

Risk Factors for MRSA Carriage

Date of Search: 08/09/2016

Sources Searched: Medline, Embase, DynaMed.

Risk factors:

- **factors that facilitate transmission of community-acquired MRSA**
 - crowding
 - frequent skin-to-skin contact between individuals
 - compromised skin surfaces
 - sharing contaminated personal items
 - poor personal cleanliness and hygiene
- **populations associated with higher risk of community-acquired MRSA**
 - IV drug use
 - serious underlying illnesses
 - previous antimicrobial therapy
 - recent hospitalization
 - young children (especially in day care centers)
 - athletes (especially with contact sports)
 - prisoners
 - military personnel
 - selected ethnic populations (Native Americans/Alaska Natives, Pacific Islanders, African Americans) have been associated with outbreaks
 - black persons (vs. white persons) in Atlanta, Georgia
 - men who have sex with men
 - veterinarians, pet owners, and pig farmers
- **generally accepted risk factors for nosocomial MRSA**
 - advanced age
 - male gender
 - previous hospitalization
 - prolonged hospitalization

- intensive care unit (ICU) admission
- chronic medical illness
- prior and prolonged antibiotic treatment
- presence and size of wound
- exposure to colonized or infected patient
- presence of invasive indwelling devices
- residents in long-term care facility
- References - [Postgrad Med J 2002 Jul;78\(921\):385 full-text](#), [Mayo Clin Proc 2005 Sep;80\(9\):1201](#), [CMAJ 2007 Jan 2;176\(1\):54 full-text](#), [Clin Infect Dis 2005 Jul 15;41\(2\):159 full-text](#), [N Engl J Med 2005 Apr 7;352\(14\):1436 full-text](#)

Source: DynaMed [Internet]. Ipswich (MA): EBSCO Information Services. 1995 - . Record No. 189788, Methicillin-resistant Staphylococcus aureus (MRSA); [updated 2016 Sep 01, cited **09/09/2016**]; [about 28 screens]. Available from <http://web.a.ebscohost.com/dynamed/detail?vid=7&sid=c073b5d0-869d-4b5b-ad58-5cffc7ed688f%40sessionmgr4008&hid=4106&bdata=JnNpdGU9ZHluYW1lZC1s aXZlJnNjb3BIPXNpdGU%3d#AN=189788&db=dme> . Registration and login required.

I will email you the full DynaMed topic to you.

Search History:

5. Medline; risk*.ti; 353690 results.
6. Medline; exp RISK FACTORS/; 642376 results.
7. Medline; 5 OR 6; 822140 results.
8. Medline; "METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS".ti; 8953 results.
9. Medline; *METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS/; 7192 results.
10. Medline; MRSA.ti; 3796 results.
11. Medline; 8 OR 9 OR 10; 13907 results.
12. Medline; 7 AND 11; 1281 results.
13. Medline; (high* adj2 risk*).ti; 31319 results.
14. Medline; 11 AND 13; 37 results.
15. Medline; (risk* adj2 population*).ti,ab; 35642 results.
16. Medline; (risk* adj2 group*1).ti,ab; 24631 results.
17. Medline; (risk* adj2 patient*1).ti,ab; 125769 results.
18. Medline; 15 OR 16 OR 17; 178386 results.
19. Medline; 11 AND 18; 387 results.
20. Medline; (identifiable adj2 risk*).ti,ab; 1113 results.
21. Medline; 11 AND 20; 10 results.
22. Medline; 14 OR 19 OR 21; 412 results.
23. Medline; *RISK FACTORS/; 993 results.
24. Medline; 5 OR 23; 354118 results.
25. Medline; 11 AND 24; 415 results.
26. Medline; 22 OR 25; 723 results.
27. Medline; 26 [Limit to: (Language English)]; 679 results.
28. Medline; exp CARRIER STATE/ [Limit to: (Language English)]; 15047 results.
29. Medline; 27 AND 28 [Limit to: (Language English)]; 188 results.
30. EMBASE; "METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS".ti; 10818 results.
31. EMBASE; MRSA.ti; 5793 results.
32. EMBASE; *METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS/; 11409 results.
33. EMBASE; 30 OR 31 OR 32; 17676 results.
34. EMBASE; *HIGH RISK POPULATION/; 3095 results.
35. EMBASE; 33 AND 34; 2 results.
36. EMBASE; exp HIGH RISK POPULATION/; 91980 results.
37. EMBASE; exp BACTERIUM CARRIER/; 2717 results.

38. EMBASE; 33 AND 36 AND 37; 16 results.
39. EMBASE; *RISK FACTOR/; 41074 results.
40. EMBASE; 33 AND 37 AND 39; 3 results.
41. EMBASE; 33 AND 37 AND 39; 3 results.
42. EMBASE; 33 AND 39; 91 results.
43. EMBASE; exp RISK FACTOR/; 766879 results.
44. EMBASE; 33 AND 37 AND 43; 101 results.
45. EMBASE; 33 AND 36; 161 results.
47. EMBASE; *BACTERIUM CARRIER/; 919 results.
48. EMBASE; 33 AND 47; 142 results.
49. Medline; (carriage OR carrier*).ti; 35085 results.
50. Medline; 11 AND 49; 467 results.
51. Medline; 7 AND 50; 106 results.
52. EMBASE; (carriage OR carrier*).ti; 38780 results.
53. EMBASE; 33 AND 52; 624 results.
54. EMBASE; 43 AND 53; 153 results.

Title: Colonization With Methicillin-resistant Staphylococcus aureus and Risk for Infection Among Asymptomatic Athletes: A Systematic Review and Metaanalysis.

Citation: Clinical infectious diseases : an official publication of the Infectious Diseases Society of America, Jul 2016, vol. 63, no. 2, p. 195-204, 1537-6591 (July 15, 2016)

Author(s): Karanika, Styliani, Kinamon, Tori, Grigoras, Christos, Mylonakis, Eleftherios

Abstract: Athletes are a vulnerable population for methicillin-resistant Staphylococcus aureus (MRSA) infection. Our aim was to determine MRSA colonization in asymptomatic athletes and estimate the risk for subsequent MRSA infection. We searched the PubMed and EMBASE (through 29 October 2015) for studies on MRSA colonization among asymptomatic athletes. The pooled prevalence of MRSA colonization among athletes was 6% (95% confidence interval [CI], 1,13), and it was higher in the United States (8%; 95% CI, 2,17). USA300 was the most common strain detected (22%), and 62% and 36% of isolates were resistant to clindamycin and trimethoprim/sulfamethoxazole, respectively. The prevalence of MRSA colonization among collegiate athletes reached 13% (95% CI, 4,25). Sports with the highest prevalence among collegiate athletes were wrestling (22%; 95% CI,

0,85), football (8%; 95% CI, 3,15) and basketball (8%; 95% CI, 0,28). The risk for MRSA skin and soft tissue infection within 3 months after documented colonization among MRSA-colonized athletes was significantly higher than for noncolonized athletes (relative risk = 7.37, 95% CI, [2.47,21.94]).

Decolonization treatment among colonized athletes decreased significantly the risk for infection (relative risk reduction = 0.33; 95% CI, .03,4.28). The prevalence of MRSA colonization among asymptomatic athletes is comparable to that among individuals with chronic illness, it is higher among collegiate athletes and can be twice that for patients in intensive care units. Importantly, colonization is associated with a >7-fold increase in the incidence of subsequent MRSA infection. Infection control and decontamination protocols for this population need to be studied and implemented with urgency. © The Author 2016. Published by Oxford University Press for the Infectious Diseases Society of America. All rights reserved. For permissions, e-mail journals.permissions@oup.com.

Source: Medline

Full Text:

Available from *Oxford University Press* in [Clinical Infectious Diseases](#); Note: ; Collection notes: To access please select Login with Athens and search and select NHS England as your institution before entering your NHS OpenAthens account details.

Title: Not just a matter of size: A hospital-level risk factor analysis of MRSA bacteraemia in Scotland

Citation: BMC Infectious Diseases, May 2016, vol./is. 16/1(no pagination), 1471-2334 (21 May 2016)

Author(s): Gibbons C.L., van Bunnik B.A.D., Blatchford O., Robertson C., Porphyre T., Imrie L., Wilson J., Fitzgerald J.R., Woolhouse M.E.J., Chase-Topping M.E.

Language: English

Abstract: Background: Worldwide, there is a wealth of literature examining patient-level risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia. At the hospital-level it is generally accepted that MRSA bacteraemia is more common in larger hospitals. In Scotland, size does not

fully explain all the observed variation among hospitals. The aim of this study was to identify risk factors for the presence and rate of MRSA bacteraemia cases in Scottish mainland hospitals. Specific hypotheses regarding hospital size, type and connectivity were examined. Methods: Data from 198 mainland Scottish hospitals (defined as having at least one inpatient per year) were analysed for financial year 2007-08 using logistic regression (Model 1: presence/absence of MRSA bacteraemia) and Poisson regression (Model 2: rate of MRSA bacteraemia). The significance of risk factors representing various measures of hospital size, type and connectivity were investigated. Results: In Scotland, size was not the only significant risk factor identified for the presence and rate of MRSA bacteraemia. The probability of a hospital having at least one case of MRSA bacteraemia increased with hospital size only if the hospital exceeded a certain level of connectivity. Higher levels of MRSA bacteraemia were associated with the large, highly connected teaching hospitals with high ratios of patients to domestic staff. Conclusions: A hospital's level of connectedness within a network may be a better measure of a hospital's risk of MRSA bacteraemia than size. This result could be used to identify high risk hospitals which would benefit from intensified infection control measures.

Publication Type: Journal: Article

Source: EMBASE

Full Text:

Available from *BioMed Central* in [BMC Infectious Diseases](#)

Available from *ProQuest* in [BMC Infectious Diseases](#)

Title: Gender differences in rates of carriage and bloodstream infection caused by methicillin-resistant *Staphylococcus aureus*: are they real, do they matter and why?

Citation: *Clinical infectious diseases* : an official publication of the Infectious Diseases Society of America, Dec 2015, vol. 61, no. 11, p. 1708-1714, 1537-6591 (December 1, 2015)

Author(s): Humphreys, Hilary, Fitzpatrick, Fidelma, Harvey, Brian J

Abstract: There is increasing interest in sexual and gender dimorphism in disease. We reviewed the epidemiology of methicillin-resistant *Staphylococcus*

aureus (MRSA) carriage and bloodstream infection (BSI), which shows a male predominance, and explored some of the possible reasons. Males are more prone to bacterial sepsis, but some studies suggest females may have a poorer prognosis from BSI. Hand-hygiene behavior varies according to gender. Males are less compliant, which in turn may predispose them to higher colonization and infection rates. Female hormones such as estrogen affect the expression of virulence factors in *Pseudomonas aeruginosa*, and although not studied, this may also apply to *S. aureus*. Further research is required on the relationship between gender and risk of infection, the reasons for higher MRSA carriage and BSI rates in males, the value of gender-specific infection prevention campaigns, and other factors such as the possible role of contact sports and occupation. © The Author 2015. Published by Oxford University Press on behalf of the Infectious Diseases Society of America. All rights reserved. For Permissions, please e-mail: journals.permissions@oup.com.

Source: Medline

Full Text:

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Title: Advanced age and long-term care facility stay as risk factors for methicillin-resistant *Staphylococcus aureus* infection

Citation: Antimicrobial Resistance and Infection Control, June 2015, vol./is. 4/(no pagination), 2047-2994 (June 16, 2015)

Author(s): Pobiega M., Chmielarczyk A., Pomorska-Wesolowska M., Ziolkowski G., Wojkowska-Mach J.

