Quality Improvement for Hospital Epidemiology and Infection Prevention Programs: A Practical Approach

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Florida Hospital, Orlando

FIME Patient Safety & Quality Congress
July 17, 2018

2017: Zero Accident Deaths on Commercial Passenger Jets

Outline & Objectives

- Current state: the need for QI in healthcare & infection prevention
- Principles of QI, applied to Florida Hospital
- Examples of QI projects at FH
  - Improving immunization
  - *C. difficile* reduction
  - *Legionella*
  - Organisms of epidemiologic significance

Numerical Impact of Med Errors

- Estimates: 50-400K deaths
- Heterogenous definitions
- Don't argue about numbers, get to work!

Institute of Medicine, To Err is Human 1999
James JT. J Patient Saf 2013;9: 122-128
Makary M. BMJ 2016; 353 i2139
https://oig.hhs.gov/oei/reports/oei-06-09-00090.pdf
New York Times, August 2016
http://www.nytimes.com/2016/08/16/upshot/death-by-medical-error-adding-context-to-some-scary-numbers.html

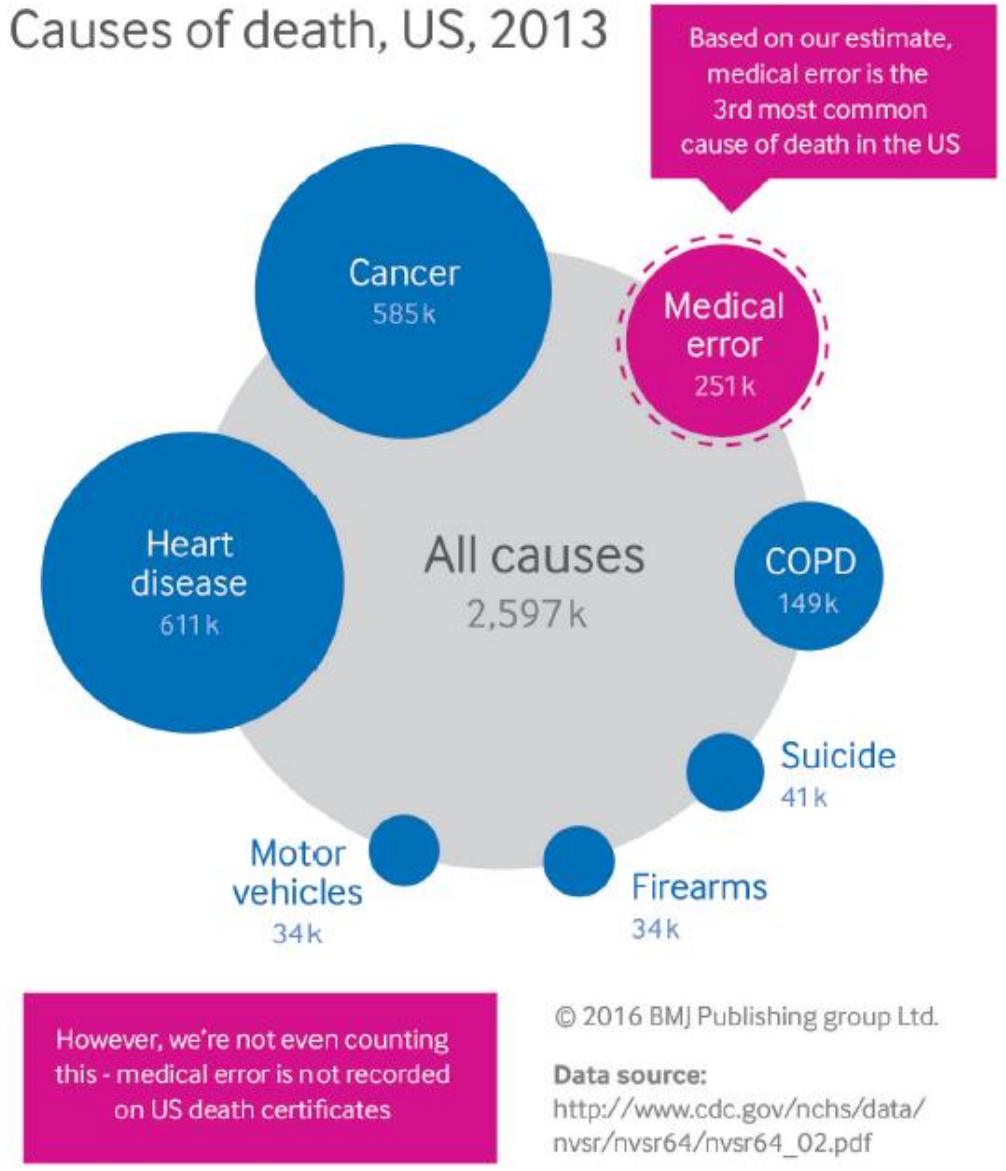


Fig 1 Most common causes of death in the United States, 2013[2]

Accountability for Healthcare Quality & Safety

- Consumers
- Payors: CMS (15% HAI)
- Legislators: public reporting
- Employers: Leapfrog (22% HAI)

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

FIVE-STAR RATED

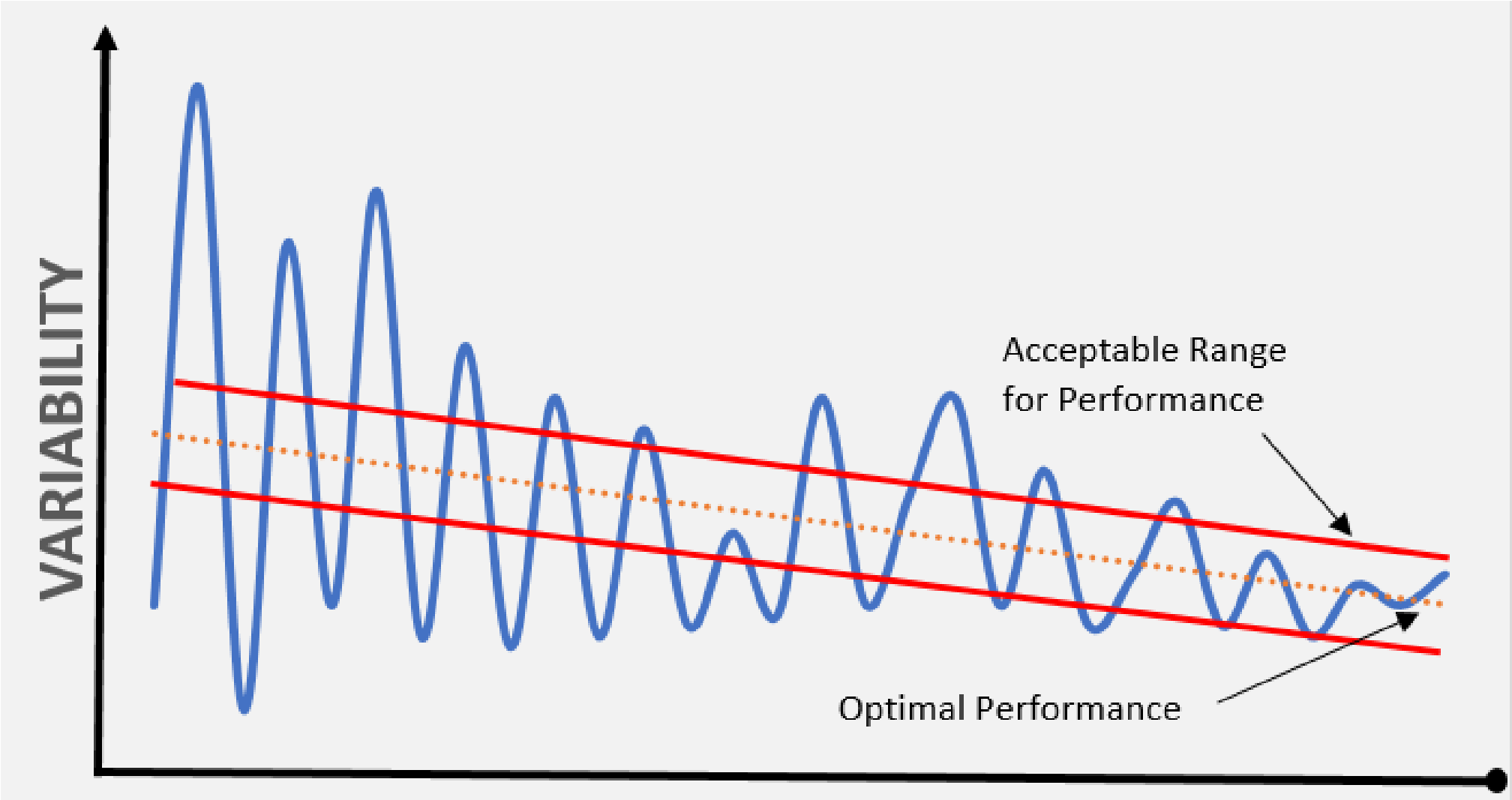
Burden of Healthcare Associated Infections

- 1 in 25 hospitalized will develop HAI (~722K)
- 75K deaths
- Pneumonia & SSIs rank #1

Type of infection	*Estimated number per year*	*Estimated cost per infection*	*Most common microbiologic etiologies*
Surgical site infection	157,500	$12,000 to $35,000	*Staphylococcus aureus,* coagulase-negative staphylococci, *Escherichia coli*
Catheter-associated urinary tract infection	93,300	$1,000	*E. coli, Pseudomonas aeruginosa, Klebsiella* species
Clostridium difficile infection	80,400	$6,000 to $9,000	*C. difficile*
Central line–associated bloodstream infection	71,900	$7,000 to $29,000	*S. aureus,* coagulase-negative staphylococci, *Enterococcus* species
Ventilator-associated pneumonia	49,900	$20,000 to $29,000	*S. aureus, P. aeruginosa, Klebsiella* species

Magill SS et al. N Engl J Med. 2014;370(13):1198-1208
Scott RD. http://www.cdc.gov/hai/pdfs/hai/scott_costpaper.pdf
Table from Hsu VP. Prevention of Health Care-Associated Infections. Am Fam Physician 2014;90(6)

