Tackling Emerging and Re-emerging Infections

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Disclosures

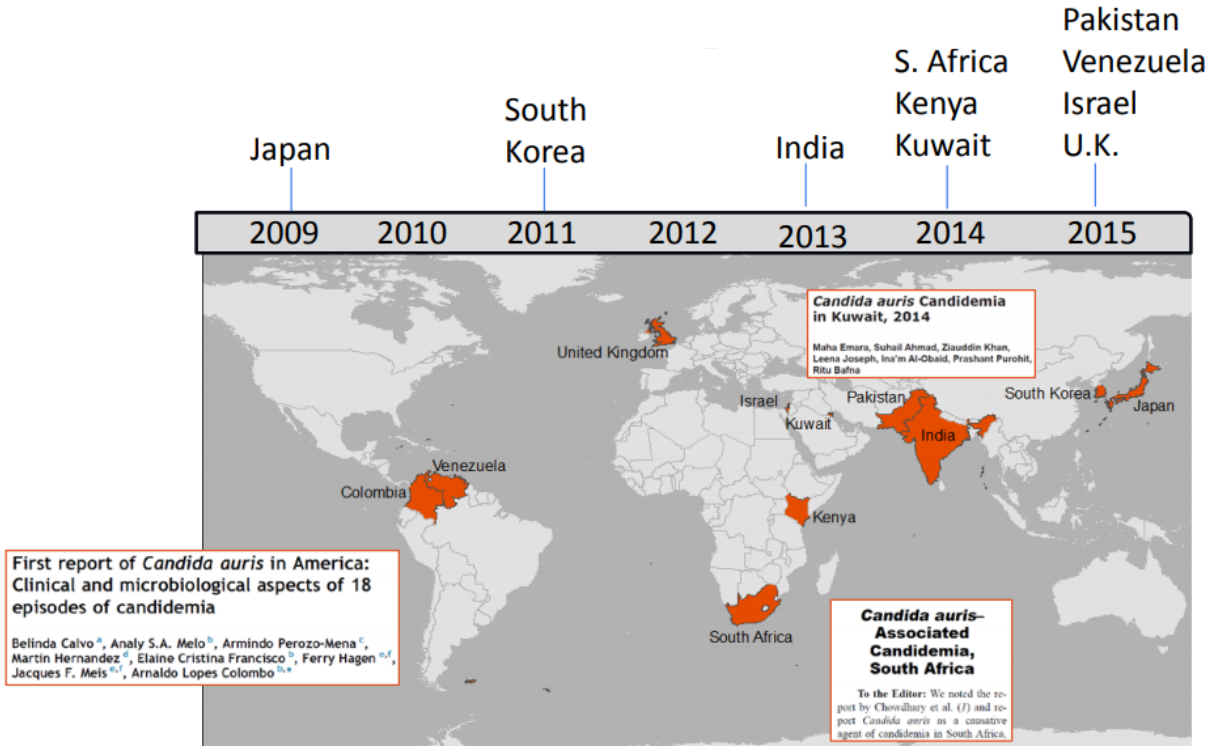
- Conducting clinical studies in which participating hospitals and nursing homes receive contributed products from Stryker (Sage Products), Molnlycke, 3M, Xttrium, Clorox, and Medline
- Companies contributing product have no role in design, conduct, analysis, or publication

Emerging & Re-Emerging Diseases

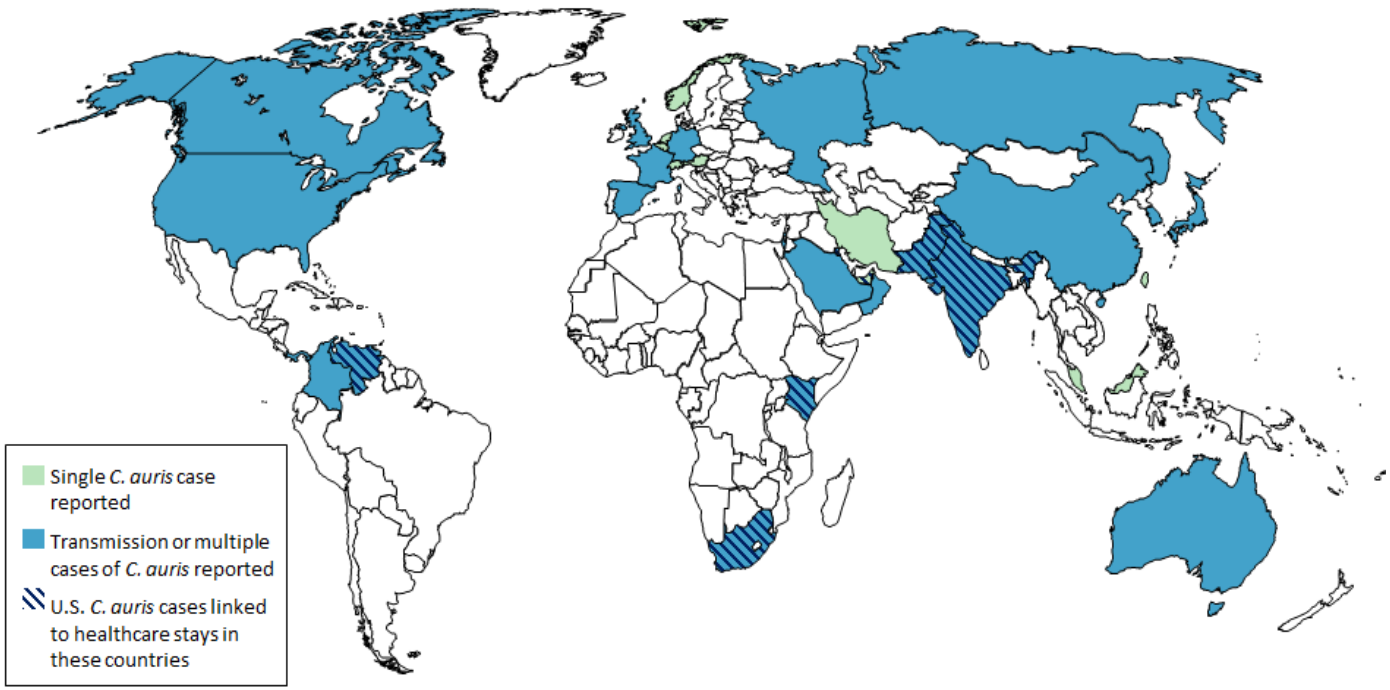
- Practical infection control considerations
  - *Candida auris*
  - Carbapenem Resistant Enterobacteriaceae (CRE)
  - Measles

Candida auris

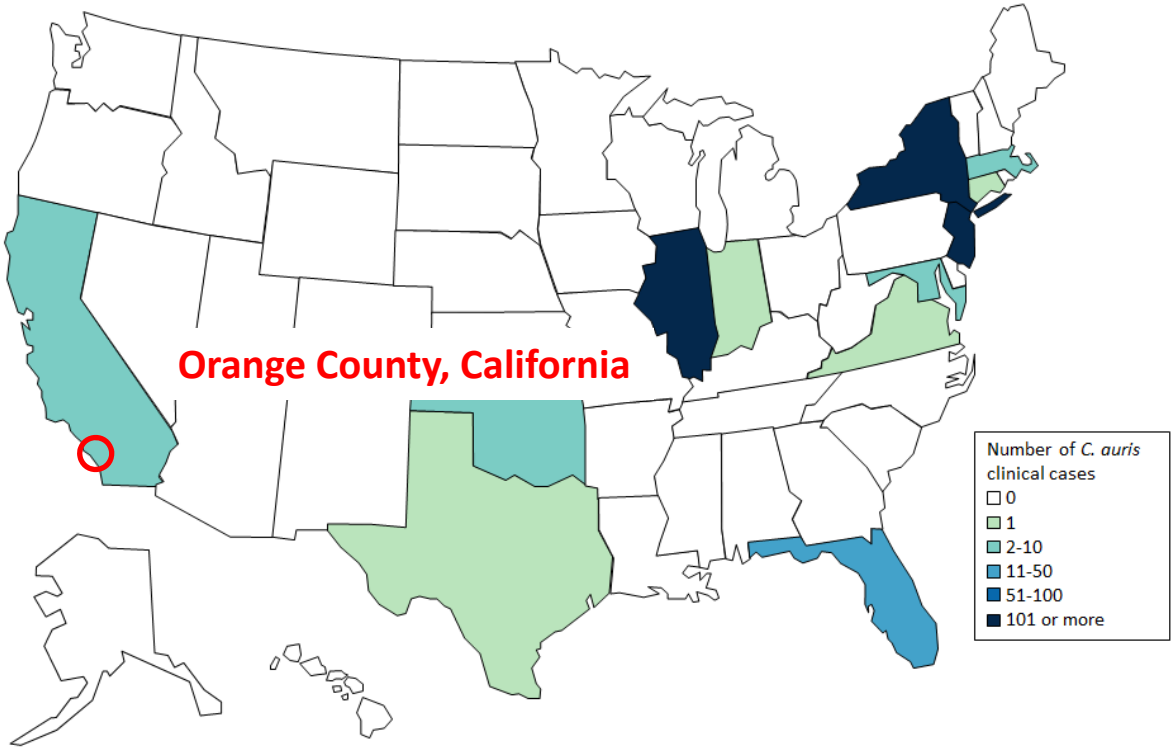
C. auris Rapid Worldwide Spread



Countries from which *Candida auris* cases have been reported, as of February 28, 2019



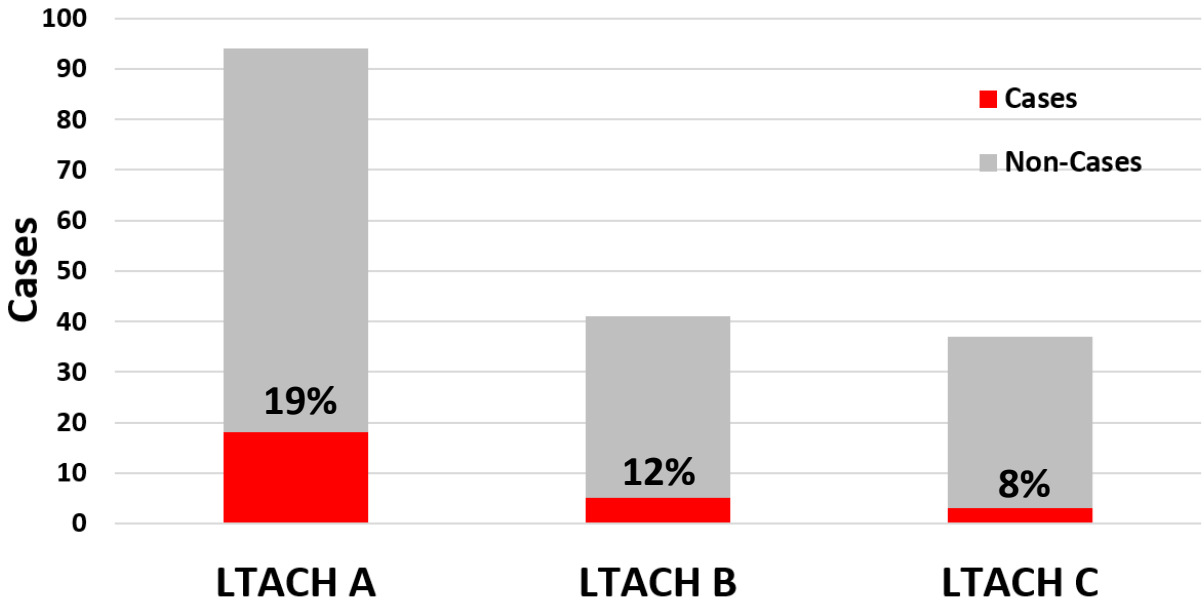
U.S. Map: Clinical cases of *Candida auris* reported by U.S. states, as of February 28, 2019



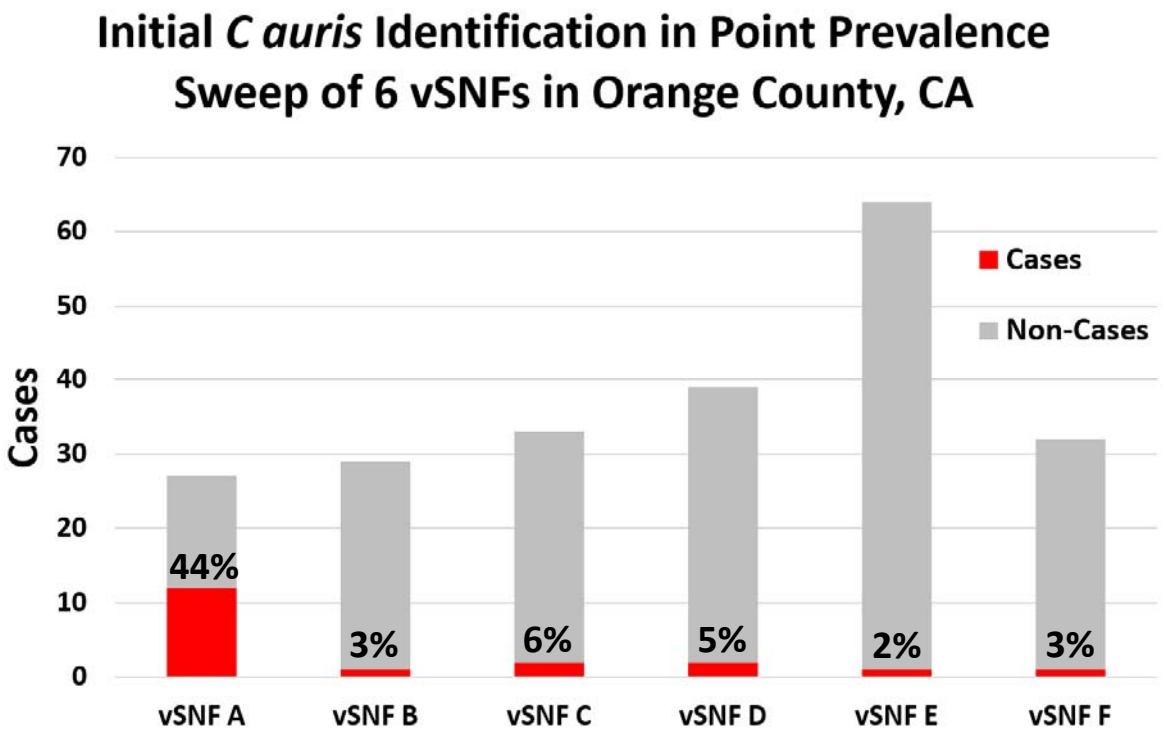
Orange County (OC), California

- A Los Angeles County laboratory serving regional nursing homes started to screen all yeast in urine for *C auris*
  - Identified *C auris* in an OC long term acute care hospital
  - Activated CDC response
- Active screening finds **45 initial cases**
  - All 3 LTACHs serving adults had *C auris*
    - 26 initial cases
  - 6 of 14 ventilator skilled nursing facilities (vSNFs) had cases
    - 19 initial cases