Language: English

Abstract: Introduction: Methicillin-resistant *Staphylococcus aureus* (MRSA) is no longer only a nosocomial pathogen. It has emerged as an important cause of community-associated infections. Objectives: The aim of this study was to analyze risk factors for MRSA infections in geriatric population (60 years and more) in south of Poland and assess antimicrobial susceptibility of the isolates. Methods: Non-repetitive samples were collected from hospitalized (12

hospitals) and non-hospitalized (outpatient care and three long-term care facilities) patients presenting infections (wounds, lower respiratory infection (LRI), bloodstream and eye infections) throughout the southern Poland (Malopolska and Silesia) in 2013. Relation between age, type of infection, presence of comorbidities and probability and epidemiology of MRSA infection were analyzed. Results: MRSA prevalence was 17.2%, in patients with advanced age (>90 years) was 42.1% and in LRI was 39.3%. Factors association with MRSA infection in geriatric population were advanced age, (OR 2.78; 95%CI 1.079-7.163), the presence of lower respiratory tract infection (OR 3.44; 95%CI 1.544-7.644) and staying in the LTCF (OR 5.27; 95%CI 2.02-13.74). Community-acquired infections (prevalence 13.9%) were significantly more often connected with MSSA, than MRSA (OR 0.42; 95%CI 0.24-0.68). MRSA isolates were more often resistant for all studied antibiotics, except teicoplanin and oxazolidinones. MIC50 and MIC90 for vancomycin and tigecycline were higher for MRSA strains. Conclusion: Age 90+ and LTCF staying are important risk factors for MRSA - increased risk of drug resistance almost 3-times. High drug resistance indicates a significant therapeutic limitations, especially in the elderly.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Full Text:

Available from *Free Access Content* in [Antimicrobial Resistance and Infection Control](#)

Available from *BioMed Central* in [Antimicrobial Resistance and Infection Control](#)

Available from *National Library of Medicine* in [Antimicrobial Resistance and Infection Control](#)

Available from *ProQuest* in [Antimicrobial Resistance and Infection Control](#)

Title: Variable performance of models for predicting methicillin-resistant *Staphylococcus aureus* carriage in European surgical wards

Citation: BMC Infectious Diseases, February 2015, vol./is. 15/1(no pagination), 1471-2334 (February 27, 2015)

Author(s): Lee A.S., Pan A., Harbarth S., Patroni A., Chalfine A., Daikos G.L., Garilli S., Martinez J.A., Cooper B.S.

Language: English

Abstract: Background: Predictive models to identify unknown methicillin-resistant *Staphylococcus aureus* (MRSA) carriage on admission may optimise targeted MRSA screening and efficient use of resources. However, common approaches to model selection can result in overconfident estimates and poor predictive performance. We aimed to compare the performance of various models to predict previously unknown MRSA carriage on admission to surgical wards. Methods: The study analysed data collected during a prospective cohort study which enrolled consecutive adult patients admitted to 13 surgical wards in 4 European hospitals. The participating hospitals were located in Athens (Greece), Barcelona (Spain), Cremona (Italy) and Paris (France). Universal admission MRSA screening was performed in the surgical wards. Data regarding demographic characteristics and potential risk factors for MRSA carriage were prospectively collected during the study period. Four logistic regression models were used to predict probabilities of unknown MRSA carriage using risk factor data: "Stepwise" (variables selected by backward elimination); "Best BMA" (model with highest posterior probability using Bayesian model averaging which accounts for uncertainty in model choice); "BMA" (average of all models selected with BMA); and "Simple" (model including variables selected >50% of the time by both Stepwise and BMA approaches applied to repeated random sub-samples of 50% of the data). To assess model performance, cross-validation against data not used for model fitting was conducted and net reclassification improvement (NRI) was calculated. Results: Of 2,901 patients enrolled, 111 (3.8%) were newly identified MRSA carriers. Recent hospitalisation and presence of a wound/ulcer were significantly associated with MRSA carriage in all models. While all models demonstrated limited predictive ability (mean c-statistics <0.7) the Simple model consistently detected more MRSA-positive individuals despite screening fewer patients than the Stepwise model. Moreover, the Simple model improved reclassification of patients into appropriate risk strata compared with the Stepwise model (NRI 6.6%, P = .07). Conclusions: Though commonly used, models developed using stepwise variable selection can have relatively poor predictive value. When developing MRSA risk indices, simpler models, which account for uncertainty in model selection, may better stratify patients' risk of unknown MRSA carriage.

Publication Type: Journal: Article

Source: EMBASE

Full Text:

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Available from *ProQuest* in [BMC Infectious Diseases](#)

Title: Risk factors for development of methicillin-resistant *Staphylococcus aureus*-positive clinical culture in nasal carriers after decolonization treatment

Citation: American journal of infection control, July 2014, vol./is. 42/7(e75-e79), 1527-3296 (01 Jul 2014)

Author(s): Hernandez-Porto M., Castro B., Ramos M.J., Arias A., Aguirre-Jaime A., Lecuona M.

Language: English

Abstract: BACKGROUND: Active surveillance systems are effective in reducing health care-associated infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA). Nonetheless, some patients develop MRSA infection despite control measures. We tried to identify risk factors related to the appearance of MRSA at sites other than the nasal fossa in patients who were nasal carriers of MRSA. METHODS: A retrospective case-control study was conducted in an active surveillance program for MRSA between January 2009 and December 2010 at a Spanish teaching hospital. Cases were patients with MRSA in the anterior nares and a length of stay of at least 5 days who developed MRSA-positive clinical culture after decolonization treatment had started. Controls were patients with the same characteristics as the case group, except that they did not develop MRSA-positive clinical culture as verified by negative clinical cultures. RESULTS: After intrinsic and extrinsic risk factors were analyzed, the emergence of mupirocin-resistant MRSA clones after decolonization treatment, and residence in a nursing home were marginally significant in the univariate analysis. The detection of the emergence of mupirocin-resistant MRSA clones was independently associated with the detection of MRSA in other clinical locations. CONCLUSIONS: In an active surveillance program for MRSA it is important to determine the mupirocin susceptibility of the isolates to determine appropriate treatment and to verify negativity after decolonizing treatment has been completed.

Publication Type: Journal: Article

Source: EMBASE

Title: Risk factors associated with methicillin-resistant staphylococcus aureus (MRSA) bacteremia in the United States

Citation: Value in Health, May 2014, vol./is. 17/3(A9), 1098-3015 (May 2014)

Author(s): Pawar A.M., Willey C.J., Caffrey A.R.

Language: English

Abstract: Objectives: MRSA bacteremia is associated with significantly greater mortality, length of stay (LOS), and hospital costs compared to methicillin-susceptible *S. aureus* (MSSA) bacteremia. With the changing epidemiology of *S. aureus* infections, we sought to identify risk factors for MRSA bacteremia. Methods: Our case-control study identified MRSA (cases) or MSSA (controls) bacteremia hospitalizations, using diagnosis codes, from the 2009 Nationwide Inpatient Sample (n= 7,810,762). These were further categorized into community-associated (principal diagnoses) or hospital-associated (secondary diagnoses) infections. Significant independent predictors of MRSA bacteremia, as compared to MSSA bacteremia, were identified from logistic regression models. Differences in outcomes were assessed with X² or Wilcoxon tests. Results: Our study included 12,907 MRSA and 9,380 with MSSA bacteremia hospitalizations. Lower median household income (< \$38,999 versus \$63,000 or more) was significantly associated with MRSA bacteremia (odds ratio [OR]= 1.34, p< 0.01). African Americans (OR= 1.32, p< 0.01) were at higher risk while Asian or Pacific Islanders (OR= 0.80, p= 0.02) were at lower risk of developing MRSA bacteremia compared to Whites. The presence of certain comorbidities increased the risk of MRSA bacteremia as compared to MSSA (p< 0.01): paralysis (OR= 1.65), other neurological disorders (OR= 1.38), chronic pulmonary disease (OR= 1.27), peripheral vascular disease (OR= 1.27), psychosis (OR= 1.23), weight loss (OR= 1.19), and renal failure (OR= 1.13). Alternatively, the odds of other comorbidities were lower with MRSA bacteremia (p< 0.01): coagulopathy (OR= 0.85), hypertension (OR= 0.84), and metastatic cancer (OR= 0.77). Similar results were found in community-associated and nosocomial infection subgroups. MRSA was associated with

significantly higher mortality (MRSA 63%, MSSA 37%), LOS (MRSA 16 days, MSSA 14 days), and hospital costs (MRSA \$114,176, MSSA \$104,408) ($p < 0.01$).
Conclusions: Our study identified additional predictors of MRSA bacteremia among a large, nationally representative source population of 7 million patients. These included income, race, and comorbidities, which were either risk factors for MRSA bacteremia, as compared to MSSA, or protective against MRSA, indicating a greater association with MSSA.

Publication Type: Journal: Conference Abstract

Source: EMBASE

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Available from *John Wiley and Sons* in [Value In Health](#)

Title: Risk factors for methicillin resistant *Staphylococcus aureus*: A multi-laboratory study

Citation: PLoS ONE, February 2014, vol./is. 9/2(no pagination), 1932-6203 (26 Feb 2014)

Author(s): Catry B., Latour K., Jans B., Vandendriessche S., Preal R., Mertens K., Denis O.

Language: English

Abstract: Background: The present study aimed to investigate the dose response relationship between the prescriptions of antimicrobial agents and infection/colonization with methicillin resistant *Staphylococcus aureus* (MRSA) taking additional factors like stay in a health care facility into account. Methods: Multi-centre retrospective study on a cohort of patients that underwent microbiological diagnostics in Belgium during 2005. The bacteriological results retrieved from 17 voluntary participating clinical laboratories were coupled with the individual antimicrobial consumption patterns (July 2004-December 2005) and other variables as provided by pooled data of health insurance funds. Multivariate analysis was used to identify risk factors for MRSA colonization/infection. Results: A total of 6844 patients of which 17.5% died in the year 2005, were included in a logistic regression

model. More than 97% of MRSA was associated with infection (clinical samples), and only a minority with screening/colonization (1.59%). Factors (95% CI) significantly ($p < 0.01$) associated with MRSA in the final multivariate model were: admission to a long term care settings (2.79-4.46); prescription of antibiotics via a hospital pharmacy (1.30-2.01); age 55+ years (3.32-5.63); age 15-54 years (1.23-2.16); and consumption of antimicrobial agent per DDD (defined daily dose) (1.25-1.40). Conclusions: The data demonstrated a direct dose-response relationship between MRSA and consumption of antimicrobial agents at the individual patient level of 25-40% increased risk per every single day. In addition the study indicated an involvement of specific healthcare settings and age in MRSA status. © 2014 Catry et al.

Publication Type: Journal: Article

Source: EMBASE

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Available from *National Library of Medicine* in [PLoS ONE](#)

Available from *Allen Press* in [PLoS One](#)

Title: Livestock-associated MRSA carriage in patients without direct contact with livestock

Citation: PloS one, 2014, vol./is. 9/6(e100294), 1932-6203 (2014)

Author(s): van Rijen M.M., Bosch T., Verkade E.J., Schouls L., Kluytmans J.A.

Language: English

Abstract: BACKGROUND: Livestock-associated MRSA (MC398) has emerged and is related to an extensive reservoir in pigs and veal calves. Individuals with direct contact with these animals and their family members are known to have high MC398 carriage rates. Until now it was assumed that MC398 does not spread to individuals in the community without pig or veal calf exposure. To test this, we identified the proportion of MC398 in MRSA positive individuals without contact with pigs/veal calves or other known risk factors (MRSA of unknown origin; MUO).METHODS: In 17 participating hospitals, we determined during two years the occurrence of MC398 in individuals without direct contact

with livestock and no other known risk factor (n = 271) and tested in a post analysis the hypothesis whether hospitals in pig-dense areas have higher proportions of MC398 of all MUO. RESULTS: Fifty-six individuals (20.7%) without animal contact carried MC398. In hospitals with high pig-densities in the adherence area, the proportion of MC398 of all MUO was higher than this proportion in hospitals without pigs in the surroundings. CONCLUSIONS: One fifth of the individuals carrying MUO carried MC398. So, MC398 is found in individuals without contact to pigs or veal calves. The way of transmission from the animal reservoir to these individuals is unclear, probably by human-to-human transmission or by exposure to the surroundings of the stables. Further research is needed to investigate the way of transmission.

Publication Type: Journal: Article

Source: EMBASE

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Title: A systematic literature review and meta-analysis of factors associated with methicillin-resistant *Staphylococcus aureus* colonization at time of hospital or intensive care unit admission

Citation: *Infection Control and Hospital Epidemiology*, October 2013, vol./is. 34/10(1077-1086), 0899-823X (October 2013)

Author(s): McKinnell J.A., Miller L.G., Eells S.J., Cui E., Huang S.S.

