

Self-Reported Psychological Stress and Prevalence of Methicillin-Resistant Staphylococcus Aureus Nasal Carriage among Beef Meatpacking Workers in Nebraska

Kirsten Brownstein

January 14, 2013

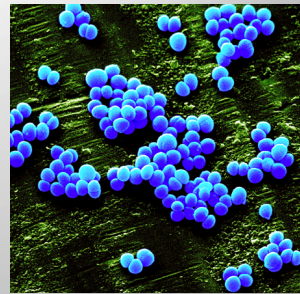
The George Washington University

School of Public Health and Health Services

Department of Environmental and Occupational Health

MRSA

- Pathogenic bacteria resistant to beta-lactam antimicrobials
- 1.5% prevalence of MRSA colonization
- Public health impact (CDC, 2010)
 - 82,042 infections
 - 11,478 deaths
- MRSA types
 - HA-MRSA (1960s)
 - CA-MRSA (1990s)
 - **Livestock-associated MRSA** (2000s)



LA-MRSA, Occupational Risk and Stress

- Prevalent in various food producing animals
- Occupational groups at risk:
 - Farmers (pig/veal calf/cattle)
 - Veterinarians
 - Slaughterhouse personnel
- Risk factors for transmission
 - Contact w/animals and animal byproducts
 - Workplace environmental contamination
 - Presence of skin-breaking wounds and infections
 - Stress???
- Biological stress response linked with immune suppression
- Stress factors associated with increased:
 - Infection susceptibility
 - Symptom severity
 - Illness duration
 - Pathogen carriage
- Psychological stressors in the slaughterhouse
 - Animal slaughter
 - Long work hours
 - Discrimination
 - Line speed
 - High workload
 - Low task variety



Study Aims and Hypotheses

Primary aim:

To examine association between self-reported psychological stress and MRSA colonization and infection risk among beef meatpackers in NE

Hypothesis:

Higher self-reported psychological stress will be associated with increased risk of MRSA carriage and infection




Secondary aim:

To examine the association between occupational factors (job category and hours worked per week) and self-reported psychological stress among beef meatpackers in NE

Hypothesis:

Kill floor work and working >40 hrs/wk will be associated with higher self-reported psychological stress

Methods

- Study design: cross-sectional survey (GWU IRB approval)
- Study population: 2000 member unionized workforce at NE beef meatpacking plant
- Subject recruitment:
 - convenience sample of 137 workers
 - Four-day enrollment at union Local office
 - Inclusion criteria: current plant employee, ≥ 18 y/o
 - Exclusion criterion: past 3 month travel outside U.S.
- Data collection: nasal swabs and questionnaires
 - Sociodemographic variables
 - Potential confounders
 - Occupational factors
 - Kessler 6-Item Psychological Distress Scale (K6)

Methods: K6 and Psychological Assessment

- Reliable, validated screen for significant psychological distress (SPD)

Stress symptoms

Nervous
 Hopeless
 Restless or fidgety
 So sad that nothing could cheer you up
 That everything was an effort
 Worthless

Past month prevalence

“.....of the time”
 (0) None
 (1) A little
 (2) Some
 (3) Most
 (4) All

- Prevalence scores summed across symptoms (0-24)
- Total K6 score >12 = SPD

Methods: Statistical Analysis

- Descriptive statistics
- Shapiro-Wilk test for normality (*age, work hrs/wk, K6 score*)
- Mann-Whitney U-test for median K6 score differences
- Relative risk comparisons to test associations between all other main outcome and effects (*95% CIs, exact p-values*)

Main outcome variables

S. aureus carriage (Y/N)
 MRSA carriage (Y/N)
 SPD [K6 score > 12] (Y/N)
 Total K6 score (0-24)

Main effect variables

Kill floor worker (Y/N)
 Work hrs/week (≤ 40 vs > 40)
 SPD [K6 score > 12], (Y/N)
 Total K6 score (0-24)

Results: Descriptive Statistics

Characteristic	Total (n=137)	
	No.	(%)
Age ^a , y, mean \pm SD	44.1 \pm 11.0	
≤ 44	71	(52.2)
> 44	65	(47.8)
Sex		
Male	76	(55.5)
Female	61	(44.5)
Race		
White	10	(7.3)
Non-White [‡]	127	(92.7)
Work hrs/week, median (min-max)	40 (33.5-65)	
≤ 40	86	(62.8)
> 40	51	(37.2)
Job Category		
Pen floor	1	(0.7)
Kill floor	40	(29.2)
Cut floor	71	(51.8)
Box room	8	(5.8)
Shipping	5	(3.7)
Maintenance	2	(1.5)
Other	10	(7.3)