Initial *C auris* Identification in Point Prevalence Sweep of 3 LTACHs in Orange County, CA



E Karmarkar, CDC, IDWeek 2019



E Karmarkar, CDC, IDWeek 2019

C auris Spread & Containment

- Screening repeated until 4 weeks without new cases
- From February – October 2019
  - 165 *C auris* cases found in OC long term care facilities
  - 5 Candidemia events
- **Containment**
  - **2 of 3 LTACHs rapidly contained**
  - **5 of 6 vSNFs rapidly contained**

E Karmarkar, CDC, IDWeek 2019

C auris Spread & Containment

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  - 165 *C auris* cases found in OC long term care facilities
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- Containment
  - 2 of 3 LTACHs rapidly contained
  - 5 of 6 vSNFs rapidly contained
- **Several transfers to hospitals without spread**

E Karmarkar, CDC, IDWeek 2019

OC health CARE AGENCY

CD HEALTH ALERT

Critical Communicable Disease Information for Orange County Medical Providers

Candida auris Cases in Kindred Hospital, Santa Ana

March 22, 2019

Multiple patients colonized with *Candida auris* (*C. auris*) have been identified recently at Kindred Hospital, Santa Ana. These patients are the first identified in Southern California. The Orange County Health Care Agency and the California Department of Public Health are working with Kindred to identify additional colonized patients and institute infection control precautions to prevent further *C. auris* spread.

While this investigation is occurring, OCHCA recommends that all hospitals perform admission screening and institute empiric Contact precautions for patients who have been admitted to Kindred Hospital, Santa Ana, since February 1, 2019.

UC Irvine *Candida auris* Strategy

- Entry point query if patient from affected facility
  - Infection prevention alerted
  - Environmental services supervisors alerted
- Expanded contact precautions, minimize room exit
- Obtain screening swabs
- Initiate admission decolonization protocol
  - CHG and nasal iodophor (all contact precaution rooms)
- Bleach at bedside

Hospital ED and Procedural Area Prompts

- Screen for patients coming from affected sites

Public Health Screening

Has this patient been admitted to any of the following facilities since February 1, 2019?

☐ Kindred, Westminster ☐ French Park Care Center

☐ None

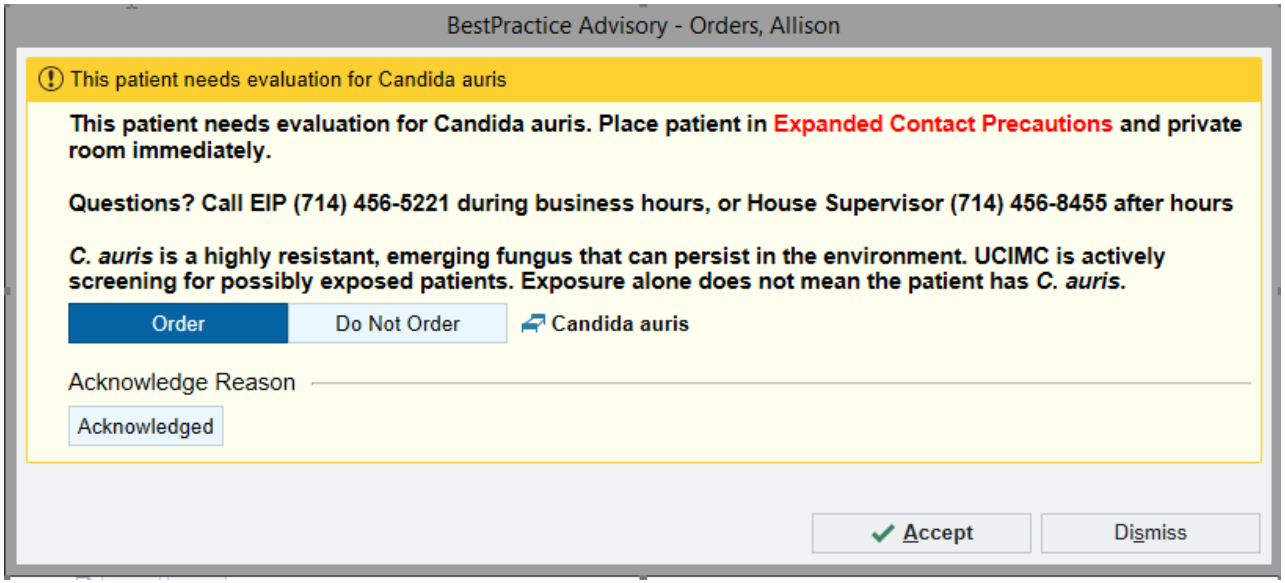
C. auris is a highly resistant, emerging fungus that can persist in the environment. UCIMC is actively screening for possibly exposed patients. Exposure alone does not mean the patient has *C. Auris*.

If the patient has been admitted to any of the listed facilities since Feb 1, 2019

1. Place patient in Expanded Contact Precautions and private room immediately.
2. Call EIP (714) 456-5221 during business hours, call House Supervisor (714) 456-8455 after hours

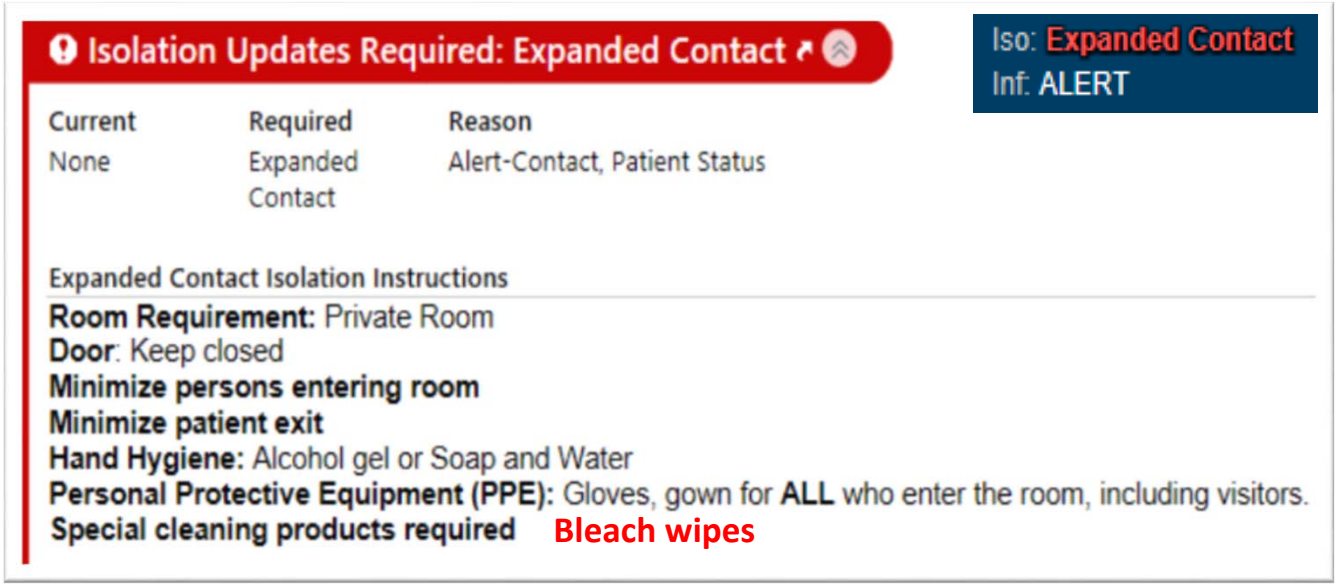
Prompt Special Precautions

- Screen for patients coming from affected sites
- If affected site → prompt Expanded Contact Precautions



Expanded Contact Precautions

- Screen for patients coming from affected sites
- If affected site → prompt Expanded Contact Precautions



ALL VISITORS MUST:

1. **PERFORM HAND HYGIENE**
2. **WEAR GOWN (CLOSED AT NECK AND WAIST)**
3. **WEAR GLOVES**

REMOVE PPE, PERFORM HAND HYGIENE ON ROOM EXIT

VISITORS SHOULD MINIMIZE FREQUENCY OF ENTRY AND EXIT

EXPANDED CONTACT

STOP Check with NURSE

Clean HANDS

Wear GOWN & GLOVES

Keep DOOR CLOSED

C. auris Tools/Materials

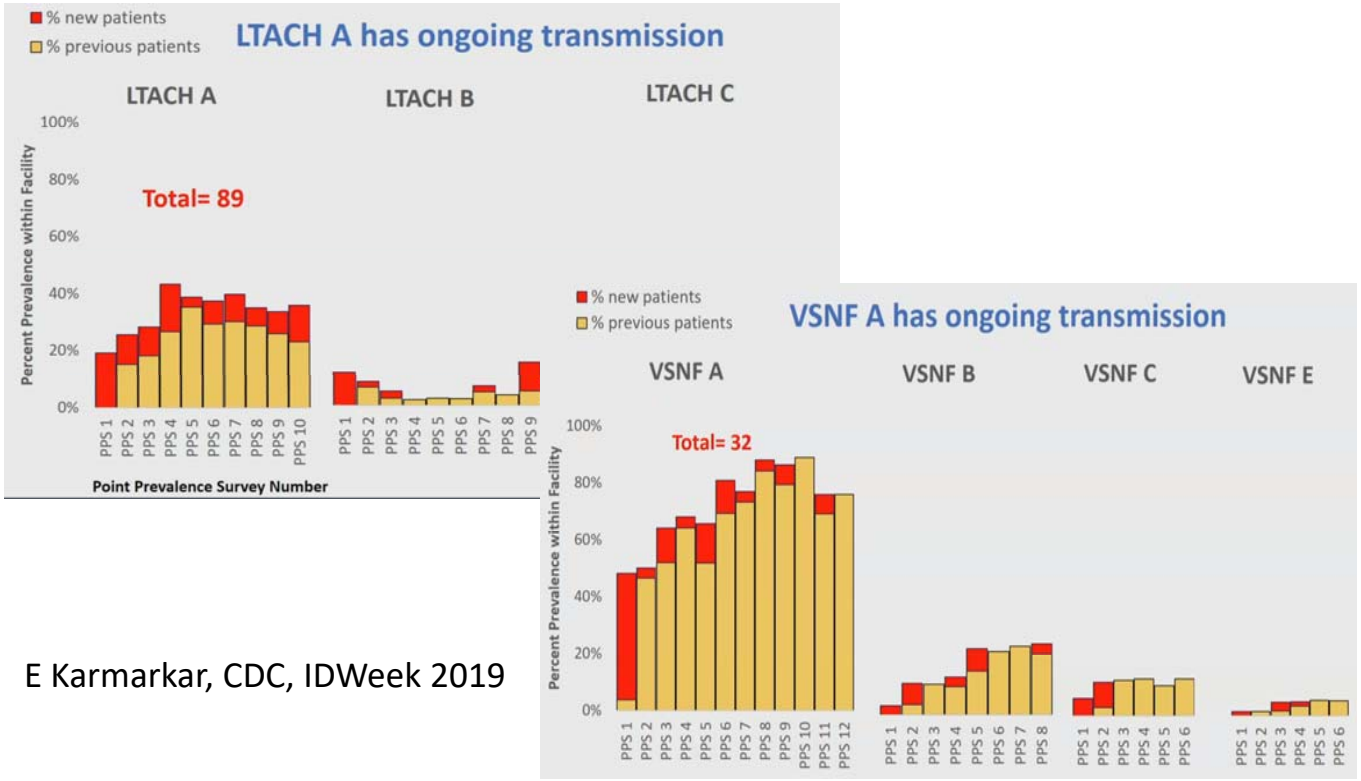
Internal UC Irvine Health Documents for *C auris*

- ✓ Patient Care Protocol
- ✓ *C. auris* Staff Information Sheet
- ✓ Transport Protocol
- ✓ *C. auris* Clinical Update
- ✓ Expanded Contact Precautions Signage
- ✓ Door Stop Sign

