March 23, 2017

Power, special interests, and objectivity in science

Continuing the case for community-driven epidemiology to combat pollution profiteering

2017 Steve Wing Environmental Justice Seminar

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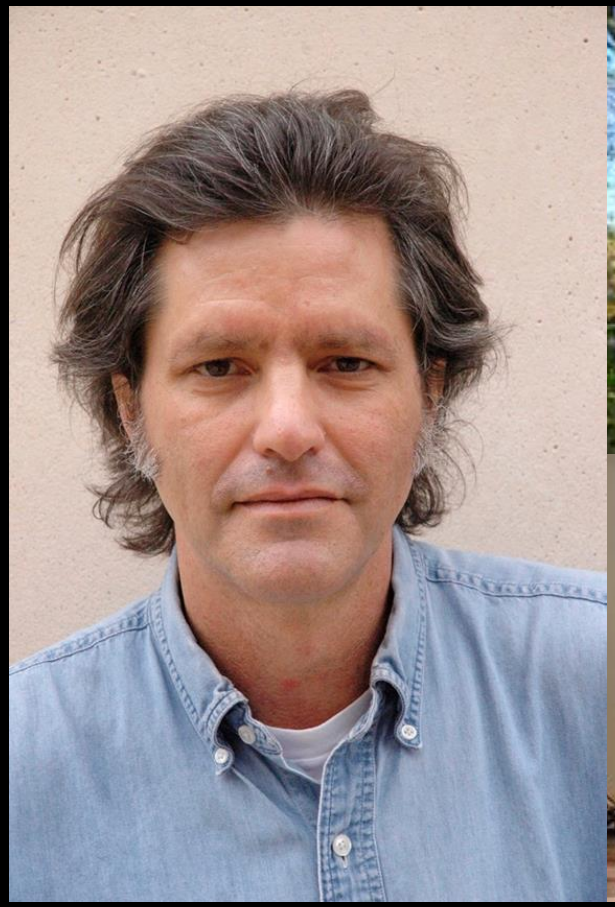
http://www.jhsph.edu/departments/environmental-health-and-engineering/faculty/research/heaney/

Remembering Steve Wing 1952-2016
A passion for environmental justice



https://www.niehs.nih.gov/news/newsletter/2016/12/science-highlights/wing/index.htm

https://www.ncbi.nlm.nih.gov/pubmed/?term=Wing%20S%5BAuthor%5D&cauthor=true&cauthor_uid=18556620

Outline

- Ideas Steve imparted about objectivity in science
  - Insights he shared to replicate his *"Community-driven epidemiology & environmental justice"* class at JHSPH
- Who are scientists' clients?
  - Why not community?
- What forces can lead to obscuring of the truth?
- How to overcome obfuscation and barriers to knowledge generation in specific places & for specific populations?
  - Case for community-driven epidemiology
  - Example: Emerging pathogens at human-livestock interface
- Walking the walk - A self-critical perspective on rationalization as an early career scientist

Objectivity in science 1/4

Clients scientists serve

Who are scientists' typical clients?

How do these clients shape the research questions that are prioritized?

How do these clients perpetuate knowledge gaps on specific topics, in specific places, and among specific populations?

Objectivity in science 2/4

Alignments & conflicts of interest

Should scientists work with communities or organizations that may take an advocacy position?

Should scientists themselves be prepared to take an advocacy position–is further research needed?

If yes, is critical to maintain transparency about alignments & conflicts of interest – both financial & non-financial

http://www.azquotes.com/quote/1383789
https://drdebbright.files.wordpress.com/2013/02/self-criticism-2.jpg

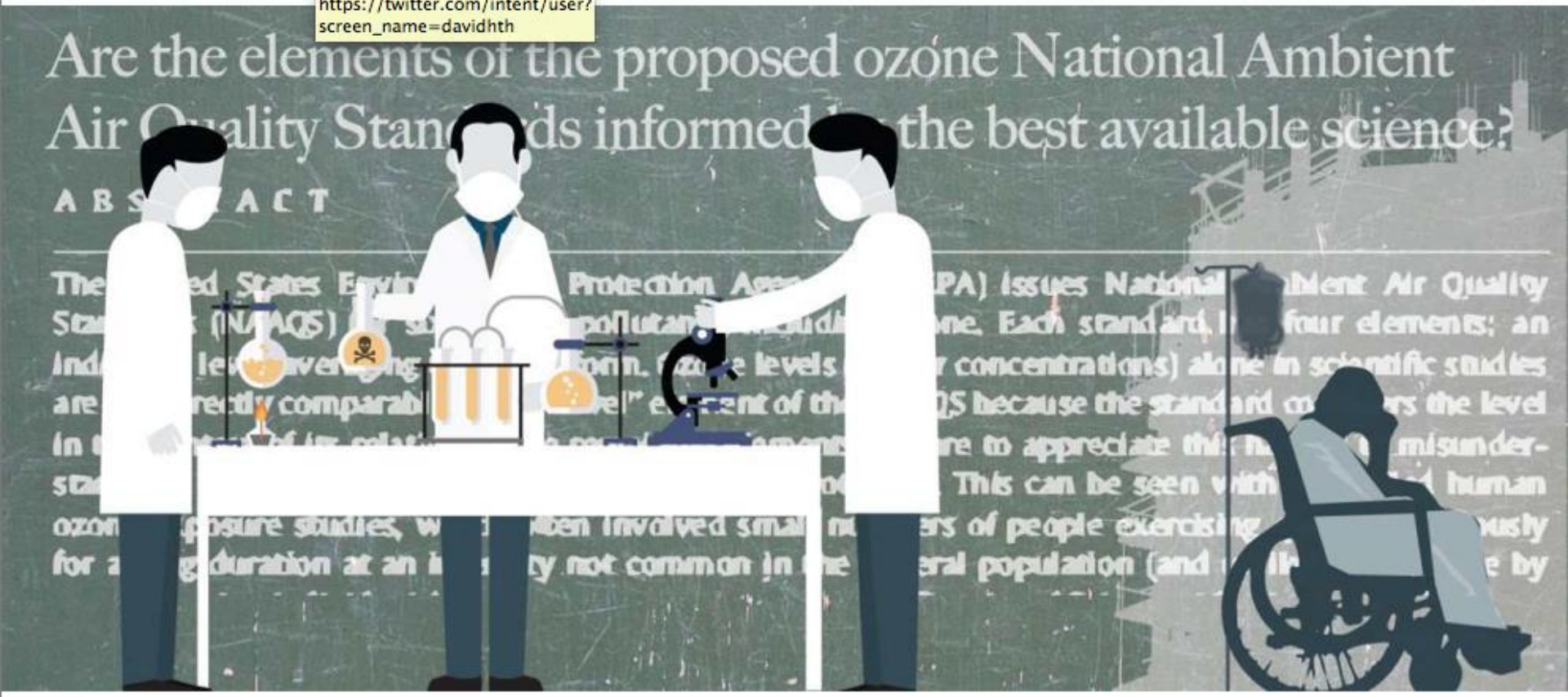
Science for Sale

Meet the 'rented white coats' who defend toxic chemicals

How corporate-funded research is corrupting America's courts and regulatory agencies

By David Heath email 5:00 am, February 8, 2016 Updated: 5:00 am, February 8, 2016

https://twitter.com/intent/user?screen_name=davidhth



Emilie Udell for the Center for Public Integrity

https://www.publicintegrity.org/2016/02/08/19223/meet-rented-white-coats-who-defend-toxic-chemicals

REUTERS

MONEY NEWS | Wed Mar 15, 2017 | 6:51am IST

Plaintiffs in U.S. lawsuit say Monsanto ghostwrote Roundup studies

Monsanto logo is displayed on a screen where the stock is traded on the floor of the New York Stock Exchange (NYSE) in New York City, U.S. on May 9, 2016. REUTERS/Brendan McDermid/File Photo - RTX2UVSG

By **Brendan Pierson**

http://in.reuters.com/article/monsanto-cancer-lawsuit-idINKBN16M067

ENVIRONMENTAL COMMUNICATION, 2017
http://dx.doi.org/10.1080/17524032.2016.1275736

Routledge
Taylor & Francis Group

RESEARCH ARTICLE

OPEN ACCESS

Does Engagement in Advocacy Hurt the Credibility of Scientists? Results from a Randomized National Survey Experiment

John E. Kotcher [a], Teresa A. Myers[a], Emily K. Vraga [a], Neil Stenhouse[b] and Edward W. Maibach[a]

[a]Department of Communication, Center for Climate Change Communication, George Mason University, Fairfax, VA, USA; [b]Department of Life Sciences Communication, University of Wisconsin-Madison, Madison, WI, USA

ABSTRACT

It is often assumed that issue advocacy will compromise the credibility of scientists. We conducted a randomized controlled experiment to test public reactions to six different advocacy statements made by a scientist —ranging from a purely informational statement to an endorsement of specific policies. We found that perceived credibility of the communicating scientist was uniformly high in five of the six message conditions, suffering only when he advocated for a specific policy—building more nuclear power plants (although credibility did not suffer when advocating for a different specific policy—carbon dioxide limits at power plants). We also found no significant differences in trust in the broader climate science community between the six message conditions. Our results suggest that climate scientists who wish to engage in certain forms of advocacy have considerable latitude to do so without risking harm to their credibility, or the credibility of the scientific community.

ARTICLE HISTORY
Received 31 May 2016
Accepted 1 December 2016

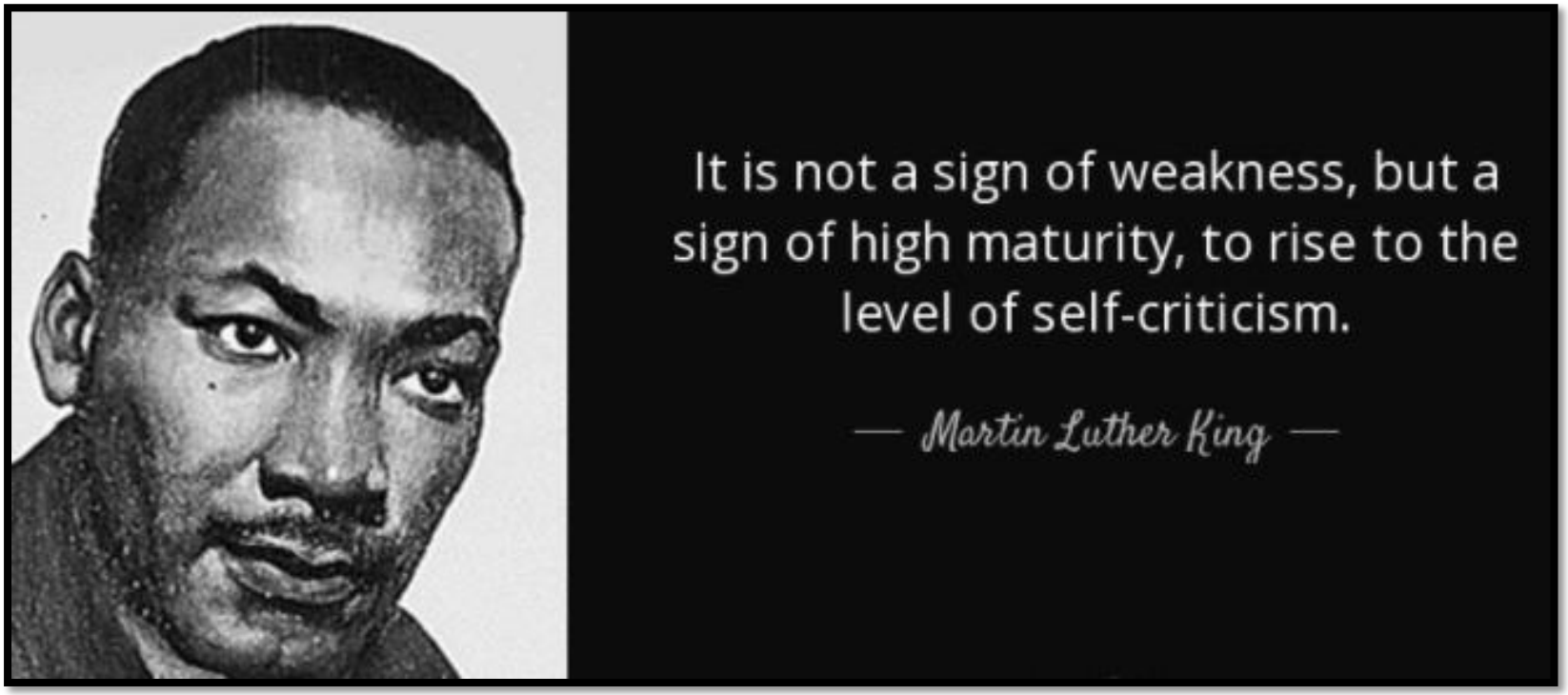
KEYWORDS
Advocacy; credibility; climate change; trust in scientists; public engagement; message effects

Objectivity in science 3/4

Design & methodology

http://i.imgur.com/OZsAa8G.jpg

Objectivity in science 4/4



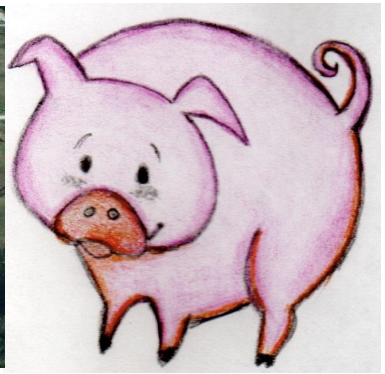
Necessary level of criticism (inward & outward) may break-down given structure of incentives, rewards, & pressures

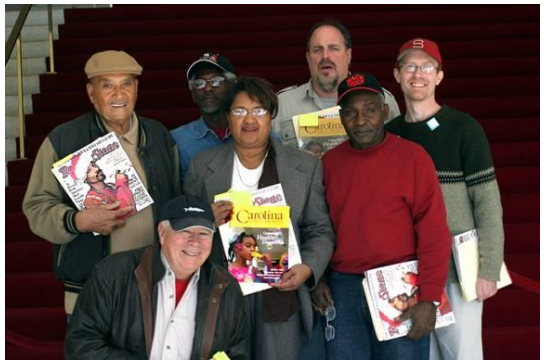
http://www.azquotes.com/quote/1383789
https://drdebbright.files.wordpress.com/2013/02/self-criticism-2.jpg

