Prevention of Respiratory Virus Infections

Presented by:

Anthony Baffoe-Bonnie MD FIDSA
Associate Professor of Medicine, Infectious Diseases Section
Virginia Tech Carilion School of Medicine (VTCSOM)
Medical Director of Infection Prevention and Control
Carilion Clinic

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VCU

VDH VIRGINIA DEPARTMENT OF HEALTH

No relevant disclosures

Objectives

- Review the etiology and epidemiology of common agents responsible for viral respiratory infections
- Highlight how viral respiratory infections may be complicated by lower respiratory tract infections
- Discuss the impact of respiratory viral infections in the healthcare setting
  - HCWs
  - Patients
- Enumerate strategies to prevent and control respiratory infections in healthcare settings
- Leveraging your local health department in respiratory viral infection prevention

Respiratory Viral Infections

URI is reportedly the most common acute illness in United States, with the average adult estimated to have about 2-4 cold episodes/year

- coinfection with > 1 virus (such as rhinovirus and enterovirus) is possible in patients with upper respiratory infections

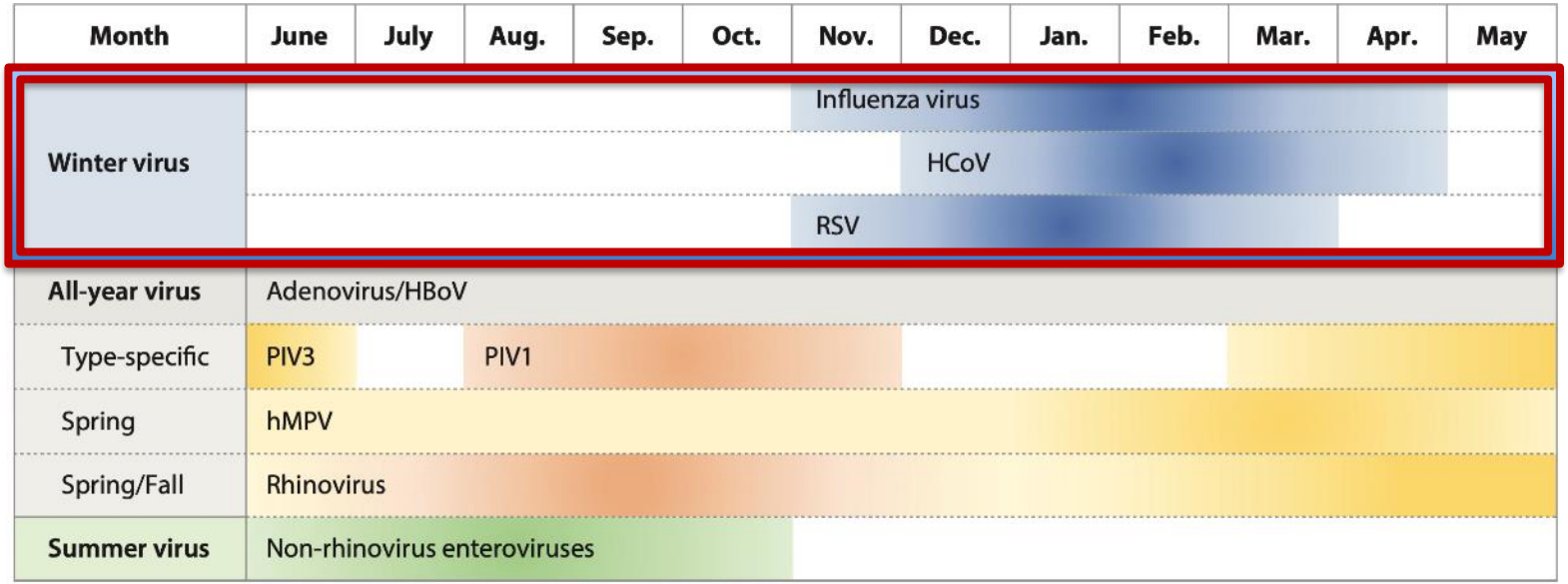
The most common viruses causing acute respiratory infections in children are rhinoviruses, respiratory syncytial virus (RSV), and influenza.

In adults, rhinoviruses, influenza, and coronaviruses, including SARS-CoV-2 (the virus responsible for COVID-19), are major culprits.

Influenza Other Respir Viruses 2022 Sep;16(5):891
Ann Intern Med. 2016 Mar 15;164(6):425-34,

Respiratory Viral Infections

Upper respiratory infections (URI), or "common colds" are acute, generally viral infections of the upper respiratory tract causing symptoms such as nasal congestion, sneezing, low grade fever, malaise and/or throat pain.



Seasonality of respiratory virus infection in temperate regions

Annu. Rev. Virol. 2020. 7:83–101

Respiratory Viral Infections

Respiratory viral infections have a wide spectrum of presentations and disease severity.

In children, these infections frequently manifest as mild symptoms such as cough, runny nose, and fever, but they can also lead to severe complications like bronchiolitis and pneumonia, especially in infants and those with underlying health conditions.

These complications can require hospitalization and intensive care, imposing a considerable burden on pediatric healthcare resources.

In older adults and persons with chronic medical conditions including immunocompromised individuals, acute respiratory viral infections may progress or be complicated with bacterial co-infection

Influenza Other Respir Viruses 2022 Sep;16(5):891
Ann Intern Med. 2016 Mar 15;164(6):425-34,

Respiratory Viral Infections

Virus exposure, attachment and entry into upper respiratory tract host cells

Virus replication, spread and inflammatory response

Tissue damage and progressive pathology in respiratory tract

Lower respiratory tract infection with virus +/- co-infection with bacteria

The severity and outcome of microbial infections are determined by **host**, **pathogen**, and **environmental factors.**

As the pathogen colonizes the host, it encounters members of the resident microbiota and/or other pathogens.

These interactions can influence microbial pathogenesis, including increased bacterial adhesion, enhanced virion stability, and modulation of the immune response by one microbe that benefits the other.

Particularly relevant in anatomical sites that have complex microbial communities, including the respiratory tract

Spaeder MC, Fackler JC. Hospital-acquired viral infection increases mortality in children with severe viral respiratory infection. *Pediatr Crit Care Med* 2011; 12:e317–21
Manchai et al. Hospital acquired viral respiratory tract infections: An underrecognized nosocomial infection. Infection, Disease and Health. 2020;25:175-180
Sender V, Hentrich K, Henriques-Normark B. Virus-Induced Changes of the Respiratory Tract Environment Promote Secondary Infections With Streptococcus pneumoniae. Front Cell Infect Microbiol. 2021 Mar 22;11:643326.
Manna S, McAuley J, Jacobson J, Nguyen CD, Ullah MA, Sebina I, Williamson V, Mulholland EK, Wijburg O, Phipps S, Satzke C. Synergism and Antagonism of Bacterial-Viral Coinfection in the Upper Respiratory Tract. mSphere. 2022 Feb 23;7(1):e0098421

Respiratory Viral Infections

Virus exposure, attachment and entry into upper respiratory tract host cells

Virus replication, spread and inflammatory response

Tissue damage and progressive pathology in respiratory tract

Lower respiratory tract infection with virus +/- co-infection with bacteria

Younger age group

Older hospitalized patient with

- immunosuppression or
- multiple co-morbidities including heart and lung disease

Benign course of an upper respiratory viral infection may progress to severe disease

Spaeder MC, Fackler JC. Hospital-acquired viral infection increases mortality in children with severe viral respiratory infection. *Pediatr Crit Care Med* 2011; 12:e317–21

Manchai et al. Hospital acquired viral respiratory tract infections: An underrecognized nosocomial infection. Infection, Disease and Health. 2020;25:175-180

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Respiratory Viral Infections in the Healthcare Setting

- Healthcare workers may be affected by respiratory viral infections. Incidence mirrors community transmission rates
  - Absenteeism and presenteeism in healthcare workers due to respiratory illness
    - 89% of 152 HCWs reported 1 influenza or respiratory symptom over study period
    - 68% of HCWs worked with symptoms of influenza on some 8.8% of study days*
    - In a prospective study of 170 HCWs, positive viral shedding noted in symptomatic HCWs of which 46% reported working while ill.
  - Respiratory viral infections in HCWs may impact staffing

Kuster, S et al. Absenteeism and presenteeism in healthcare workers due to respiratory illness. *ICHE, 42*(3), 268-273
Esbenshade et al. Respiratory Virus Shedding in a Cohort of On-Duty Healthcare Workers Undergoing Prospective Surveillance. *ICHE34*(4), 373-378

Respiratory Viral Infections in the Healthcare Setting

- Patients may either present with a respiratory viral infection (RVI) from the community or develop nosocomial infection
  - In a single center study over an 8 yr period there were 436 hospital –onset RVIs. Most occurred during the fall-winter months of October to March (315/436, 72.2%)
    - Influenza (124/436, 28.4%),
    - RSV (84/436, 19.3%),
    - Rhinovirus (114/436, 26.1%)
    - HMPV (40/436, 9.2%),
    - Parainfluenza (52/436, 11.9%),
    - Adenovirus (22/436, 5.0%)
  - Hospital-acquired respiratory viral infections are associated with **increased length-of-stay** and **high mortality rates**, particularly in patients who are elderly, have compromised immune systems, or underlying heart and lung disease

Selina Ehrenzeller et al. Impact of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Prevention Measures on Non-SARS-CoV-2 Hospital-Onset Respiratory Viral Infections: An Incidence Trend Analysis From 2015–2023, *Clinical Infectious Diseases*, 2023

Respiratory Viral Infections in the Healthcare Setting

- 283 patients met definition of hospital acquired viral respiratory infection over the study period (2012-2018). Single center retrospective study in Northern Australia

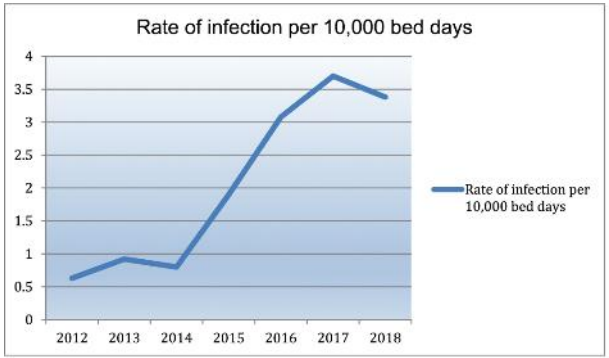


Figure 1 Rate of infection per 10,000 bed days from 2012 to 2018.

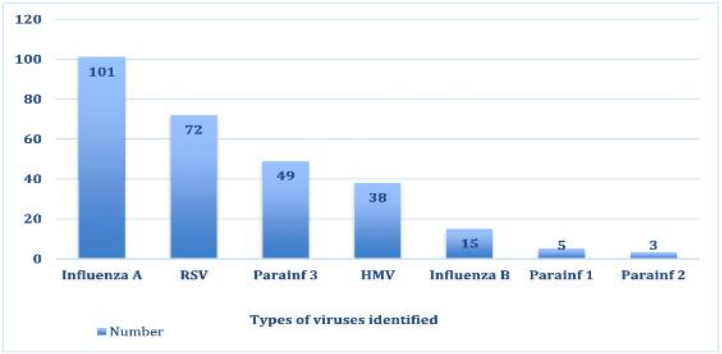


Figure 2 The incidence of virus types in HA-VRI.

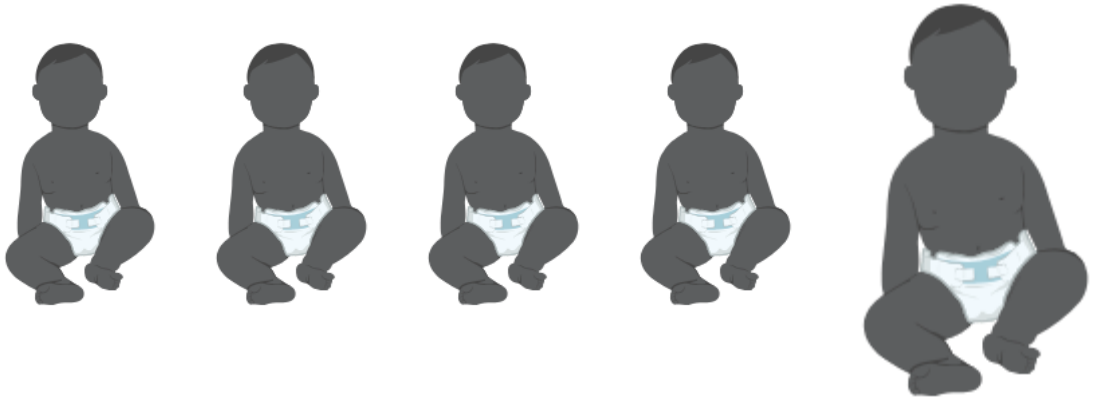
- The rate of hospital acquired respiratory viral infections increased over study period with younger patients more likely to be admitted to intensive care and need mechanical ventilation.

- A higher mortality was found with individuals in the older age category. The morbidity and mortality did not differ based on the virus type.

Manchai et al. Hospital acquired viral respiratory tract infections: An underrecognized nosocomial infection. Infection, Disease and Health. 2020;25:175-180

Respiratory Viral Infections in the Healthcare Setting

- In one study, **1 in 5 children** admitted to a pediatric intensive care unit (ICU) due to a respiratory viral infection had acquired the infection in the hospital.

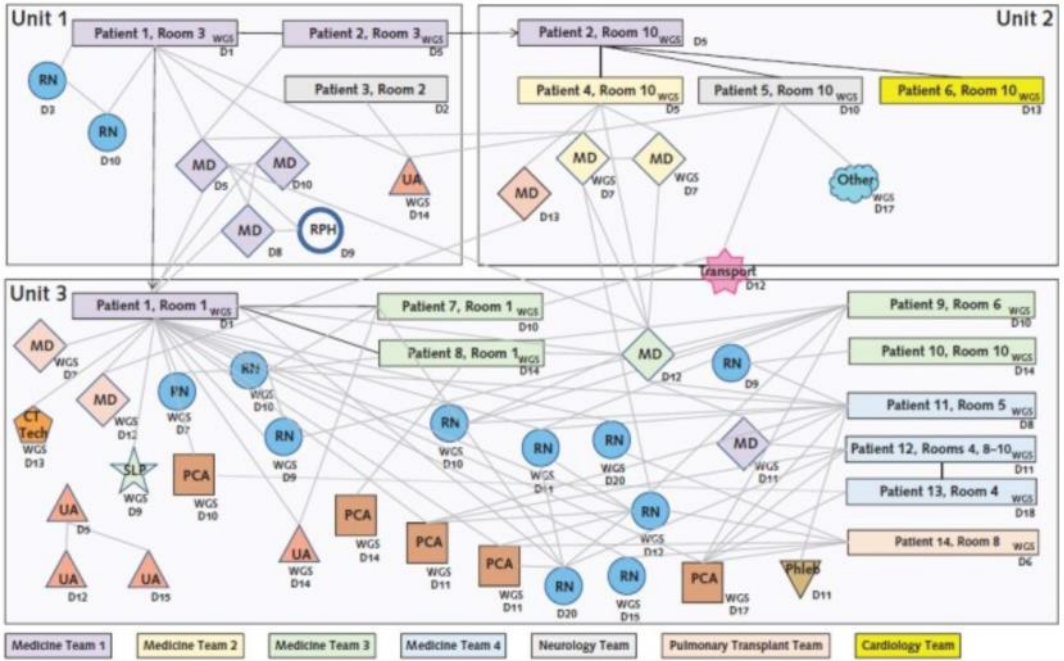


6 –fold risk of mortality

- These children had an approximately 6-fold increased likelihood of mortality compared with those who had community-acquired respiratory viral infections

Spaeder MC, Fackler JC. Hospital-acquired viral infection increases mortality in children with severe viral respiratory infection. *Pediatr Crit Care Med* 2011; 12:e317–21

Respiratory Viral Infections in the Healthcare Setting



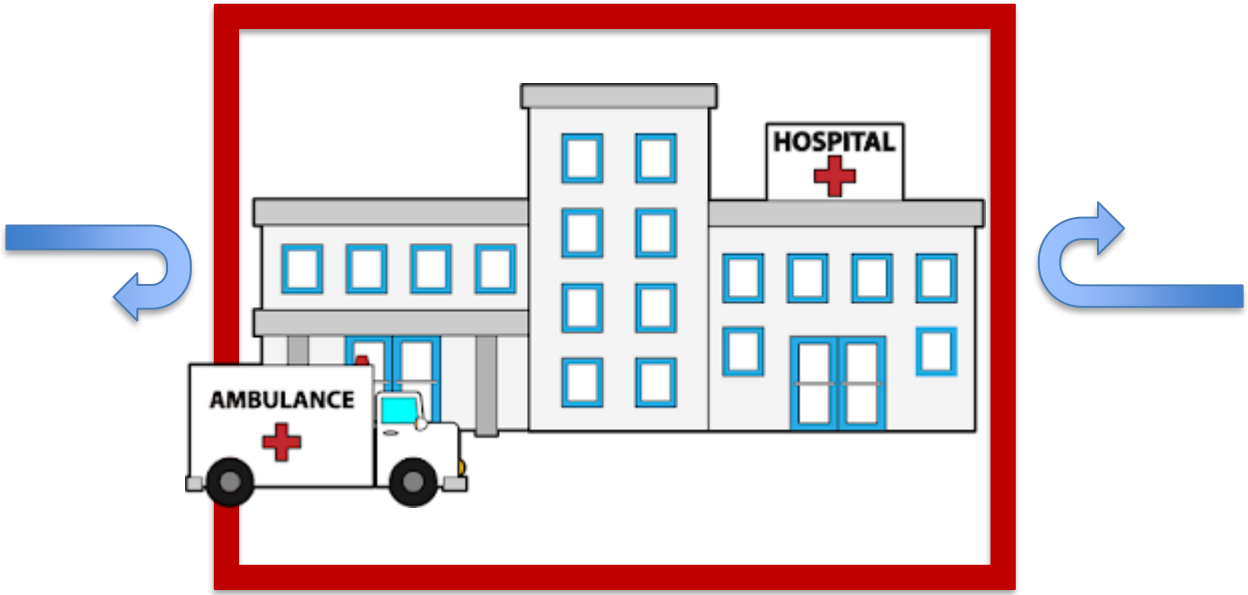
Cluster map depicting locations, role groups, medical teams, and interconnections among SARS-CoV-2 infected staff members and patients

SARS-CoV-2 and other respiratory viral infections can be transmitted in the healthcare setting between HCWs and patients in a complex pattern

Klompas M et al. SARS-CoV-2 Cluster in an Acute Care Hospital. Ann Intern Med. 2021 Jun;174(6):794-802.

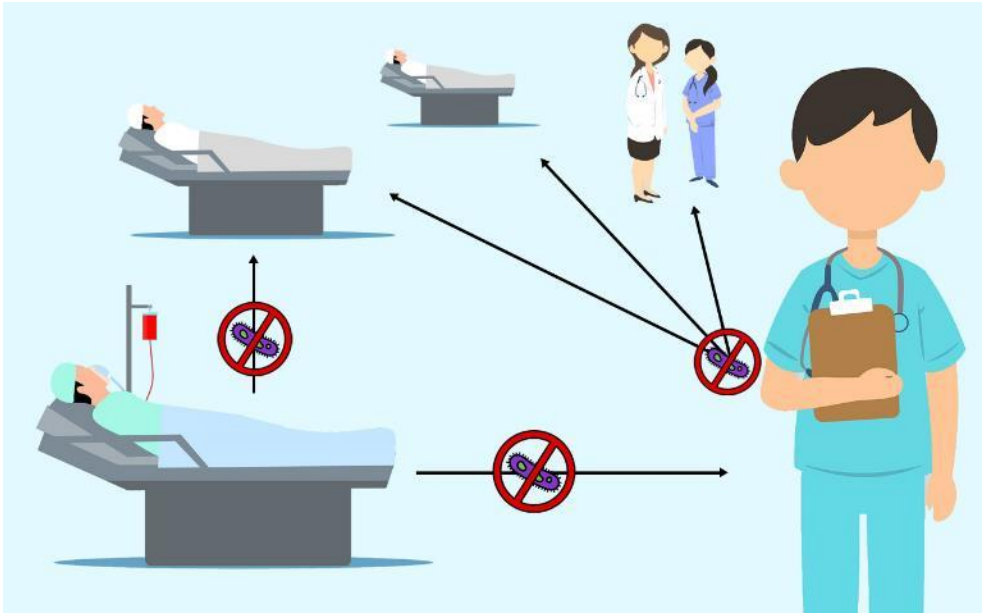
Preventative Strategies

Preventative Strategies



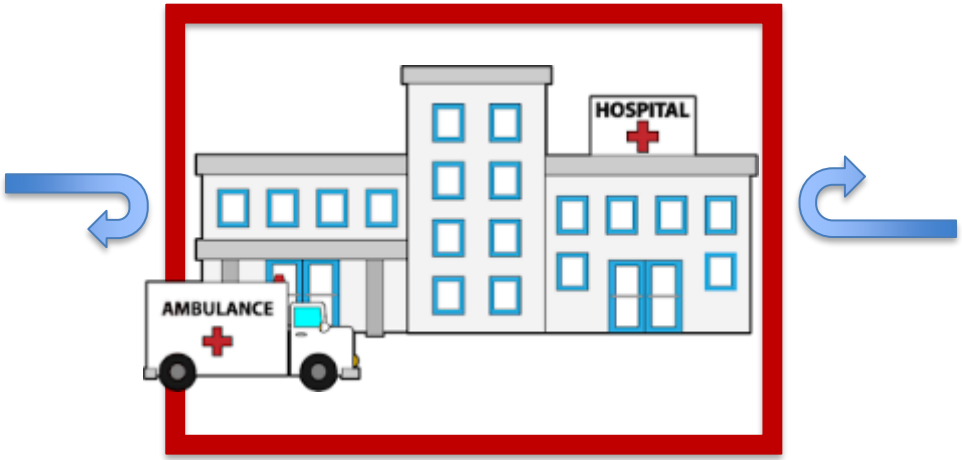
Prevent or minimize introduction of
respiratory viruses into the healthcare setting

Preventative Strategies

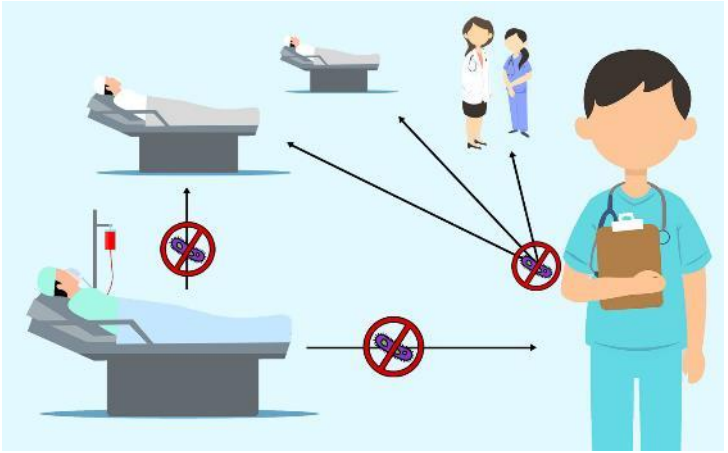


Prevent or minimize transmission of respiratory viruses within the healthcare setting

Preventative Strategies

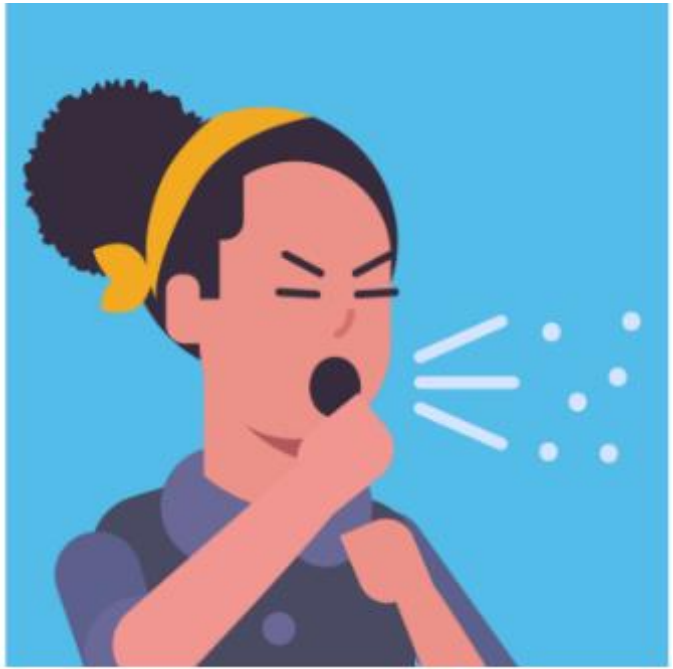


Prevent or minimize introduction of respiratory viruses into the healthcare setting



Prevent or minimize transmission of respiratory viruses in the healthcare setting

Monitor and Manage Ill Healthcare Personnel

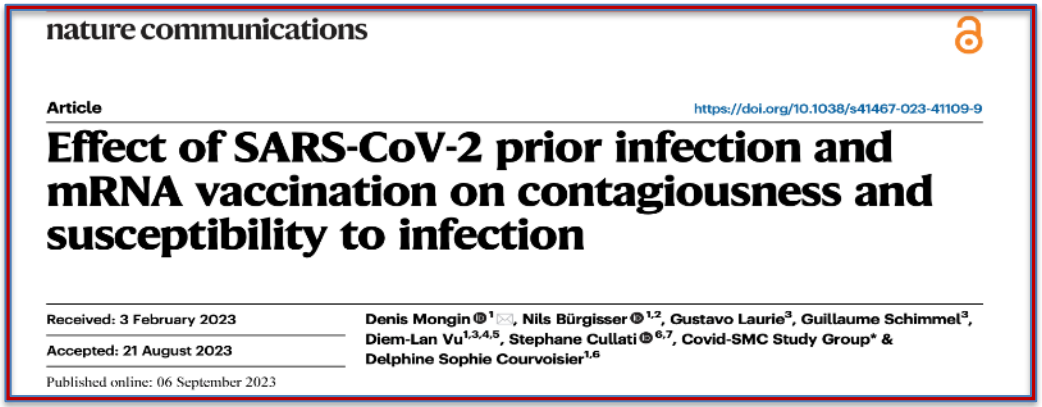


Healthcare workers should have a simple and clear process that they follow when ill

Facility sick leave policies should be non-punitive and flexible to prevent presenteeism

https://www.cdc.gov/infectioncontrol/guidelines/viral/prevent-viral.html

Vaccination Protects the Workforce and the Patient



nature communications

Article

https://doi.org/10.1038/s41467-023-41109-9

Effect of SARS-CoV-2 prior infection and mRNA vaccination on contagiousness and susceptibility to infection

Received: 3 February 2023

Accepted: 21 August 2023

Published online: 06 September 2023

Denis Mongin[1], Nils Bürgisser[1,2], Gustavo Laurie[3], Guillaume Schimmel[3], Diem-Lan Vu[1,3,4,5], Stephane Cullati[6,7], Covid-SMC Study Group* & Delphine Sophie Courvoisier[1,6]

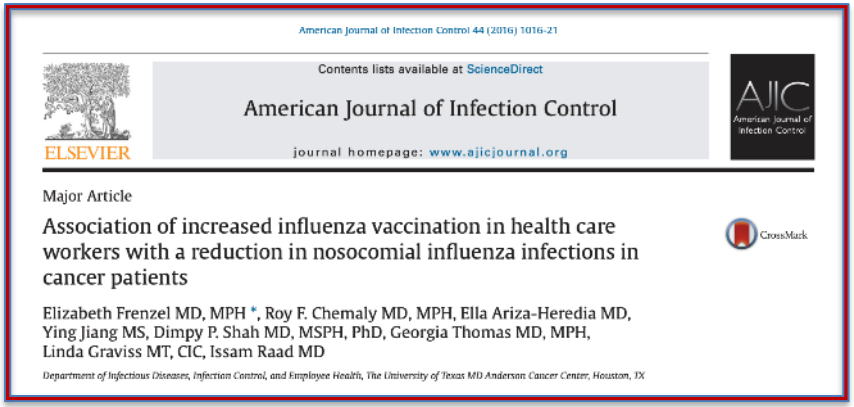
50,000+ SARS-CoV-2 positive cases and over 100,000 contacts studied to understand the impact of immune status on the secondary attack rate (SAR)

A vaccinated index case-patient was associated with a lower SAR, when the last dose of vaccination was less than 6 months before the index-contact date

The immunity granted by mRNA vaccines played a significant role in reducing the infectiousness and contributed to decreasing the transmission of SARS-CoV-2.

Mongin, D., Bürgisser, N., Laurie, G. *et al.* Effect of SARS-CoV-2 prior infection and mRNA vaccination on contagiousness and susceptibility to infection. *Nat Commun* **14**, 5452 (2023)

Vaccination Protects the Workforce and the Patient



American Journal of Infection Control 44 (2016) 1016-21

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients

Elizabeth Frenzel MD, MPH *, Roy F. Chemaly MD, MPH, Ella Ariza-Heredia MD, Ying Jiang MS, Dimpy P. Shah MD, MSPH, PhD, Georgia Thomas MD, MPH, Linda Graviss MT, CIC, Issam Raad MD

Department of Infectious Diseases, Infection Control, and Employee Health, The University of Texas MD Anderson Cancer Center, Houston, TX

The influenza vaccination rate of all employees significantly increased from 56% (8,762/ 15,693) in 2006-2007 to 94% in 2013-2014 (P < .0001).

The proportion of nosocomial influenza infections significantly decreased (P = .045) during the study period and was significantly associated with increased HCW vaccination rates in the nursing staff (P = .043) and in personnel working in high-risk areas (P = .0497).

Increased HCW vaccination rates were associated with a reduction in the proportion of nosocomial influenza infections in immunocompromised cancer patients.

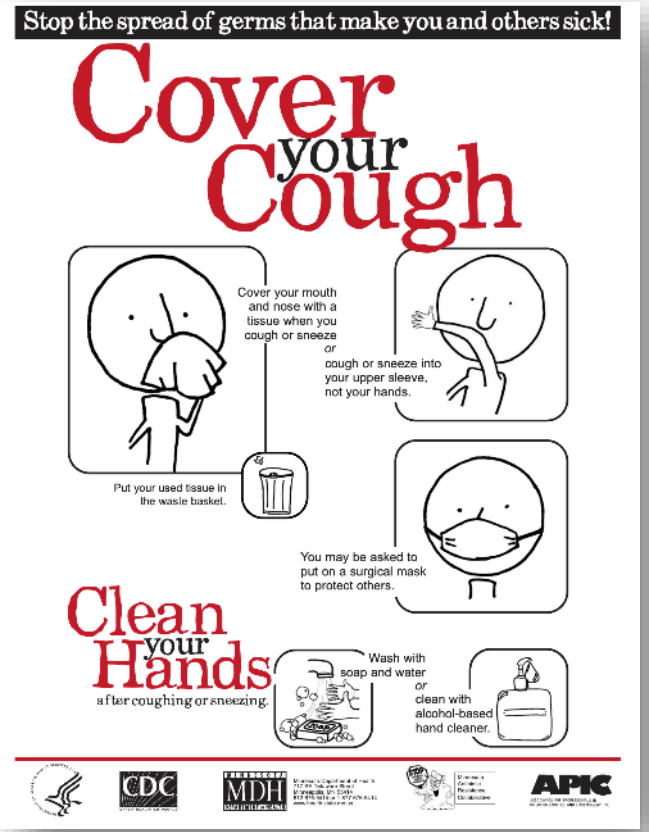
Frenzel et al. Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients. Am J Infect Control. 2016 Sep 1;44(9):1016-21.

Respiratory Hygiene and Cough Etiquette

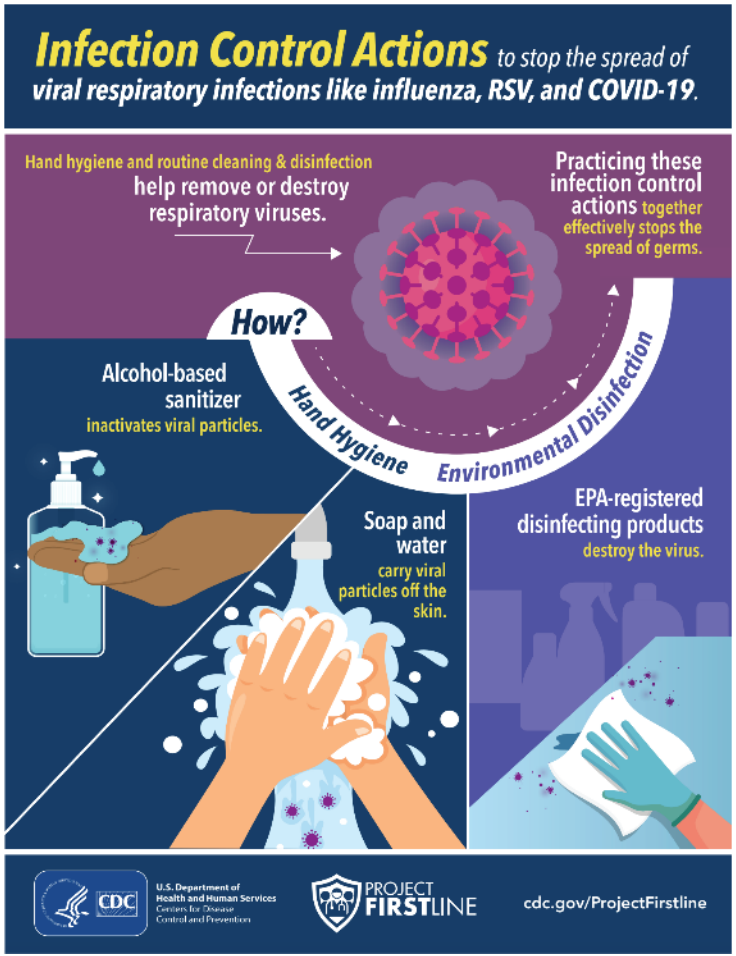
Visible reminders about the need for these practices at entrances and triage or waiting areas

Use CDC Project FirstLine Tools
https://blogs.cdc.gov/safehealthcare/actions-for-respiratory-virus-season/

Provide facemasks, hand sanitizers and tissue disposal receptacles

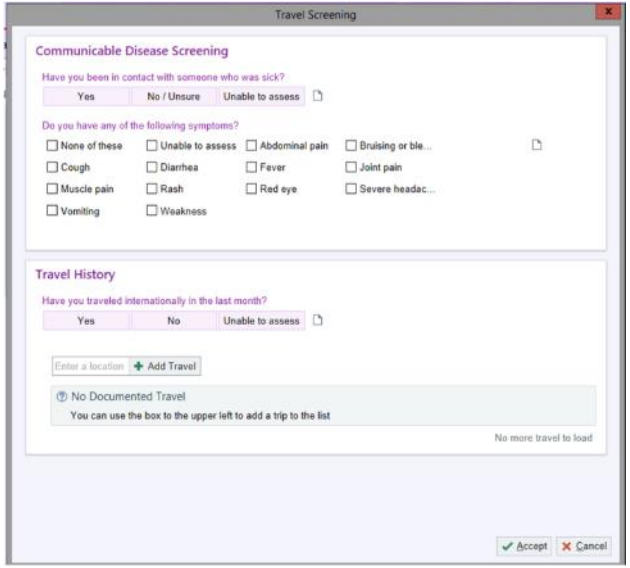


https://stacks.cdc.gov/view/cdc/23304



https://www.cdc.gov/infectioncontrol/projectfirstline/healthcare/print.html#anchor_1646671363779

Broad Communication About Infection Control Practices



Symptom screening should be done with all patient scheduling and at initial point of contact to the health care system (triage or registration

STOP!

If you are experiencing:

- Fever or Chills
- Cough
- Shortness of breath
- Fatigue
- Muscle or body aches
- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

Please REPORT immediately to the registration desk!

Simple, clear and broad messaging to patients seeking care and accompanying visitors to aid in triaging

https://www.cdc.gov/coronavirus/2019-ncov/hcp/non-us-settings/sop-triage-prevent-transmission.html

Administrative and Engineering Controls

Protection of healthcare workers and patients in a congregate setting through physical barriers at the reception, separate triage areas and distancing with seating

Limiting time spent in triage areas and waiting rooms by proactive and creative scheduling processes especially during periods when community spread of respiratory viruses is high

Single patient rooms or cohorting if needed

Working with facility engineers to improve ventilation delivery (eg. ensure air vents are not blocked) and indoor air quality in patient rooms and shared spaces

https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html

Broader Use of Source Control

Source control refers to use of respirators or well-fitting facemasks to cover a person's mouth and nose to prevent spread of respiratory secretions when they are breathing, talking, sneezing, or coughing.

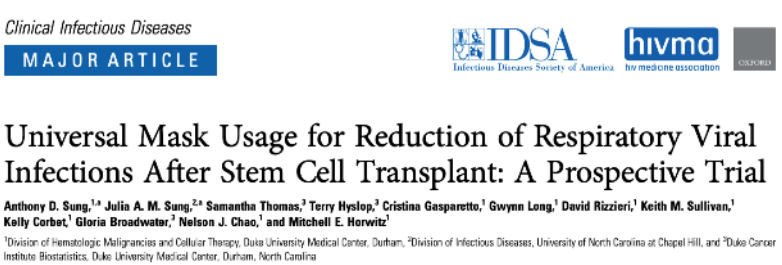
- Healthcare workers, patients and visitors

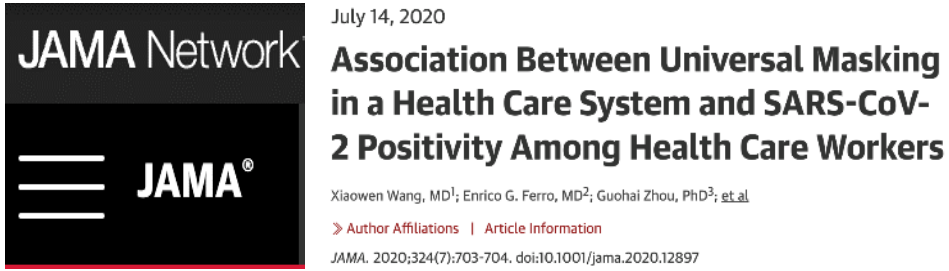
May be considered during:

- Respiratory virus season (e.g., October – April)
- Local increases in ED and outpatient visits for influenza-like illness and COVID-19
- Local outbreaks on specific units in a facility

https://www.cdc.gov/infectioncontrol/guidelines/viral/prevent-viral.html#print

Broader Use of Source Control





Pre- pandemic era, prospective study

Nosocomial transmission of respiratory viral infections decreased by 50-60% in a high-risk population when masking compliance rates were high.

During the intervention period, the positivity rate decreased linearly from 14.65% to 11.46%

Universal masking was associated with a significantly lower rate of SARS-CoV-2 positivity among HCWs

Sung AD et al. Clin Infect Dis. 2016 Oct 15;63(8):999-1006
Wang et al. JAMA. 2020;324(7):703-704

Broader Use of Source Control

Strategies	Description	Advantages of the strategy	Disadvantages of the strategy
Symptom-based precautions	Wearing a surgical mask in addition to standard precautions by patients with respiratory symptoms	- Better compliance with policy - Lower utilization of supplies - Better HCP-patient relationship	- Does not prevent asymptomatic and presymptomatic transmission - Requires high levels of vaccine and infection-induced immunity
Targeted masking	Wearing of a face mask in direct patient contact (either all patients or immunocompromised patients only)	- Better compliance with policy - Protection of (vulnerable) patients	- Does not prevent staff-to-staff transmission - Interferes with HCP-patient relationship
Epidemiology-based universal masking	Wearing surgical masks by all staff (clinical and nonclinical), patients, and visitors during high level of community transmission	- Adjustment to the risk of transmission, more acceptable by HCPs - Increased adherence and compliance with policy - Responsible utilization of supplies	- Difficult to implement in regions without sentinel data or wastewater surveillance - Challenge of back-and-force institution of a radical intervention in a complex environment

Caroline et al. ASHE.2023,3 e128,1-8

Broader Use of Source Control

Strategies	Description	Advantages of the strategy	Disadvantages of the strategy
Season-based universal masking	Wearing a surgical mask by all staff (clinical and nonclinical), patients, and visitors during seasonal respiratory viral periods	- Adjustment to the theoretical risk of transmission of all respiratory viruses with a seasonal pattern - Takes into account the risk of asymptomatic and presymptomatic respiratory infections - Prevents hospital functioning	- Decreased adherence from HCPs during low level of community transmission - Not covering non-seasonal respiratory infections - Utilization of supplies
Targeted continuous masking	Wearing of a face mask by all HCPs during their entire shifts in areas with patient care	- Prevents HCP-patient and patient-patient asymptomatic and presymptomatic transmission - Increased adherence due to consistency of the strategy - Prevents presenteeism or absenteeism in clinical areas - Mitigates presenteeism in clinical areas - Preserves patient safety - Maintains clinical activity	- Utilization of supplies - Not preventing staff-to-staff transmission in nonclinical areas - Interferes with HCP-patient relationship
Permanent universal masking	Wearing a surgical mask by all staff (clinical and nonclinical), patients, and visitors at any time	- Prevents asymptomatic and presymptomatic transmission in the hospital - Prevents absenteeism - Mitigates presenteeism - Preserves patient safety - Maintains hospital activity	- Lack of adherence and compliance related to fatigue, discomfort and tolerability - Large utilization of supplies

Caroline et al. ASHE.2023,3 e128,1-8

Personal Protective Equipment (PPE)

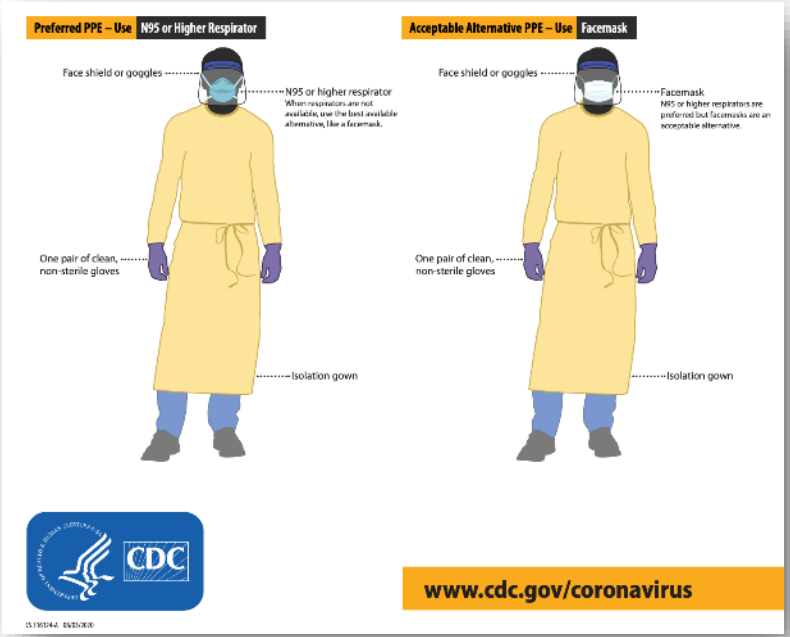
Droplet Precautions are intended to prevent transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions

The use of the mask is in addition to standard precautions, which includes use of a face shield or goggles as well as gown and gloves if contact with blood/body fluids is possible.

https://www.vdh.virginia.gov/content/uploads/sites/13/2016/03/LTC_DropletPrecautionsForCareProviders_FAQ.pdf

Infectious agents for which droplet precautions are indicated include *B. pertussis*, influenza virus, adenovirus, rhinovirus, N. meningitides, and group A streptococcus (for the first 24 hours of antimicrobial therapy).