Language: English

Abstract: Objective. Screening for methicillin-resistant *Staphylococcus aureus* (MRSA) in high-risk patients is a legislative mandate in 9 US states and has been adopted by many hospitals. Definitions of high risk differ among hospitals and state laws. A systematic evaluation of factors associated with colonization is lacking. We performed a systematic review of the literature to assess factors associated with MRSA colonization at hospital admission. design. We searched MEDLINE from 1966 to 2012 for articles comparing MRSA colonized and

noncolonized patients on hospital or intensive care unit (ICU) admission. Data were extracted using a standardized instrument. Meta-analyses were performed to identify factors associated with MRSA colonization. results. We reviewed 4,381 abstracts; 29 articles met inclusion criteria (patients). MRSA colonization at np76,913 hospital admission was associated with recent prior hospitalization (odds ratio [OR], 2.4 [95% confidence interval (CI), 1.3-4.7]; P <.01), nursing home exposure (OR, 3.8 [95% CI, 2.3-6.3]; P <.01), and history of exposure to healthcare-associated pathogens (MRSA carriage: OR, 8.0 [95% CI, 4.2-15.1]; Clostridium difficile infection: OR, 3.4 [95% CI, 2.2-5.3]; vancomycin-resistant Enterococci carriage: OR, 3.1 [95% CI, 2.5- 4.0]; P <.01 for all). Select comorbidities were associated with MRSA colonization (congestive heart failure, diabetes, pulmonary disease, immunosuppression, and renal failure; P <.01 for all), while others were not (human immunodeficiency virus, cirrhosis, and malignancy). ICU admission was not associated with an increased risk of MRSA colonization (OR, 1.1 [95% CI, 0.6-1.8]; P=.87). conclusions. MRSA colonization on hospital admission was associated with healthcare contact, previous healthcare-associated pathogens, and select comorbid conditions. ICU admission was not associated with MRSA colonization, although this is commonly used in state mandates for MRSA screening. Infection prevention programs utilizing targeted MRSA screening may consider our results to define patients likely to have MRSA colonization. © 2013 by The Society for Healthcare Epidemiology of America.

Publication Type: Journal: Review

Source: EMBASE

Title: Medical and Household Characteristics Associated with Methicillin Resistant Staphylococcus aureus Nasal Carriage among Patients Admitted to a Rural Tertiary Care Hospital

Citation: PLoS ONE, August 2013, vol./is. 8/8(no pagination), 1932-6203 (26 Aug 2013)

Author(s): Schinasi L., Wing S., MacDonald P.D.M., Richardson D.B., Stewart J.R., Augustino K.L., Nobles D.L., Ramsey K.M.

Language: English

Abstract: Background:Methicillin resistant Staphylococcus aureus (MRSA) poses a threat to patient safety and public health. Understanding how MRSA is acquired is important for prevention efforts. This study investigates risk factors for MRSA nasal carriage among patients at an eastern North Carolina hospital in 2011.Methods:Using a case-control design, hospitalized patients ages 18 - 65 years were enrolled between July 25, 2011 and December 15, 2011 at Vidant Medical Center, a tertiary care hospital that screens all admitted patients for nasal MRSA carriage. Cases, defined as MRSA nasal carriers, were age and gender matched to controls, non-MRSA carriers. In-hospital interviews were conducted, and medical records were reviewed to obtain information on medical and household exposures. Multivariable conditional logistic regression was used to derive odds ratio (OR) estimates of association between MRSA carriage and medical and household exposures.Results:In total, 117 cases and 119 controls were recruited to participate. Risk factors for MRSA carriage included having household members who took antibiotics or were hospitalized (OR: 3.27; 95% Confidence Interval (CI): 1.24-8.57) and prior hospitalization with a positive MRSA screen (OR: 3.21; 95% CI: 1.12-9.23). A lower proportion of cases than controls were previously hospitalized without a past positive MRSA screen (OR: 0.40; 95% CI: 0.19-0.87).Conclusion:These findings suggest that household exposures are important determinants of MRSA nasal carriage in hospitalized patients screened at admission. © 2013 Schinasi et al.

Publication Type: Journal: Review

Source: EMBASE

Full Text:

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Available from *Allen Press* in [PLoS One](#)

Title: Lifestyle-Associated Risk Factors for Community-Acquired Methicillin-Resistant Staphylococcus aureus Carriage in the Netherlands: An Exploratory Hospital-Based Case-Control Study

Citation: PLoS ONE, June 2013, vol./is. 8/6(no pagination), 1932-6203 (19 Jun 2013)

Author(s): van Rijen M.M.L., Kluytmans-van den Bergh M.F.Q., Verkade E.J.M., ten Ham P.B.G., Feingold B.J., Kluytmans J.A.J.W., Hendriks Y., op den Kamp D., Kluytmans J., Kluytmans - van den Bergh M., Ladestein R., Punselie R., van Rijen M., Verkade E., Ernest M., Brekelmans M., Willemse P., Wulf M., ten Feld N., Postma B., Terwee M., de Ruiten T., Wijker A., Feingold B., Silbergeld E., Hamers H., Wintermans R., Das P., Sanders E., van Dam D., Diederer J., ten Ham P., Nolles L., van der Vorm E., Smeulders A., Verduin K., Buiting A., Hormann H., Nieuwkoop E., Haverkate D., Verweij P., Bonten M., van der Jagt-Zwetsloot M., Troelstra A., Berkhout H., van den Hout L., Kaiser A., Vandenbroucke-Grauls C.

Language: English

Abstract: Background:Community-acquired MRSA (CA-MRSA) is rapidly increasing. Currently, it is unknown which reservoirs are involved. An exploratory hospital-based case-control study was performed in sixteen Dutch hospitals to identify risk factors for CA-MRSA carriage in patients not belonging to established risk groups.Methods:Cases were in- or outpatients from sixteen Dutch hospitals, colonised or infected with MRSA without healthcare- or livestock-associated risk factors for MRSA carriage. Control subjects were patients not carrying MRSA, and hospitalised on the same ward or visited the same outpatients' clinic as the case. The presence of potential risk factors for CA-MRSA carriage was determined using a standardised questionnaire.Results:Regular consumption of poultry (OR 2{dot operator}40; 95% CI 1{dot operator}08-5{dot operator}33), cattle density per municipality (OR 1{dot operator}30; 95% CI 1{dot operator}00-1{dot operator}70), and sharing of scuba diving equipment (OR 2{dot operator}93 95% CI 1{dot operator}19-7{dot operator}21) were found to be independently associated with CA-MRSA carriage. CA-MRSA carriage was not related to being of foreign origin.Conclusions:The observed association between the consumption of poultry and CA-MRSA carriage suggests that MRSA in the food chain may be a source for MRSA carriage in humans. Although sharing of scuba diving equipment was found to be associated with CA-MRSA carriage, the role played by skin abrasions in divers, the lack of decontamination of diving materials, or the favourable high salt content of sea water is currently unclear. The risk for MRSA MC398 carriage in areas with a high cattle density may be due to environmental contamination with MRSA MC398 or human-to-human transmission. Further studies are warranted to confirm our findings and to determine the absolute risks of MRSA acquisition associated with the factors identified. © 2013 van Rijen et al.

Publication Type: Journal: Article

Source: EMBASE

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Title: Prevalence and risk factor analysis for methicillin-resistant *Staphylococcus aureus* colonization in an acute care hospital

Citation: Antimicrobial Resistance and Infection Control, June 2013, vol./is. 2/(no pagination), 2047-2994 (June 20, 2013)

Author(s): Oh M.L., Tan S.Y.

Language: English

Abstract: Introduction: Methicillin-resistant *Staphylococcus aureus* (MRSA) infections have been associated with increased mortality and hospital costs. Active surveillance cultures (ASCs) for MRSA and aggressive contact precautions have been shown to reduce MRSA transmission. Universal screening incurs financial and physical resources. Objectives: To determine the prevalence of MRSA colonization at admission and to identify risk factors associated with MRSA colonization in adult patients. Methods: This study was conducted in 2 wards (one medical and one surgical, each 44 bedded) in Changi General Hospital. ASCs were performed from 20 Jan 2010 to 7 Jul 2010 on all patients admitted to these wards. ASC specimens consisted of one swab from the nares and another from axilla/ groin. A random sample of MRSA-positive and MRSA-negative patients were reviewed for demographics and risk factors for MRSA colonization. Results: A total of 2090 patients were screened on admission. 129 medical and 93 surgical patients were MRSA positive on entry (total 222, 10.6%). 136 MRSA-positive patients were randomly selected and analyzed for risk factors for MRSA colonization. The mean age was 67.3 years (77.1% > 60 years old) and average length of stay was 19 days. Among the 136, patients, 14% had urinary catheter, 38.2% diabetes, 17.6% malignancy, 5.1% chronic kidney disease and 14/7% had skin ulcer. 48 MRSA-

negative patients were randomly selected and analysed as a control group. The mean age was 57.9 years and average length of stay was 13.6 days. Among the 48 patients, 4.2% had urinary catheter, 20.8% diabetes, 14.6% malignancy, 4.2% chronic kidney disease and 6.3% had skin ulcer. Significant risk factors for MRSA colonization at admission included residence in a long term care facility, previous MRSA infection or colonization and diabetes mellitus. The majority of MRSA-positive patients were >60 years and had prolonged hospitalization. Conclusion: The prevalence of MRSA colonization was 10.6%. Risk factors for MRSA colonization included residence in a long term care facility, diabetes and previous MRSA colonization/infection. This study revealed the high burden of MRSA in Singapore. Knowledge of risk factors for MRSA colonization offer selective screening for MRSA based on risk factors as a more cost-effective strategy in reducing MRSA transmission.

Publication Type: Journal: Conference Abstract

Source: EMBASE

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Title: Patient-level factors associated with methicillin-resistant *Staphylococcus aureus* carriage at hospital admission: a systematic review.

Citation: American journal of infection control, Mar 2013, vol. 41, no. 3, p. 214-220, 1527-3296 (March 2013)

Author(s): Forster, Alan J, Oake, Natalie, Roth, Virginia, Suh, Kathryn N, Majewski, Jake, Leeder, Ciera, van Walraven, Carl

Abstract: Selective methicillin-resistant *Staphylococcus aureus* (MRSA) screening programs target high-risk populations. To characterize high-risk populations, we conducted this systematic review to identify patient-level factors associated with MRSA carriage at hospital admission. Studies were identified in the MEDLINE (1950-2011) and EMBASE (1980-2011) databases.

English studies were included if they examined adult populations and used multivariable analyses to examine patient-level factors associated with MRSA carriage at hospital admission. From each study, we abstracted details of the population, the risk factors examined, and the association between the risk factors and MRSA carriage at hospital admission. Our electronic search identified 972 citations, from which we selected 27 studies meeting our inclusion criteria. The patient populations varied across the studies. Ten studies included all patients admitted to hospital, and the others were limited to specific hospital areas. MRSA detection methods also varied across studies. Ten studies obtained specimens from the nares only, whereas other studies also swabbed wounds, catheter sites, and the perianal region. Methods of MRSA diagnoses included polymerase chain reaction tests, cultures in various agar mediums, and latex agglutination tests. Patient age, gender, previous admission to hospital, and previous antibiotic use were the risk factors most commonly examined. The risk factor definition and study methods varied among studies to an extent that precluded meta-analysis. The existing literature cannot be used to identify risk factors for MRSA colonization at the time of hospitalization. Future studies should be aware of the differences in the existing literature and aim to develop standardized risk factor definitions. Copyright © 2013 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Mosby, Inc. All rights reserved.

Source: Medline

Title: Risk factors for previously unknown methicillin-resistant *Staphylococcus aureus* carriage on admission to 13 surgical wards in Europe.

Citation: The Journal of hospital infection, Feb 2013, vol. 83, no. 2, p. 107-113, 1532-2939 (February 2013)

Author(s): Pan, A, Lee, A, Cooper, B, Chalfine, A, Daikos, G L, Garilli, S, Goossens, H, Malhotra-Kumar, S, Martínez, J A, Patroni, A, Harbarth, S, SURF study group (MRSA colonisation on admission to surgical wards in Europe: identification of risk factors), in collaboration with the MOSAR-04 Study Team

Abstract: Early identification of methicillin-resistant *Staphylococcus aureus* (MRSA) carriers may be helpful for clinical and epidemiological reasons. To identify and compare risk factors of previously unknown MRSA carriage on admission to 13 surgical wards in France, Greece, Italy, and Spain. The study

was a prospective observational cohort study which enrolled consecutive patients screened for MRSA on admission to surgical wards. Sociodemographic data, comorbidities and possible risk factors for MRSA were recorded. A multivariate logistic regression model was used to predict probabilities of previously unknown MRSA colonization on admission based on patient characteristics. Prediction rules for MRSA carriage were developed and evaluated using the c-statistic. Of 2901 patients enrolled, admission screening identified 111 (3.8%) new MRSA carriers. Independent risk factors for MRSA carriage were urinary catheterization (odds ratio: 4.4; 95% confidence interval: 2.0-9.9), nursing home residency (3.8; 1.9-7.7), chronic skin disease (2.9; 1.5-5.8), wounds/ulcers (2.4; 1.5-4.0), recent hospitalization (2.2; 1.5-3.3), diabetes (1.6, 1.02-2.5), and age >70 years (1.5; 1.03-2.3). However, risk factors varied between centres. The c-statistic for the common prediction rule for all centres was 0.64, indicating limited predictive power. Risk profiles for MRSA carriers vary between surgical wards in European countries. Identifying local risk factors is important, as a common European prediction rule was found to be of limited clinical value. Copyright © 2012 The Healthcare Infection Society. Published by Elsevier Ltd. All rights reserved.