Greatest Threat to Healthcare: Variability



Edelstein P. Addressing the greatest threat to healthcare. ELSEVIER white paper, Oct 2016. Accessed at https://www.elsevier.com/__data/assets/pdf_file/0005/221918/WhitePaper-CareVariability-US-V03.pdf

- Care-delivery processes are not standardized, are dependent on individuals, which leads to errors.
- The technology is the easiest part
- The hard part is how to get the doctors, nurses, and administrators to agree on what is the best way to deliver the care

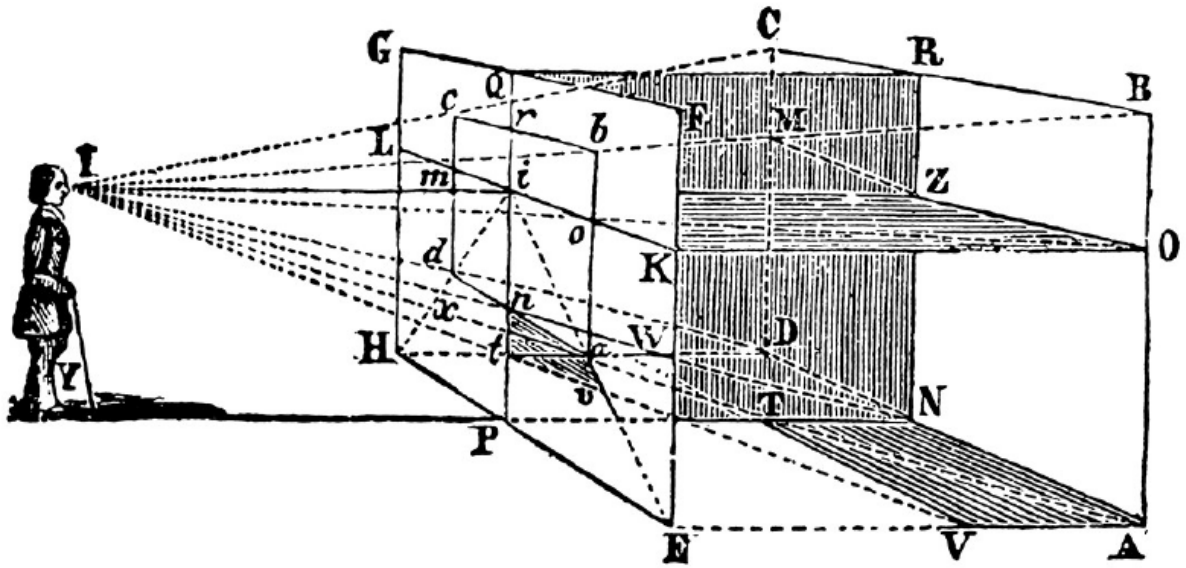
Harvard Business Review

IT

Why Process Is U.S. Health Care's Biggest Problem

by John S. Toussaint and Kathryn Correia

MARCH 19, 2018

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HATHAWAY
JPMORGAN CHASE &

The Case for Quality Improvement: It's Here and Works!

- Systematic, continuous actions leading to measurable improvement in performance of healthcare services
- Basics
  - Analyzes data
  - Establishes culture of quality
  - Determines & prioritizes potential areas for improvement
  - Ongoing evaluation
  - Communicate & spread successes

About Our Facility

- Nine-campus system with 2,247 acute care beds
- 120K admissions, 500K ED visits
- Committed to safety & improved patient outcomes
- Infection prevention program focused on HAI and outbreak prevention

How We Approach QI Improvement

Team

CHOOSING A TOPIC

- What is the impact?
  - Mortality
  - Reimbursement
- What is the necessity?
- Is it measurable?
- Is it feasible?

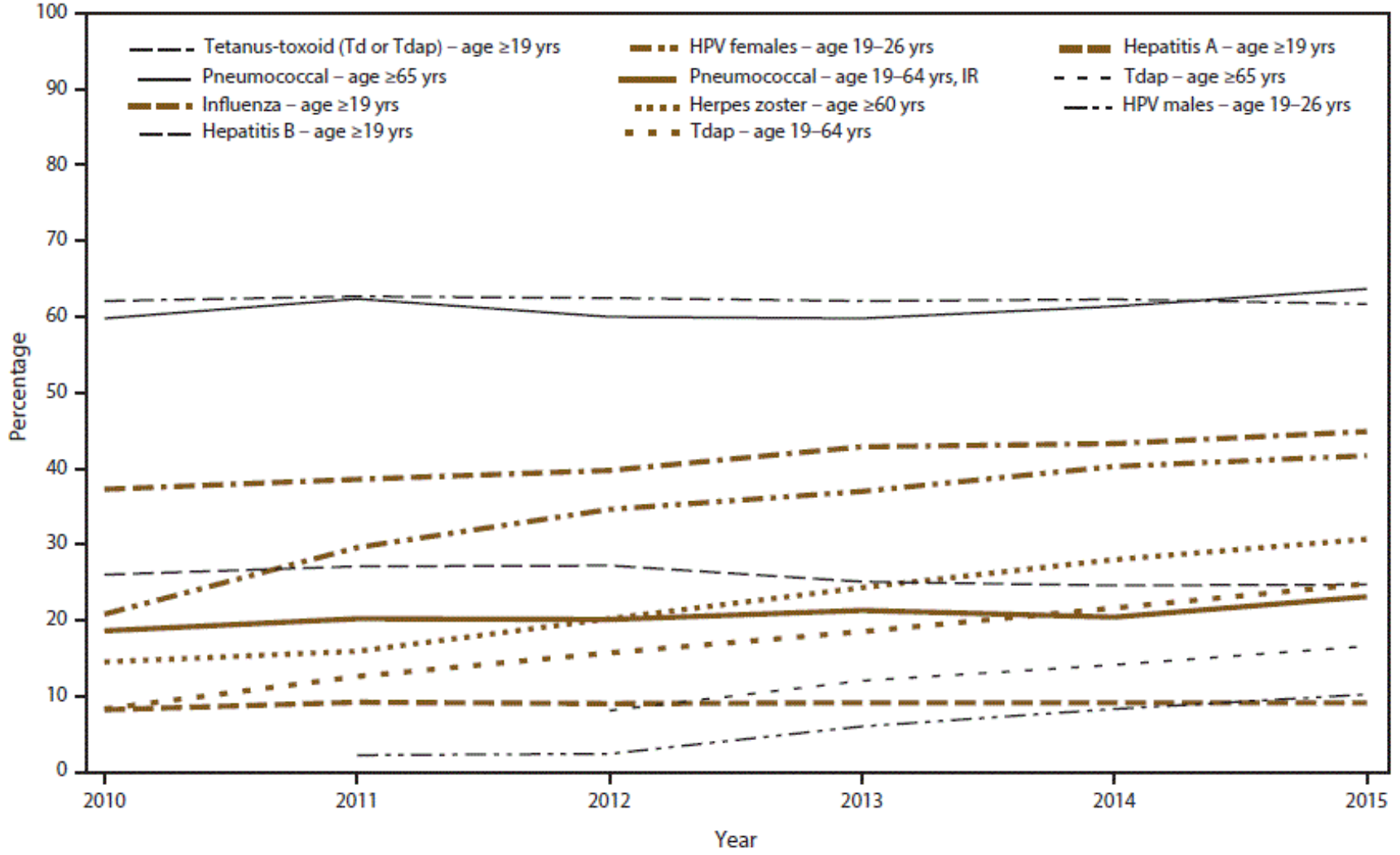
STEPS

- Leadership support
- Define scope, objectives, goals, team
- Develop strategies, assess barriers
- Implement, measure and analyze
- Feedback
- Reincorporate lessons learned

QI Area #1: Low Vaccination Rates in the Ecosystem

Proportion of Adults Receiving Vaccines

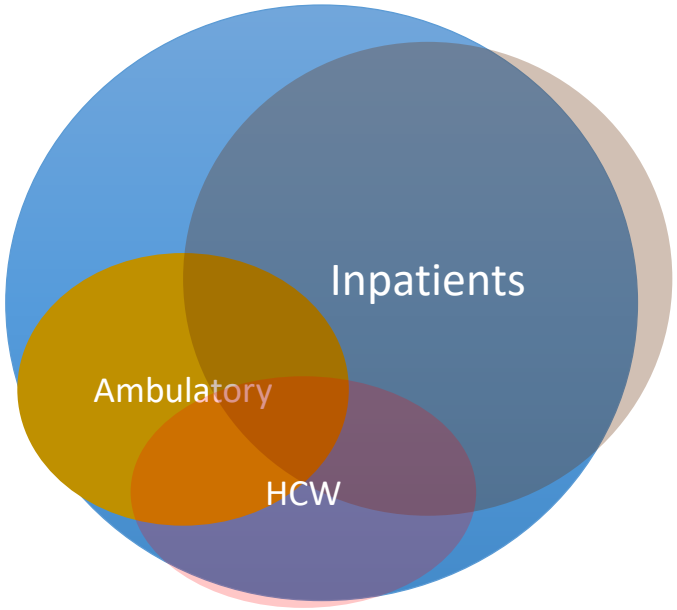
US National Health Interview Survey, 2010-15