Continuing the case for community-driven epidemiology

Example of emerging pathogens at human-livestock interface

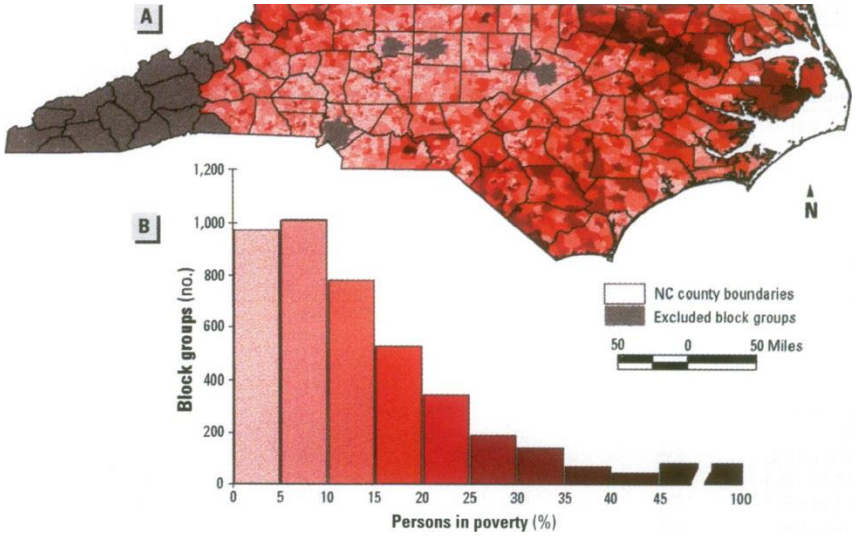
Building on Steve's research of environmental and health implications of industrialization of livestock production in North Carolina

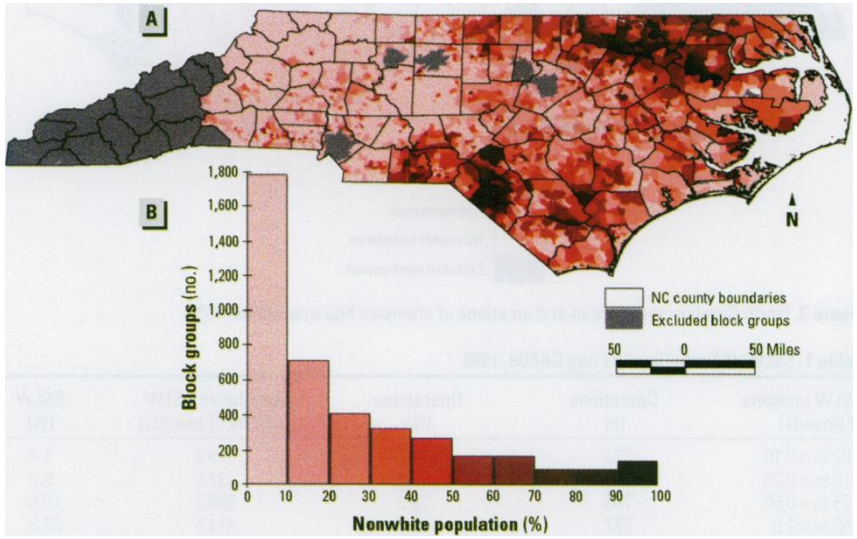


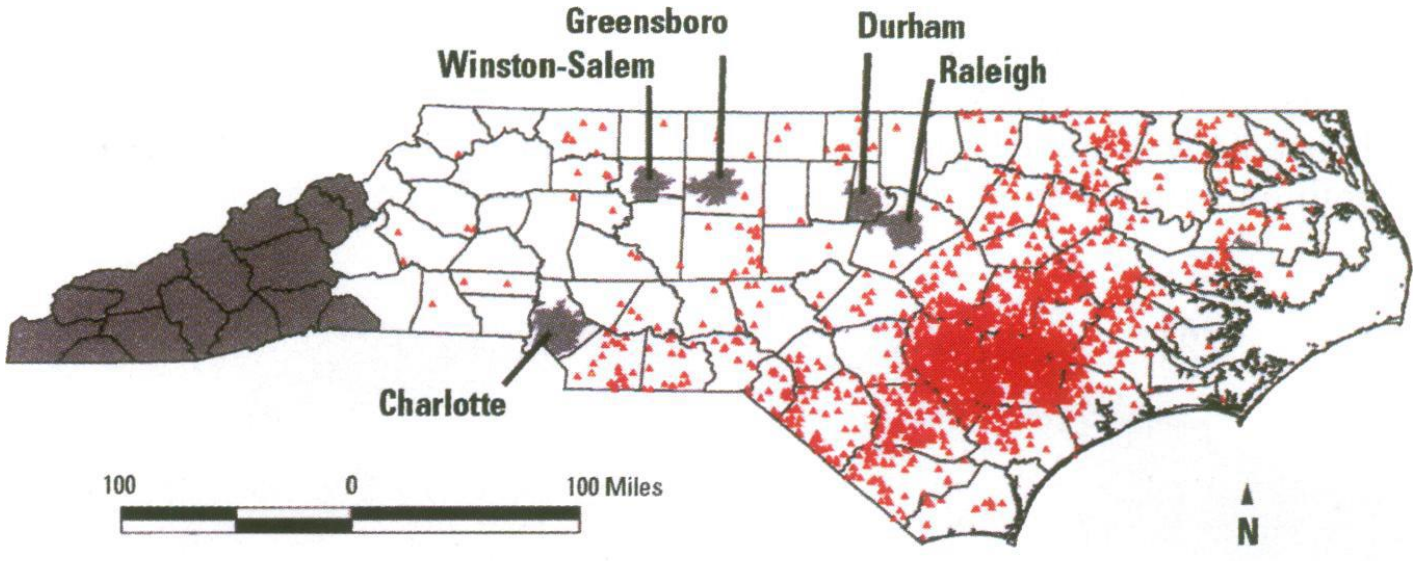


Community health effects of industrial hog operations (CHEIHO) Study

Industrialization of hog production in NC



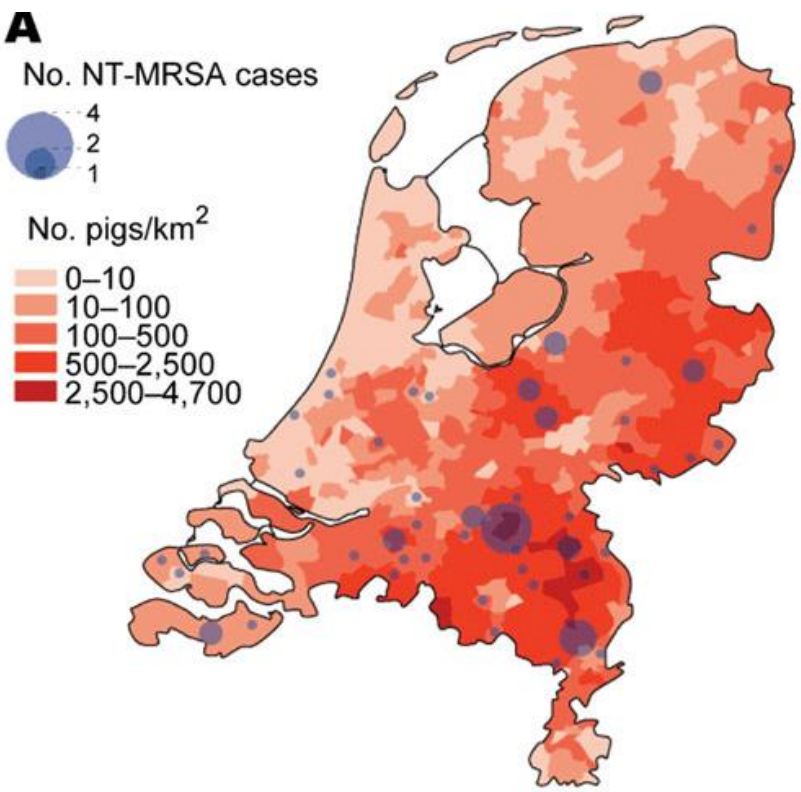


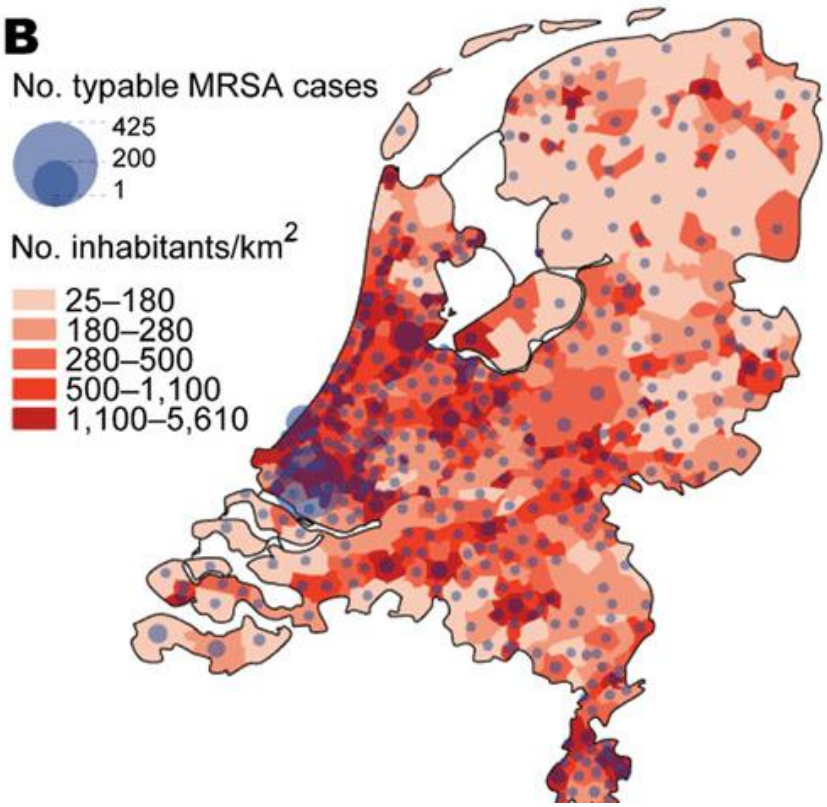


Adapted from Wing et al., 2000. Env. Hlth. Persp.

Continuing the case for community-driven epidemiology

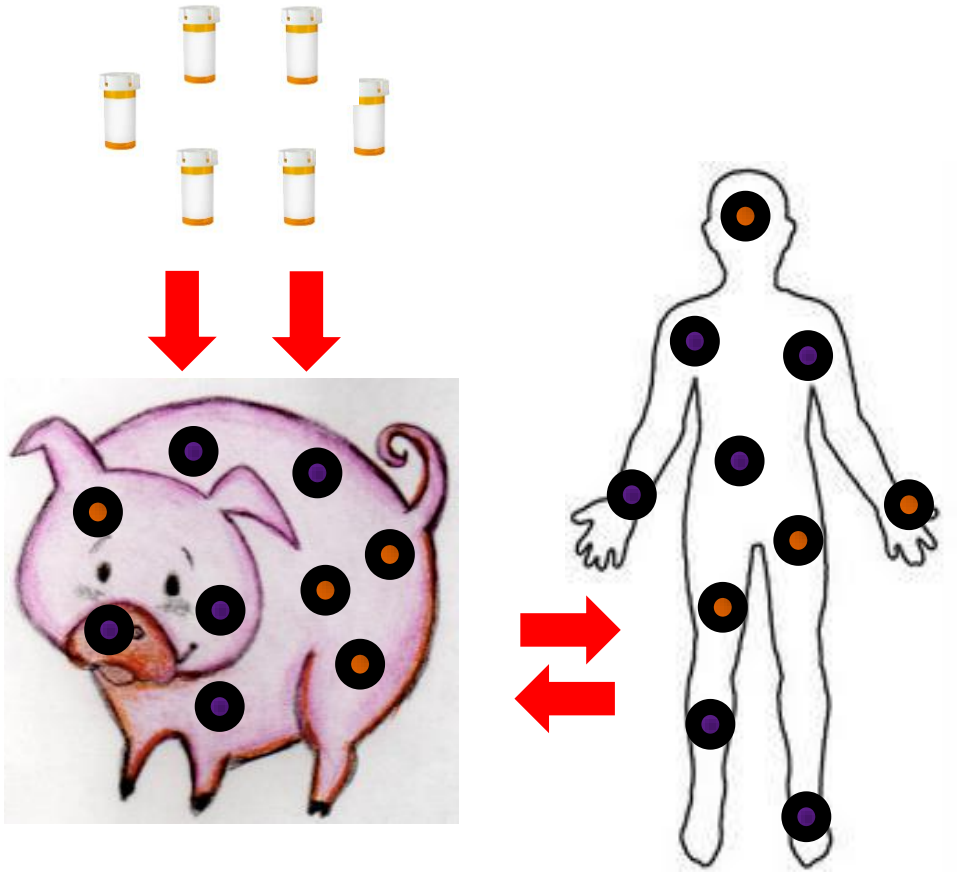
Example of emerging pathogens at human-livestock interface





van Loo et al., Emergence of methicillin-resistant *Staphylococcus aureus* of animal origin in humans. Emerging Infectious Diseases. 2007. 13(12)1834-1839.

Antimicrobial resistant *S. aureus* in humans and livestock



1. Persoons D, Van Hoorebeke S, Hermans K, Butaye P, de Kruif A, Haesebrouck F, et al. Methicillin-resistant Staphylococcus aureus in poultry. Emerg Infect Dis 2009;15(3):452-3.
2. Silbergeld EK, Graham J, Price LB. Industrial food animal production, antimicrobial resistance, and human health. Annu Rev Public Health 2008;29:151-69.
3.Price et al. *Staphylococcus aureus* CC398: host adaptation and emergence of methicillin resistance in livestock. mBio 3(1):e00305-11. 2012.

