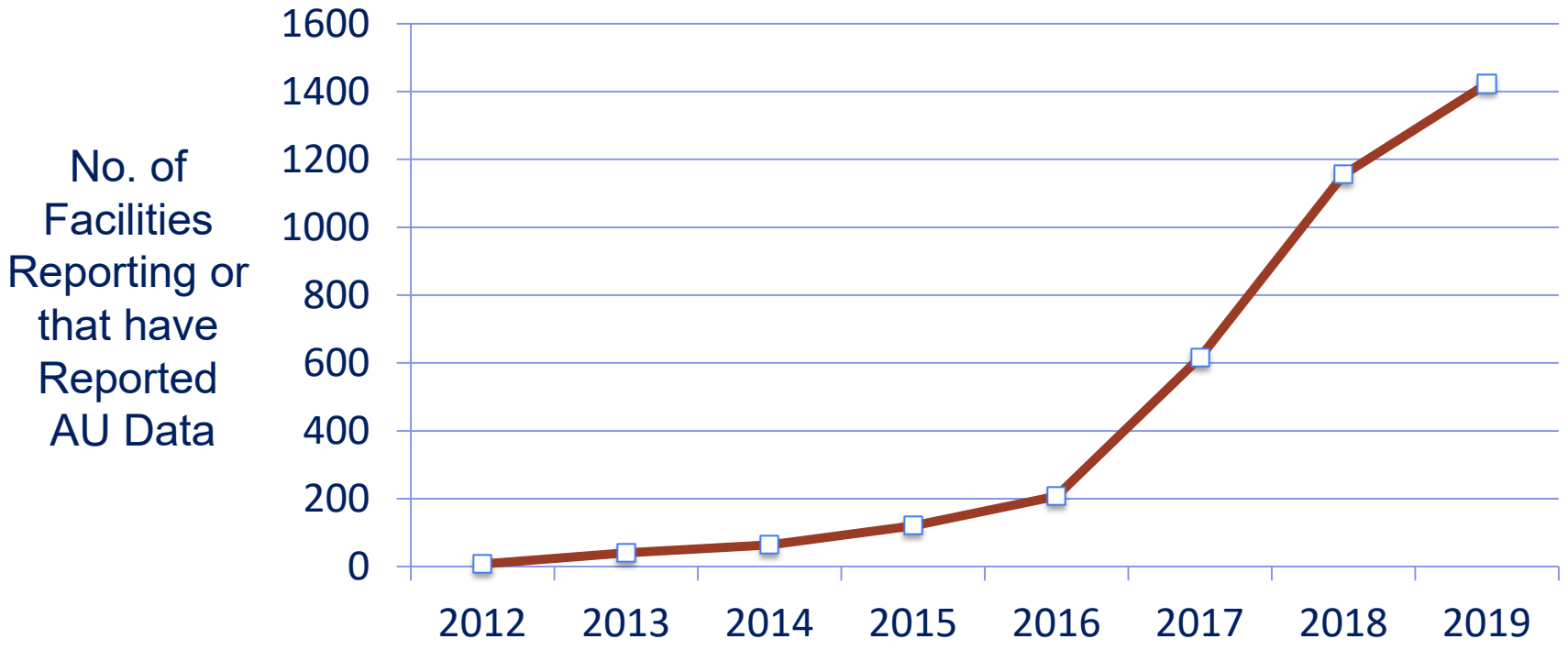
- Risk adjustment is critical- how do we do that?
- Requires care in interpretation.
  - A high ratio might reflect perfectly good use.
  - A low ratio might reflect poor use.
- Will the SAAR help stewardship program find opportunities for improvement?
- Will the SAAR accurately reflect improvements?

Using Data To Understand And Inform Actions

- What can we learn from the top performers?
- All of them do prior authorization and/or post prescription review.



Yearly Submission into the NSHN Antibiotic Use Option*



*As of Sept 1, 2019

Connecting the Dots - The Key Role of the Microbiology Lab

- Our experience in infection prevention has shown us that the microbiology lab must be a key partner.
- We've seen that the mis-use of lab tests can adversely impact our infection prevention efforts.
- The same holds true for antibiotic stewardship.