^aAge and smoking data missing for 1 subject

[‡]Among non-white subjects, 126 identified as Hispanic and 1 identified as Asian

Overall prevalence: K6 scores:

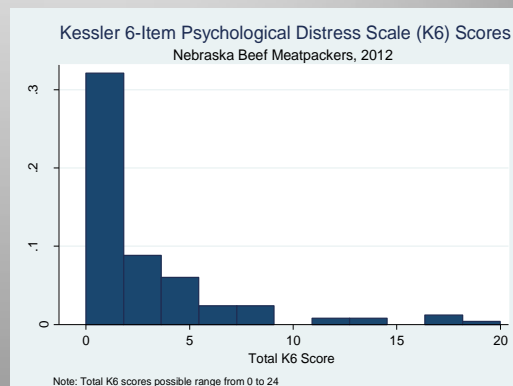
S.aureus: 26.3%

Median: 1

MRSA: 4.4%

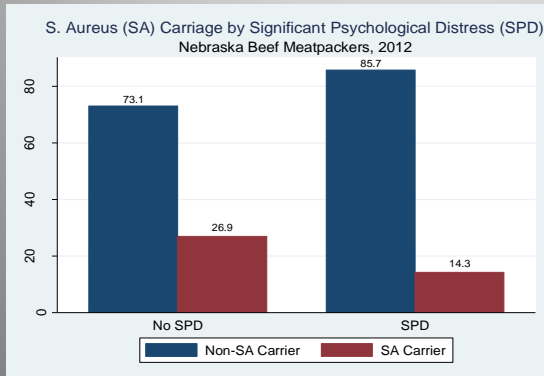
Range: 0-20

SPD: 5.1%



Results: *S.aureus* and Stress

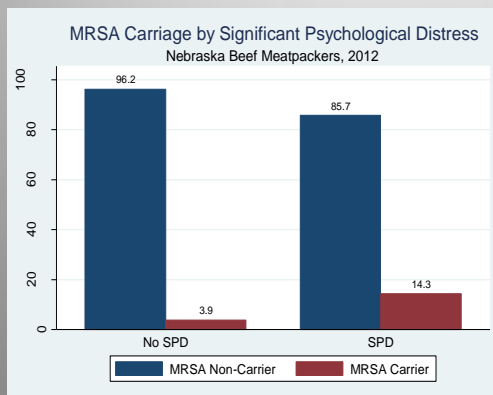
- SPD and K6 score were not associated with *S.aureus* carrier status



	SPD	No SPD
<i>S. aureus</i> Carrier	1	35
Non- <i>S.aureus</i> Carrier	6	95
Relative Risk = 0.53 (0.08, 3.33), p=0.68		

Results: MRSA and SPD

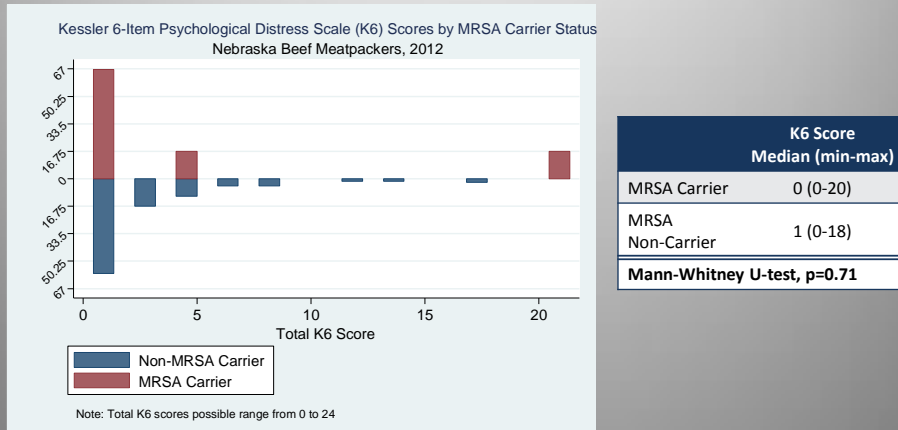
- SPD was not associated with MRSA carrier status