Source: Medline

Title: Prospective Analysis Methicillin-resistant Staphylococcus aureus and its Risk Factors.

Citation: Journal of global infectious diseases, Jan 2013, vol. 5, no. 1, p. 19-25, 0974-777X (January 2013)

Author(s): Abdallah, Soad A, Al-Asfoor, Khulood K, Salama, Mona F, Al-Awadi, Bashayer M

Abstract: Since the early nineties, a new methicillin-resistant Staphylococcus aureus (MRSA) has existed in a form correlating with community health personnel. Community-acquired MRSA (CA-MRSA) could be differentiated from healthcare-associated MRSA (HA-MRSA) microbiologically, epidemiologically, and molecularly. To determine the prevalence, risk factors of MRSA infections in community and hospital. The incidence and risk factors for CA-MRSA and HA-MRSA among patients of medical, surgical, and pediatrics wards and ICU at a Kuwaiti teaching hospital between 1 March 2011 and 30 November 2011 were studied. Cultures for MRSA were taken from nasal

(nostril), groin, axilla, wound, sputum, or throat, and the inguinal area in all enrolled patients upon admission. All preserved isolates were examined for their susceptibility to different types of antibiotics. A total of 71 MRSA patients admitted to different hospital wards were examined. Among these patients, 52 (73.2%) were carriers of MRSA before they were admitted to the hospital. Nineteen patients (26.8%) were found to have acquired MRSA during their stay in the hospital. Twenty-nine patients (40.8%) were given mupirocin local skin antibiotic. Binomial and the t-test (paired) were used to compare the prevalence of CA-MRSA and HA-MRSA; significant correlation ($P < 0.05$) between the type of MRSA and different wards, sites, and lengths of hospital stay was found. The level of serum albumin that is routinely measured at hospital admission is a predictor to MRSA infection. This study suggests that *S. aureus* and MRSA should become a national priority for disease control to avoid outbreaks.

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Title: Identifying the risk factors for hospital-acquired methicillin-resistant *Staphylococcus aureus* (MRSA) infection among patients colonized with MRSA on admission.

Citation: *Infection control and hospital epidemiology*, Dec 2012, vol. 33, no. 12, p. 1219-1225, 1559-6834 (December 2012)

Author(s): Fukuta, Yuriko, Cunningham, Candace A, Harris, Patricia L, Wagener, Marilyn M, Muder, Robert R

Abstract: Methicillin-resistant *Staphylococcus aureus* (MRSA) is a major pathogen in hospital-acquired infections. MRSA-colonized inpatients who may benefit from undergoing decolonization have not been identified. To identify risk factors for MRSA infection among patients who are colonized with MRSA at hospital admission. A case-control study. A 146-bed Veterans Affairs

hospital. Case patients were those patients admitted from January 2003 to August 2011 who were found to be colonized with MRSA on admission and then developed MRSA infection. Control subjects were those patients admitted during the same period who were found to be colonized with MRSA on admission but who did not develop MRSA infection. A retrospective review. A total of 75 case patients and 150 control subjects were identified. A stay in the intensive care unit (ICU) was the significant risk factor in univariate analysis ($P < .001$). Prior history of MRSA ($P = .03$), transfer from a nursing home ($P = .002$), experiencing respiratory failure ($P < .001$), and receipt of transfusion ($P = .001$) remained significant variables in multivariate analysis. Prior history of MRSA colonization or infection ($P = .02$), difficulty swallowing ($P = .04$), presence of an open wound ($P = .02$), and placement of a central line ($P = .02$) were identified as risk factors for developing MRSA infection for patients in the ICU. Duration of hospitalization, readmission rate, and mortality rate were significantly higher in case patients than in control subjects ($P < .001$, $.001$, and $< .001$, respectively). MRSA-colonized patients admitted to the ICU or admitted from nursing homes have a high risk of developing MRSA infection. These patients may benefit from undergoing decolonization.

Source: Medline

Title: Evaluation of non-healthcare risk factors for methicillin-resistant staphylococcus aureus infection

Citation: Epidemiology, September 2012, vol./is. 23/5 SUPPL. 1(S526), 1044-3983 (September 2012)

Author(s): Casey J., Stewart W., Schwartz B.

Language: English

Abstract: Background: Over the past decade in the United States, the incidence of community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) infection has increased and its epidemiology has changed. As opposed to healthcare-associated MRSA, CA-MRSA generally affects a younger and healthier population and often presents as a skin and soft tissue infection (SSTI). Obesity and season have been identified as risk factors for SSTI infection and community socioeconomic deprivation (CSD) has been linked to several health outcomes, but none have been assessed as risk factors for CA-MRSA in a

population-based study in the United States. Objectives: To conduct a population-based study to describe the epidemiology of and to evaluate obesity, season and CSD as risk factors for CA and HA-MRSA infection in Pennsylvania, USA. Methods: 1,713 CA-MRSA and 1,521 healthcare-associated (HA) MRSA cases were identified from over 400,000 primary care patients of the Geisinger Clinic in Pennsylvania from 2001 to 2010. A nested case-control study was conducted using the Clinic's electronic health record. Spatial analysis and multilevel logistic regression were employed to explore associations between obesity, season, residential environment and CSD and MRSA infection while adjusting for potential confounding variables. Results: From 2005-09, the years of complete data, CA and HA-MRSA cases increased by 24% and 6% annually, respectively, while outpatient visits, a surrogate for the denominator, increased by 4% per year. Obesity was associated with CA-MRSA in both children (adjusted odds ratio 1.6, 95% confidence interval 1.2-2.3) and adults (1.3, 1.1-1.6), as were summer (1.3, 1.1-1.6) and fall (1.5, 1.3-1.8) seasons. Associations with CSD and effect modification of these associations will also be presented. Conclusions: CA has surpassed HA-MRSA as a cause of MRSA infection in Pennsylvania. Obesity, summer and fall seasons, and CSD were all associated with MRSA case status and should be further evaluated.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Full Text:

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Title: Calibration of a Model Predicting Nasal MRSA carriage according to prevalence

Citation: International Journal of Medical Microbiology, September 2012, vol./is. 302/(137), 1438-4221 (September 2012)

Author(s): Elias J., Heuschmann P.U., Vogel U.

Language: English

Abstract: Background: Calibration refers to the ability of a model to accurately predict probabilities and enable risk stratification. This feature is an important

basis for decision-making processes, as valid probabilities inform treatment and infection control practice. Frequently, however, properties of predictive models are assessed by discrimination abilities only, i.e. the skill to separate positive from negative results. Moreover, tools for the adjustment of predicted risk according to different prevalence rates, which influence individual risk, are lacking. **Materials and Methods:** Our derivation cohort (DC) consisted of 3091 individuals admitted consecutively in 2007 and 2008 to 13 different wards and the emergency department of a tertiary referral center. Patients were screened for nasal carriage of MRSA within two days of admission. Logistic and non-linear regression was used to fit models predicting probabilities of nasal carriage and the molecular test's expected positive predictive value (PPV). The internal validation cohort (IVC) comprised 2043 individuals admitted to four wards between 2008 and 2012. **Results:** Prevalence of MRSA carriage in DC was 2.3%. Risk factors associated with individual probability of carriage included age, nursing home residency, emergency admission, and presence of an admission diagnosis with headers "A" or "J" according to ICD-10. Based on the corresponding coefficients of the multivariate logistic regression model, we established a score for predicting MRSA carriage ranging from 0 up to 200, calculated by subtracting 10 from age, and adding 37, 22, and 39 points in case of nursing home residency, emergency admission, and an admission diagnosis starting with letters "A" or "J", respectively. The score was also used to model the molecular test's expected positive predictive value (PPV). The Hosmer-Lemeshow-Test confirmed good fit for both models ($p > 0.05$). As the prevalence in IVC was lower than that of DC (1.7%), we explored whether adjustment for prevalence affected calibration. Based on the outputs from the internal validation cohort we proposed a score correction derived from the odds ratio of the cohort under analysis and the derivation cohort. While both uncorrected and corrected models showed acceptable fit according to the Hosmer-Lemeshow-Test ($p > 0.05$), correction increased the models' fit substantially. **Conclusion:** The proposed score accurately predicts both individual risk for nasal carriage and the expected PPV of a molecular MRSA test. Correction for prevalence increases the model's validity, making it particularly useful for low prevalence settings.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Title: Carriage of methicillin-resistant *Staphylococcus aureus* on admission to European rehabilitation centres--a prospective study.

Citation: Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases, Jun 2012, vol. 18, no. 6, p. E164., 1469-0691 (June 2012)

Author(s): Bilavsky, E, Lerman, Y, Rabinovich, A, Salomon, J, Lawrence, C, Rossini, A, Salvia, A, Samsó, J V, Fierro, J, Hochman, M, Kazma, M, Klein, A, Schwaber, M J, Carmeli, Y, MOSAR WP5 study team

Abstract: This study aimed to determine the prevalence of and risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) carriage among patients newly admitted to rehabilitation centres. It is a prospective study examining MRSA carriage on admission to seven rehabilitation wards in four countries. Risk factors for MRSA carriage were analysed using univariate and multivariate analyses. A total of 1204 patients were studied. Among them, 105 (8.7%) had a positive admission MRSA screening result. The MRSA carriers were more likely to be male, to have had a recent stay in another long-term-care facility or >2 weeks acute-care hospital stay, history of colonization with MRSA, reduced level of consciousness, peripheral vascular disease and pressure sores. In multivariable logistic regression male gender (odds ratio (OR) 2.2, 95% confidence interval (CI) 1.4-3.6, p 0.001), history of MRSA positivity (OR 6.8, 95% CI 3.8-12.3, p <0.001), peripheral vascular disease (OR 2.5, 95% CI 1.2-5, p 0.013), recent stay in another long-term-care facility (OR 2.1, 95% CI 1.3-3.5, p 0.004), or long (>2 weeks) acute-care hospital stay (OR 1.9, 95% CI 1.2-3, p 0.004), remained significant risk factors for MRSA carriage. MRSA carriage is common on admission to rehabilitation centres but less so, than previously described in long-term-care facilities. Male gender, history of MRSA positivity, previous hospitalization and peripheral vascular disease may predict MRSA carriage, and may serve as indicators for using pre-emptive infection control measures. © 2012 The Authors. Clinical Microbiology and Infection © 2012 European Society of Clinical Microbiology and Infectious Diseases.

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Title: Risk factor score to predict mrsa colonization at hospital admission

Citation: American Journal of Infection Control, June 2012, vol./is. 40/5(e185), 0196-6553 (June 2012)

Author(s): Torres K., Sampathkumar P., Siska M.

Language: English

Abstract: Background/Objectives: Methicillin resistant staphylococcus aureus (MRSA) continues to be a problem in health care facilities nationwide. Active surveillance cultures at admission are recommended as an important component of a hospitals infection control program; however, there is lack of consensus on which patients to screen. In facilities with a low prevalence of MRSA, screening all admissions is unlikely to be cost-effective. We conducted a retrospective analysis of nine risk factors and derived a risk factor score to identify patients with the highest likelihood of MRSA colonization.

