Cost Analysis of Universal Screening vs. Risk Factor-Based Screening for MRSA
Dr. Virginia Roth, The Ottawa Hospital
A Webber Training Teleclass

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Cost Analysis of Universal Screening vs. Risk Factor-Based Screening for MRSA

Dr. Virginia Roth
The Ottawa Hospital

Hosted by Nicole Kenny
Virox Technologies Inc.

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Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Background

- Compared to MSSA
  - Increased cost ($3,700 per infection)
    - Higher readmission, length of stay
  - Increased mortality
  - Fewer therapeutic options
- Colonization precedes infection (10:1)
  - Can persist for months – years
- Emergence of community MRSA in 1998

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Tansarli et al. Expert Rev Anti Infect Ther 2013;
Nathwani J Infect 2009

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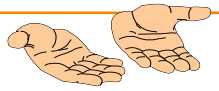
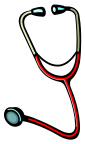
Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Control Measures



- Spread by direct contact
- Asymptomatic MRSA carriers → reservoir for transmission
- Infection control strategies - variably effective:
  - Screening
  - Contact precautions
  - Contact tracing
  - Decolonization



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Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Admission Screening

Risk-Factor Based (Targeted) Screening

- Screening based on pre-defined high-risk factors

Universal Screening

- Screening all patients for MRSA upon admission

- In past:
  - Lack of agreement, inconclusive evidence
  - Mandatory in certain jurisdictions
  - Patient safety movement

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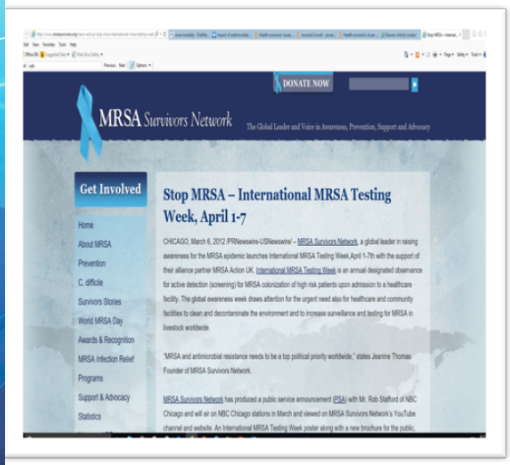

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Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Impact of Screening

Comparison	HCA-MRSA Acquisition	HCA-MRSA Infection
Universal vs No Screening	↓	↓ 45-70%
Universal vs Targeted Screening	NA ↓↑	↓ 0.12-52% ↓
ICU Universal vs No Screening	↓↑	↓↑
Surgical Patients vs No Screening		↓
Targeted vs No Screening		

Glick et al. Am J Infect Control 2014

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INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY JANUARY 2016, VOL. 37, NO. 1

ORIGINAL ARTICLE

Universal vs Risk Factor Screening for Methicillin-Resistant *Staphylococcus aureus* in a Large Multicenter Tertiary Care Facility in Canada

V. R. Roth, MD;[1,2,3] T. Longpre, MSc;[3] M. Taljaard, PhD;[2,3] D. Coyle, MD;[2,3] K. N. Suh, MD;[1,2,3] K. A. Muldoon, MPH;[4] K. Ramotar, PhD;[2,5] A. Forster, MD[1,2,3]

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SETTING

- The Ottawa Hospital
  - Multicenter tertiary care facility
  - 1,200 beds:
    - med, surg, obstetrics, ICU, mental health, rehab
- MRSA Control Measures:
  - Targeted admission screening
  - Contact Precautions: hand hygiene, gowns, gloves
  - Contract screening, blocked beds
  - Private room, bathroom
  - Dedicated patient care equipment
  - Decolonization not routinely performed

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Staff at the Ottawa Hospital are Battling Outbreak of a Superbug

CJOH-TV

"Superbug" Hits City Hospitals
The Ottawa Citizen

Hospital Battles Superbug
The Sun

Ottawa Hospital's Civic Campus hit with Outbreak of Resistant Bacteria
CHRO

Superbug Outbreak at the Ottawa Hospital, Civic Site
CJOH

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OUR BURNING PLATFORM FOR CHANGE

- Risk-factor based (targeted) admission screening limited:
  - Compliance 30 – 70%
  - Missed Community MRSA
- Economic models supported universal screening
  - Projected > $400,000 annual savings
- Recent switch to PCR testing

Lee et al. Infect Control Hosp Epidemiol 2010

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OBJECTIVES

- Assess the impact of universal admission screening on healthcare-associated MRSA rates
  - All patients admitted through the ED
  - All elective admissions
  - All patients transferred from another institution
- Compare the annual and per patient costs of universal versus risk factor-based MRSA screening