- ✓ *C. auris* Colonization Info for Patients
- ✓ *C. auris* FAQs
- ✓ Public Health Swab Collection Instructions
- ✓ CHG Bathing Information
- ✓ Nasal Iodophor Application Information

UCI Health

C auris Persistence Post-Containment



E Karmarkar, CDC, IDWeek 2019

Structure to Containment: *Candida auris*

- **Predicting spread**
  - Characteristics of the OC facilities that lack containment
  - Why do hospitals generally limit spread
- **Common findings in facilities with persistent spread**
  - Hand hygiene <50%
  - Environmental cleaning <60%
  - Insufficient audits

E Karmarkar, CDC, IDWeek 2019

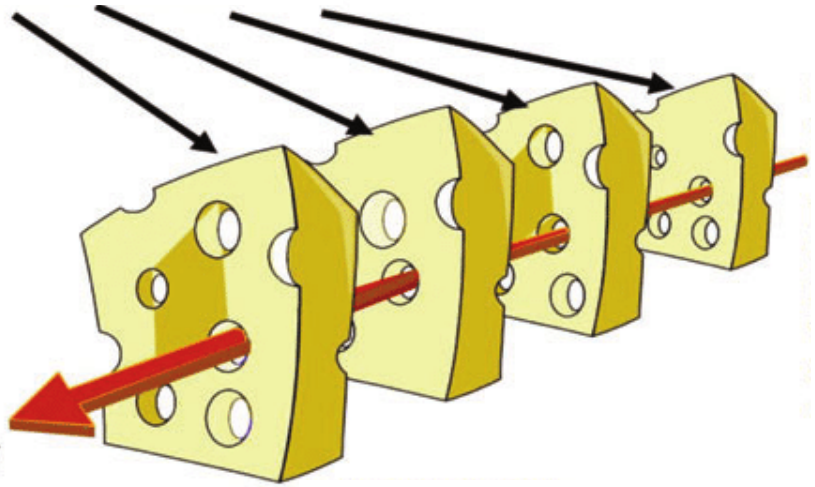
Usual U.S. Hospital ICU Practice

Hand Hygiene
Failure 20%

Contact Precautions
Failure 35%

Cleaning
Failure 35%

Decolonization
Failure 20%



0.5% transmission risk per encounter

ACTIVE ERRORS

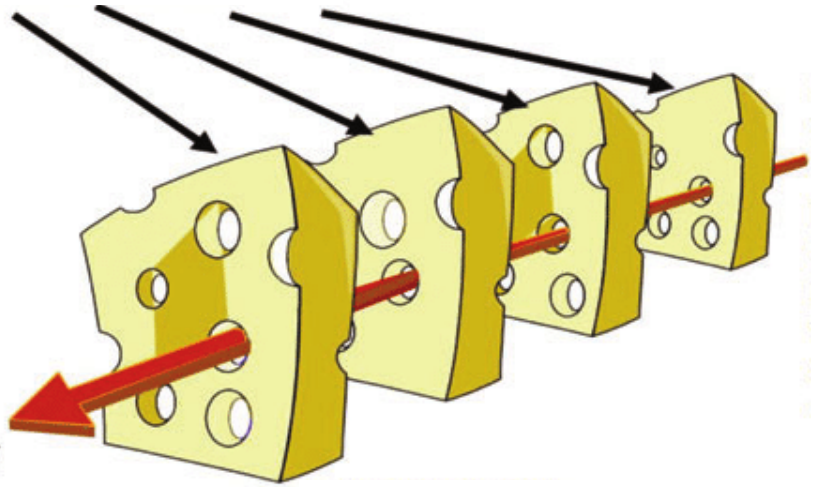
Usual U.S. Nursing Home Practice

Hand Hygiene
Failure 40%

Contact Precautions
Failure 95%

Cleaning
Failure 65%

Decolonization
Failure N/A



25% transmission risk per encounter

ACTIVE ERRORS

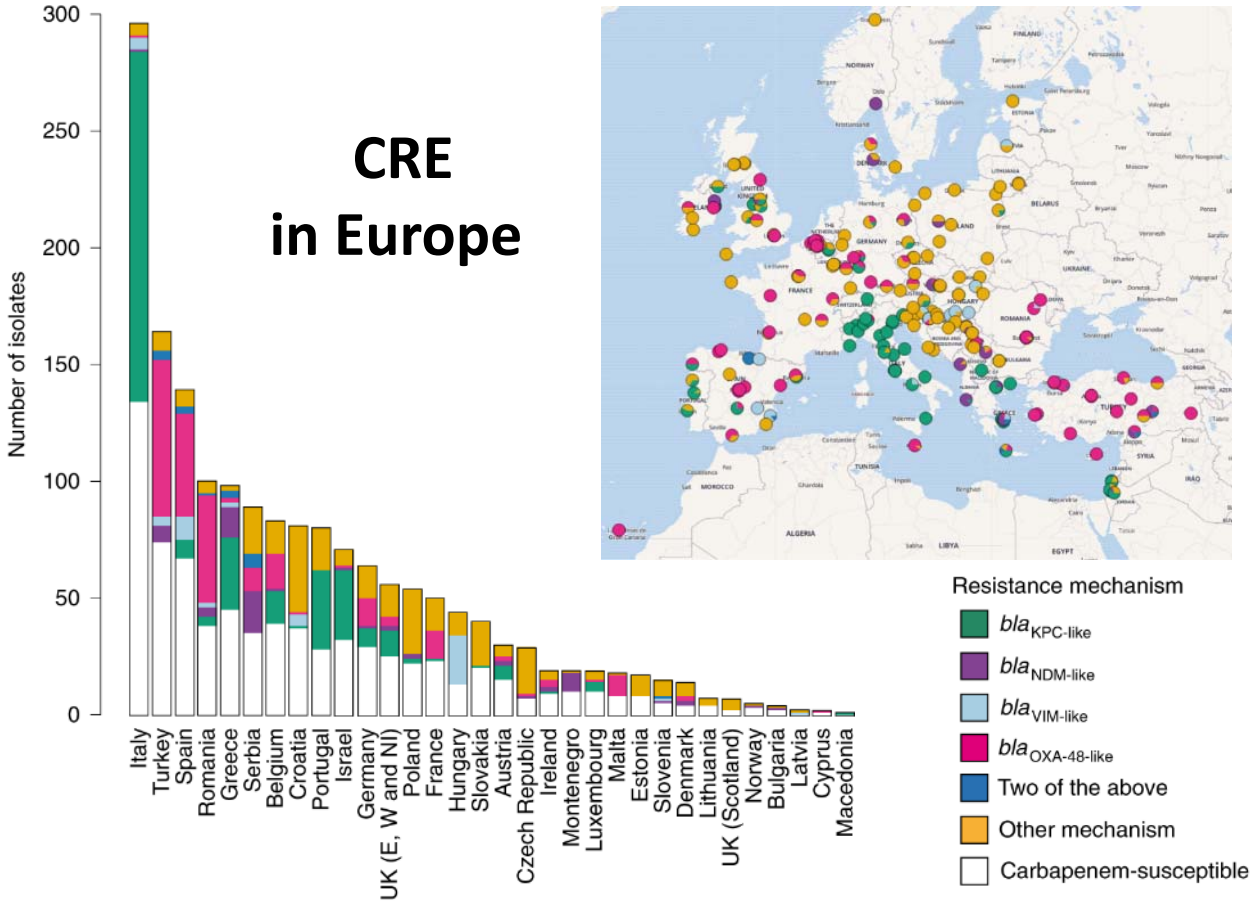
C auris Spread: Prevention Success

Key Elements to Success

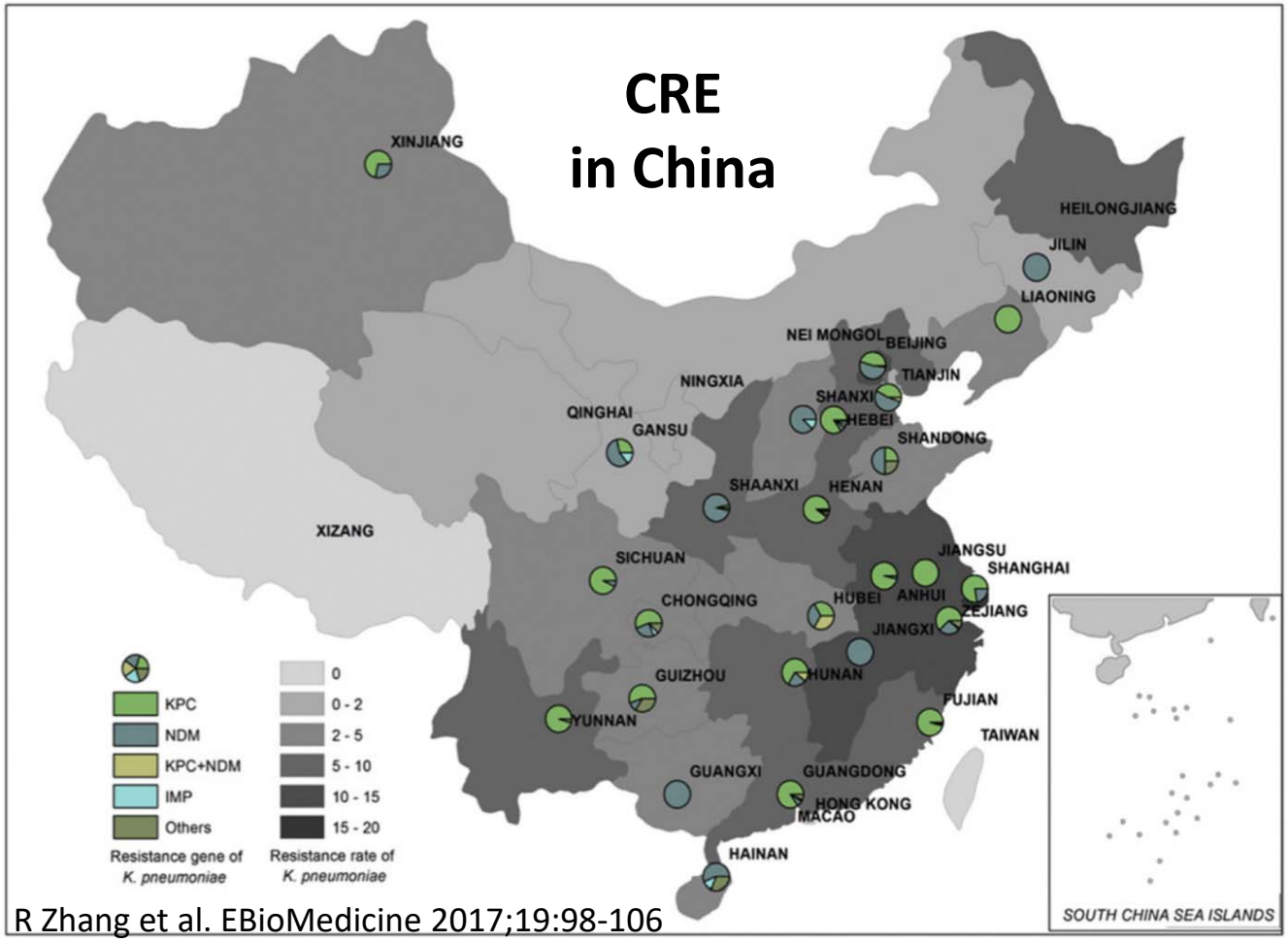
- Communication – prevent interfacility spread
- Automation - prompts to ensure detection
- Adherence – multiple high fidelity transmission barriers
- Clear directions, signage, and protocols
- Audit and feedback