Global dissemination of livestock-associated *S. aureus* (including CC398)

Community-associated meticillin-resistant *Staphylococcus aureus*

Frank R DeLeo, Michael Otto, Barry N Kreiswirth, Henry F Chambers

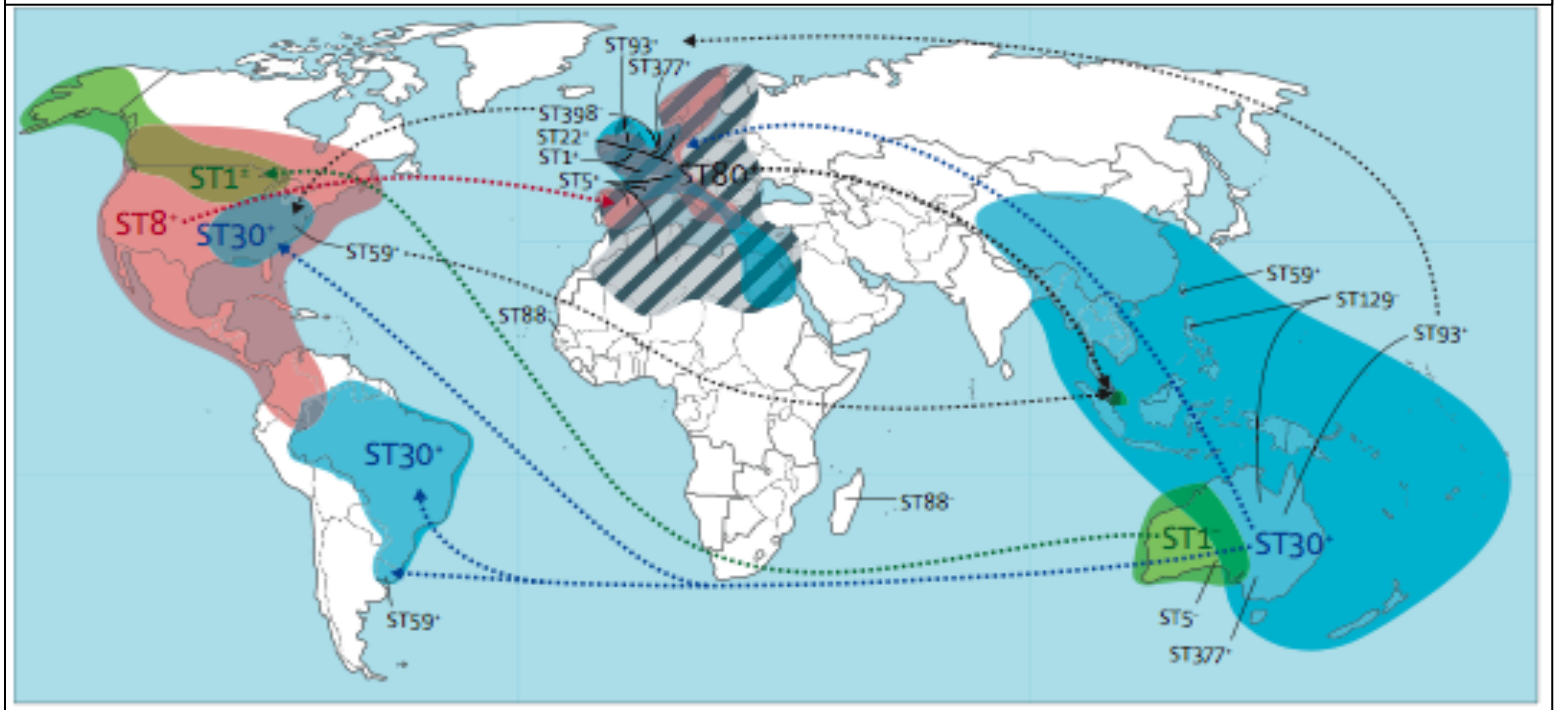


Figure 1: **Global distribution of community-associated meticillin-resistant *Staphylococcus aureus* (CA-MRSA) by multilocus sequence type (ST)**
Dotted lines indicate possible route of dissemination of the CA-MRSA strains. Estimates of the areas are shown in which infections with the main strains—ie, ST1 (green), ST8 (red), ST30 (blue), and ST80 (grey hatched)—have been reported. +=Panton-Valentine leukocidin (PVL)-positive strains. −=PVL-negative strains. ±=combination of PVL-positive and PVL-negative strains.

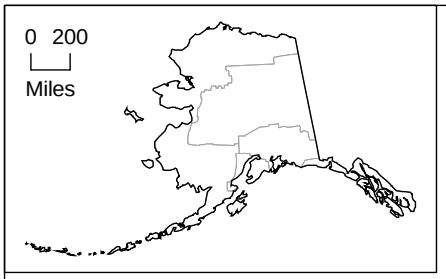
https://www.ncbi.nlm.nih.gov/pubmed/20206987

World Health Organization

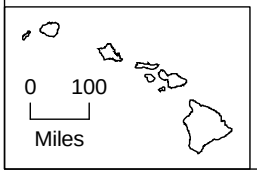
Human-kind is in danger of entering a post-antibiotic era…

What is state of knowledge in the US?

Hogs and Pigs - Inventory: 2007



http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Ag_Atlas_Maps/Livestock_and_Animals/

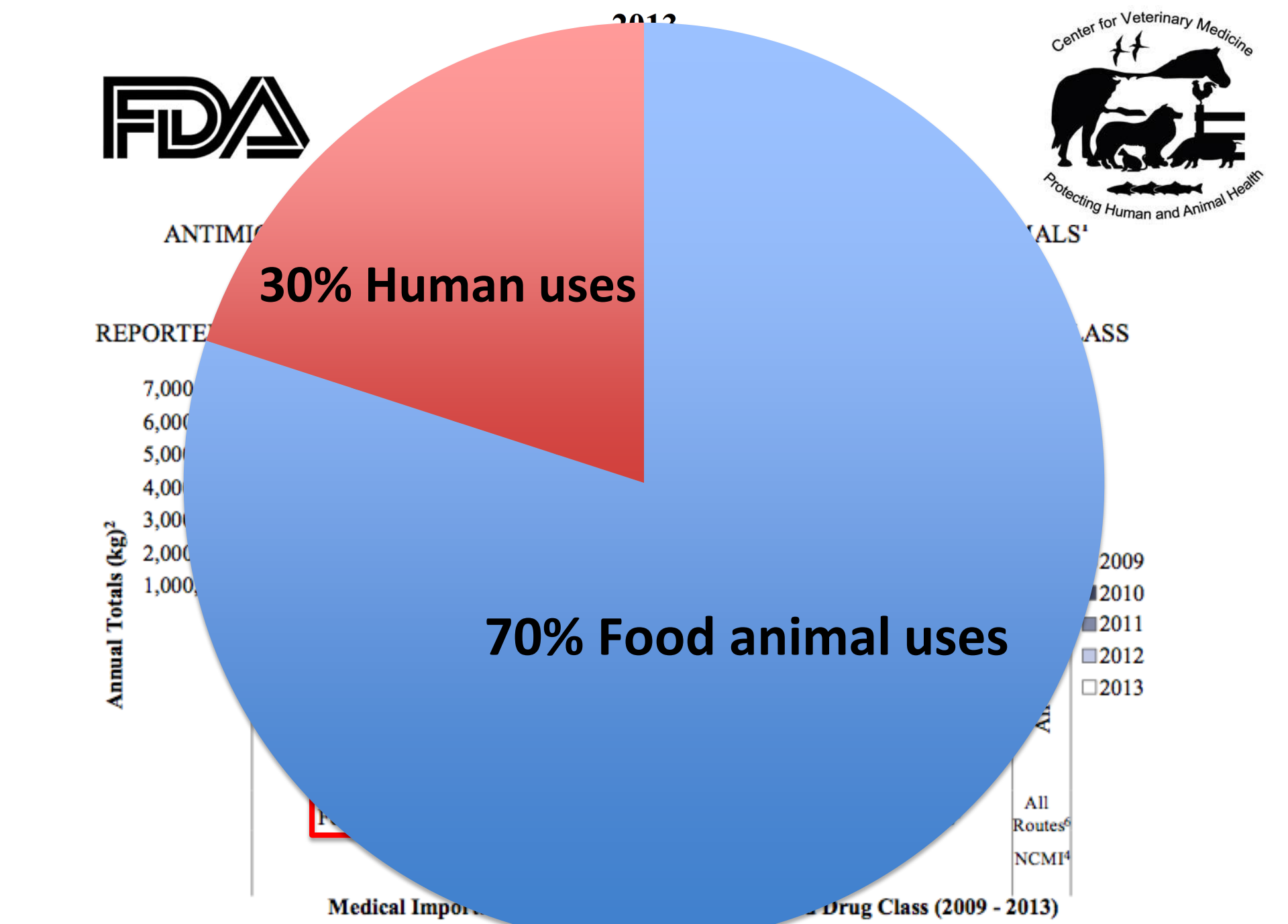


1 Dot = 20,000 Hogs and Pigs

0 100
Miles

United States Total
67,786,318

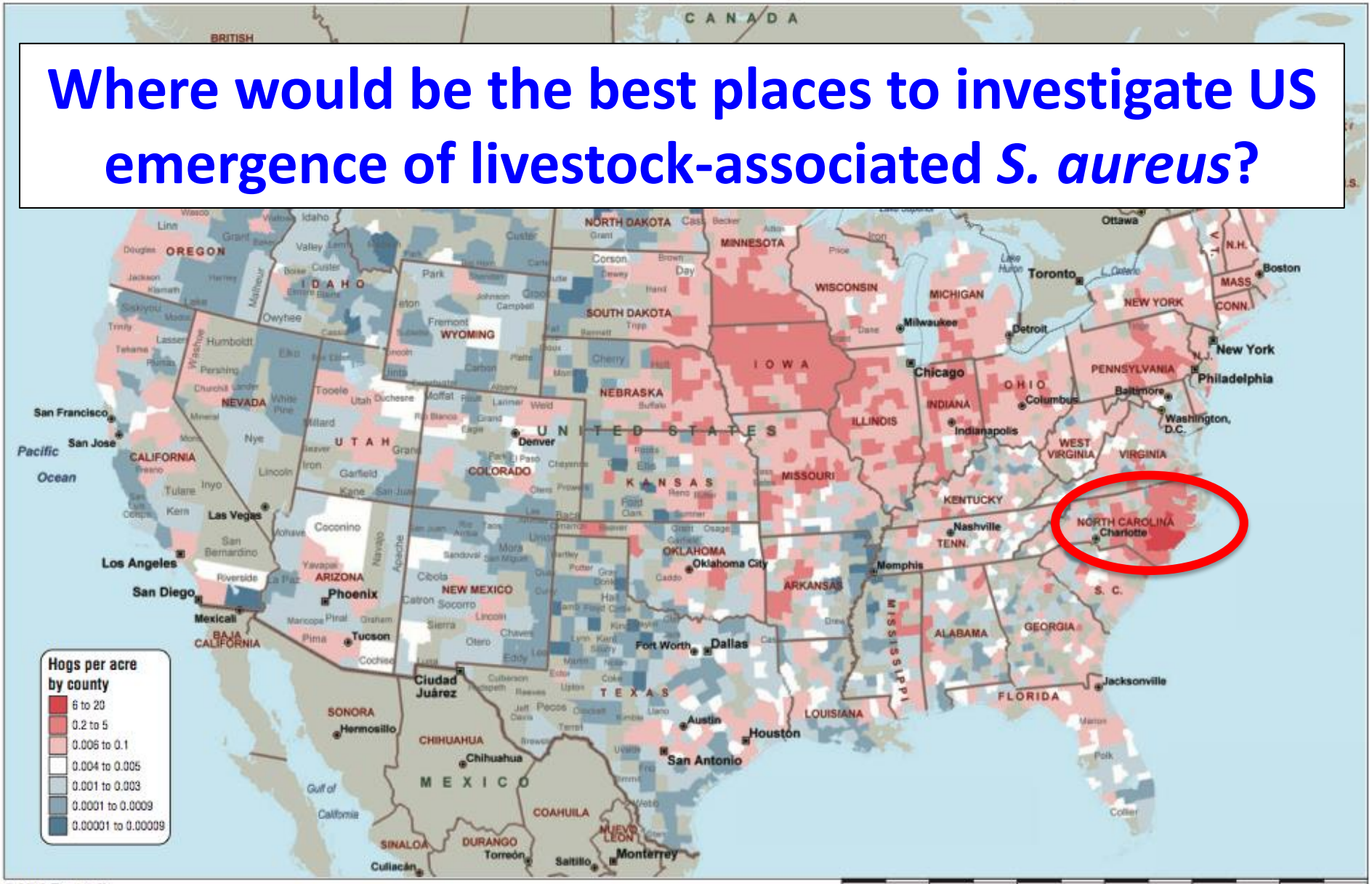
07-M149
U.S. Department of Agriculture, National Agricultural Statistics Service



http://www.fda.gov/downloads/ForIndustry/UserFees/AnimalDrugUserFeeActADUFA/UCM440584.pdf

Hog density by county

Where would be the best places to investigate US emergence of livestock-associated *S. aureus*?



This map plots the hog inventory per cropland acre by county based on data from the 2007 Census of Agriculture. County inventories of hogs were summed together before dividing by the number of acres in cropland production for each county for this map. The 10 most hog-dense counties included Duplin, N.C. (14.343 hogs per acre); Bladen, N.C. (11.499 hogs per acre); Sampson, N.C. (10.234 hogs per acre); Onslow, N.C. (7.290 hogs per acre); Pender, N.C. (7.163 hogs per acre); Greene N.C. (6.112 hogs per acre); Wayne, N.C. (4.054 hogs per acre); Jones, N.C. (3.885 hogs per acre); Lenoir, N.C. (3.267 hogs per acre), and Richmond, N.C. (2.963 hogs per acre).