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STUDY DESIGN

Quasi-experimental

- Risk Factor-Based Screening: 24 mo
- Universal Screening: 20 mo

1º outcome: HCA-MRSA acquisition per 100,000 patient-days

- Segmented regression analysis

2º outcomes (to account for threats to validity)

- Incidence of HCA - *C. difficile*
- Mupirocin use
- Regional MRSA rates

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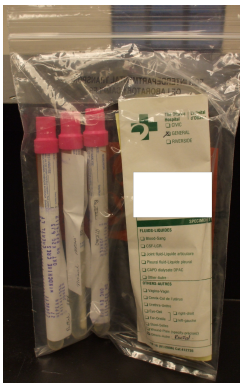
LAB METHODS

- Screening swabs from nares, rectum and open wounds
- Incubated overnight in broth
- Tested using RT-PCR
- Culture confirmation of PCR positive
- Results available within 24 hr



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COST ANALYSIS

- Operational costs of screening
  - Specimen collection, lab costs
- Costs of additional cases identified
  - Infection control, contact precautions, housekeeping, private room
- Cost savings of fewer nosocomial cases
  - Healthcare costs of colonization & infection
- Sensitivity analysis

PLOS ONE 2016

RESEARCH ARTICLE

Cost Analysis of Universal Screening vs. Risk Factor-Based Screening for Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Virginia R. Roth[1,2,3]*, Tara Longpre[3], Doug Coyle[3,4], Kathryn N. Suh[1,2,3], Monica Taljaard[2,3], Katherine A. Muldoon[4,5], Karamchand Ramotar[2,5], Alan Forster[1,2,3]

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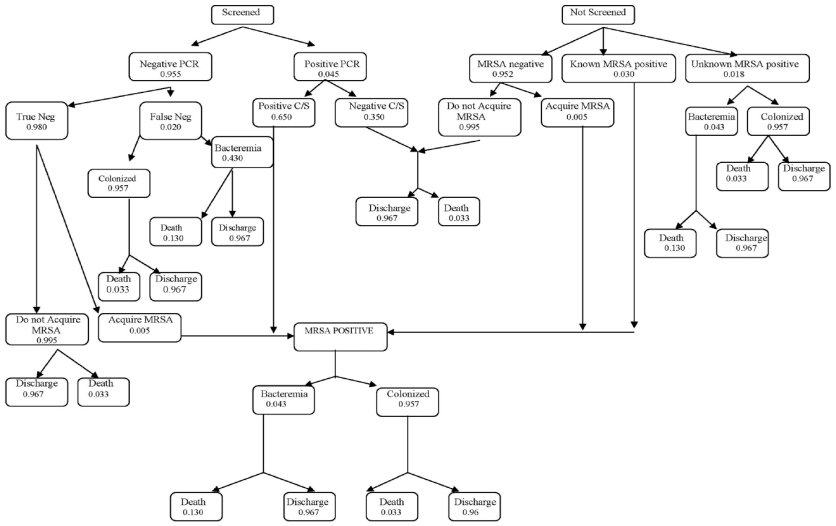
METHODS – DECISION MODEL



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RESULTS – STUDY POPULATION

	Risk-Factor Screening Jan 2006 – Dec 2007	Universal Screening Jan 2008 – Aug 2009
Number of Admissions	76,273	61,782
Number Screened (%)	22,271 (29.2)	51,815 (83.8)
Total MRSA positive cases on admission (% of admissions)	745 (1.0)	1,621 (2.6)
MRSA Detection Rate per 1,000 admissions	9.8	26.2
Nosocomial MRSA Cases	323	321
Nosocomial MRSA rate /100,000 pt days	41.8	47.5
MRSA Bacteremia Cases	14	14
MRSA Bacteremia rate /100,000 pt days	1.8	2.1

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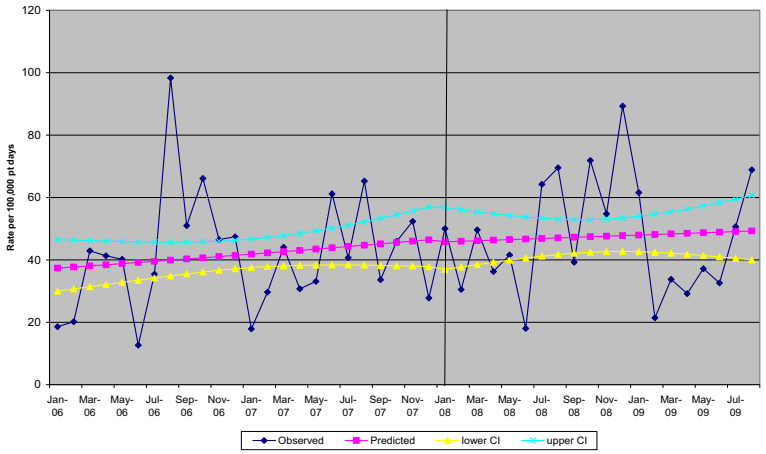
Healthcare-Associated MRSA Rates Pre- and Post-Intervention (Per 100,000 Patient Days)