Methods: We conducted a retrospective study of 496 adult patients admitted to an acute care hospital. We abstracted data on 9 variables reported in the literature as risk factors for MRSA colonization (nursing home residence, diabetes, presence of chronic skin condition or active skin infection, antibiotic use within the past 3 months, transfer from an outside hospital, hospitalization in the 12 months prior to admission, presence of an indwelling medical device at admission, chronic hemodialysis, and immunocompromise). Statistical analysis was performed with Chi-Square tests and multivariate logistic regression to determine factors that were most strongly associated with MRSA colonization. These were then used to generate a risk factor score to identify patients at risk for MRSA colonization on admission. Results: Of the 496 patients screened with nasal swabs, 34(6.9%) were colonized with MRSA. Multivariate analysis showed that a combination of 4 risk factors (nursing home residence, diabetes, hospitalization in the 12 months prior to admission, and presence of a chronic skin condition or active skin infection) was most significantly associated with MRSA colonization. This model had an area under-the-curve of 0.85 on the Receiver Operating Characteristic (ROC) curve indicating that it would be an accurate indicator of MRSA colonization. Based on the odds ratios for each risk factor, we designated a weighted score to each variable (6 points for hospitalization within 12 months of current admission, 5

points for nursing home residence, 4 points for chronic skin condition or active skin infection, 3 points for diabetes). Thus a total score of 0 to 18 was possible. Using a score of 6 or greater as the threshold for screening, only 52% of admissions would be screened and almost all (94%) of the MRSA patients would be identified. Using a score of 8 or greater, only 20% of patients would be screened, but one-third of the MRSA colonized patients would be missed (Table 1). (Table Presented) Conclusions: We identified a risk factor score that can predict MRSA colonization in adult patients. If validated prospectively, this score can increase the cost effectiveness of screening, by reducing the numbers of patients who need to be screened for MRSA at admission.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Title: Consumption of meat as a risk factor for MRSA carriage: A case-control study

Citation: Clinical Microbiology and Infection, April 2012, vol./is. 18/(696), 1198-743X (April 2012)

Author(s): Van Rijen M.M.L., Kluytmans-Van Den Bergh M.F.Q., Ten Ham P.B.G., Verkade E.J.M., Kluytmans J.A.J.W.

Language: English

Abstract: Objectives: Although the Scandinavian Countries and the Netherlands have managed to keep their meticillin-resistant *Staphylococcus aureus* (MRSA) prevalence rates low by applying the Search and Destroy strategy, in recent years a rapid increase in MRSA has been observed in patients without known risk factors, that is, MRSA of unknown source (MRSA-US). The aim of this case-control study was to identify risk factors for MRSA-US in the Netherlands. Methods: Cases and controls were selected from July 2009 until July 2011 from 16 Dutch hospitals. A case was defined as a hospitalised patient or patient visiting the outpatients' clinic that was colonised or infected with MRSA-US. A control was defined as a hospitalised patient without MRSA admitted to the same ward or visiting the same outpatients' clinic as the case on the day the MRSA positive culture was reported. Both cases and controls were aged 1 year or older, had no previous history of MRSA colonisation or

infection and had no known risk factor(s) for MRSA as described in the Dutch MRSA guideline. Cases and controls were visited at home to take an extended questionnaire on potential risk factors for MRSA, including country of origin, attendance of day care centre, profession, contact sports, diving, visiting sauna, travel, getting pierced/tattoos/acupuncture, meat consumption and smoking. Nasal and throat swabs were taken, both from cases and controls and from their household members. Results: In 2 years, 96 cases and 96 controls were enrolled. Consumption of pork, beef and chicken, all at least once a week was found to be a risk factor for MRSA carriage (cases: 57/96, controls: 40/ 96, OR = 2.05 95% CI 1.11-3.79). No other risk factors could be identified. Conclusion: Consumption of meat was identified as a statistically significant risk factor for carriage of MRSA of unknown source in patients admitted to the hospital. Where the contamination of different types of meat with MRSA has been reported previously, the results of this study suggest that consumption of MRSA contaminated meat may indeed result in the acquisition of MRSA by humans.

Publication Type: Journal: Conference Abstract

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Title: Universal screening for meticillin-resistant *Staphylococcus aureus* in acute care: risk factors and outcome from a multicentre study.

Citation: The Journal of hospital infection, Jan 2012, vol. 80, no. 1, p. 31-35, 1532-2939 (January 2012)

Author(s): Reilly, J S, Stewart, S, Christie, P, Allardice, G M, Stari, T, Matheson, A, Masterton, R, Gould, I M, Williams, C

Abstract: A Health Technology Assessment (HTA) model on effectiveness of meticillin-resistant *Staphylococcus aureus* (MRSA) screening in Scotland suggested that universal screening using chromogenic agar was the preferred

option in terms of effectiveness and cost. To test the model's validity through a one-year pilot-study. A large one-year prospective cohort study of MRSA screening was carried out in six acute hospitals in NHS Scotland, incorporating 81,438 admissions. Outcomes (MRSA colonization and infection rates) were subjected to multivariable analyses, and trends before and after implementation of screening were compared. The initial colonization prevalence of 5.5% decreased to 3.5% by month 12 of the study ($P < 0.0001$). Colonization was associated with the number of admissions per patient, specialty of admission, age, and source of admission (home, other hospital or care home). Around 2% of all admissions with no prior history of MRSA infection or colonization tested positive. Those who were screen positive on admission and not previously known positive were 12 times more likely than those who screened negative to develop infection, increasing to 18 times if they were both screen positive and previously known positive. MRSA infections (7.5 per 1000 inpatient-days overall) also reduced significantly over the study year ($P = 0.0209$). The risk factors identified for colonization and infection indicate that a universal clinical risk assessment may have a role in MRSA screening. Copyright © 2011 The Healthcare Infection Society. Published by Elsevier Ltd. All rights reserved.

Source: Medline

Title: Risk factors associated with the conversion of meticillin-resistant *Staphylococcus aureus* colonisation to healthcare-associated infection.

Citation: The Journal of hospital infection, Nov 2011, vol. 79, no. 3, p. 194-197, 1532-2939 (November 2011)

Author(s): Harinstein, L, Schafer, J, D'Amico, F

Abstract: The objective of the study was to identify risk factors for healthcare-associated meticillin-resistant *Staphylococcus aureus* (HA-MRSA) infections in patients with MRSA colonisation over an extended time period. This was a case-control study conducted at a community teaching hospital. Patients included 41 cases and 82 controls, aged ≥ 18 years, who were nares colonisation culture positive for MRSA and either did or did not develop an HA-MRSA infection within 60 days after index colonisation, respectively. Potential risk factors evaluated included: patient demographics, comorbid conditions, medication use, presence of invasive devices, presence of wounds or other

infections, nutritional status, number of hospitalisations and time to infection development. In the univariate analysis, the presence of peripheral vascular disease, three or more comorbidities, a central venous catheter, a Foley catheter, or two or more hospitalisations were significantly associated with increased risk for HA-MRSA infection. Multivariate analysis yielded a model that included presence of a central venous catheter (OR: 8.00; 95% CI: 3.13-20.4) or two or more hospitalisations (OR: 3.37; 95% CI: 1.37-8.26) as independent risk factors for MRSA infection in those with MRSA colonisation. In conclusion, risk factors independently associated with the conversion of MRSA colonisation to HA-MRSA infection include the presence of a central venous catheter or two or more hospitalisations. Strategies involving risk factor minimisation may be helpful in reducing HA-MRSA infections in this patient population. Copyright © 2011 The Healthcare Infection Society. Published by Elsevier Ltd. All rights reserved.

Source: Medline

Title: Prevalence and risk factors for carriage of methicillin-resistant *Staphylococcus aureus* (MRSA) in 17 German hospitals: Results of a point-prevalence study in the rural district Hannover

Citation: International Journal of Medical Microbiology, September 2011, vol./is. 301/(100), 1438-4221 (September 2011)

Author(s): Chaberny I.F., Behrends H.-B., Hopken M.-E.W., Klingebiel B., Mai U., Ott E.

Language: English

Abstract: Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) represents the predominant multidrug-resistant organism and is a wellknown causative agent of healthcare-associated infections in hospitals. However, only few data about its overall prevalence in certain geographical areas are yet available. Objectives: To determine the prevalence of MRSA including the proportion of Panton-Valentine Leukocidin (PVL) positive strains among inpatients in the rural district Hannover (Germany). In addition we checked for patient subgroups that may be at an increased risk for MRSA carriage. Method: A point-prevalence study was conducted in 17 hospitals from October 1, 2009 through March 31, 2010. Inpatients were screened by cultures from nose,

throat and broken skin and patient data was recorded. MRSA isolates were tested for PVL and were analysed by staphylococcal protein A (spa) typing. Results: MRSA was isolated from 118 (3.9%) of 3,013 consenting inpatients. The MRSA prevalence in different hospitals ranged from 0.8% to 12.5%. 42% of all identified MRSA carriers were detected on internal medicine wards and 30% on surgery wards. 92 (78%) were newly identified MRSA carriers. In 3 of 17 hospitals an alert system was in place. The spa typing revealed 26 distinct spa types. The spa type t032 (so called "Barnimer" strain) was the predominant strain type (67%) followed by t003 (3%), t011 (3%), t020 (3%) and t002 (2%). The PVL gene was only present in two (1.7%) MRSA strains. Factors independently associated with MRSA as determined by multivariate analysis were: (a) age older than 68 years (OR, 1.86; CI95, 1.24-2.85), (b) history of surgery (OR, 1.98; CI95, 1.29- 3.02), (c) prior antibiotic therapy (OR, 1.73; CI95, 1.15-2.62), (d) history of MRSA carrier status (OR, 3.27; CI95, 1.71-5.95), (e) presence of open skin lesions (OR, 2.77; CI95, 1.64-4.52), and (f) care on an internal medicine ward (OR, 1.99; CI95, 1.30-3.02). Conclusion: The results of our study revealed that 78% of all MRSA-positive inpatients had been missed. Hence, screening for MRSA on admission is useful to identify the imported cases and should be performed on wards harboured patients at risk, e.g. internal medicine and surgery. On the basis of our results, the respective hospital of the rural district Hannover can optimize its comprehensive infection control strategies against MRSA.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Title: Prevalence of and risk factors for MRSA carriage in companion animals: A survey of dogs, cats and horses

Citation: Epidemiology and Infection, July 2011, vol./is. 139/7(1019-1028), 0950-2688;1469-4409 (July 2011)

Author(s): Loeffler A., Pfeiffer D.U., Lindsay J.A., Magalhaes R.J.S., Lloyd D.H.

Language: English

Abstract: We investigated the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) carriage in a convenience sample of purposely

selected populations of dogs, cats and horses in the Greater London area. Swabs from carriage sites were pooled, enriched and processed by standard bacteriological methods. The presence of *nuc* and *mecA* was confirmed for MRSA. Risk factors were investigated among veterinary treatment group animals using exact logistic regression analysis. Twenty-six (1.53%) MRSA carriers were identified in the 1692 animals (15/704 dogs, 8/540 cats, 3/152 horses). Animals presenting for veterinary treatment more frequently carried MRSA than healthy animals (OR 7.27, 95% CI 2.18-24.31, $P < 0.001$). Concurrent carriage of non-MRSA coagulase-positive staphylococci was associated with MRSA carriage (OR 0.088, 95% CI 0.016-0.31, $P < 0.001$); none of the other 13 putative risk factors was significant. MRSA carriage was rare in the selected companion animal populations. The absence of typical risk factors indicates that companion animals act as contaminated vectors rather than as true reservoirs. © Cambridge University Press 2010.

Publication Type: Journal: Article

Source: EMBASE

Full Text:

Available from *ProQuest* in [Epidemiology and Infection](#)

Title: Determinants of MRSA carriage/infection in health care workers in the Netherlands

Citation: BMC Proceedings, June 2011, vol./is. 5/(no pagination), 1753-6561 (29 Jun 2011)

Author(s): Van Rijen M., Kluytmans J.

Language: English

Abstract: Introduction / objectives: Nosocomial transmission is considered to be the most important source for MRSA colonisation of health care workers (HCW). However, the epidemiology is changing and communityacquired MRSA is increasing. The objective of this study was to investigate the determinants of MRSA carriage/infections in HCW in The Netherlands. Methods: All newly identified HCW with MRSA in seventeen hospitals in the Netherlands were included from January 2009 until December 2010. MRSA determinant analysis was done based on the HCW's history combined with molecular typing results

and then classified in risk groups described in the national infection prevention guidelines. Results: In two years 68 HCW were found to be MRSA positive for the first time. Analysis of risk factors revealed that 27.9% of the HCW (n=19) were considered to be caused by nosocomial transmission, 19.1% (n=13) had been exposed to pigs/veal calves, 10.3% (n=7) had worked in a foreign hospital, 1.5% (n=1) were colonised due to transmission in a psychiatric home and 41.2% (n=28) could not be classified in a known risk group. Based on spa-typing, Livestock Associated MRSA (ST-398) was found in 100% of the HCW who had been exposed to pigs/veal calves (n=13), in 16.7% of the HCW who had worked in a foreign hospital (1 positive, 5 negative, 1 unknown) and in 15.8% of the HCW who were colonised due to nosocomial transmission (3 positive, 16 negative) . Remarkably, 22.2% of the strains in the group with unknown determinants belonged also to this clonal complex (6 positive, 21 negative, 1 unknown). Conclusion: The majority (n=28) of newly identified MRSA positive HCW reported no known source. Strains with spa-types indicative for Livestock Associated MRSA were found in 18.9% of individuals who did not report contact to livestock. This indicates that LA-MRSA is spreading, in the community and/or in the hospital.