Carbapenem-Resistant Enterobacteriaceae

CRE in Europe



David S et al. Nature Microbiology 2019;4:1919-29



R Zhang et al. EBioMedicine 2017;19:98-106

CRE in Southeast Asia

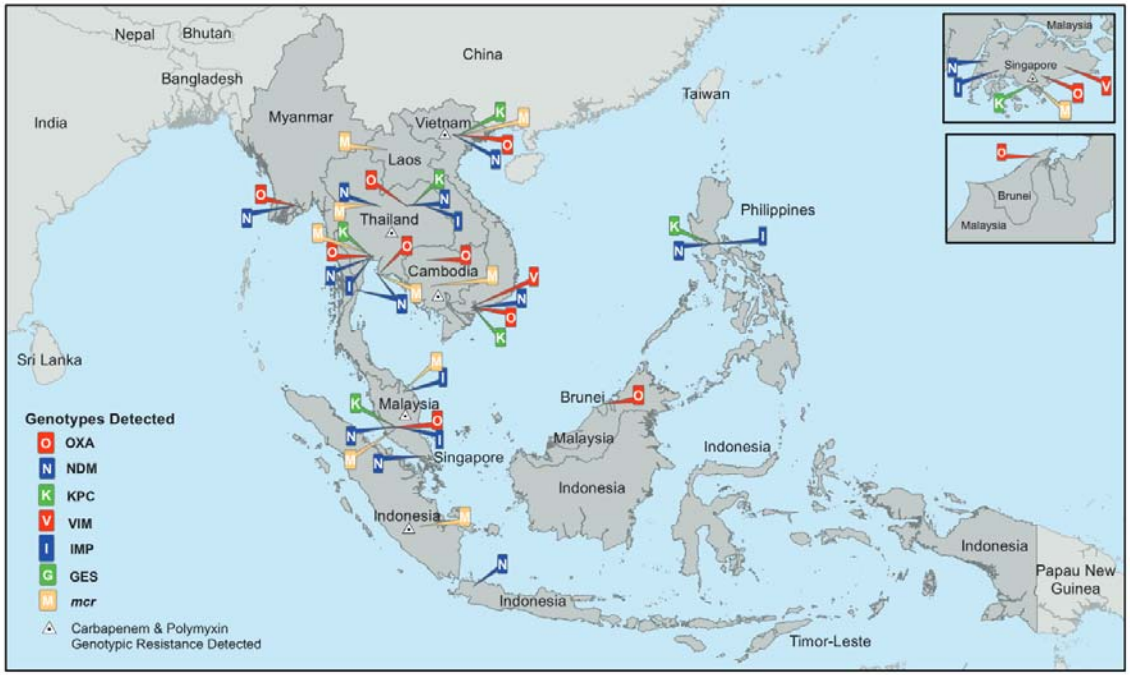
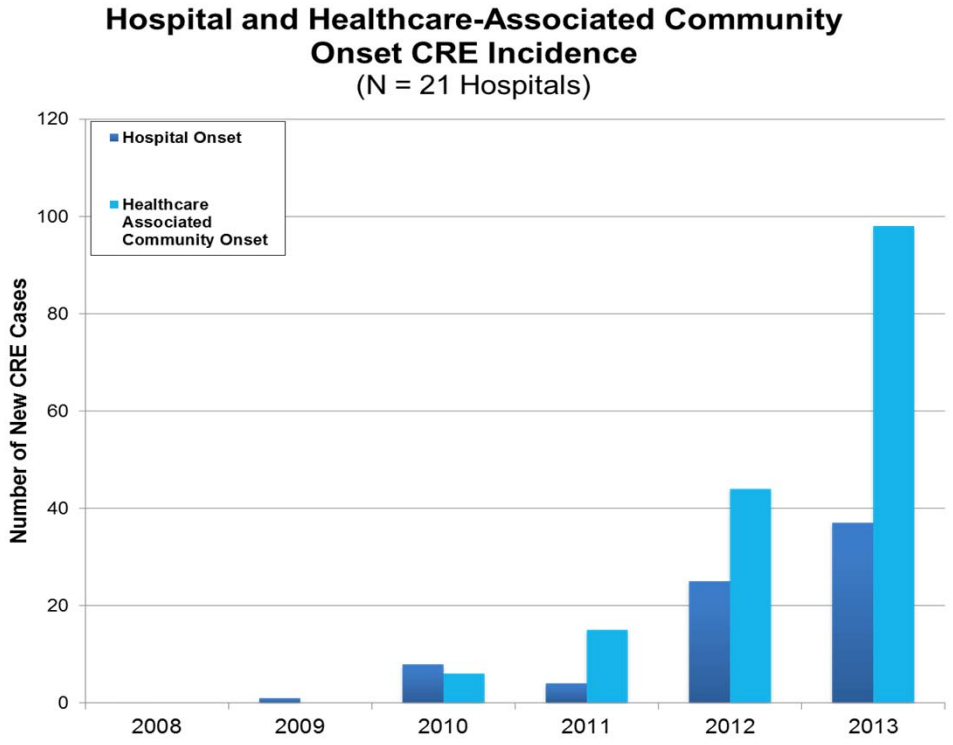


Fig. 3. Carbapenem and polymyxin(s) resistance genotypes.

CRE Trends in Orange County, California

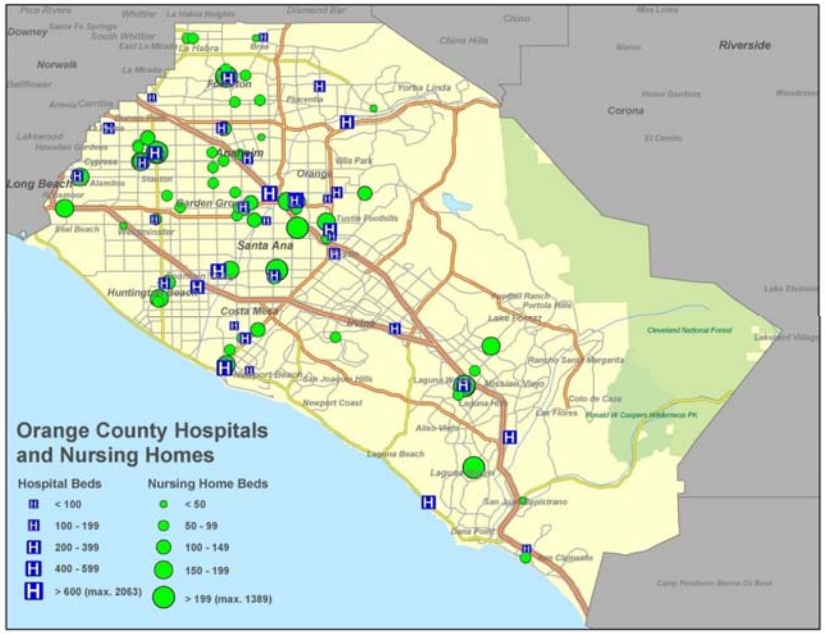


Gohil SK AJIC 2017; 45:1177-82

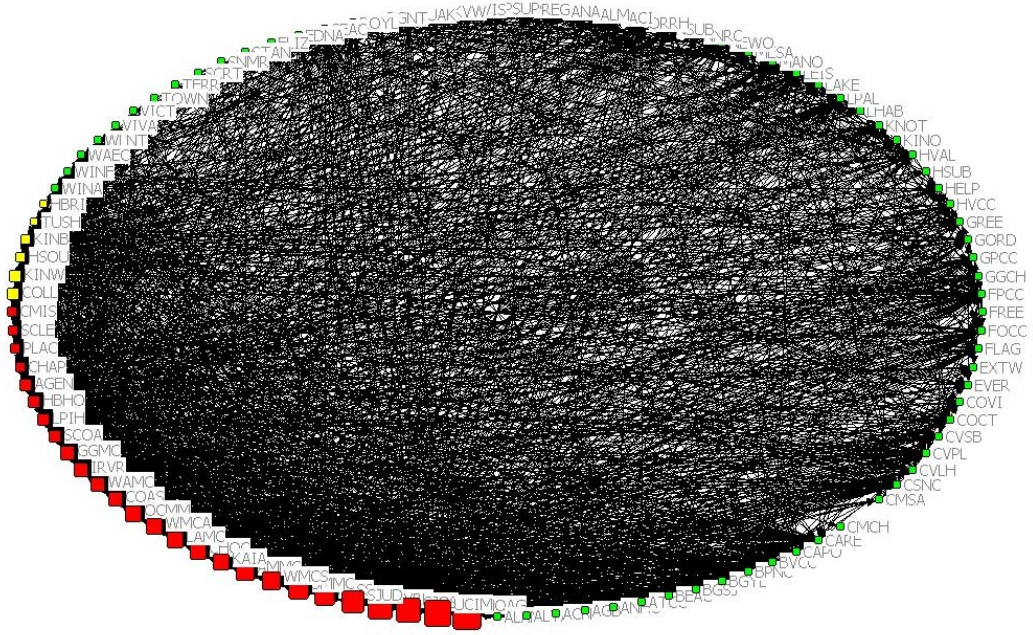
Orange County, California

3.1 million population

- 32 hospitals, 6 LTACHs, and 102 nursing homes

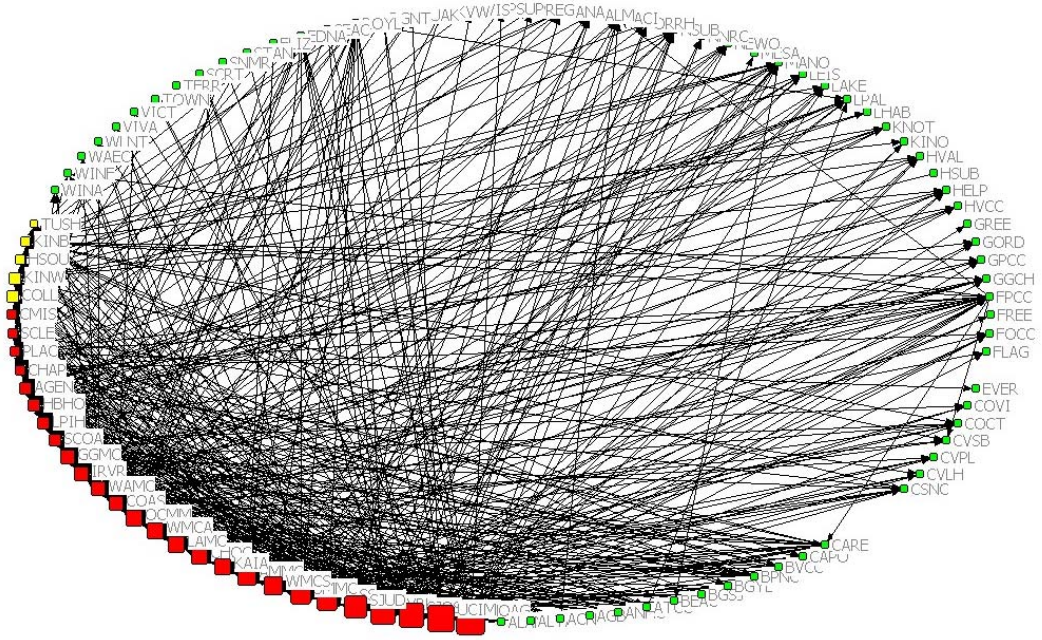


OC Hospitals & Nursing Homes
1 patient shared



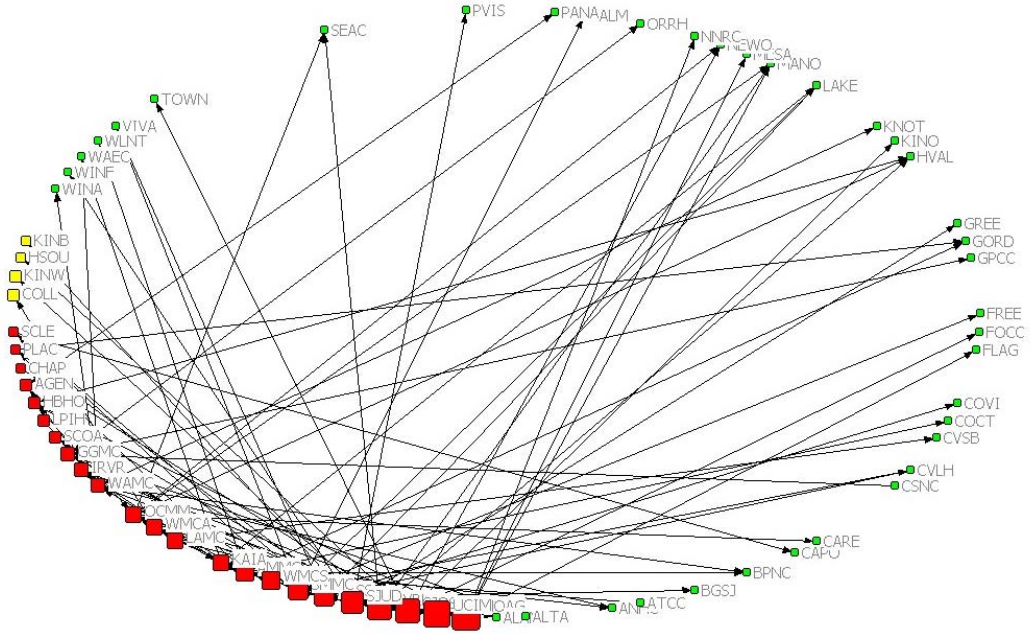
Lee BY et al. Plos ONE. 2011;6(12):e29342

OC Hospitals & Nursing Homes
10 patient shared



Lee BY et al. Plos ONE. 2011;6(12):e29342

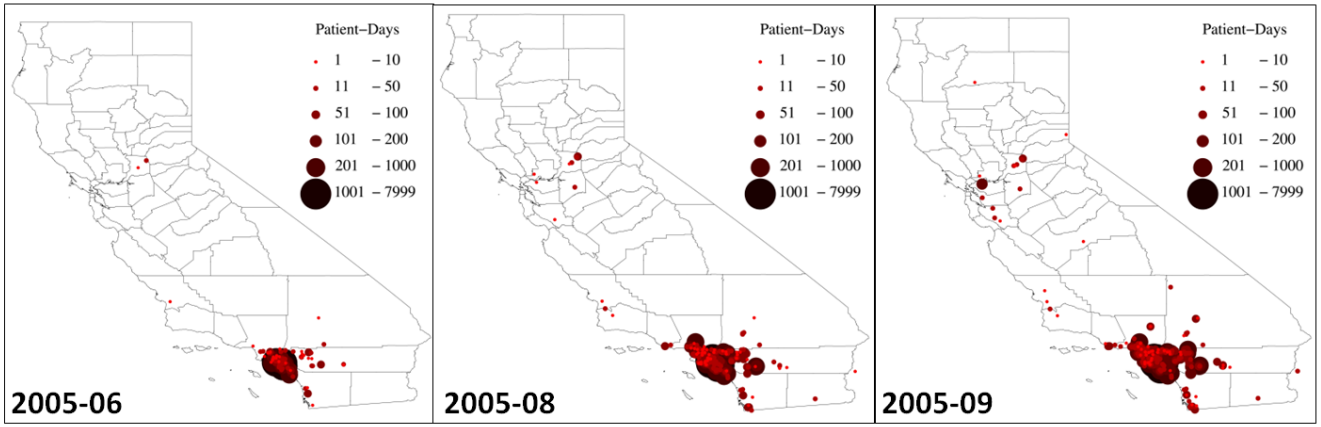
OC Hospitals & Nursing Homes
100 patient shared