Personal Protective Equipment (PPE)

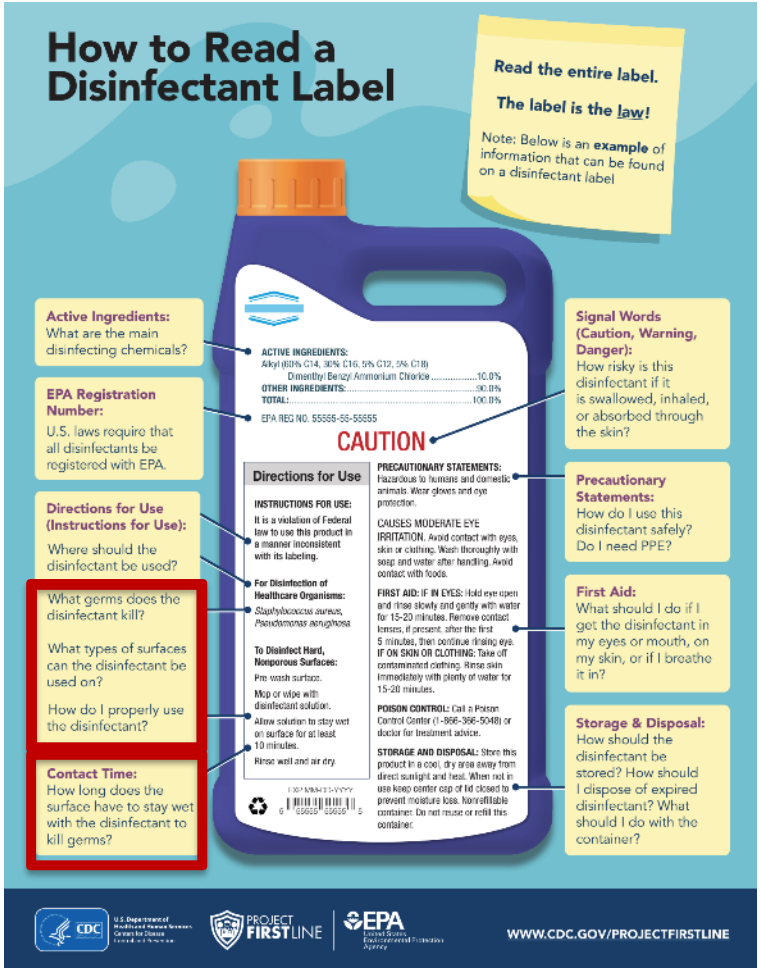


Healthcare workers who enter the room of a patient with suspected or confirmed SARS-CoV-2 infection should adhere to

- Standard Precautions and
- Use a NIOSH Approved particulate respirator with fit-tested N95 filters or higher
- Gown, gloves, and eye protection (i.e., goggles or a face shield that covers the front and sides of the face)

https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html

Environmental Cleaning



Lobby areas, cafeterias, and waiting rooms are all high-traffic spaces where respiratory viruses can spread.

These areas should be cleaned regularly.

It's also important to disinfect reusable devices and not reuse disposable items.

https://blogs.cdc.gov/safehealthcare/actions-for-respiratory-virus-season/
https://www.cdc.gov/hai/pdfs/HowToReadALabel-Infographic-508.pdf

The Role of Your Public Health Department in Preventing Respiratory Viral Infections in Healthcare Settings

- Keep communication lines open to learn what may be going on in your community – they have surveillance data on multiple conditions including respiratory viral activity
- Education of staff about PPE use – donning and doffing, fit-testing
- Help with resources for outbreak prevention, management and mitigation

The Role of Your Public Health Department in Preventing Respiratory Infections in Healthcare Settings

https://www.vdh.virginia.gov/tuberculosis/

The Role of Your Public Health Department in Preventing Respiratory Infections in Healthcare Settings

VDH VIRGINIA DEPARTMENT OF HEALTH

Tuberculosis Disease and Latent Tuberculosis Infection Reporting Guidance in Virginia

What to report:

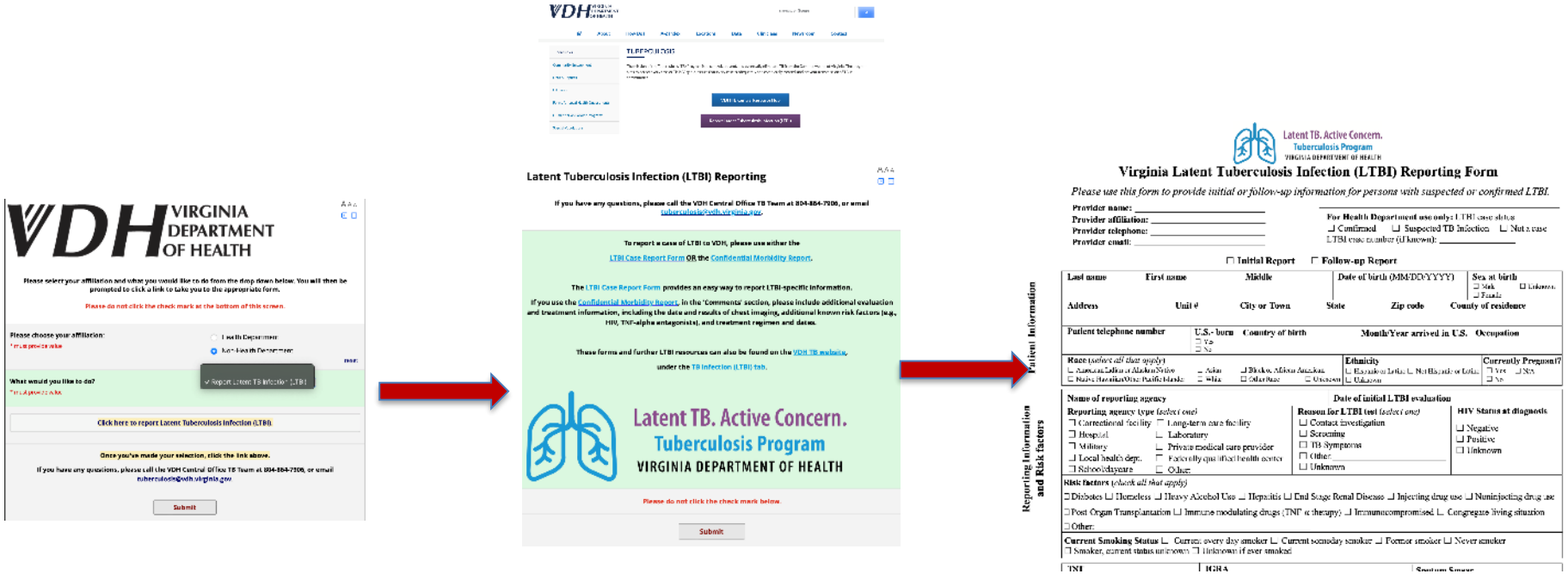
Presumptive or Confirmed Latent Tuberculosis Infection:

Latent tuberculosis infection should be reported to VDH within three days of diagnosis.

- Positive tuberculin skin test (TST)
  OR
- Positive interferon gamma release assay (IGRA)
  AND
- TB disease ruled-out (negative chest x-ray, no symptoms of active TB)

https://www.vdh.virginia.gov/tuberculosis/

The Role of Your Public Health Department in Preventing Respiratory Infections in Healthcare Settings



In Virginia, latent TB reporting can be done by leveraging the VDH portal

Summary

Healthcare acquired respiratory viral infections occur frequently especially during the cold and flu season.

Healthcare workers and visitors are can spread respiratory viruses to patients seeking care for other conditions

The very young and elderly can have complications from healthcare acquired respiratory viral infections leading to increased morbidity and mortality

There are multiple proven strategies to mitigate the spread of respiratory viral illness in healthcare settings

The local health department is a partner in preventing respiratory infection outbreaks in healthcare settings.

Thank You

Use the following infection control measures to prevent and slow the spread of respiratory infections in your facility.

Use of well-fitting masks or respirators, that cover a person's mouth and nose, can prevent the spread of germs when people are breathing, talking, sneezing, or coughing.

Encourage everyone in your facility to get recommended vaccinations. Vaccination is a safe and effective strategy for reducing disease spread and staff absenteeism.

Practice physical distancing, particularly in shared spaces such as waiting rooms, and implement screening and triage procedures. Use signs as visual reminders for patients, implement rapid screening, and separate symptomatic patients as soon as possible.

Practice respiratory hygiene and cough etiquette and encourage others to do the same. Provide masks, tissues, and no-touch receptacles for tissue disposal at facility entrances, triage areas, and waiting rooms.

Clean your hands regularly with an alcohol-based hand sanitizer or soap and water. Share key messages and reminders within in your facility by using CDC's Clean Hands Count resources.

Clean and disinfect regularly. Lobby areas, cafeterias, and waiting rooms are all high-traffic spaces where germs can spread. It's also important to disinfect reusable devices and not reuse disposable items.

Check that the air handling in your facility is functioning as it should. Make sure air vents aren't blocked, and consult with facilities management to ensure the heating, ventilation, and air conditioning, or HVAC, system is working efficiently for proper ventilation.

www.cdc.gov/ProjectFirstline

WE HAVE THE POWER TO STOP INFECTIONS. TOGETHER.

CDC

PROJECT FIRSTLINE

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Prevention of Ventilator-Associated Events

Presented by:

Michel Klompas MD, MPH, FIDSA, FSHEA
Hospital Epidemiologist, Brigham and Women's Hospital, Boston, MA
Professor, Harvard Medical School and Harvard Pilgrim Health Care Institute

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  - Centers for Disease Control and Prevention
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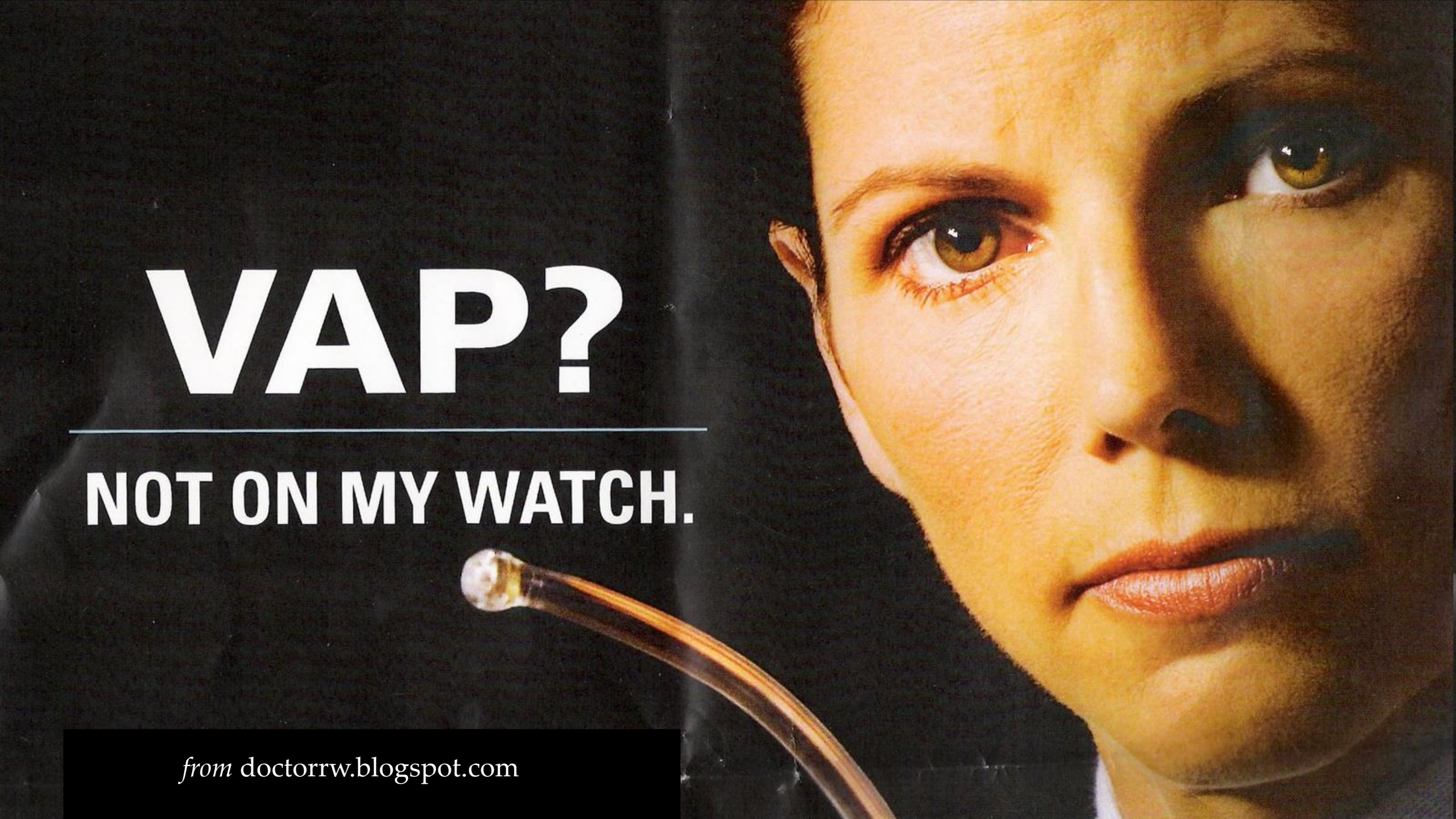
  - Agency for Healthcare Research and Quality

- **Royalties**
  - UpToDate Inc.


VAP?
NOT ON MY WATCH.
from doctorrw.blogspot.com

Why did CDC replace VAP with VAE?

The Challenge of VAP Diagnosis

- **Many complications of critical care present with the same clinical signs as VAP**
  - Radiographic opacities
  - Fever
  - Abnormal white blood cell count
  - Impaired oxygenation
  - Increased pulmonary secretions

“Diffuse patchy airspace disease right greater than left with obliteration of both hemi-diaphragms. Opacities possibly slightly increased since yesterday accounting for changes in patient position and inspiration. This could represent atelectasis, pneumonia, or effusion.”

Sources of fever and infiltrates

- **ARDS**
- **Thromboembolic disease**
- **Hemorrhage**
- **Infarction**
- **Fibrosis**
- **Carcinoma**
- **Lymphoma**
- **Contusion**

Tracheobronchitis

CLABSI

UTI

Drug fever

PLUS

Pulmonary edema

Atelectasis

Contusion

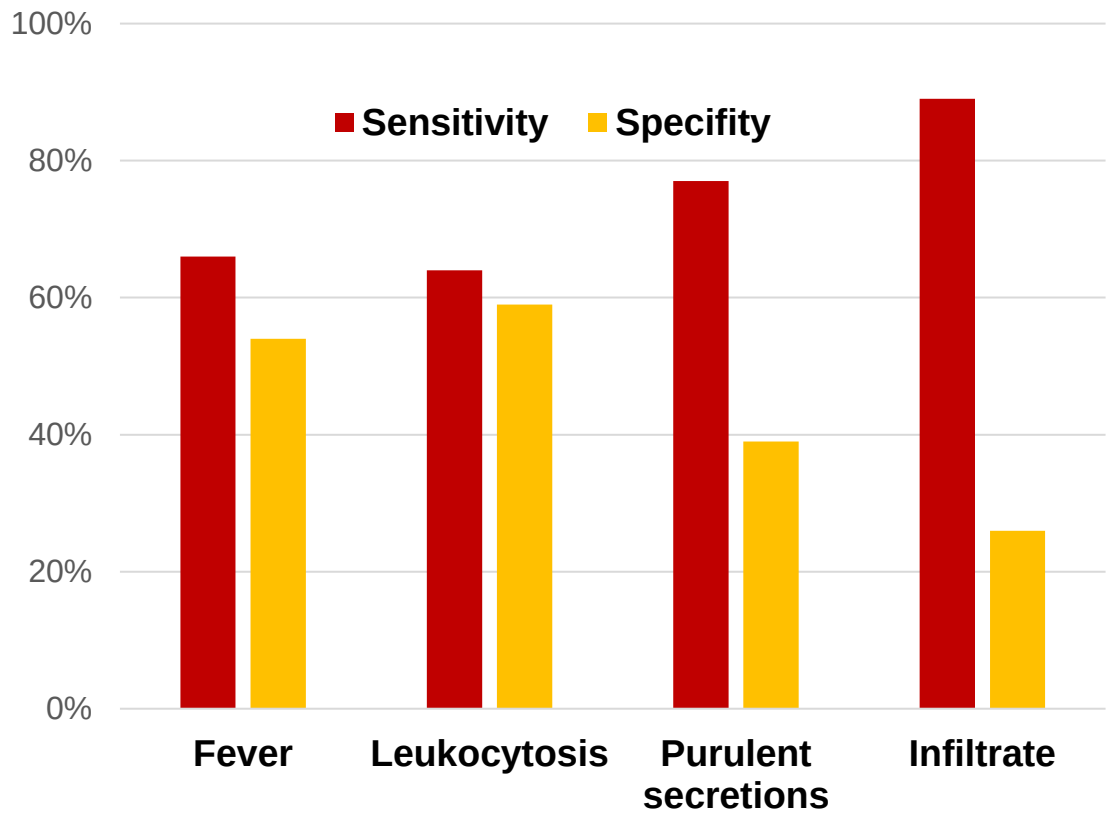
Fibrosis

Meduri, *Chest* 1994; 106:221-235
Petersen, *Scand J Infect Dis* 1999; 31:299-303

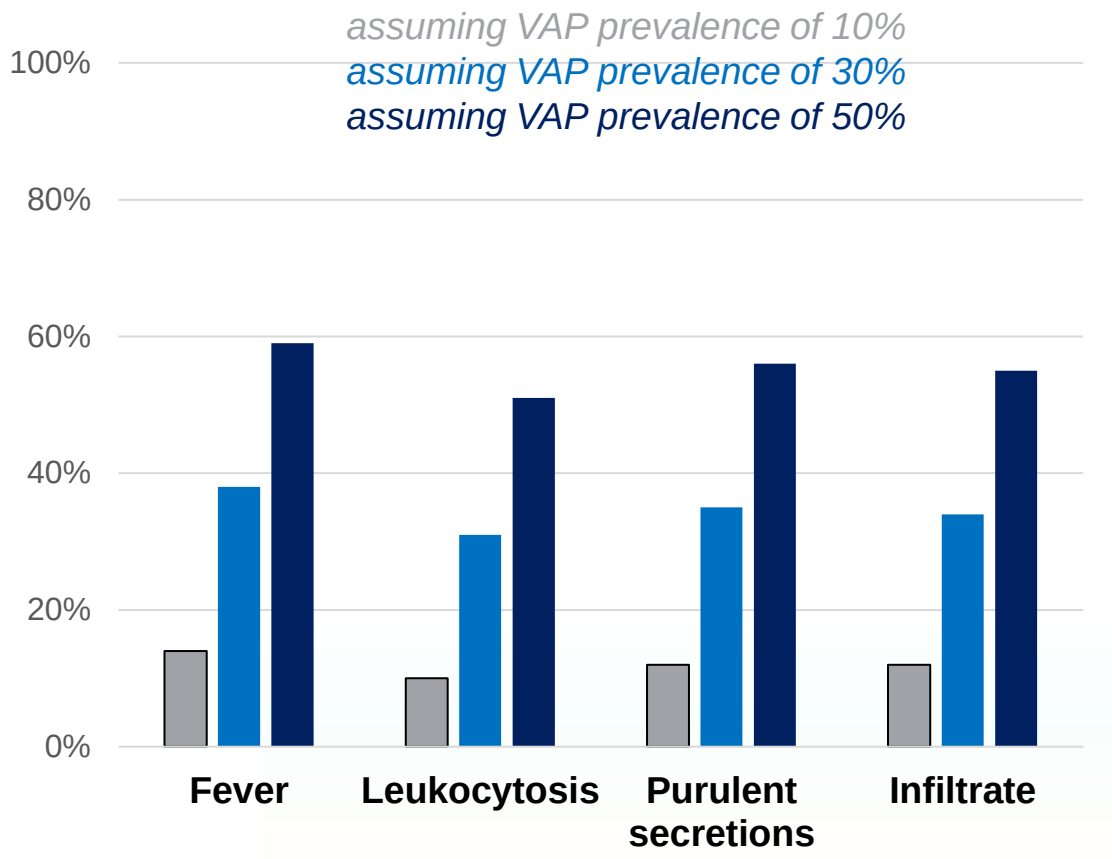
Accuracy of Clinical Signs for VAP

Meta-analysis of 25 studies examining accuracy of clinical signs for VAP relative to histology, N=75 to 336 per sign

Sensitivity and Specificity



Positive Predictive Value

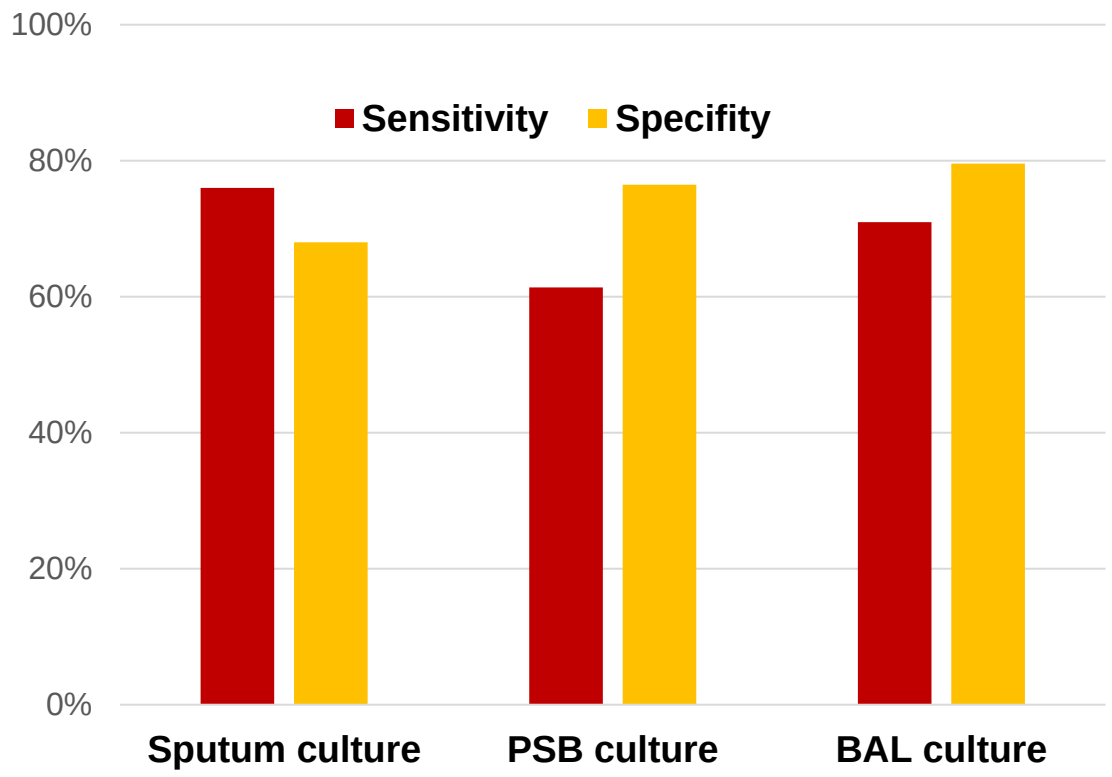


Fernando, *Intensive Care Med* 2020;46:1170-9

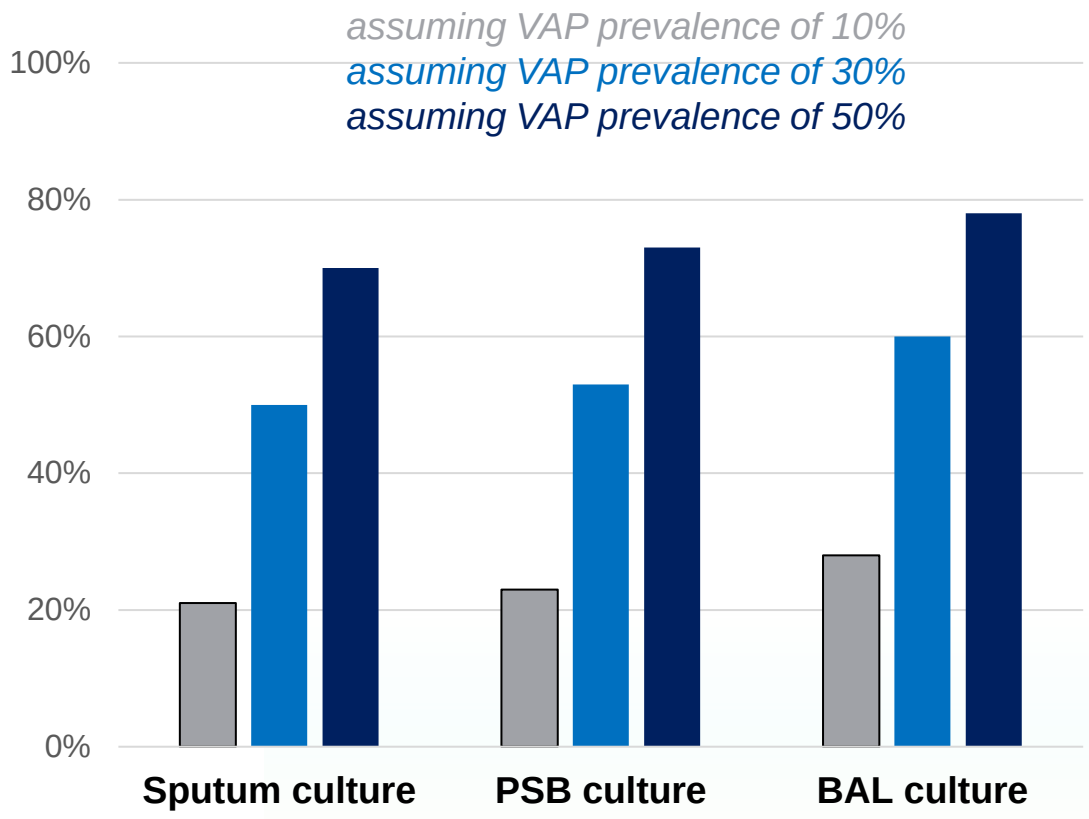
Accuracy of Respiratory Cultures for VAP

Meta-analysis of 25 studies examining accuracy of clinical signs for VAP relative to histology, N=75 to 336 per sign

Sensitivity and Specificity



Positive Predictive Value



Fernando, *Intensive Care Med* 2020;46:1170-9

Implications for Prevention

The Classic Ventilator Bundle

Elevate the head of the bed

Daily sedative interruptions

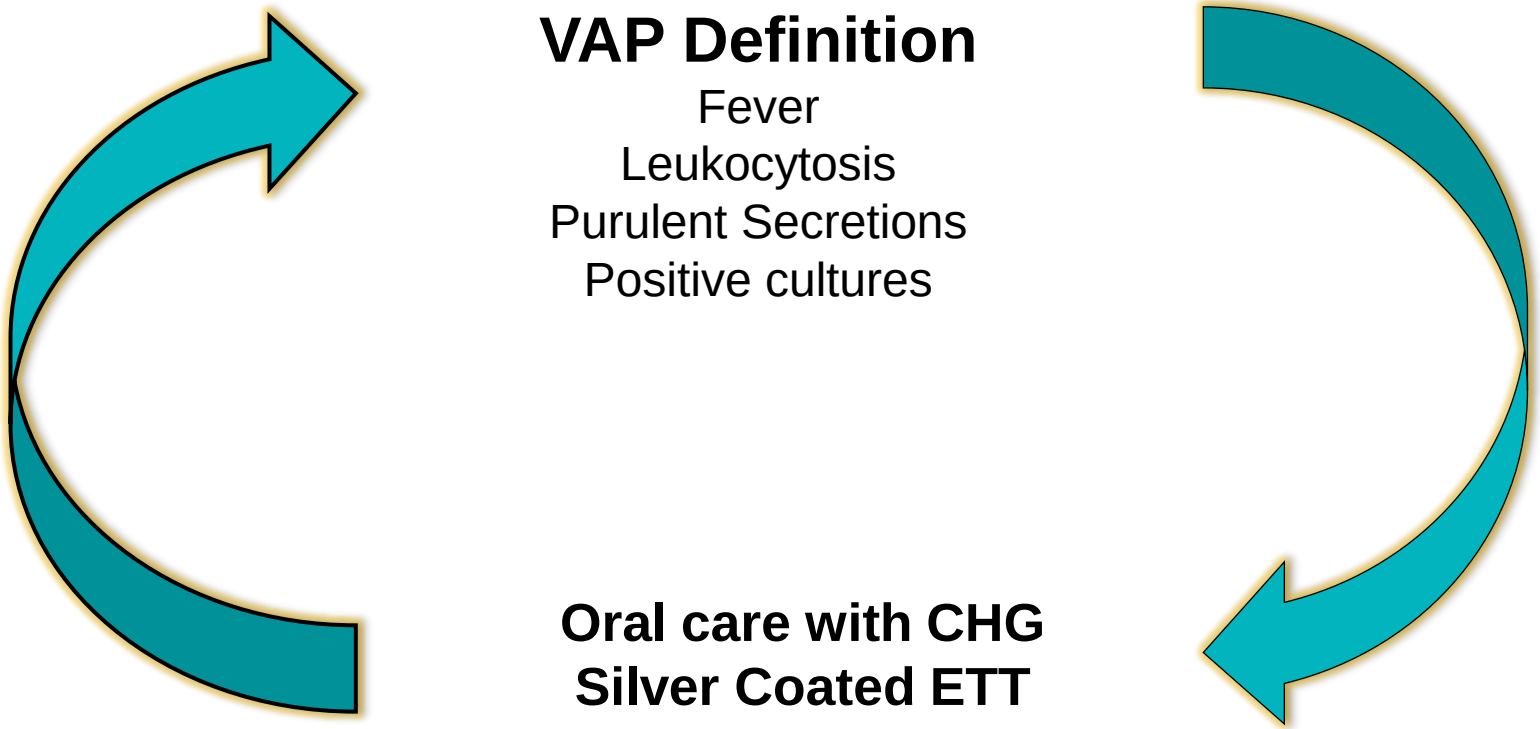
Spontaneous breathing trials

Stress ulcer prophylaxis

DVT prophylaxis

Oral care with chlorhexidine

Circularity Between VAP Prevention Practices and the VAP Definition



Stress Ulcer Prophylaxis

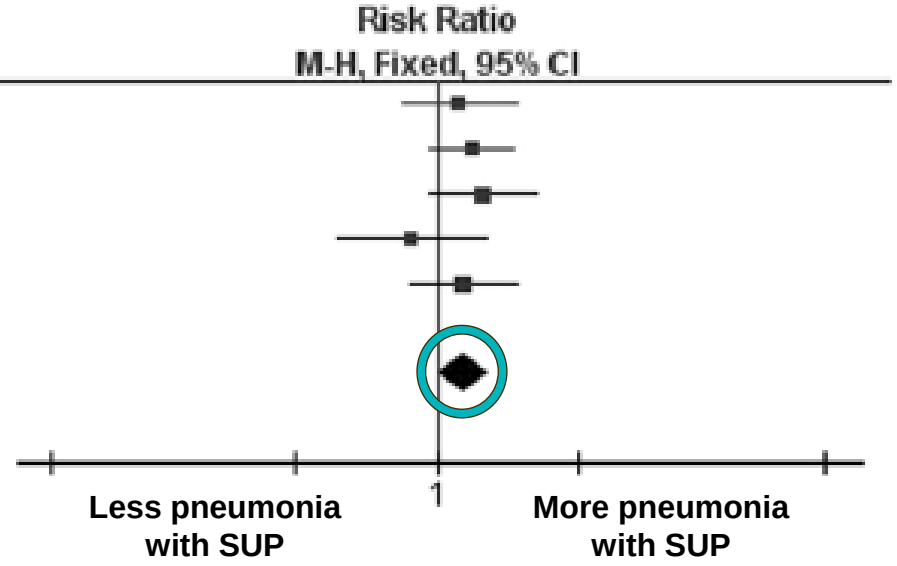
Randomized controlled trials of ulcer prophylaxis vs placebo in patients getting enteral nutrition

Ventilator-associated pneumonia

	Antacid		Placebo			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
Alhazzani 2017	10	49	6	42	18.5%	1.43 [0.57, 3.60]
Apte 1992	11	16	7	18	18.8%	1.77 [0.91, 3.44]
Ben-menachem 1994	25	200	6	100	22.9%	2.08 [0.88, 4.91]
Lin 2016	4	60	6	60	17.2%	0.67 [0.20, 2.24]
Selvanderan 2016	12	106	8	108	22.7%	1.53 [0.65, 3.59]
Total (95% CI)		**431**		**328**	**100.0%**	**1.53 [1.04, 2.27]**
Total events	62		33			

Heterogeneity: $Chi^2 = 2.50$, $df = 4$ ($P = 0.65$); $I^2 = 0\%$

Test for overall effect: $Z = 2.14$ ($P = 0.03$)



Significantly higher risk for VAP!

Crit Care 2018;22:20

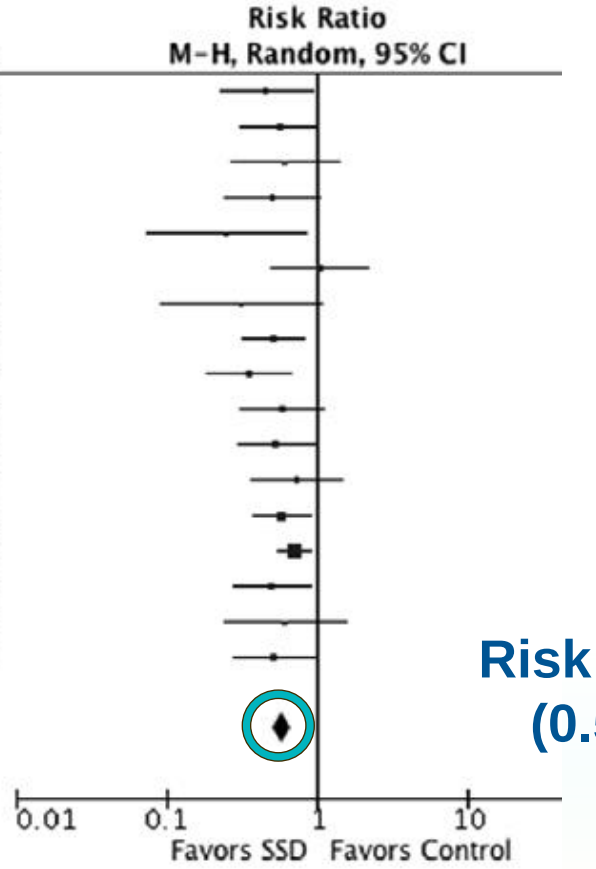
Subglottic Secretion Drainage

Meta-Analysis of randomized trials: ***Significantly Lower VAP Rates***

Study or Subgroup	SSD Events	SSD Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Mahul 1992	9	70	21	75	3.8%	0.46 [0.23, 0.93]	1992
Valles 1995	14	95	25	95	5.5%	0.56 [0.31, 1.01]	1995
Kollef 1999	8	160	15	183	2.8%	0.61 [0.27, 1.40]	1999
Bo 2000	8	35	15	33	3.7%	0.50 [0.25, 1.03]	2000
Smulders 2002	3	75	12	75	1.3%	0.25 [0.07, 0.85]	2002
Girou 2004	5	8	6	10	3.5%	1.04 [0.50, 2.18]	2004
Liu S 2006	3	48	10	50	1.3%	0.31 [0.09, 1.07]	2006
Liu Q 2006	14	41	30	45	8.5%	0.51 [0.32, 0.82]	2006
Lorente 2007	11	140	31	140	4.6%	0.35 [0.19, 0.68]	2007
Zheng 2008	9	30	16	31	4.6%	0.58 [0.31, 1.11]	2008
Yang 2008	12	48	20	43	5.6%	0.54 [0.30, 0.97]	2008
Bouza 2008	13	345	19	369	4.0%	0.73 [0.37, 1.46]	2008
Lacherade 2010	25	169	42	164	9.6%	0.58 [0.37, 0.90]	2010
Tao 2014	52	102	34	47	28.3%	0.70 [0.54, 0.91]	2014
Damas 2014	15	170	32	182	5.7%	0.50 [0.28, 0.89]	2014
Koker 2014	5	23	10	28	2.3%	0.61 [0.24, 1.53]	2014
Gopal 2015	13	120	25	120	5.0%	0.52 [0.28, 0.97]	2015
Total (95% CI)		**1679**		**1690**	**100.0%**	**0.58 [0.51, 0.67]**	
Total events	219		363				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 12.12$, df = 16 (P = 0.74); $I^2 = 0\%$

Test for overall effect: Z = 7.71 (P < 0.00001)



Risk Ratio 0.58 (0.51- 0.67)

Crit Care Med 2016;44:830-840

Subglottic Secretion Drainage

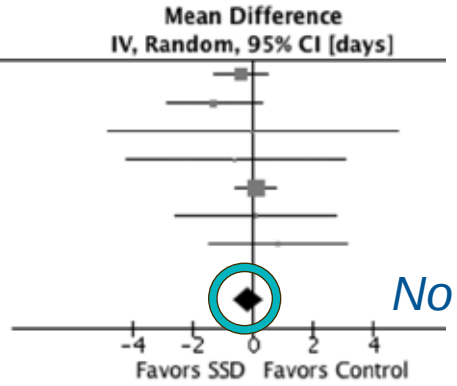
Meta-Analysis of randomized trials: ***No Impact on Ventilator Days or ICU Days***

Ventilator Days

	SSD			Control				Mean Difference	
Study or Subgroup	Mean [days]	SD [days]	Total	Mean [days]	SD [days]	Total	Weight	IV, Random, 95% CI [days]	Year
Kollef 1999	1.5	3.3	160	1.9	5.1	183	29.1%	-0.40 [-1.30, 0.50]	1999
Smulders 2002	5.8	4.4	75	7.1	5.4	75	9.5%	-1.30 [-2.88, 0.28]	2002
Liu S 2006	15	14	48	15	10	50	1.0%	0.00 [-4.83, 4.83]	2006
Lorente 2007	10.5	15.91	140	11.1	15.19	140	1.8%	-0.60 [-4.24, 3.04]	2007
Bouza 2008	2	5.3	345	1.9	3.8	369	50.8%	0.10 [-0.58, 0.78]	2008
Lacherade 2010	10.9	10.6	169	10.8	14	164	3.3%	0.10 [-2.57, 2.77]	2010
Damas 2014	11.71	11.87	170	10.87	9.79	182	4.5%	0.84 [-1.44, 3.12]	2014
Total (95% CI)			**1107**			**1163**	**100.0%**	**-0.16 [-0.64, 0.33]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.68$, df = 6 (P = 0.72); $I^2 = 0\%$

Test for overall effect: Z = 0.64 (P = 0.52)



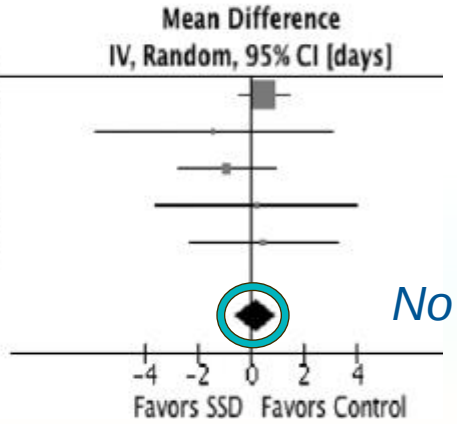
No difference!

ICU Days

	SSD			Control				Mean Difference	
Study or Subgroup	Mean [days]	SD [days]	Total	Mean [days]	SD [days]	Total	Weight	IV, Random, 95% CI [days]	Year
Kollef 1999	3.7	4.6	160	3.2	4.5	183	66.3%	0.50 [-0.47, 1.47]	1999
Lorente 2007	14.1	17.91	140	15.5	19.93	140	3.1%	-1.40 [-5.84, 3.04]	2007
Bouza 2008	5.6	10.7	345	6.5	14.2	369	18.3%	-0.90 [-2.74, 0.94]	2008
Lacherade 2010	15.9	14.4	169	15.7	20.4	164	4.3%	0.20 [-3.60, 4.00]	2010
Damas 2014	16.2	13.52	170	15.76	13.15	182	8.0%	0.44 [-2.35, 3.23]	2014
Total (95% CI)			**984**			**1038**	**100.0%**	**0.17 [-0.62, 0.95]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.27$, df = 4 (P = 0.69); $I^2 = 0\%$

Test for overall effect: Z = 0.41 (P = 0.68)



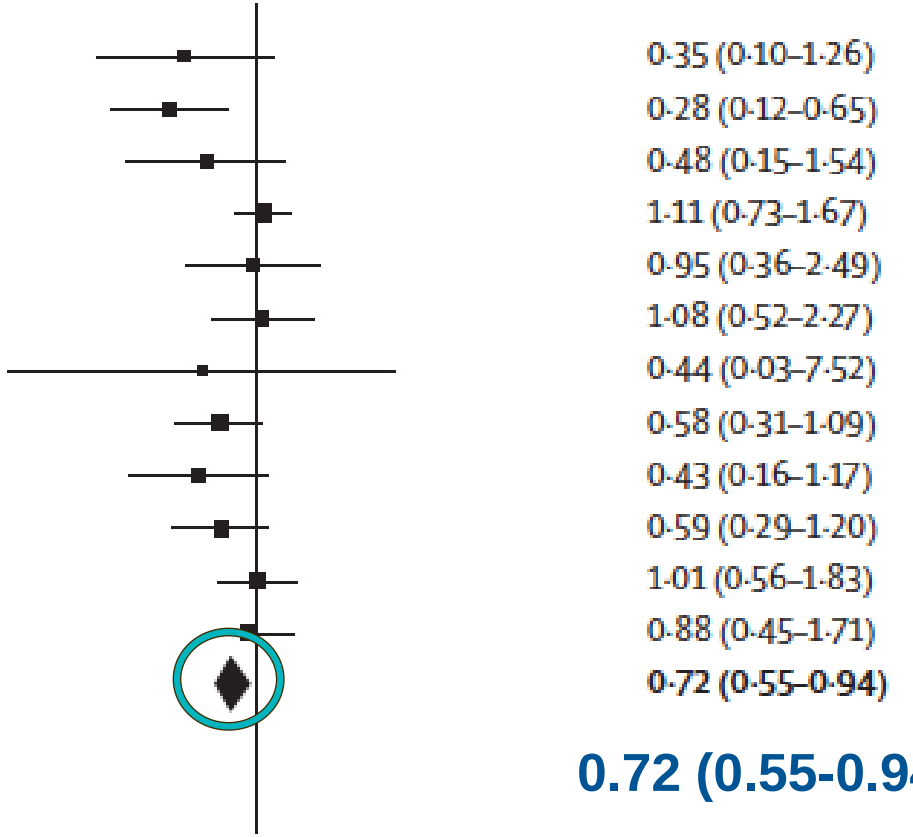
No difference!