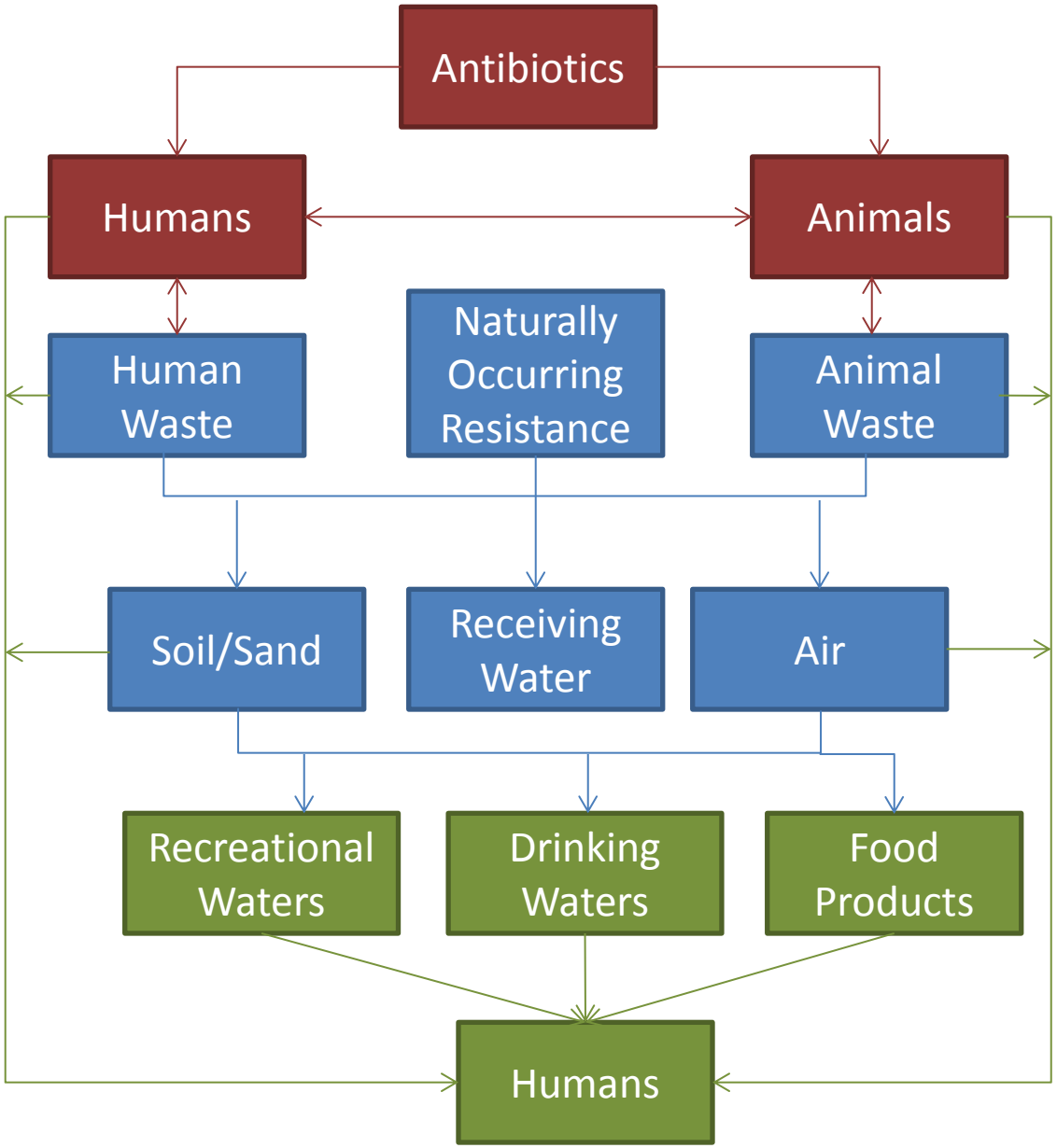
Concentrated Animal Feeding Operation - CAFO

http://www.nytimes.com/interactive/2016/10/09/magazine/big-food-photo-essay.html?_r=0


Potential for environmental & occupational exposure & infection

Spraying of hog lagoon waste in the rain
Source: Neuse River Foundation

Complex community exposure dynamics



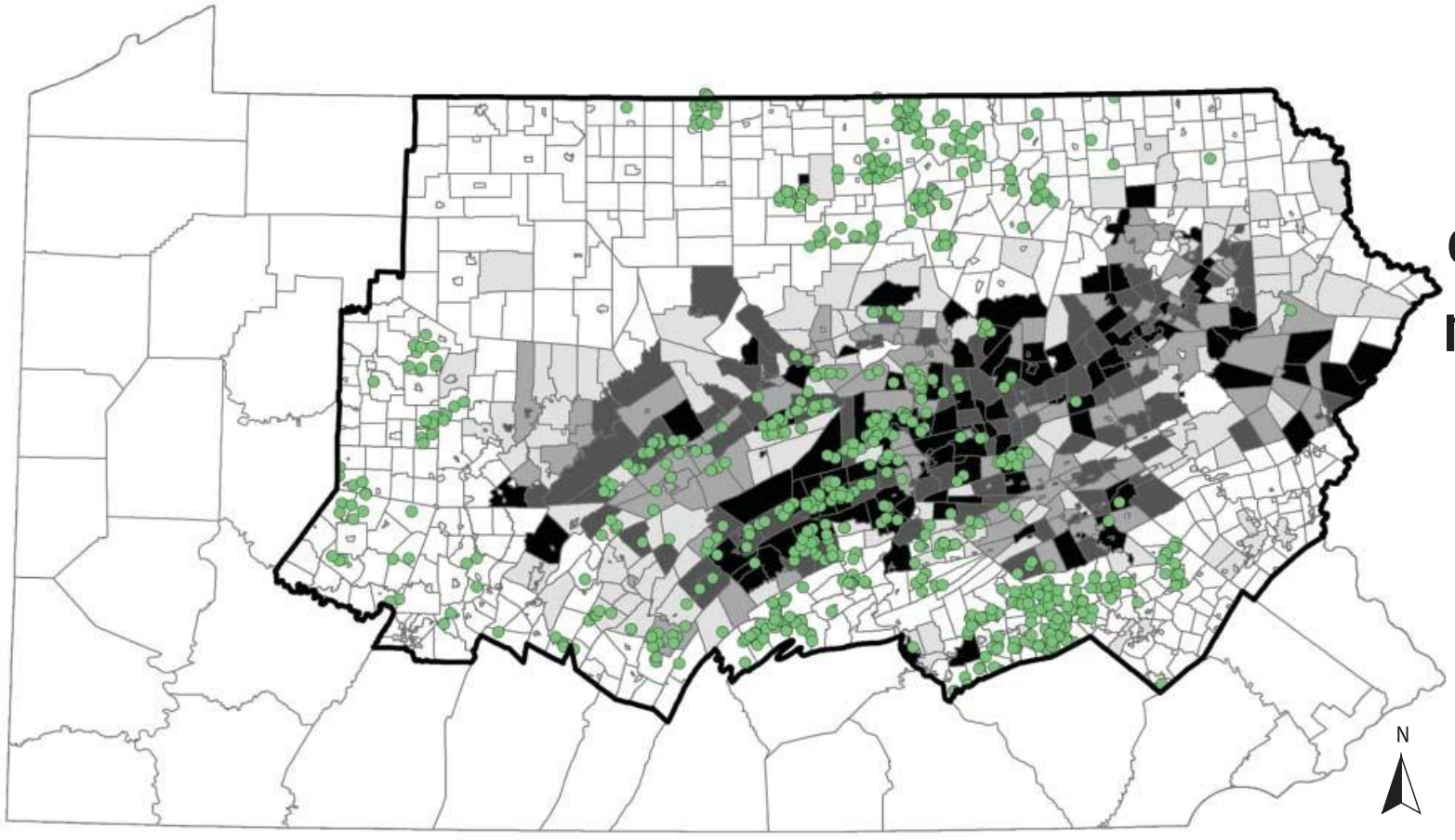
Antibiotic Use

Environmental Reservoirs of Resistance Elements

Human Exposures

Slide courtesy of Jill Stewart, PhD

Figure 1. Crop Field Locations and Methicillin-Resistant *Staphylococcus aureus* (MRSA) Rates



Origin

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Joan A.
Keeve E

CONCLUSIONS AND RELEVANCE Proximity to swine manure application to crop fields and livestock operations each was associated with MRSA and skin and soft-tissue infection. These findings contribute to the growing concern about the potential public health impacts of high-density livestock production.

Crop field locations and rates of MRSA per 1000 Geisinger Health System (GHS) primary care patients in townships, boroughs, and cities. Rates in communities with fewer than 50 GHS patients were not estimated. The map demonstrates that crop fields were often located in areas with a range of human population densities.

Human MRSA infections are associated with living proximal to swine CAFO manure land application crop fields.

But what are pathways of potential exposure for humans?

Can we study exposure & infection among frontline populations living near and/or working at swine CAFOs?

Exposure via surface water supplies proximal to swine CAFO lagoon waste spray fields

Science of the Total Environment 505 (2015) 487–493

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Occurrence of methicillin-resistant *Staphylococcus aureus* in surface waters near industrial hog operation spray fields

S.M. Hatcher [a], K.W. Myers [a,1], C.D. Heaney [a,b,f,2], J. Larsen [c], D. Hall [d], M.B. Miller [e], J.R. Stewart [a,*]

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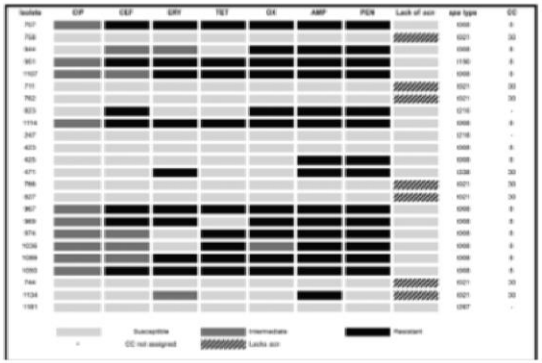
[b] Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health, 615 North Wolfe Street, Baltimore, Maryland 21205, United States
[c] Microbiology and Infection Control, Statens Serum Institute, 5 Artillerivej, 46/104, DK-2300 Copenhagen S, Denmark
[d] Rural Empowerment Association for Community Help, 2389 W. Wards Bridge Road, Warsaw, NC 28398, United States
[e] Department of Pathology and Laboratory Medicine, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7525, United States
[f] Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, 615 North Wolfe Street, Baltimore, Maryland 21205, United States

HIGHLIGHTS

- The presence of waterborne MRSA near industrial hog operations is unknown.
- We studied the presence of MRSA in surface water near industrial hog operations.
- We used a combination of culture, biochemical, and molecular confirmation methods.
- MRSA was detected in nine surface water samples.
- Both human and non-human origin *S. aureus* were present in surface water near lHOs.

GRAPHICAL ABSTRACT



Hepatitis E virus a
concentrated anim

Jennifer Gentry-Shields

HIGHLIGHTS

- Hepatitis E virus was detected
sample.
- Somatic coliphages were dete
98% of samples.
- F+ coliphages were detected in
samples.
- 21 F+ coliphage isolates (3%) we
phage, which all belonged to geno

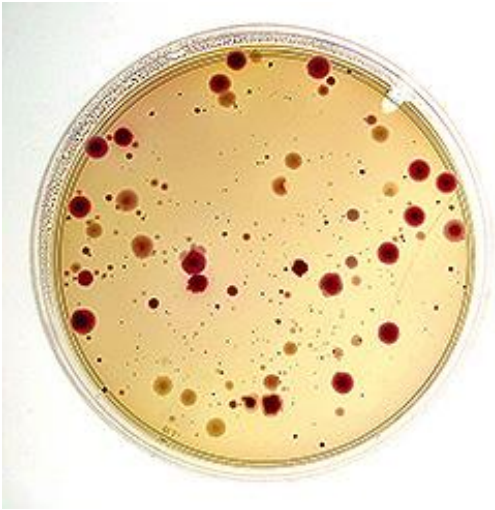
Source t
concent

Christoph

HIGHLIG

- We studied t
- Fecal indicat
- Swine-specifi
- Swine-specifi

Characterization of *S. aureus*



Are *mecA/mecC* genes present, cefoxitin resistant? ✓ MRSA

Is *scn* gene absent? ✓ Indicator of livestock adaption

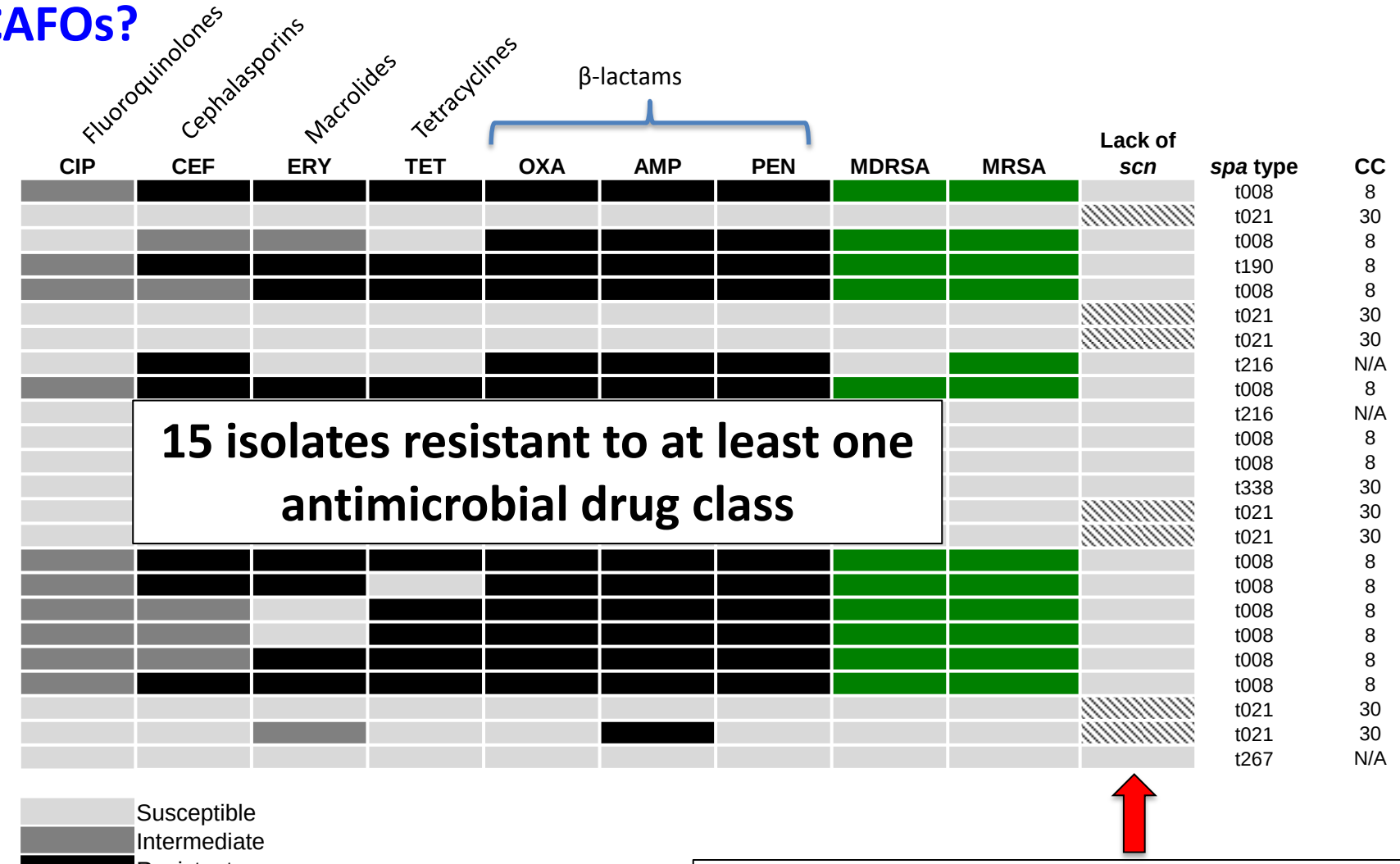
Is strain type CC398 or CC9? ✓ Indicator of livestock adaption

Is isolate resistant to tetracycline? ✓ Indicator of livestock adaption

Is isolate resistant to ≥3 classes of antibiotics? ✓ MDRSA

Slide courtesy of Maya Nadimpalli, PhD

Are drug-resistant *S. aureus* in surface waters proximal to swine CAFOs?