Lee BY et al. Plos ONE. 2011;6(12):e29342

Regional Spread of MRSA

- Long carrier state: MRSA
- 5-year accrual of other-hospital exposures from MRSA+ patients within 365 days of discharge from single hospital



Datta R ICHE 2015; 36(11):1275-82

MRSA Carriers From a Single Hospital

1 year post-discharge period, 5 year horizon

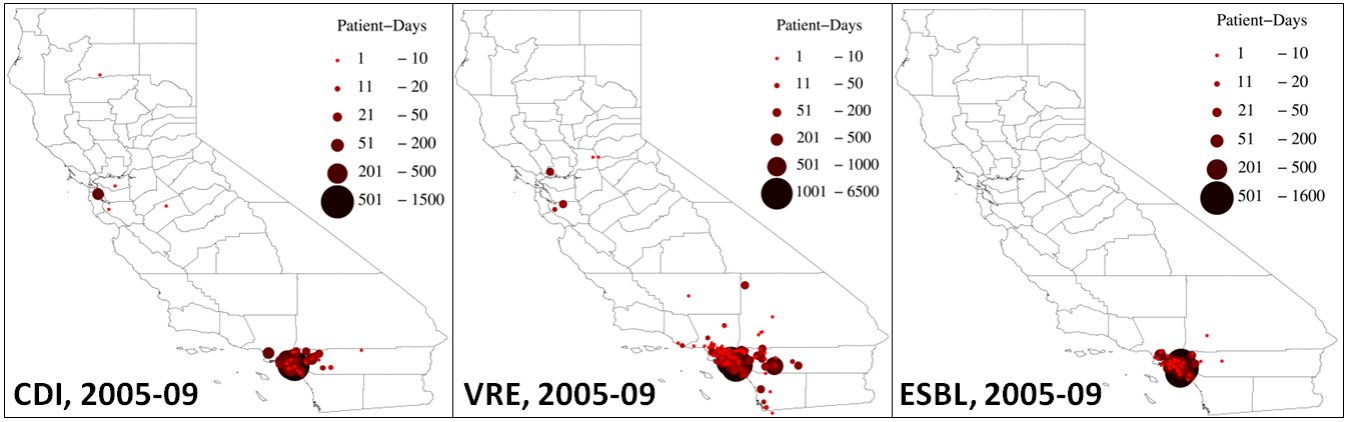
- MRSA Exposures to Unique Facilities
  - 137 Hospitals and 103 nursing homes
- MRSA Exposures to Regions
  - 103 Cities in 14 Counties
- Patient Days of Exposures
  - 19,428 Hospital days and 39,376 nursing home days

Datta R ICHE 2015; 36(11):1275-82

Regional Spread of Other MDROs

	By Facility		By Region		By Patient-Days	
	Hospitals	NH [A]	Cities	Counties	Hospital	NH [A]
CDI	36	35	38	9	3,178	4,410
VRE	117	83	93	11	12,518	20,968
ESBL	45	37	42	4	9,112	6,396

[A] Nursing home



Datta R ICHE 2015; 36(11):1275-82

SHIELD OC Project

- CDC funded regional project to reduce MDROs
- Interest in emerging and endemic pathogens
- Part 1: Simulate impact of various regional interventions
- Part 2: Implement the winning strategy

Regional Modeling and Prevention

- Orange County patient-level data
  - Line item hospitalization data
  - Line item nursing home data
- Actual patient sharing patterns, length of stay
- Included MDRO prevalence, where known
- Modeled transmission, infection, interventions
- Decolonization intervention was the most impactful

Bartsch SM et al. ICHE 2018;39(5):516-24
Bartsch SM et al. Clin Microbiol Infect 2017;23(1):48 e9-48
Lee BY et al Am J Epi 2016; 183(5) 471-9
Lee BY et al Am J Epi 2016; 183(5) 480-9
Slayton RB et al MMWR 2015;64(30):826-32

MAJOR ARTICLE

Prevention of Colonization and Infection by *Klebsiella pneumoniae* Carbapenemase–Producing Enterobacteriaceae in Long-term Acute-Care Hospitals

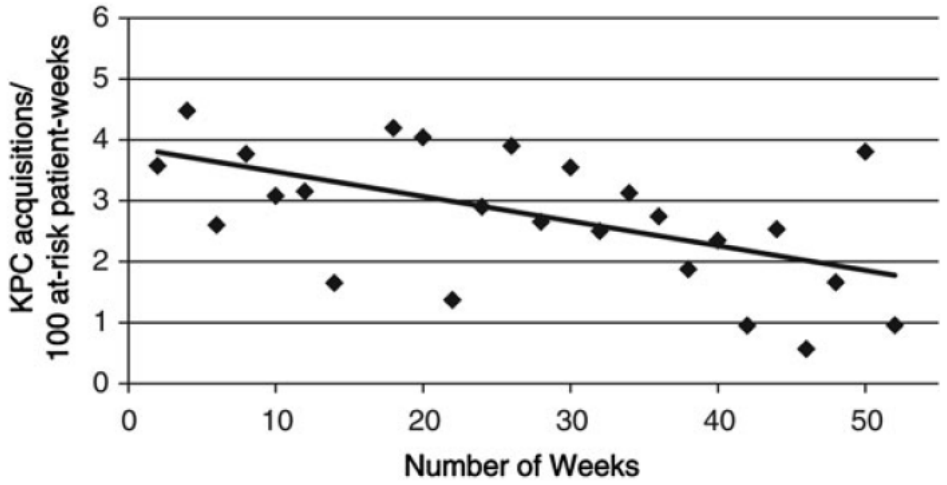
Mary K. Hayden,[1,2] Michael Y. Lin,[1] Karen Lolans,[2] Shayna Weiner,[1] Donald Blom,[1] Nicholas M. Moore,[3] Louis Fogg,[4] David Henry,[5] Rosie Lyles,[6] Caroline Thurlow,[1] Monica Sikka,[1] David Hines,[7] and Robert A. Weinstein[1,6]; for the Centers for Disease Control and Prevention Epicenters Program

Hayden MK. Clin Infect Dis 2015 Apr 15;60(8):1153-61.

CRE in 4 LTACHs, Chicago

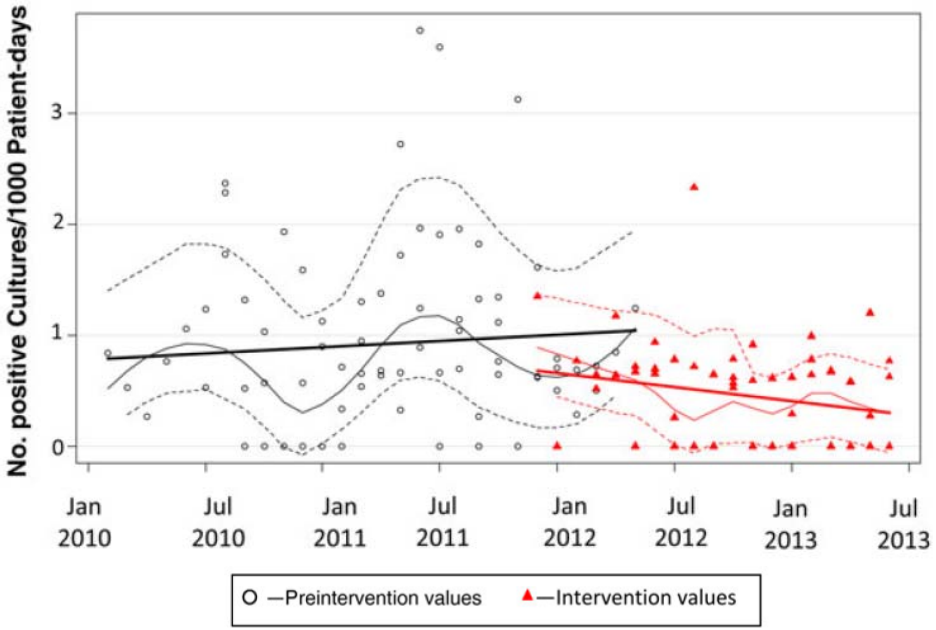
- High endemic prevalence
  - 21% admission prevalence
  - 46% point prevalence
- Intervention – 19 months
  - Rectal screens on admission and every other week
  - Pre-emptive contact precautions pending results
  - Contact precautions if positive
  - Daily chlorhexidine (CHG) bathing
  - Hand hygiene monitoring

Impact on CRE Acquisition



Hayden MK. Clin Infect Dis 2015 Apr 15;60(8):1153-61.

Impact on CRE Bacteremia



Hayden MK. Clin Infect Dis 2015 Apr 15;60(8):1153-61.

Case for Regional Decolonization

Multidrug Resistant Organisms (MDROs) are contagious

Decolonization benefit:

- Individual high-risk patients
- Individual units (ICUs), direct and indirect effects

What about a region?

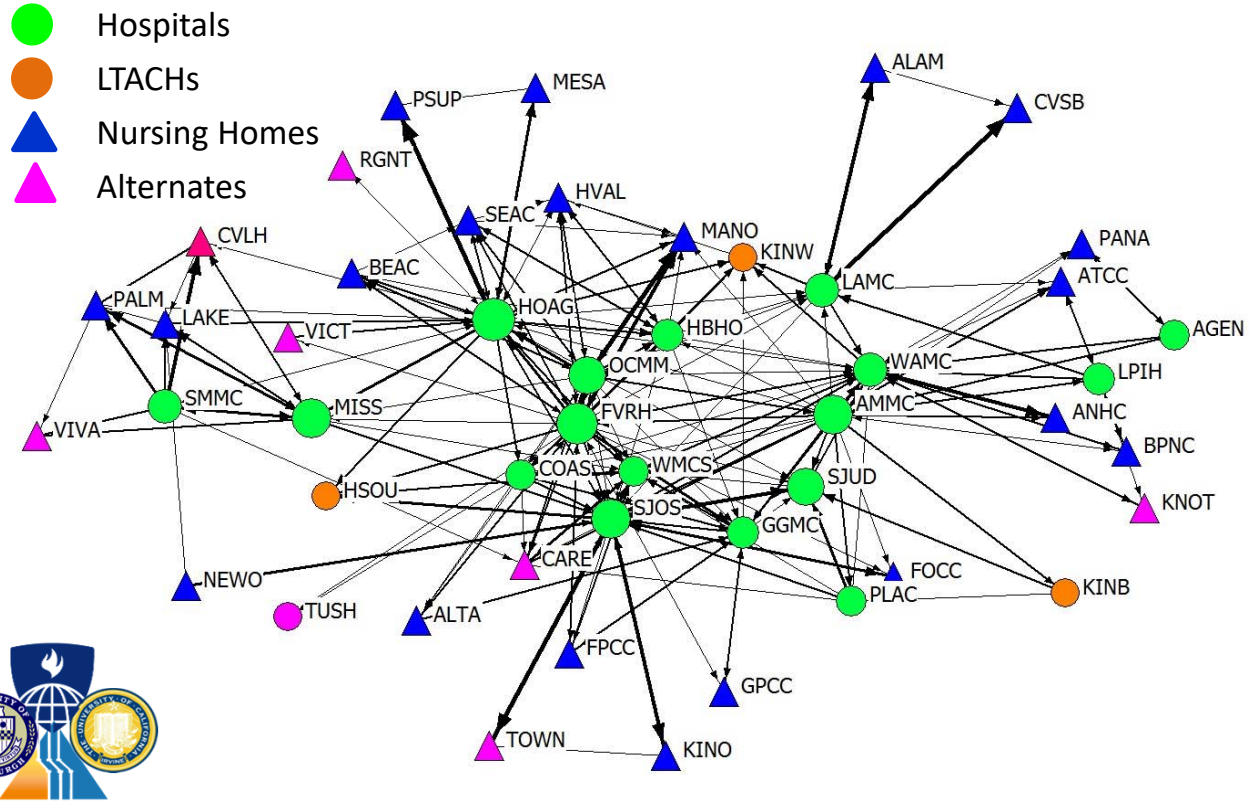
- Healthcare facilities care for high-risk patients
- Healthcare facilities share patients
- Synergy?