Crit Care Med 2016;44:830-840

Oral Care with Chlorhexidine: Significantly *Lower* VAP Rates

Chlorhexidine					
De Riso et al (1996)[18]	3	173	9	180	3·8%
Fourrier et al (2000)[13]	5	30	18	30	7·0%
Houston et al (2002)[20]	4	270	9	291	4·4%
MacNaughton et al (2004)[22]	32	91	28	88	14·1%
Grap et al (2004)[14]	4	7	3	5	5·9%
Fourrier et al (2005)[19]	13	114	12	114	8·3%
Bopp et al (2006)[17]	0	2	1	3	0·9%
Koeman et al (2006)[21]	13	127	23	130	9·9%
Tantipong et al (2008)[23]	5	102	12	105	5·5%
Scannapieco et al (2009)[26]	14	116	12	59	8·8%
Bellisimo-Rodriguez et al (2009)[24]	16	64	17	69	10·6%
Panchabhai et al (2009)[25]	14	88	15	83	9·4%
Subtotal (95% CI)		**1184**		**1157**	**88·5%**
Total events	123		159		
Heterogeneity: τ^2=0·06, χ^2=15·54, df=11 (p=0·16); I^2=29%					
Test for overall effect: Z=2·40 (p=0·02)					

Ventilator-Associated Pneumonia



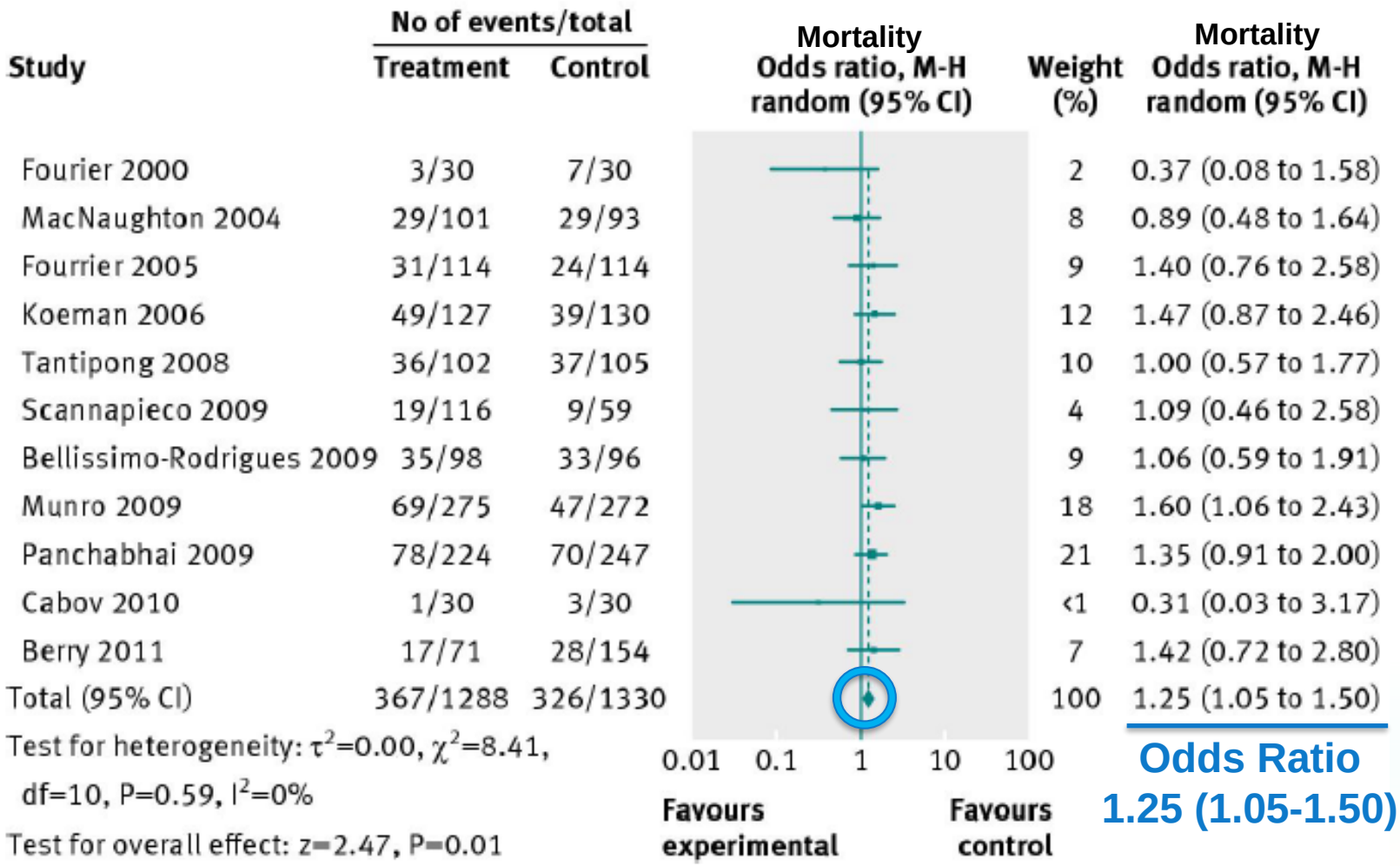
	0·35 (0·10–1·26)
	0·28 (0·12–0·65)
	0·48 (0·15–1·54)
	1·11 (0·73–1·67)
	0·95 (0·36–2·49)
	1·08 (0·52–2·27)
	0·44 (0·03–7·52)
	0·58 (0·31–1·09)
	0·43 (0·16–1·17)
	0·59 (0·29–1·20)
	1·01 (0·56–1·83)
	0·88 (0·45–1·71)
	0·72 (0·55–0·94)

0.72 (0.55-0.94)

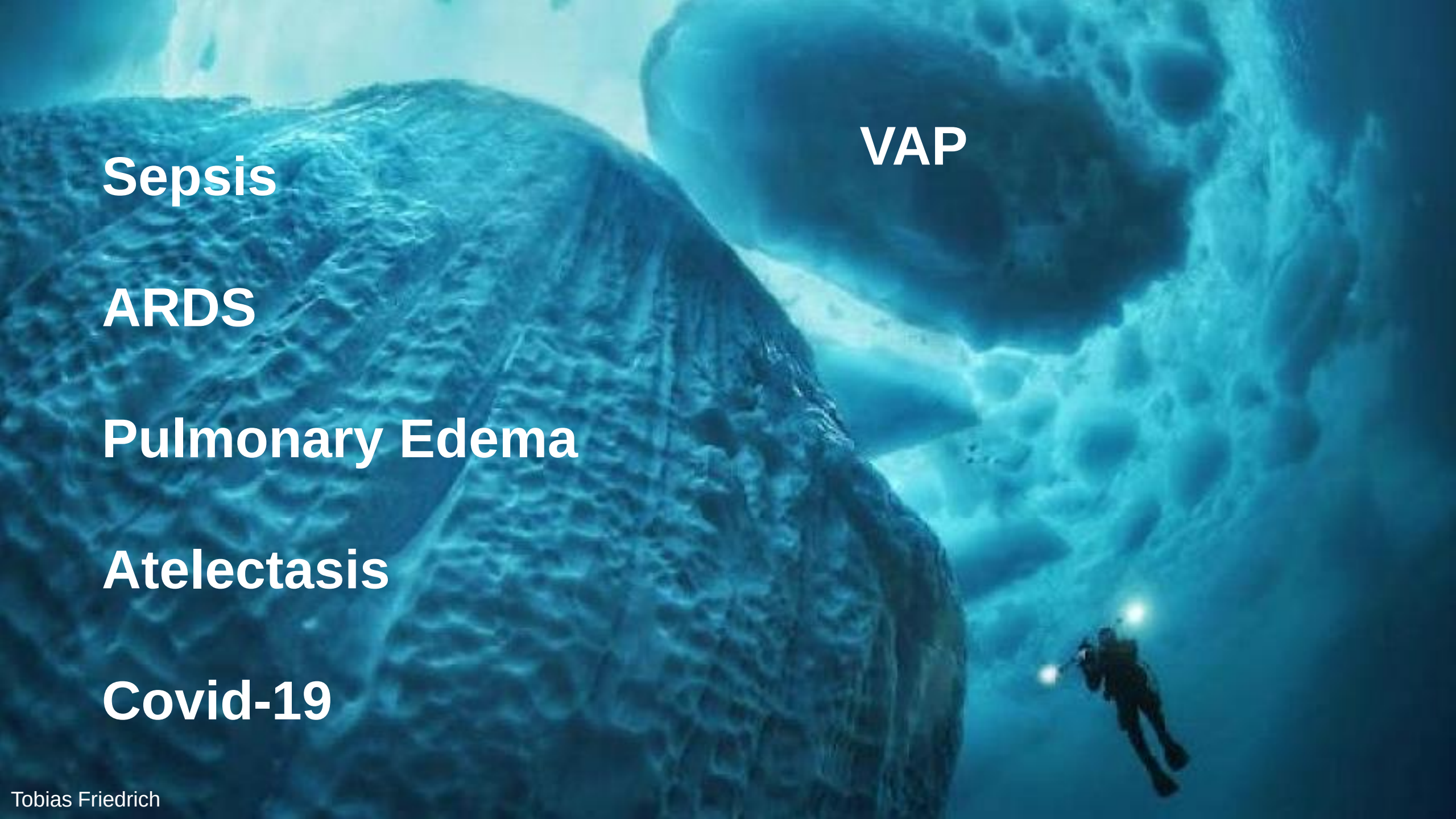
Significantly lower VAP rates!

Lancet Infectious Disease 2011;11:845

Oral Care with Chlorhexidine: Significantly *Higher* Mortality Rates



BMJ 2014;348:g2197


VAP
Sepsis
ARDS
Pulmonary Edema
Atelectasis
Covid-19

Implications for Surveillance

CDC's VAP Surveillance Definition

2008

Patient must fulfill each of the three categories below:

Chest Radiograph	*Any one of the following:* 1. New, progressive, or persistent infiltrate 2. Consolidation 3. Cavitation
Systemic Signs	*Any one of the following:* 1. Temperature >38°C 2. WBC <4,000 or >12,000 WBC/mm^3 3. For adults 70 years old, altered mental status with no other recognized cause
Pulmonary Signs	*Any two of the following:* 1. New onset of purulent sputum, or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements 2. New onset or worsening cough, or dyspnea, or tachypnea 3. Rales or bronchial breath sounds 4. Worsening gas exchange, increased oxygen requirements, or increased ventilation demand

Complicated

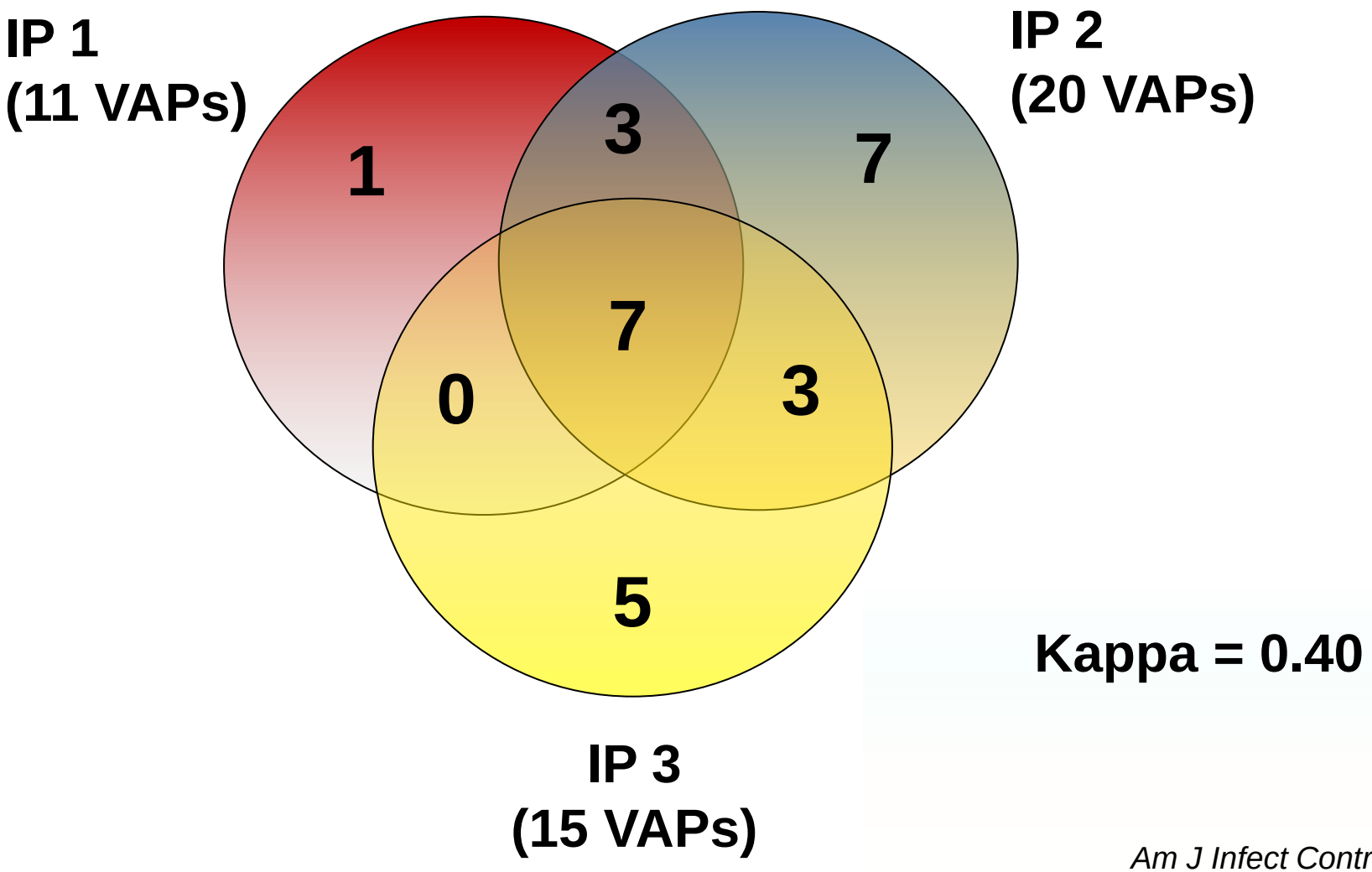
Labor Intensive

Subjective

Non-Specific

Interobserver Agreement in VAP Surveillance

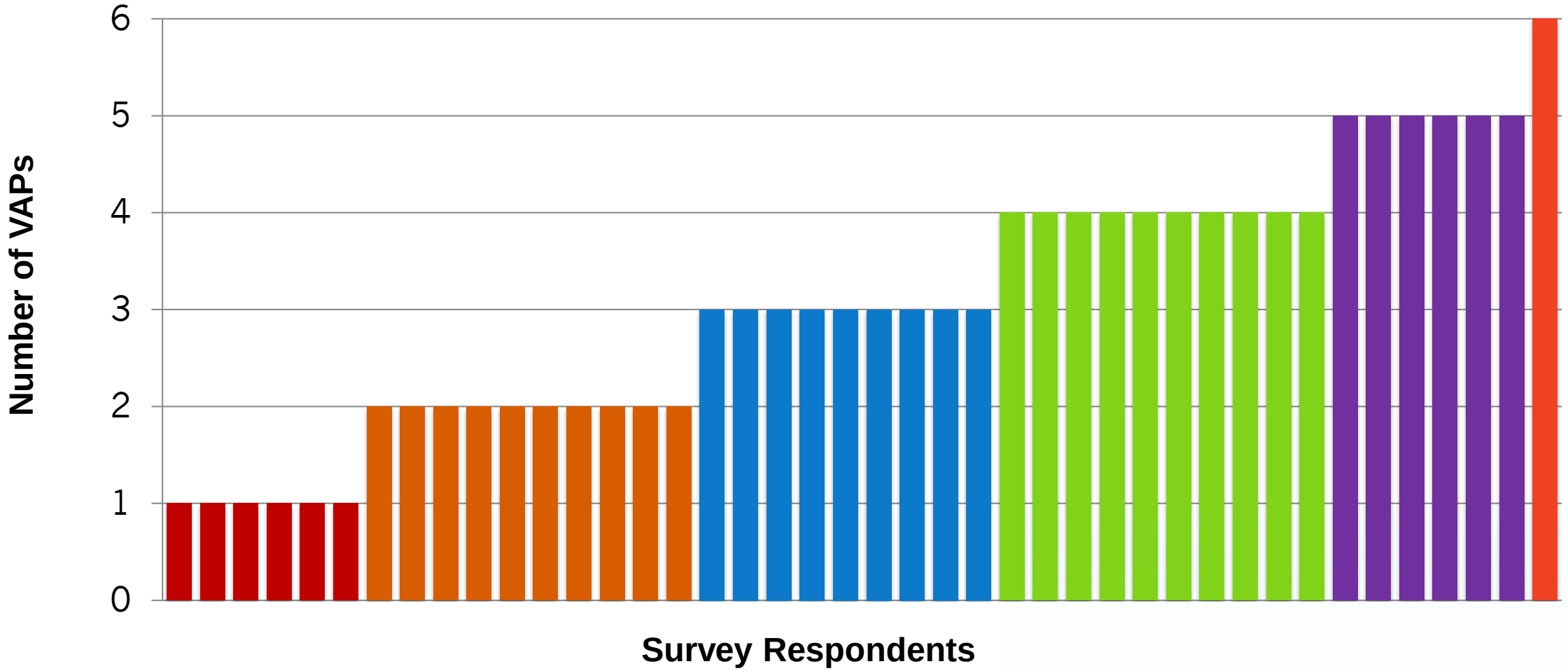
50 ventilated patients with respiratory deterioration



Kappa = 0.40

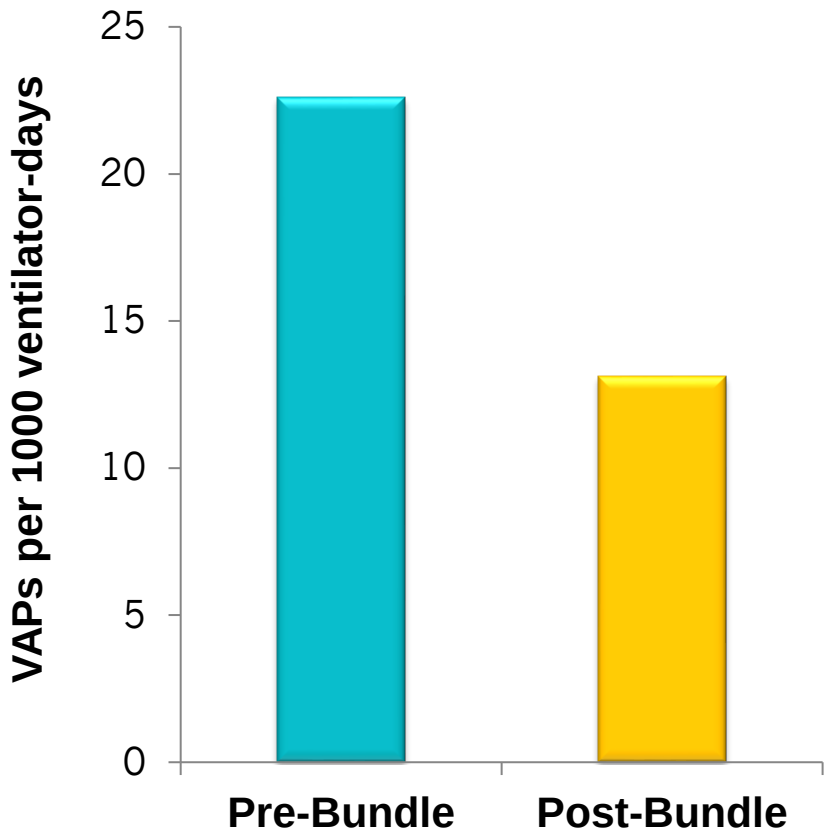
Am J Infect Control 2010:38:237

6 Case Vignettes Presented to 43 Reviewers



Crit Care Med 2014;42:497

How do we interpret a drop in VAP rates?



Better Care?

Stricter Surveillance?

Less colonization vs less VAP?

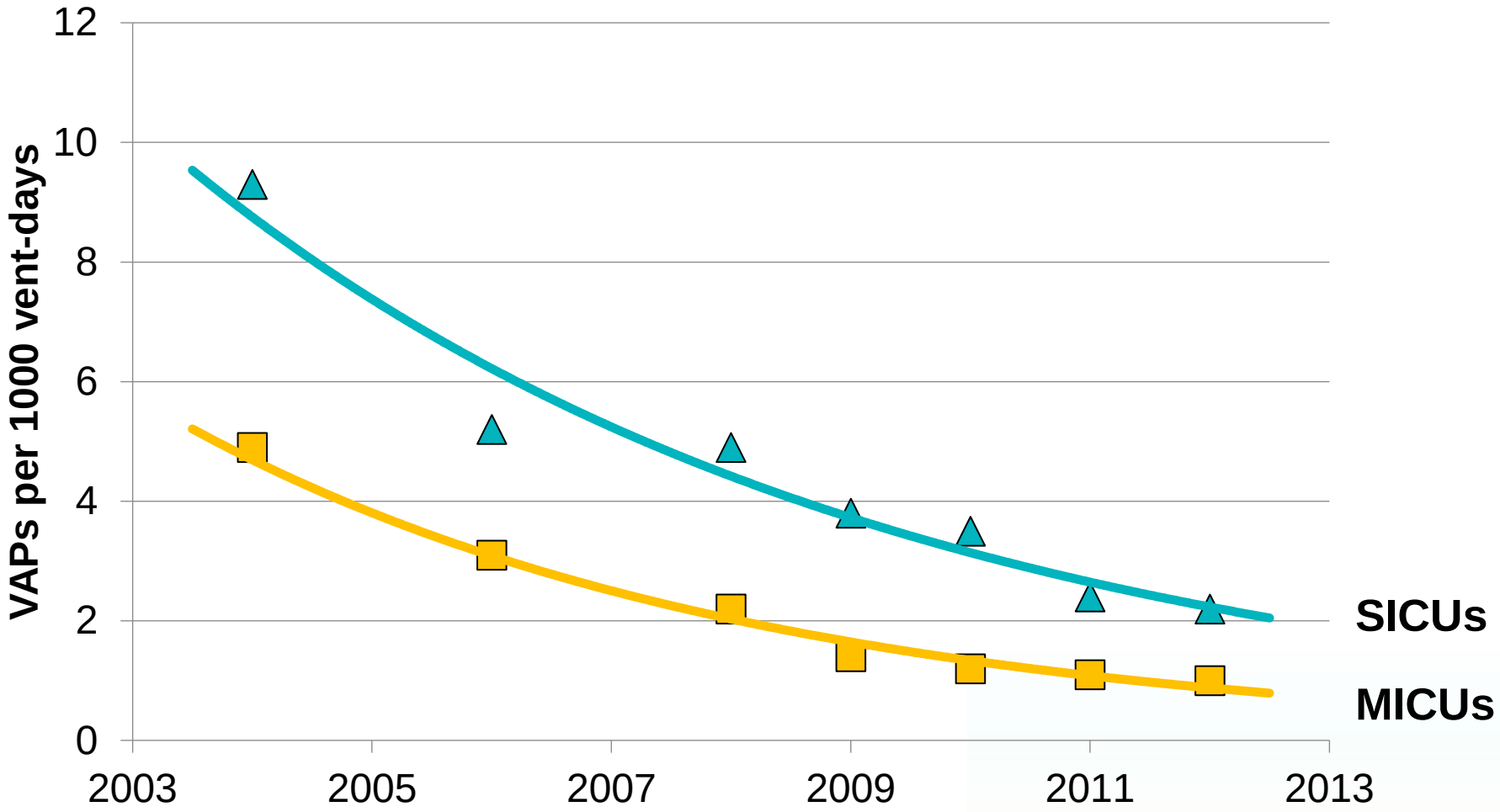
Change in case mix?

Some combination of the above?

Am J Infect Control 2012;40:408-410

U.S. National VAP Rates

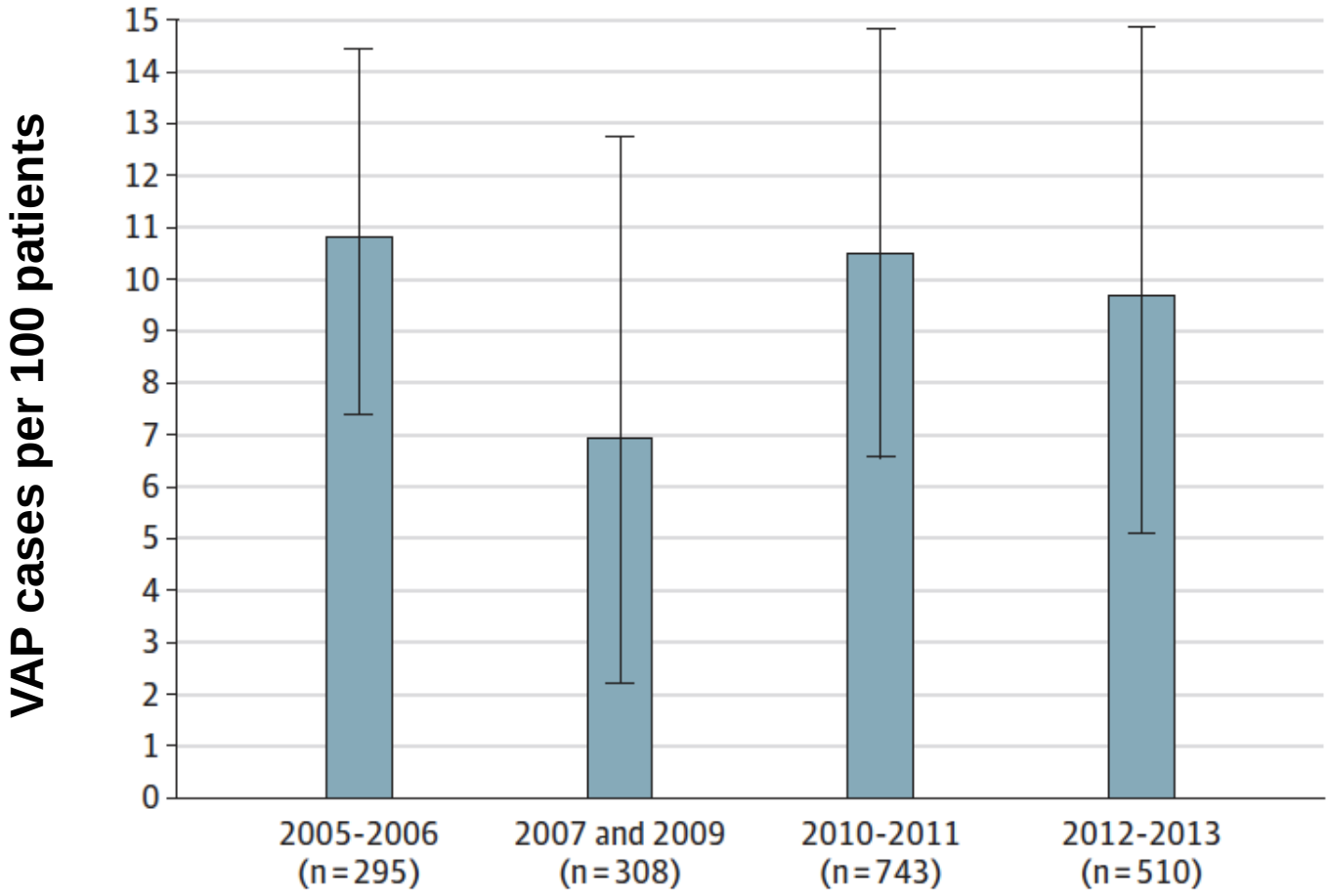
Cases Reported to CDC by Hospitals, 2004-2012



Source: CDC NNIS and NHSN

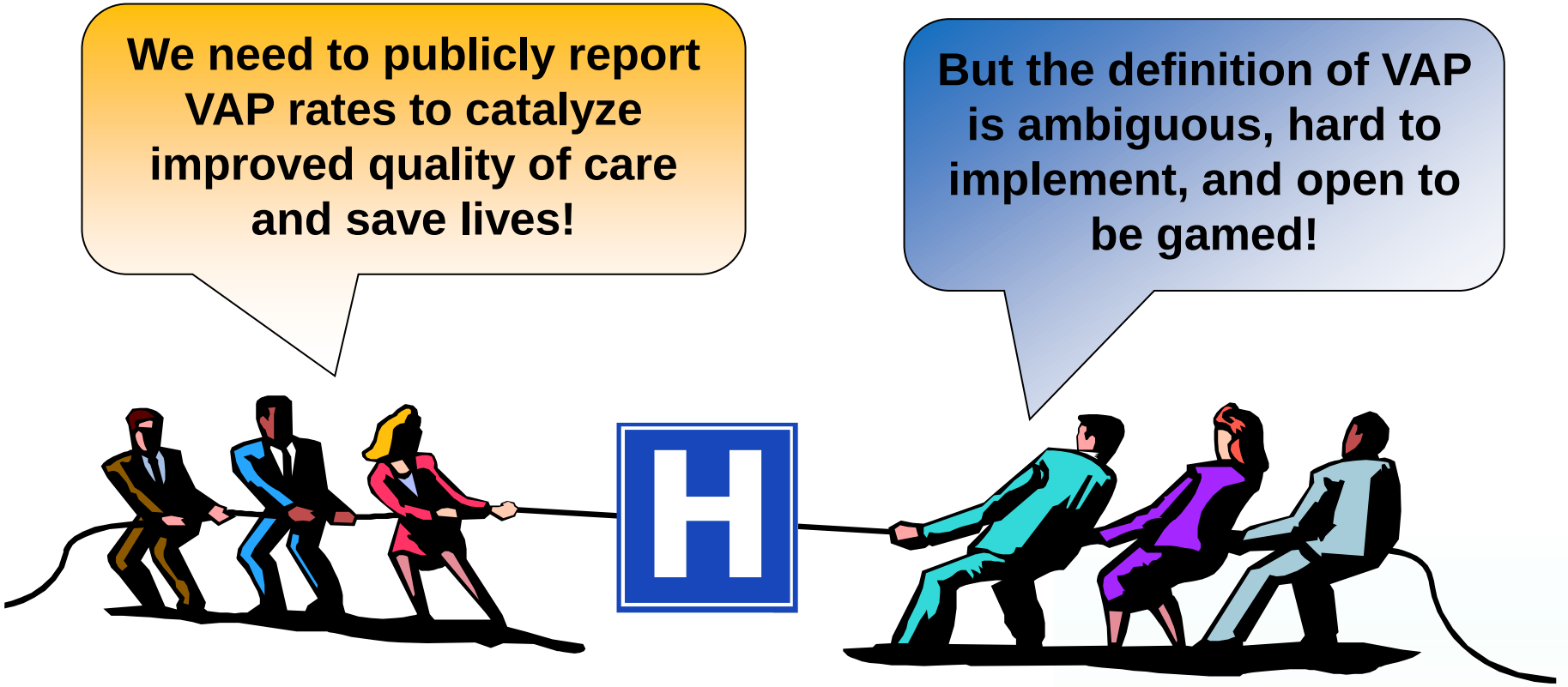
U.S. National VAP Rates, 2005-2013

Centers for Medicare and Medicaid Services Audits



JAMA 2016;316:2427-2429

Where does this leave hospitals?



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Council of State and Territorial Epidemiologists

Leaders in Applied Public Health Epidemiology

Special Point of View Article

Developing a New, National Approach to Surveillance for Ventilator-Associated Events*

Shelley S. Magill, MD, PhD[1]; Michael Klompas, MD, MPH[2,3,4]; Robert Balk, MD[5,6]; Suzanne M. Burns, RN, ACNP, MSN, RRT[6,7]; Clifford S. Deutschman, MS, MD[6,8]; Daniel Diekema, MD[9,10]; Scott Fridkin, MD[1]; Linda Greene, RN, MPS[11,12]; Alice Guh, MD, MPH[1]; David Gutterman, MD[6,13]; Beth Hammer, RN, MSN, ANP-BC[6,14]; David Henderson, MD[15]; Dean Hess, PhD, RRT[16,17,18]; Nicholas S. Hill, MD[6,19]; Teresa Horan, MPH[1]; Marin Kollef, MD[6,20]; Mitchell Levy, MD[6,21]; Edward Septimus, MD[22,23]; Carole VanAntwerpen, RN, BSN[24,25]; Don Wright, MD, MPH[26]; Pamela Lipsett, MD, MHPE[6,27]

Critical Care Medicine 2013;41:2467-2475

VAE: An Alternative Approach to Surveillance

- **Broaden the focus of surveillance from pneumonia alone to the syndrome of ventilator complications in general**
  - More accurate description of what can be reliably determined using surveillance definitions
  - Emphasizes the importance of preventing ***all*** complications of mechanical ventilation, not just pneumonia

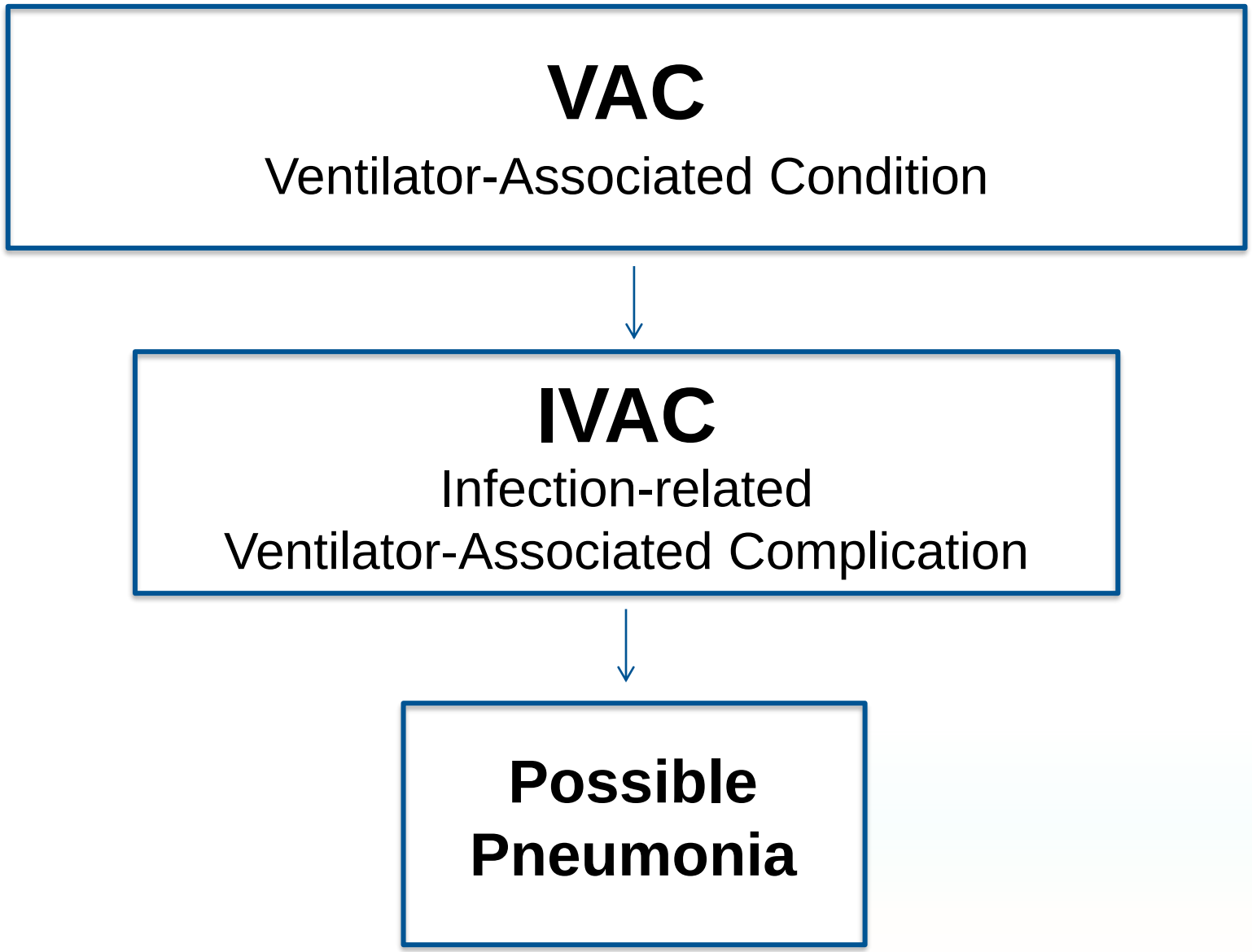
- **Streamline the definition using quantitative criteria**
  - Reduce ambiguity
  - Improve reproducibility
  - Enable electronic collection of all variables

Ventilator-Associated Events (VAE)

Sustained rise in daily minimum PEEP ≥3cm or FiO2 ≥20 points after a period of stable or improving daily minimum PEEP or FiO2

Date	PEEP (min)	FiO2 (min)
Jan 1	10	100
Jan 2	5	50
Jan 3	5	40
Jan 4	5	40
Jan 5	5	50
Jan 6	8	60
Jan 7	8	40
Jan 8	5	40
Jan 9	5	40

VAE


VAC
Ventilator-Associated Condition
IVAC
Infection-related
Ventilator-Associated Complication
Possible
Pneumonia

Pediatric Ventilator-Associated Events (PedVAE)

Sustained rise in daily minimum MAP ≥4cm or FiO2 ≥25 points after a period of stable or improving daily minimum MAP or FiO2

Date	MAP (min)	FiO2 (min)
Jan 1	7	100
Jan 2	7	50
Jan 3	8	40
Jan 4	8	40
Jan 5	8	60
Jan 6	12	50
Jan 7	12	40
Jan 8	5	40
Jan 9	5	40

PedVAE

https://www.cdc.gov/nhsn/vae-calculator/index.html

National Healthcare Safety Network (NHSN)

Start Over | Calculate IVAC | Explain... | Go to PVAP

MV Day	Date	Hide... Min. PEEP (cmH_2O)	Hide... Min. FiO_2 (21 - 100)	VAE	T<36° or T>38°	WBC ≤ 4,000 or WBC ≥ 12,000 cells/mm^3	Add... Remove... Choose a Drug: CEFEPIME	QAD
1	12/3/2023	5	60				☐	
2	12/4/2023	5	40				☐	
† 3	12/5/2023	5	40		☐	☐	☐	
† 4	12/6/2023	10	70	‡ IVAC	☑	☐	☑	¶ yes
† 5	12/7/2023	8	50		☐	☑	☑	¶ yes
† 6	12/8/2023	8	40		☐	☐	☑	¶ yes
7	12/9/2023	5	40				☑	¶ yes
8	12/10/2023	5	40				☑	¶ yes
9	12/11/2023	5	40				☑	¶ yes
10	12/12/2023						☑	¶ yes

Legend: † - VAE Window | ‡ - VAE Date | ¶ - Qualifying Antimicrobial Day (QAD)

Brief report

Assessment of an automated surveillance system for detection of initial ventilator-associated events

Dooshanveer Nuckchady MD[a], Michael G. Heckman MS[b], Nancy N. Dieh
Tara Creech RN[c], Darlene Carey RN, MSN[c], Robert Domnick BS[d],
Walter C. Hellinger MD[a,*]

Major Article

Development and validation of an automated ventilator-associated event electronic surveillance system: A report of a successful implementation

Courtney Hebert MD, MS [a,b,*], Jennifer Flaherty RN, MPH, CIC [c]
Justin Smyer MLS (ASCP)CM, MPH, CIC [d], Jing Ding PhD [e]
ngino MD [b,c]

Electronic Implementation of a Novel Surveillance Paradigm for Ventilator-associated Events

Feasibility and Validation

Peter M. C. Klein Klouwenberg[1,2,3*], Maaike S. M. van Mourik[1*], David S. Y. Ong[1,2,3], Janneke H
Marcus J. Schultz[4], Olaf L. Cremer[2], and Marc J. M. Bonten[1,3]; on behalf of the MARS C

Building and Validating a Computerized Algorithm for Surveillance of Ventilator-Associated Events

[1,6] Joseph Ellsworth, BSHA;[2] Najia Huda, MD;[3] Anupama Neelakanta, MD, MPH;[4] Thomas Chevalier, BSN, CIC;[2]
Sims, MPH, CIC;[5] Sorabh Dhar, MD;[6] Mary E. Robinson, BSBA;[2] Keith S. Kaye, MD, MPH[6]

Development, Implementation and Use of Electronic Surveillance for Ventilator-Associated Events (VAE) in Adults

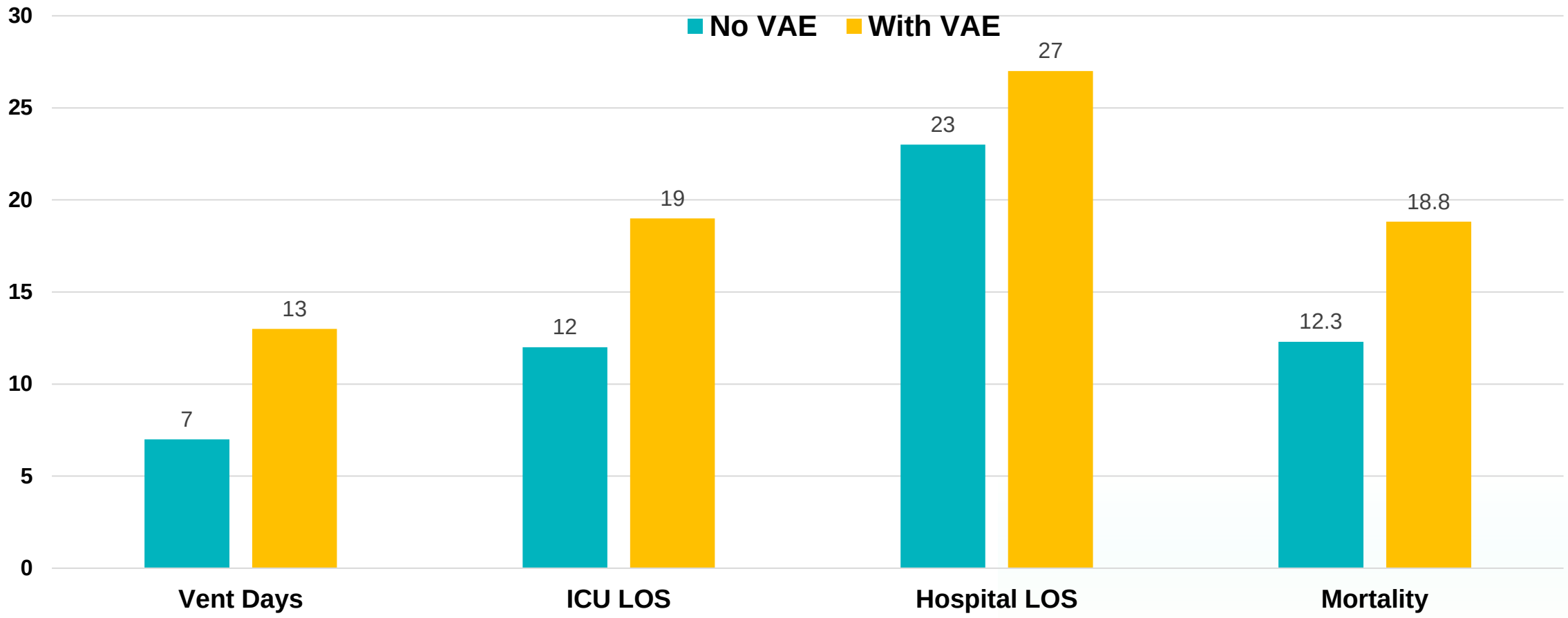
Ervina Resetar, MIM, PMP[1,3], Kathleen M. McMullen, MPH, CIC[2], Anthony J. Rus
MPH[2], Joshua A. Doherty, BS[3], Kathleen A. Gase, MPH, CIC[3], Keith F. Woeltje, MD,