Asymptomatic Bacteriuria in Hospitalized Patients

Study	Patient Population	Lack of Adherence to Guidelines
Dalen, 2005	Catheter associated ASB n=29	52% prescribed antibiotics
Gandhi, 2009	Patients with UTI diagnosed n=49	32.6% did not meet criteria for UTI
Cope, 2009	Catheter associated ASB n=169	32% prescribed antibiotics
Spivak, 2017	Patients with bacteruria n=2225	72% of patients with ASB got antibiotics

Dalen DM et al. Can J Infect Dis Med Microbiol. 2005;16:166.
Gandhi T et al. Infect Control Hosp Epidemiol. 2009;30:193.
Cope M et al. Clin Infect Dis. 2009;48:1182.
Spivak ES et al. Clin Infect Dis, 2017;65:910

New CDI Testing Guidance: IDSA & SHEA

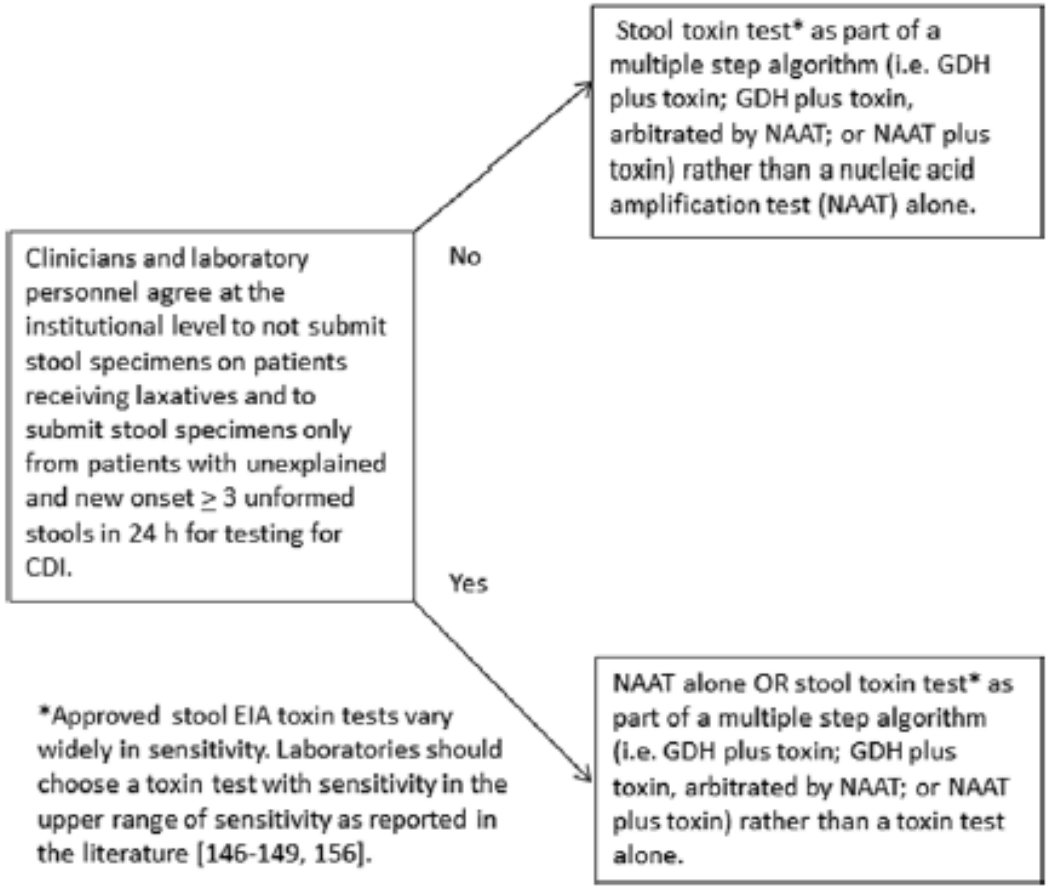


Figure 2. *Clostridium difficile* infection laboratory test recommendations based on preagreed institutional criteria for patient stool submission. Abbreviations: CDI, *Clostridium difficile* infection; EIA, enzyme immunoassay; GDH, glutamate dehydrogenase; NAAT, nucleic acid amplification test.

The Key Role of the Microbiology Lab

- We’re also seeing more and more new tests coming on-line.
- Often with the promise of better results for better care.
- Results have been mixed.