Publication Type: Journal: Conference Abstract

Source: EMBASE

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Title: Prevalence and risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) carriage on admission to different hospital sectors in two European countries

Citation: BMC Proceedings, June 2011, vol./is. 5/(no pagination), 1753-6561 (29 Jun 2011)

Author(s): Lee A., Carmeli Y., Chalfine A., Derde L., Malhotra-Kumar S., Martinez J.A., Salomon J., Torres A., Vidal J., Harbarth S.

Language: English

Abstract: Introduction / objectives: Knowledge of local MRSA epidemiology at both facility and ward level helps target control measures. This study aimed to determine the prevalence of and risk factors for MRSA colonisation on admission to different healthcare sectors in two European countries. Methods: Four centres in Spain and France enrolled in 3 intervention trials of MRSA control performed universal MRSA screening on admission to intensive care units (ICUs), surgical wards and rehabilitation units from August 2008 to March 2010. Demographic and comorbidity data were collected. Univariate and multivariate logistic regression analyses were used to identify risk factors for unknown MRSA carriage on admission. Results: Overall, 1780 previously unknown MRSA carriers were screened, 403 (23%) in ICUs, 1099 (62%) in surgical wards and 278 (16%) in rehabilitation wards. The prevalence of unknown MRSA carriage on admission was 2.7% in ICUs, 3.6% in surgical wards and 7.9% in rehabilitation units. No independent risk factors for MRSA carriage on admission to the ICUs were found. Risk factors for surgical wards were age, wounds, nursing home residency and tracheostomy. Rehabilitation unit risk factors were renal failure, diabetic foot, recent antibiotic use and neuro-rehabilitation. Conclusion: Prevalence and risk profiles for MRSA carriage on admission to different healthcare sectors varied widely, emphasising the importance of local surveillance data to enable adaptation of MRSA control policies at the ward level.

Publication Type: Journal: Conference Abstract

Source: EMBASE

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Available from *ProQuest* in [BMC Proceedings](#)

Title: Effective screening for methicillin-resistant *Staphylococcus aureus* on the basis of hospital-specific risk factors

Citation: *Clinical Microbiology and Infection*, May 2011, vol./is. 17/(S340), 1198-743X (May 2011)

Author(s): Buhling A., Tech R., Mydlak K., Thorausch P., Schwab F., Schenke K.

Language: English

Abstract: Objectives: The aim of this study was to determine the MRSA prevalence and the risk factors for MRSA-carriage of patients admitted to a hospital and therefore to find the most effective search policy as an additional part of anti-MRSA-measures. Methods: A 9 month MRSA-admission screening was performed in a 230-bed hospital. Risk factors to be colonised with MRSA at admission were determined using a questionnaire based on recommendations of the Robert Koch-Institute (RKI), the German institution for disease control and prevention. In addition to these factors we included the age in the analysis. All inpatients provided a nasal swab at admission. Patients who were able to answer the questionnaire were included. Microbiological identification was performed on a MRSA-selective medium and on Columbia blood agar. Species diagnostic and susceptibility testing were performed by VITEK2. Meticillin resistance was confirmed by penicillin-binding protein 2a latex agglutination test. To determine independent risk factors statistical analysis was done using univariable and multivariable logistic regression analysis. Results: From all 7906 admitted patients 6296 (79.6%) provided nasal swabs. 5244 patients of them (83.3%) had a fully filled questionnaire and were included in the further analysis. 47 MRSA-carrier-cases were detected (prevalence of 0.9 MRSA/100 admissions). Independent risk factors were previous MRSA-carriage, need for long-term care, receipt of any antibiotics during the previous six months and age. We found 761 patients with RKI-risk factors (14.5%) and 2653 patients older than 67 years (50.6%). Only 24 (51%) of all MRSA-colonised patients performed official RKI-risk factors including 11 (23.4%) patients with previous carriage. Remarkably, 36 (76.6%) of all MRSA-carriers aged >67 years. Conclusion: The results have shown that for this particular hospital age >67 years and previous MRSA-carriage are effective and sensitive indicators for a MRSA colonisation at admission. These independent and easy to establish risk factors were included in screening policy. To find a search policy for MRSA-carriage on admission for an individual hospital it can be recommended to perform a short time screening of all patients with parallel analysis of risk factors.

Publication Type: Journal: Conference Abstract

Source: EMBASE

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Available from *Wiley-Blackwell Free Backfiles NHS* in [Clinical Microbiology and Infection](#)

Title: Who are the carriers of MRSA in the community? A prospective study in the Pays de la Loire region of France.

Citation: Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases, Jul 2010, vol. 16, no. 7, p. 915-920, 1469-0691 (July 2010)

Author(s): Thibaut, S, Caillon, J, Lepelletier, D, Lombrail, P, Potel, G, Ballereau, F, Microbiology laboratories of the Pays de la Loire Region

Abstract: The aim of this study was to determine the demographic characteristics of methicillin-resistant *Staphylococcus aureus* (MRSA) carriers in the community, to assess their risk factors and possible past hospitalization history and to describe the different resistance phenotypes of community isolates of *S. aureus*. Data were collected over the course of 16 months (from June 2005 to September 2006) in the Pays de la Loire region of France by MedQual, a network of private biological analysis laboratories. This work was based solely on the analysis of strains isolated in the community as opposed to isolates from private facilities such as nursing homes or hospitals. The antimicrobial susceptibility results for a total of 313 MRSA isolates were included in this study. The isolates were most frequently recovered from skin and soft tissue infections (41.2%), urine (38.3%) and genital samples (8.3%). We distinguished 36 patients without classical risk factors (WRF), such as demographic individual medical, healthcare exposure, carried MRSA, from the other 277 patients with at least one risk factor (RF). WRF MRSA patients were younger than RF patients and an infection was more often found among WRF patients. MRSA strains isolated from RF patients were resistant to ofloxacin in 81.1% of cases, whereas only 50% of the MRSA strains isolated from WRF patients were resistant ($p < 0.001$). Nine resistance phenotypes were observed among the 313 MRSA strains. MRSA resistance profiles in the community have evolved in recent years. Therefore, it is necessary to study the resistance phenotypes of the circulating strains in order to adapt therapeutic care in the community.

Source: Medline

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Title: Hospitalization earlier than 1 year prior to admission as an additional risk factor for methicillin-resistant *Staphylococcus aureus* colonization.

Citation: *Infection control and hospital epidemiology*, May 2010, vol. 31, no. 5, p. 538-540, 1559-6834 (May 2010)

Author(s): McAllister, Laura, Gaynes, Robert P, Rimland, David, McGowan, John E

Abstract: Our case-control study sought to identify risk factors for colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) at hospital admission among patients with no known healthcare-related risk factors. We found that patients whose most recent hospitalization occurred greater than 1 year before their current hospital admission were more likely to have MRSA colonization. In addition, both the time that elapsed since the most recent hospitalization and the duration of that hospitalization affected risk.

Source: Medline

Title: Companion animals: A reservoir for methicillin-resistant *Staphylococcus aureus* in the community?

Citation: *Epidemiology and Infection*, May 2010, vol./is. 138/5(595-605), 0950-2688;1469-4409 (May 2010)

Author(s): Loeffler A., Lloyd D.H.

Language: English

Abstract: This article reviews the literature on the epidemiology of methicillin-resistant *Staphylococcus aureus* (MRSA) in dogs, cats and horses. Over the past 10 years, MRSA has emerged as an important pathogen in veterinary medicine, especially in countries with a high MRSA burden in human hospitals. During the same period, community-associated MRSA (CA-MRSA) infections in humans without apparent links to healthcare facilities have increased dramatically. Although animal infections occur outside human hospitals, significant epidemiological, clinical and genetic differences exist between CA-MRSA in humans and the majority of MRSA infections in the different animal species. The recognition of MRSA in animals has raised concern over their role as potential reservoirs or vectors for human MRSA infection in the community. However, available data on MRSA transmission between humans and companion animals are limited and the public health impact of such transmission needs to be the subject of more detailed epidemiological studies. © Cambridge University Press 2010.

Publication Type: Journal: Review

Source: EMBASE

Full Text:

Available from *ProQuest* in [Epidemiology and Infection](#)

Title: Risk factors for MRSA carriage at admission to rehabilitation centres

Citation: *Clinical Microbiology and Infection*, April 2010, vol./is. 16/(S268), 1198-743X (April 2010)

Author(s): Lerman Y., Naamana W., Vidal Samsó J., Fierro Banzo J., Formisano R., Salvia A., Rossini A., Balice M.P., Salomon J., Lawrence C., Lasley J., Hart J., Paul M., Isakov E., Lidji S., Hochman M., Kazma M., Klein A., Mishali H., Carmeli Y.

Language: English

Abstract: Background: Identification of MRSA carriers upon admission to rehabilitation center may be important in order to install preventive measures. We aimed to investigate the prevalence and predictors of MRSA carriage in this setting. Methods: A multicenter European study on prevention of spread of resistance is conducted as part of MOSAR in 8 rehabilitation wards. A

prospective case-control study performed between Oct 08 and September 09. 742 patients to were screened for nasal carriage of MRSA on admission to the study wards. Swabs were plated on BBLII CHROMagar plates, and suspected colonies which were coagulase positive were identified as MRSA. Demographic and clinical data were collected from patient's records. Risk factor univariate and multivariate analysis were performed using SPSS software. Results: 742 patients (age 72, 44.5% male) were screened, 64 (8.6%) were found as MRSA carriers. Carriage varied between the centers (7.4%-14.6%), MRSA positive cases where compared to MRSA negative controls: cases were more frequently younger than 65 (38% vs. 26%), female sex (74% vs. 58%), admitted after >2 weeks acute care hospital stay (58% vs. 40%), admitted with an infection or colonization (30% vs. 19%), admitted after staying in other long term care facility (30% vs. 13%), had peripheral vascular disease (16% vs. 6%), and had been treated with BL/BLI antibiotic (18% vs. 6%) or antibiotics classified as other (32% vs. 15%) in the past month. Multivariate model identified the following independent predictors for MRSA carriage; female sex ($p < 0.001$); admitted after staying in other long term care facility ($p = 0.003$), BL/BLI antibiotic treatment ($p = 0.008$); treatment with antibiotics classified as "Other" ($p = 0.017$). Conclusions: MRSA carriage on admission to rehabilitation center was found commonly, but prevalence varied widely. Predictors identified in this study are not specific enough to direct infection control measures.

Publication Type: Journal: Conference Abstract

Source: EMBASE

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Title: Meticillin-resistant *Staphylococcus aureus* carriage in UK veterinary staff and owners of infected pets: new risk groups.

Citation: The Journal of hospital infection, Mar 2010, vol. 74, no. 3, p. 282-288, 1532-2939 (March 2010)

Author(s): Loeffler, A, Pfeiffer, D U, Lloyd, D H, Smith, H, Soares-Magalhaes, R, Lindsay, J A

Abstract: Meticillin-resistant *Staphylococcus aureus* (MRSA) nasal carriage on admission to hospital remains one of the most important risk factors for subsequent infection. Identification of high risk groups for MRSA carriage is vital for the success of infection control programmes. Veterinary staff may be one such risk group but little is known about pet owners and the role of contact with infected pets. As part of a UK-wide case-control study investigating risk factors for MRSA infection in dogs and cats between 2005 and 2008, 608 veterinary staff and pet owners in contact with 106 MRSA and 91 meticillin-susceptible *S. aureus* (MSSA)-infected pets were screened for *S. aureus* nasal carriage. Laboratory isolation and characterisation included salt broth enrichment, standard and automated microbiological tests, demonstration of the *S. aureus*-specific thermonuclease gene (*nuc*) and of *mecA*, and polymerase chain reaction-based lineage characterisation. MRSA carriage was 12.3% in veterinarians attending MRSA-infected animals and 7.5% in their owners. In the MSSA control group, MRSA carriage was 4.8% in veterinary staff and 0% in owners. Veterinary staff carried MRSA more frequently than owners (odds ratio: 2.33; 95% confidence interval: 1.10-4.93). All MRSA from humans and all but one animal MRSA were CC22 or CC30, typical for hospital MRSA in the UK. This study indicates for the first time an occupational risk for MRSA carriage in small animal general practitioners. Veterinary staff and owners of MRSA-infected pets are high risk groups for MRSA carriage despite not having direct hospital links. Strategies to break the cycle of MRSA infection must take these potential new reservoirs into account. Copyright 2009 The Hospital Infection Society. Published by Elsevier Ltd. All rights reserved.