No resistance to gatifloxacin, gentamycin, levofloxacin, linezolid, rifampin, quinupristin, trimethroprim/sulfamexazole, or clindamycin

Slide courtesy of Sarah Hatcher, PhD

How many workers are there on the front lines?

- Estimates of US pop at risk:
  - In 2005, ~850,000 industrial food animal production workers[1]
  - ~54,000 with direct livestock contact[2]
- Operations are geographically concentrated in US
- Is gap in understanding of MRSA & MDRSA carriage in this pop in US

1. USDA-NASS. 2006a. Demographics: Farm labor. Washington, D.C.: USDA National Agricultural Statistics Service. Available at: http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1063. Accessed 6 September 2012.
2. Gray, G. et al., *Pandemic influenza planning: Shouldn't swine and poultry workers be included?* Vaccine, 2007. **25**(22): p. 4376-4381.

Challenge: Context and community dynamics of livestock production work in NC

Eastern North Carolina:

- Rural, diverse racial/ethnic pop's, low-income
- Populations have a high distrust of medical/health research
- Little industry/employer cooperation with public health research
- No union or other organizing/representation
- Lack of healthcare
- Workers are in an extremely vulnerable position

Central challenge:

How can we engage livestock workers to improve knowledge about questions transmission dynamics and persistence of zoonotic infectious diseases?

How to build evidence base?

Partnership with community

- **Community-based participatory research (CBPR)**
  - **Overcoming barriers together to build the evidence base**

- **Rural Empowerment Association for Community Help** (REACH) in Duplin County, North Carolina www.duplinreach.org
  - "Hog capitol of the world"

- In addition to environmental health education, REACH provides diverse social and community-building services for industrial hog operation workers and other community members in rural eastern North Carolina

REACH partners at NC Legislature

OPEN ACCESS Freely available online

Livestock-Associated Methicillin a
Staphylococcus aureus Is Present
Antibiotic-Free Livestock Operatio
Carolina

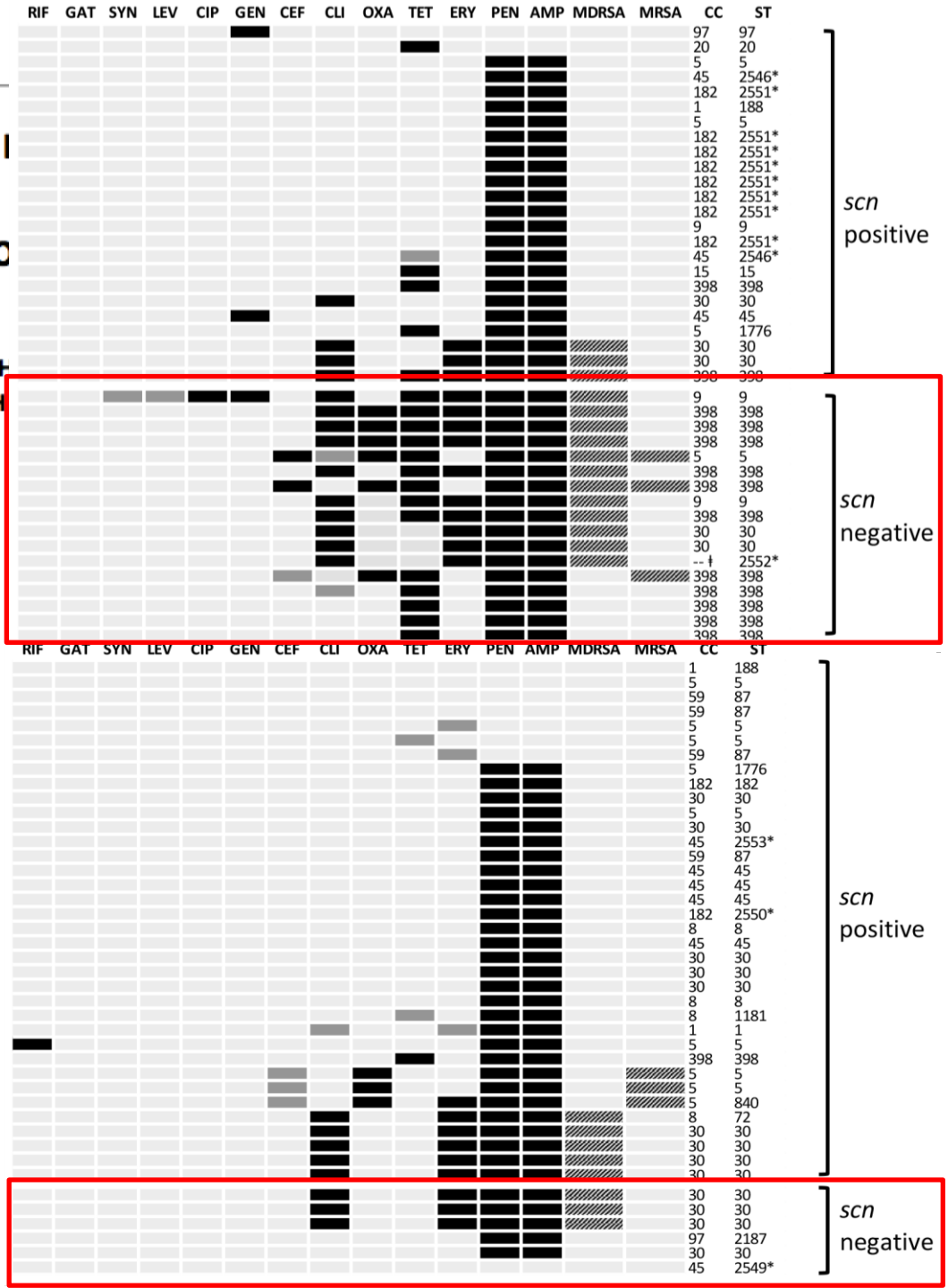
Jessica L. Rinsky[1☯], Maya Nadimpalli[2☯], Steve Wing[1], Devon H
Jesper Larsen[5], Marc Stegger[5], Jill Stewart[2], Christopher D. H

CAFO exposure group

■ Resistant ■ Intermediate Resistance □ Susceptible

Antibiotic-free livestock operation exposure group

■ Resistant ■ Intermediate Resistance □ Susceptible



Rinsky et al., PLOS ONE 2013.

What conclusions can be drawn based on cross-sectional study among NC livestock workers?

- Similar proportion of carriage of *S. aureus* and MRSA in CAFO and AFLO groups – but *S. aureus* and MRSA appear to be different between groups
- Greater proportion of MDRSA among CAFO vs. AFLO group participants
  - Despite traditional *S. aureus* risk factors being more prevalent in AFLO group
- Livestock-associated *S. aureus* make up a large proportion of MRSA and MDRSA isolates found among the CAFO exposure group
- Differences exist in the antibiotic resistance patterns observed for the industrial and antibiotic-free participants (tet, in particular)

Who else is contributing to the evidence base in the U.S.?

Who is funding their research (and what are their findings)?

OPEN ACCESS Freely available online

PLOS ONE

Methicillin-Resistant *Staphylococcus aureus* in Pigs and Farm Workers on Conventional and Antibiotic-Free Swine Farms in the USA

Tara C. Smith[1]*, Wondwossen A. Gebreyes[2], Melanie J. Abley[2], Abby L. Harper[1], Brett M. Forshey[1], Michael J. Male[1], H. Wayne Martin[3], Bayleyegn Z. Molla[2], Srinand Sreevatsan[3], Siddhartha Thakur[4], Madhumathi Thiruvengadam[3], Peter R. Davies[3]

"MRSA-positive pigs and people were clustered in four conventional swine farms in Iowa and Illinois…"

"The relatively low prevalence of MRSA we observed among conventional herds confirms that routine antimicrobial use in pigs is not a sufficient cause for emergence of LA-MRSA."

What result is not reported? LA-MRSA was not detected on any ABF farms in the study

Abstract

Staphylococcus aureus (LA-MRSA). This study aimed to investigate the occurrence and prevalence of MRSA in general and LA-MRSA in particular in pigs and farm workers in five states. We collected nasal swabs from pigs and farm workers at 45

"The high prevalence of MRSA reported on an ABF herd in Canada suggests that exposure to antimicrobials is also not a necessary condition for the occurrence of LA-MRSA in pigs."

variant, was predominant among both human and swine isolates. These results confirm the presence of LA-MRSA in pigs and swine farm workers in the USA, but the prevalence found is relatively low compared with European studies

"A substantial obstacle to conducting this study was difficulty in recruiting farms.

Citation: Smith TC, Gebreyes WA, Abley MJ, Harper AL, Forshey BM, et al. (2013) Methicillin-Resistant *Staphylococcus aureus* in Pigs and Farm Workers on Conventional and Antibiotic-Free Swine Farms in the USA. PLoS ONE 8(5): e63704. doi:10.1371/journal.pone.0063704

Funded under grants 08-178, 08-179, and 08-180 from the National Pork Board

Funding: Funded under grants 08–178, 08–179, and 08–180 from the National Pork Board (http://www.pork.org/Home.aspx#.UBgPJ7pCN8E). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: TS is a PLOS ONE Editorial Board member. This does not alter the authors' adherence to all the PLOS ONE policies on sharing data and materials.

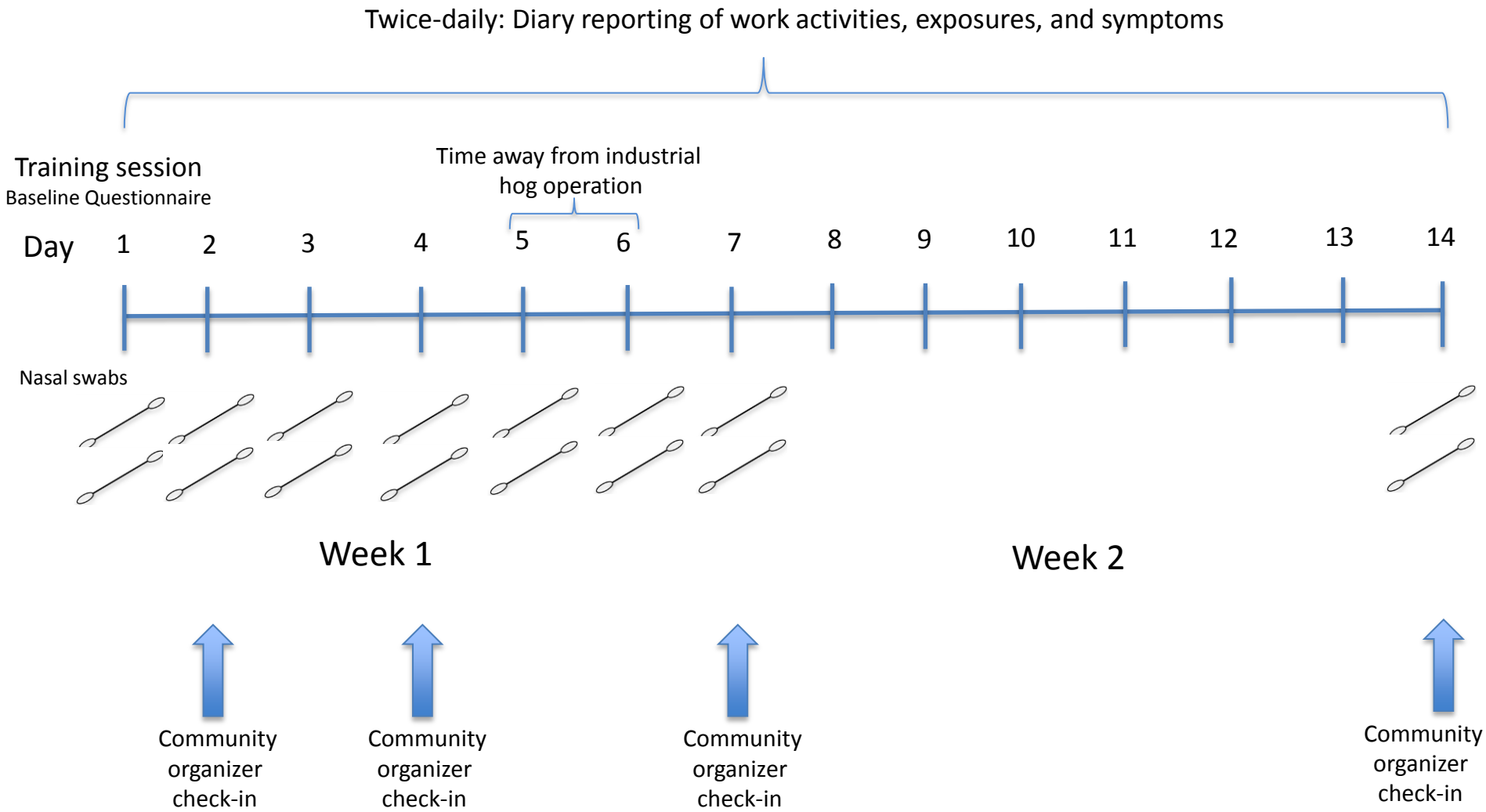
* E-mail: tara-smith@uiowa.edu

What about temporality of *S. aureus* exposure?