We Need Better Diagnostic Tools in Microbiology

We Need Better Diagnostic Tools in Microbiology

This Will Only Get More Challenging

- MALDI-TOF
- PNA-FISH
- Multi-plex PCR panels are now available for respiratory and GI specimens.

The other available panels are:

- BIOFIRE® FILMARRAY® ME panel
- BIOFIRE® FILMARRAY® BCID panel
- BIOFIRE® FILMARRAY® GI panel
- BIOFIRE® FILMARRAY® Pneumonia Panel *plus*

22 targets at once

TOP

The BIOFIRE® FILMARRAY® Respiratory Panel *2 plus* is incredibly comprehensive, with **simultaneous testing for 22 of the most common pathogens involved in TRI**.

Viruses	Bacteria	
Adenovirus Coronavirus 229E Coronavirus HKU1 Coronavirus OC43 Coronavirus NL63 Human Metapneumovirus Human Rhinovirus/Enterovirus Influenza A Middle East Respiratory Syncial CoronaVirus (Mers-CoV)	Influenza A/H1 Influenza A/H1-2009 Influenza A/H3 Influenza B Parainfluenza 1 Parainfluenza 2 Parainfluenza 3 Parainfluenza 4 RSV	*Bordetella pertussis* *Bordetella parapertussis* *Chlamydophila pneumoniae* *Mycoplasma pneumoniae*

GI Multiplex Panel

Rapid detection of gastrointestinal infections caused by:

-*Campylobacter* species (*Campylobacter jejuni/Campylobacter coli/Campylobacter upsaliensis*)

-*Clostridioides (Clostridium) difficile* toxin A/B

-*Plesiomonas shigelloides*

-*Salmonella* species

-*Vibrio* species (*Vibrio parahaemolyticus, Vibrio vulnificus, Vibrio cholerae*)

-*Vibrio cholerae*

-*Yersinia species*

-Enteroaggregative *Escherichia coli* (EAEC)

-Enteropathogenic *E coli* (EPEC)

-Enterotoxigenic *E coli* (ETEC)

-Shiga toxin

-*E coli* O157

-*Shigella*/Enteroinvasive *E coli* (EIEC)

-*Cryptosporidium* species

-*Cyclospora cayetanensis*

-*Entamoeba histolytica*

-*Giardia*

-Adenovirus F 40/41

-Astrovirus

-Norovirus GI/GII

-Rotavirus A

-Sapovirus

New and Better Microbiology Tests Will Not Solve All of Our Stewardship Challenges

- In a 2011 survey in ~180 hospitals, CDC and state collaborators reviewed charts of patients who got antibiotics to determine the reason for use:
  - Lower respiratory tract infections: 34.6%
  - Urinary tract infections: 22.3%
  - Skin and soft tissue infections: 16.1%
- Total for these three: 73%!

JAMA. 2014;312(14):1438-1446

Routine molecular point-of-care testing for respiratory viruses in adults presenting to hospital with acute respiratory illness (ResPOC): a pragmatic, open-label, randomised controlled trial

Nathan J Brendish, Ahalya K Malachira, Lawrence Armstrong, Rebecca Houghton, Sandra Aitken, Esther Nyimbili, Sean Ewings, Patrick J Lillie, Tristan W Clark

Lancet Respir Med 2017; 5: 401–11

- Influenza A (H1 and H3), influenza B, respiratory syncytial virus, rhinovirus or enterovirus (without specifying which), human metapneumovirus, parainfluenza virus types 1–4, coronaviruses (OC43, 229E, HKU1, and NL63), and adenovirus.
- Did not reduce portion of patients treated with antibiotics
  - Many patients treated before results available
- No reduction in duration of antibiotics overall
  - More patients in POCT had single doses, brief courses
  - Improved influenza detection and antiviral use
- Reduced length of stay!