An automated retrospective VAE-surveillance tool for future quality improvement studies

Oliver Wolffers[1,2✉], Martin Faltys[3], Janos Thomann[1], Stephan M. Jakob[3], Jonas Marschall[1],
Tobias M. Merz[3,4] & Rami Sommerstein[1,5✉]

VAE Associated with Poor Outcomes

Propensity matched analysis of 1803 VAEs vs 2,319 patients without VAEs, West China Hospital, 2015-2018*



*Variables in propensity score included age, APACHE II, comorbidities, pneumonia, organ failure, surgery, transfusions, immunosuppressives, central lines, IMV after ICU admission

Zhu, *Infect Control Hospital Epidemiol* 2022;1:48-55

VAE Associated with Poor Outcomes

- **Meta-analysis**
  - 18 studies
  - 61,489 patients

VAE Patients

2x

More Likely to Die
Compared to Non-VAE Patients

VAE

1.5x

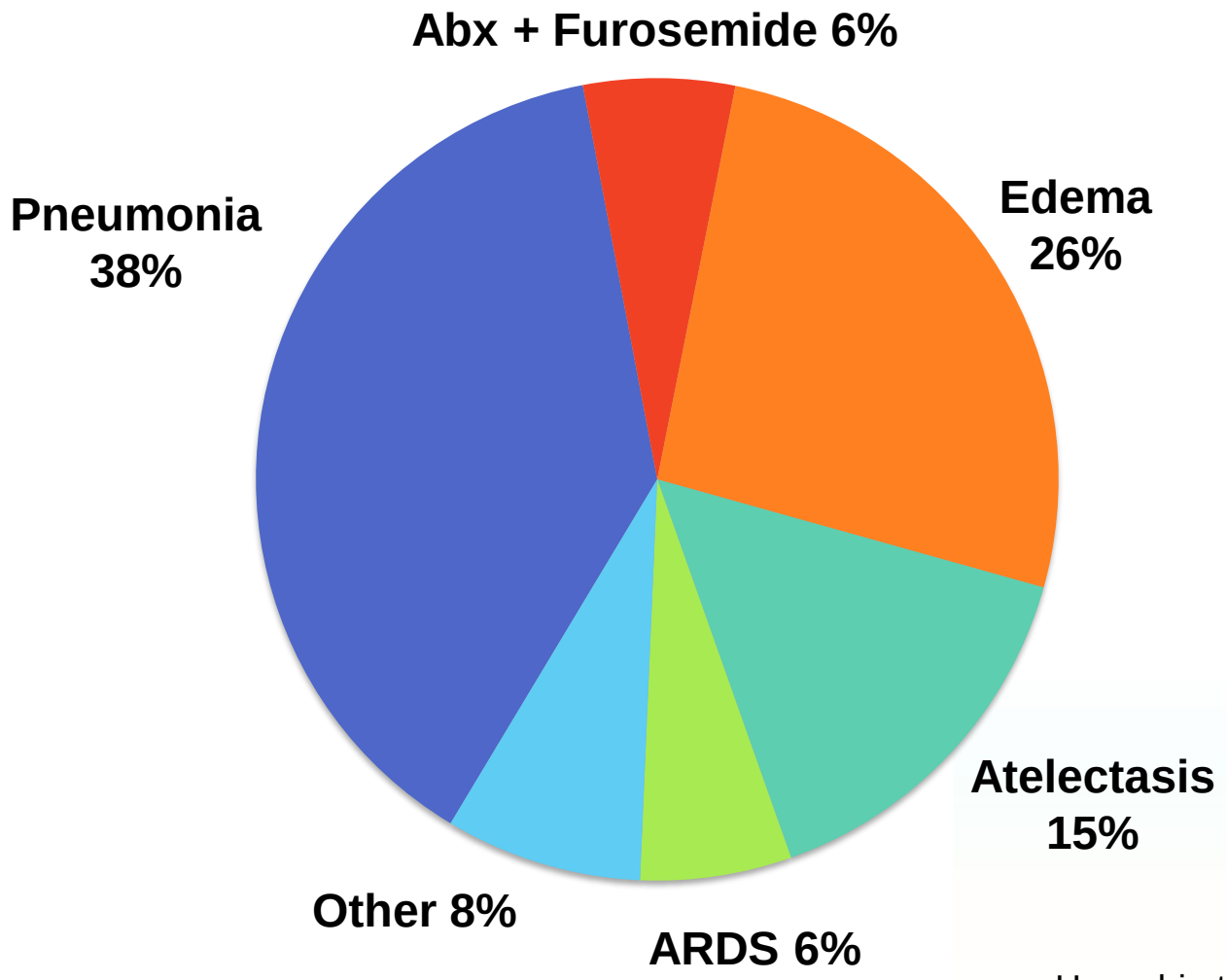
More Deadly
than VAP

Fan, *Crit Care* 2016;20:338


VAE ≠ VAP

Qualitative analysis of 153 VAEs

Royal Brisbane & Women's Hospital, Queensland, Australia

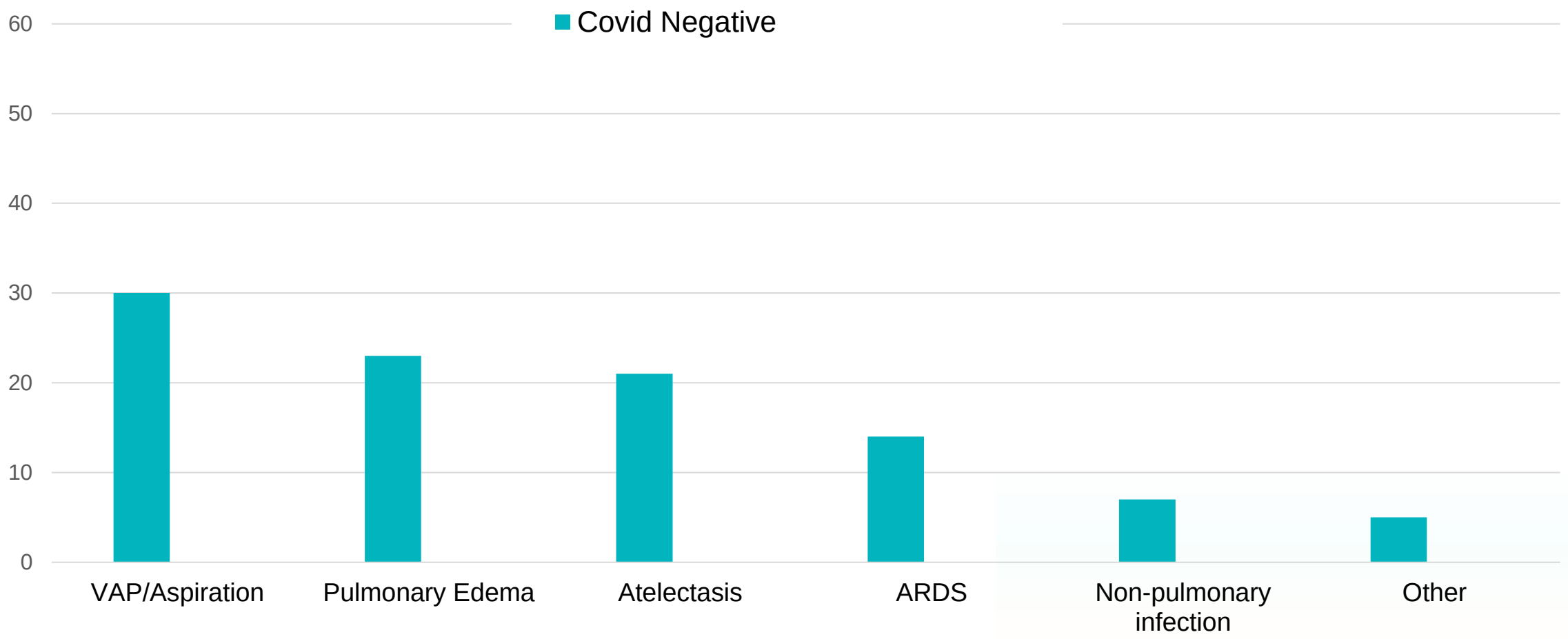


Hayashi et al. *Clin Infect Dis* 2013;56:471-477

VAE = VAP +
Fluid +
ARDS +
Atelectasis

Impact of Covid on VAE

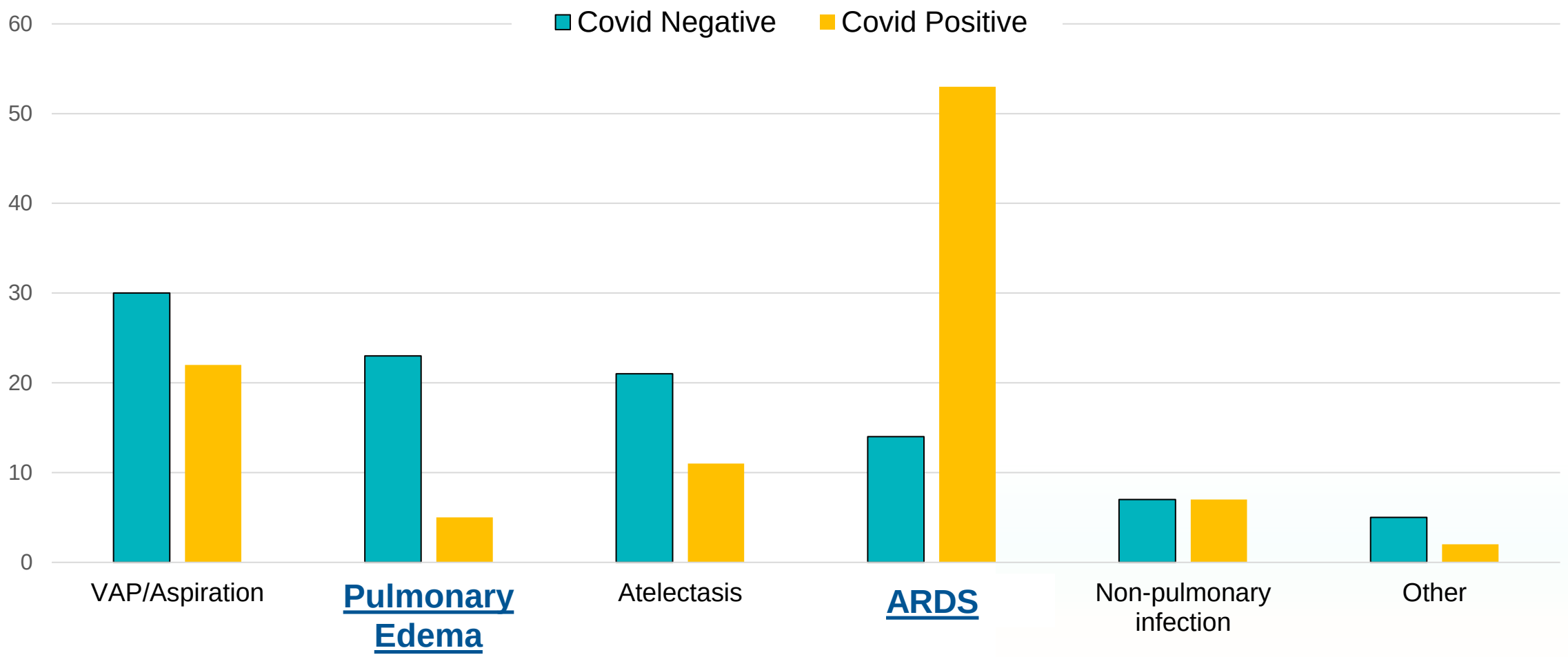
Clinical events leading to VAE in 200 randomly selected VAEs (½ with Covid, ½ without), March-Aug 2020, Mass General Brigham Hospitals



Weinberger, *Annals ATS* 2022;19:82-89

Impact of Covid on VAE

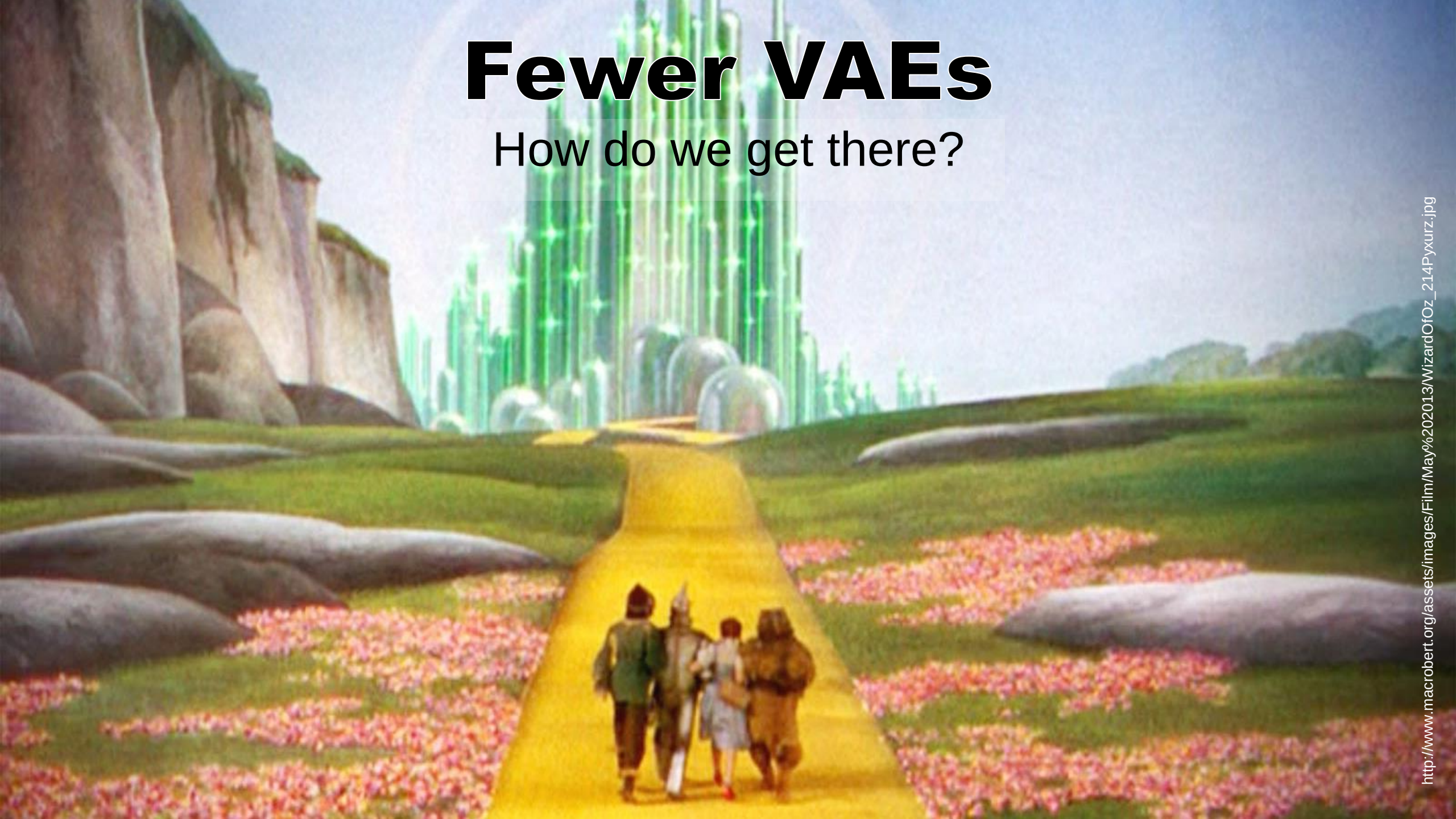
Clinical events leading to VAE in 200 randomly selected VAEs (½ with Covid, ½ without), March-Aug 2020, Mass General Brigham Hospitals



Weinberger, *Annals ATS* 2022;19:82-89

Fewer VAEs

How do we get there?



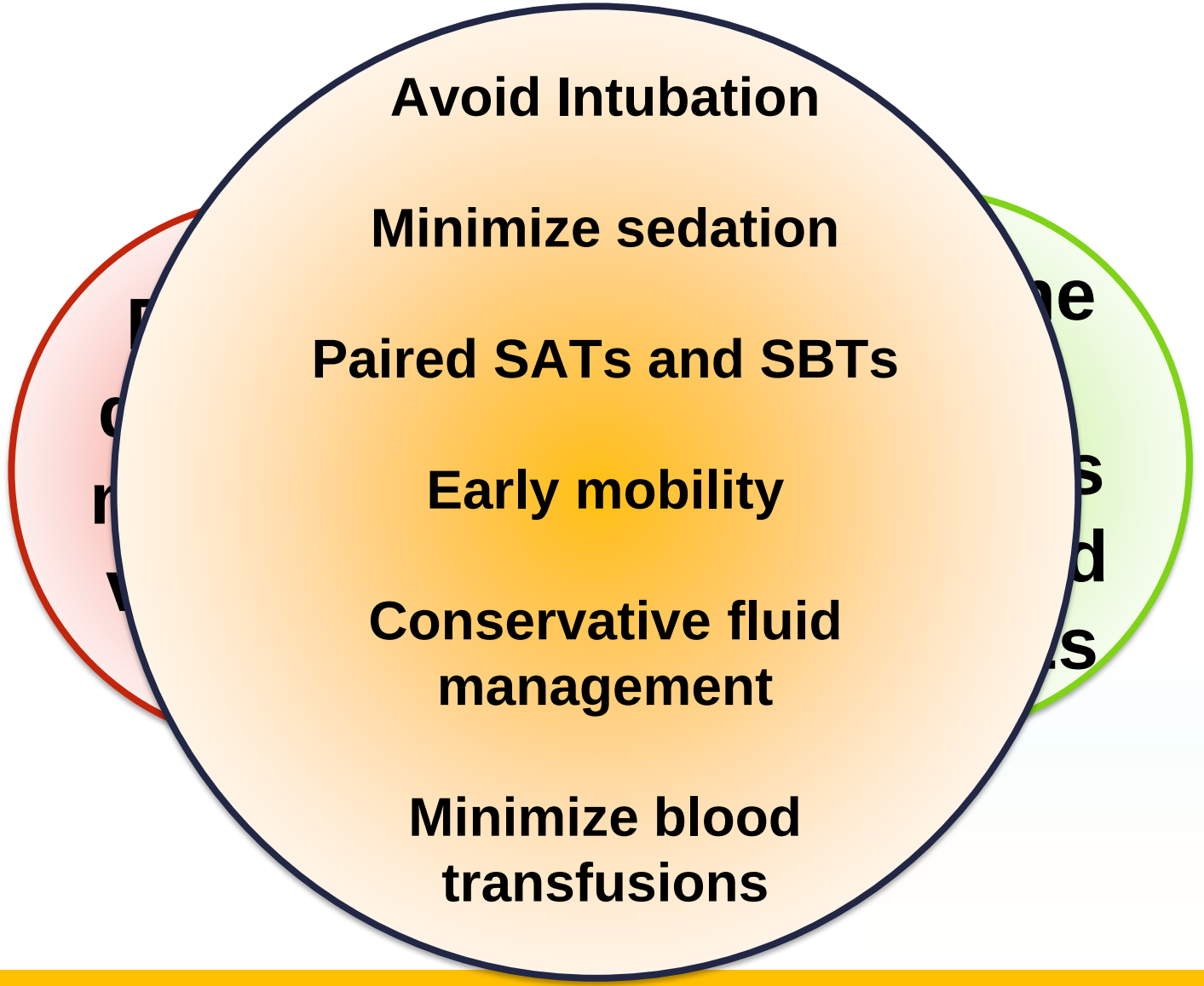
http://www.macrobert.org/assets/images/Film/May%202013/WizardOfOz_214Pyxurz.jpg

Strategies for Preventing VAEs

Decrease duration of mechanical ventilation

Target the primary conditions associated with VAEs

Strategies for Preventing VAEs



VAE Prevention Strategies

Well aligned with other best practice initiatives

	ABCDEF	Choosing Wisely	PAD Guidelines	Surviving Sepsis	Strategies to Prevent VAP
Minimize sedation	✓	✓	✓	✓	✓
Paired SATs and SBTs	✓	✓	✓	✓	✓
Early Mobility	✓		✓	✓	✓
Conservative fluid management				✓	
Conservative transfusion thresholds		✓		✓	

Ventilator Bundle Compliance and VAEs

Retrospective analysis of 5,539 patients on mechanical ventilation

adjusted for comorbidities, severity of illness, contraindications, etc.

Spontaneous breathing trials

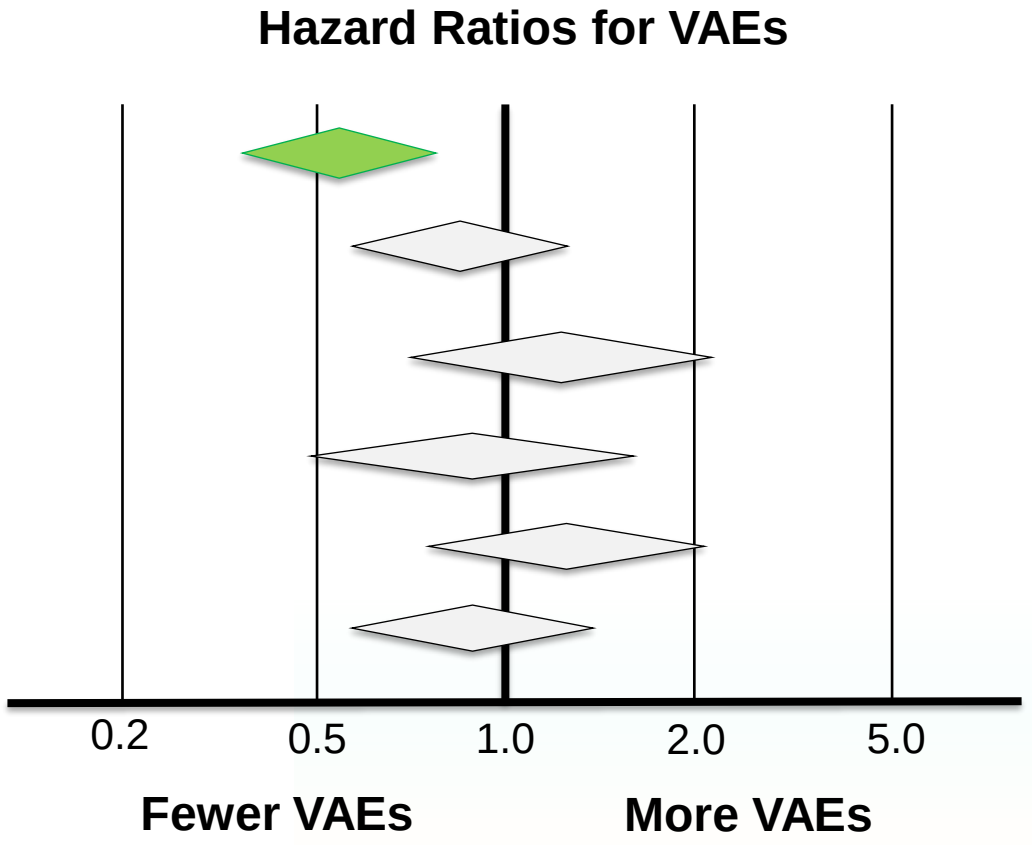
Spontaneous awakening trials

Head of bed elevation

Thromboprophylaxis

Stress ulcer prophylaxis

Oral care with chlorhexidine



JAMA Internal Med 2016;176:1277-1283

Ventilator Bundle Compliance and Death

Retrospective analysis of 5,539 patients on mechanical ventilation

adjusted for comorbidities, severity of illness, contraindications, etc.

Spontaneous breathing trials

Spontaneous awakening trials

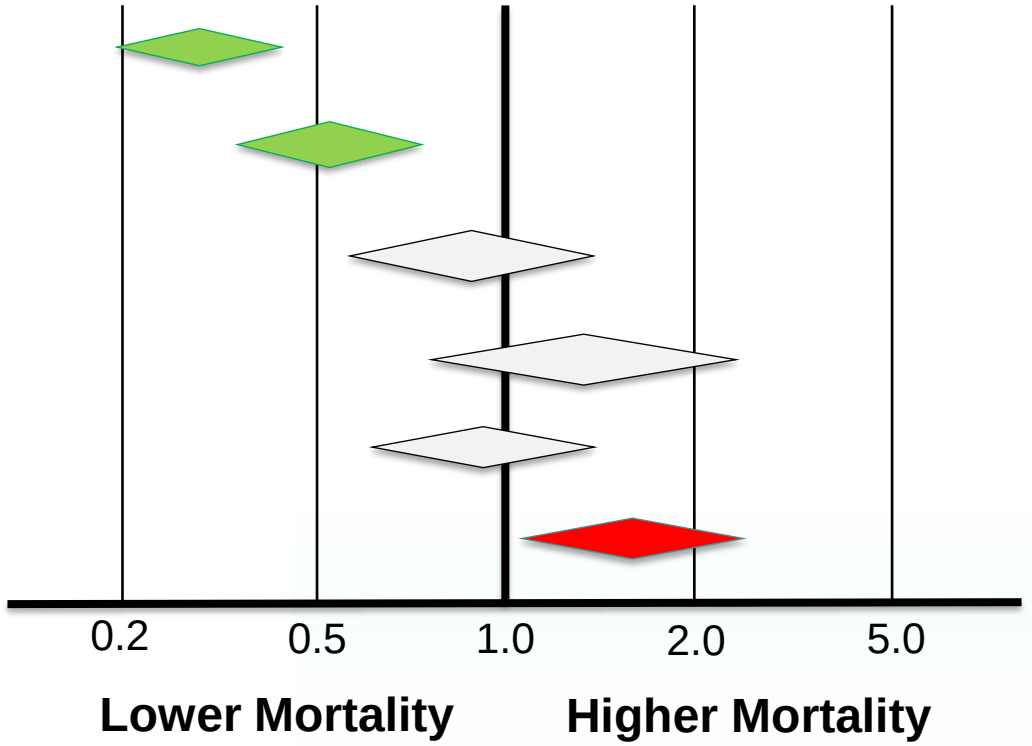
Head of bed elevation

Thromboprophylaxis

Stress ulcer prophylaxis

Oral care with chlorhexidine

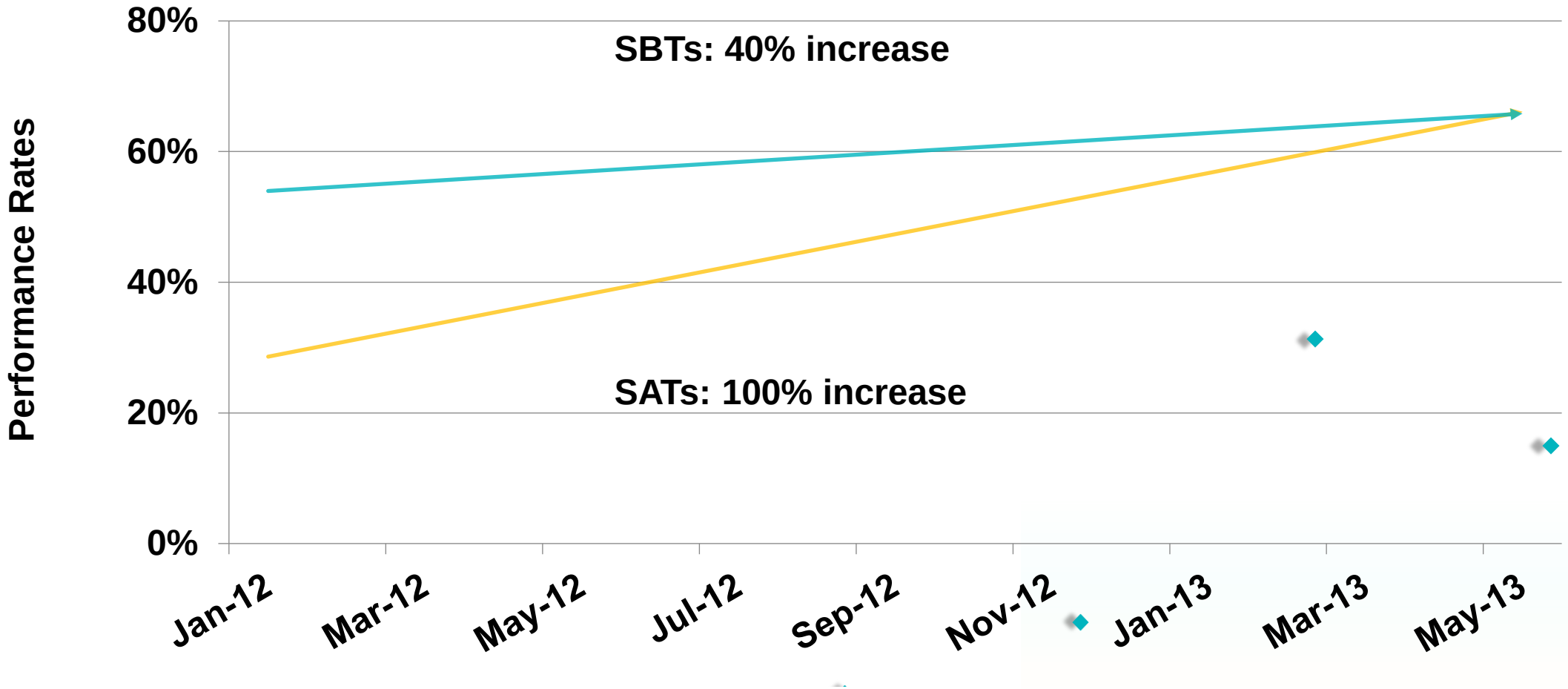
Hazard Ratios for Ventilator Death



JAMA Internal Med 2016;176:1277-1283

SATs and SBTs Lower VAE Rates

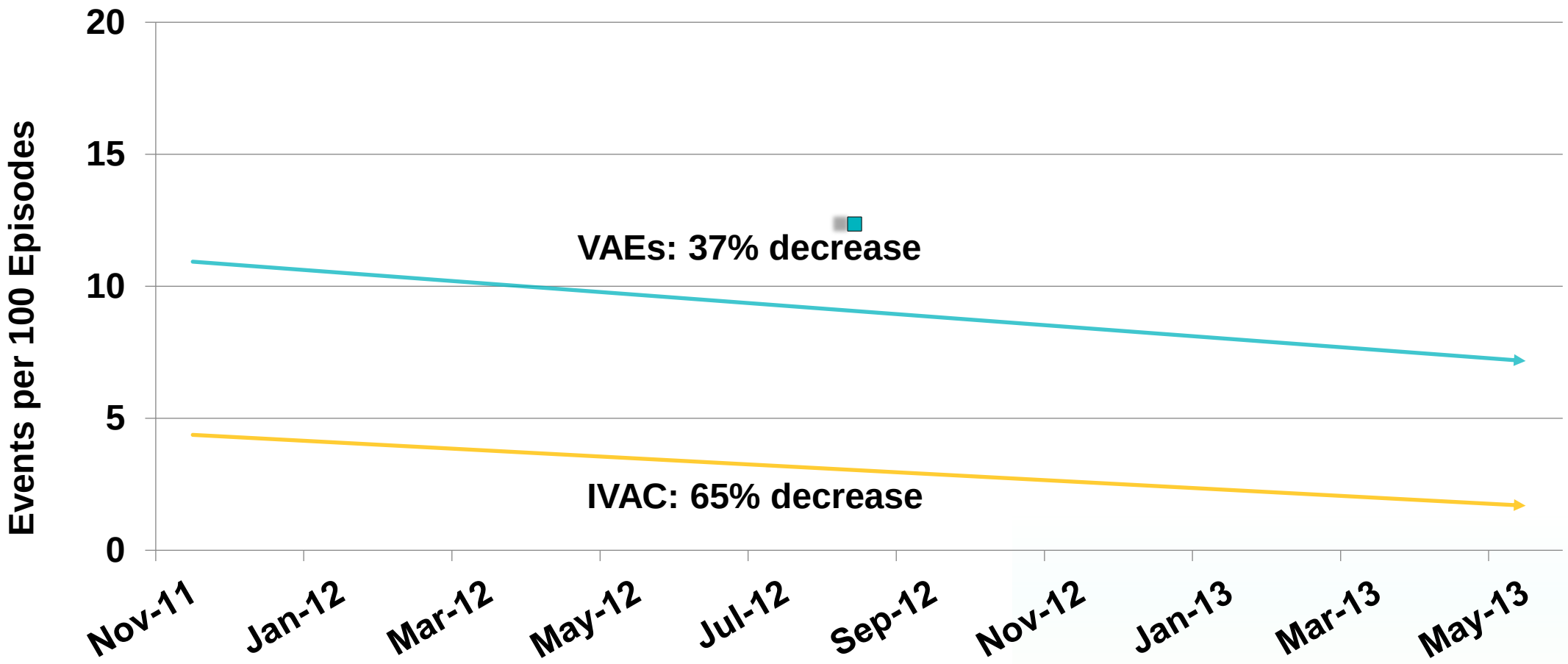
CDC Prevention Epicenters care improvement collaborative, 12 ICUs, 5164 patients, 2011-2013



Am J Resp Crit Care Med 2015;191:292-301

Ventilator-Associated Events

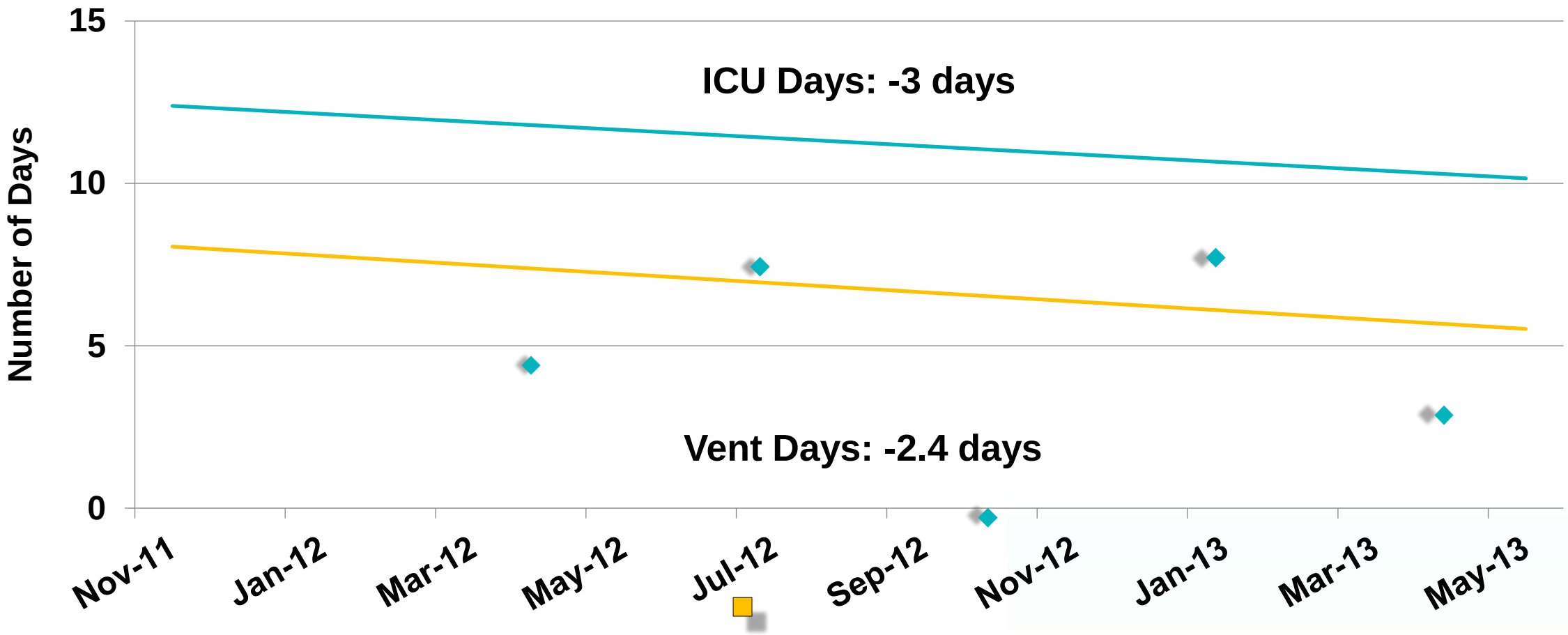
CDC Prevention Epicenters care improvement collaborative, 12 ICUs, 5164 patients, 2011-2013



Am J Resp Crit Care Med 2015;191:292-301

Ventilator Days and ICU Days

CDC Prevention Epicenters care improvement collaborative, 12 ICUs, 5164 patients, 2011-2013

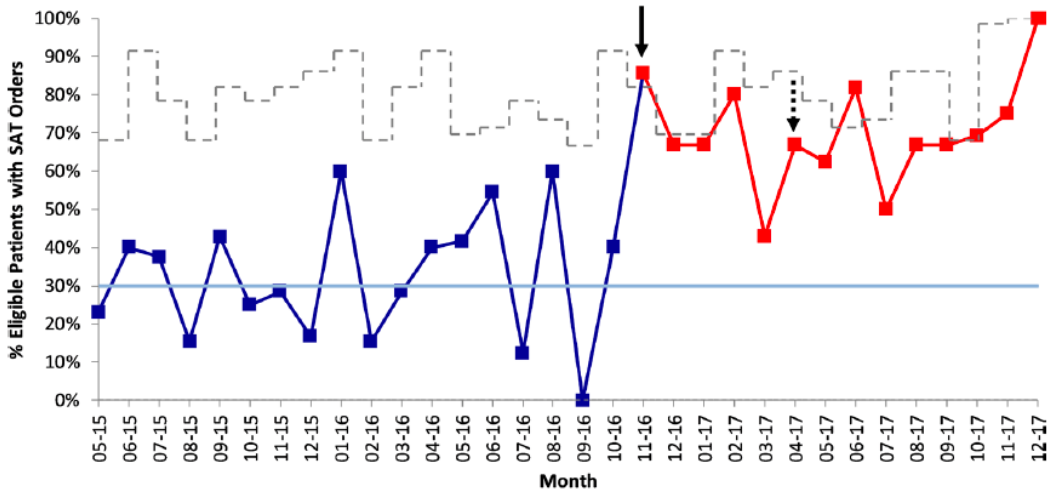


Am J Resp Crit Care Med 2015;191:292-301

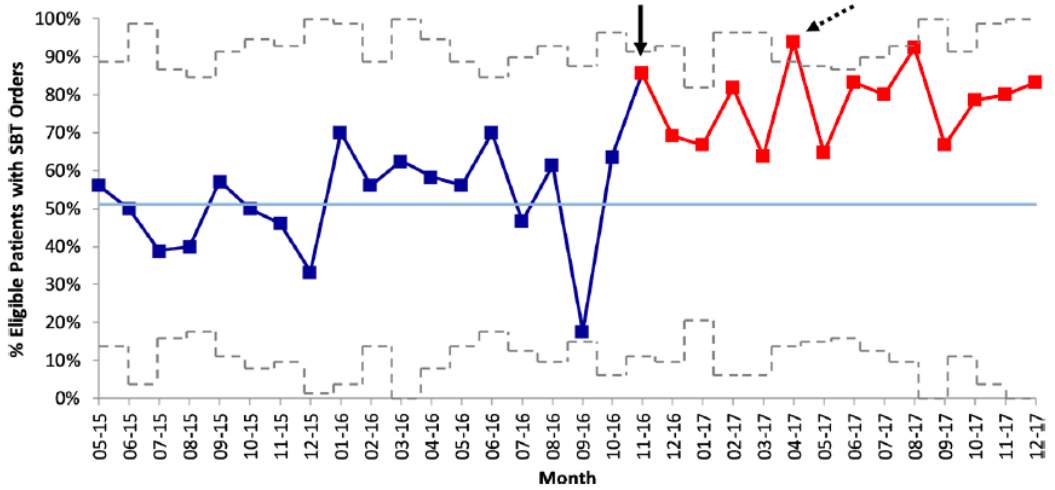
Increase in SATs & SBTs associated with Fewer VAEs

Quality improvement initiative, Veterans Affairs Greater Los Angeles, 2015-2017

Spontaneous Awakening Trials



Spontaneous Breathing Trials



Chumpia, *BMJ Open Quality* 2019;8:e000426

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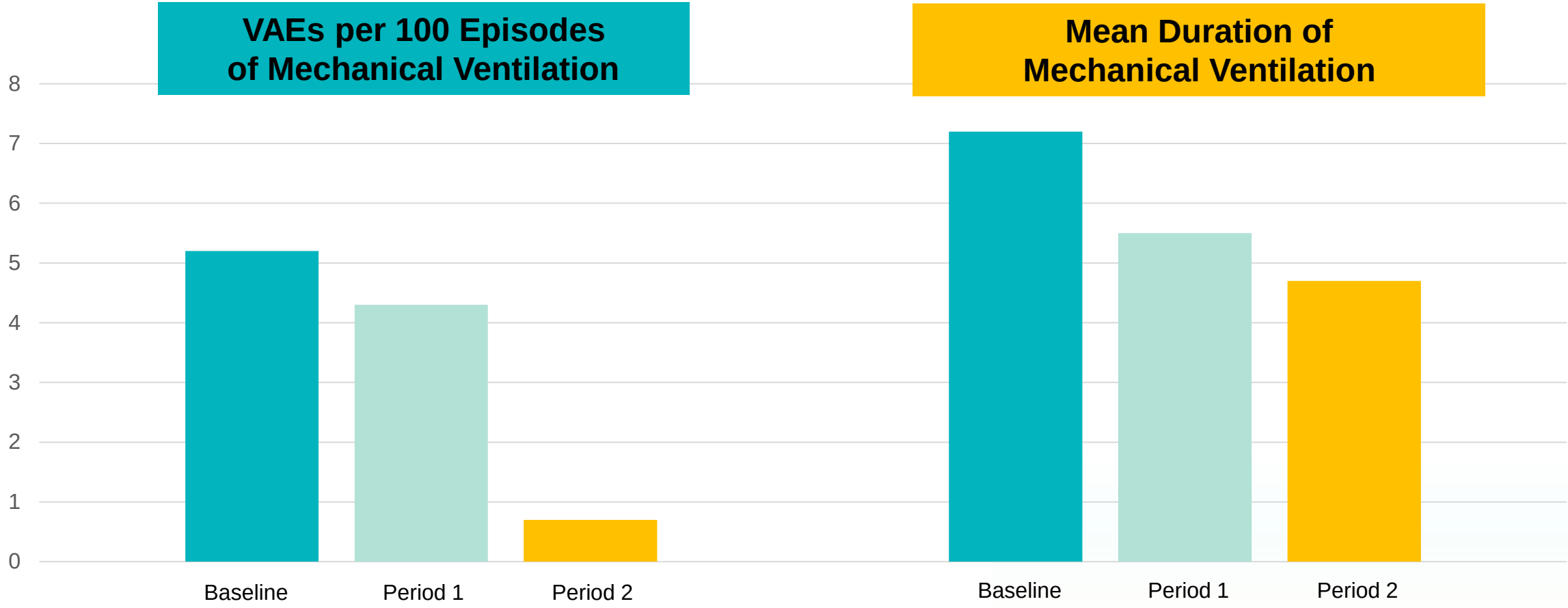


