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# Risk of Organism Acquisition From Prior Room Occupants: A Systematic Review and Meta-Analysis

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# Disclosures

- Brett Mitchell Chair of Scientific Committee
- Brett Mitchell Interim Editor-in-Chief of Infection Disease and Health
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# Background

- Environment plays a role in facilitating the transmission of important pathogens
- Organisms survive
- Studies have shown that if a patient is admitted to a room where the prior occupant was colonised or infected with a hospital pathogen, there is an increased risk of the next patient acquiring the same organism

# Purpose of systematic review

- Determine whether being admitted to a room where the prior occupant was colonized or infected with an organism increases the risk of acquiring that organism.
  - Explore differences in the risk of acquisition between Gram-positive and Gram-negative organisms.

# Methods: Search strategy

- Systematic review and meta-analysis
- PROSPERO: CRD42015016273
- Medline/PubMed,Cochrane and CINHAL
- Observational studies, last 30 years
- Must have examined exposure or acquisition in a hospitalized  population where the prior room occupant was colonized or infected with a specific organism

# Methods

## Organisms

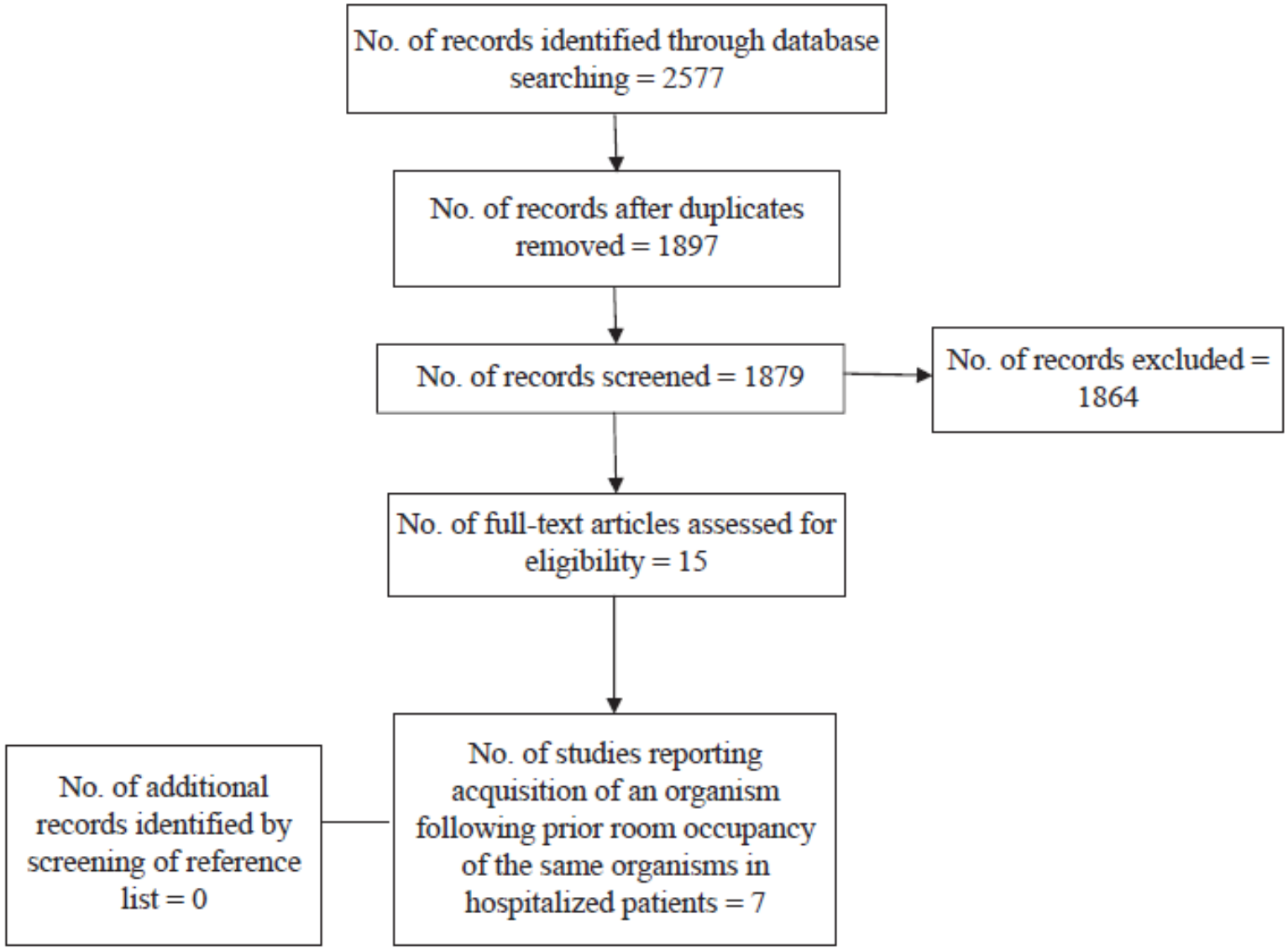
- *Acinetobacter*
- *Escherichia coli*
- *Klebsiella*
- *Pseudomonas*
- *E*nterobacter
- *Citrobacter*
- *Proteus*
- *Serratia*
- *Enterococcus*
- *C.difficile*
- *S.aureus* & VRE