ORIGINAL ARTICLE

Procalcitonin-Guided Use of Antibiotics for Lower Respiratory Tract Infection

David T. Huang, M.D., M.P.H., Donald M. Yealy, M.D., Michael R. Filbin, M.D., Aaron M. Brown, M.D., Chung-Chou H. Chang, Ph.D., Yohei Doi, M.D., Ph.D., Michael W. Donnino, M.D., Jonathan Fine, M.D., Michael J. Fine, M.D., Michelle A. Fischer, M.D., M.P.H., John M. Holst, D.O., Peter C. Hou, M.D., et al., for the ProACT Investigators*

July 19, 2018
N Engl J Med 2018; 379:236-249
DOI: 10.1056/NEJMoa1802670

- Conclusions
- The provision of procalcitonin assay results, along with instructions on their interpretation, to emergency department and hospital-based clinicians did not result in less use of antibiotics than did usual care among patients with suspected lower respiratory tract infection

Dr. John Bartlett observed

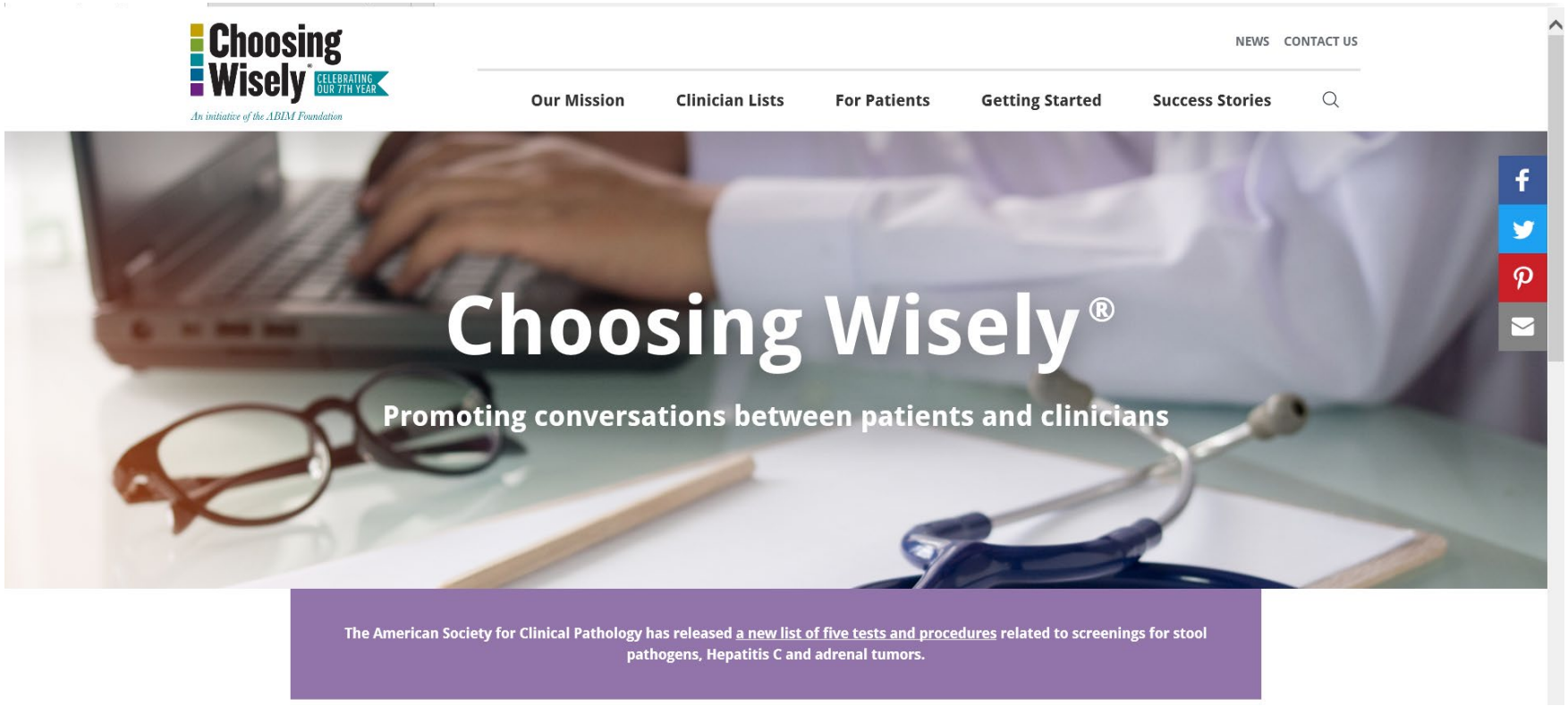
“our technical capabilities are exceeding our ability to apply them effectively and economically to human problems…..faced with a superabundance of academic information and pressure to perform exhaustive, expensive, clinically irrelevant [testing]….which, when misguided….misleads physicians into erroneous diagnosis and inappropriate therapy”

Dr. John Bartlett observed - In 1974!