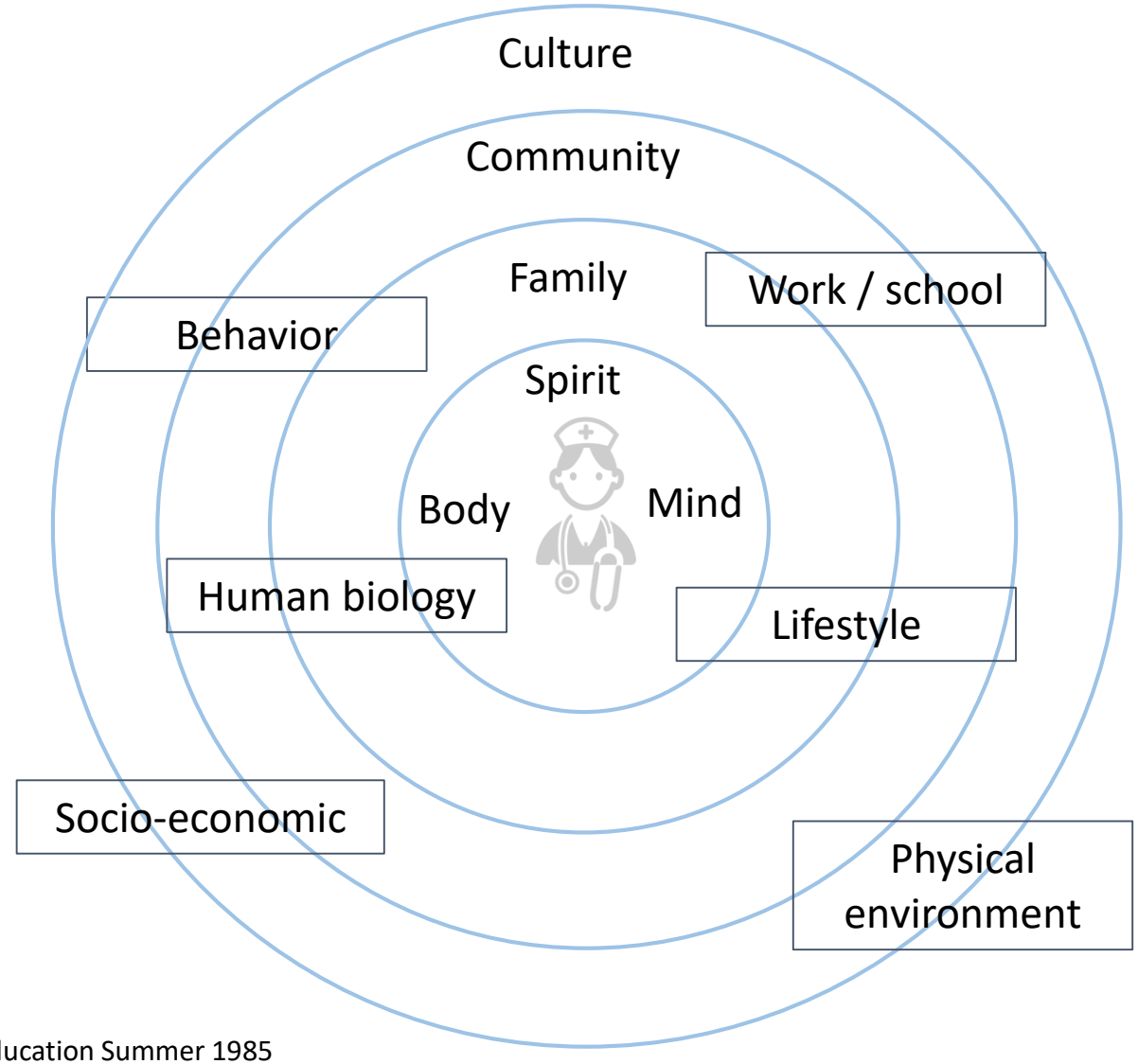
CDC MMWR 2017 Accessed at https://www.cdc.gov/mmwr/volumes/66/ss/ss6611a1.htm

Defining Scope & Getting Leadership Support for Each Ecosystem

- Leadership: operational, clinical champion, who is accountable
- Inpatients & healthcare workers (HCW)
  - Rationale: regulatory, standards of care, reimbursement
  - Inpatients: new process change (pneumococcal, flu)
  - HCW: how to make more available, enhance current process (TdaP, flu)
- Ambulatory: residency program & clinic director (TdaP, flu, pneumococcal, zoster)



Developing Strategy: Determinants of Health



Adapted from Hancock and Perkins, Health Education Summer 1985

Strategy: Assess Barriers & Opposition to Vaccines

Barriers to Immunization

Patient Barriers

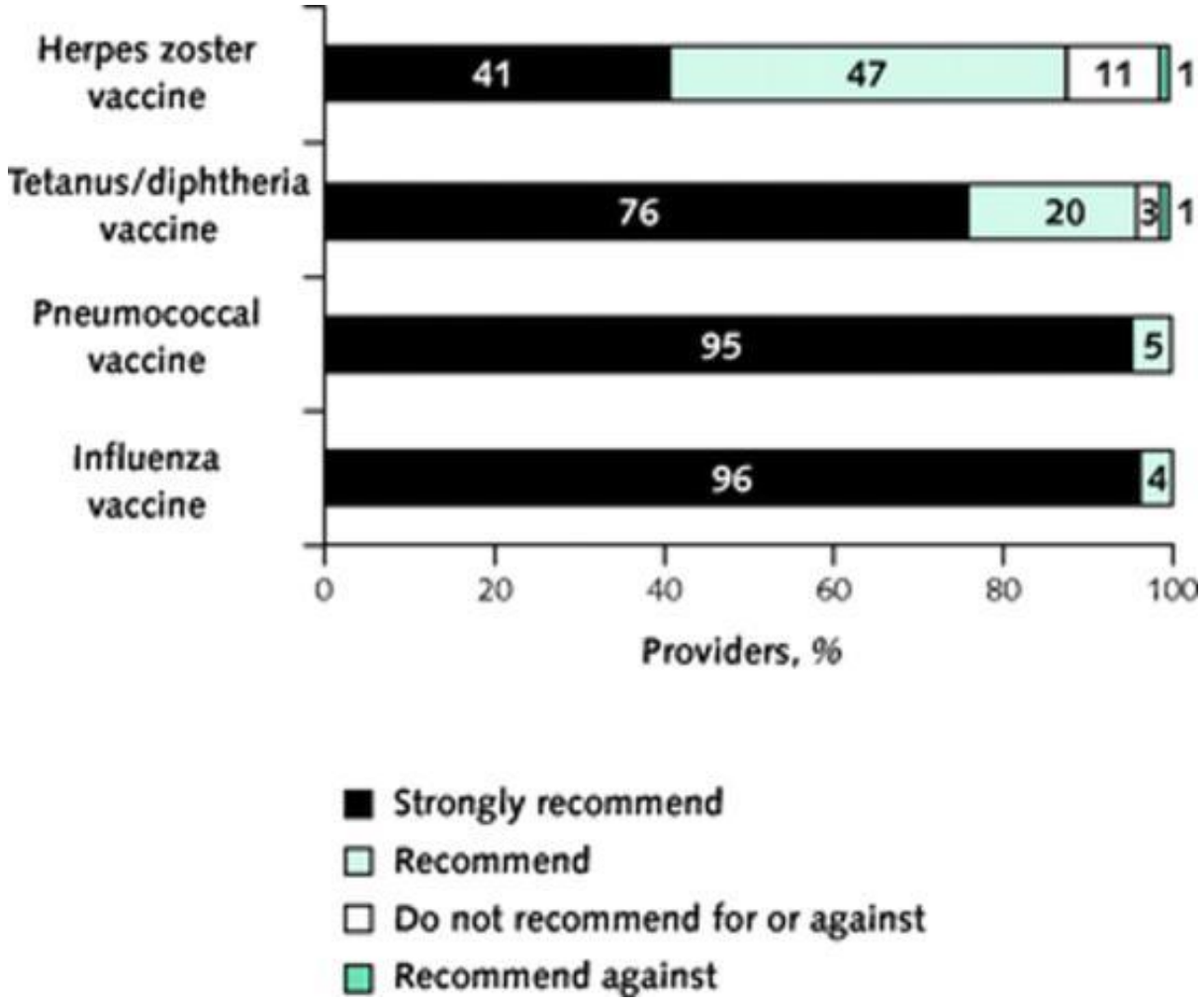
- Economic
- Lack of access
- Mistaken assumptions
  - Efficacy/safety
  - I don’t need
  - Educational deficit
- Provider did not recommend

Provider Barriers

- Economic
- Lack of a system
- Lack of time
- Patient refused
- Provider did not recommend
  - Training / culture
  - Low priority
  - Apathy

(1) Poland GA, Immunization against vaccine-preventable diseases: overcoming the barriers to adult vaccination. Medscape Education accessed June 2, 2013 at http://www.medscape.org/viewarticle/5617065; (2) Johnson DR. Barriers to adult immunization *Am J Med* 2008;121:S28-35 (3) Hurley LP. Ann Int Med 2010; 152:555-560

Strategy: Make Strong Recommendation for Vaccine



Ding H, et al. *Am J Obstet Gynecol*. 2011;204(6 Suppl 1):S96-S106.

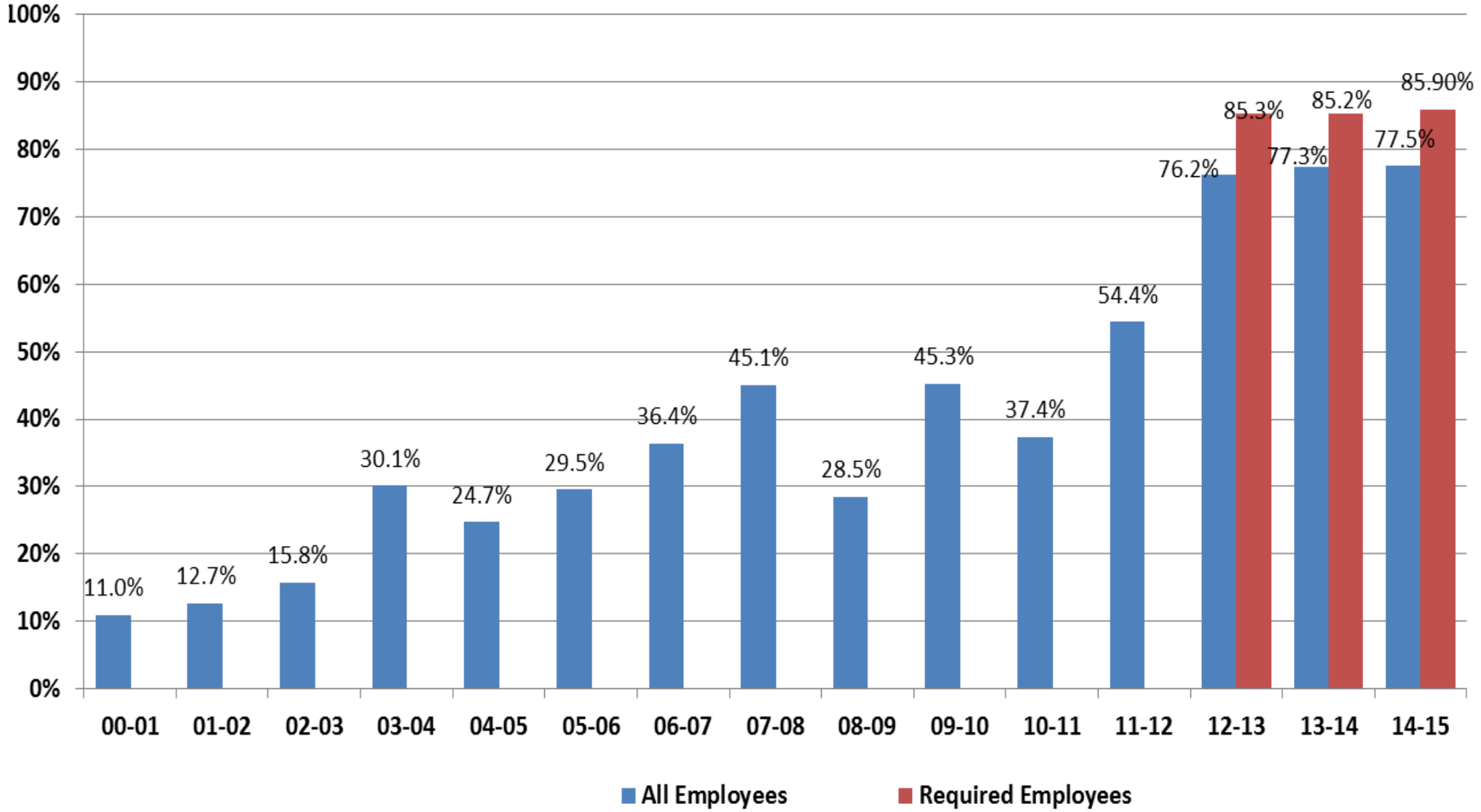
Hurley LP. Ann Int Med 2010; 152:555-560 Accessed at https://annals.org/article.aspx?articleid=745758