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SEGMENTED REGRESSION MODELING

	MRSA Rates		CDI Rates		Mupirocin Prescription Rates		Regional MRSA Rates	
	Rate	p-value	Rate	p-value	Rate	p-value	Rate	p-value
Baseline rate per 100,000 pt-days	46.79		41.01		76.22		7.39	
Change in pre-intervention rate (24 month risk factor screening period)	0.40	0.482	-0.95	0.026	0.70	0.155	0.10	0.017
Change in pre-post rate (Immediate rate difference)	-1.11	0.923	12.52	0.142	3.93	0.694	0.83	0.316
Change in post-intervention rate (20 month universal screening period)	-0.21	0.826	0.24	0.753	-0.78	0.331	-0.20	0.004

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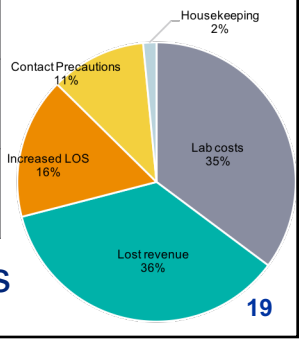
COST ANALYSIS OF RISK FACTOR-BASED VS UNIVERSAL ADMISSION SCREENING

	% Patients Screened	Annual Cost	Cost per Patient
Risk Factor	30	$780,000	$128.03
Universal	83	$1.94M	$145.79
Difference		**$1.16M**	**$17.76**



Universal Screening Costs

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SENSITIVITY ANALYSIS - COST

- Universal screening less costly when:
  - MRSA prevalence is low (1-3%): $3.03 - $30.75 saved per patient screened
  - Acquisition rates are very high (>60%): $0.74 saved per patient screened
- Little impact:
  - Probability of false negative, unknown
  - Probability of MRSA acquisition, MRSA infection

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CONCLUSIONS

Universal screening (vs Risk factor-based):

- Improved MRSA detection 3-fold
- Did not reduce MRSA acquisition
- Did not impact MRSA bacteremia
- Cost an additional $17.75 per patient

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WHY DIDN'T IT WORK?

- Compliance with infection control practices <100%
- Moderately low MRSA prevalence: 2.6%
- 84% admission screening compliance ≠ "universal"
- Did not include impact of universal decolonization

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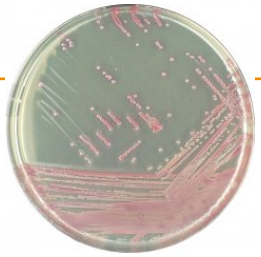
WHAT'S AN ICP TO DO?



- Screening
  - Less costly rapid detection methods
  - Risk-factor based (depending on local epidemiology):
    - All patients admitted through ED
    - All direct transfers
    - All admissions to ICU and Rehab
- Strict adherence to infection control measures
- Consider universal decolonization
  - May prevent 44% of colonization and 45% of infections

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Gidengil et al. Infect Control Hosp Epidemiol 2015

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May 5, 2017	*(FREE … WHO Teleclass - Europe)* **SPECIAL LECTURE FOR 5 MAY** Speaker: **Prof. Didier Pittet**, World Health Organization, Geneva *Sponsored by the World Health Organization Infection Control Global Unit (www.who.int/gpsc/en)*
May 18, 2017	**THE AIRBORNE SPREAD OF INFECTIOUS AGENTS: SURVIVAL AND DECONTAMINATION OF HUMAN PATHOGENS IN INDOOR AIR** Speaker: **Prof. Syed A. Sattar**, University of Ottawa Faculty of Medicine
May 30, 2017	*(European Teleclass)* **THE GOOD THE BAD AND THE UGLY METHODS FOR BEDPAN MANAGEMENT** Speaker: **Gertie van Knippenberg-Gordebeke**, International Consultant Infection Prevention, The Netherlands *Sponsored by CleanIs (www.cleanis.com)*
June 1, 2017	**USING UNOFFICIAL SOURCES TO MONITOR OUTBREAKS OF EMERGING INFECTIOUS DISEASES: LESSONS FROM PROMED** Speaker: **Prof. Lawrence Madoff**, Harvard University Medical School, Editor of ProMED Mail
	(South Pacific Teleclass)

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