"our technical capabilities are exceeding our ability to apply them effectively and economically to human problems…..faced with a superabundance of academic information and pressure to perform exhaustive, expensive, clinically irrelevant [testing]….which, when misguided….misleads physicians into erroneous diagnosis and inappropriate therapy"

Where Does This Leave Us?

- We have two roles to play when it comes to microbiology testing in infection prevention:
  - What are the right tests to bring into our hospitals?
  - How can we help people use and interpret them properly?
- There is huge overlap here with stewardship.
- Sometimes the most important question is not “what test do I order?”, but “do I need to order a test at all?”
- This can be broadly thought of as “diagnostic stewardship”

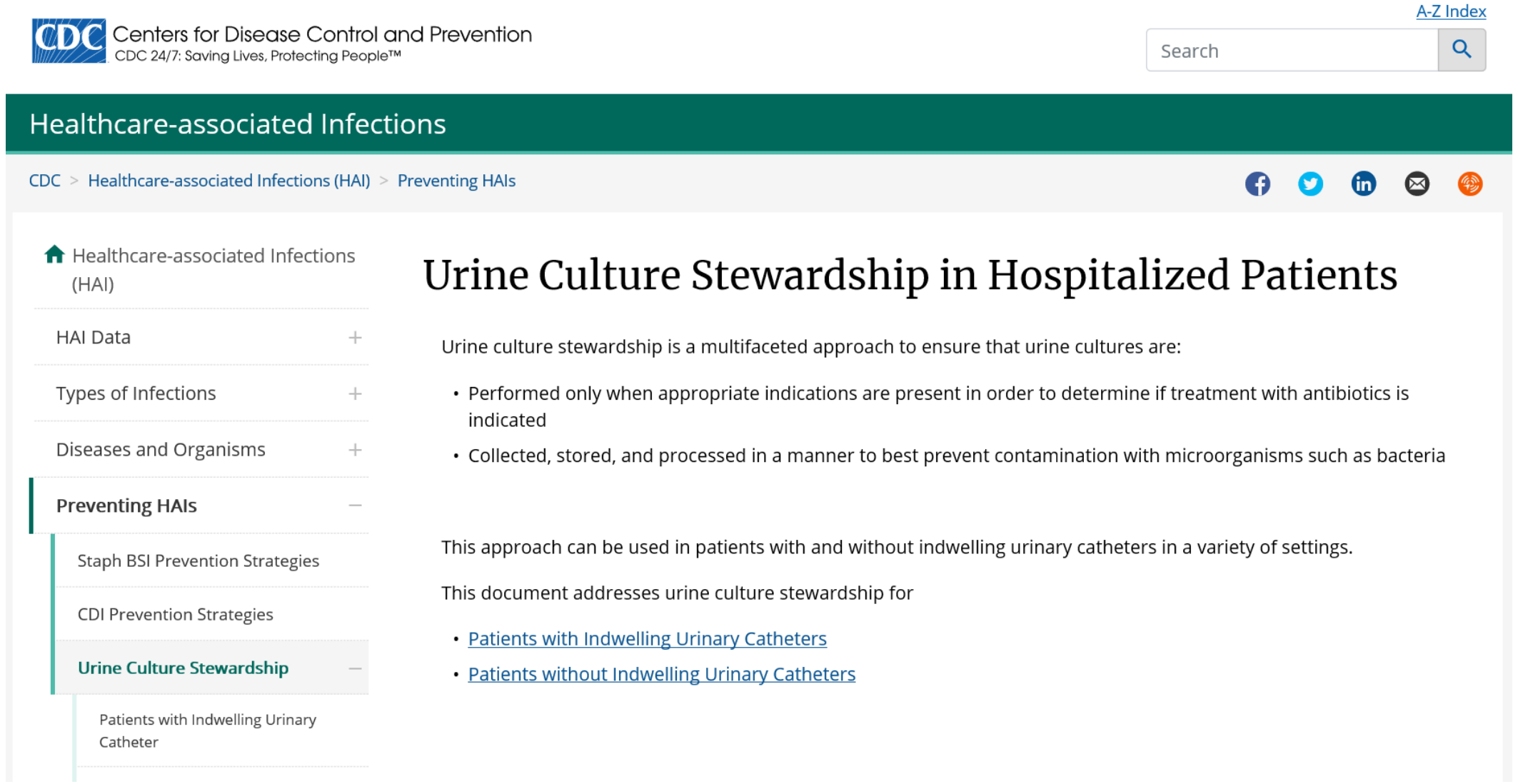


- Choosing Wisely is an initiative of the ABIM Foundation that seeks to advance a national dialogue on avoiding unnecessary medical tests, treatments and procedures.
- Unnecessary urine cultures are highlighted.