## Exclusions

- Conference abstracts,
- Letters to editors
- Reviews
- Papers written in languages other than English

# Methods

- Assessed risk of bias (ROB) and quality using modified version of NOS (Wells et al., 2014)
- Random effects model used for meta-analysis
- Heterogeneity assessed using $I^2$ statistic


No. of records identified through database searching = 2577
No. of records after duplicates removed = 1897
No. of records screened = 1879
No. of records excluded = 1864
No. of full-text articles assessed for eligibility = 15
No. of studies reporting acquisition of an organism following prior room occupancy of the same organisms in hospitalized patients = 7
No. of additional records identified by screening of reference list = 0

# Results

| Study (lead author) | Year | Study duration | Study setting (country) | Study design | Organisms |
|---|---|---|---|---|---|
| **Huang** | 2005 | 20 months | USA | Cohort | VRE. MRSA |
| **Mitchell** | 2014 | 24 months | Australia | Cohort | MRSA |
| **Datta** | 2011 | 20 months | USA | Cohort | VRE, MRSA |
| **Ajao** | 2013 | 93 months | USA | Cohort | ESBL-producing Gram negative |
| **Drees** | 2008 | 14 months | USA | Cohort | VRE |
| **Nseir** | 2011 | 12 months | France | Cohort | *A.baumanni*i, ESBL-producing Gram negative, *P. aeruginosa* |
| **Shaughnessy** | 2011 | 16 months | USA | Cohort | *C. difficile* |

# Results

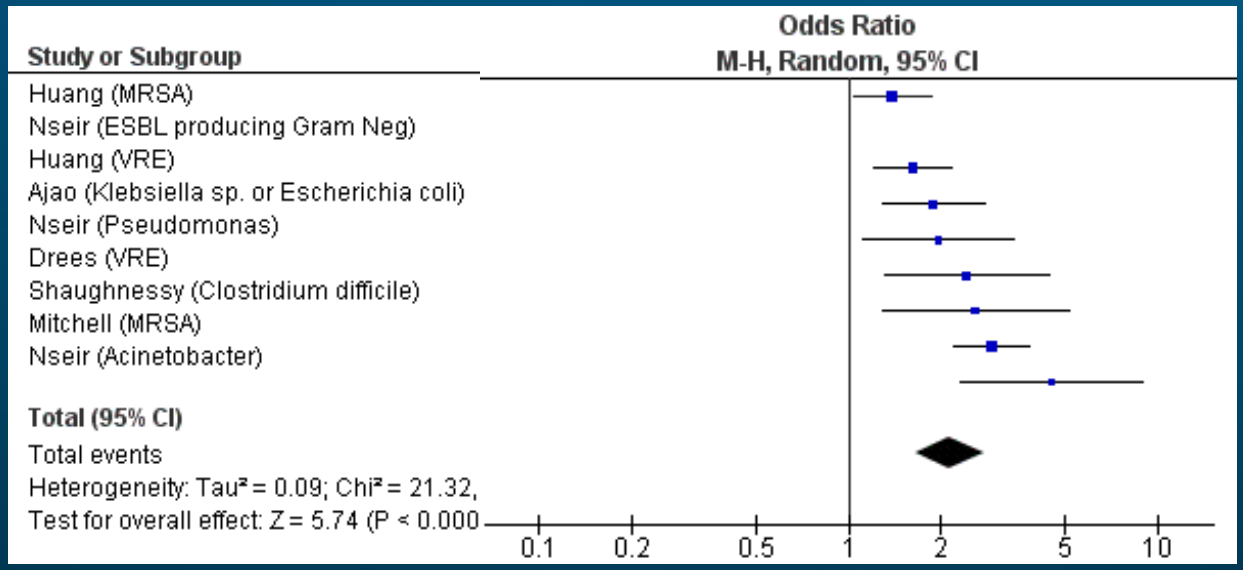
- 4,643 ‘exposed’ patients → 287 (6.2% ) acquired the same species of organism.
- 34,886 ‘unexposed’ patients → 1,112 (3.2%)