	SPD	No SPD
MRSA Carrier	1	5
Non-MRSA Carrier	6	125
Relative Risk = 3.71 (0.50, 27.66), p=0.27		

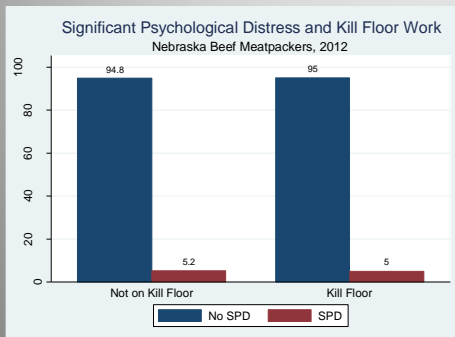
Results: MRSA and K6 Score

- K6 scores did not differ significantly by MRSA carrier status ($p=0.71$)



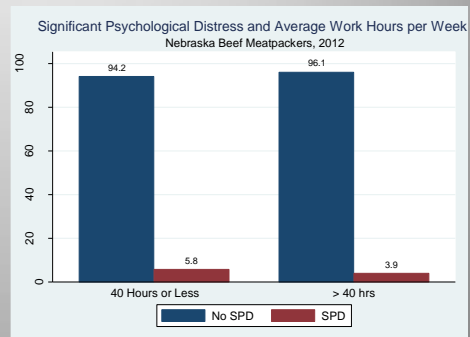
Results: Stress and Occupational Factors

- No significant associations with either SPD or K6 score
- Non-significant findings between work hours and SPD suggest a negative relationship



	Kill Floor	Non Kill Floor
SPD	2	5
No SPD	38	92

Relative Risk = 0.97 (0.20, 4.79), $p=1.00$

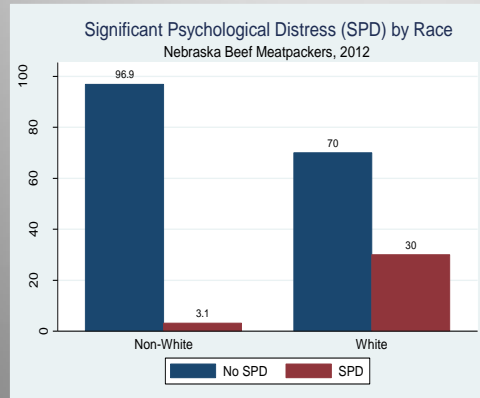


	> 40 hrs/week	≤ 40 hrs/week
SPD	2	5
No SPD	49	81

Relative Risk = 0.67 (0.14, 3.35), $p=1.00$

Results: SPD and Race

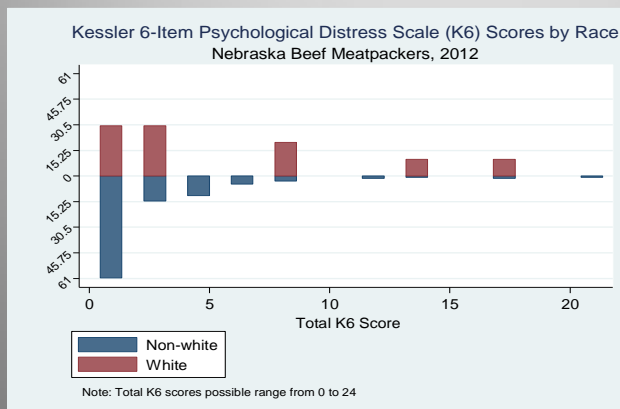
- Whites were more likely than non-whites to have SPD



	Whites	Non-Whites
SPD	3	7
No SPD	4	123
Relative Risk = 9.53 (2.47, 36.80), p=0.01		

Results: K6 Scores and Race

- White workers had statistically significant higher K6 scores than non-white workers



	K6 Score Median (min-max)
White	2 (0-18)
Non-White	1 (0-20)
Mann-Whitney U-test, p=0.05	

Discussion of Key Findings

- Beef meatpackers have elevated risk of MRSA nasal carriage and SPD compared to general population
- Higher psychological distress reported by whites
- No relationship between psychological distress and nasal colonization
- Kill floor work and work hours not related to psychological distress