“Kicking CAUTI”- Improving Antibiotic Use Through Better Test Ordering

- Developed a simple algorithm to guide sending of urine cultures.
- Overtreatment of ASB during intervention fell:
- From 1.6 to 0.6 per 1000 bed-days; (IRR, 0.35; 95% CI, 0.22-0.55)
- Reductions persisted during the maintenance period: 0.4 per 1000 bed-days; (IRR, 0.24; 95% CI, 0.13-0.42)
- $P < .001$ for both

JAMA Intern Med. 2015 Jul;175(7):1120-7.



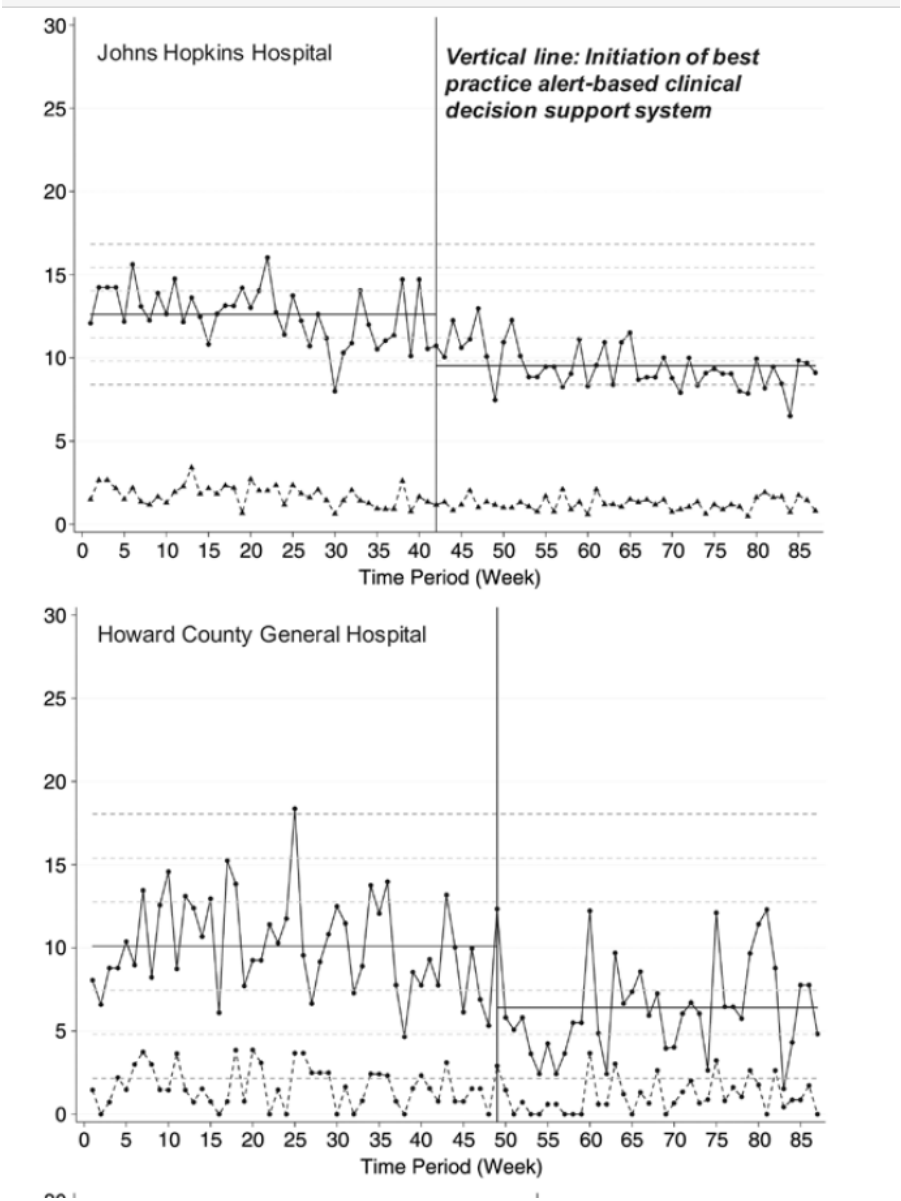
- https://www.cdc.gov/hai/prevent/cauti/index.html