Source: Medline

Title: Clustering and risk factors of methicillin-resistant staphylococcus aureus carriage in two italian long-term care facilities

Citation: Infection, June 2009, vol./is. 37/3(216-221), 0300-8126 (June 2009)

Author(s): Brugnaro P., Fedeli U., Pellizzer G., Buonfrate D., Rassa M., Boldrin C., Parisi S.G., Grossato A., Palu G., Spolaore P.

Language: English

Abstract: Background: : Methicillin-resistant Staphylococcus aureus (MRSA) is a well-recognized agent of health care-associated infections in long-term care facilities, but few data about the circulation of MRSA in this setting in Italy are available. The aim of the study is to determine the prevalence and risk factors for MRSA carriage in nursing home residents in Vicenza (northeastern Italy). Patients and Methods: : A point prevalence survey was conducted in two long-term care facilities (subdivided into 15 wards) from 12 June 2006 to 6 July 2006. Anterior nasal swabs were obtained from residents and laboratory screening for MRSA was performed; full antibiotic susceptibility was assessed in MRSA isolates. Macrorestriction analysis of chromosomal DNA was carried out by pulsed field gel electrophoresis (PFGE). For each subject, demographic data, length of stay, dependency, cognitive function, presence of medical devices, comorbidities, current and previous antibiotic treatment, previous hospital admission and presence of infection were assessed on the day of sample collection. Factors that were found to be significantly associated with MRSA carriage at univariate analysis were introduced into multilevel logistic regression models in order to estimate the odds ratios (OR) with 95% confidence intervals (CI) for the risk of MRSA colonization, taking into account the clustering of patients within wards. Results: : Nasal swabs were obtained in 551 subjects; overall 43 MRSA carriers were detected (7.8%; CI = 5.7-10.4%). The rate of nasal carriers was very similar in the two institutions, and varied from 0% (0/36) to 18% (7/39) between wards. Only two out of 15 wards were found to have no MRSA carriers; overall, three pairs of colonized roommates were detected. Upon multilevel logistic regression, the risk of MRSA carriage was increased in patients with cancer (OR = 6.4; CI = 2.5-16.4), in those that had undergone recent hospitalization (OR = 2.2; CI = 1.0-4.4), and it reached OR = 4.0 (CI = 1.7-9.9) in those with three or more antibiotic treatments in the previous year; about 10% of the variability in MRSA carriage could be attributed to differences between wards. Pulsed field gel electrophoresis analysis permitted the definition of six clusters; two of these comprised 78.6% of the studied isolates and were quite similar, with one being more strongly represented among subjects hospitalized in the previous 12 months. All of the MRSA strains were resistant to ciprofloxacin; nevertheless, the majority were susceptible to most other non-beta-lactam antibiotics. Conclusion: : The study suggests that nursing homes are a significant reservoir for MRSA. Statistical and PFGE analyses indicate a scenario where MRSA seems to be endemic and individual risk factors, namely recent hospitalizations and repeated antibiotic treatments, play a major role in the selection of drug-resistant organisms.

Infection control measures should be coordinated among different health care settings, and the appropriate use of antibiotics has emerged as an important issue for improving the quality of care. © 2008 Springer.

Publication Type: Journal: Article

Source: EMBASE

Full Text:

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Available from *ProQuest* in [Infection](#)

Title: High risk for nasal carriage of methicillin-resistant *Staphylococcus aureus* among Danish veterinary practitioners

Citation: Scandinavian Journal of Work, Environment and Health, April 2008, vol./is. 34/2(151-157), 0355-3140 (April 2008)

Author(s): Moodley A., Nightingale E.C., Stegger M., Nielsen S.S., Skov R.L., Guardabassi L.

Language: English

Abstract: Objectives: Due to their multiple antibiotic resistance properties, methicillin-resistant *Staphylococcus aureus* (MRSA) are a major public health problem. After the recently described emergence of MRSA in animals, the authors investigated the risk of nasal MRSA carriage among people with professional contact with animals. Methods: Nasal swabs and information on animal exposure and known MRSA risk factors were obtained from participants (N=702) at five conferences organized by national veterinary and farmer associations and students at a business school in Denmark. All of the participants were screened by standard microbiological techniques for MRSA detection and characterization. Results: MRSA carriage was significantly ($P<0.02$) higher among the veterinary practitioners (3.9%) than among the participants not professionally exposed to animals (0.7%). Six of the nine MRSA strains isolated from veterinary practitioners belonged to clonal complexes (CC) previously associated with horses (CC8), small animals (CC22), and pigs (CC398). Although four of the nine positive veterinarians carried the CC associated with pigs, exposure to small animals, cattle, or horses, but not to pigs, was found to be a significant risk factor. Conclusions: The results indicate

that veterinarians are at risk of MRSA carriage. Veterinary professionals should be informed about this emerging occupational health risk and educated about preventive measures. Collaboration between national medical and veterinary institutions is urgently needed to control the spread of these unwanted bacteria in the community.

Publication Type: Journal: Article

Source: EMBASE

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Available from *ProQuest* in [Scandinavian Journal of Work, Environment and Health](#)

Title: Methicillin-resistant *Staphylococcus aureus* nasal carriage among injection drug users: Six years later

Citation: *Journal of Clinical Microbiology*, February 2008, vol./is. 46/2(477-479), 0095-1137 (February 2008)

Author(s): Al-Rawahi G.N., Schreuder A.G., Porter S.D., Roscoe D.L., Gustafson R., Bryce E.A.

Language: English

Abstract: A survey in 2000 to detect methicillin-resistant *Staphylococcus aureus* (MRSA) colonization in Vancouver downtown east side injection drug users (IDUs) revealed an MRSA nasal colonization incidence of 7.4%. This is a follow-up study to determine the current prevalence of MRSA colonization and to further characterize the isolates and risk factors for colonization. In this point prevalence study of MRSA nasal carriage among IDUs, nasal swabs were cultured to detect *S. aureus*. Isolates were studied for their antimicrobial susceptibility patterns and the presence of *mecA* and Panton-Valentine leukocidin (PVL) genes and by pulsed-field gel electrophoresis (PFGE). *S. aureus* was isolated from 119 of 301 (39.5%) samples; three (2.5%) participants had both methicillin-sensitive *S. aureus* (MSSA) and MRSA, resulting in 122 isolates. Of these, 54.1% were MSSA and 45.9% were MRSA, with an overall MRSA rate of 18.6%. USA-300 (CMRSA-10) accounted for 75% of all MRSA isolates; 25% were USA-500 (CMRSA-5). None of the USA-500 isolates were positive for PVL; 41 (97.6%) USA-300 isolates contained PVL. One MSSA isolate, from an

individual also carrying USA-300, was positive for PVL. The PFGE pattern of this MSSA isolate was related to that of the MRSA strain. The antibiograms of USA-300 compared to USA-500 isolates showed 100% versus 7.1% susceptibility to trimethoprim-sulfamethoxazole (TMP-SMX) and 54.8% versus 7.1% susceptibility to clindamycin. MRSA nasal colonization in this population has increased significantly within the last 6 years, with USA-300 replacing the previous strain. Most of these strains are PVL positive, and all are susceptible to TMP-SMX. Copyright © 2008, American Society for Microbiology. All Rights Reserved.

Publication Type: Journal: Article

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Title: Prevalence of and risk factors for methicillin-resistant *Staphylococcus aureus* carriage at hospital admission.

Citation: Infection control and hospital epidemiology, Nov 2007, vol. 28, no. 11, p. 1314-1317, 0899-823X (November 2007)

Author(s): Casas, Irma, Sopena, Nieves, Esteve, Maria, Quesada, Maria Dolores, Andrés, Isabel, Matas, Lourdes, Blanco, Silvia, Pedro-Botet, Maria Luisa, Caraballo, Montse, Ausina, Vicente, Sabrià, Miquel

Abstract: To determine the prevalence of and risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) carriage at the time of admission to our hospital, we screened the medical records of 1,128 patients for demographic and clinical data. The antimicrobial resistance pattern and genotype of MRSA isolates were studied. The prevalence of MRSA carriage at hospital admission was 1.4%. Older patients and patients previously admitted to healthcare centers were the most likely to have MRSA carriage at admission.

Source: Medline

Title: Duration of methicillin-resistant *Staphylococcus aureus* carriage, according to risk factors for acquisition.

Citation: Infection control and hospital epidemiology, Nov 2006, vol. 27, no. 11, p. 1206-1212, 0899-823X (November 2006)

Author(s): Marschall, Jonas, Mühlemann, Kathrin

Abstract: To examine the duration of methicillin-resistant *Staphylococcus aureus* (MRSA) carriage and its determinants and the influence of eradication regimens. Retrospective cohort study. A 1,033-bed tertiary care university hospital in Bern, Switzerland, in which the prevalence of methicillin resistance among *S. aureus* isolates is less than 5%. A total of 116 patients with first-time MRSA detection identified at University Hospital Bern between January 1, 2000, and December 31, 2003, were followed up for a mean duration of 16.2 months. Sixty-eight patients (58.6%) cleared colonization, with a median time to clearance of 7.4 months. Independent determinants for shorter carriage duration were the absence of any modifiable risk factor (receipt of antibiotics, use of an indwelling device, or presence of a skin lesion) (hazard ratio [HR], 0.20 [95% confidence interval {CI}, 0.09-0.42]), absence of immunosuppressive therapy (HR, 0.49 [95% CI, 0.23-1.02]), and hemodialysis (HR, 0.08 [95% CI, 0.01-0.66]) at the time MRSA was first MRSA detected and the administration of decolonization regimen in the absence of a modifiable risk factor (HR, 2.22 [95% CI, 1.36-3.64]). Failure of decolonization treatment was associated with the presence of risk factors at the time of treatment (P=.01). Intermittent screenings that were negative for MRSA were frequent (26% of patients), occurred early after first detection of MRSA (median, 31.5 days), and were associated with a lower probability of clearing colonization (HR, 0.34 [95% CI, 0.17-0.67]) and an increased risk of MRSA infection during follow-up. Risk factors for MRSA acquisition should be carefully assessed in all MRSA carriers and should be included in infection control policies, such as the timing of decolonization treatment, the definition of MRSA clearance, and the decision of when to suspend isolation measures.

Source: Medline

Title: Evaluating the probability of previously unknown carriage of MRSA at hospital admission

Citation: American Journal of Medicine, March 2006, vol./is. 119/3(275.e15-275.23), 0002-9343 (March 2006)

Author(s): Harbarth S., Sax H., Fankhauser-Rodriguez C., Schrenzel J., Agostinho A., Pittet D.

Language: English

Abstract: PURPOSE: We determined the prevalence and risk profile of patients with previously unknown carriage of methicillin-resistant *Staphylococcus aureus* (MRSA) at hospital admission. SUBJECTS AND METHODS: We conducted a 7-month, prospective case-controlled study in adult inpatients admitted to a university hospital with endemic MRSA. Multivariate conditional logistic regression for data sets matched 1:4 was performed to identify the risk profile of newly identified MRSA carriers. RESULTS: Overall, 399 of 12 072 screened admissions (prevalence, 3.3%) were found colonized (n = 368, 92%) or infected (n = 31, 8%) with MRSA. In 204 cases (prevalence, 1.7%), MRSA carriage was newly identified. Without screening on admission, 49% (196/399) of MRSA carriers would have been missed. We identified nine independent risk factors for newly identified MRSA carriage at admission (adjusted odds ratio): male sex (1.9); age greater than 75 years (2.0); receipt of fluoroquinolones (2.7), cephalosporins (2.1), and carbapenems (3.2) in the last 6 months; previous hospitalization (1.9) or intravenous therapy (1.7) during the last 12 months; urinary catheter at admission (2.0); and intrahospital transfer (2.4). A risk score (range, 0-13) was calculated by adding points assigned to these variables. On the basis of analysis of 1006 patients included in the case-controlled study, the probability of MRSA carriage was 8% (28/342) in patients with a low score (<1), 19% (92/482) in patients with an intermediate score (2-4), and 46% (84/182) in patients with a high score (>5). The risk score had good discrimination (c-statistic, 0.73) and showed excellent calibration (P = .88). CONCLUSIONS: On-admission prevalence of previously unknown MRSA carriers was high. Applying the risk score to newly admitted patients with an intermediate or high probability of MRSA carriage could allow a more effective MRSA control strategy. © 2006 Elsevier Inc. All rights reserved.