Among industrial hog operation (IHO) workers

- Without access to the workplace, how can we advance causal inference about livestock-associated *S. aureus* exposure dynamics?
- Exploit temporality of transient occupational exposure windows
- Use time since last industrial hog operation (IHO) work shift to:
  - Examine persistence of exposure measures when IHO workers have time off
  - Repeated-measures (panel study design)

14 day pilot study of 22 industrial hog operation workers



Occupational and Environmental medicine

BMJ

ORIGINAL ARTICLE

Persistence of livestock-associated antibiotic-resistant *Staphylococcus aureus* among industrial hog operation workers in North Carolina over 14 days

Maya Nadimpalli,[1] Jessica L Rinsky,[2] Steve Wing,[2] Devon Hall,[3] Jill Stewart,[1] Jesper Larsen,[4] Keeve E Nachman,[5,6,7] Dave C Love,[5,6] Elizabeth Pierce,[1] Nora Pisanic,[6] Jean Strelitz,[2] Laurel Harduar-Morano,[2] Christopher D Heaney[6,8]

Nadimpalli M, *et al*. *Occup Environ Med* 2014;**0**:1–10. doi:10.1136/oemed-2014-102095

What this paper adds

- While cross-sectional studies have examined prevalence of nasal carriage of antibiotic-resistant *Staphylococcus aureus* of livestock origin among industrial hog operation workers, no studies to date have assessed persistence of carriage of these bacteria among workers in the USA.
- We found that nearly half (45.5%) of the 22 industrial hog operation workers who participated were persistent carriers of livestock-associated *S. aureus* over a 14-day period, which included up to 96 h away from work.
- Persistent carriers of livestock-associated *S. aureus* included six persistent carriers of livestock-associated multidrug-resistant *S. aureus* and one persistent carrier of livestock-associated methicillin-resistant *S. aureus*.
- Our findings in this occupational setting are of interest because persistent nasal carriage of *S. aureus* has previously been associated with increased risk of infection in clinical settings.

The New York Times

SCIENCE

Taking a Health Hazard Home

By STEPHANIE STROM SEPT. 15, 2014

If IHO workers can take antibiotic-resistant *S. aureus* home, what are the exposure implications for their household members?

Are children at unique risk of exposure?

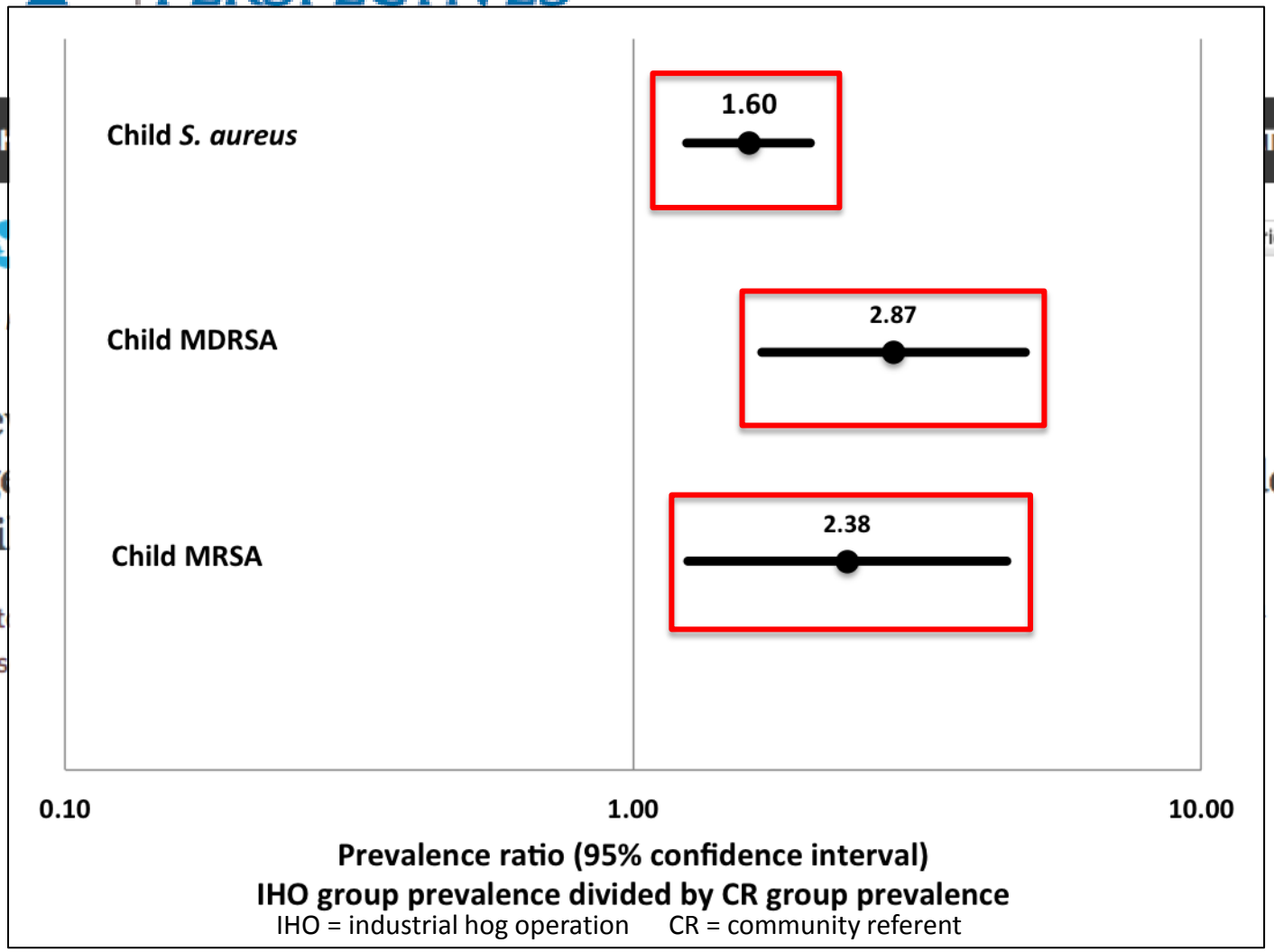
ehp ENVIRONMENTAL HEALTH PERSPECTIVES

RESEARCH

Environ Health

The Pre
Carriage
and Chi

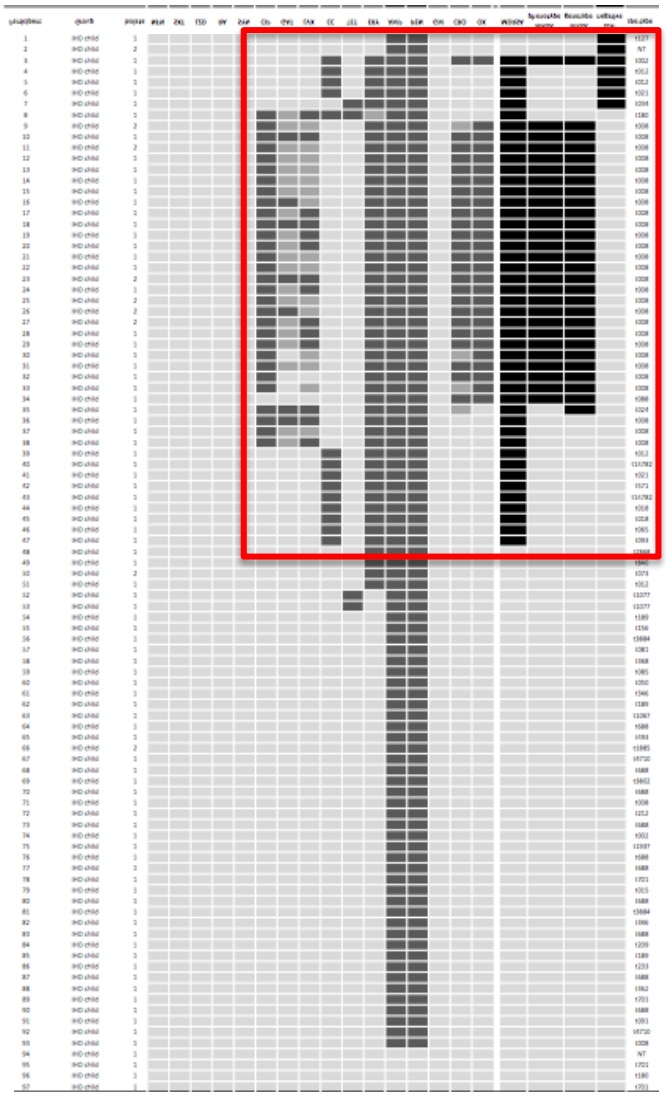
Sarah M. Hat
Amanda Kros



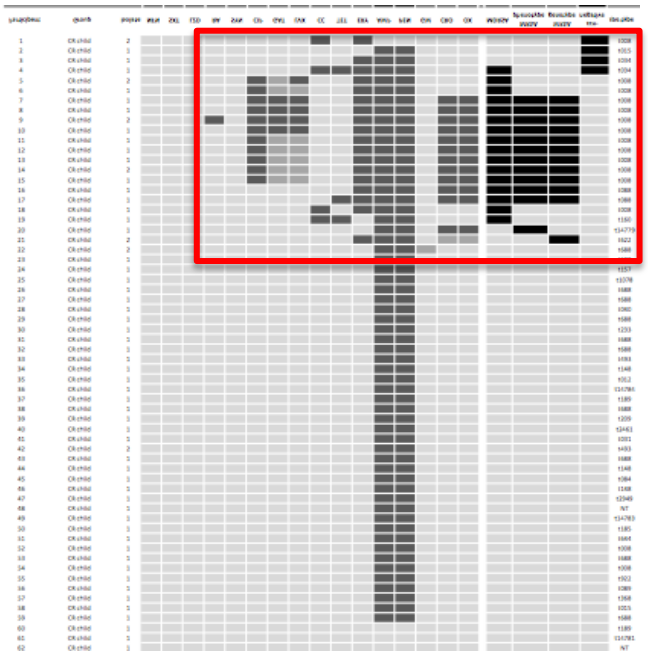
http://dx.doi.org/10.1289/EHP35

IHOs and children's antibiotic-resistant (ABR) *S. aureus* exposure

IHO children



Community referent children

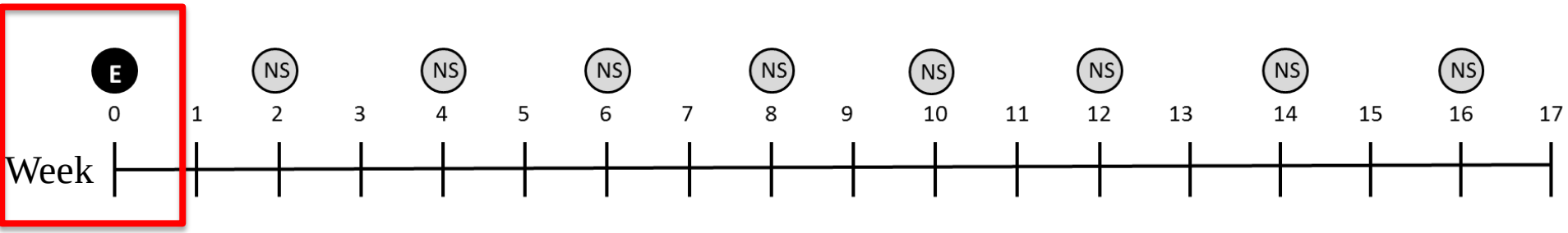


http://dx.doi.org/10.1289/EHP35

Is nasal carriage related to adverse health outcomes among IHO workers and their household contacts?

Larger IHO worker cohort with 4 mo. of follow-up

103 industrial hog operation workers
80 household contacts (26 adults, 54 minors)



E Enrollment session, baseline questionnaires completed and nasal swabs collected

NS Nasal swabs collected and bi-weekly questionnaire completed

1,459 nasal swabs collected

183 nasal swabs collected at baseline

M Nadimpalli et al. **Livestock-associated, antibiotic-resistant *Staphylococcus aureus* nasal carriage and recent skin and soft tissue infection among industrial hog operation workers.** PLOS ONE. 2016.