Addressing *C. difficile* Through Better Use of Diagnostics

- Investigators at Johns Hopkins health system developed a best practice alert in the order system which was triggered in the setting of:
- (i) laxative administration within the preceding 48 hours,
- (ii) negative C. difficile test within the previous 7 days,
- (iii) a positive test within the previous 14 days

- Masako Mizusawa et al. CID 2019

Results: Weekly Number of C. difficile Tests Ordered



Improving Antibiotic Prescribing for Respiratory Cultures

- Beginning in May 2016, respiratory cultures with no dominant organism growth and no Pseudomonas sp. or Staphylococcus aureus were reported by the clinical microbiology laboratory as “commensal respiratory flora only: No S. aureus/MRSA [methicillin-resistant Staphylococcus aureus] or P. [Pseudomonas] aeruginosa.” Before intervention, these were reported as “commensal respiratory flora.”

Musgrove, MA. Open Forum Infect Dis. 2018 Jul; 5(7): ofy162.

Improving Antibiotic Prescribing for Respiratory Cultures

- De-escalation/discontinuation was more commonly performed in the intervention group (39% vs 73%, P < .001).
- After adjusting for APACHE II and Charlson Comorbidity Index, the intervention comment was associated with a 5.5-fold increased odds of de-escalation (adjusted odds ratio, 5.5; 95% confidence interval, 2.8–10.7).
- Acute kidney injury was reduced in the intervention phase (31% vs 14%, P = .003).

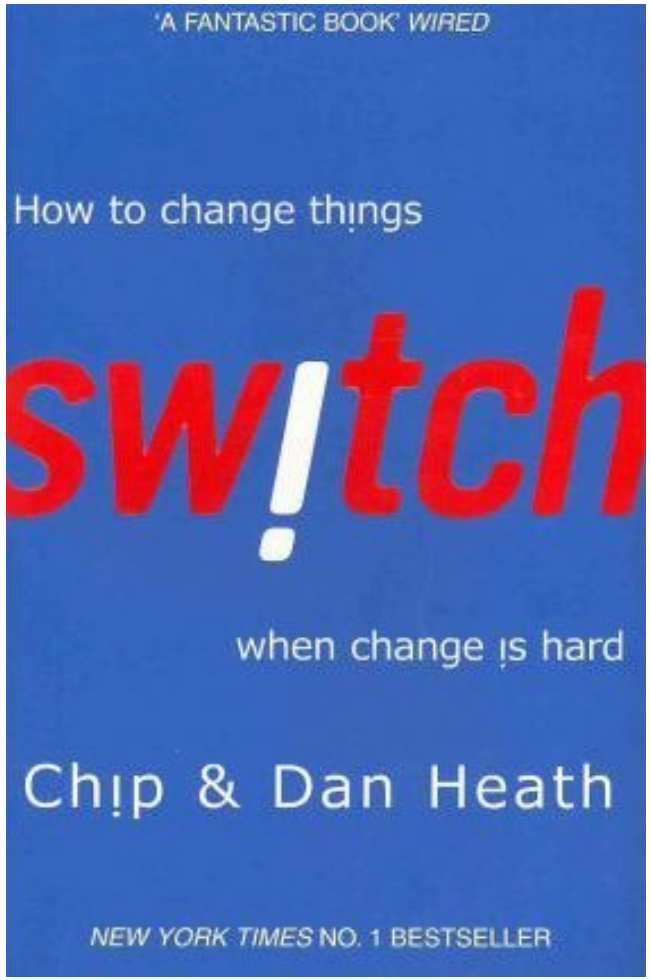
Musgrove, MA. Open Forum Infect Dis. 2018 Jul; 5(7): ofy162.

Using Behavioral Psychology in Infection Prevention Interventions

- We’re beginning to tap into this powerful tool.
- We need to do it more!

Using Behavioral Psychology in Infection Prevention Interventions

- Direct the rider
  - Follow the bright spots
- Motivate the elephant
  - Find the feeling
- Shape the path
  - Tweak the environment



Using Behavioral Psychology in Infection Prevention Interventions

- Direct the rider- Follow the bright spots
- “Positive deviance”- what can we learn from high performers that will help us improve practices?