Chumpia, *BMJ Open Quality* 2019;8:e000426

Bedside Prompts on SATs, SBTs, and Impending VAEs

Population Summary (fake data)

All Markers

Missed SBT
3 patients

Late SAT
2 patients

Missed SAT
1 patient

Short SAT
1 patient

Long SAT
1 patient

SAT w/o Titration
1 patient

Eckland, Erin **(71 F)**
ICU A RM 01 BD 01 Visit **V67960**
Number of Active Markers: 5

SAT Occurred Outside the Configured Protocol Period	03/13/15	10:19
Set Ve high alarm limit is non-compliant with operational	03/13/15	06:48

Underhurst, Uw
ICU A RM 01 BD 0
Number of Active Ma
SAT Duration Great
Maximum Configure
Increased Sedation

Odelfield, Octavian **(85 M)**
ICU A RM 02 BD 04 Visit **V67980**
Number of Active Markers: 1

Patient is Trending Toward a VAE Event - Day 1	03/13/15	00:00

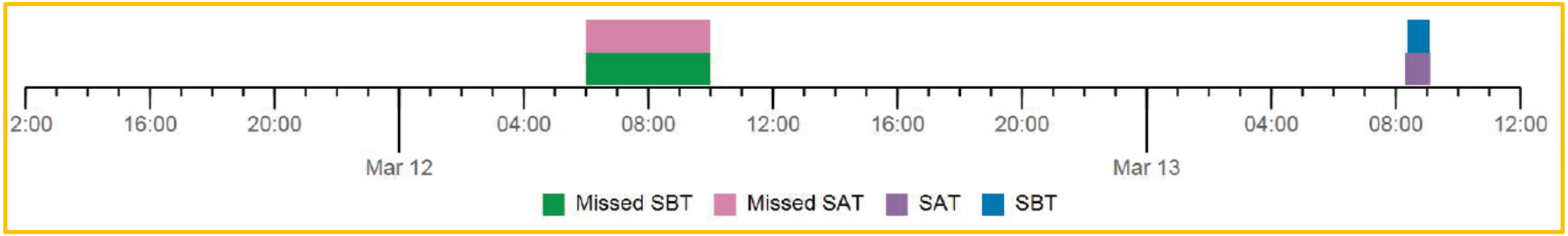
Tamarack, Tim
ICU A RM 04 BD 1
Number of Active Ma
Increased Sedation
Set Ve high alarm li
compliant with oper
policy

Impending VAEs

VAE Surveillance

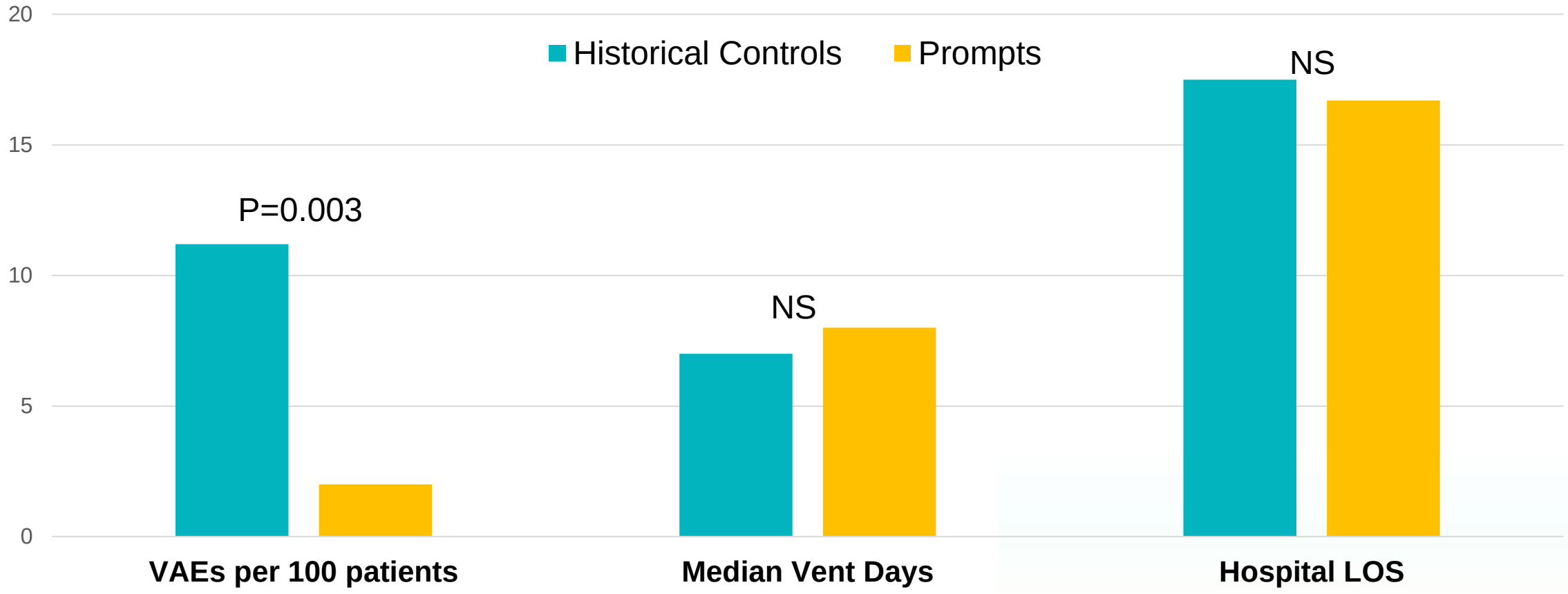
Patient		03/11/15	03/12/15	03/13/15
Smith, James 5 days on vent	FiO2	→	↑	↗
	PEEP	→	↗	↗
Townsley, Peter 7 days on vent	FiO2	→	↑	→
	PEEP	aprv	aprv	aprv
Adams, Roger 3 days on vent	FiO2	→	→	→
	PEEP	→	→	↑
Sanders, Henry 9 days on vent	FiO2	↗	↗	→
	PEEP	→	→	↑

Missed SAT or SBT



Bedside Prompts on SATs, SBTs, and Impending VAEs

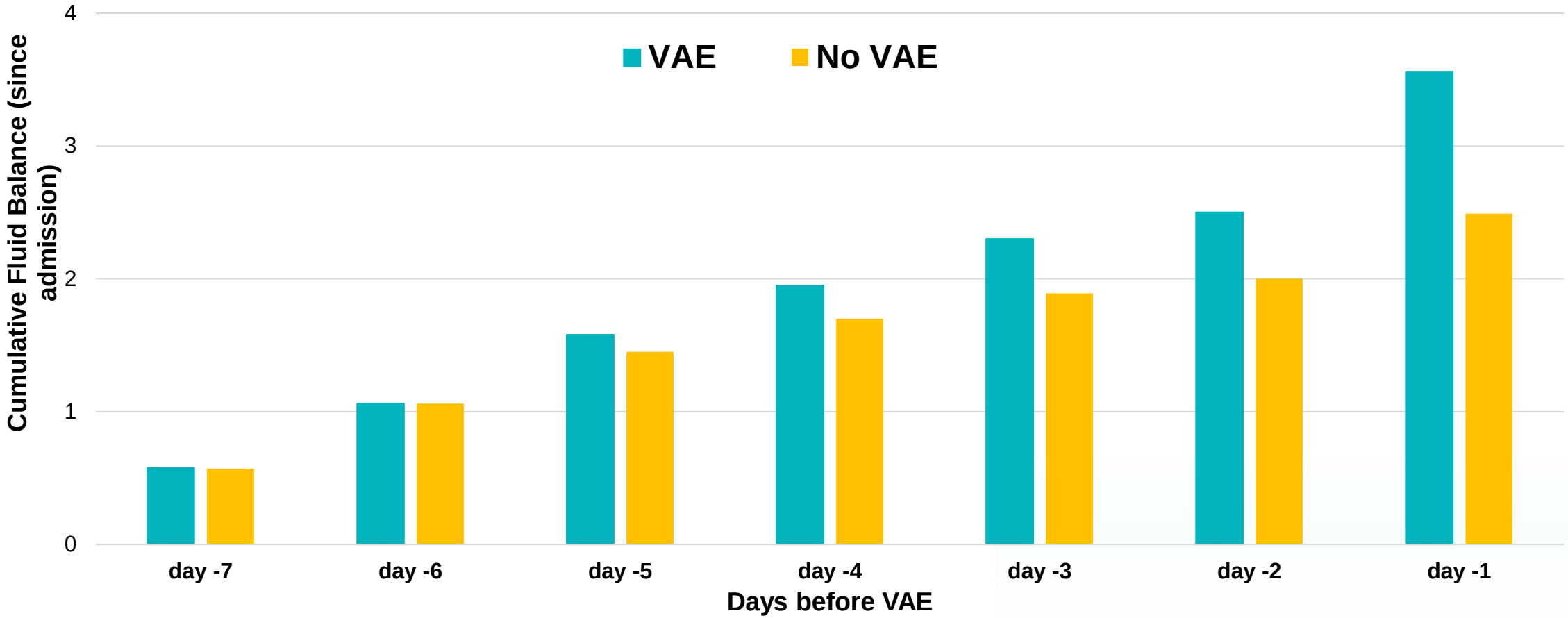
Retrospective evaluation of use of bedside electronic rounding tool with SAT, SBT, and impending VAE prompts on outcomes amongst 150 intervention patients vs 187 historical control patients



Oglesby, *Critical Care Explorations* 2021;3(4):e0379

Strong Association between Fluid Balance and VAEs

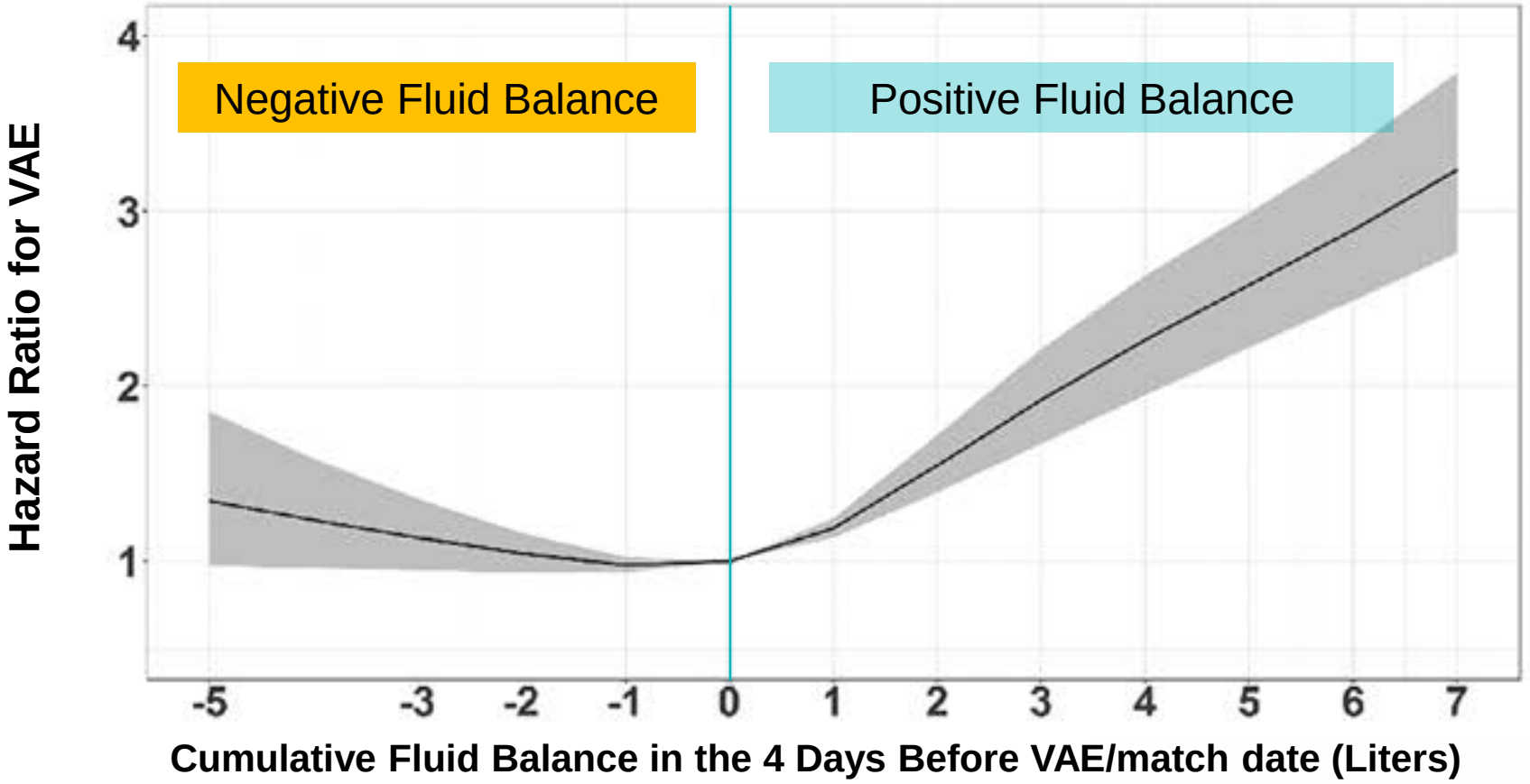
Cumulative fluid balance amongst 1,528 VAE patients matched to 3,038 non-VAE patients on basis of age, time to VAE, and time from ICU admission until initiation of mechanical ventilation, West China Hospital, 2015-2018.



Wang, *Critical Care Medicine* 2022;50:307-316

Strong Association between Fluid Balance and VAEs

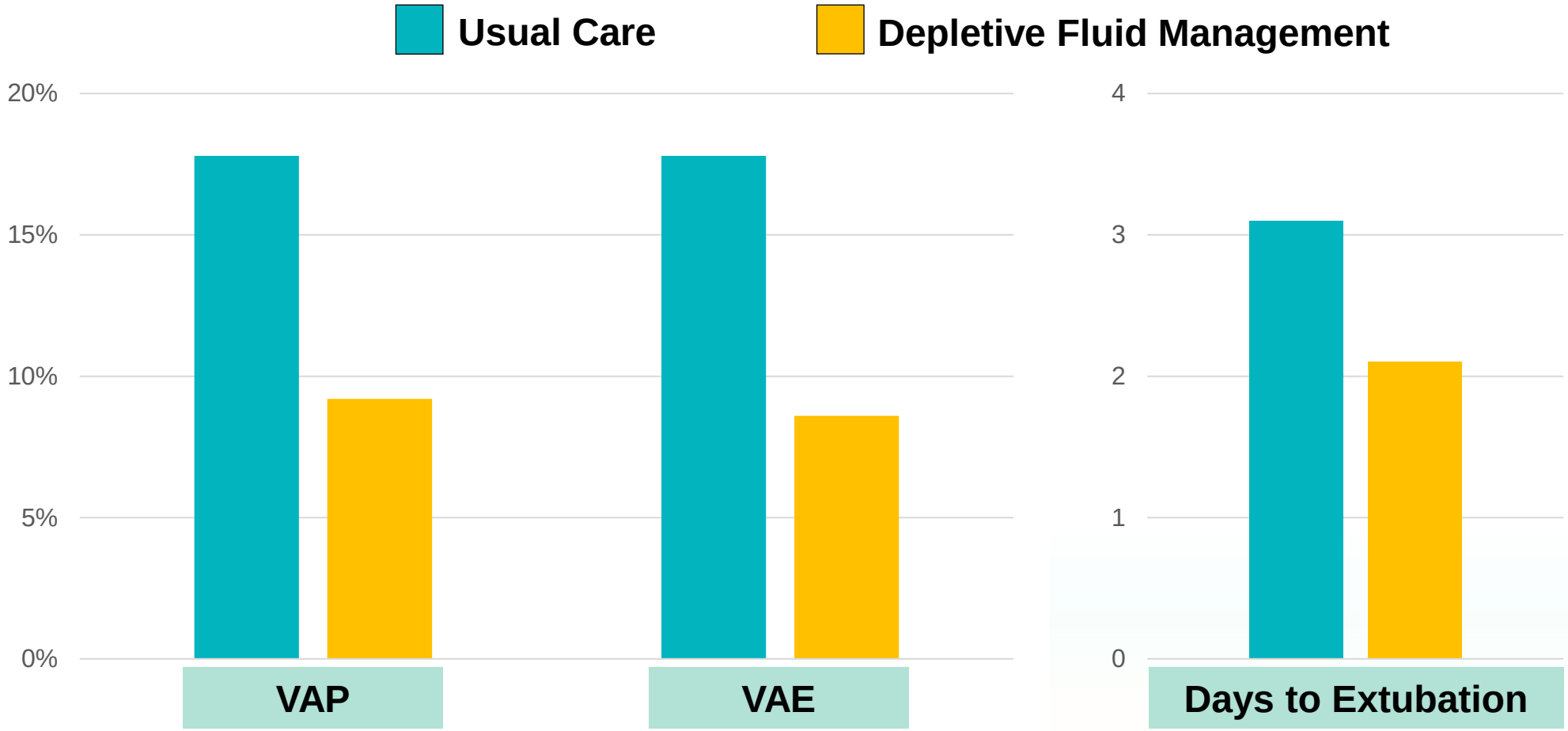
Cumulative fluid balance amongst 1,528 VAE patients matched to 3,038 non-VAE patients on basis of age, time to VAE, and time from ICU admission until initiation of mechanical ventilation, West China Hospital, 2015-2018.
Adjusted for demographics, ICU type, comorbidities, ICU diagnosis, APACHE II, meds, procedures, and others.



Wang, *Crit Care Med* 2022;50:307-316

Depletive Fluid Management Lowers VAE Rates

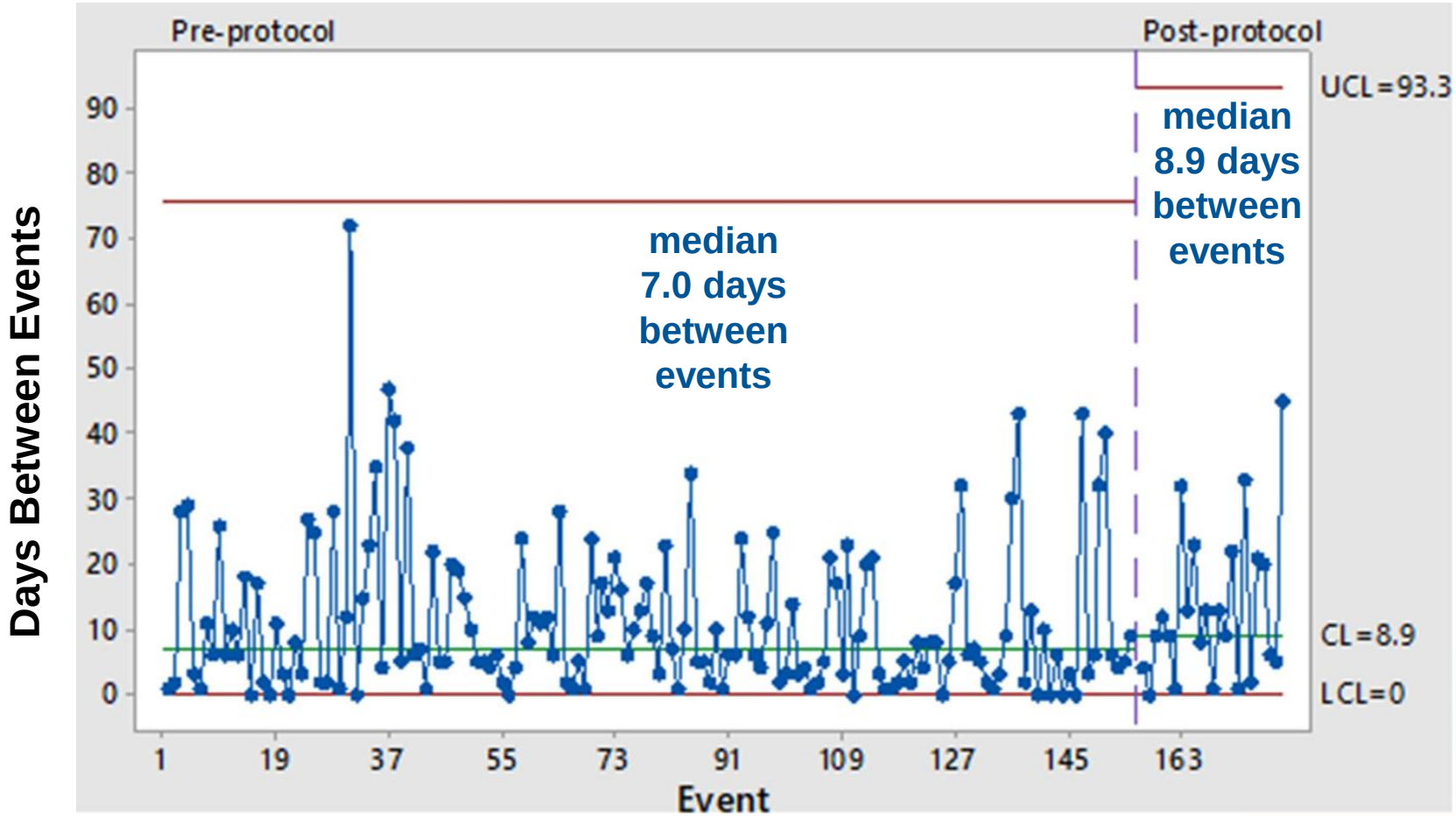
Randomized controlled trial of depletive fluid management during ventilator weaning (smaller volume infusions, more diuresis), N=304



Chest 2014;146:58-65

Change Default PEEP from 5 to 8cm H_2O

Retrospective analysis of change in starting PEEP from 5 to 8cm H_2O, University of Toledo, 2014-2019



VAC Rates Before

7.1

per 1000 vent-days

VAC Rates After

4.4*

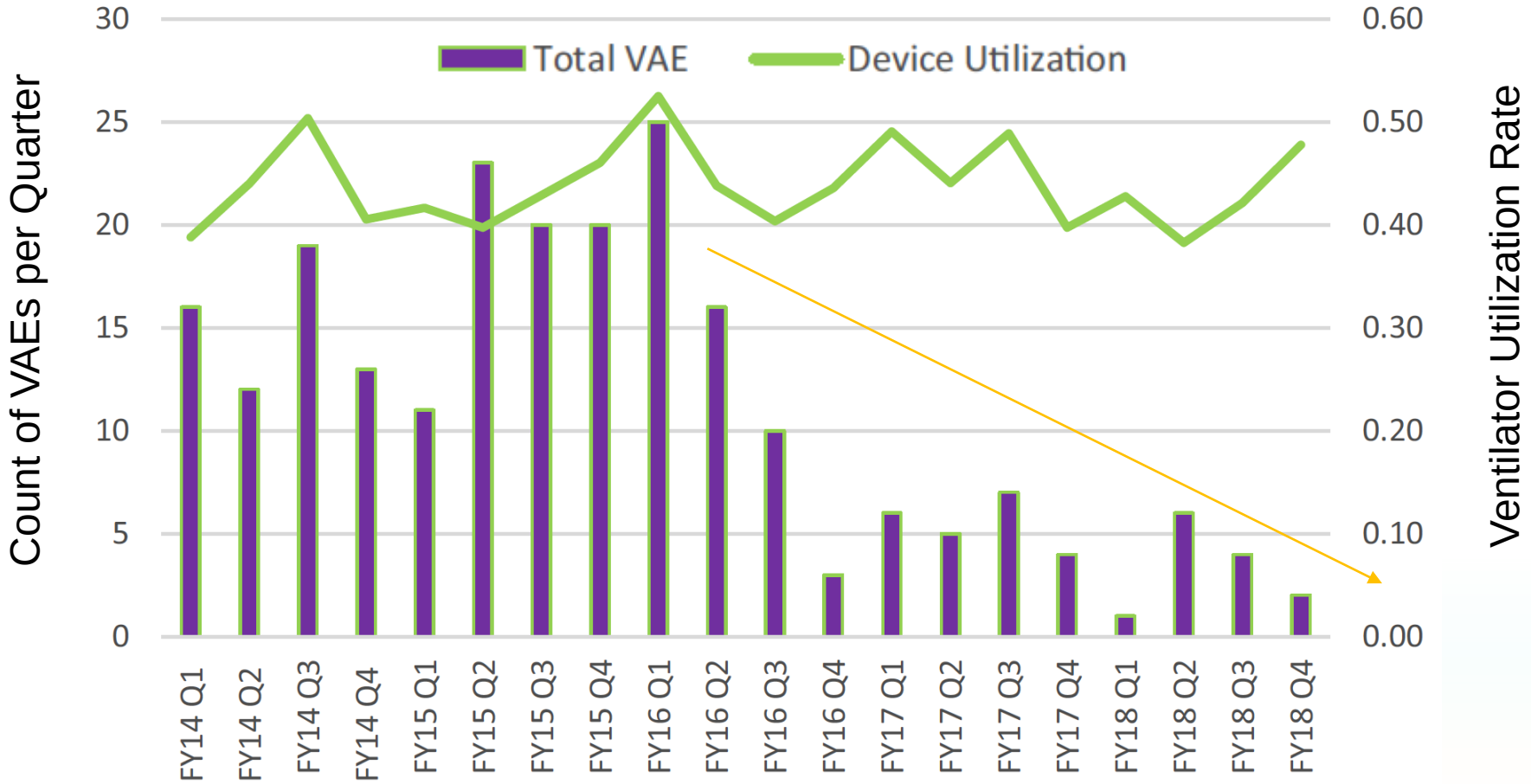
per 1000 vent-days

** non-significant*

Barnett, *Frontiers in Medicine* 2021;8:744651

Change Default PEEP from 5 to 6cm H_2O

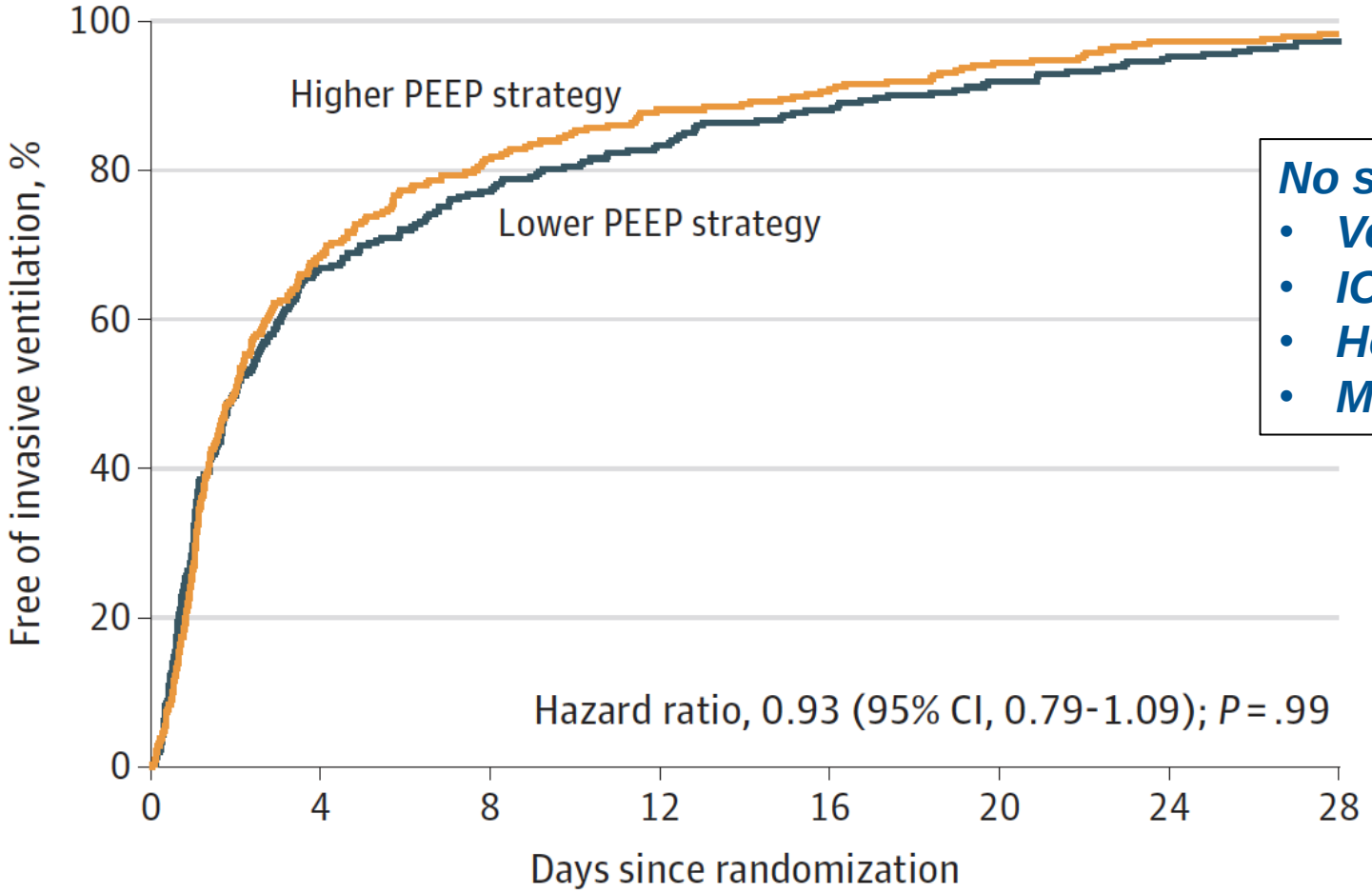
Serial implementation of readiness to wean protocols, change in default PEEP from 5 to 6, increased emphasis on mobilizing patients, root cause analyses on all VAEs, 2015-2018, Saint Francis Hospital, CT



Seaver, *Am J Infect Control* 2020;48:828-30

Is there any benefit associated with higher vs lower default PEEP?

980 ICU patients <u>without</u> ARDS randomized to PEEP 0-5cm H2O vs 8cm H2O, 8 hospitals, Netherlands



No significant differences in:

- ***Ventilator-free days***
- ***ICU length-of-stay***
- ***Hospital length-of-stay***
- ***Mortality***

RELAx Collaborative, JAMA. 2020;324:2509-2520

What about PedVAE?

Multicenter Quality Improvement Initiative

Members of the Children's Hospital Solutions for Patient Safety network created a PedVAE reporting and quality improvement bundle. Uptake varied across the network. Outcomes compared in adopters vs non-adopters.

Multidisciplinary Apparent Cause Analyses	Daily Discussion of Extubation Readiness	Daily Discussion of Fluid Balance Goals

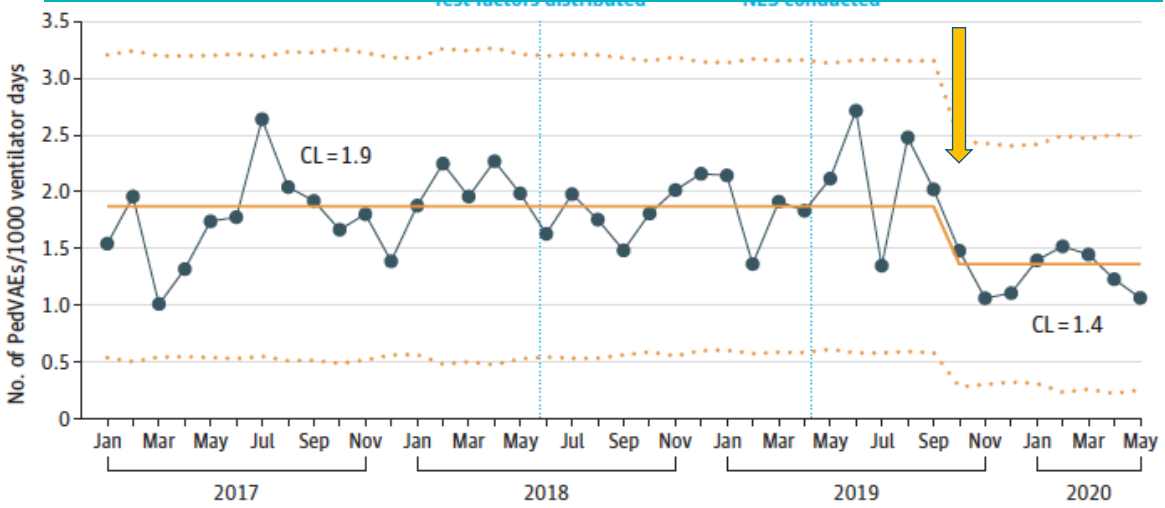
• Multidisciplinary ACA event form completed for each PedVAE
• ACA used to inform Pareto charts of institution-specific causes of PedVAE to identify areas for improvement
	• Discussion included:
	  • Necessity for ETT
	  • Target extubation time
	  • Respiratory support plan
	  • Pre-extubation sedation, or analgesics, or restraints
	  • Post-extubation sedation or analgesic plan
	  • Scheduled re-evaluation time
		• Discussion of patient-specific fluid balance goals
		• Documentation of fluid balance goal at least daily

Wu, *JAMA Network Open* 2023;6(12):e2346545

Multicenter Quality Improvement Initiative

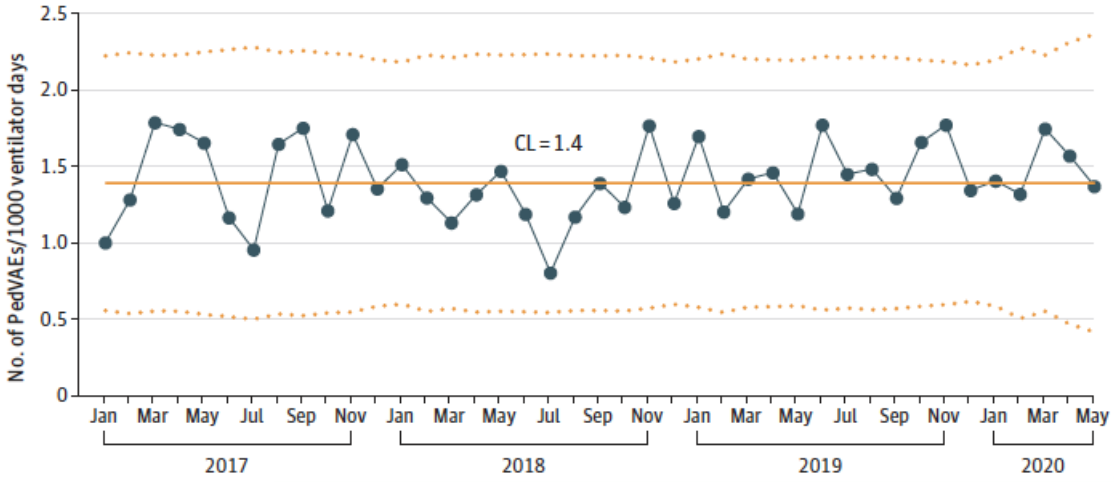
Members of the Children's Hospital Solutions for Patient Safety network created a PedVAE reporting and quality improvement bundle. Uptake varied. Outcomes compared in 12 adopting vs 33 non-adopting hospitals.

Adopters of ≥1 Bundle Component



26% drop in PedVAE rates from 1.9 to 1.4 events per 1000 ventilator-days

Bundle Non-Adopters



No change in PedVAE rates

Wu, *JAMA Network Open* 2023;6(12):e2346545

Ventilator-associated events

A patient safety opportunity

- **Broaden Awareness**
  - Provides hospitals with a fuller picture of serious complications in mechanically ventilated patients
- **Catalyze Prevention**
  - A significant portion of VAEs are preventable through well-accepted best practices in critical care
- **Reflect and Inform Progress**
  - VAE surveillance provides an efficient and objective yardstick to measure and benchmark progress

NEJM 2013;368:1472

Summary

- VAP is a **poor metric for benchmarking** and quality improvement
  - Diagnosis subjective and inaccurate
  - High interobserver variability
  - Poor guide to selecting prevention practices that will improve patient outcomes

- CDC created **ventilator-associated event definitions** to enhance objectivity, automation, and expand prevention efforts
  - Suitable for automated surveillance

- Strategy to lower VAE rates and improve outcomes is to **reduce ventilator days & prevent the primary conditions associated with VAEs** (pneumonia, ARDS, atelectasis, fluid overload)
  - Avoid intubation
  - Minimize sedation
  - Paired daily SATs and SBTs
  - Early mobility
  - Conservative fluid management
  - Minimize blood transfusions

Thank You!

mklompas@bwh.harvard.edu

Extending the Reach of Infection Prevention: A Nurse Link Program in Action

Presented by:

Madhuri Sopirala, MD, MPH
Chief, Infection Prevention, Parkland Health
Associate Professor, Infectious Diseases, UT Southwestern Medical Center

December 2023

Virginia Infection Prevention Training Center

VCU

VDH VIRGINIA DEPARTMENT OF HEALTH

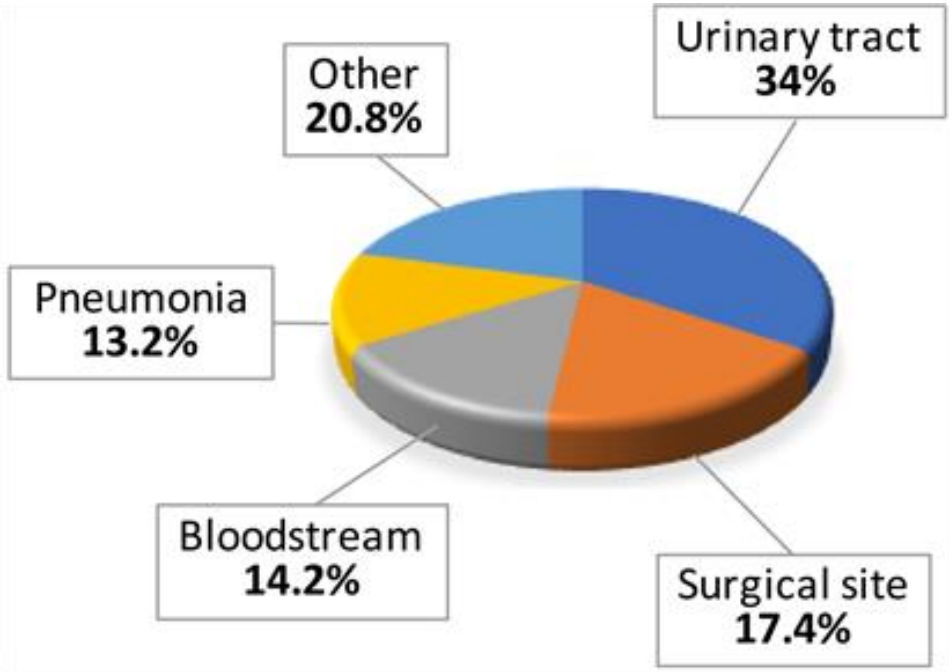
Financial Disclosures

- No disclosures

Objectives

- Describe the concept of Link Nurse Program
- Describe the strategies for building an effective Link Nurse Program
- Describe strategies to achieve long term success with a Link nurse program
- Describe examples of successful projects undertaken by Link Nurse programs

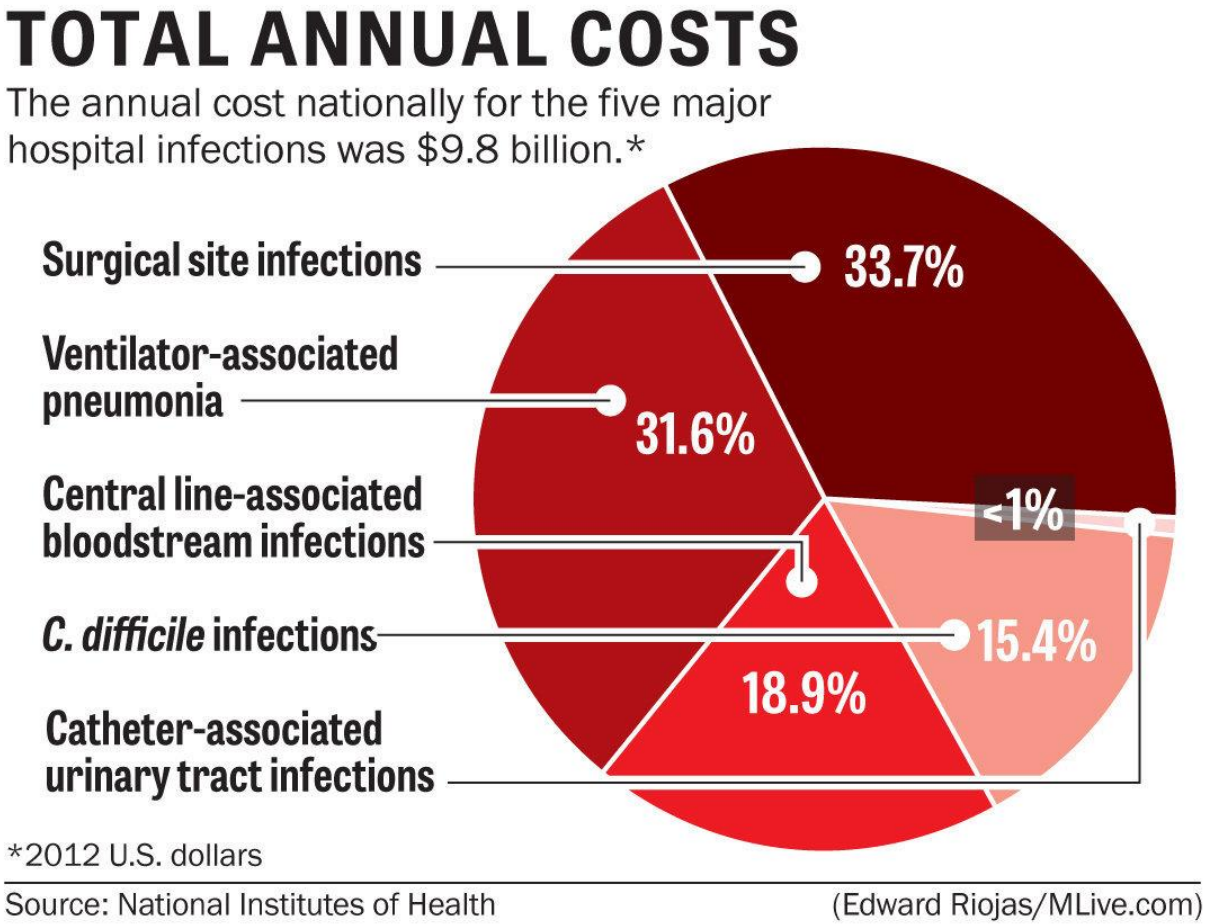
Burden of Healthcare Acquired Infections (HAI)



Approximately 2 million individuals are annually infected by antibiotic resistant strains

Antibiotic resistant infections cost the US healthcare system approximately $34 billion per year

Financial Burden of Healthcare Acquired Infections (HAI)



Our Infection Prevention Program

Compliance Improvement Measures

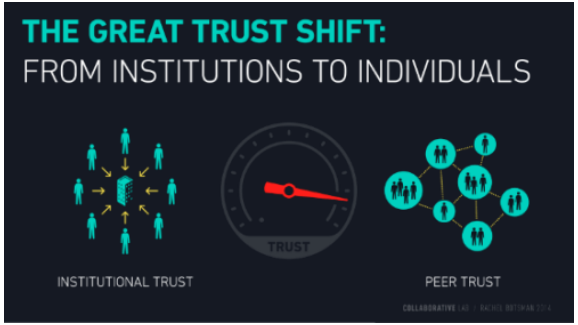
- Periodic e-mailing to all HCWs
- Reminders during grand rounds
- On the spot teaching when observed
- Signs on doors
- Hand outs
- Posters
  - All with a modest increase for a **short period of time**
- Yearly infection control tests for all employees
- Audits and feedback to unit leaders

The Idea of Infection Prevention Champions

https://www.cdc.gov/hai/prevent/tap/preventionchampions.html

Decentralizing Infection Prevention

- Evidence supports spread of infection prevention (IP) knowledge beyond IP professionals to other healthcare workers (HCW) for ongoing success
- Collaboration between IP professionals and staff nurses from the individual patient care units (PCUs) to reduce HCA infections has been described in the past
- However, the strategies for carrying out the collaboration and the success of such programs were variable



Randomized Controlled trial comparing Link Nurse intervention to no intervention

ELSEVIER

American Journal of Infection Control

Volume 19, Issue 2, April 1991, Pages 86-91

Article

The enhancement of infection control in-service education by ward opionion leaders

W.H. Seto MRCP(U.K.), MRCPath. [a b], T.Y. Ching RN [a b], K.Y. Yuen MD [a b], Y.B. Chu BSc [a b], W.L. Seto MA [a b]

The enhancement of infection control in-service education by ward opinion leaders

- A guideline on urinary catheter care was introduced in three groups (A, B, and C) of two randomly allocated wards.
- Two opinion leaders per ward were identified by nurses in groups A and B.
  - Group A Education: in-service lectures for 30% of nurses and opinion leaders' tutorials for all nurses
  - Group B: opinion leaders' tutorials alone
- Group C: Lectures alone
- Before and after the education program, the guideline's frequency of practice was assessed by surveying 30% of randomly selected nurses and by direct observation.
- Results of the survey: comparable for groups A and B and both groups were significantly higher ($p < 0.05$) than C, suggesting that informational transmission by opinion leaders was superior to that by the lecture.
- However, practices by direct observation in group A were significantly better ($p < 0.05$) than those in B, indicating that staff compliance is best achieved by using both opinion leaders and lectures.
- The lecture probably endorsed the opinion leaders' leadership, enhancing their ability to influence the staff.