Strategy: Standing Orders Are Effective in Improving Rates!

- Written protocols approved by authorized practitioner
  - Assess patient's need for vaccination
  - Administer vaccine without clinician's direct involvement at time of interaction
- Most effective single approach to improve adult vaccinations, yet utilized in less than 50% of providers
- Consists of assessment, documentation, management of medical emergency, adverse events, authorization
- Nurses design protocols, counsel patients, administer vaccine

www.thecommunityguide.org/vaccines/standingorders.html

Florida Hospital Employee Influenza Vaccination Rate, 2000-15



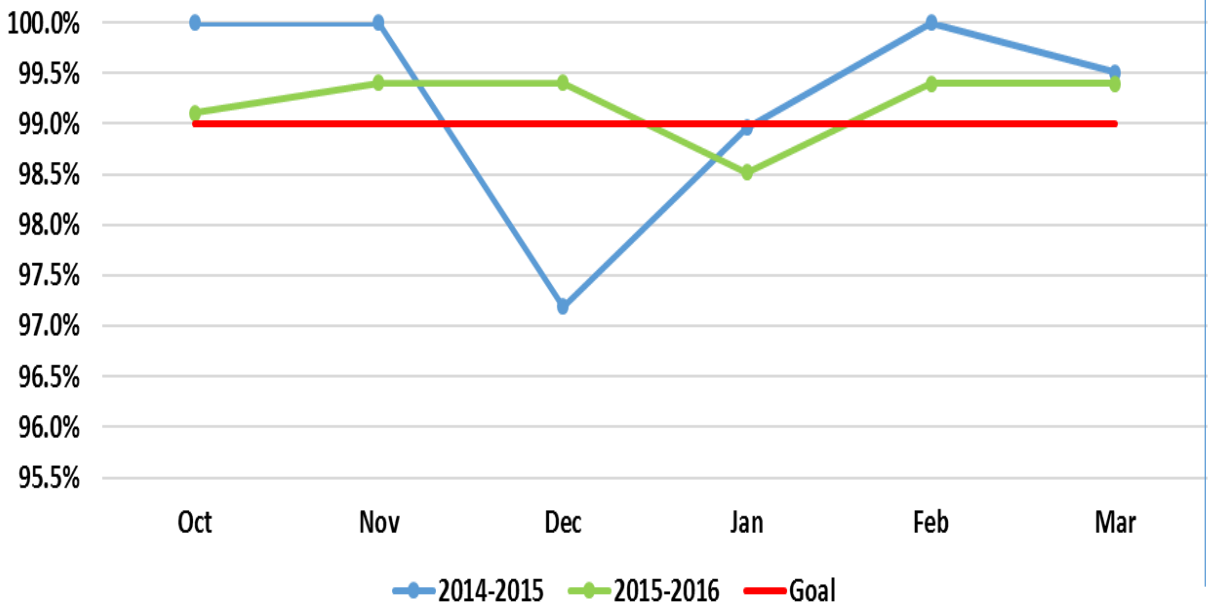
Redesign What Doesn't Work. If Patient Refuses

- Patient refusal does not necessarily mean opposition
- Assess barriers, listen to concerns
  - Financial
  - Pain with multiple vaccines
  - Specific vaccine
- Explain, but avoid pushing the issue
  - Scientific-clinical data, anecdotes, graphic images failed to sway parents opposed to MMR
  - Mixed results with HCW flu vaccination despite education, counseling
    - Randomized cluster trial: no change in flu vaccination rates among HCW using personalized counseling and education (FH unpublished data)

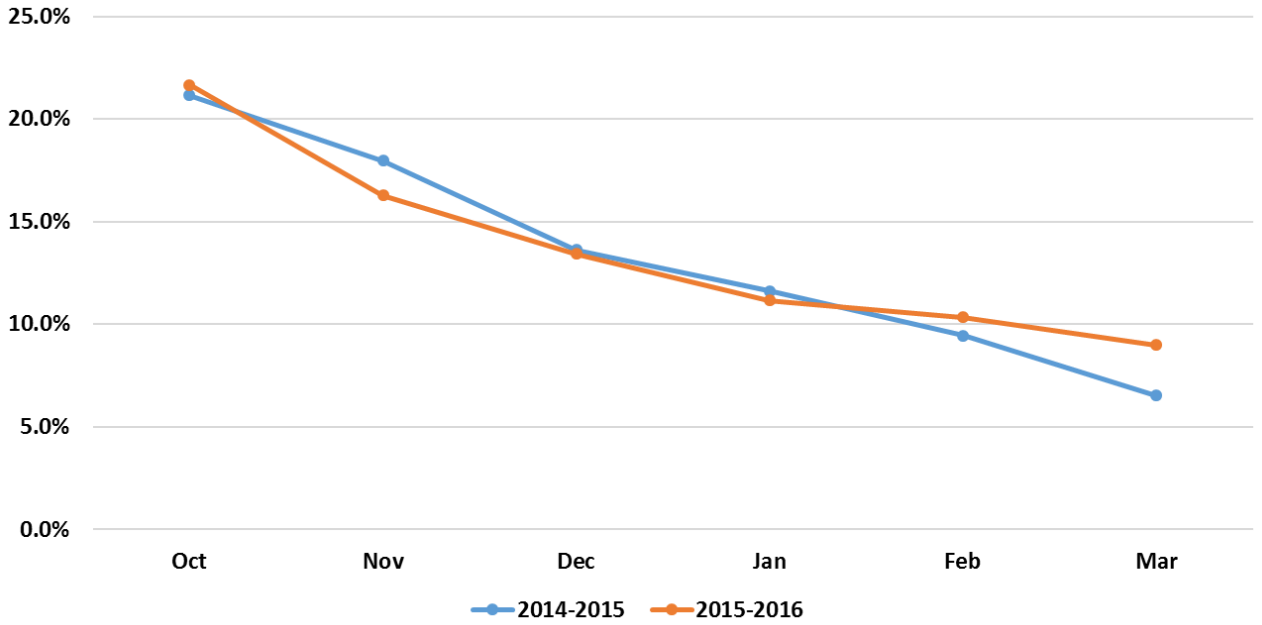
Diekema D. Responding to parental refusals of immunization of children. Pediatrics 2005;115:1428
Nyhan B. Effective messages in vaccine promotion: a randomized trial. Pediatrics. 2014 Apr;133(4):e835-42; Diekema D. Responding to parental refusals of immunization of children. Pediatrics 2005;115:1428

Despite Regulatory Compliance, Opportunities Exist to Improve Inpatient Flu Vaccination Rates

Percentage of Eligible Inpatients Offered Flu Vaccine, Florida Hospital, 2014-16



Flu Vaccine Inpatient Immunization Rates, Florida Hospital, 2014-16



- Hospital reported high compliance in offering inpatient flu vaccines to US Centers for Medicare & Medicaid
- Did not translate into significant vaccination rates, despite adding nurse scripting for 2015-16 season
- Need a redesign of inpatient vaccination process to improve rates

Designing a Community Initiative to Improve Adult Vaccination Rates

- Started 2016 October; in progress
- Orlando has many of the essential ingredients
  - Two large healthcare systems
  - Champions & administrative support
  - Relatively low vaccination rate
  - State vaccination registry: Florida Shots
- Objective: Implement an integrated community partnership approach to improve vaccination rates

