An evaluation of the environmental factors that impact on operating room air quality & the risk for development of surgical site infections

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Mercy Health

Care first

Introduction

Surgical site infections (SSIs) have substantial impacts on patient outcomes and are associated with increased healthcare costs. A scoping review identified two areas for infection prevention associated with SSIs.

1. Preoperative screening and optimisation of patient risk factors
2. Intraoperative interventions
    - Surgical technique
    - Prophylactic antibiotics
    - Adherence to infection prevention practices

Objectives

An integrative review was completed to identify operating room (OR) staff behavioral factors and adherence to infection prevention impacting;

- air quality
- surface contamination
- OR microbial load

The aims of the Integrative review were:

1. To evaluate evidence for the impact of surgical attire on air quality and surface contamination
2. To evaluate the evidence that increased foot traffic has negative impacts on air quality and SSI rates

Methodology

The integrative approach was chosen as included studies used a wide range of research designs including: *experimental simulation studies, retrospective and prospective observational studies, interventional studies.*

- Population – Patients undergoing joint replacement surgery
- Intervention – OR foot traffic & choice of surgical attire
- Outcome measures – OR air quality, staff compliance with guidelines, staff behavior change

Search Strategy

Databases searched were: MEDLINE Complete; CINAHL Complete; the Cochrane Library of Systematic Reviews

The key search terms included: '*total joint arthroplasty', 'surgical site infection', 'periprosthetic joint infection', 'operating room traffic', 'laminar airflow', 'airflow systems', 'staff behaviour', 'surgical attire'*

Inclusion / Exclusion criteria

(1) Published between 2000 to 2018

(2) Published in the English language;