Am J Infect Control. 1991 Apr;19(2):86-91

Randomized controlled trial comparing Link Nurse intervention to no intervention

Evaluating the efficacy of the infection control liaison nurse in the hospital

T Y Chung RN
Infection Control Sister, Queen Mary Hospital

and W H Seto MRCP(UK) MRCPath
Senior Clinical Bacteriologist, Department of Microbiology, University of Hong Kong, Queen Mary Hospital, Hong Kong

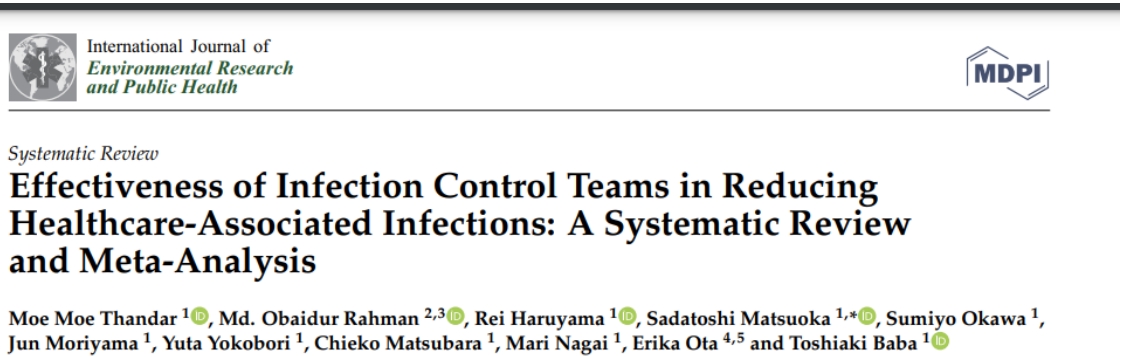
Journal of Advanced Nursing. 1990,15,1128-113

The enhancement of infection control in-service education by ward opinion leaders

- A urinary catheter care guideline on was introduced in a 1000-bed hospital in Hong Kong.
- The 27 public wards were divided randomly into a test (24 wards) and control group (three wards), and ICLNs were appointed in the test group by the nursing administration.
- For education, the ICN conducted in-service lectures for both groups, while in the test group, the ICLNs also conducted tutorials for all ward nurses.
- Before and after the education program, prevalence surveys were conducted to detect incorrect practices on urinary catheter care.
- Three practices evaluated were the securing of catheters, presence of kinking and the use of urinary bags with a drainage spigot.
- Before education, the percentage of incorrect practices in the test groups was 63%, which was comparable to the 68% of the control group (P= 0.40)
- After education, the percentage of incorrect practices in the test group (36%) was significantly lower than the 48% in the control group (P< 0 05)
- This indicates that ICLNs can indeed enhance the education program for infection control

Am J Infect Control. 1991 Apr;19(2):86-91

A Systematic Review and Meta-Analysis of Infection Control Link Nurse Programs



International Journal of *Environmental Research and Public Health*

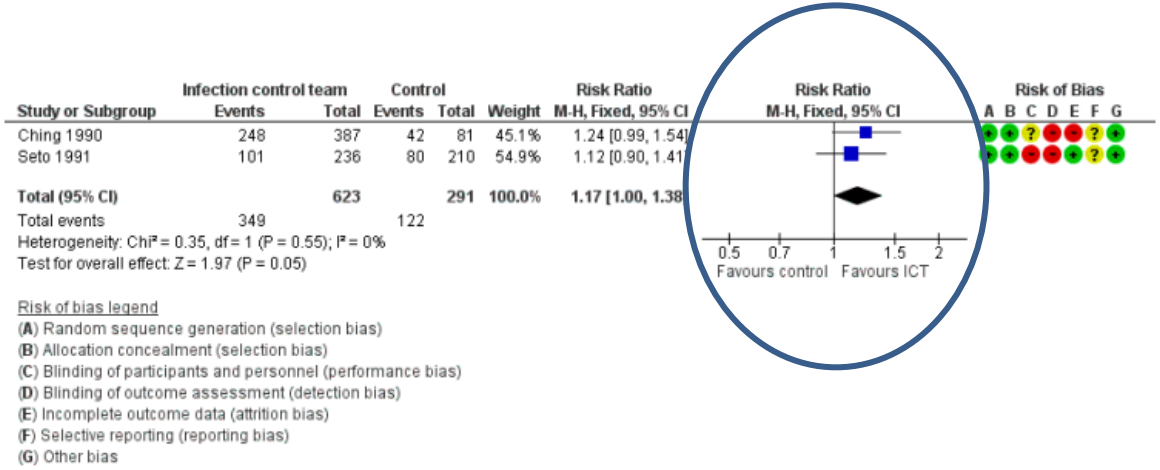
MDPI

Systematic Review

Effectiveness of Infection Control Teams in Reducing Healthcare-Associated Infections: A Systematic Review and Meta-Analysis

Moe Moe Thandar [1], Md. Obaidur Rahman [2,3], Rei Haruyama [1], Sadatoshi Matsuoka [1,*], Sumiyo Okawa [1], Jun Moriyama [1], Yuta Yokobori [1], Chieko Matsubara [1], Mari Nagai [1], Erika Ota [4,5] and Toshiaki Baba [1]

A Systematic Review and Meta-Analysis



Study or Subgroup	Infection control team Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ching 1990	248	387	42	81	45.1%	1.24 [0.99, 1.54]
Seto 1991	101	236	80	210	54.9%	1.12 [0.90, 1.41]
Total (95% CI)		**623**		**291**	**100.0%**	**1.17 [1.00, 1.38]**
Total events	349		122			

Heterogeneity: Chi² = 0.35, df = 1 (P = 0.55); I² = 0%
Test for overall effect: Z = 1.97 (P = 0.05)

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Int. J. Environ. Res. Public Health 2022, 19, 17075

Infection Control Link Nurse Program addressing health care-acquired MRSA

American Journal of Infection Control 42 (2014) 353–0

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Infection Control Link Nurse Program: An interdisciplinary approach in targeting health care-acquired infection

Madhuri M. Sopirala MD, MPH [a,b,*], Lisa Yahle-Dunbar RN, CIC [b], Justin Smyer MLS(ASCP)CM, MPH [b], Linda Wellington RN, CIC [b], Jeanne Dickman MT, CIC [b], Nancy Zikri PhD, MPH [b], Jennifer Martin RN, MPH [b], Pat Kulich RN, CIC [b], David Taylor PhD [b], Hagop Mekhjian MD [c], Mary Nash PhD [d], Jerry Mansfield PhD [d], Preeti Pancholi PhD [e], Mary Howard RN [d], Linda Chase PhD [d], Susan Brown RN [d], Kristopher Kipp RN [d], Kristen Lefeld MHA [b], Amber Myers MPH [b], Xueliang Pan PhD [f], Julie E. Mangino MD [a,b]

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Infection Control Link Nurse Program addressing CAUTI

American Journal of Infection Control 46 (2018) 743-6

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Impact of a change in surveillance definition on performance assessment of a catheter-associated urinary tract infection prevention program at a tertiary care medical center

Madhuri M. Sopirala MD, MPH [a,*], Asma Syed MD [a], Roman Jandarov PhD [b], Margaret Lewis MSN [c]

[a] University of Cincinnati College of Medicine, Cincinnati, OH
[b] Division of Biostatistics and Bioinformatics, Department of Environmental Health, University of Cincinnati College of Medicine, Cincinnati, OH
[c] University of Cincinnati Medical Center, Cincinnati, OH

Concept of Link Nurse Program

A Multidisciplinary Approach to Reducing Hospital Acquired Infections Utilizing the Link Nurse Program

A Link nurse program involves nurses of each individual patient care unit (PCU) in a multi-disciplinary team

It works toward education, promotion of awareness, and reinforcement of implementation of proper infection prevention/control techniques

Challenges in building a Link Nurse Program

- Infection preventionists and hospital epidemiologists do not have authority over hospital staff
- Funding
- Staff engagement for long periods of time
- Maintaining legitimacy for long periods of time
- Showing the worth of the program

How do we build this program and make it effective?

Challenges in building a Link Nurse Program

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How do we build this program and make it effective?

Lateral Leadership

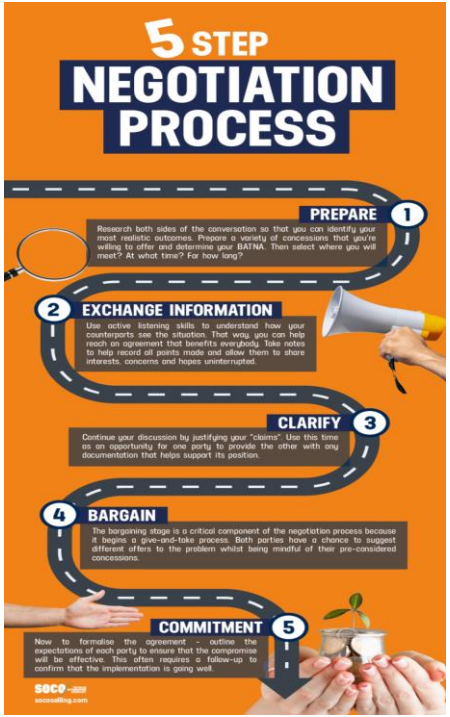
1. Use techniques of conversation, negotiation and decision-making

Elements of Lateral Leadership:

https://www.linkedin.com/pulse/lateral-leadership-without-superior-function-wolfgang-grilz

Negotiating with Nursing Leadership

Building Link Nurse Program: Apply Principles of Lateral leadership



- Prepare to engage with HAI data and its implications
- Benefits of extending the reach of infection prevention
  - Staff better prepared
  - Better publicly reported profile
  - Contribution to special programs such as MAGNET
  - Much to gain with very little investment
- Ask for commitment (paid time) to attend the Link Nurse baseline training and to attend monthly one-hour meeting
- Clarify and address their concerns
- Bargain – offer something new that they value in exchange for their support

2. Legitimacy

Elements of Lateral Leadership:

https://www.linkedin.com/pulse/lateral-leadership-without-superior-function-wolfgang-grilz

Building Link Nurse Program: Apply Principles of Lateral leadership

Establish Legitimacy

- Getting nursing leadership on board to create an unofficial hierarchy for infection prevention (in creating and running the Link Nurse Program)
- Get approval from medical leadership
  - Funding
  - Approve goals along with nursing leadership
  - Create legitimacy and unofficial hierarchy for infection prevention
  - Support with physician accountability when needed

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Nursing Administration

- Select 1-2 staff nurses per unit to function as link nurses
- Allow time for link nurses to perform their duties and attend link nurse meetings

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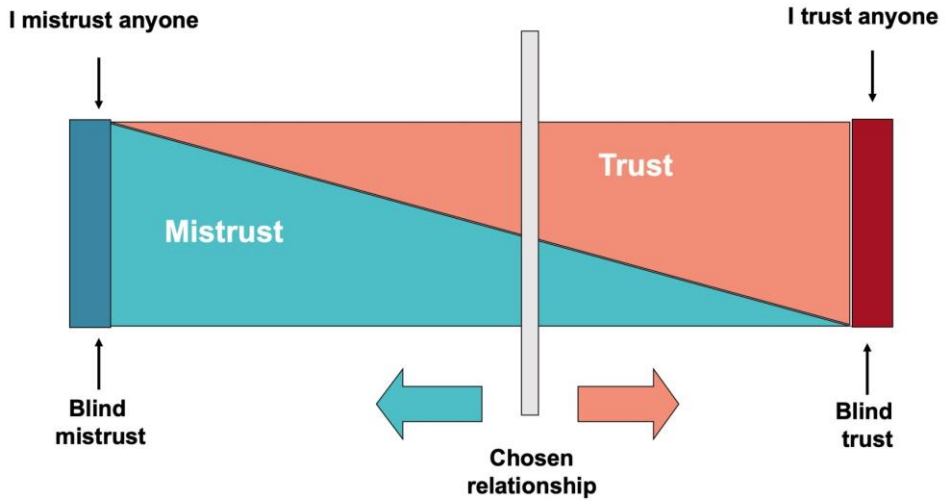
Medical Staff Administration

- Provide funding for the link nurse training and monthly meetings
- Provide funding for the monthly incentive strategy towards improving HH and CI
- Share monthly HH compliance data with the medical staff

3. Balancing the tension between trust and control

Elements of Lateral Leadership:



https://www.linkedin.com/pulse/lateral-leadership-without-superior-function-wolfgang-grilz

Establish Trust

Building Link Nurse Program: Apply Principles of Lateral leadership

- Transparency
- Visibility from executive leadership
- Make it clear that link nurses are supported in their efforts
- Follow through on meeting topics and discussions
- Provide reliable data and resources
- Maintain credibility

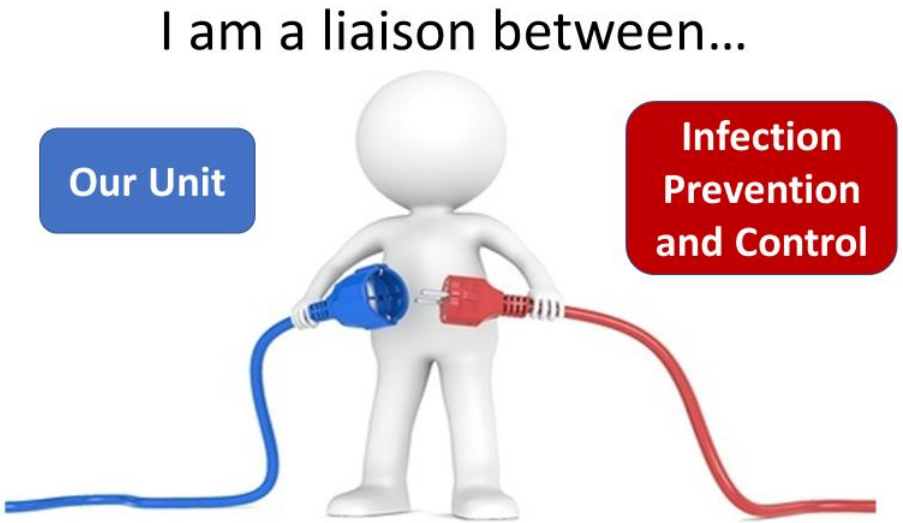
You are our Link Nurse… What does that mean?

Prepare a job description

Image: TravelNursing.org

Duties of Link Nurse…

Link nurses essentially serve as the link between patient care units and the infection preventionists



3D image obtained from: https://emergingrnleader.com/disconnect-nurse-leaders-staff/

Duties of Link Nurse…

- Monitoring and reinforcing infection prevention/control measures
- Reporting events and allowing for feedback to allow for strategies for improvement in infection prevention/control measures

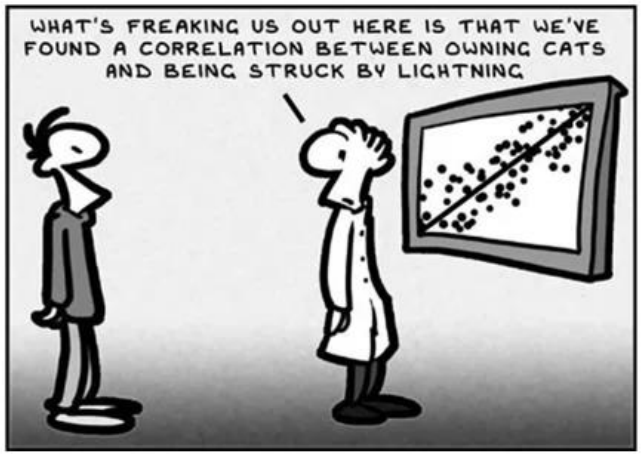
Image: https://study.com/academy/lesson/community-health-definition-care.html

shutterstock - 38472400

Duties of Link Nurse…

Duties involve sharing information, data, and propagating infection prevention principles with their staff in their patient care unit

I will bring back education and data from IPC to you



Duties of Link Nurse…

Eyes and ears to IPC and bring back ideas and concerns from the unit

I bring concerns or ideas from you to Infection Prevention and Control (IPC) and vice versa… I will work with you and IPC to address those

Create a Job Description

The Link-Nurse (LN) Job description

Purpose of Implementation of the Link-Nurse (LN) System

Link nurse system objectives are to prevent or minimize risks of healthcare-associated infections (HAIs) for patients, personnel, and visitors at The OSUMC facilities. In a hospital with a large size, it is important to have continued presence of infection control through out the hospital in all patient care units to ensure maximum effort towards prevention of HAIs. Infection control link nurses serve as a link between their own patient care units and the infection control team (ICT). Infection control link nurses are structured with their role to own the infection control issues in their units and motivate staff to improve practice and increase awareness among them. They are empowered to identify and report the non-compliance issues associated with infection control practices. Accordingly, they play a pivotal role in the linkage of existing and essential measures: feedback and reporting processes, and other traditionally advocated methods such as hand-hygiene and contact isolation compliance.

Overall Goals of the Link-Nurse (LN) Curriculum

A link nurse will have the following characteristics:

- Preferably an "opinion leader" or respected person
- Sufficient standing to have authority with managers and colleagues
- Open to approaching others
- Communicative
- Comfortable with feedback

After undergoing the formal training offered by The Department of Epidemiology, she/he will have

- Ability to act as a link between clinical areas & ICT
- Ownership of infection control in the unit
- Basic and up-to-date knowledge and skills of hospital infection control in instructing colleagues and other healthcare personnel in his or her ward or unit.
- Ability to be an educational role model of healthcare personnel for routine infection control practice in his or her ward or unit.
- Ability to identify and plan to solve issues concerning infection control in his or her ward or unit in accordance with ICT.

- Ability to implement new infection control interventions with an understanding of unit-specific challenges, and ability to promote strategies that are most likely to be successful in his or her ward or unit.

Responsibilities of the LN

The day-to-day tasks of a LN, while maintaining the primary role as bedside caregiver on his or her unit include

- Monitor compliance with hand hygiene and isolation.
- Ensuring prompt isolation of infected patients in collaboration with the charge nurse of his or her unit in accordance with hospital policy.
- Share data provided by ICT with staff periodically.
- Assist in early detection of outbreaks by reporting unusual occurrences.
- Planning to avoid spread of outbreak pathogens such as MRSA in his or her own ward or unit, under the supervision of ICT members.
- Propagate infection control principles among staff on the units on a periodic basis by ongoing education.
- Remind staff/physicians of compliance on a day-to-day basis and on the spot.
- Report non-compliant staff/physicians to the Medical Director of Epidemiology and/or the respective infection control practitioners (ICPs).
- Act under the supervision of the ICP as a resource and role model for colleagues.
- Monitoring by observation that hygiene maintenance or usage of environment and equipment in his or her unit are being carried out in accordance with hospital policy.
- Casual interactions with ICP (during ICP rounds)
- Formal meeting with ICP each month to report any problems
- Meeting with all link nurses and ICPs every 3 months

Educational Programs

A training program for LN includes:

Training in basic infection control and learn practical infection control on the job through having frequent communication with members of the ICT.

Examples of subjects of lectures;

1. Principles of hospital acquired infections and their control.
2. Basic bacteriology for antimicrobial-resistant bacteria.
3. Interpretation of microbiological data.
4. Identify the beginning of an outbreak.

Challenges in building a Link Nurse Program

- Infection preventionists and hospital epidemiologists do not have authority over hospital staff
- Funding
- Staff engagement for long periods of time
- Maintaining legitimacy for long periods of time
- Showing the worth of the program

How do we build this program and make it effective?

Responsibilities of Infection Prevention Team

Clinical Epidemiology*

- Annual new link nurse training
- Organize monthly link nurse meetings
- Provide weekly HCA-MRSA data to the link nurses
- Provide monthly HH and CI data to the link nurses
- Address issues/barriers to optimizing compliance with HH and CI identified by link nurses
- Follow-up of physician breaches by the Infectious Diseases / Clinical Epidemiology physicians

*Infection Prevention and Control

Link Nurse Training

- Classroom lectures detailing principles of infection prevention, microbiology lab tour, real-time role play scenarios for non-compliance
- Create semi-experts in infection prevention

Training Agenda

AGENDA FOR INFECTION CONTROL LINK NURSE TRAINING

8:00-8:15	**Welcome and Pre-Test**
8:15-8:55	**Healthcare Acquired Infections**
8:55-9:30	**Culture of Safety**
9:30-10:00	**Germ Theory and The Importance of Hand Hygiene**
10:00-10:15	**Break**
10:30-11:10	**Basic Microbiology and Common Hospital Organisms**
11:20-12:00	**Lab Tour and Workflow**
12:00-12:30	**LUNCH**
12:30-1:30	**Multidrug Resistant Organisms - Types of Isolation**
1:30-2:30	**Healthcare Acquired Infections**
2:30-2:45	**Break**
2:45-3:30	**Healthcare Acquired Infections Prevention Strategies Part II**
3:30-4:00	**Review/Role Playing and Post-Test**

Microbiology and Link Nurse

Clinical Microbiology Laboratory

- Overview of Microbiology Lab Testing (individual workstations)
- Specimen collection and rejection policies
- Communication of significant lab results including multidrug resistant organisms

Monthly Meetings

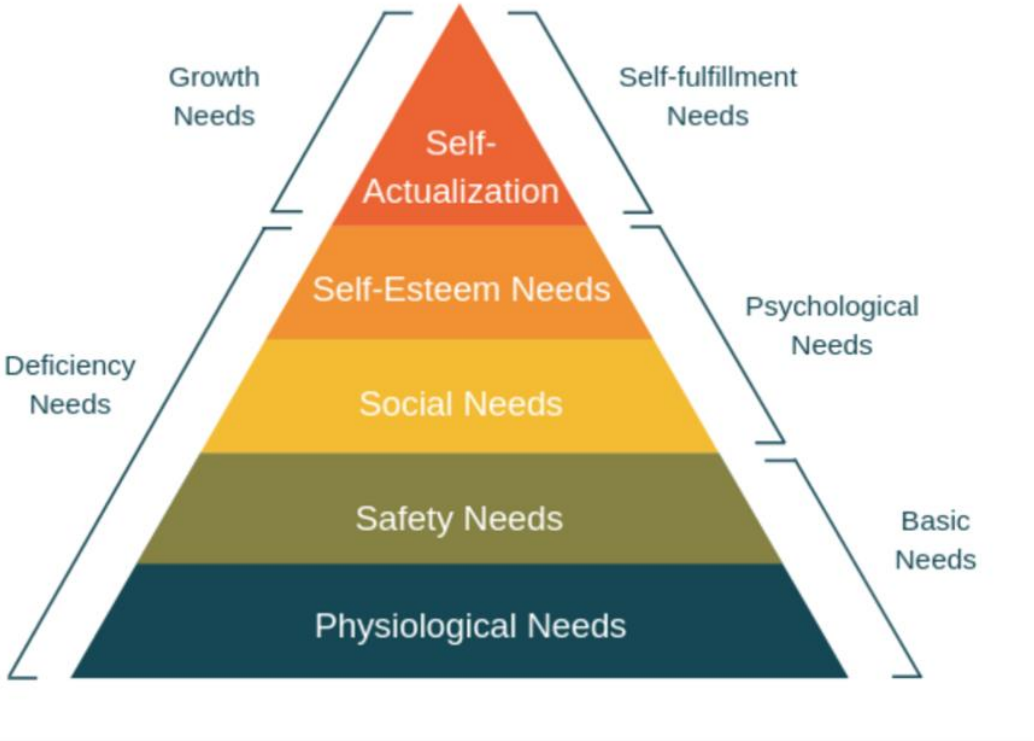
- Provide a support system
- Provide a way to communicate openly
- Provide follow up on concerns brought up by link nurses
- Provide continued education
- Make it interactive

Agenda for monthly meetings

- Provide unit specific data – selective infection data and corresponding process measure data
- Collate and present audit data if link nurses are conducting audits
- Short education on the topic the link nurse program is currently addressing
- Assign tasks and provide resources
- Breakout sessions into small groups with respective infection preventionists (encourages active participation)

P. S. Provide lunch – ours was always pizza and salad

Maslow's Hierarchy of Needs: These must be met for successful commitment



Your program has to:

- Provide safe space for open discussions
- Create an environment where they feel they are part of a group and are being supported
- Conduct interactive meetings that provide followup on issues discussed with so that they feel they are being part of something important, feeling a sense of contribution and being valued and they are being agents of change
- Provide ways to realize self fulfillment and personal growth – e.g., clinical ladder opportunities, showcasing their work at regional or national meetings etc.

Challenges in building a Link Nurse Program

- Infection preventionists and hospital epidemiologists do not have authority over hospital staff
- Funding
- Staff engagement for long periods of time
- Maintaining legitimacy for long periods of time
- Showing the worth of the program

How do we build this program and make it effective?

Link Nurse Projects

- Specific
- Measurable
- Attainable
- Realistic
- Timely

Infection Control Link Nurse Program addressing health care-acquired MRSA

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Link Nurse Responsibilities…

Link Nurse

- Monitor HCW hand hygiene and contact isolation compliance during their scheduled shift
- Educational activities sharing information provided by Infection Prevention Department
  - Short presentations at staff meetings. Information bulletins, in-service education, one-on-one education to the staff
  - Identify issues/barriers related to optimizing compliance with hand hygiene and contact isolation on their units

Hand Hygiene Competition – an example of things you could do

Date:

Judges:

- Chief Nursing Officer
- Associate Chief Nursing Officer
- Director of Nursing Education

Guideline:

Our unit will be judged on two aspects:

- Staff engagement: Excitement, innovation and extent on staff involvement (including medical staff and your unit's EMS staff)
- Power Point Slide Presentation displaying and describing your unit's effort (5 min) – quality of the presentation, quality of work done on the unit including reminders, prompts, posters

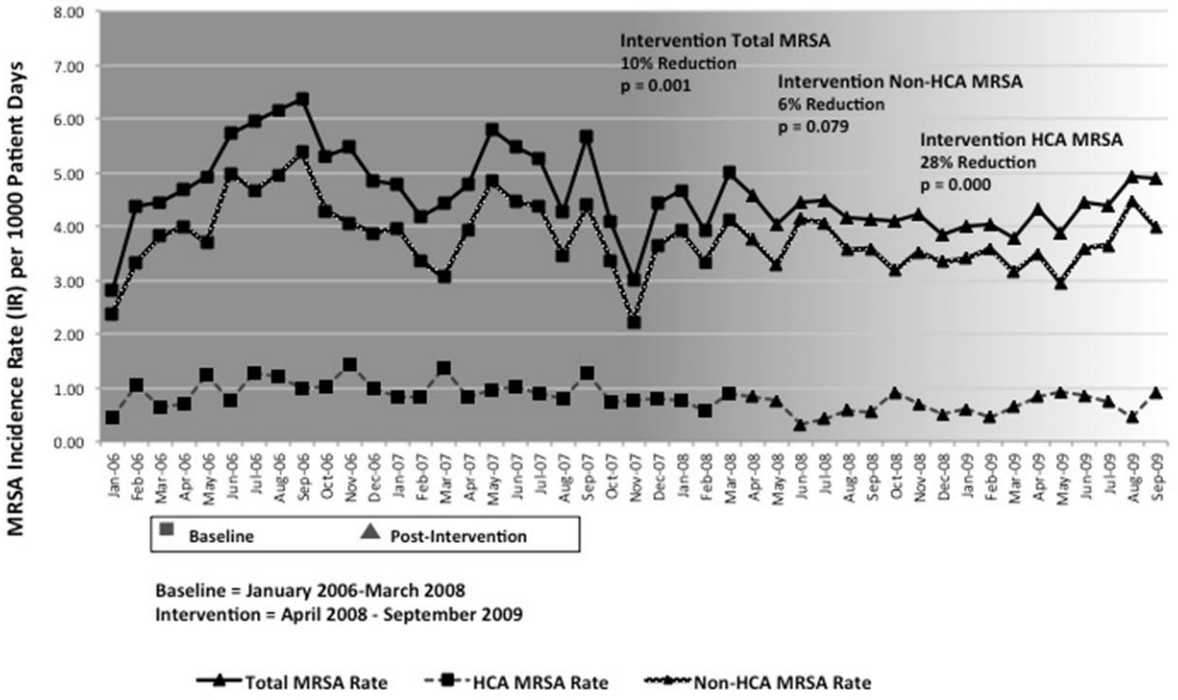
Note: Make sure regulations are followed when posting reminders, prompts or posters on the unit (make sure to get verbal approval from your manager)

Outcome Measures

- Primary outcome measure was HCA-MRSA incidence per 1,000 patient-days Total MRSA incidence rate
- Non-HCA-MRSA incidence rate
- Total MRSA bacteremia incidence rate
- HCA-MRSA bacteremia incidence rate
- Non-HCA-MRSA bacteremia incidence rate
- Hand soap/sanitizer use per month
- Hand hygiene compliance

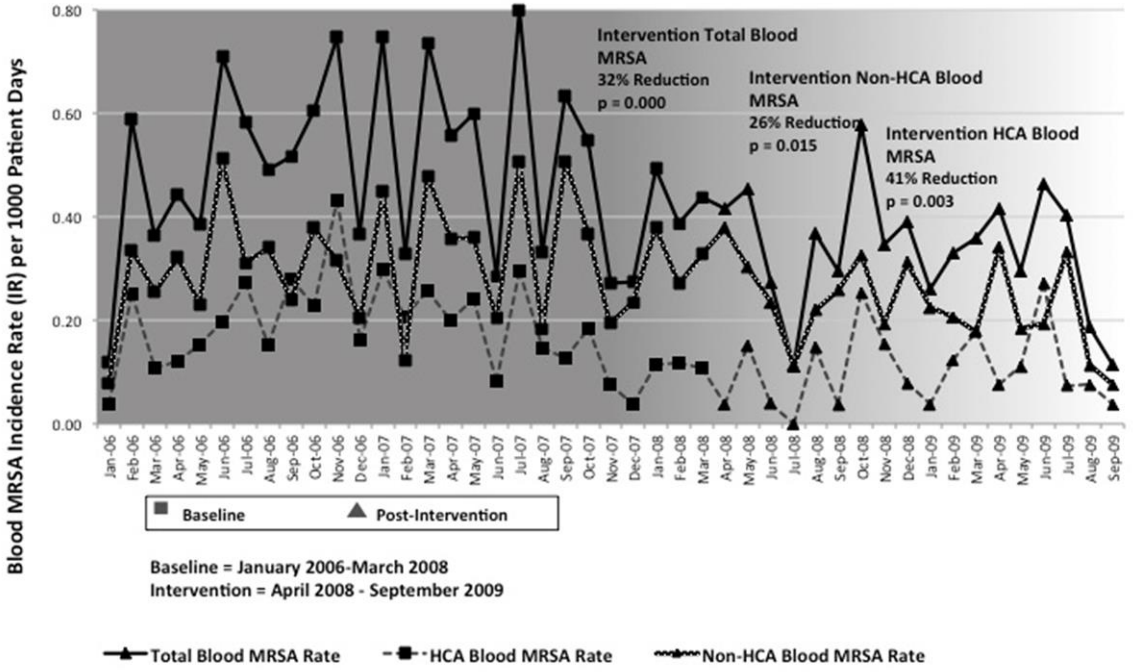
Sopirala MM et al. Am J Infect Control. 2014 April ; 42(4): 353–359.

Total MRSA, Non-HCA and HCA MRSA



Sopirala MM et al. Am J Infect Control. 2014 April ; 42(4): 353–359.

Total Blood MRSA, Non-HCA Blood and HCA Blood MRSA



Sopirala MM et al. Am J Infect Control. 2014 April ; 42(4): 353–359.

Outcome Measures

Hand soap and sanitizer usage in the intervention period compared with baseline period

	Surveillance period	Soap and hand sanitizer usage	Standard deviation (range)	*P* value
Monthly mean of soap and hand sanitizer usage	Baseline	19,301	5,559 (2,232-27,000)	-
	Intervention	31,794	6,962 (20,354-47,245)	< .001

Sopirala MM et al. Am J Infect Control. 2014 April ; 42(4): 353–359.

Infection Control Link Nurse Program

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VCU Virginia Infection Prevention Training Center

Sopirala MM et al. Am J Infect Control. 2018 Jul;46(7):743-746

Outcome measures

Objective: Reduce CAUTI rates in the ICU by implementation of the Link nurse program

Outcome measure:

- Monthly CAUTI incidence

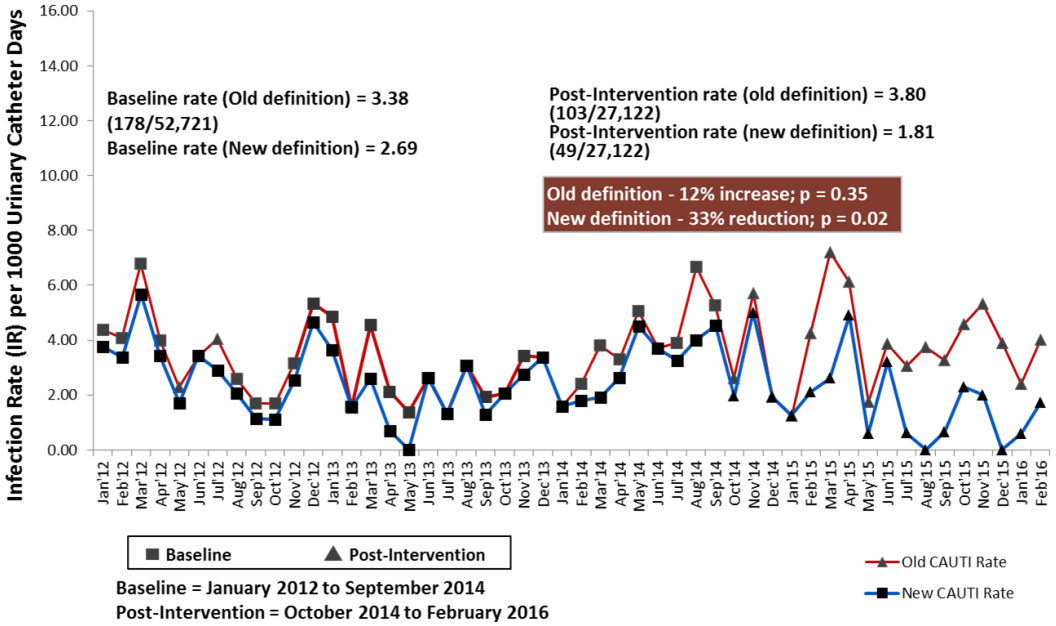
Sopirala MM et al. Am J Infect Control. 2018 Jul;46(7):743-746

Monthly education and activities of Link Nurses who were focused on CAUTI prevention during the intervention period

Intervention Month	Link Nurse Meeting Activity
September 2014	8-hour infection prevention training for Link Nurses
October 2014	Link Nurse return demonstration training of urinary catheter maintenance
November 2014	Cross-sectional audit of all urethral catheters in the hospital
December 2014	• Link Nurse training on collection of urine cultures • Shared urethral catheter audit results • Link Nurse self-commitment to 3 action items for their units based on the audit results
January 2015	• Sharing of unit-based CAUTI prevention activities by Link Nurses • Specific instructions for urine culture collection shared with Link Nurses
February 2015	• Foley insertion competency training using mannequin • Assignment to Link Nurses to perform competency training on their units for urinary catheter insertion and maintenance
March 2015	CAUTI prevention objectives and strategies engaging patients and family members shared with Link Nurses to be disseminated on their units
April 2015	Catheter insertion competencies on units completed by Link Nurses and shared at the meeting
May–July 2015	Link Nurses shared their unit-based activities
August 2015	Roll out of urinary catheter kit to standardize step-by-step process of insertion; Link Nurses educated on the kit and helped with the roll-out
September 2015–February 2016	Link Nurses shared their unit-based activities

Sopirala MM et al. Am J Infect Control. 2014 April ; 42(4): 353–359.

Reduction in CAUTI



Sopirala MM et al. Am J Infect Control. 2018 Jul;46(7):743-746

Challenges

- The large size of our health care system and the diversity of our hospitals posed a challenge.
  - Clinical Epidemiology obtained support from the individual nursing leaders at each of these hospitals, who were engaged from the beginning. This approach helped us overcome local obstacles within the hospitals.
- Another challenge was maintaining the interest of link nurses over long periods of time.
  - We addressed this by making the sessions interactive, by dividing link nurses into small groups for a part of every monthly meeting, by pairing small groups of link nurses with infection preventionists for one-on-one sessions, by organizing lectures based on the interests of link nurses, and by providing regular, monthly feedback on their unit-specific performance.
  - Our infection preventionists also developed an ongoing working relationship with their link nurses and approached them with questions and any issues originating from their PCUs.
- Maintaining credibility for the program is a challenging task.
  - We achieved this by addressing every question or issue brought up by the link nurses.
  - We shared the experience with the group to facilitate group learning from individual experiences.
  - Clinical Epidemiology maintains ownership of the data feedback, conduct of the training sessions and monthly meetings, and addressing the issues suggested by the link nurses.

Avoided Cost

- Using the mean attributable cost for MRSA infections ($35,367 per case)
- The number of HCA-MRSA cases for intervention period was projected using the rate from baseline period and period's actual PDs
- We calculated that the number of infections avoided over the 2-year period was 198 with an avoided cost of $7,002,666

Our experience

- Significant decrease in two different healthcare acquired infections (HAI) in two different academic health systems demonstrated with implementation of Link nurse program
- Can be used to target other HAI

Summary

In summary,

- Infection prevention Link Nurse programs have been shown to be successful when robust training and follow up is involved
- Since infection prevention programs do not have hierarchal authority over hospital staff, it is important to apply principles of lateral leadership for building a link nurse program
- Choose projects with SMART goals so that they are specific, measurable, attainable, realistic and timely
- Always be sure to show the effect of your program to all stakeholders so the program benefits from continued resources and funding

Questions?