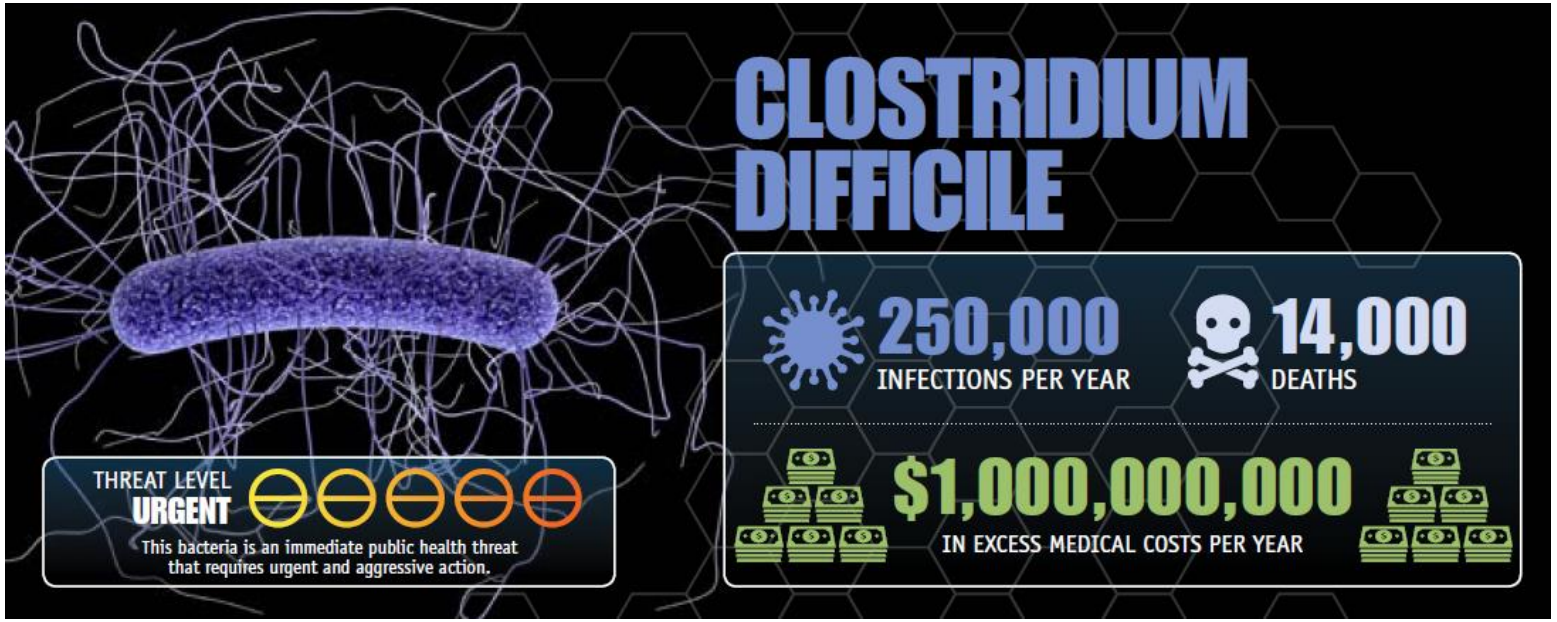
Designing Community Initiative, continued

- Potential strategies
  - Community summit
  - Reach out to consumers: marketing, advertising, social media, doctor's offices
  - Provider education & initiative: vaccination workshop
- Potential partners (stakeholders)
  - Private healthcare systems, including ambulatory
  - Industry
  - Pharmacies
  - Community health centers
  - Department of Health
- Opportunities
  - Scope: which stakeholders, which immunizations
  - Measurement: before & after rates, # of vaccines utilized

QI Area #2: Reduce High Healthcare-Onset *C. difficile* Rates

Impact of *C. difficile* Infections

- 15-30% of antibiotic-associated diarrhea
- 250-500K / year; 11K to 29K deaths annually
- 70% of all acute gastroenteritis deaths, mostly among 65 and older



Graphic from CDC. Antibiotic Resistance Threats in the United States, 2013; Lessa FC. N Engl J Med 2015;372:825-34.
Hall AJ. Clin Infect Dis 2012;55(2):216-23

The Problem with HAI *C. difficile* Infections

- Most cases due to expression of delayed onset disease from colonization, NOT hospital transmission
- Most cases of hospital-onset diarrhea are NOT CDI – laxatives, TF, antibiotics, etc
- Testing using PCR is extremely, maybe too sensitive
- Overtesting leads to overtreatment, overreporting, financial penalties

Walker AS, Eyre DW. Characterisation of *Clostridium difficile* hospital ward-based transmission using extensive epidemiological data and molecular typing. *PLoS Med* 2012;9:e1001172;
Kamboj J., Sepkowitz K et al. ***Infect Control Hosp Epidemiol***. 2016 Jan;37(1):8-15. doi: 10.1017/ice.2015.237
Cohen SH, et al. *Infect Control Hosp Epidemiol.* 2010;31(5):431-455.

What is Diarrhea? Bristol Stool Form Scale

Guideline: 3 or more unformed stools within a 24 hour period

Forming the Team

- Requires administrative support
- Team members and roles
  - IP: The “glue”, sets expectations, metrics
  - Pharmacist: reviewing indications and appropriateness of AST, abx
  - EVS: staffing ratio, standardized process, monitoring
  - Lab: rejecting formed stool, testing algorithm
  - Nursing: assess clinical symptoms
  - Physicians: Judicious testing, use abx, AST only when necessary, therapy

Reducing HO-*C. Diff* at FH: Four-Pronged Strategy & Summary of Actions

How can we measure that each action is making a difference?

Environmental Cleaning at FH

- Focus on traditional cleaning
  - Evaluating but not yet adopted UV-C
  - Sporicidal agent
  - Standardization of process
- Expectations & accountabilities
  - Staff ratio
  - Cleaning time
  - Management bonus
  - Metrics: internal & external audit agreements
    - ATP
    - Process