Symptoms of skin & soft tissue infection

Participants reported:

Symptoms of skin and soft tissue infection in prior 3 months

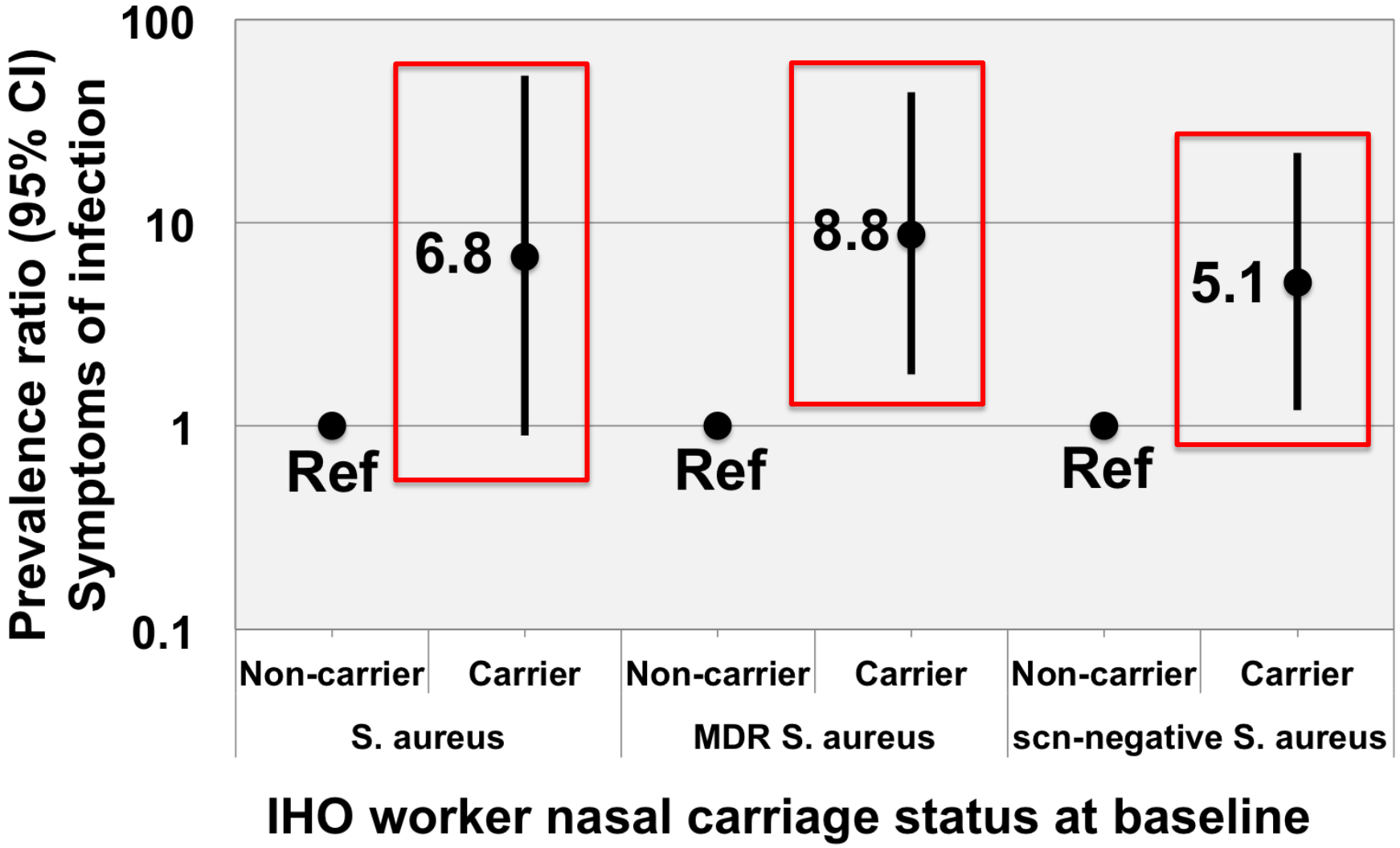
Doctor-confirmed *S. aureus* infections in past three months

Despite small numbers, this is the first time symptoms of SSTI have been reported in this NC study population.

Participant type	Number who reported SSTI	Doctor-confirmed infections
Worker (N=103)	6 (5.8%)	1 (1%)
Minor (N=54)	6 (11%)	1 (2%)

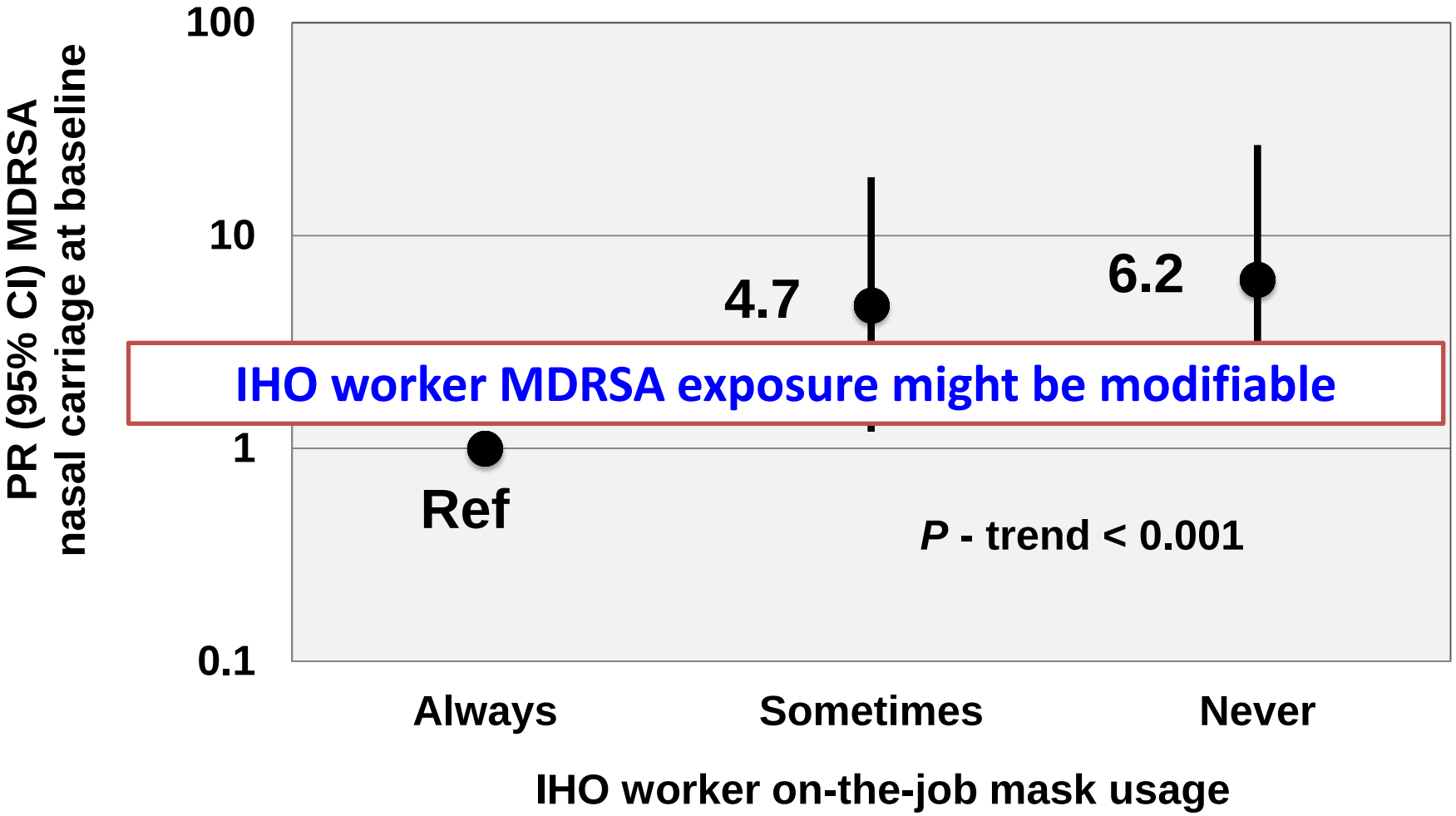
M Nadimpalli et al. **Livestock-associated, antibiotic-resistant *Staphylococcus aureus* nasal carriage and recent skin and soft tissue infection among industrial hog operation workers.** PLOS ONE. 2016.

Association between baseline *S. aureus* nasal carriage and symptoms of skin and soft tissue infection (SSTI) among IHO workers



M Nadimpalli et al. **Livestock-associated, antibiotic-resistant *Staphylococcus aureus* nasal carriage and recent skin and soft tissue infection among industrial hog operation workers.** In press, PLOS ONE.

Not wearing a protective face mask is associated with IHO worker MDRSA carriage



Current state of US evidence base

Antimicrobial use in livestock and human health

- Is there sufficient evidence to warrant policy change?
  - At individual worker level: PPE/mask usage
  - At facility level: Ban of non-therapeutic antimicrobial use in livestock production
  - Herd stocking density & sanitation conditions
- Or is further research needed?
  - What are the remaining knowledge gaps?
  - Who will fill them?

Current state of US evidence base

Antimicrobial use in livestock and human health

- Understand triggers of physiologic symptoms and *S. aureus* infection following CAFO work exposure
  - Complex mixture of pathogens, AMR resistance genes, bioaerosols, chemicals
- Build tools to assess subclinical immunologic shifts to advance understanding of individuals' susceptibility:
  - What pushes non-carriers → carriers?
  - What pushes carriers → physiologic symptoms?
  - What pushes carriers → frank infection?
- Who clears *S. aureus* after exposure and why?
  - Pathogen characteristics (whole-genome sequencing)
  - Disturbance of microbiota
  - Host immunity

Finally…

A self-critical perspective on rationalization as an early career scientist

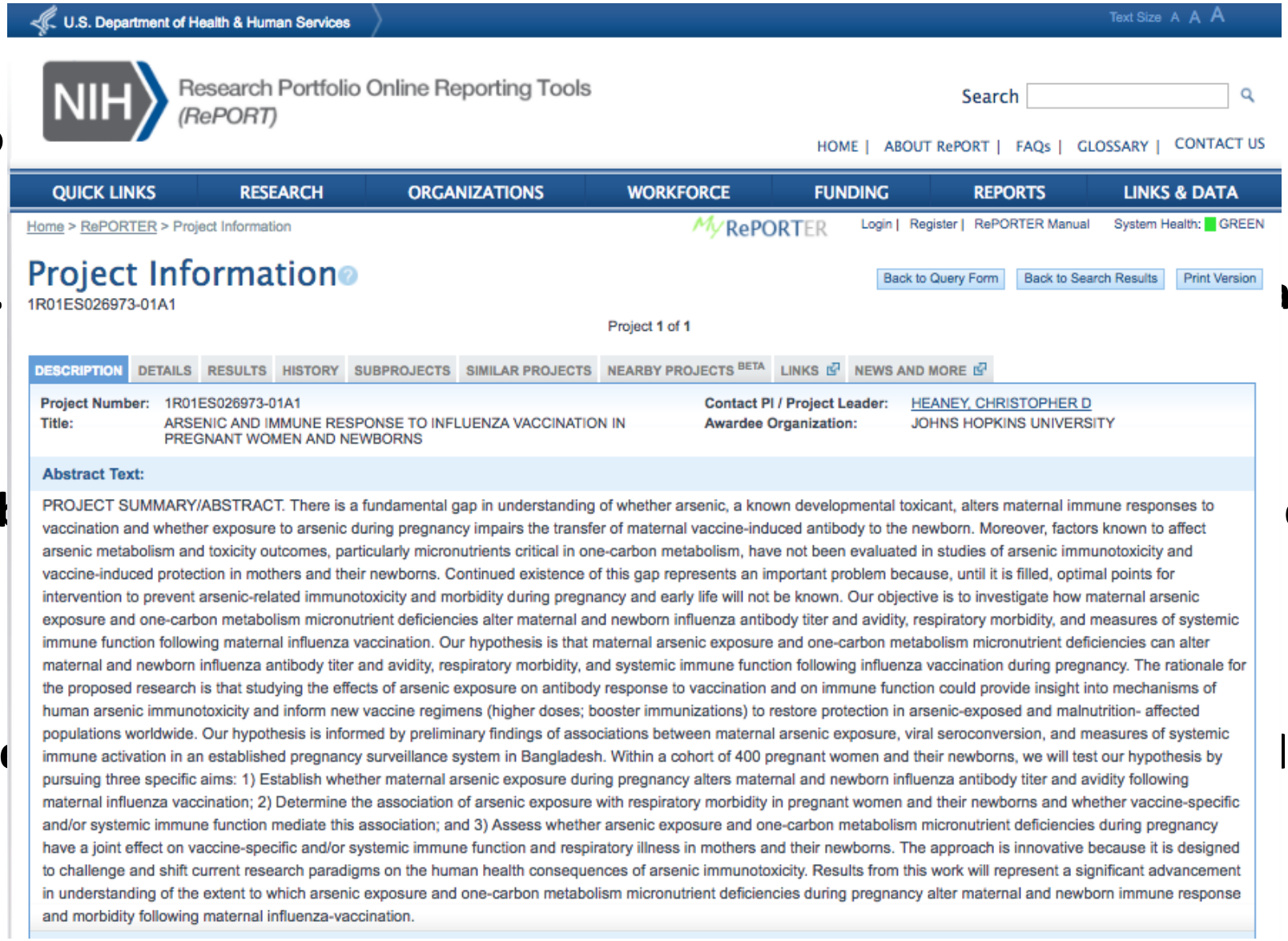
How to continue to walk the walk…

Some goals of an early career academic scientist

- Publish
- Get research funding
- Teach courses
- Contribute to professional practice
- Perform academic service
- Build a national reputation in field
- All in order to…?
- Get promoted and remain in academic field

How to do all this within a given institution's promotion timeline structure?

Every path is different…



U.S. Department of Health & Human Services

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Project 1 of 1

DESCRIPTION | DETAILS | RESULTS | HISTORY | SUBPROJECTS | SIMILAR PROJECTS | NEARBY PROJECTS BETA | LINKS | NEWS AND MORE

Project Number: 1R01ES026973-01A1
Title: ARSENIC AND IMMUNE RESPONSE TO INFLUENZA VACCINATION IN PREGNANT WOMEN AND NEWBORNS

Contact PI / Project Leader: HEANEY, CHRISTOPHER D
Awardee Organization: JOHNS HOPKINS UNIVERSITY

Abstract Text:

PROJECT SUMMARY/ABSTRACT. There is a fundamental gap in understanding of whether arsenic, a known developmental toxicant, alters maternal immune responses to vaccination and whether exposure to arsenic during pregnancy impairs the transfer of maternal vaccine-induced antibody to the newborn. Moreover, factors known to affect arsenic metabolism and toxicity outcomes, particularly micronutrients critical in one-carbon metabolism, have not been evaluated in studies of arsenic immunotoxicity and vaccine-induced protection in mothers and their newborns. Continued existence of this gap represents an important problem because, until it is filled, optimal points for intervention to prevent arsenic-related immunotoxicity and morbidity during pregnancy and early life will not be known. Our objective is to investigate how maternal arsenic exposure and one-carbon metabolism micronutrient deficiencies alter maternal and newborn influenza antibody titer and avidity, respiratory morbidity, and measures of systemic immune function following maternal influenza vaccination. Our hypothesis is that maternal arsenic exposure and one-carbon metabolism micronutrient deficiencies can alter maternal and newborn influenza antibody titer and avidity, respiratory morbidity, and systemic immune function following influenza vaccination during pregnancy. The rationale for the proposed research is that studying the effects of arsenic exposure on antibody response to vaccination and on immune function could provide insight into mechanisms of human arsenic immunotoxicity and inform new vaccine regimens (higher doses; booster immunizations) to restore protection in arsenic-exposed and malnutrition- affected populations worldwide. Our hypothesis is informed by preliminary findings of associations between maternal arsenic exposure, viral seroconversion, and measures of systemic immune activation in an established pregnancy surveillance system in Bangladesh. Within a cohort of 400 pregnant women and their newborns, we will test our hypothesis by pursuing three specific aims: 1) Establish whether maternal arsenic exposure during pregnancy alters maternal and newborn influenza antibody titer and avidity following maternal influenza vaccination; 2) Determine the association of arsenic exposure with respiratory morbidity in pregnant women and their newborns and whether vaccine-specific and/or systemic immune function mediate this association; and 3) Assess whether arsenic exposure and one-carbon metabolism micronutrient deficiencies during pregnancy have a joint effect on vaccine-specific and/or systemic immune function and respiratory illness in mothers and their newborns. The approach is innovative because it is designed to challenge and shift current research paradigms on the human health consequences of arsenic immunotoxicity. Results from this work will represent a significant advancement in understanding of the extent to which arsenic exposure and one-carbon metabolism micronutrient deficiencies during pregnancy alter maternal and newborn immune response and morbidity following maternal influenza-vaccination.