Using Behavioral Psychology in Infection Prevention Interventions

- Motivate the elephant- Find the feeling
- “You are a Top Performer:
  You are in the top 10% of clinicians. You wrote 0 prescriptions out of 21 acute respiratory infection cases that did not warrant antibiotics. ”
- “You are not a Top Performer:
  Your inappropriate antibiotic prescribing rate is 15%. Top performers' rate is 0%. You wrote 3 prescriptions out of 20 acute respiratory infection cases that did not warrant antibiotics.”
- Mean antibiotic prescribing for antibiotic-inappropriate diagnoses decreased from 19.9% to 3.7% (-16.3%)

Meeker, Linder, et al. *JAMA* 2016;315(6): 562-570.

Motivate the Elephant- The "Ikea Effect"

- Perhaps stewardship interventions would be more effective if they were designed in collaboration with providers.
- Maybe especially with the providers who are the worst offenders.
- This approach has been effective in improving prescribing in hospitals Europe and the US.
- And had added benefits:
  - Stewardship interventions became a partnership
  - Stewardship programs could refer outliers and complainers to someone in their own department

Haas MK et al. Open Forum Infectious Diseases. 2016
Sikkens et al. JAMA Intern Med, 2017

Using Behavioral Psychology in Infection Prevention Interventions

- Shape the path- Tweak the environment
- We have lots of opportunities here with the growth of computer order entry and electronic health record systems.
- Best practice alerts
- Hard stops and forced functions
- Automatic stop orders
- Opt-out protocols

Lessons From Behavioral Psychologists- “Opt-Out” Policies

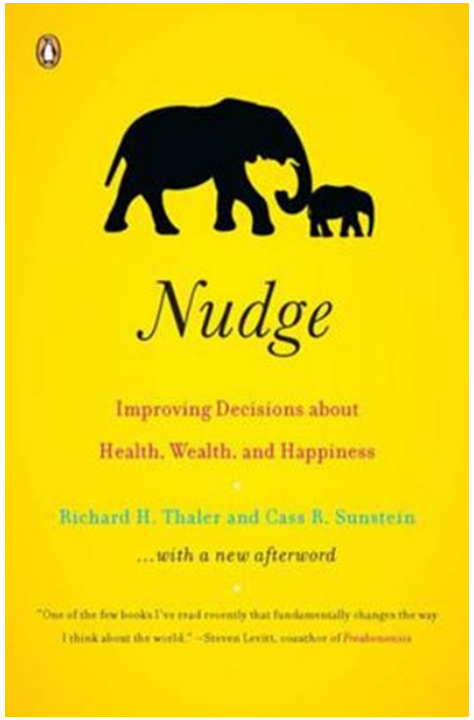
- Organ donation rates in “opt-out” countries ~90% vs <15% in opt-in
- Retirement savings “opt-out” policies increase participation by 35%
- Why not for antibitoics?
- Duke conducting an opt-out on a study for patients started on a sepsis pathway.
- For patients who don’t meet sepsis criteria after a pre-specified time, antibiotics will automatically be de-escalated unless the provider opts out.

https://sparq.stanford.edu/solutions/opt-out-policies-increase-organ-donation
https://www.nber.org/aginghealth/summer06/w12009.html

Shape The Path. How To Put New Ideas Into Practice?

- Max Planck:
- A scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it.

- Thaler and Sunstein:
- You find ways to nudge them forward.



What Is a Nudge?

- Different from a forced function or automatic stop.
- Guides people to make the optimal selection while still preserving a wide range of choice freedom.
- Putting the preferred test selection or antibiotic at the top of the selection options.
- Putting a comment in the microbiology results.

Conclusions

- Diagnostic stewardship is the perfect intersection of infection prevention, antibiotic stewardship and microbiology.
- If we can get this right, it's a win-win-win-win.
  - With patients being the ultimate winner
- For this to work, all three of these groups has to be equally engaged and aware of what's possible.
- You will be perfectly positioned after today.

Now It’s Your Turn

- Pick a group at your table and design a diagnostic stewardship intervention.
- Think about how you might apply some type of behavioral psychology principle to your intervention.
- It can be similar to something you’ve already seen! But think about what you might do differently.