SHIELD OC Regional Collaborative

- CDC, California state, and OC county public health collaborative
- Coordinated by UC Irvine, Harbor UCLA
- 38-facility decolonization intervention
- **Invited hospitals and nursing homes with highest shared patients by network analysis**
- Outcomes
  - Point prevalence MDROs (swabs)
  - Countywide MDRO clinical cultures

Shared **H**ealthcare **I**ntervention to **E**liminate **L**ife-threatening **D**issemination of MDROs in Orange County

Target Facilities from Network Analyses



Replacing Soap with CHG

- Nursing homes and LTACHs – universal use
- Hospitals – ICU and contact precaution rooms
- Liquid chlorhexidine (shower)
  - 4% rinse off
- Chlorhexidine cloths (bed baths)
  - 2% leave on

4 oz (hospitals)

Gallon (nursing homes)

Cloths for both

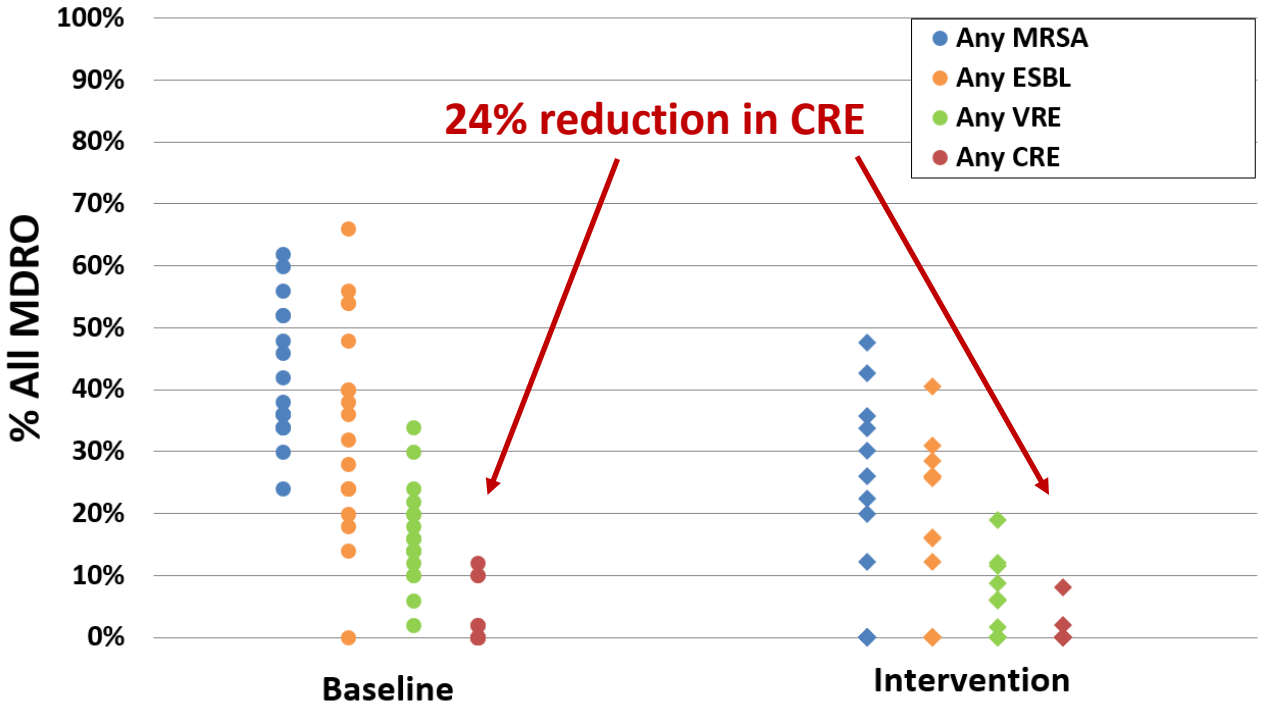
Nasal Decolonization

- 10% Povidone-iodine swabs (iodophor)
- Hospital: for 5 days in contact precaution rooms
- Nursing homes/LTACHs: on admit and M-F every other week

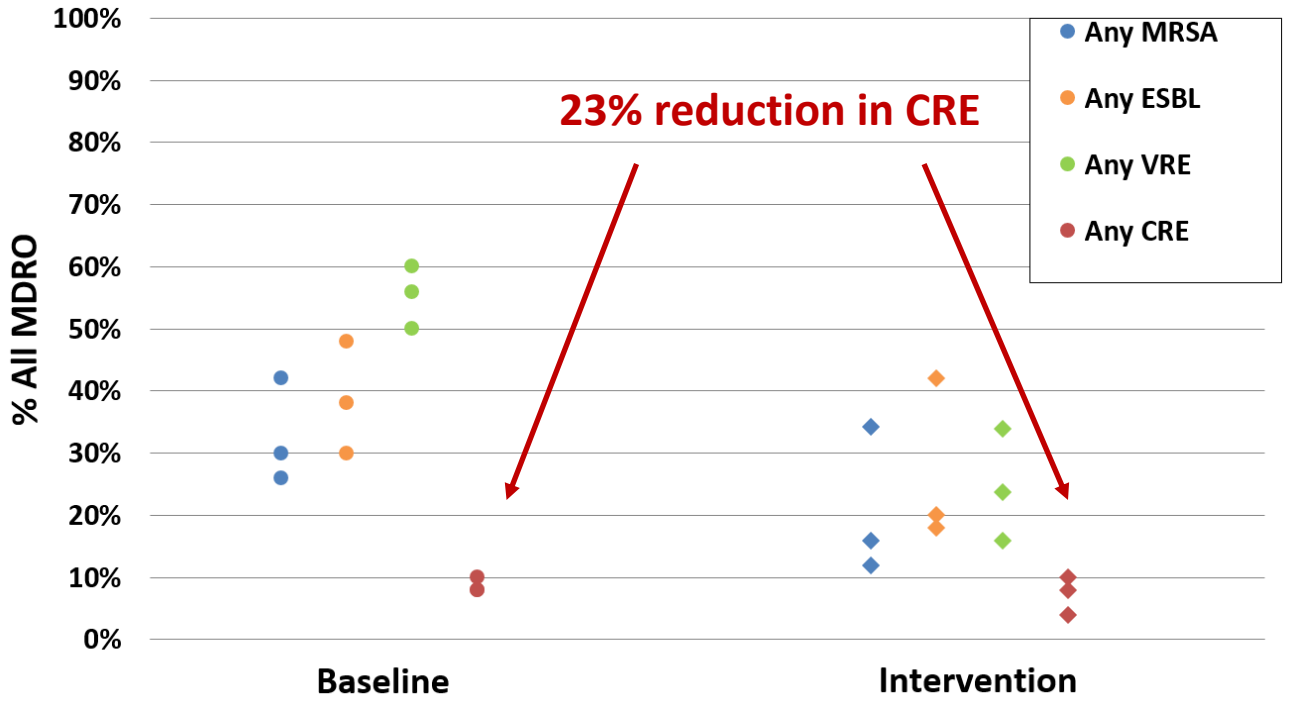
Pre & Post Swabbing Assessment

- Point prevalence assessment for quality improvement
- Body swabs: nasal, skin, peri-rectal
  - Hospitals: 50 patients in contact precautions
  - LTACHs: 50 representative patients
  - Nursing homes
    - Pre: 50 representative residents
    - Post: All residents
- Logistical support by SHIELD OC team
  - Provided materials, de-identified labels
  - Transport and process swabs at central laboratory (UCI)

SHIELD Impact: Nursing Homes
22% Reduction in MDROs

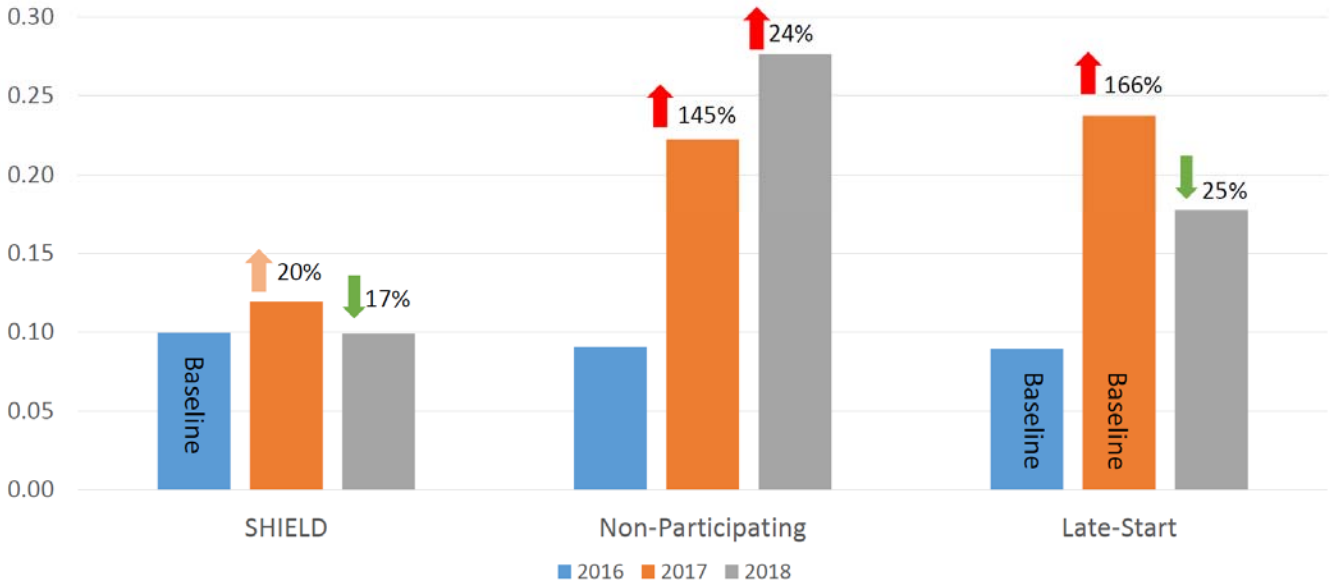


SHIELD Impact: LTACHs
34% Reduction in MDROs



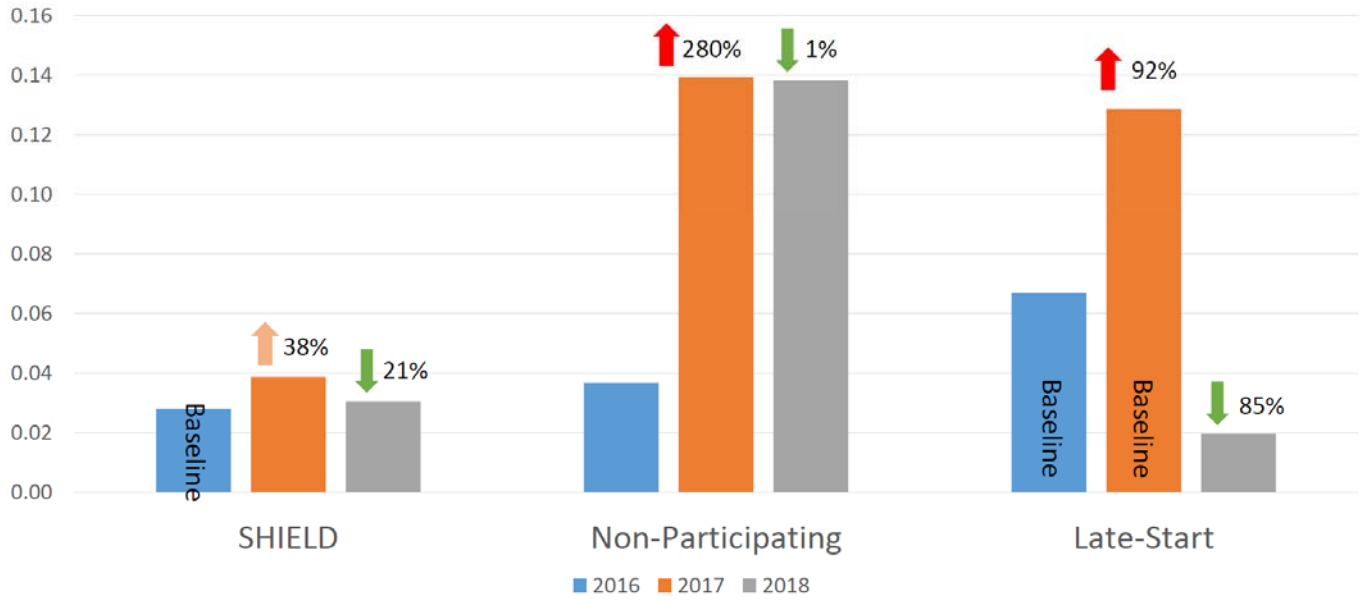
CRE Rates at OC Hospitals

Year-to-year comparison of months July-March

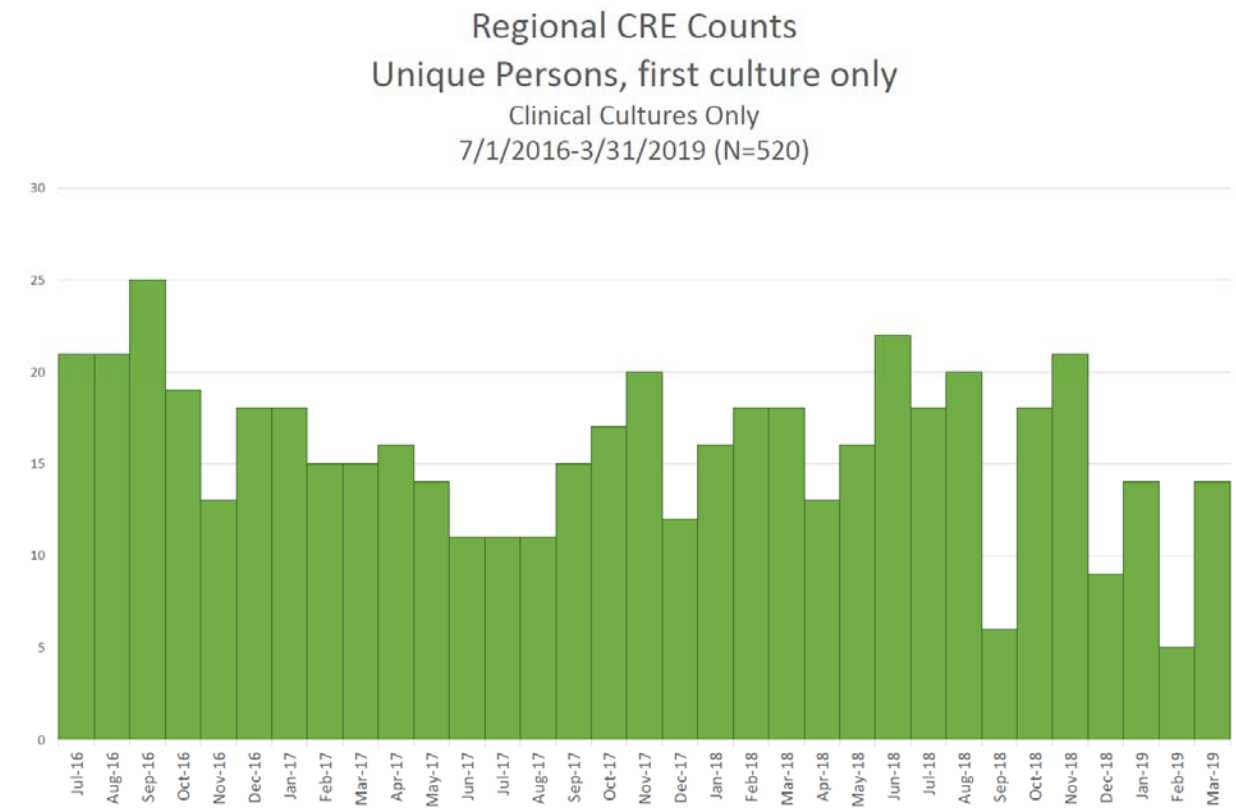


Hospital Onset CRE Rates at OC Hospitals

Year-to-year comparison of months July-March



Clinical Cultures in Orange County



CRE Spread: Prevention Success

- Public health coordination is key for facilities to cooperate in their response
- Early joint responses involving a strategy where synergy is expected may be most impactful
- Effective monitoring of microbiology results