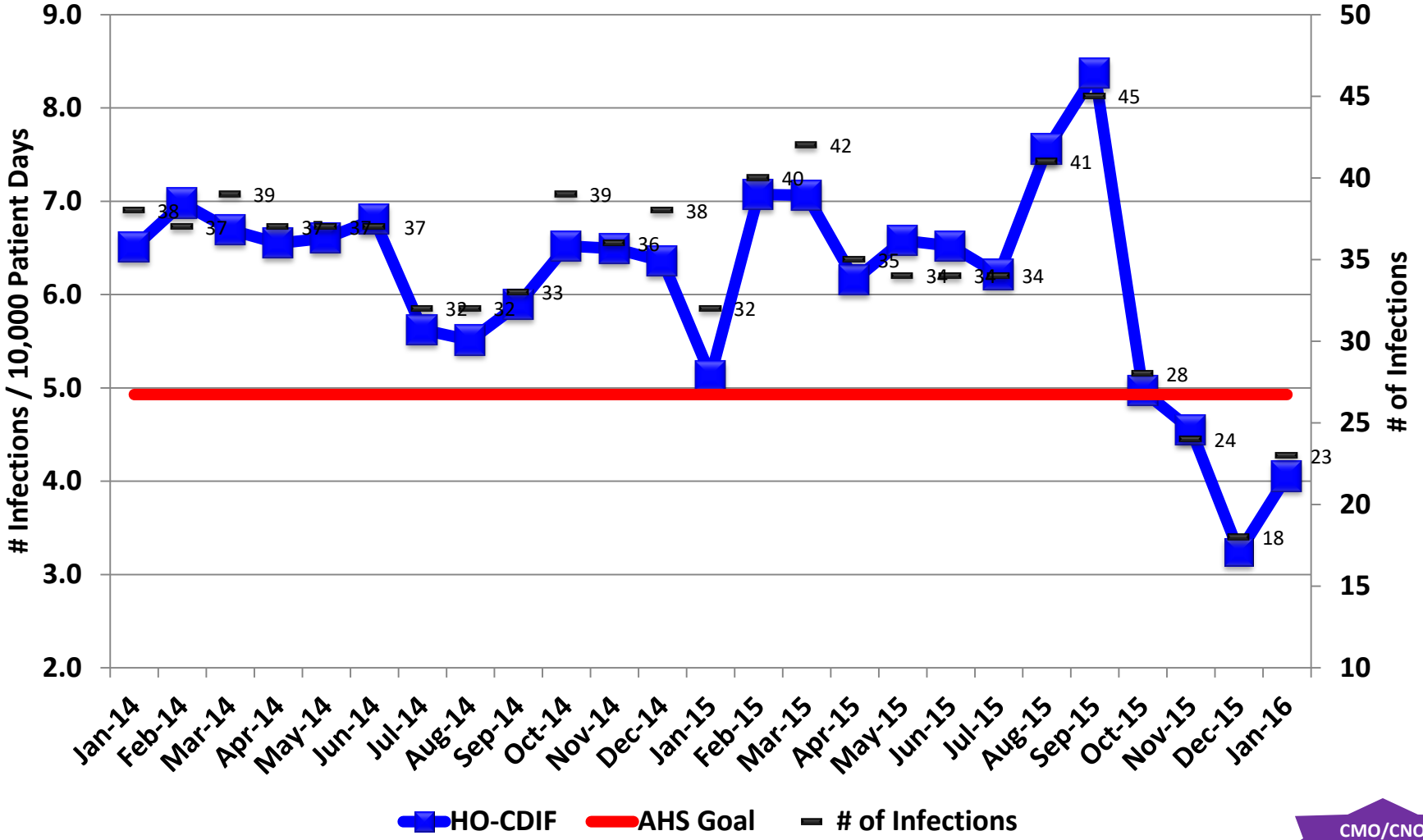
Learning from Industry

The Walt Disney Company

Better

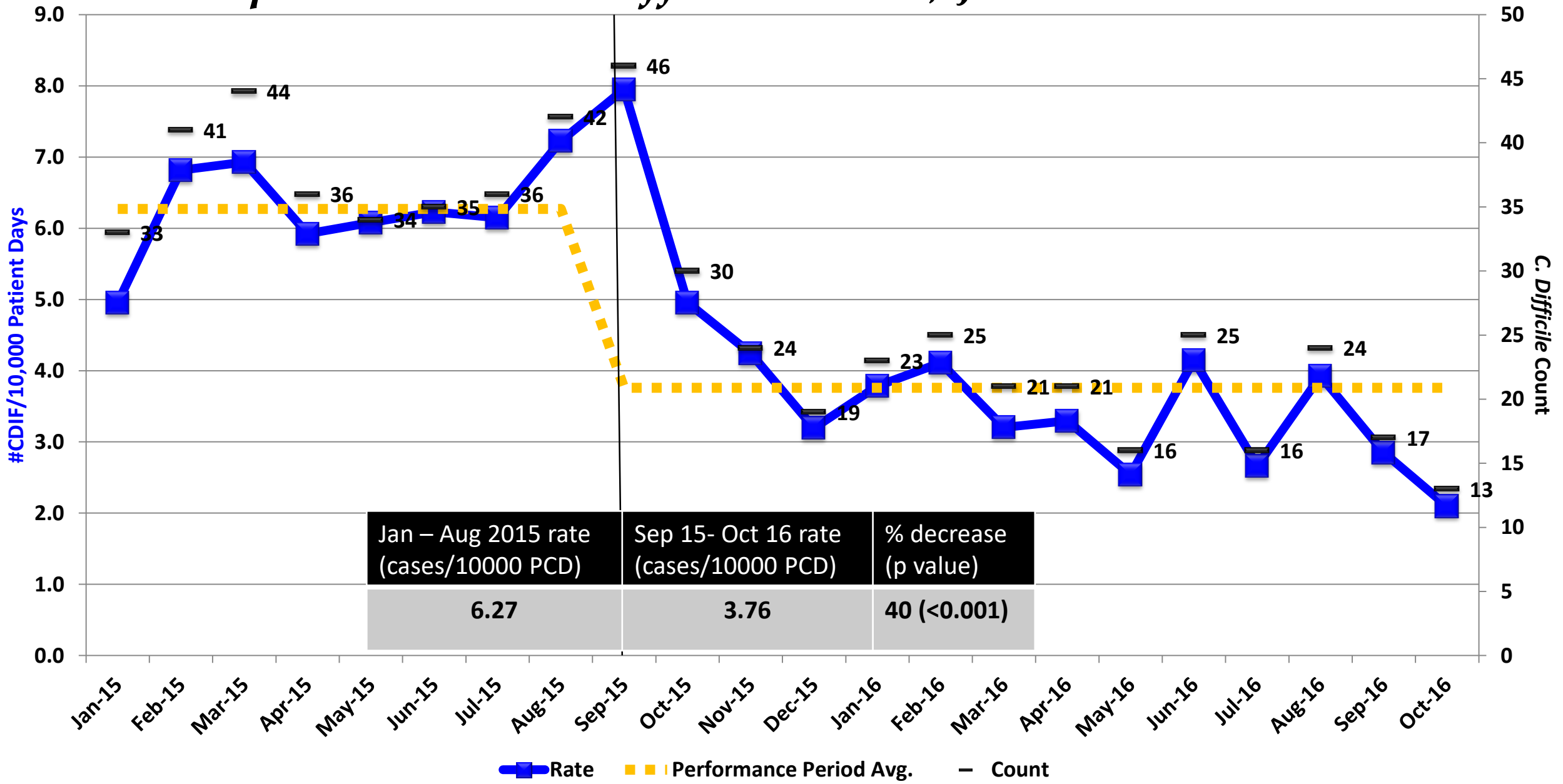
HO C. difficile Rate

FH System; Source-NHSN

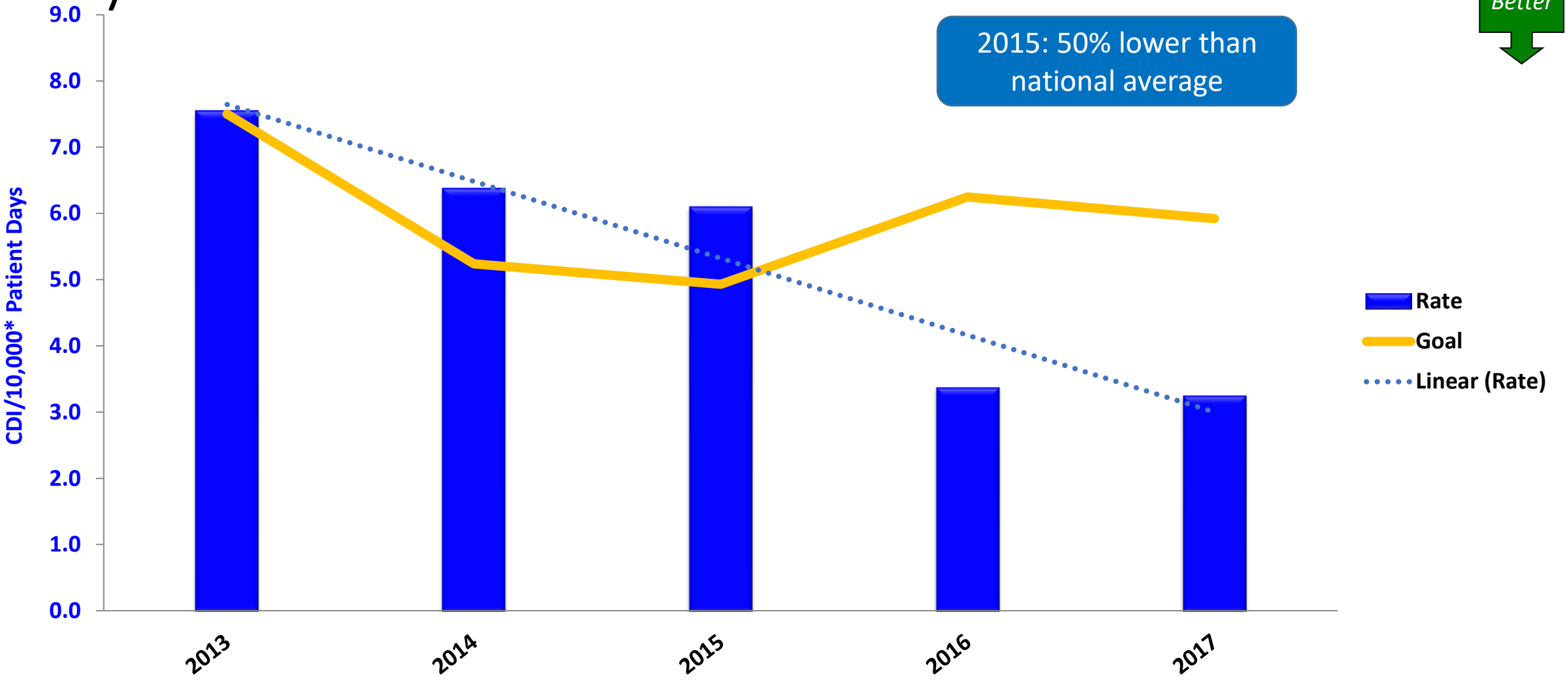


CMO/CNO Slide

Hospital Onset C. difficile Rates, Jan 2015-Oct 2016



System CDI RATE



QI Area #3: Developing a Water Management Program

The Sentinel Event

- Prior to 2016, FH had no specific Water Management Program (WMP)
  - No issues with hospital-onset *Legionella* cases
  - Managed water-borne outbreaks; sterile water where appropriate
  - Facilities: ensured availability of potable water where needed
- November 2015: reported to FLDOH-Orange a case of possible hospital-onset legionellosis
- January 2016: FLDOH-Orange requested and conducted water tests in Ginsburg Tower
  - 2 of 4 water samples positive for *Legionella*
  - Enhanced DOH investigation is opened

Media Coverage

Orlando Sentinel

B2 | Orlando Sentinel Friday, January 22, 2016

LOCAL & STATE

Hospital takes steps after Legionella tests

By Naseem S. Miller
Staff Writer

Florida Hospital Orlando's water tested positive last week for the respiratory germ Legionella, leading the hospital to hire a firm to flush its water system.

Hospital officials said there are currently no confirmed cases of hospital-acquired Legionnaires' disease. They added the hospital's water is safe to drink.

As a precaution, the hospital is testing at-risk patients for the infection and has instructed the staff to follow certain measures to prevent vulnerable patients from potential exposure to the germ.

The chain of events began late last year, when a critically ill patient at Florida Hospital Orlando tested positive for Legionella.

The hospital notified the Florida Department of Health, which tested the hospital's water and confirmed on Jan. 13 that the water had tested positive for the bacteria.

The hospital hired water management and Legionella-testing firm Phigenics to flush its water system, a process that will take several weeks.

Florida Hospital officials said the strain of Legionella found in the hospital water system is different from that of the patient last year, so it's not clear where the patient was infected.

They did not disclose the patient's condition, citing patient privacy laws.

"We know that Legionnaire's disease is something that we have to keep in the back of our minds for patients who have a weak immune system," said Dr. Vincent Hsu, hospital epidemiologist at Florida Hospital. "We've educated our physicians on signs and symptoms of the disease and we always want to encourage our providers to be on the lookout for it."

The Legionella bacteria is found in fresh water. It also thrives in warm water, like the water in hot tubs, large plumbing systems or air conditioning systems of large buildings. Hsu compared the bacteria's presence in the water with the presence of other germs in the environment that could cause food-poisoning under the right conditions.

If Legionella-contaminated water is breathed in, it can infect the lungs and cause pneumonia, or what's known as Legionnaires' disease. The disease is not transmitted from person to person and it doesn't sicken the majority of people who are exposed to it.

Signs of the disease can include high fever, chills and cough. Some people also suffer from muscle aches and headaches, and some will have gastrointestinal symptoms, according to the Florida Department of Health.

The infection can be successfully treated with antibiotics, but it can pose a high risk to older adults, smokers and people who have a weakened immune system.

Each year, between 8,000 and 18,000 people in the United States need care in a hospital due to Legionnaires' disease, according to the CDC.