Please direct questions to:

Madhuri M. Sopirala, MD, MPH
E-mail: madhuri.sopirala@UTSouthwestern.edu

MRSA Infection Prevention Updates

Presented by:

Michelle Doll, MD, MPH
Associate Professor Infectious Disease, VCU School of Medicine
Hospital Epidemiologist, VCU Health System

September 2024

Virginia Infection Prevention Training Center

VCU

VDH VIRGINIA DEPARTMENT OF HEALTH

Objectives:

1. Describe why prevention of MRSA infection in healthcare settings is a CDC priority
2. Describe the rationale for transmission-based precautions related to MRSA
3. List additional MRSA control interventions, in addition to contact precautions
4. List process measures related to MRSA prevention that should be tracked and reported to stakeholders
5. Describe available resources to assist in MRSA prevention

MRSA is a “Bad Bug”

- 60 y/o woman with renal disease on hemodialysis via an AV graft – develops chills with dialysis sessions.
- Admitted for further work up, found to have high-grade MRSA bacteremia, vegetation on her tricuspid valve, septic pulmonary emboli to the lungs, possible osteomyelitis/discitis of the lumbar spine, and involvement of the AVG requiring vascular surgery intervention –
- Prolonged hospital stay for sepsis and work up/treatment as above- discharge to SNF on long term IV antibiotics

MRSA Infections are Common, Aggressive, (often) Preventable:

Types of Infections:

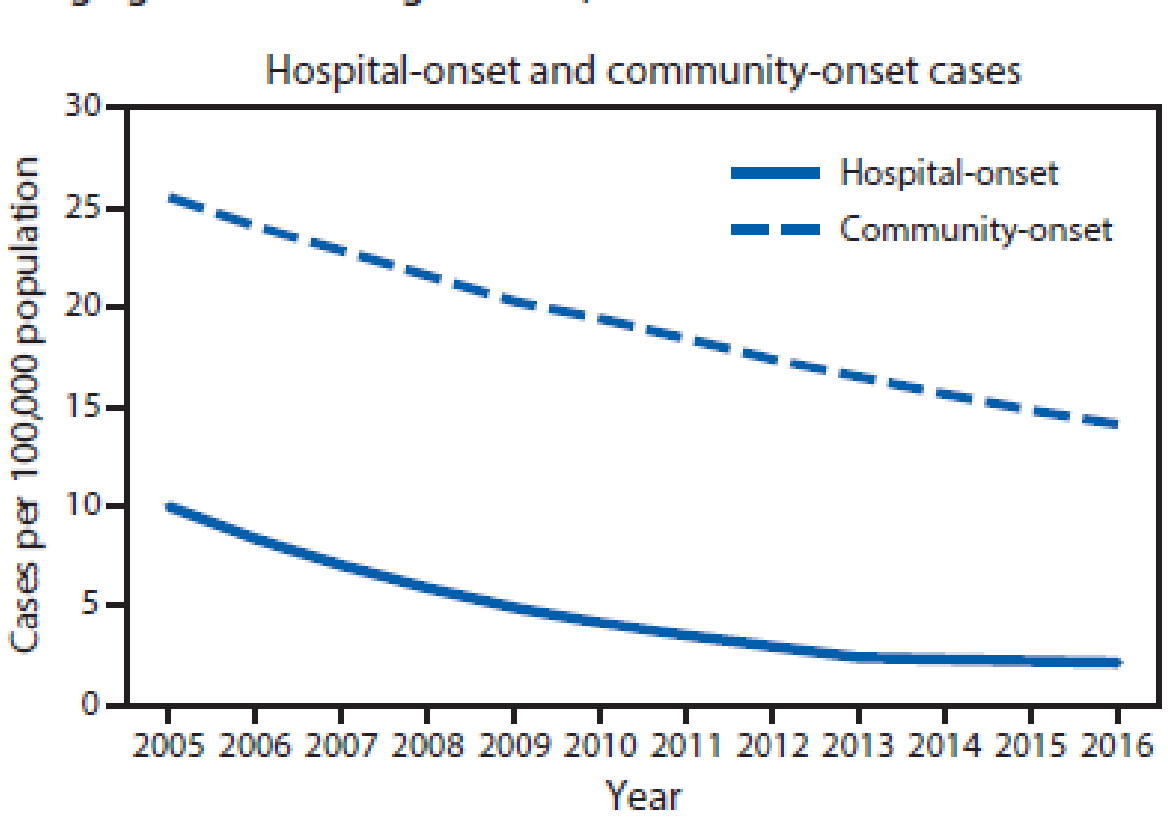
- Skin and soft tissue infections
- Bloodstream infection
- Sepsis
- Surgical site infections
- Pneumonia
- Bone and joint infections
- Endocarditis

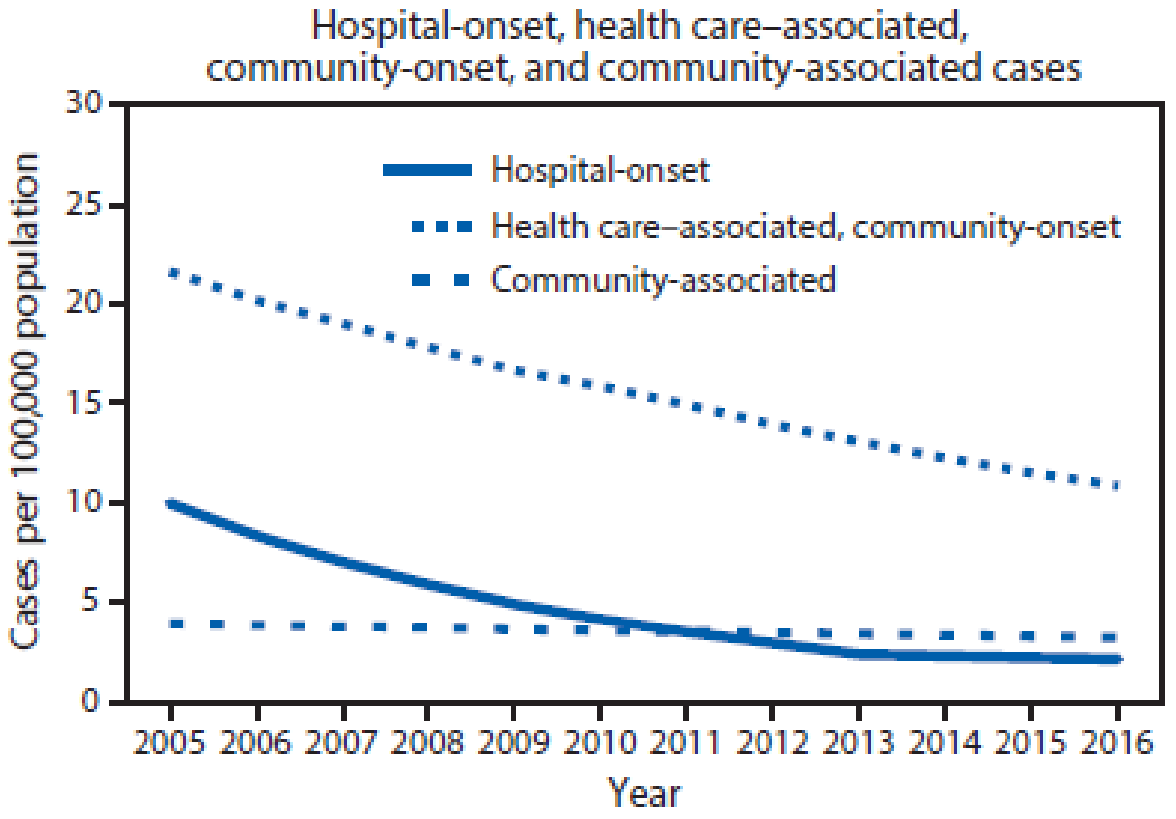
Patient at Increased Risk:

- Central lines or other medical devices
- Surgery
- Dialysis
- IVDU
- Burns

MRSA Rates overall Declining*

FIGURE 1. Adjusted* methicillin-resistant *Staphylococcus aureus* bloodstream infection rates from population based surveillance — six U.S. Emerging Infections Program sites,† 2005–2016





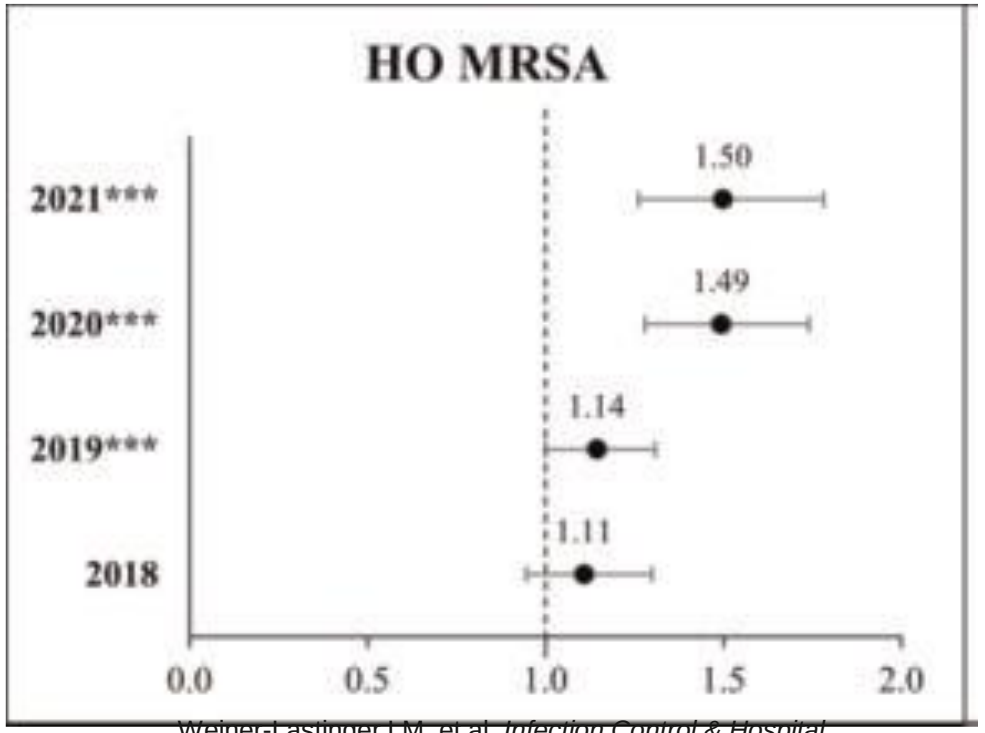
*Increase secondary to COVID-19

Kourtis AP, et al. MMWR Morb Mortal Wkly Rep 2019;68:214–219.
DOI: http://dx.doi.org/10.15585/mmwr.mm6809e1

Stressors Increase MRSA Rates:

Changes in 2020 NHSN SIRs for Acute Care Facilities:

	2020 Q1	2020 Q2	2020 Q3	2020 Q4
CLABSI	↓ -11.8%	↑ 27.9%	↑ 46.4%	↑ 47.0%
CAUTI	↓ -21.3%	No Change[1]	↑ 12.7%	↑ 18.8%
VAE	↑ 11.3%	↑ 33.7%	↑ 29.0%	↑ 44.8%
SSI: Colon surgery	↓ -9.1%	No Change[1]	↓ -6.9%	↓ -8.3%
SSI: Abdominal hysterectomy	↓ -16.0%	No Change[1]	No Change[1]	↓ -13.1%
Laboratory-identified MRSA bacteremia	↓ -7.2%	↑ 12.2%	↑ 22.5%	↑ 33.8%
Laboratory-identified CDI	↓ -17.5%	↓ -10.3%	↓ -8.8%	↓ -5.5%



Weiner-Lastinger LM, et al. *Infection Control & Hospital Epidemiology*. 2022;43(1):12-25. doi:10.1017/ice.2021.362

Rose A, et al. Trends in Staphylococcus aureus Bacteremia Rates among U.S. Acute Care Hospitals, January 2017- June 2021. OFID 2022:9(S2). IDSA abstract ofac492.1493.

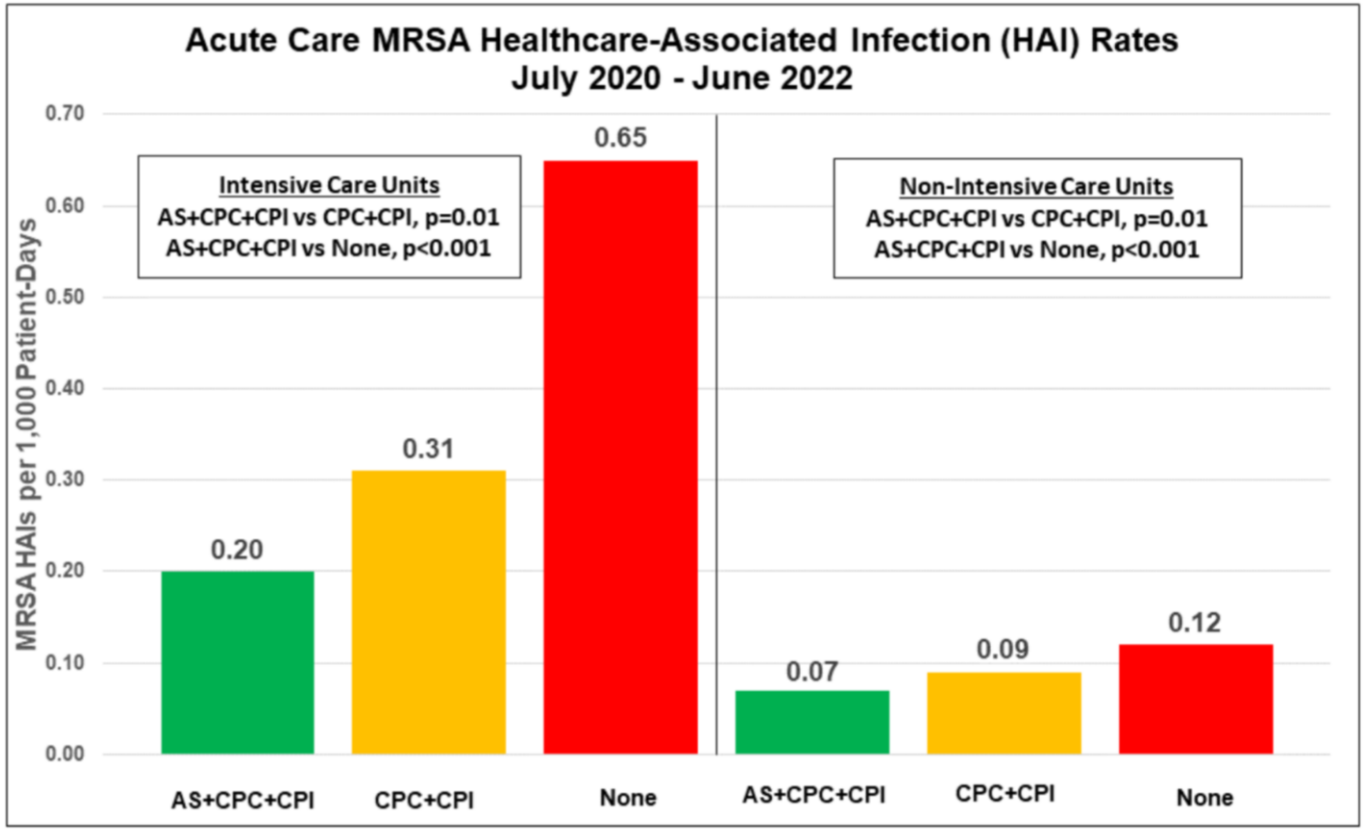
COVID-19 and Healthcare Under Stress:

- Data from all 123 acute care VA facilities: 917,591 admissions, >5,000,000 patient days, and 568 MRSA HAIs:

- Similar facility types*
- Similar patient populations
- Similar other IP procedures
- **Same Timeframe**

- CAUTI rates unchanged

*Adjusted for facility complexity and monthly COVID19 admissions – NO difference in these relationships



AS = active surveillance

CPC = contact precautions for MRSA colonized patients

CPI = contact precautions for MRSA infected patients

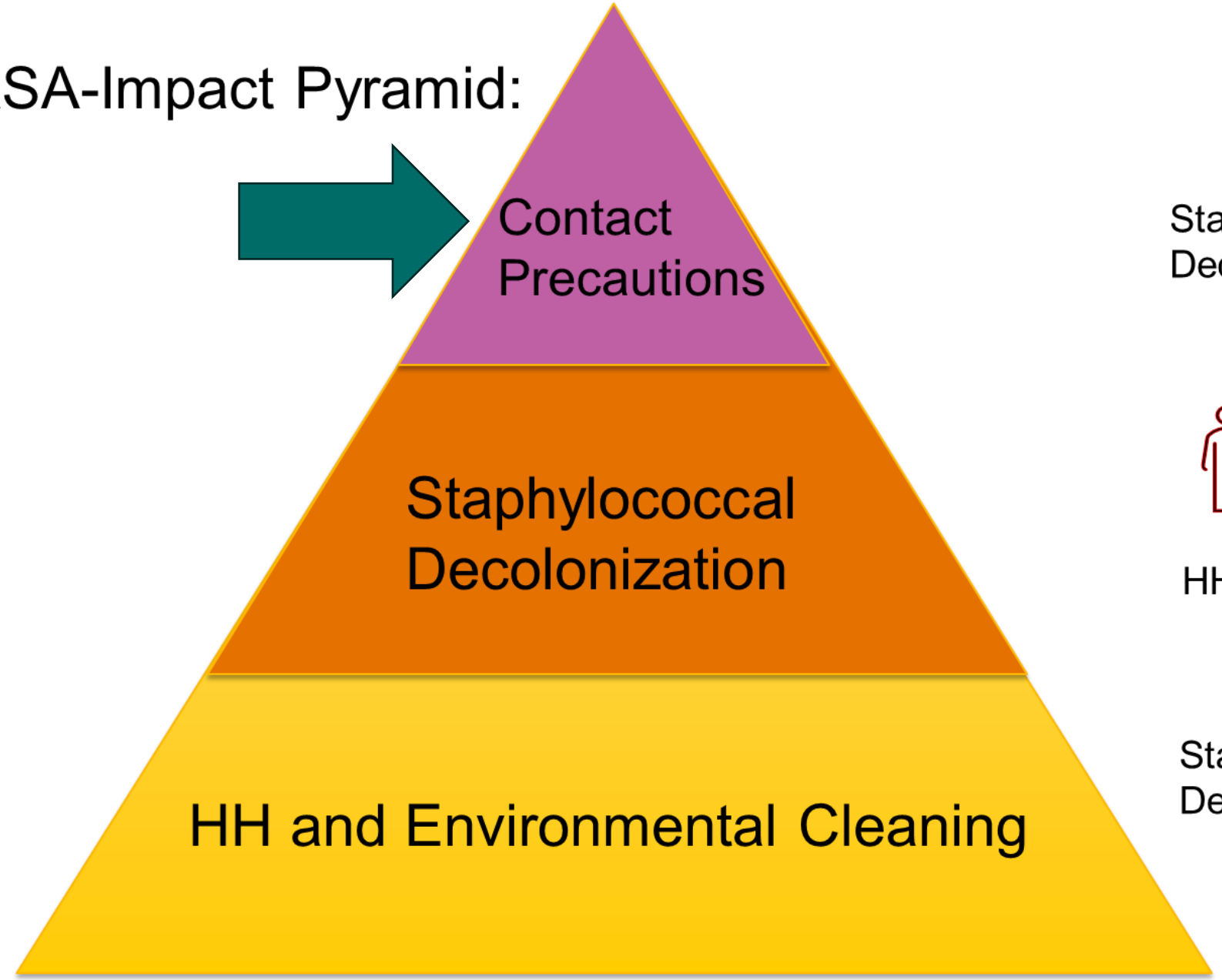
Evans ME, et al. Clin Infect Dis. 2023 Nov 17;77(10):1381-1386. doi: 10.1093/cid/ciad388.

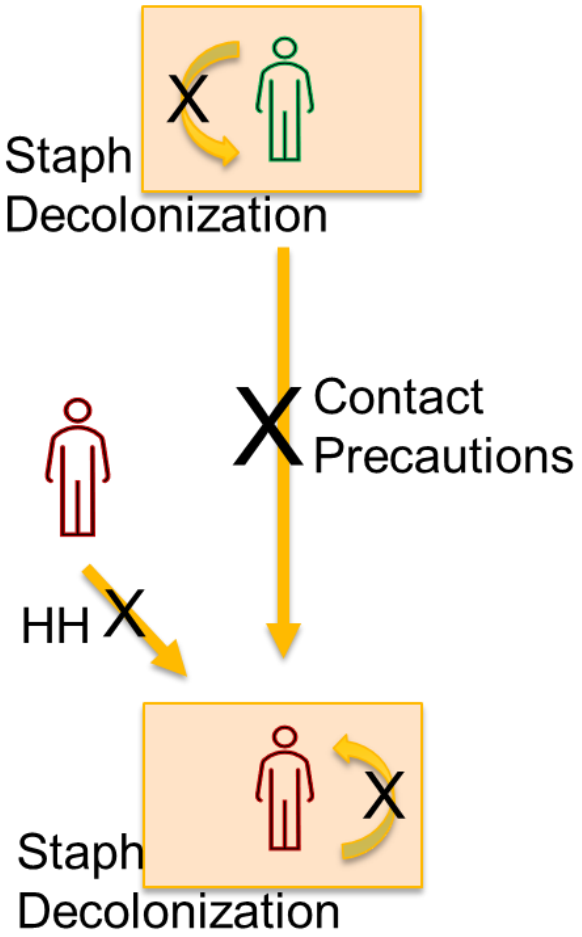
CDC MRSA Prevention Guidance:

1. Follow Existing Guidance for Prevention of:
   - CLABSI
   - SSI
   - Dialysis BSI
   - VAP
2. Decolonization
   - ICU, CVCs, High Risk Surgery (Ortho/Neuro/CT)
3. Monitor and Feedback HO-Staph aureus (MRSA or MSSA)
   - Ensure HH, PPE adherence, CP, environmental cleaning

https://www.cdc.gov/staphylococcus-aureus/hcp/prevent-in-acute-care-facilities/index.html

The MRSA-Impact Pyramid:



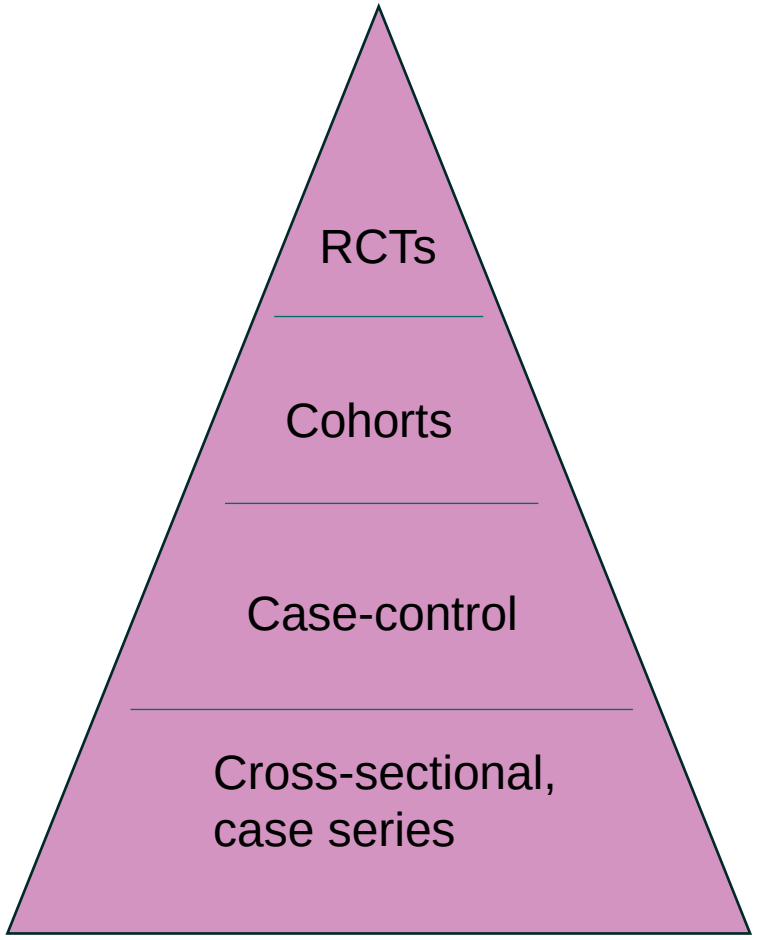


Contact Precautions for MRSA

- Increasingly Controversial – BUT is still a CDC and SHEA*/APIC Core Recommendation for Acute Care Facilities
- Gown and gloves for all patient encounters if infected OR colonized with MRSA
- In LTC, Enhanced barrier precautions would be the approach: Gown and gloves for contaminating activities with the colonized/infected resident

Why the Drama?

- High-quality data to support benefit of CP in preventing MRSA is lacking: largely observational*
- Because MRSA is common, “endemic”, it equates to A LOT of CPs, and adherence becomes increasingly difficult with increasing burden of CP
- Concerns about healthcare waste and sustainability are gaining traction



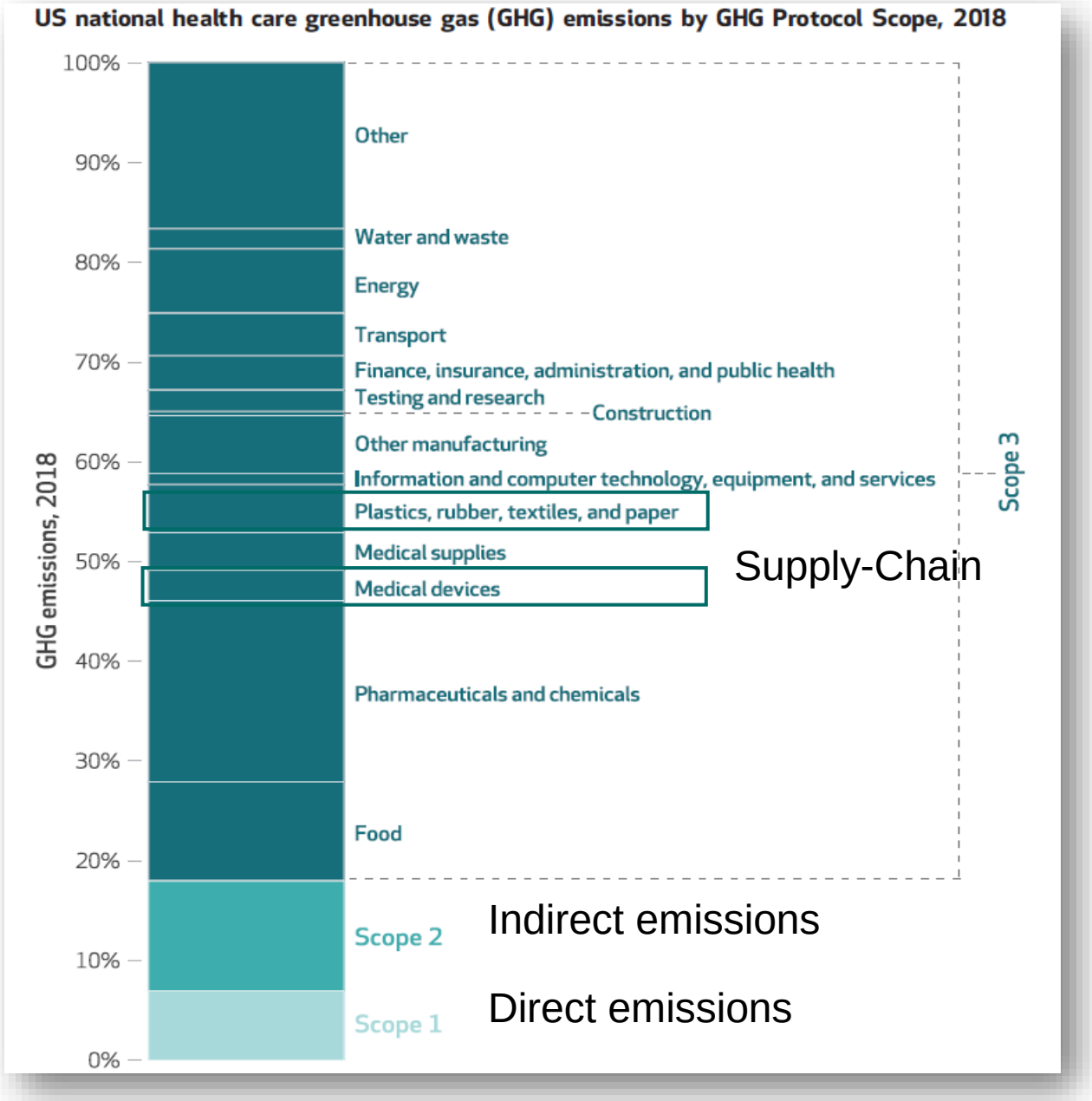
RE: Environmental Impact

PPE is a *fraction* of Healthcare-associated waste:

Nevertheless, PPE appears in 100% of the articles written on HC-associated waste.

Lack of conversation about more sustainable PPE options.

Lack of conversation about other opportunities to mitigate waste at all levels of the system.



Eckelman MJ, et al. Health Care Pollution And Public Health Damage In The United States: An Update. Health Aff (Millwood). 2020 Dec;39(12):2071-2079. doi: 10.1377/hlthaff.2020.01247.

“Perfect Epidemiologic Studies are rare. Find available data that is not fatally flawed and use it to improve public health”

– Dr. Geoffrey Rose, London School of Hygiene & Trop Med.

Farr BM. ICHE 2006;27(10):1096-1106

BUGG Study

Design:

- Cluster-randomized Universal Gown/Gloving vs. standard practice*,
- 20 adult ICUs
- 26,180 patients

Finding:

- Decrease of 2.98 MRSA acquisitions per 1000 patient days with UGG vs. Standard
- Less HCP room entries with improved HH in intervention ICUs

*Standard practice = CP for known MRSA infected/colonized (ie in absence of active surveillance data)

Harris AD, et al. *JAMA*. 2013 Oct 16;310(15):1571-80. doi: 10.1001/jama.2013.277815

Do Gowns and Gloves prevent MRSA = **YES**, Based on the BUGG Study: At approximately 3 Less MRSA Acquisitions per 1000 patient days

- MRICU + STICU = 1500 patient days / month
- 4.5 less MRSA acquisitions / month across these 2 units

PPE as MRSA Prevention in LTC:

- 12 nursing homes split into 2 groups: Cluster-randomized by facility:
  - Group 1: Standard precautions, passive surveillance MDROs
  - Group 2: Gown/gloves for care of patients with urinary catheters and/or feeding tubes*, active surveillance for MDROs, Staff education/HH
    - NOT isolated – continued to attend group activities, meals etc
    - TBP in both groups per NH policy (ie yes isolation for C. auris or influenza for example)
- FINDINGS:
  - Less MDRO prevalence in patients with devices in intervention NHs
  - Less MRSA acquisition
  - Less clinically diagnosed UTIs

Mody L, et al. A Targeted Infection Prevention Intervention in Nursing Home Residents with Indwelling Devices: A Randomized Clinical Trial. JAMA Internal Medicine 2015;175:714-23.

SHEA Compendium: MRSA Update 2023

Essential practices	
1	Implement a MRSA monitoring program. (Quality of evidence: LOW)
2	Conduct a MRSA risk assessment. (Quality of evidence: LOW)
3	Promote compliance with the CDC or WHO hand hygiene recommendations. (Quality of evidence: MODERATE)
4	Use contact precautions for MRSA-colonized and MRSA-infected patients. A facility that chooses or has already chosen to modify the use of contact precautions for some or all of these patients should conduct a MRSA-specific risk assessment to evaluate the facility for transmission risks and to assess the effectiveness of other MRSA risk mitigation strategies (eg, hand hygiene, cleaning and disinfection of the environment, single occupancy patient rooms), and establish a process for ongoing monitoring, oversight, and risk assessment. (Quality of evidence: MODERATE)
5	Ensure cleaning and disinfection of equipment and the environment. (Quality of evidence: MODERATE)
6	Implement a laboratory-based alert system that notifies HCP of new MRSA-colonized or MRSA-infected patients in a timely manner. (Quality of evidence: LOW)
7	Implement an alert system that identifies readmitted or transferred MRSA-colonized or MRSA-infected patients. (Quality of evidence: LOW)
8	Provide MRSA data and outcome measures to key stakeholders, including senior leadership, physicians, nursing staff, and others. (Quality of evidence: LOW)
9	Educate healthcare personnel about MRSA. (Quality of evidence: LOW)
10	Educate patients and families about MRSA. (Quality of evidence: LOW)
11	Implement an antimicrobial stewardship program. (Quality of evidence: LOW)

Popovich KJ, Aureden K, Ham DC, et al. SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in acute-care hospitals: 2022 Update. *Infection Control & Hospital Epidemiology*. 2023;44(7):1039-1067. doi:10.1017/ice.2023.102

SHEA Compendium: MRSA Update 2023

- Consider your population when determining and implementing your MRSA control program
  - Burn units?
  - NICU?
  - Expanding service lines? Surgeries?
- One hospital’s experience will not necessarily transfer to yours
  - Importance of foundational practices
- Note: the Appendix of the document contains implementation guidance for Active Surveillance and Decolonization strategies

Special Approaches to MRSA:

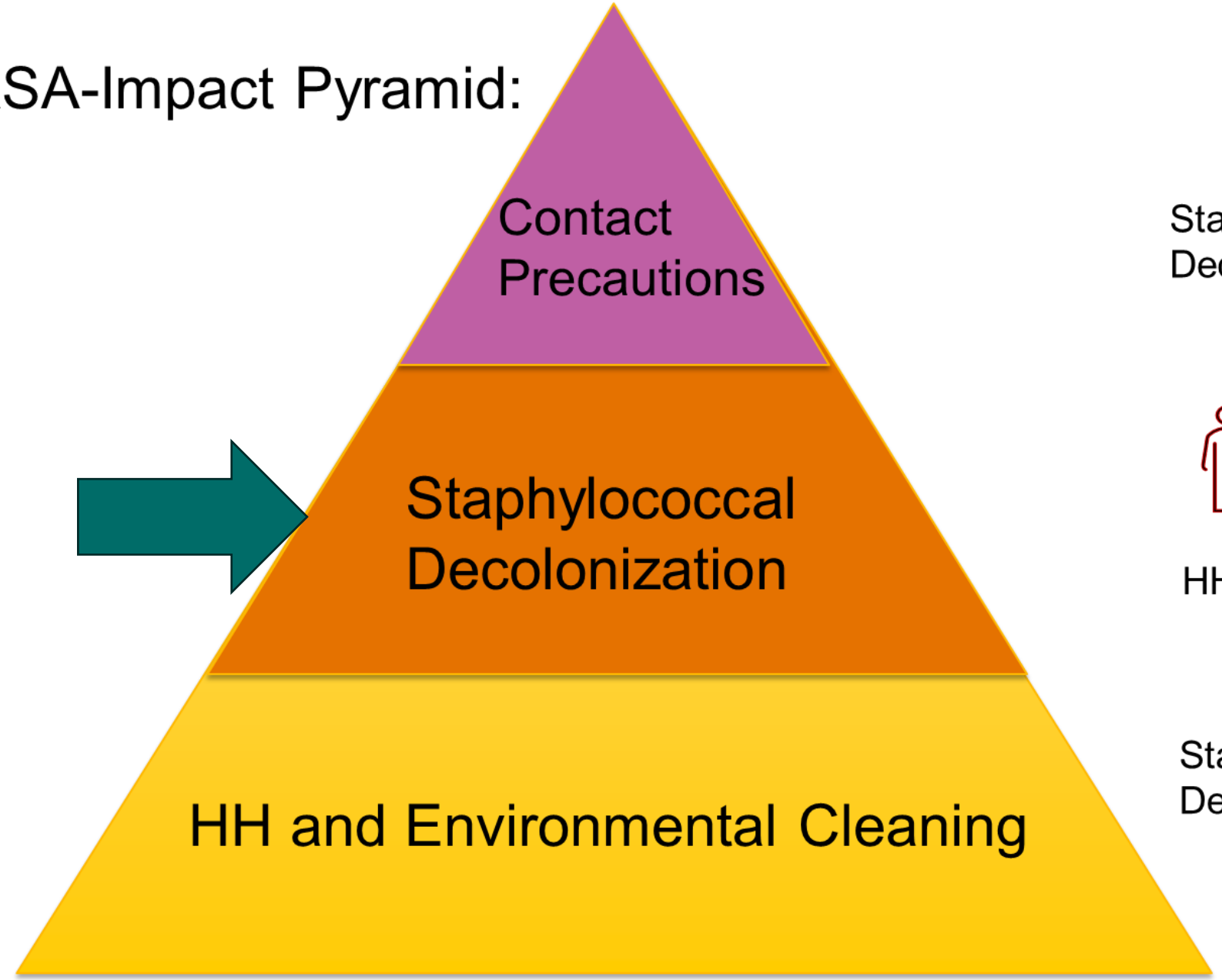
Criticism of AST, and decolonization focusing only on the MRSA-colonized is that it fails to take into account other organism(s), like MSSA:

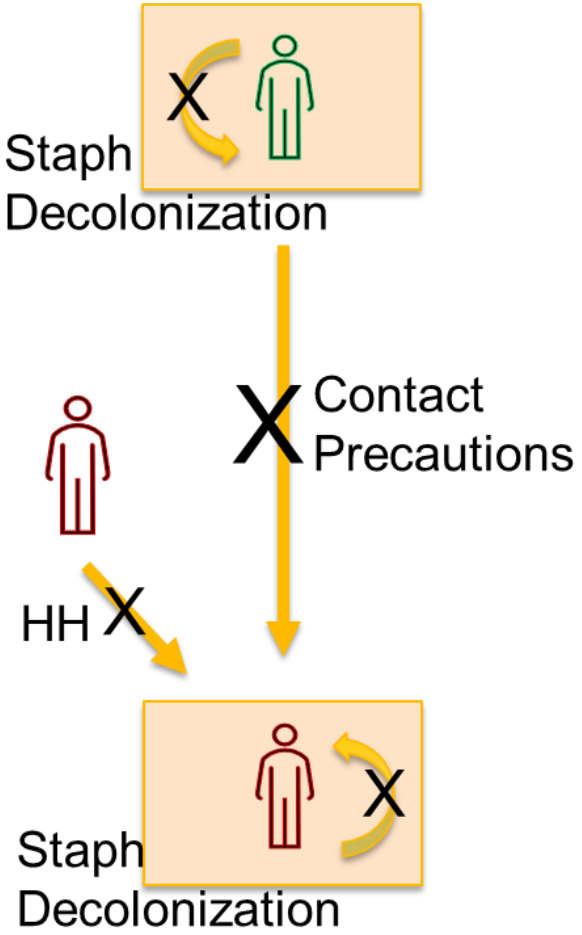
MSSA is also aggressive, likely shares transmission factors with MRSA, and will be missed by an IP program that focuses specifically on MRSA via AST/isolation:

Additional approaches	
Active surveillance testing (AST)	
1	Implement a MRSA AST program for select patient populations as part of a multifaceted strategy to control and prevent MRSA. (Quality of evidence: MODERATE). Note: Specific populations may have different evidence ratings.
2	Active surveillance for MRSA in conjunction with decolonization can be performed in targeted populations prior to surgery to prevent post-surgical MRSA infection. (Quality of evidence: MODERATE)
3	Active surveillance with contact precautions is inferior to universal decolonization for reduction of MRSA clinical isolates in adult ICUs. (Quality of evidence: HIGH)
4	Hospital-wide active surveillance for MRSA can be used in conjunction with contact precautions to reduce the incidence of MRSA infection. (Quality of evidence: MODERATE)
5	Active surveillance can be performed in the setting of a MRSA outbreak or evidence of ongoing transmission of MRSA within a unit as part of a multifaceted strategy to halt transmission. (Quality of evidence: MODERATE)
Screen healthcare personnel (HCP) for MRSA infection or colonization	
1	Screen HCP for MRSA infection or colonization if they are epidemiologically linked to a cluster of MRSA infections. (Quality of evidence: LOW)
MRSA decolonization therapy	
1	Use universal decolonization (daily CHG bathing plus 5 days of nasal decolonization) for all patients in adult ICUs to reduce endemic MRSA clinical cultures. (Quality of evidence: HIGH)
2	Perform preoperative nares screening with targeted use of CHG and nasal decolonization in MRSA carriers to reduce MRSA SSI, in surgical procedures involving implantation of hardware. (Quality of evidence: MODERATE)
3	Screen for MRSA and provide targeted decolonization with CHG bathing and nasal decolonization to MRSA carriers in surgical units to reduce postoperative MRSA inpatient infections. (Quality of evidence: MODERATE)
4	Provide CHG bathing plus nasal decolonization to known MRSA carriers outside the ICU with medical devices, specifically central lines, midline catheters, and lumbar drains, to reduce MRSA clinical cultures. (Quality of evidence: MODERATE)
5	Consider postdischarge decolonization of MRSA carriers to reduce postdischarge MRSA infection and readmission. (Quality of evidence: HIGH)
6	Neonatal ICUs should consider targeted or universal decolonization during times of above-average MRSA infection rates or targeted decolonization for patients at high risk of MRSA infection (eg, low birthweight, indwelling devices, or prior to high-risk surgeries). (Quality of evidence: MODERATE)
7	Burn units should consider targeted or universal decolonization during times of above average MRSA infection rates. (Quality of evidence: MODERATE)
8	Consider targeted or universal decolonization of hemodialysis patients. (Quality of evidence: MODERATE)
9	Decolonization should be strongly considered as part of a multimodal approach to control MRSA outbreaks. (Quality of evidence: MODERATE)
Universal use of gowns and gloves	
1	Use gowns and gloves when providing care to or entering the room of all adult ICU patients, regardless of MRSA colonization status. (Quality of evidence: MODERATE)

Popovich KJ, Aureden K, Ham DC, et al. SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in acute-care hospitals: 2022 Update. *Infection Control & Hospital Epidemiology*. 2023;44(7):1039-1067. doi:10.1017/ice.2023.102

The MRSA-Impact Pyramid:





REDUCE MRSA

Design

3 Groups:

1. Admit screening/CP
2. Admit screening/CP + Targeted Decolonization
3. Admit screening/CP + Universal Decolonization

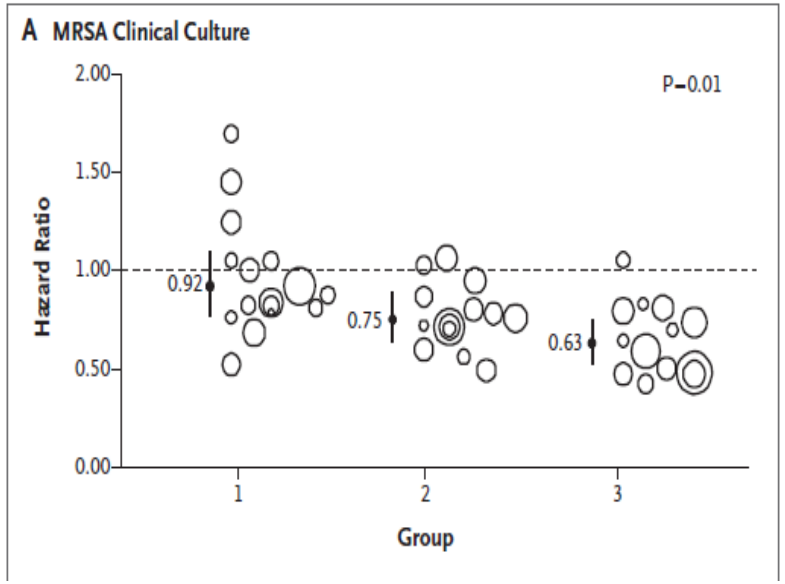
- 74 ICUs in 43 hospitals
- 74,256 patients

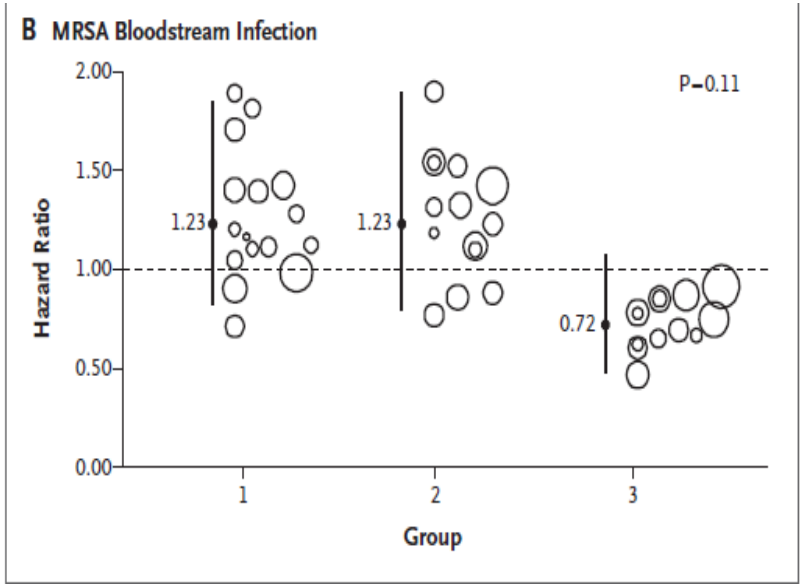
Findings

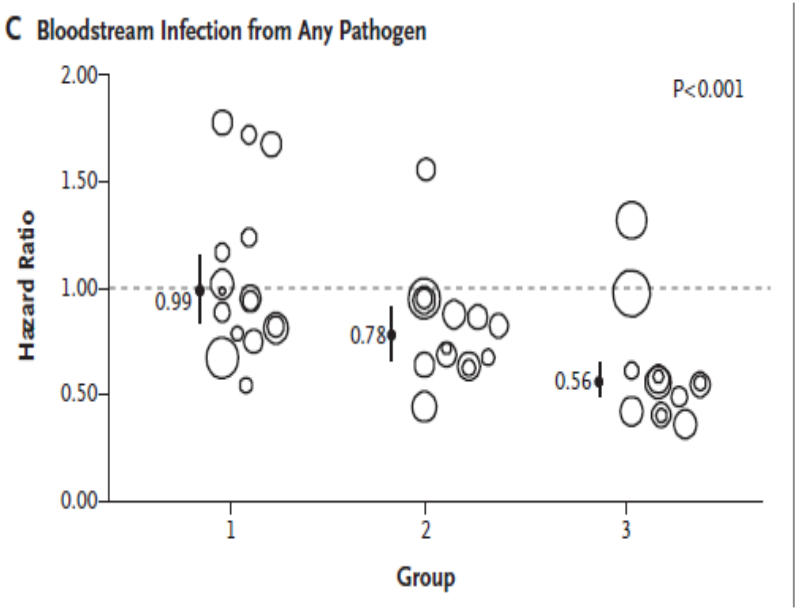
- Universal Decolonization (Group 3) had the greatest reduction in MRSA clinical cultures, MRSA BSI, and all cause BSI

Huang SS, et al. Targeted versus universal decolonization to prevent ICU infection. N Engl J Med. 2013 Jun 13;368(24):2255-65. doi: 10.1056/NEJMoa1207290.