- Pooled acquisition OR for all the organisms included in the six studies was 2.14 (95% CI = 1.65–2.77)
- Pooled acquisition OR for Gram-negative organisms was 2.65(95% CI = 2.02–3.47) and 1.89 (95% CI = 1.62–2.21) for Gram-positive organisms

| Study or Subgroup | Decreased acquisition Events | Total | Control Events | Total | Weight | Odds Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|---|
| Huang (MRSA) | 57 | 1454 | 248 | 8697 | 16.2% | 1.39 [1.04, 1.86] |
| Nseir (ESBL producing Gram Neg) | 8 | 50 | 50 | 461 | 0.0% | 1.57 [0.70, 3.52] |
| Huang (VRE) | 58 | 1291 | 256 | 9058 | 16.2% | 1.62 [1.21, 2.16] |
| Ajao (Klebsiella sp. or Escherichia coli) | 32 | 648 | 235 | 8723 | 14.2% | 1.88 [1.29, 2.74] |
| Nseir (Pseudomonas) | 21 | 85 | 61 | 426 | 10.4% | 1.96 [1.12, 3.45] |
| Drees (VRE) | 19 | 138 | 31 | 500 | 9.7% | 2.42 [1.32, 4.43] |
| Shaughnessy (Clostridium difficile) | 10 | 91 | 77 | 1679 | 8.3% | 2.57 [1.28, 5.15] |
| Mitchell (MRSA) | 74 | 884 | 163 | 5344 | 16.4% | 2.90 [2.18, 3.86] |
| Nseir (Acinetobacter) | 16 | 52 | 41 | 459 | 8.6% | 4.53 [2.32, 8.86] |
| **Total (95% CI)** | | **4643** | | **34886** | **100.0%** | **2.14 [1.65, 2.77]** |
| Total events | 287 | | 1112 | | | |

Heterogeneity: Tau² = 0.09; Chi² = 21.32, df = 7 (P = 0.003); I² = 67%

Test for overall effect: Z = 5.74 (P < 0.00001)



# Results - sub analysis

- Gram negative organisms, *A. baumannii* had the highest odds ratio (OR 4.53 = 2.32-8.86).
- Further sub-analyses → no differences:
  - *C.difficile* against the MRSA studies;
  - MRSA against the VRE studies;
  - *Klebsiella* species and *E.coli* ESBL-producing Gram-negative bacilli with *Pseudomonas aeruginosa* against *Acinetobacter baumannii*.
  - In acquisition between ESBL producing organisms and MRSA or VRE.

# Key points

- Admission to a room previously occupied by a patient infected and/or colonised with a specific pathogen is a risk factor for acquisition.
- Regardless of the organism (species) the risk of acquisition increases
- Greater pooled acquisition rate for Gram-negative organisms

# Implications

- ICPs - understanding and managing the risks associated with the determination of room placement.
- Knowing the status of the prior room occupant may serve as important information in decision-making
- Current cleaning practices fail to reduce the risk of acquisition.
- Supports the need to improve hospital design
- Wider public → our study opens up a discussion about what is deemed acceptable risk.

# Limitations

- Constrained by the limitations of the individual studies reviewed
  - inability to conduct meta-regression
  - different approaches to testing the efforts of the participants, potential variations in microbiological testing methods
  - the presumption of acquisition based on epidemiological evidence
  - the inability to account for colonisation pressure

# Conclusion

- Prior room occupancy is a risk factor for acquisition

- Renewed interest and emphasis on hospital cleaning, and particularly discharge or terminal cleaning.

(Journal of Hospital Infection, 91(3):211-7)

# References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