Publication Type: Journal: Article

Source: EMBASE

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Title: Risk factors for colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) in patients admitted to an urban hospital: emergence of community-associated MRSA nasal carriage.

Citation: *Clinical infectious diseases* : an official publication of the Infectious Diseases Society of America, Jul 2005, vol. 41, no. 2, p. 159-166, 1537-6591 (July 15, 2005)

Author(s): Hidron, Alicia I, Kourbatova, Ekaterina V, Halvosa, J Sue, Terrell, Bianca J, McDougal, Linda K, Tenover, Fred C, Blumberg, Henry M, King, Mark D

Abstract: Surveillance cultures performed at hospital admission have been recommended to identify patients colonized with methicillin-resistant *Staphylococcus aureus* (MRSA) but require substantial resources. We determined the prevalence of and risk factors for MRSA colonization at the time of hospital admission among patients cared for at a public urban hospital. Anterior nares cultures were obtained within 48 h after admission during a 1-month period. A case-control study and molecular typing studies were performed. A total of 53 (7.3%) of 726 patients had a nares culture positive for MRSA, and 119 (16.4%) had a nares culture that was positive for methicillin-susceptible *S. aureus*. In multivariate analysis, risk factors for MRSA colonization included antibiotic use within 3 months before admission (odds ratio [OR], 2.5; 95% confidence interval [CI], 1.2-5.0), hospitalization during the past 12 months (OR, 4.0; 95% CI, 2.0-8.2), diagnosis of skin or soft-tissue infection at admission (OR, 3.4; 95% CI, 1.5-7.9), and HIV infection. A total of 47 (89%) of 53 case patients colonized with MRSA had at least 1 of these independent risk factors, in contrast to 343 (51%) of 673 control patients (OR, 7.5; 95% CI, 3.2-17.9). Molecular typing demonstrated that 16 (30%) of 53 MRSA nares isolates (2.2% of the 726 isolates) belonged to the USA300 community-associated MRSA (CA-MRSA) genotype. The prevalence of MRSA colonization at the time of patient admission was high (>7%). Limiting surveillance cultures to patients with ≥ 1 of the identified risk factors may allow for targeted screening. The emergence of CA-MRSA colonization represents a new, unrecognized reservoir of MRSA within hospitals, potentially increasing the risk for horizontal transmission.

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Title: Methicillin-resistant Staphylococcus aureus disease in three communities

Citation: New England Journal of Medicine, April 2005, vol./is. 352/14(1436-1444+1505), 0028-4793 (07 Apr 2005)

Author(s): Fridkin S.K., Hageman J.C., Morrison M., Sanza L.T., Como-Sabetti K., Jernigan J.A., Harriman K., Harrison L.H., Lynfield R., Farley M.M.

Language: English

Abstract: BACKGROUND: Methicillin-resistant Staphylococcus aureus (MRSA) infection has emerged in patients who do not have the established risk factors. The national burden and clinical effect of this novel presentation of MRSA disease are unclear. METHODS: We evaluated MRSA infections in patients identified from population-based surveillance in Baltimore and Atlanta and from hospital-laboratory-based sentinel surveillance of 12 hospitals in Minnesota. Information was obtained by interviewing patients and by reviewing their medical records. Infections were classified as community-acquired MRSA disease if no established risk factors were identified. RESULTS: From 2001 through 2002, 1647 cases of community-acquired MRSA infection were reported, representing between 8 and 20 percent of all MRSA isolates. The annual disease incidence varied according to site (25.7 cases per 100,000 population in Atlanta vs. 18.0 per 100,000 in Baltimore) and was significantly higher among persons less than two years old than among those who were two years of age or older (relative risk, 1.51; 95 percent confidence interval, 1.19 to 1.92) and among blacks than among whites in Atlanta (age-adjusted relative risk, 2.74; 95 percent confidence interval, 2.44 to 3.07). Six percent of cases were invasive, and 77 percent involved skin and soft tissue. The infecting strain of MRSA was often (73 percent) resistant to prescribed antimicrobial agents. Among patients with skin or soft-tissue infections, therapy to which the infecting strain was resistant did not appear to be associated with adverse

patient-reported outcomes. Overall, 23 percent of patients were hospitalized for the MRSA infection. CONCLUSIONS: Community-associated MRSA infections are now a common and serious problem. These infections usually involve the skin, especially among children, and hospitalization is common. Copyright ©; 2005 Massachusetts Medical Society.

Publication Type: Journal: Article

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Title: Risk factors and molecular analysis of community methicillin-resistant *Staphylococcus aureus* carriage.

Citation: Journal of clinical microbiology, Jan 2005, vol. 43, no. 1, p. 132-139, 0095-1137 (January 2005)

Author(s): Lu, Po-Liang, Chin, Lien-Chun, Peng, Chien-Fang, Chiang, Yi-Hsiung, Chen, Tyen-Po, Ma, Ling, Siu, L K

Abstract: A total of 1,838 subjects from the community and 393 subjects from health care-related facilities in Taiwan were evaluated for the prevalence of nasal *Staphylococcus aureus* colonization and to identify risk factors associated with *S. aureus* and methicillin-resistant *S. aureus* (MRSA) colonization. Among the community subjects, 3.5% had nasal MRSA colonization. Subjects from health care-related facilities had a lower *S. aureus* colonization rate (19.1%) than community subjects (25.2%) but had a significantly higher rate of colonization with MRSA (7.63%). Age ($P < 0.001$) was a significant risk factor for *S. aureus* colonization, with subjects under age 20 years or between 71 and 80 years showing higher rates of colonization. Recent gastrointestinal disease ($P = 0.011$) and hospital admission ($P = 0.026$) were risk factors for nasal MRSA colonization. Comparison of hospital MRSA isolates with the colonization

strains by staphylococcal cassette chromosome mec (SCCmec) gene typing and pulsed-field gel electrophoresis (PFGE) typing revealed that most MRSA strains carried in the community were SCCmec type IV and that most clinical hospital isolates were type III, while health care facility-related carriage isolates were mainly SCCmec type III and type IV. Two new variant SCCmec types were identified. Six clusters of PFGE patterns were distinguished: two mainly comprised health care facility-related MRSA strains, three mainly comprised community MRSA strains, and one comprised mixed community and health care facility-related MRSA strains. In conclusion, a high prevalence of MRSA colonization was observed among people with no relationship to the hospital setting. The high level of multiple-drug resistance among community MRSA strains in association with the previously reported excessive use of antibiotics in Taiwan highlights the importance of the problem of antibiotic selective pressure. Our results indicate that both the clonal spread of MRSA and the transmission of hospital isolates contribute to the high MRSA burden in the community.

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Title: High-risk populations for nasal carriage of methicillin-resistant *Staphylococcus aureus*.

Citation: Journal of infection and chemotherapy : official journal of the Japan Society of Chemotherapy, Jun 2004, vol. 10, no. 3, p. 189-191, 1341-321X (June 2004)

Author(s): Fukuda, Minoru, Tanaka, Hironori, Kajiwara, Yoshifumi, Sugimura, Tsugimi, Oda, Eiko, Suenaga, Hisami, Yoshimura, Masaya, Iino, Toshiyuki, Togawa, Megumi, Hirakata, Yoichi, Soda, Hiroshi, Oka, Mikio, Kohno, Shigeru, Oshibuchi, Toru

Abstract: To determine the population at high risk of nasal carriage of methicillin-resistant *Staphylococcus aureus* (MRSA) on hospital patients admission, a nasal swab was taken from the following patients: (1) those aged

70 years or over (age ≥ 70), (2) non ambulatory receiving regular home visits by nurses and physicians (visiting), (3) residents of nursing homes (nursing home), (4) patients from other hospitals (another Hp), and (5) those scheduled for surgery (presurgery). Between March and July 2000, a total of 412 patients were admitted and 136 were enrolled. MRSA was isolated from 12 (8.8%) patients. The number of patients positive for MRSA in the five groups, age ≥ 70 , visiting, nursing home, another Hp, and presurgery, were 3 of 68, 3 of 21, 2 of 3, 3 of 9, and 1 of 35, respectively. Multivariate analysis revealed that living in a nursing home [odds ratio (OR) = 32.82, P = 0.010] or coming from another hospital (OR = 14.55, P = 0.0043) were high risk factors with for nasal carriage of MRSA. Furthermore, patients' ages were further divided into three categories, ≤ 79 , 80-89, ≥ 90 , and regarded as independent high risk factors (OR = 3.08, P = 0.043). The results were that advanced living in a age (≥ 80 , ≥ 90), living in a nursing home or coming from another hospital are high risk factors of nasal carriage of MRSA on hospital admission.

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Title: Prevalence and risk factors for carriage of methicillin-resistant *Staphylococcus aureus* at admission to the intensive care unit: Results of a multicenter study

Citation: Archives of Internal Medicine, January 2003, vol./is. 163/2(181-188), 0003-9926 (27 Jan 2003)

Author(s): Lucet J.-C., Chevret S., Durand-Zaleski I., Chastang C., Regnier B.

Language: English

Abstract: Background: Detection of methicillin-resistant *Staphylococcus aureus* (MRSA) carriers on admission to the intensive care unit (ICU) is an important component of strategies for controlling the spread of MRSA. Methods: A prospective multicenter study was conducted in 14 French ICUs for 6 months. All patients were screened within 24 hours after admission, using nasal and cutaneous swabs. In addition, clinical samples were obtained. Patient data collected on ICU admission included presence of immunosuppression; history of hospital stay, surgery, antimicrobial treatments, or previous colonization with MRSA; chronic health evaluation and McCabe scores; reason for

admission; whether the patient was transferred from another ward; severity of illness; presence of skin lesions; and invasive procedures. Risk factors for MRSA carriage at ICU admission were estimated, and significantly associated variables were used to develop a predictive score for MRSA carriage. A cost-benefit analysis was then performed. Results: Of the 2347 admissions with MRSA screening, 162 (6.9%; range, 3.7%-20.0% among ICUs) were positive for MRSA, of whom 54.3% were detected through screening specimens only. Of the 2310 first admissions (vs repeat admissions) to the ICU, 96 were newly identified MRSA carriers. Factors associated with MRSA carriage in the multivariate analysis were age older than 60 years, prolonged hospital stay in transferred patients, history of hospitalization or surgery, and presence of open skin lesions in directly admitted patients. Only universal screening detected MRSA carriage with acceptable sensitivity. A cost-benefit analysis confirmed that universal screening and preventive isolation were beneficial. Conclusions: The prevalence of MRSA carriage on admission to the ICU is high in this endemic setting. Screening for MRSA on admission is useful to identify the imported cases and should be performed in all ICU-admitted patients.

Publication Type: Journal: Article

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Title: Risk factors for persistent carriage of methicillin-resistant *Staphylococcus aureus*.

Citation: Clinical infectious diseases : an official publication of the Infectious Diseases Society of America, Dec 2000, vol. 31, no. 6, p. 1380-1385, 1058-4838 (December 2000)

Author(s): Harbarth, S, Liassine, N, Dharan, S, Herrault, P, Auckenthaler, R, Pittet, D

Abstract: We determined risk factors associated with persistent carriage of methicillin-resistant *Staphylococcus aureus* (MRSA) among 102 patients enrolled in a double-blind, placebo-controlled trial of nasally administered mupirocin ointment. MRSA decolonization was unsuccessful in 77 (79%) of 98 patients who met the criteria for evaluation. By univariate analysis, 4 variables were found to be associated with persistent MRSA colonization ($P < .1$ for all 4): absence of mupirocin treatment, previous fluoroquinolone therapy, ≥ 2 MRSA-positive body sites, and low-level mupirocin resistance. After multivariable Cox proportional hazards modeling, the presence of ≥ 2 positive body sites (adjusted hazard ratio [AHR], 1.7; 95% confidence interval [CI], 1.0-2.9) and previous receipt of a fluoroquinolone (AHR, 1.8; 95% CI, 1.0-3.3) were independently associated with MRSA persistence, whereas nasal mupirocin tended to confer protection (AHR, 0.6; 95% CI, 0.4-1.0). Low-level mupirocin resistance was observed in 9 genotypically different MRSA strains and was not independently associated with chronic MRSA carriage (AHR, 1.5; 95% CI, 0.9-2.5). Our findings suggest that multisite MRSA carriage and previous receipt of a fluoroquinolone are independent risk factors for persistent MRSA colonization.

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