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

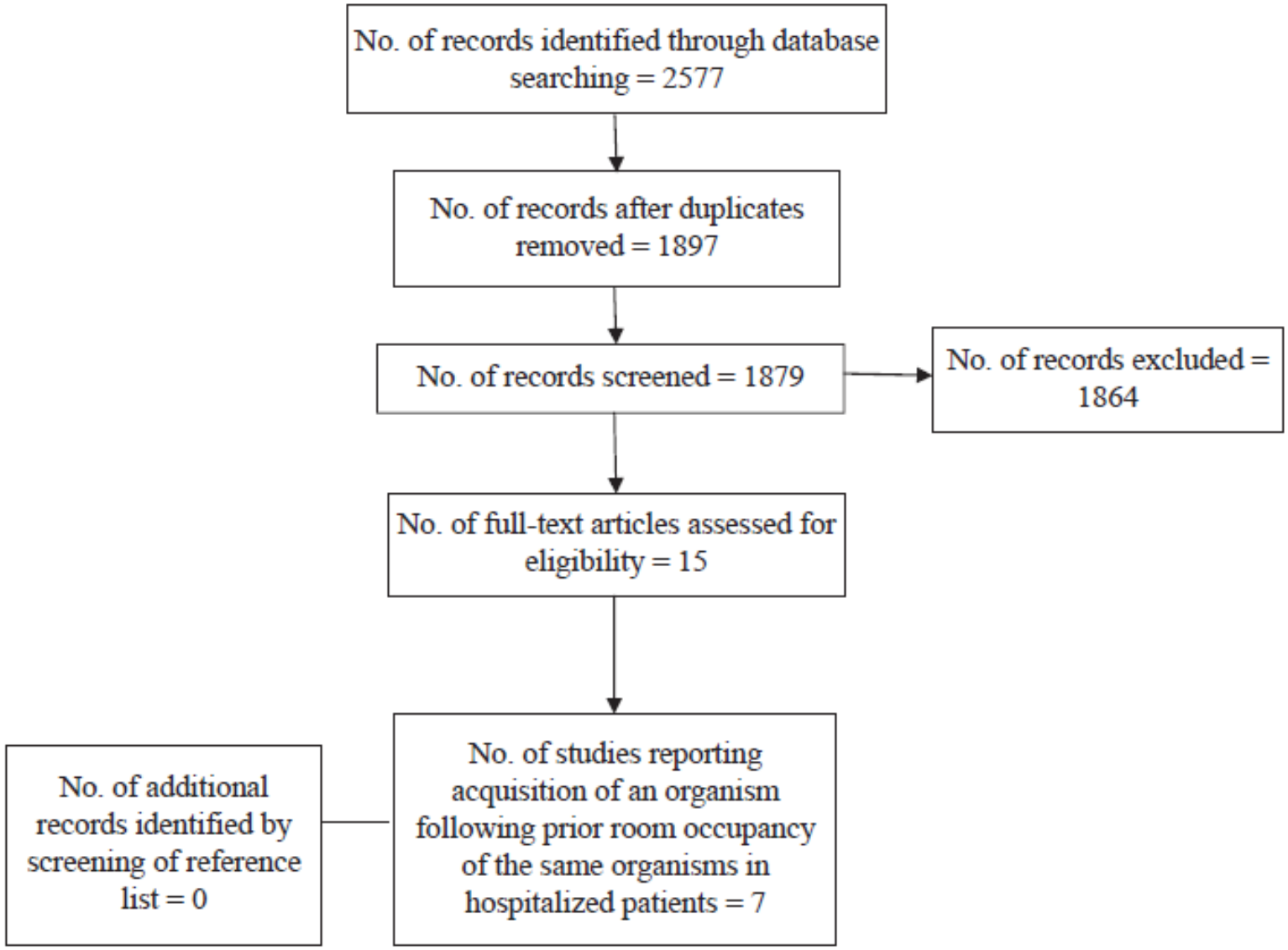
- *Acinetobacter*
- *Escherichia coli*
- *Klebsiella*
- *Pseudomonas*
- *E*nterobacter
- *Citrobacter*
- *Proteus*
- *Serratia*
- *Enterococcus*
- *C.difficile*
- *S.aureus* & VRE

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

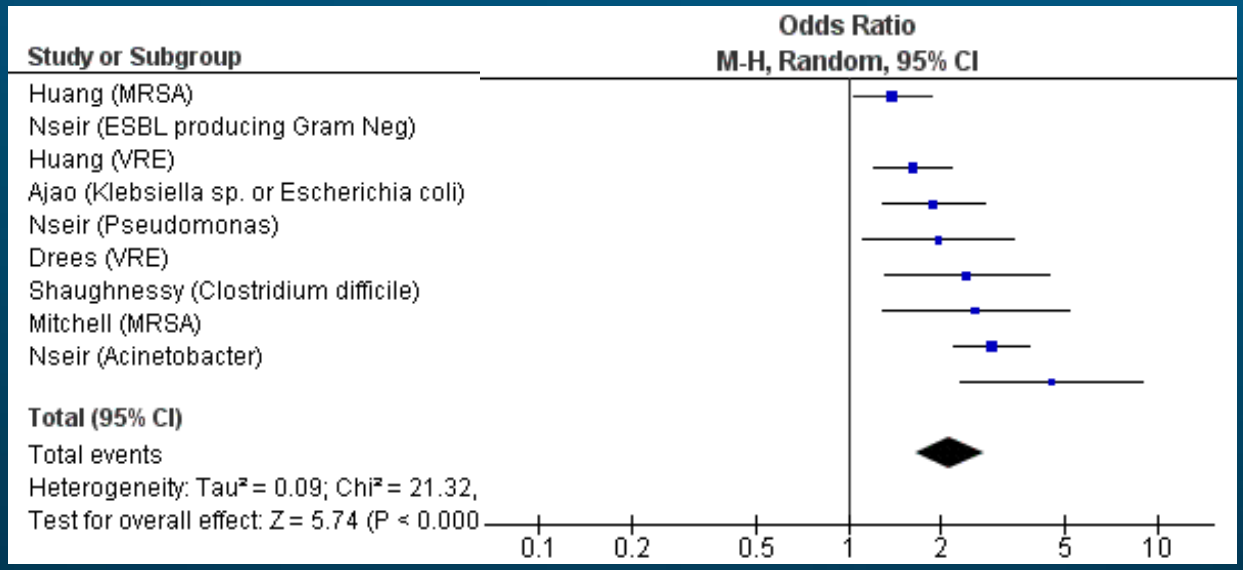
- 4,643 ‘exposed’ patients → 287 (6.2%) acquired the same species of organism.
- 34,886 ‘unexposed’ patients → 1,112 (3.2%)

- 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)

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