SHIELD Toolkits Posted Online

Nursing Home Decolonization Toolkit

Step 1: Adopt SHIELD program as Quality Assurance Performance Improvement (QAPI)

1. QAPI Project Documentation Form (PDF) (DOC)
2. Universal Plan of Care (PDF) (DOC)
3. Resident Plan of Care (PDF) (DOC)

Step 2: What to Expect? (PDF) (DOC)

Step 3: Communication to Residents

1. Admission Packet Letter (PDF) (DOC)
2. Resident/Ombudsman Information Sheet (PDF)

Step 4: Products & Protocols

1. Products (PDF) (DOC)
2. CHG Compatibility (PDF) (DOC)
3. Protocol: Bed Bath With CHG Cloths (PDF) (DOC
4. Protocol: Bed Bath With CHG Liquid (PDF) (DOC
5. Protocol: Showering With CHG (PDF) (DOC)
6. Protocol: Nasal Iodophor (PDF) (DOC)
7. Order Set Examples (PDF)
8. Admission – SHIELD Checklist (PDF) (DOC)

Step 5: Staff Education & Training

1. Paper or Computer Based Training (PDF) (PPT)
2. Staff Post-Training Test and Answer Key: Basin Bed Bathing With CHG Liquid (PDF) (DOC)
3. Staff Post-Training Test and Answer Key: CHG Cloths (PDF) (DOC)
4. Physician and Staff Notification Flyer (PDF) (DOC)
5. Staff Handouts for CHG Bathing/Showering (PDF) (PUB)
6. Staff Handout for Basin Bed Bathing With CHG (PDF) (PUB)
7. Staff Handout for Nasal Iodophor (PDF) (PUB)
8. Staff Huddle Reminder Documents (PDF) (DOC)
9. FAQ: General (PDF) (DOC)
10. FAQ: Nasal Iodophor (PDF) (DOC)
11. FAQ: CHG for Bathing (PDF) (DOC)
12. FAQ: Wound Care (PDF) (DOC)
13. FAQ: Do and Don't (PDF) (DOC)

Step 6: Resident Education & Training

1. Resident Handout for CHG Bed Bath (PDF) (PUB)
2. Resident Handout for CHG Shower (PDF) (PUB)
3. Resident Handout for Nasal Iodophor (PDF) (PUB)
4. Waterproof Shower Poster for Residents (PDF) (DOC)
5. Resident Talking Points: CHG (PDF) (DOC)
6. Resident Talking Points: Iodophor (PDF) (DOC)

Step 7: Skills Assessments and Compliance Checks

1. CHG Cloth Skills Assessment Checklist (PDF) (DOC)
2. CHG Liquid Bed Bath Skills Assessment Checklist (PDF) (DOC)
3. Resident Self-Showering Assessment (PDF) (DOC)
4. Resident Self-Bed Bath Assessment (PDF) (DOC)

Step 8: Safety and Side Effects

1. Safety and Side Effects (PDF) (DOC)
2. Side Effect Tracking Form (PDF) (DOC)

SHIELD OC Iodophor Schedule

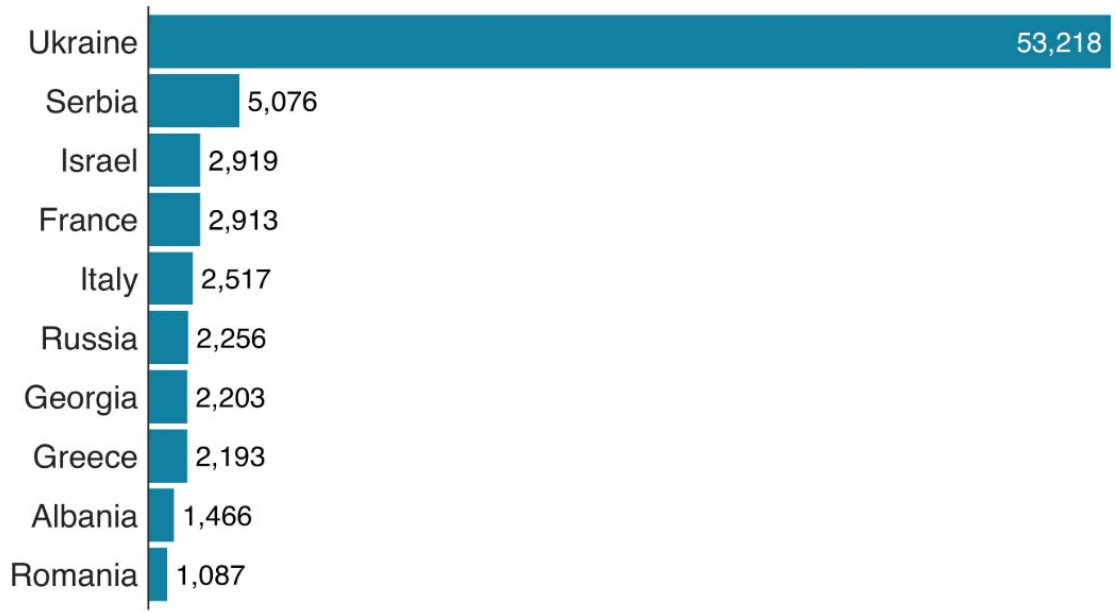
1. 2019 - Version A (PDF) (PUB)
2. 2019 - Version B (PDF) (PUB)
3. 2020 - Version A (PDF) (PUB)
4. 2020 - Version B (PDF) (PUB)

www.ucihealth.org/shield

Measles

Ukraine saw far more measles cases in 2018

Highest number of cases in WHO-defined European region

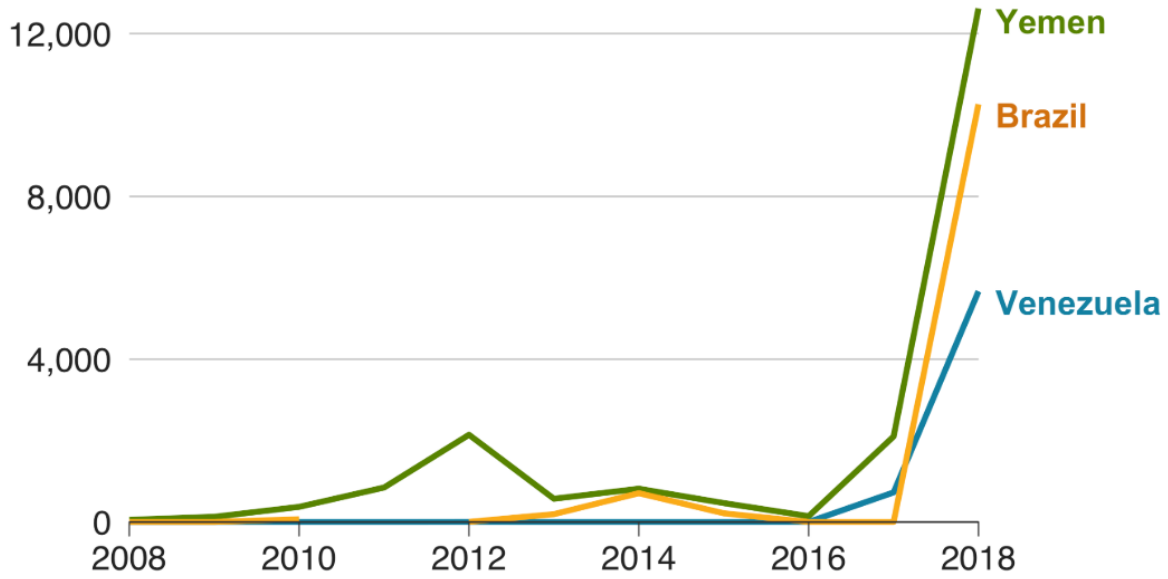


Source: World Health Organization

BBC

Vulnerable countries saw spikes last year

Number of confirmed cases of measles by year, 2008-2018



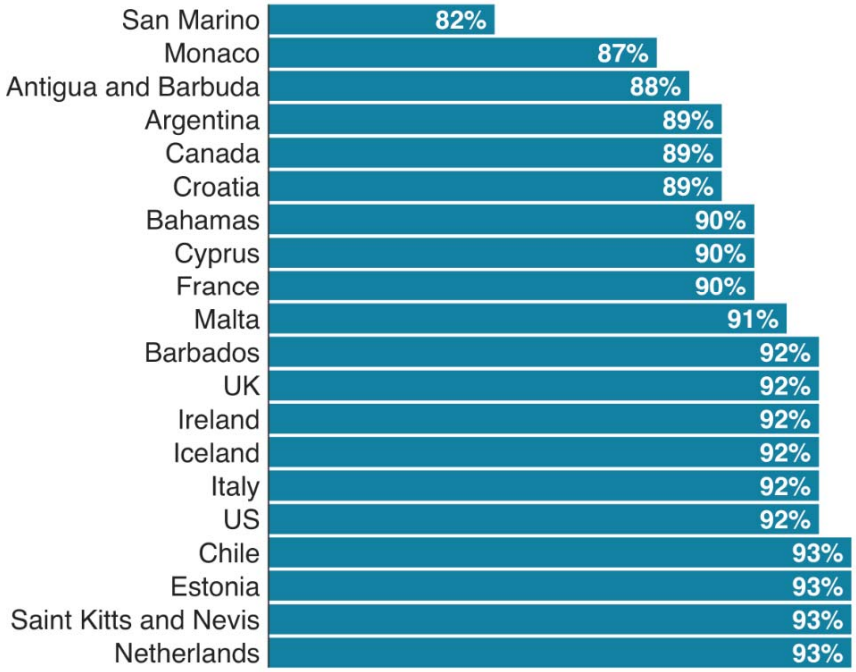
Note: There is no data for Brazil in 2011

Source: World Health Organization

BBC

Top 20 high-income countries with lowest measles vaccine coverage rates

% of surviving children under one who received the first dose of the measles vaccine, 2017



Note: The population needs to reach 93-95% coverage to achieve herd immunity

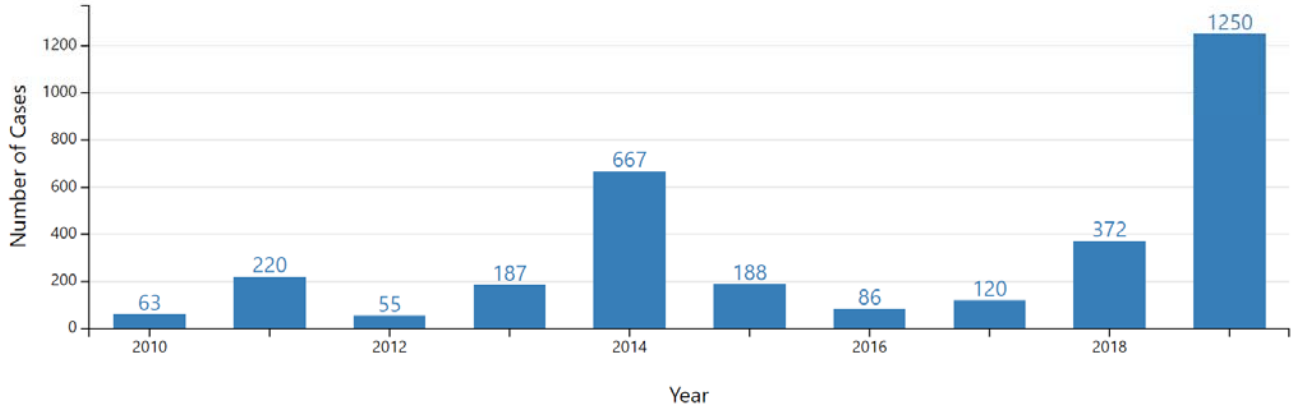
Source: Unicef/World Health Organization