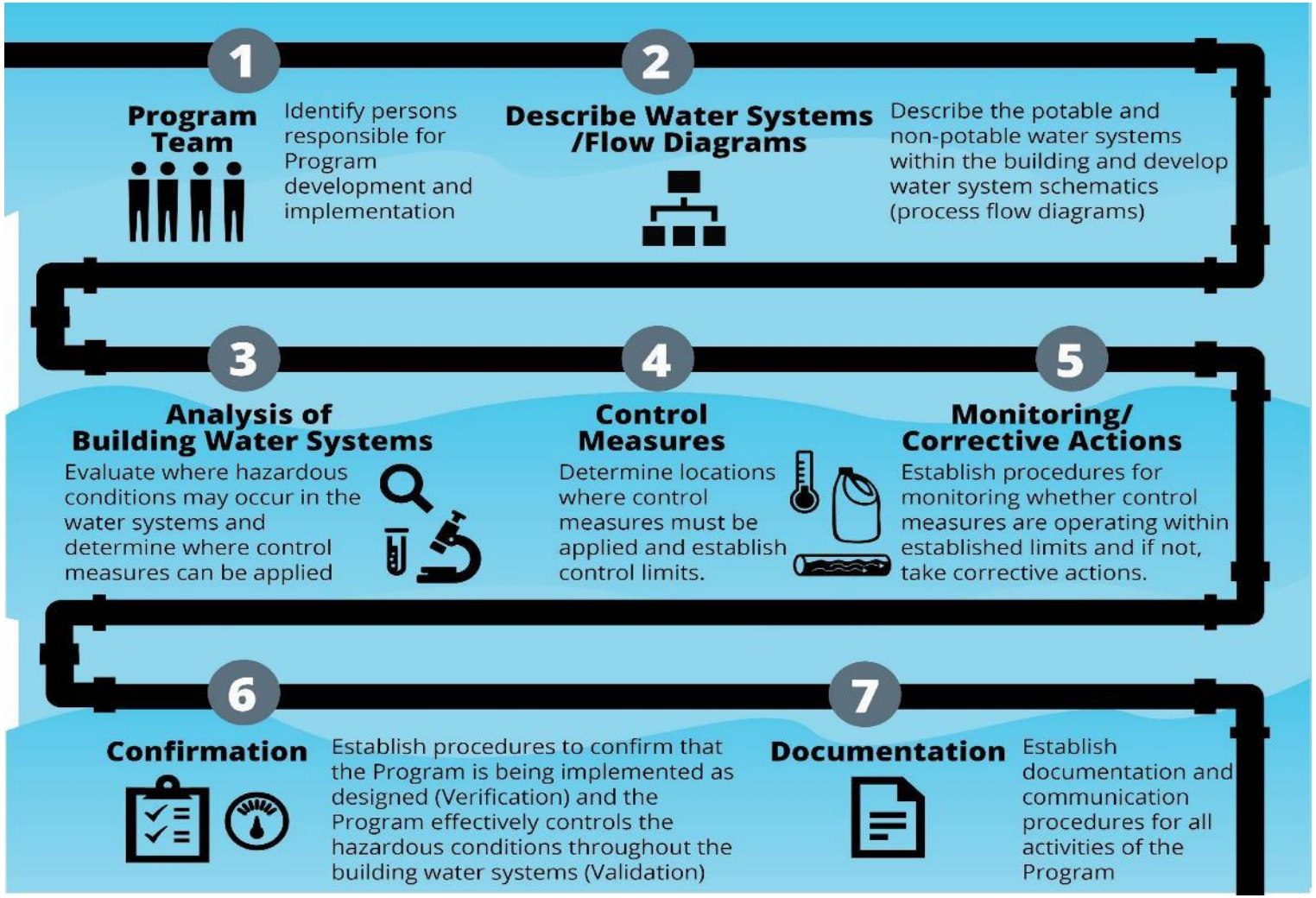
Hsu said that Florida Hospital Orlando has had no cases of hospital-acquired Legionella infection in recent history.

nmiller@tribune.com

Timeline of Events – Feb-March

- February
  - First round of environmental water testing begins: 14 of 30 samples positive for Legionella. Flushing of fixtures by EVS begins. Formal water management team created and convenes
  - Second round of tests: 1 of 30 samples positive
- March
  - Chlorine injector installed in some non-Ginsburg areas of FHO
  - Third round of tests - all samples negative.
  - FLDOH-Orange formally closes enhanced investigation; no cases of hospital-onset *Legionella* were confirmed during this time period

Approach to Effective Water Management Program Using HACCP Principles at FH



Requires thoughtful, stepwise program based on scientific evidence

- Defensible & documentable
- Complies with regulatory requirements and standards (SDWA, OSHA, ASHRAE)

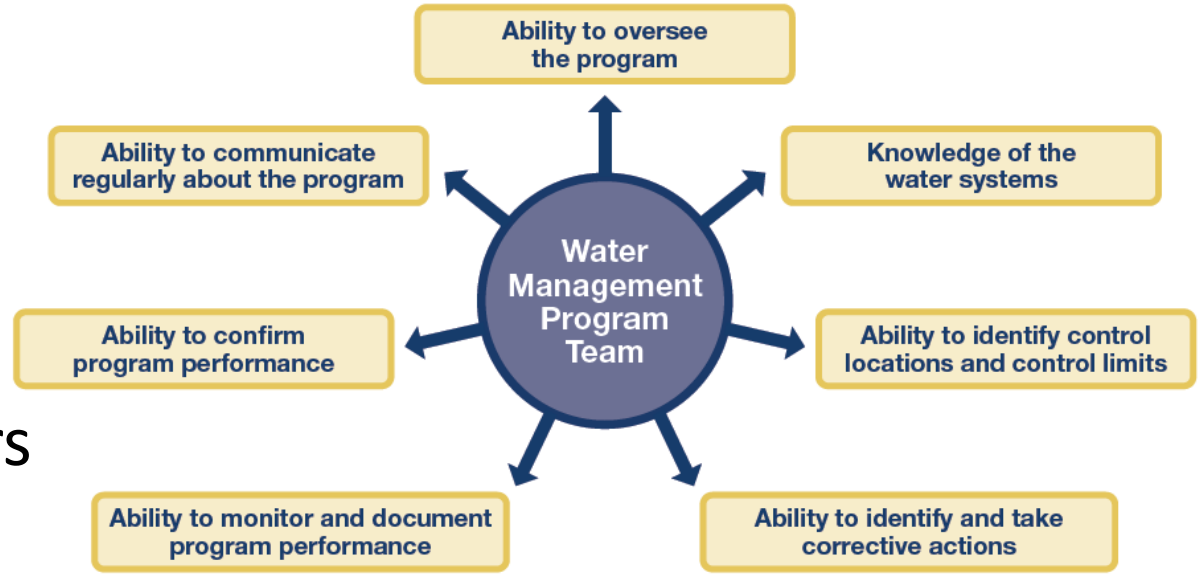
Immediate Actions (1)

- Work with reputable organization without ties to products
- As FH had no confirmed cases of hospital-onset Legionella, assess but don’t make matters worse
  - Start slow, simple is better
  - Hyperchlorination or superheating could make things a lot worse
- Communication
  - Medical staff and leadership notified
  - Media plan is developed

Immediate Actions (2)

- Surveillance
  - Active surveillance for *Legionella*
  - Strain typing of patient and water samples
- Facilities
  - Point of use filters installed and shower bans implemented in high risk areas; some auto faucets changed out to paddle.
  - Hot water temps and hot water chlorine levels found to be low, flushing in utility areas begins at 100%
- Scope
  - Focus on Ginsburg Tower
  - Begin planning to assess all campuses and start a WMP

Approach to WMP at FH: The WMT



- Water Management Team Members
  - Senior VP – facilities & clinical
  - Facilities director (system / campus)
  - EVS director
  - Clinical: Hospital epidemiology, infection prevention, patient safety
  - Phigenics
- WMT meets monthly, two subcommittees
- Mission: To prevent and control waterborne-associated healthcare risks, including *Legionella* disease, to all patients, visitors, and employees at FH

Control Measures & Verification/Validation at FH

- Remediation of dead legs – ongoing, as identified
- Recalibrated water temperature
- Replaced auto fixtures that might be faulty
- Flushing – critical component. Flushed distribution lines and fixtures to ensure fresh chlorinated water
- Installed chlorine injectors if reasonable flushing did not raise the biocide levels within acceptable range
- Verification/Validation. Kept log of all data. Will sample for *Legionella* at specified times and locations in accordance with plan

Monitoring Program includes both environmental testing and patient surveillance

Environmental

- Temp
- Oxidant

Clinical Surveillance

System Legionella Dashboard												
Performance Period Evaluation	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
Overall Legionella Testing Volume	489	375	504	614	659	688	540	542	529	456	453	483
Legionella Culture Testing Volume	64	56	69	97	95	94	62	85	91	72	80	68
Legionella AG Testing Volume	425	319	432	510	562	590	473	452	435	377	369	410
Legionella PCR Testing Volume	0	0	3	7	2	4	5	5	3	7	4	5
Rate of Overall Positive Legionella Tests	0.0	2.7	4.0	4.9	6.1	17.4	1.9	1.8	9.5	4.4	11.0	4.1
Rate of Positve Legionella Cultures	0.0	17.9	14.5	0.0	21.1	10.6	0.0	0.0	0.0	0.0	0.0	0.0
Rate of Positive Legionella AG	0.0	0.0	2.3	5.9	3.6	18.6	2.1	0.0	11.5	5.3	13.6	4.9
Rate of Positive Legionella PCR	N/A	N/A	0.0	0.0	0.0	0.0	0.0	200.0	0.0	0.0	0.0	0.0
HO Positve Legionella Tests	0	1	1	0	2	2	0	0	1	0	1	2
Test Volume POA^	406	295	402	494	529	552	418	406	412	359	359	393
Test Volume HO*	83	80	102	120	130	136	122	136	117	97	94	90

Rate is out of 1000 Legionella tests
^POA denotes testing before or on day 3
*HO denotes testing after day 3