Outcome of literature Search

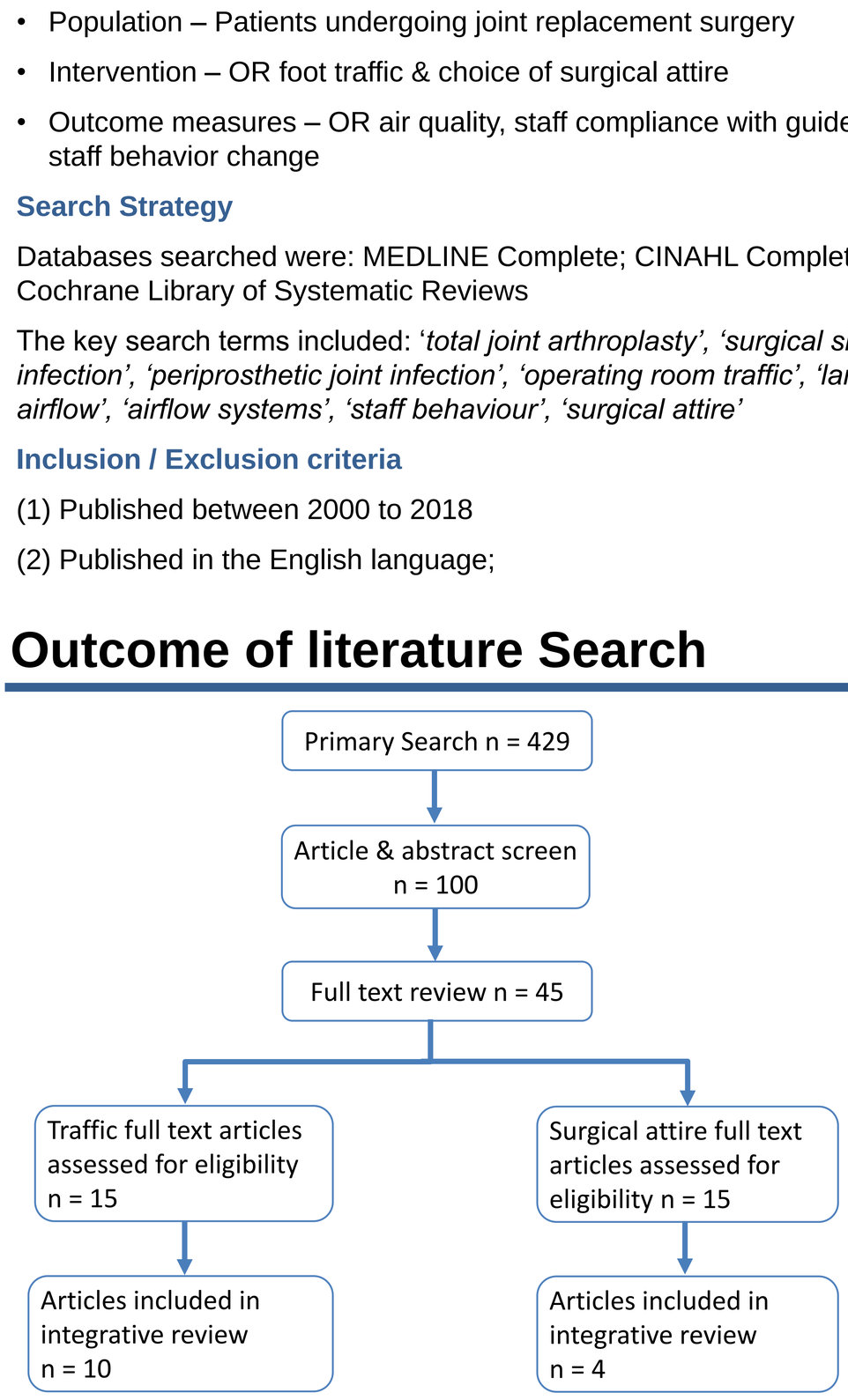

Figure 1: PRISMA flowchart

Results

Volume of traffic in the OR during surgical orthopedic cases

- The results demonstrated that staff movement in and out of the OR is high despite recommended guidelines

Author	Total door openings	Duration surgery (Mean)	No. Door openings (Mean)	Door opening rate / minute
Bedard et al. (2015)	7110	111.9	71.1	0.64
Panahi et al. (2012)	9657	119.5	8.2	0.69
Lynch et al. (2009)	488	157.0	40	0.25
Mousavi et al. (2018)	186	235.2	62	0.26

Table 1: summary of door opening events during arthroplasty surgery

Impact of foot traffic on air quality in the operating room

- OR traffic disrupts the OR airflow, resulting in increased turbulence, particle counts and colony forming units
- Elevated bacterial counts in the OR were directly linked to door openings

Clothing material types and headwear

- There is insufficient evidence for recommendations of the type of material that should be used for OR scrubs
- Skull caps (cloth & disposable) demonstrate less airborne contaminants

Quality improvement interventions

- Interventions to increase staff compliance to recommended practices had limited impact on staff behavior change
- Passive interventions (signage, education in-services, door alarms) were unable to demonstrate effective and sustained change in staff behaviour
- Verbal intervention by clinical leaders (surgeon) were able to decrease OR traffic rates

Author	QI	No surgeons	No cases	Total door opening	Total hours	Movement per hour	P value
Pulido et al. 2017	Intervention	1	50	4482	134	33	<.001
	Control	16	157	22902	498	46	

Table 2: Quality improvement initiative to decrease foot traffic in the OR

Key Findings

- OR foot traffic has a negative impact on air quality
- Cloth or disposable skull caps result in lower rates of particle shedding than bouffant hats
- Most OR recommendations are based on expert opinion

Conclusion

- There is Level IV research evidence that traffic flow in the OR has a negative impact on air quality
- There is Level III-3 research evidence that the use of cloth / disposable skull caps result in lower rates of particle shedding than disposable bouffant hats
- There is limited research available evaluating the impact of staff behaviour on the operative environment
- There is limited research evaluating the impact of staff behaviour on SSI rates
- Most recommendations for OR practice related to staff behaviour are based on expert opinion

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