BBC

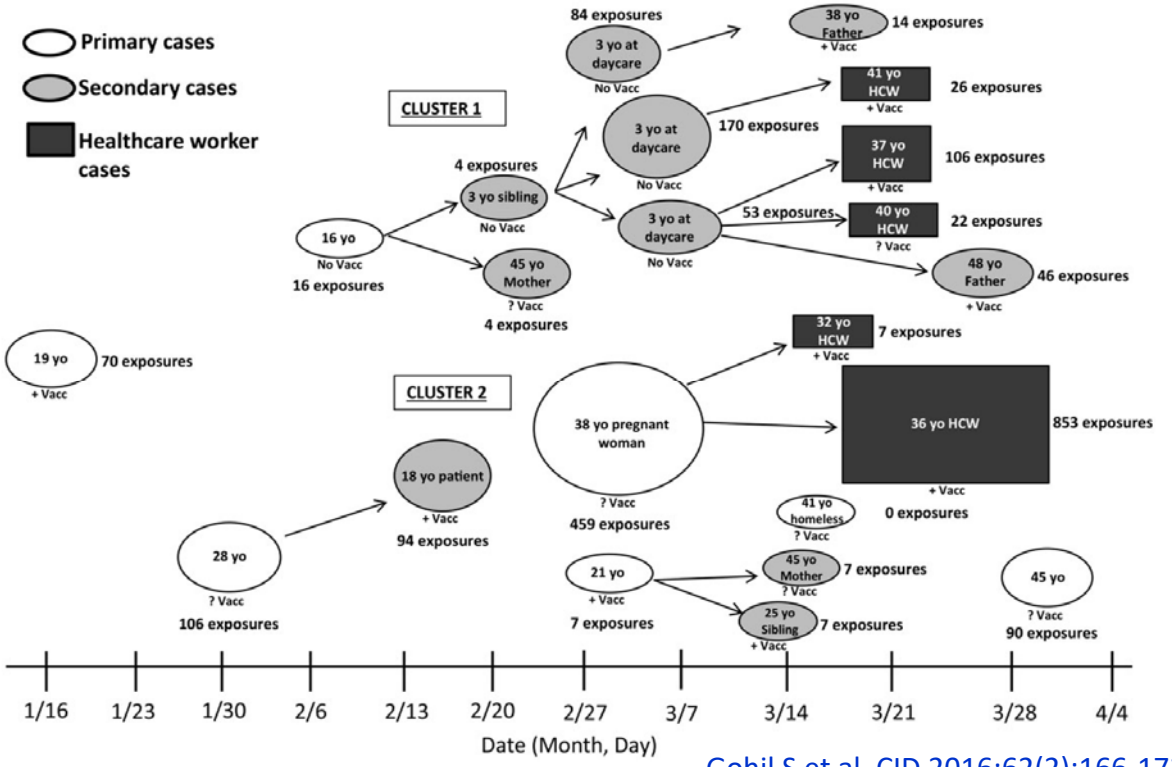
U.S. Measles Cases

Number of Measles Cases Reported by Year

2010-2019**(as of October 3, 2019)



Measles in Orange County, Jan-Apr 2014



Gohil S et al. CID 2016;62(2):166-172

Measles in Orange County, 2014-5

- 19 year old vaccinated index case (received 3 MMR vaccines), traveled to Philippines and had known exposure to measles
- Generated 22 total measles cases
- 2245 exposures, 1994 exposures in healthcare facilities
  - 15 secondary cases from known contacts
  - 13 (87%) with face-to-face exposure, 8 (62%) vaccinated
  - 5 healthcare workers generated 1014 exposures
  - 4 of 5 vaccinated, 3 had atypical mild symptoms
  - 0 secondary cases from HCW
- Vaccinated individuals have milder symptoms, but less spread

Gohil S et al. CID 2016;62(2):166-172

How Should Hospitals Respond to Measles Exposure in Community

- Problems for hospitals, clinics
  - Cases can come through any entry portal (clinic, ED)
  - Highly contagious, airborne
  - Disease poorly recognized (most U.S. MDs haven't seen it)
  - Likelihood is low (most still vaccinated)
  - Contagious 4 days prior to rash
  - Incubation period of 21 days
  - Healthcare workers not always fully vaccinated
- How to screen for a low-likelihood, high risk case?
- Everyone needs to screen, not all need to treat

UC Irvine Healthcare Worker Vaccination

- **MMR, Polio, VZV**
  - Mandatory for all healthcare workers, enforced on hire
  - Pertussis vaccine mandatory for hiring to high risk areas (ED, neonatal, oncology)
- **Influenza**
  - Annual mandatory vaccination or masking

UC Irvine Screening Protocol

- **Call Center**
  - Automated reminder call prior to all clinic visits had added message: *if exposed, call clinic before arriving*
  - Fields calls from community
  - If about measles, forwards call to designated clinic RNs
- **Designated RN protocol**
  - Assess likelihood → if real, send to designated clinic
  - Avoid ED unless seriously ill

UC Irvine Screening Protocol

- Credible Exposure
- Credible Symptoms
- Immune Status

Pre-Emptive Phone Evaluation Prior to Clinic Visit

Credible Exposure?	Credible Symptoms?	Immune?	Action (see "action based upon assessment" section)
-	-	+	Usual Triage
-	-	-	Usual Triage, Consider Vaccination
-	+	+	Clinic Fever and Rash Protocol
-	+	-	Clinic Fever and Rash Protocol
+	-	+	Usual Triage
+	-	-	Activate for Measles Prophylaxis IF Criteria Met (see below)
+	+	-	Activate Clinic R/O Measles Protocol
+	+	+	Activate Clinic R/O Measles Protocol

UCI Health

Assess Credible Exposure - Definition

- Occurred within 3 weeks (21 days) **AND one of the below**
- Exposed to a person who has a fever and rash from a foreign country
- Exposed to a person who has been diagnosed with the measles
- Present at time and location of another measles patient based upon OCPH health alert http://www.ochealthinfo.com/phs/about/dcepi/epi/dip/prevention/measles

If NO Credible Exposure

- ➔ Unlikely measles, do not perform measles rule out
- ➔ Determine if fever or rash to initiate masking and private room placement for visit
- ➔ If not immune, consider vaccination if no contraindication

UCI Health

Assess Credible Symptoms

- Rash, cough, fever, runny nose, OR red eyes will quality for credible symptoms
- Rash is maculopapular and begins from head and progresses to rest of body

Assess Immune Status

- Any **ONE** of the following constitutes immunity
  - 1 dose of measles vaccine (MMR) if pre-school aged child
  - 2 doses of measles vaccine (MMR) if K-12 child
  - 1 dose of measles vaccine in an adult who is NOT in high risk settings
  - 2 doses of measles vaccine in an adult who IS in high risk settings
  - Laboratory test confirmation of measles infection at some point in your life
  - Laboratory test confirmation of immunity to measles
  - Birth before 1957 (evidence of immunity may be needed in some situations)
- High risk settings/groups include:
  - College or graduate schools, vocational schools
  - Healthcare personnel
  - International travelers

UCI Health

Eligibility for MMR Prophylaxis in Outpatient Clinic

- If exposure occurred within 72 hours and no contraindication to MMR (live vaccine), then give one dose of MMR as prophylaxis
    - Measles vaccine can be given if ≥6 months without contraindications to live vaccine

Eligibility for IVIg or IM immunoglobulin Prophylaxis in ED/Hospital

- If pregnant AND *not immune*, IVIg should be offered if within 6 days of exposure
- If immunocompromised (regardless of prior immunity), consider IVIg if within 6 days of exposure depending on clinical decision-making of risk based upon duration of exposure, level of immunocompromise, insurance approvals, and willingness of patient to receive IVIg.
- IM immunoglobulin can be given if <12 months old or <30kg (66 lbs), and is preventative if given within 6 days of exposure

UCI Health

Credible Exposure + Credible Symptoms + Not Immune

- Make urgent curbside visit for “Rule Out Measles” Clinic
- List car make, model, color in appointment notes
- Patient told to:
  - Bring same-day urine in zipped sealable bag (non-sterile)
  - Go to specific mobile clinic location and remain in car
  - RN/MD comes to car wearing N95 mask
  - Takes throat swab for PCR
  - Takes urine bag for PCR (to be transferred to specimen cup)
  - If not immunocompromised → home to wait for results
  - If immunocompromised → immune globulin if within window
    → direct admit

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Morbidity and Mortality Weekly Report (*MMWR*)

Measles Outbreak
California, Dec 2014-Feb 2015

Zipprich J et al. MMWR Feb 2015;64(06):153-4

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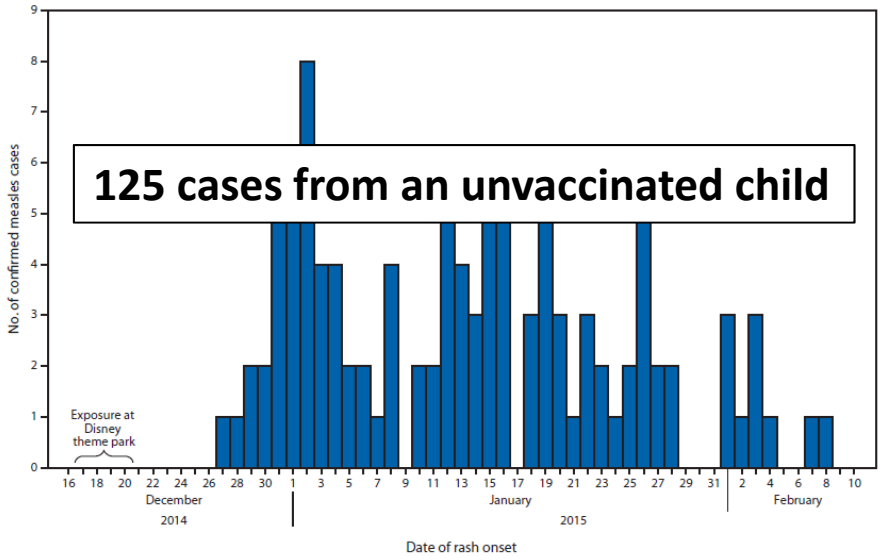
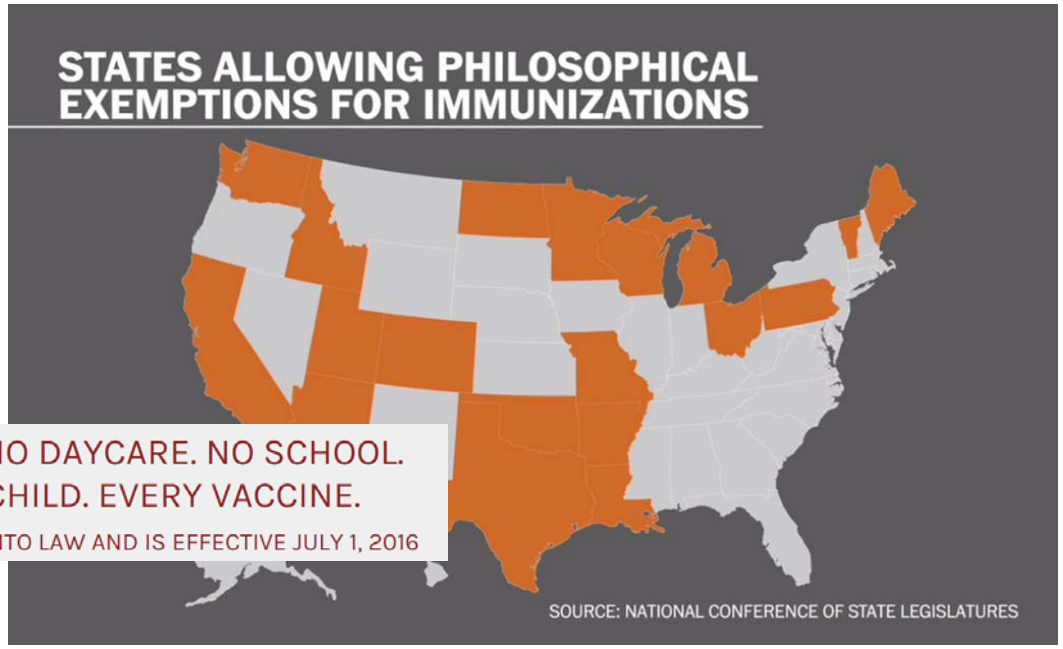


Zipprich J et al. MMWR Feb 2015;64(06):153-4

California Removes Personal Belief Exemption for Vaccines



NO SHOT. NO DAYCARE. NO SCHOOL.
EVERY CHILD. EVERY VACCINE.

SB 277 SIGNED INTO LAW AND IS EFFECTIVE JULY 1, 2016

'GROSS NEGLIGENCE'

San Diego Doctor Who Doled Out 1,000 Vaccine Exemptions Faces Medical Board Charges

Dr. Tara Zandvliet, who has written nearly a third of all vaccine exemptions for children in San Diego schools, is now accused of gross and repeated negligence.

Kelly Weill
Reporter

Updated 10.23.19 10:07PM ET / Published 10.23.19 4:19PM ET

New California law, effective in 2021, allows the state to step in when a school's vaccination rate drops below 95 percent, or when one doctor writes more than five vaccine exemptions in a year.

Containment of Emerging Diseases

- Public health coordination is critical
  - Inter-facility communication
  - Directed strategies for implementation
  - Favor synergistic strategies
  - Insist upon monitoring for high fidelity
  - Media matters
  - Vaccinate

Questions?