REDUCE MRSA







Huang SS, et al. Targeted versus universal decolonization to prevent ICU infection. N Engl J Med. 2013 Jun 13;368(24):2255-65. doi: 10.1056/NEJMoa1207290.

Decolonization in Nursing Homes:

Design

- Cluster-randomized
- Daily CHG Bathing + iodine nasal decolonization BID x 5 days (decolonization) on admit then every other week
- 28 nursing homes in CA
- >28,000 residents

Findings

- Decrease in MRSA and other MDRO colonization among residents
- Decrease in transfer back to acute care

Miller LG, et al. Decolonization in Nursing Homes to Prevent Infection and Hospitalization. N Engl J Med. 2023 Nov 9;389(19):1766-1777. doi: 10.1056/NEJMoa2215254.

Decolonization versus CHG Bathing?

CHG “Bathing”

- Applying 2% or 4% CHG solution or wipes to patient (or resident) skin, neck down, daily

Decolonization

- CHG bathing (may be only 5 days of, e.g. pre-operative)
- Nasal antibiotic or antimicrobial:
  - Mupirocin
  - Iodine
  - Alcohol
- *(Oral CHG rinse)*

But HOW do you “bathe”?

- Is bathing daily actually happening?
- What is the quality of the bathing?
  - Does it vary depending on who is doing?

Is This Patient REALLY “self-bathing”?

CHG Treatment Audit- Key

Record observations when monitoring an adult patient being bathed with CHG Wipes

Circle observed bathing process:

	Correct	Incorrect	
1	Y	N	Staff wipes entire neck area well including skin folds
2	Y	N	Staff massages skin firmly with CHG wipe to ensure adequate cleansing
3	Y	N	Staff wipes armpit and back of knees well
4	Y	N	Staff wipes in between toes and fingers
5	Y	N	Staff wipes perineal area and avoids inner labia, broken skin, or mucosal tissue
6	Y	N	Staff wipes between gluteal folds
7	Y -N/A	N	Staff wipes the 6 inches of tubing, lines, and drains closest to the patient first, then moves to wipe that area of the body.
8	Y	N	In each area of the body staff wipes moving from clean to dirty areas of the body
9	Y -N/A	N	Staff wipes to the edge of any wound, drain, ostomy, line, or like dressings.
10	Y	N	Staff wipes all intact skin below the jaw line
11	Y	N	Staff uses all 6 wipes and more if needed
12	Y	N	Staff allows CHG to air dry and does not wipe off CHG
13	Y	N	Staff uses only hospital approved skin care products
14	Y	N	CHG bathing documented

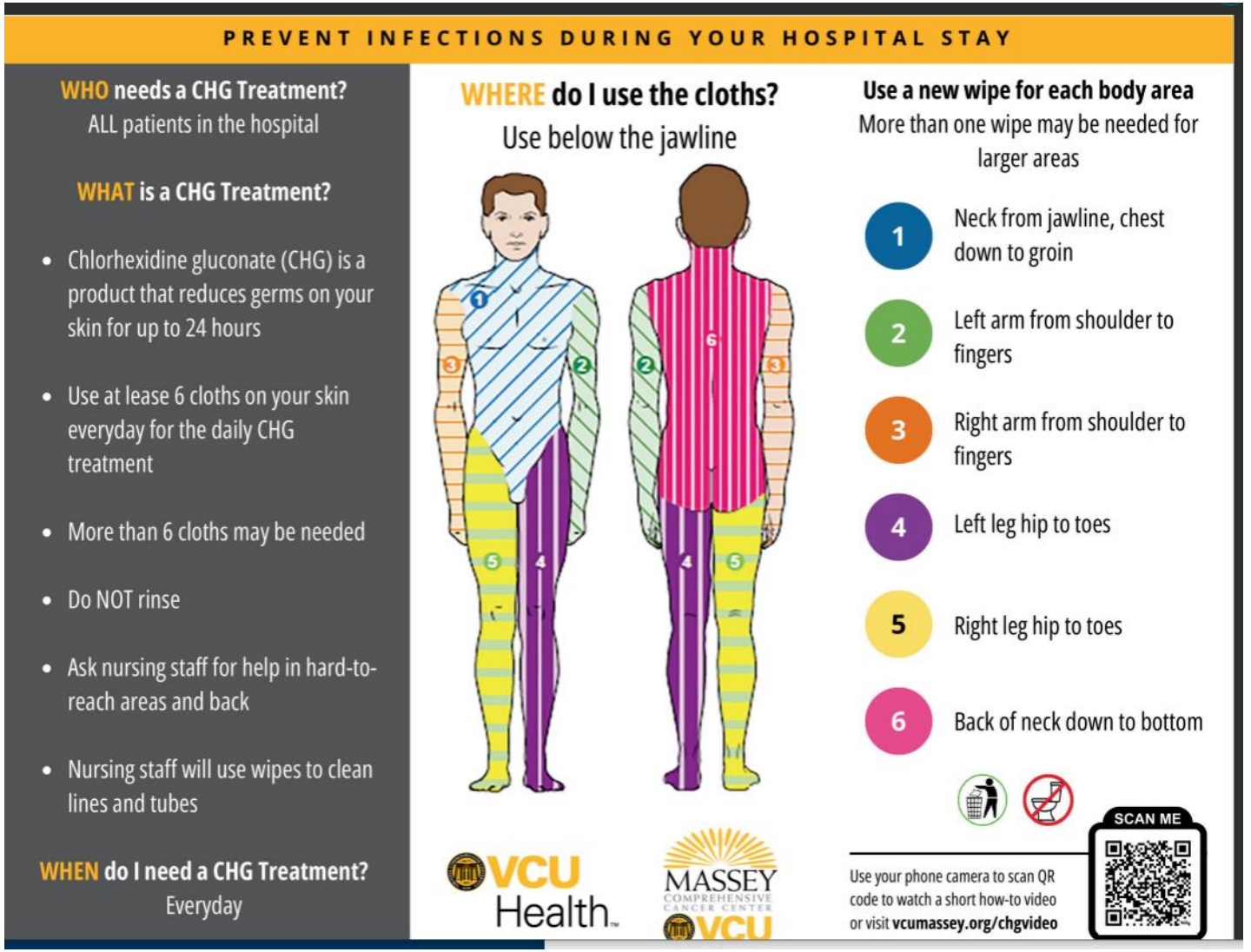
Interview staff that completed above bath on bathing best practices:

Correct answers for 15-20 on audit key

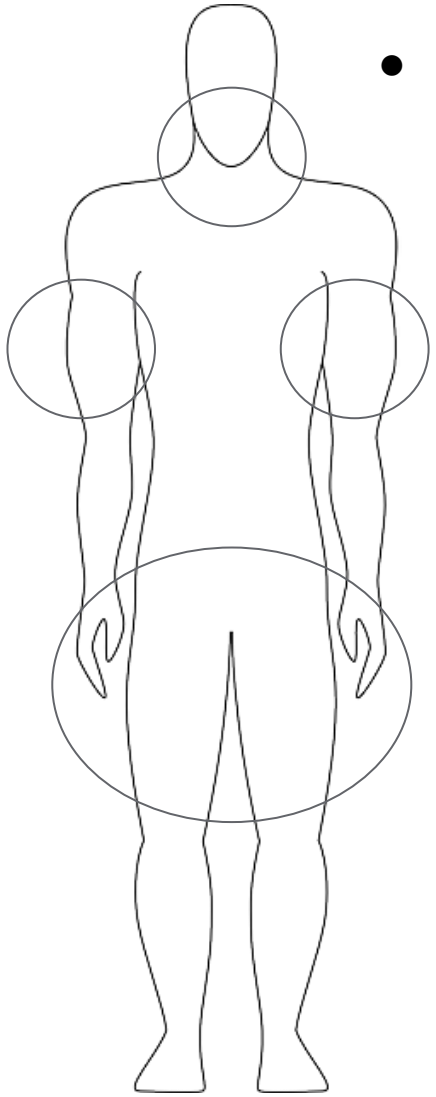
15. Explain the importance of daily CHG Treatment

Correct Answer: The main goal of Daily CHG Treatments are to prevent hospital acquired infections.

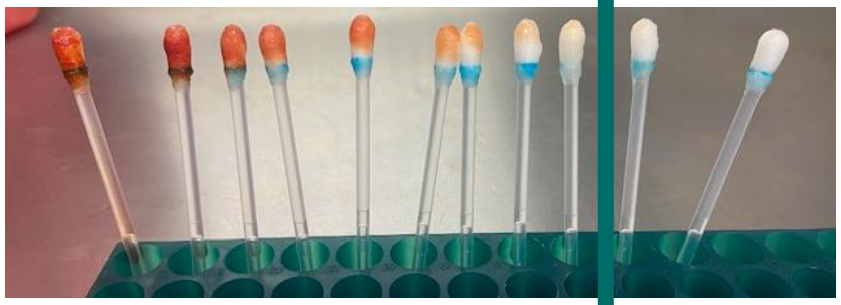
Not a “Bath” but a “Treatment”



Colormetric Chlorhexidine Gluconate Assay



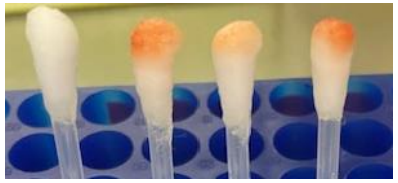
- Method adapted from USP Official Monograph for the identification of CHG solution
  - Swab skin with sterile water swab (see figure)
  - Swab saturated with freshly prepared solution cetyltrimethylammonium bromide (CTAB) + sodium hypobromide and immediately compared against the standard:

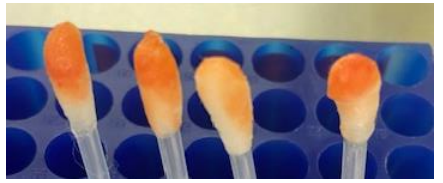


Prepared from known concentrations CHG via serial dilutions:

  - CHG concentration reflected by the color of the swab

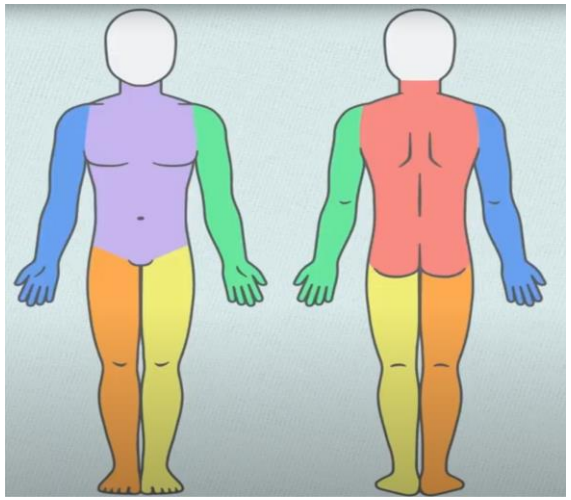
Eg:





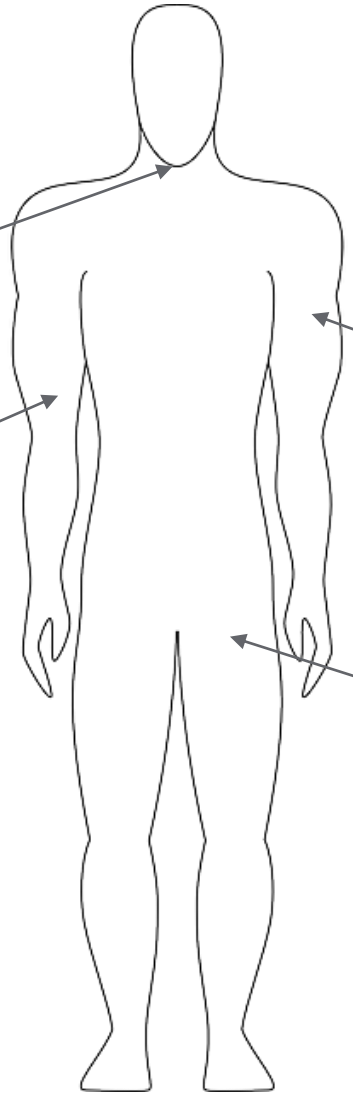
Popovich KJ, et al. Relationship between chlorhexidine gluconate skin concentration and microbial density on the skin of critically ill patients bathed daily with chlorhexidine gluconate. Infect Control Hosp Epidemiol. 2012 Sep;33(9):889-96. doi: 10.1086/667371.

CHG Adequacy by Site



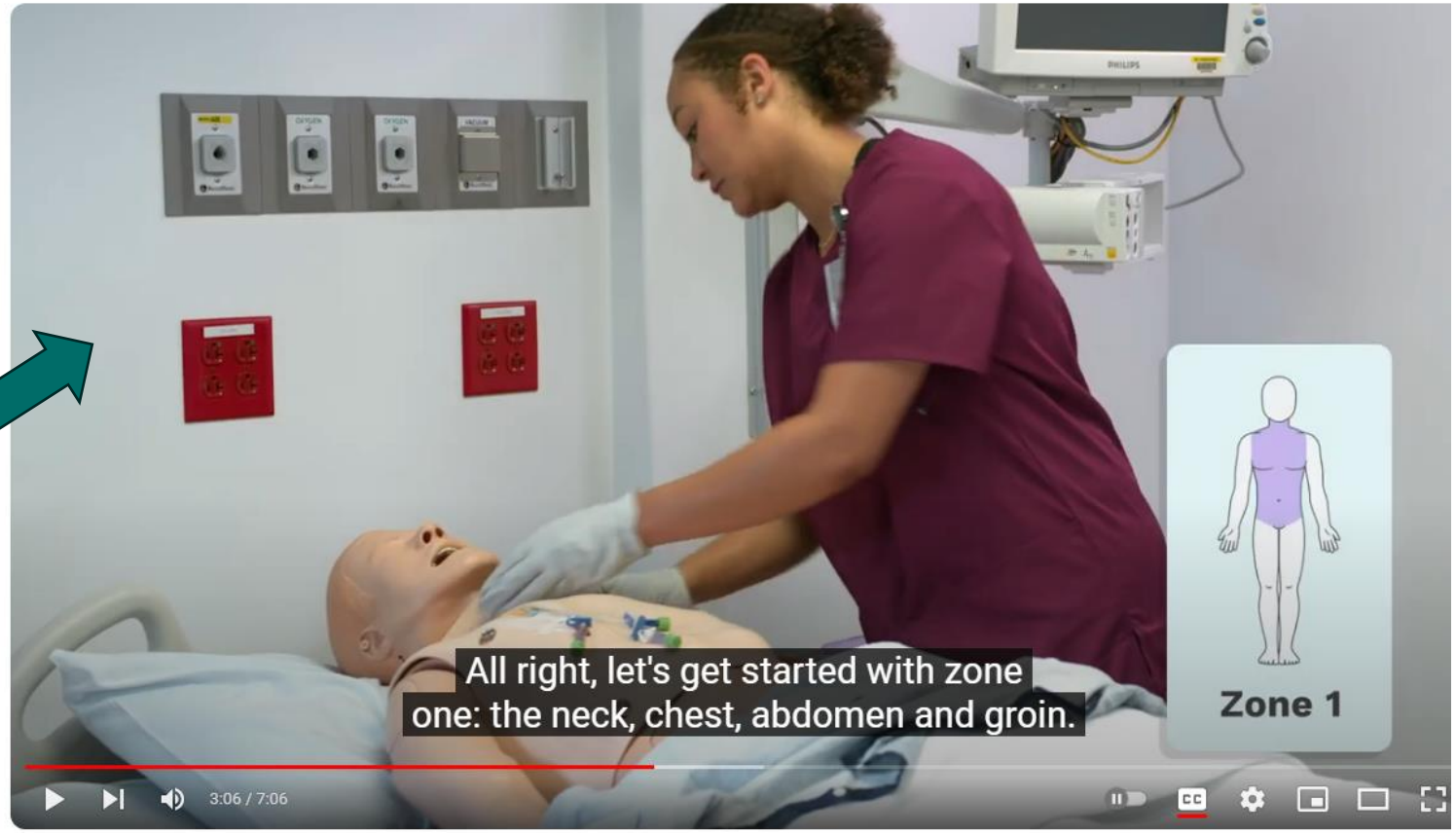
36/63 (57%)

50/62 (81%)



49/62 (79%)

48/62 (77%)

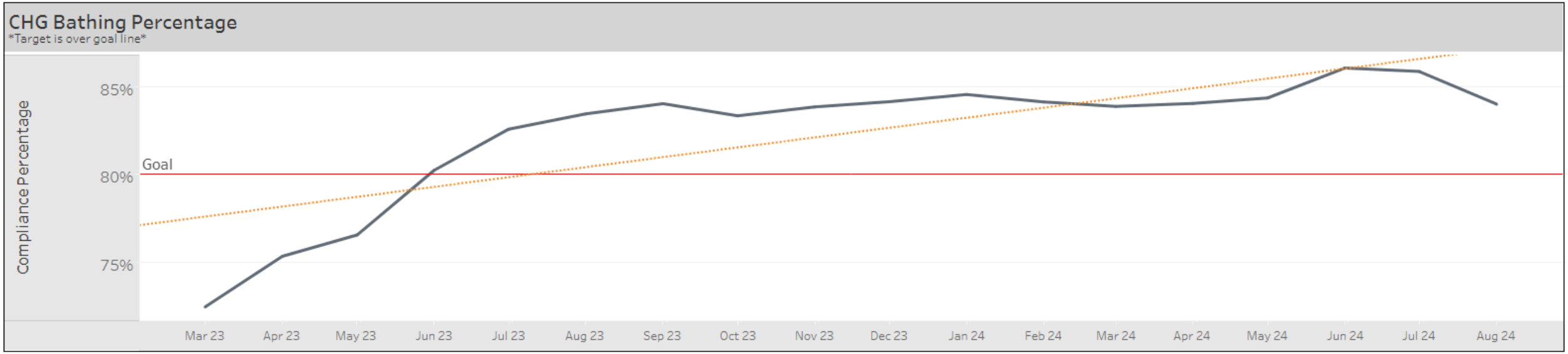


CHG Treatment: Step-by-Step Instructions for the Clinical Team

CHG Treatment: Step-by-Step for the Clinical Team:

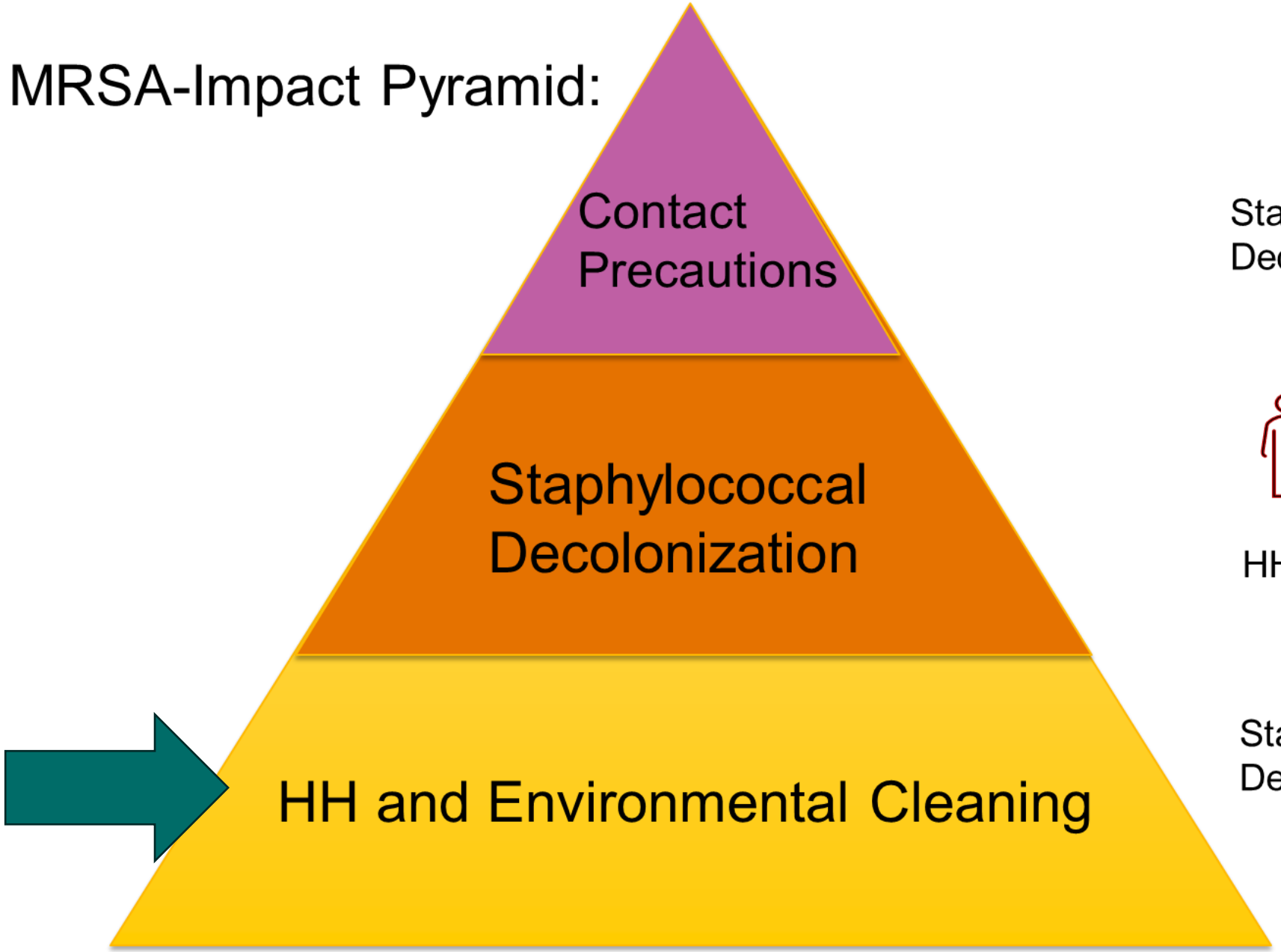
CHG Treatment: Step-by-Step Instructions for Patients:

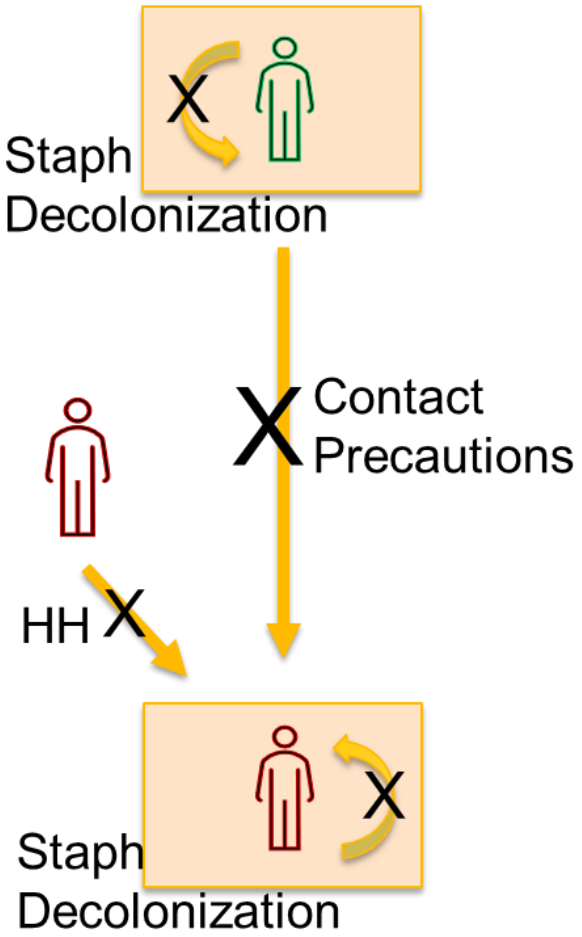
Leadership Support is Critical:



	Mar 23	Apr 23	May 23	Jun 23	Jul 23	Aug 23	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24
CHG Treatment	10,839	10,681	11,206	11,461	12,741	12,672	12,117	13,139	12,808	12,721	13,267	12,129	12,874	12,332	12,786	12,891	13,001	8,271
Total Opportunities	14,968	14,185	14,646	14,289	15,432	15,188	14,423	15,770	15,279	15,120	15,694	14,420	15,352	14,677	15,160	14,981	15,144	9,848
CHG Compliance %	72%	75%	77%	80%	83%	83%	84%	83%	84%	84%	85%	84%	84%	84%	84%	86%	86%	84%

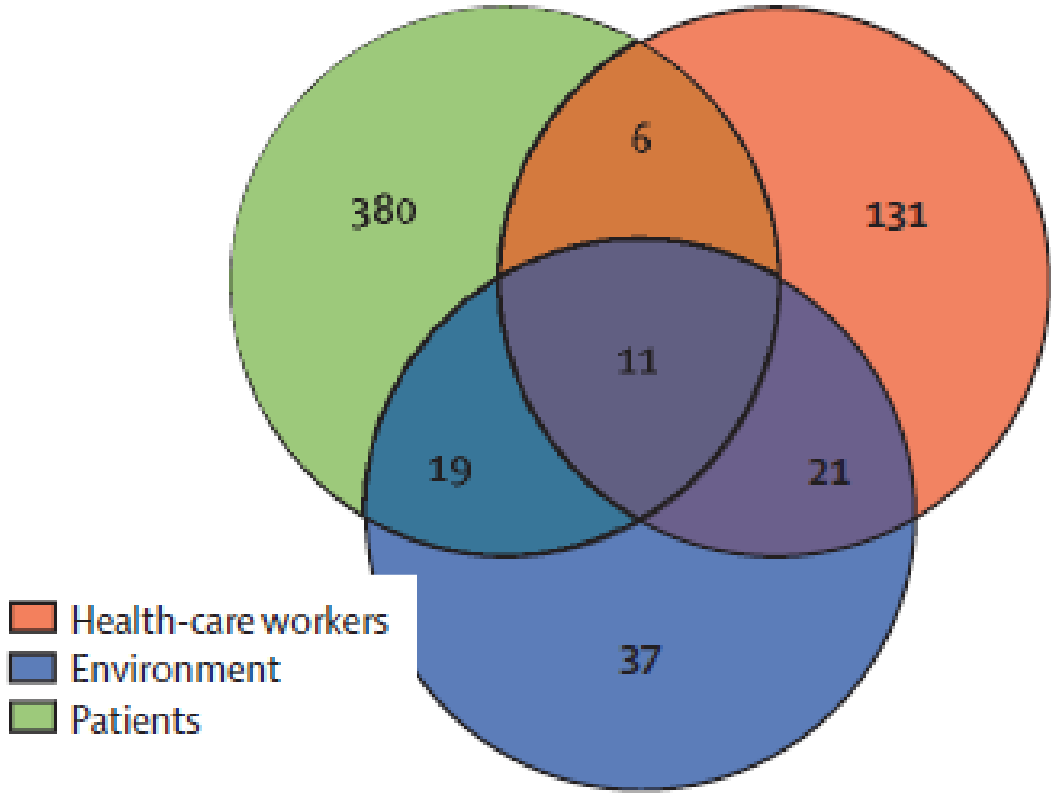
The MRSA-Impact Pyramid:





Cross-Transmission Occurs from Multiple Sources:

- Longitudinal cohort over 14 months:
  - ICU in the UK
  - Sampled198 HCPs, 40 environmental locations, 1854 patients
  - WGS on 1819 isolates:
  - 25 instances of transmission:
    - 16 patient to patient
    - 2 environ to patient
    - 7 HCP to patient

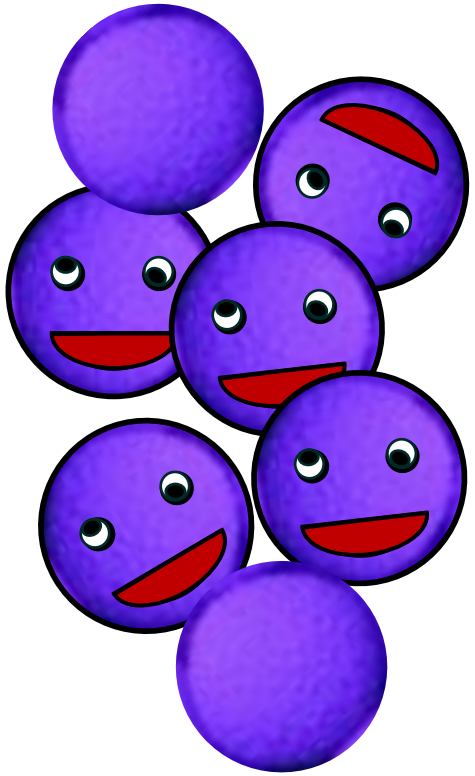


Price JR, et al. Lancet Infect Dis. 2017;17(2):207-214. doi: 10.1016/S1473-3099(16)30413-3.

Strong IP Program Throughout:

- Followed 5 moments of HH with audits
- BBE
- Nurse-patient ratio 1:1 vented, 1:2 other ICU
- MRSA active screening at admit and weekly, MRSA isolation/CPs
- 4% daily CHG treatments (all patients) with 2% mupirocin for MRSA positive
- Daily cleaning with chlorine-releasing solution
- Daily mattress/bed cleaning
- Terminal cleaning and changing of disposable curtains between patients

Price JR, et al. Lancet Infect Dis. 2017;17(2):207-214. doi: 10.1016/S1473-3099(16)30413-3.



Continuous MRSA Introduction INTO the Unit:

Decrease MRSA (and other microbial) Bioburden *to the extent possible*

How Much Benefit?

1% increase in HH rate = 0.035/10,000 patient days decrease in HCA MRSA

Table E. The final multivariate model for risk factors associated with HCA MRSA rate.

	HCA MRSA Rate			
Variable	**Effect Estimate**	**LCL**	**UCL**	**p-value**
Hand Hygiene Rate	-0.035	-0.063	-0.008	0.011
Nursing Overtime Rate	5.018	1.210	8.826	0.010
MRSA Bioburden	9.008	5.586	12.429	<.0001
Hallway Bed Utilization	0.680	0.094	1.267	0.023
Supply Room Door Closed (Reference = N)	-0.283	-0.536	-0.030	0.028
Service Type (Reference = Medicine)	-	-	-	-
Cardiac	-0.179	-0.637	0.279	0.443
Critical Care	-0.191	-0.513	0.131	0.245
Maternal, Infant, Child and Youth	-1.212	-2.027	-0.397	0.004
Older Adult	0.395	-0.078	0.868	0.101
Patient Assessment and Transition to Home	-0.359	-0.740	0.022	0.065
Rehabilitation	0.643	0.162	1.124	0.009
Surgery	0.066	-0.248	0.380	0.680

Wang X, et al. Organizational and Infrastructural Risk Factors for Healthcare-associated Clostridioides difficile Infections or Methicillin-resistant Staphylococcus aureus in Hospitals. Am J Infect Control. 2024 Aug 15:S0196-6553(24)00659-X. doi: 10.1016/j.ajic.2024.08.013.

Healthcare Providers *Dramatically* Overestimate HH Performance:

Table 2 (a) Self-reported and (b) observed hand hygiene compliance among physicians and nurses by WHO-5 indications

		(a) Self-reported compliance			(b) Directly observed compliance[#]		
		Physicians (N = 93)	Nurses (N = 225)	p^{μ}	Physicians (N = 2421)	Nurses (N = 971)	p^{μ}
"before patient contact"							
(0–100)	N[§,$]	92	218		902	294	
	(a) Mean Rate (b) Rate	81.0%	82.4%	0.522	56.9%	65.0%	0.014
	95%-CI	77.0%|85.0%	80.2%|84.6%		53.6%|60.1%	59.5%|70.5%	
"before an aseptic task"							
(0–100)	N[§,$]	90	206		246	155	
	(a) Mean Rate (b) Rate	93.4%	92.7%	0.634	31.7%	55.5%	< 0.001
	95%-CI	90.7%|96.1%	91.3%|94.2%		25.9%|37.6%	47.6%|63.4%	
"after body fluid exposure"							
(0–100)	N[§,$]	93	215		229	135	
	(a) Mean Rate (b) Rate	98.0%	96.4%	0.028	52.0%	63.0%	0.041
	95%-CI	97.1%|98.9%	95.3%|97.5%		45.4%|58.5%	54.7%|71.2%	
"after patient contact"							
(0–100)	N[§,$]	93	218		722	256	
	(a) Mean Rate (b) Rate	87.5%	87.8%	0.875	75.2%	74.2%	0.754
	95%-CI	84.2%|90.7%	85.8%|89.7%		72.1%|78.4%	68.8%|79.6%	
"after contact with patient surroundings"							
(0–100)	N[§,$]	93	214		322	131	
	(a) Mean Rate (b) Rate	71.1%	76.8%	0.051	55.6%	67.2%	0.023
	95%-CI	66.1%|76.2%	74.1%|79.5%		50.1%|61.0%	59.0%|75.3%	

Lamping J, et al Antimicrob Resist Infect Control. 2022 Dec 2;11(1):147. doi: 10.1186/s13756-022-01188-7.

So, What Works to Improve HH?

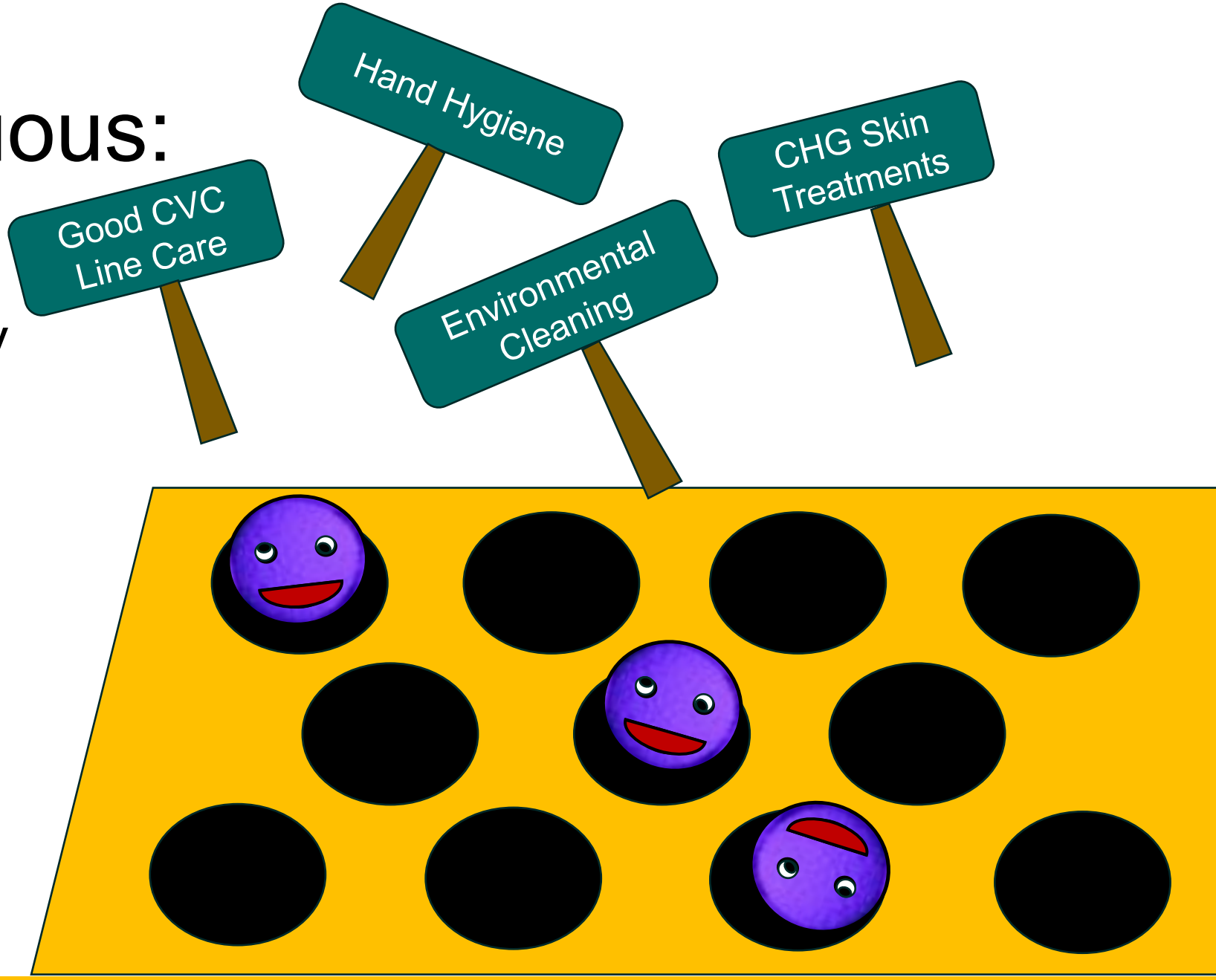
Cochrane Systemic Review: What Works to Increase HH?

- We included 26 studies in the review. Fourteen studies assessed the success of different combinations of strategies recommended by WHO to improve hand hygiene compliance. Strategies consisted of the following: increasing the availability of AHBR, education, reminders, performance feedback, administrative support and staff involvement. Six studies assessed different types of performance feedback, two studies evaluated education, three studies evaluated cues such as signs or scent, and one study assessed placement of ABHR.
- Multimodal (combinations of) strategies that include some but not all strategies recommended by WHO may slightly improve hand hygiene compliance and slightly reduce infection rates (low certainty of evidence). Multimodal interventions that include all strategies recommended by WHO may lead to little or no difference in methicillin-resistant *Staphylococcus aureus* (MRSA) infection rates (low certainty of evidence), but it is uncertain whether such WHO-based approaches improve hand hygiene compliance or reduce colonisation rates because the certainty of this evidence is very low.
- Multimodal interventions that contain all recommended strategies plus additional strategies may slightly improve hand hygiene compliance (low certainty of evidence). It is unclear whether such WHO-enhanced interventions reduce infection rates because the certainty of this evidence is very low.

Gould DJ, Moralejo D, Drey N, Chudleigh JH, Taljaard M. Interventions to improve hand hygiene compliance in patient care. Cochrane Database Syst Rev. 2017 Sep 1;9(9):CD005186. doi: 10.1002/14651858.CD005186.pub4.

It's Not Futile, It's Just Continuous:

- Anything you do to improve HH is probably helpful, at least for awhile
- Work directly with stakeholder groups to validate/improve reliability of foundational IP
- Focus on the Positive*



Feedback Performance on Process Measures to Stakeholders:

- MRSA reportable HAI rates:
- HH compliance
- PPE adherence
- CHG treatment compliance
- Cleaning audits

	Jun 23	Jul 23	Aug 23	Sept 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24
Chair	85	80	80	90%	85%	92%		90%	90%	84%	86%	91%	89%
Room In Doorknob	82	84	85%	79%	85%	83%		86%	88%	92%	92%	85%	91%
Call Box / Button	87	90	80%	90%	91%	83%		90%	88%	91%	92%	88%	89%
Tray Table	87	85	90%	88%	85%	88%		90%	90%	92%	95%	94%	93%
Bed Rails / Controls	88	96	94%	95%	90%	83%		86%	90%	89%	89%	88%	90%
RR Handrails	91	93	90%	98%	89%	95%		93%	91%	91%	92%	91%	95%
RR Light Switch	95	90	94%	88%	90%	88%		90%	88%	86%	84%	91%	89%
telephone	88	87	94%	93%	99%	88%		88%	90%	92%	97%	91%	91%
Toilet Flush Handle	86	89	94%	91%	96%	90%		95%	93%	91%	89%	94%	91%

Bathing	3,925	92%	93%	N/A	89%	100%	99%	94%	90%	95%	94%	%	93%	89%	90%
Hand Hygiene (Direct Obs)	1,672	57%	57%	87%	73%	70%	68%	74%	60%	78%	70%	%	89%	88%	91%
Central Line Checklist	157	100%	100%	86%	100%	91%	100%	90%	90%	100%	95%				
Contact Precautions	154	68%	55%	75%	73%	82%	100%	82%	22%	93%	73%				
Head of Bed	82	100%	100%	N/A	100%	100%	100%	100%	100%	91%	99%				
Urinary Catheter Review	77	100%	100%		100%	92%	100%	100%	100%	100%	99%				
Grand Total	6,067	85%	86%	87%	84%	93%	89%	87%	83%	90%	87%				

MRSA Troubles? Review Resources:

- CDC:

https://www.cdc.gov/mrsa/prevention/index.html

- Virginia VDH HAIAR Program:

https://www.vdh.virginia.gov/haiar/diseases-organisms/staphylococcus-aureus/

- APIC:

https://apic.org/resources/topic-specific-infection-prevention/methicillin-resistant-staphylococcus-aureus/

- SHEA:

https://shea-online.org/compendium-of-strategies-to-prevent-healthcare-associated-infections-in-acute-care-hospitals/

VIPTC Related Content:

- HH, Foundational:

https://vcu.mediaspace.kaltura.com/media/Hand%20Hygiene/1_xlxqop3h

- Cleaning/Disinfection, Foundational:

https://vcu.mediaspace.kaltura.com/media/Cleaning%20%26%20Disinfection/1_ye63h4p5

- HH and Cleaning/Disinfection Modules, Intermediate Course Modules (Implementation):

https://viptc.catalog.vcu.edu/browse/intermediate/courses/intermediate-course-infection-prevention

- Training Video for Staff: HH:

https://www.youtube.com/watch?v=awtSohETrQU

Summary:

- MRSA (and MSSA) are BAD BUGs, associated with invasive, disseminated, recurrent infections that are highly morbid.
- Despite being “endemic” or prominent in the community as well as the healthcare system, MRSA acquisition events remain highly connected to healthcare settings or exposure to healthcare
  - Ie even family members of hospitalized patients have increased risk..
- MRSA Prevention Efforts are Multifaceted, and include foundational IP practices of HH, cleaning, and appropriate PPE use, as well as manipulation of the patient microbiome with CHG skin treatments and/or decolonization.