Discussion of Limitations

- Small sample size
- Lack of control for confounders
- Selection bias – “healthy worker effect”
- Reporting bias – underreport of stress symptoms
- Misclassification of stress or carrier status
- Generalizability limited to unionized workforces in beef slaughter industry

Discussion: Strengths

- Novel investigation
- Source for hypothesis-generation
- Individual-level data
- Laboratory confirmation
- Union collaboration and support

Discussion: Recommendations

- Further investigation of the relationship between stress and colonization susceptibility
- Larger studies to characterize potential occupational stressors within the slaughterhouse working environment
- Better understanding of cultural bias for developing cross-culturally valid psychological assessment methods

Acknowledgments

- Dr. Jessica Leibler
- Dr. Jeanne Jordan and the Jordan lab
- Jackie Nowell at UFCW in Washington DC
- UFCW Local 22
- Dr. Lina Lander at University of Nebraska Medical Center
- Drs. Melissa Perry, Seung-Sup Kim, and Lance Price with the EOH Department



References

- Bratter JL, Eschbach K. Race/ethnic differences in nonspecific psychological distress: evidence from the National Health Interview Survey. *Soc Sci Q*. 2005;86(3):620-44.
- Campbell DS. Health hazards in the meatpacking industry. *Occup Med*. 1999;14(2):351-372.
- Centers for Disease Control and Prevention. 2010. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Methicillin-Resistant *Staphylococcus aureus*, 2010.
- Centers for Disease Control and Prevention/National Center for Health Statistics, National Health Interview Survey, January–June 2012, Sample Adult Core component.
- Emhan A, Yildiz AS, Bez Y, Kingir S. Psychological symptom profile of butchers working in slaughterhouse and retail meat packing business: a comparative study. *Kafkas Univ Vet Fak Derg*. 2012;18(2):319-322.
- Graveland H, Wagenaar JA, Heesterbeek H, Mevius D, van Duijkeren E, Heederik D. Methicillin resistant *staphylococcus aureus* ST398 in veal calf farming: Human MRSA carriage related with animal antimicrobial usage and farm hygiene. *PLoS One*. 2010;5(6):e10990. doi: 10.1371/journal.pone.0010990.
- Gorwitz RJ, Kruszon-Moran D, McAllister SK, et al. Changes in the prevalence of nasal colonization with *staphylococcus aureus* in the united states, 2001-2004. *J Infect Dis*. 2008;197(9):1226-1234. doi: 10.1086/533494.
- Holmes MA, Zadoks RN. Methicillin resistant *S. aureus* in human and bovine mastitis. *J Mammary Gland Biol Neoplasia*. 2011;16(4):373-382.
- Human Rights Watch. Blood, sweat, and fear: Workers' rights in U.S. meat and poultry plants. 2004.
- Juhász-Kaszanyitzky E, Janosi S, Somogyi P, et al. MRSA transmission between cows and humans. *Emerg Infect Dis*. 2007;13(4):630-632.

References

- Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med*. 2002;32(6):959-976.
- Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. *Arch Gen Psychiatry*. 2003;60(2):184-189.
- MacNair R. *Perpetration-induced traumatic stress: The psychological consequences of killing*. Westport, CT: Praeger Publishers; 2002.
- Manenschijn L, Jetten AM, van Wamel WJB, et al. Long-term cortisol levels are not associated with nasal carriage of *staphylococcus aureus*. *European Journal of Clinical Microbiology and Infectious Diseases*. 2011:1-4. Accessed 26 April 2012.
- Mooij TA, Jenkins J, Thijssen S. MRSA in calves. *Infectieziekten Bulletin*. 2007;18:234.
- Segerstrom SC, Miller GE. Psychological stress and the human immune system: A meta-analytic study of 30 years of inquiry. *Psychol Bull*. 2004;130(4):601-630.
- van Cleef BA, Graveland H, Haenen AP, et al. Persistence of livestock-associated methicillin-resistant *staphylococcus aureus* in field workers after short-term occupational exposure to pigs and veal calves. *J Clin Microbiol*. 2011;49(3):1030-1033.
- Waters AE, Contente-Cuomo T, Buchhagen J, et al. Multidrug-resistant *staphylococcus aureus* in US meat and poultry. *Clinical Infectious Diseases*. 2011;52(10):1227-1230. doi: 10.1093/cid/cir181.