Livestock production, antimicrobial use & resistance, & human health

Antimicrobial resistant *E. coli* before and after CA Senate Bill 27 (ARES): A natural experiment (1R01AI130066-01A1)

Senate Bill No. 27

CHAPTER 758

An act to add Chapter 4.5 (commencing with Section 14400) to Division 7 of the Food and Agricultural Code, relating to livestock.

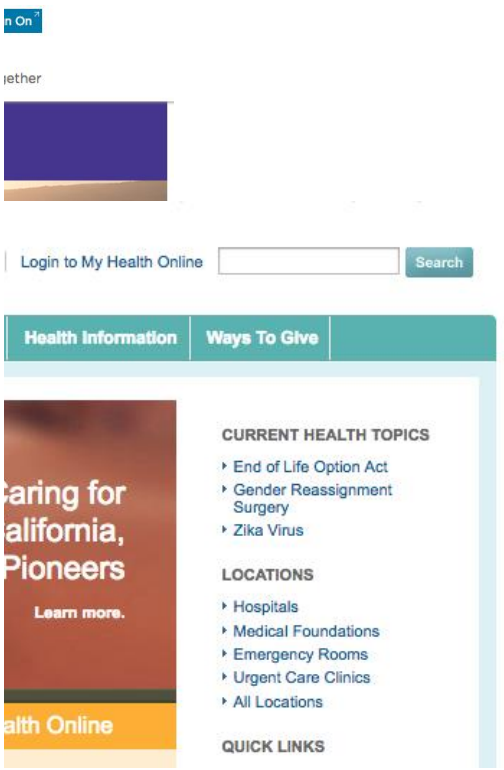
[Approved by Governor October 10, 2015. Filed with Secretary of State October 10, 2015.]

LEGISLATIVE COUNSEL'S DIGEST

SB 27, Hill. Livestock: use of antimicrobial drugs.

(1) Existing law regulates the distribution and use of livestock drugs, as defined, by the Secretary of Food and Agriculture. Existing law also requires a person to obtain a license from the secretary to manufacture, sell, distribute, or store commercial feed, including commercial feed containing drugs.

This bill would, beginning January 1, 2018, prohibit the administration of medically important antimicrobial drugs, as defined, to livestock unless ordered by a licensed veterinarian through a prescription or veterinary feed directive pursuant to a veterinarian-client-patient relationship, as specified, and would prohibit the administration of a medically important antimicrobial drug to livestock solely for purposes of promoting weight gain or improving feed efficiency. The bill would require the Department of Food and Agriculture, in consultation with the Veterinary Medical Board, the State Department of Public Health, universities, and cooperative extensions, to develop antimicrobial stewardship guidelines and best management practices on the proper use of medically important antimicrobial drugs and would require the department to gather information on medically important antimicrobial drug sales and usage, antimicrobial resistant bacteria, and livestock management practice data. The bill would require information provided pursuant to those provisions to be held confidential, as specified. The bill would authorize the department to request and receive copies of veterinary feed directives from certain persons to implement the bill's provisions. The bill would make a first violation of the bill's provisions subject to a civil penalty of up to $250 for each day a violation occurs, and would make second and subsequent violations subject to an administrative fine of $500 for each day a violation occurs, except as specified.



Pathogenicity of livestock-associated vs. community-associated *S. aureus*

Mous
skin a
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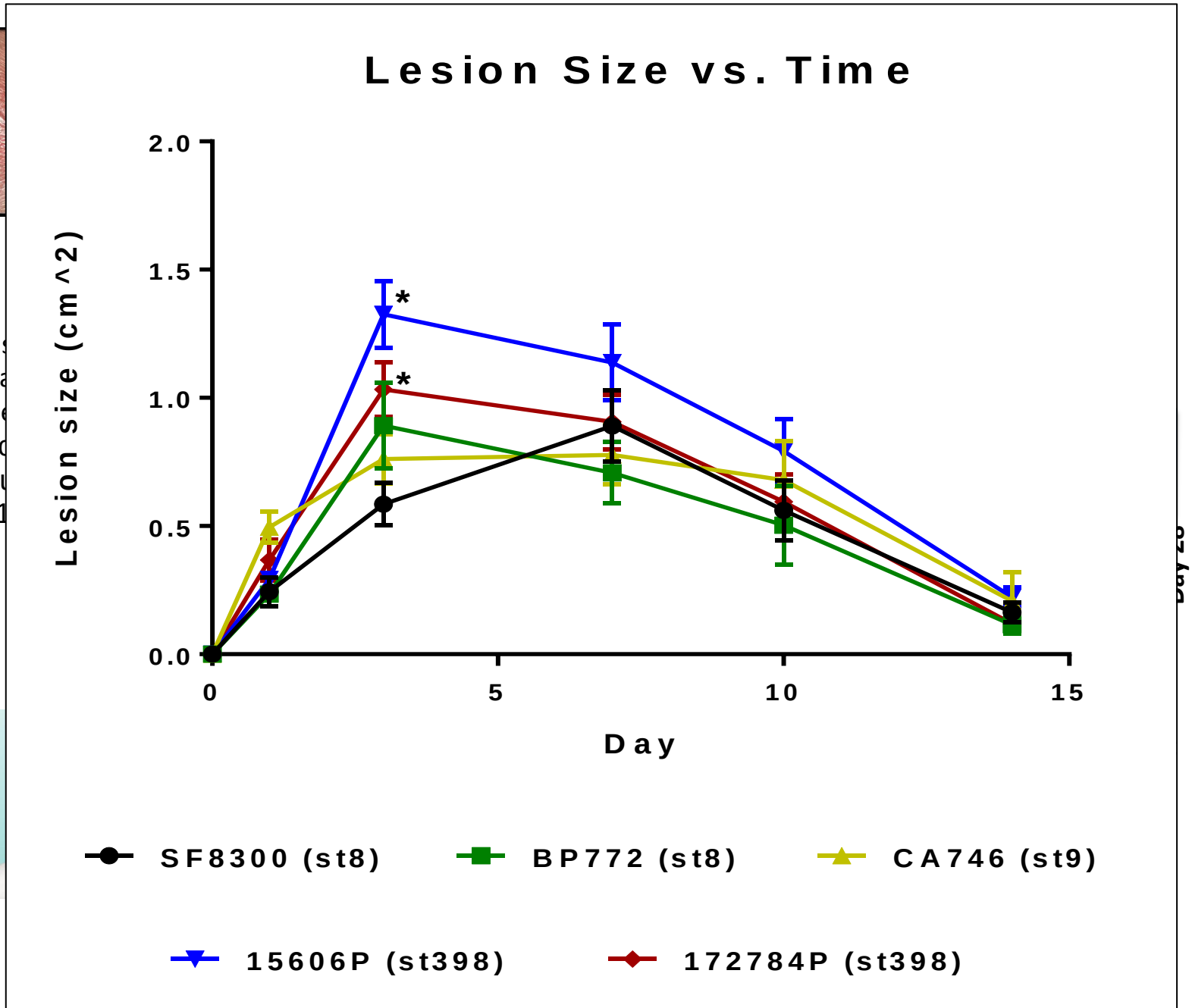


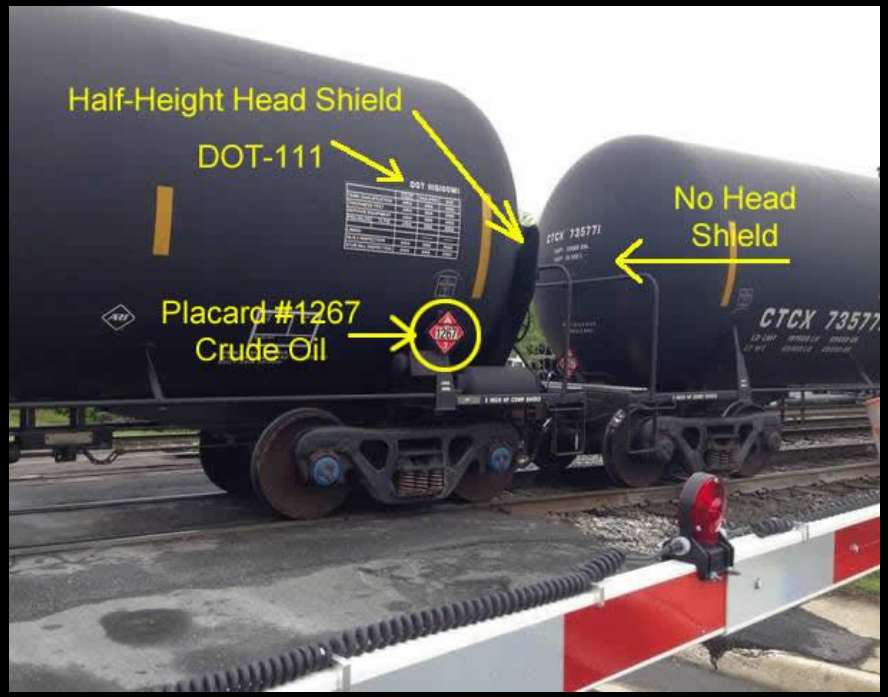
2nd year of Steve's class replicated at JHSPH

Environmental justice: Concepts, methods, and practice

Research partnership with South Baltimore's Curtis Bay Community

Systems framework to estimate and reduce the societal costs of solid waste disposal in Baltimore

Slide courtesy of students Irena Gorski & Cordelia Hao



Research partnership with Baltimore City neighbors of crude oil by rail transport lines

Assessing potential exposure & health outcomes

Slide courtesy of course student Rachel Viqueira

Acknowledgements

- Johns Hopkins University
  - Trish Perl, Barbara Detrick, Alan F. Scott, David Mohr, Karen Carroll, Kenrad Nelson, Nora Pisanic, JHU Center for a Livable Future, JHU NIOHS ERC, Fisher Center for Environmental Infectious Diseases
- Rural Empowerment Association for Community Help, Duplin County, NC
  - Dothula Baron, Devon Hall, Victor Smith, Norma Mejia, Jennifer Hall, Ronald Hall, Cliff Smith
- North Carolina Environmental Justice Network
  - Naeema Muhammad
- North Carolina Riverkeepers & Waterkeepers
  - Rick Dove, Larry Baldwin
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  - Steve Wing, Alice Ammerman, Jill Stewart, Jessica Rinsky, Maya Nadimpalli, Sarah Hatcher, Alan Kinlaw, Rachel Kauffman, Kevin Chu, Jessica Richardson, Courtney Sanford, UNC NIOSH ERC
- UNC Hospitals & School of Medicine
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- George Washington University
  - Lance Price
- Statens Serum Institut
  - Robert Skov, Jesper Larsen, Marc Stegger

Funding support from the Sherrilyn and Ken Fisher Center for Environmental Infectious Diseases, Division of Infectious Diseases of the Johns Hopkins University School of Medicine; NIOSH K01; Pilot Awards from the Johns Hopkins NIOSH ERC & UNC NIOSH ERC; E.W. “Al” Thrasher Research Fund Award; Center for a Livable Future Directed Research Grant; NSF Ecology and Evolution of Infectious Disease Program

Thank you.
Questions?

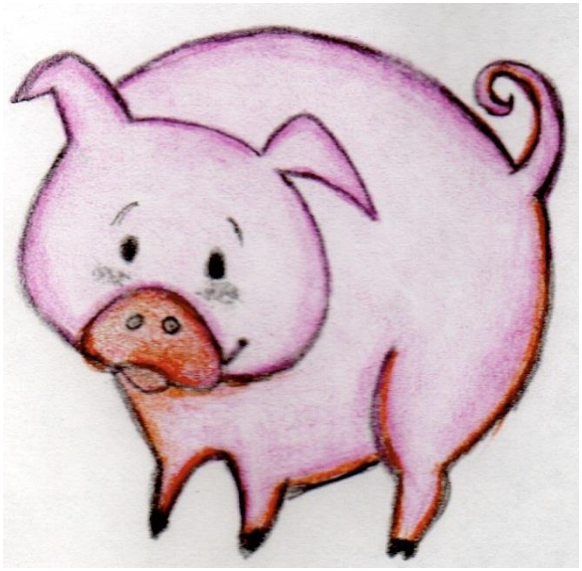

Photo credits:
Schmidt CW 2009. Swine CAFOs & Novel H1N1 Flu: Separating Facts from Fears. Environ Health Perspect 117:A394-A401. http://dx.doi.org/10.1289/ehp.117-a394
Gillings Sustainable Agricultural Project, UNC Gillings School of Global Public Health. http://gillingsproject.wordpress.com/about/
Definition of MRSA, Centers for Disease Control and Prevention. http://www.cdc.gov/mrsa/definition/index.html
Neuse River Foundation, North Carolina.