Corrective Action is Taken Based Upon Monitoring of Control Locations

Action Item Tracker

Site: All

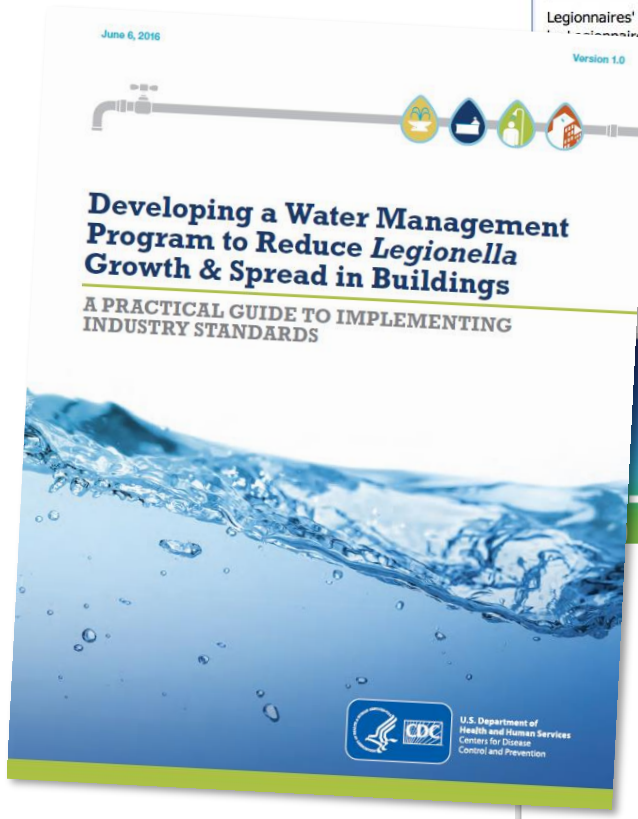
Add New Action Item | Refresh

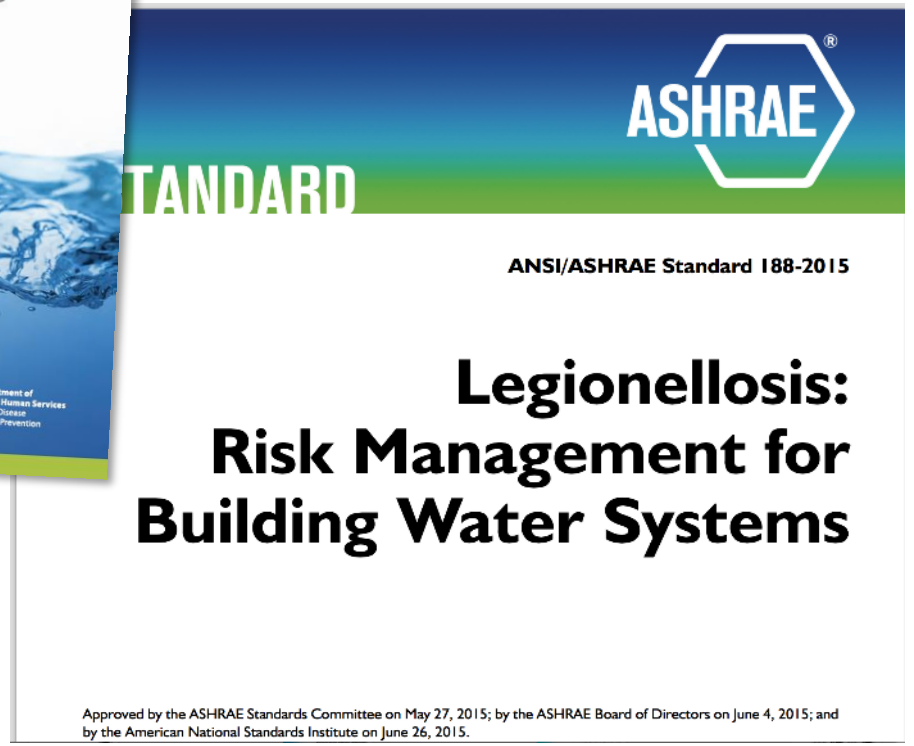
Comments	Site	Date Entered	Type	Description	Owner	Assigned To	Priority	Status	Work Order	Date Required	Date Closed	Id	Edit
0	Florida Hospital - Winter Garden	11/23/2016 12:00:00 AM	Action Item	Take necessary steps to prepare for chlorine injection on the hot water system. 1. injection and sample taps. 2. chemical drum and containment 3. eye wash station 4. equipment arrival and connection 5. start-up by Phigenics with operator training	N/A	N/A	Normal	Open		1/15/2017		76	
2	Florida Hospital - Kissimmee	11/8/2016 12:00:00 AM	Action Item	**1. Existing Building** - Audit of EVS Flushing Program - Install skid for hot water systems - Verify circulating pumps are working properly - Heavy flush (minimum 10 hours) in Room 110 - Heavy flush (minimum 10 hours) in Room 126. Change out shower wand. - Heavy flushing (minimum 10 hours) in Room 152	B Norburg	abennett	High	Open		11/16/2016		75	
1	Florida Hospital - Kissimmee	11/8/2016 12:00:00 AM	Action Item	**1. Emergency Room** - Room 22 / 28 Heavy flush and fixture change - Audit EVS Flushing Program - Start Flushing Program in ED 11/08/16 - Order and install skid for hot water system - Review mechanical tie in - Verify recirculating pumps are working properly	B Norburg	abennett	High	Open		11/16/2016		74	
2	Florida Hospital - Kissimmee	11/8/2016 12:00:00 AM	Action Item	**1. New Tower** - 1-S1 Room #3724 / 3 above 10^3 / Temp too high 126 - Audit EVS Flushing Program - Audit Hot Water System for Temperature - Flush room #3724. Change faucet out 11/08/16 – 11/09/16 - Flush Women's Restroom K-08T101 – 212A Start 11/08/16	B. Norburg	abennett	High	Closed		11/16/2016	11/17/2016 12:00:00 AM	73	
0	Florida Hospital - Orlando	11/7/2016 11:00:00 AM	Action Item	Implement a flushing program in the Cancer Center to increase the oxidant readings of the hot water system. On 11/2/2016 started flushing in the mechanical room on the 8th floor of the building.	Tally Prado	arodriguez	Normal	Closed			11/7/2016 11:00:00 AM	72	
				Post Validation Testing - Corrective Actions									

An Effective Water Management Program Works!

- Consistent with regulatory standards: OSHA, ASHRAE
- CDC has advised facilities involved in outbreaks of Legionnaires' disease to apply HACCP principles

"Since 2000, there has not been a reoccurrence in any facility that followed this recommendation" – *Claressa Lucas PhD, ELITE Program Coordinator, CDC*





QI Area #4: Partnering with Public Health to Identify Epidemiologic Organisms of PH Significance

The Need to Prepare for Emerging Infectious Diseases

Photo courtesy of CDC. Public Domain

"The health security of the U.S. is only as strong as the health security of every country around the world. We are all connected by the food we eat, the water the drink and the air we breathe." – Tom Frieden


Texas Health Presbyterian

PH-Acute Care Collaborative Efforts During Ebola, 2014-15

- DOH coordination of persons from W. Africa
- Frequent regular conference calls, written updates
- Establishment of protocols with industry (e.g. Disney, MCO), multi-governmental organizations
- Participation in drills
- Establishment of DOH ICAR through the Central Florida Disaster Medical Coalition

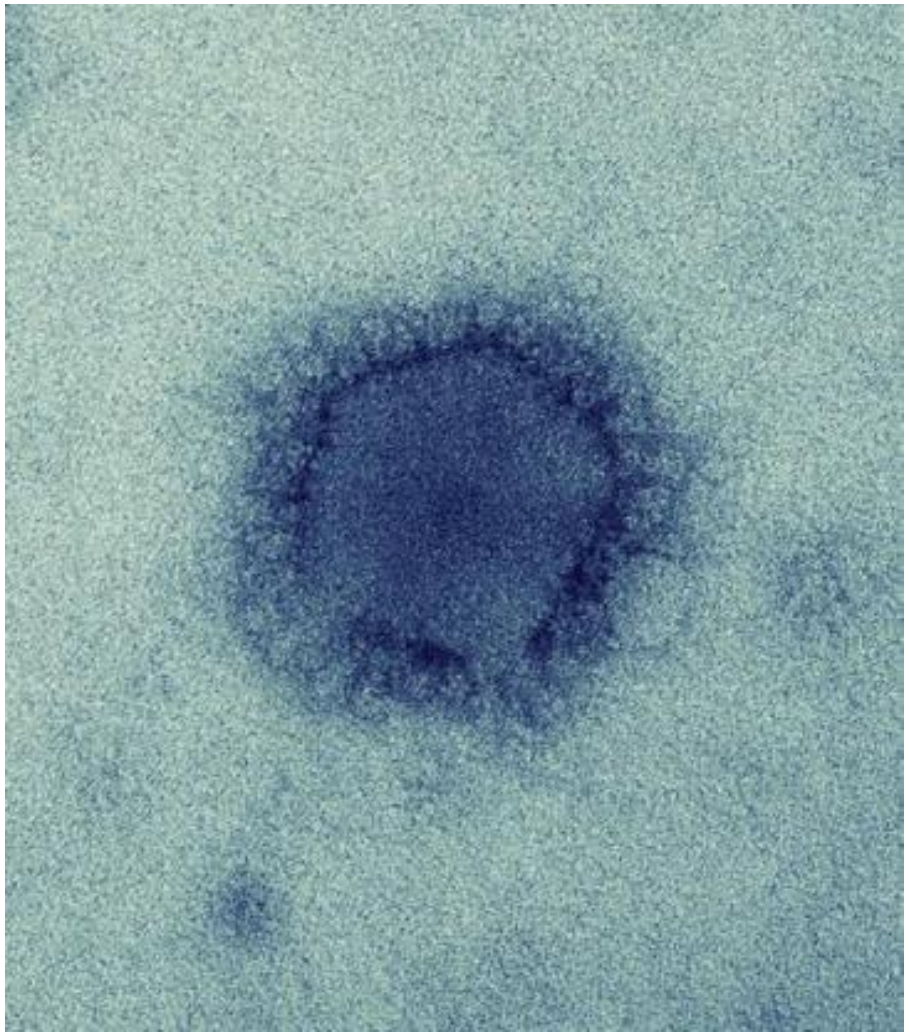
Zika, 2016-present

- Less risk, but resource-intensive
- ED screening processes
- Identification and follow-up of pregnant women through birth

Aedes aegypti. James Gathany - PHIL, CDC, Public Domain

Novel Respiratory Viruses

- Middle East Respiratory Syndrome Coronavirus (MERS-CoV)
  - May 2014, Orlando
  - FL DOH & CDC joint effort with Orlando Health
  - Updated case definitions
  - Area EDs: Travel question
- Pandemic influenza
  - Coordination of plans
  - Drills



CDC: Cynthia Goldsmith Azaibi Tamin

Amoeba Awareness: Jordan & Sebastian

- PAM: “Rare” disease
- DOH, Smelski Foundation, and Florida Hospital collaboration
  - DOH & Foundation: highly publicized and supported
  - FH: Educated clinicians, laboratory technicians, built in questions into the medical record, positive media exposure

Next Steps & The Future of QI

- No matter the future of IP, no matter what field of healthcare you are in, QI principles remain solid
- Leadership, scope, objectives, goals, team, strategies, implement, measure, analyze, feedback, improve
- Discuss
  - What are your priorities and objectives to keep patients safe?
  - What will you do now?
  - How will you get there?