

An exploration of the risk factors for developing deep wound infection after joint replacement surgery

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Introduction

In Australia there are approximately 180,000 Healthcare Associated Infections (HAIs) annually. Decreasing HAI has been identified as a quality improvement priority. Deep wound infection following joint replacement surgery has substantial impacts on patients' outcomes and healthcare costs. The research literature identified two areas for infection prevention associated with joint replacements: preoperative screening and optimisation of risk factors and intraoperative interventions including: improved surgical technique, prophylactic antibiotics and rigorous infection control practices.

Objective

The objective of the integrative review was to evaluate the evidence around the environmental and behavioural factors that may affect microbial load in the operating room, and to determine factors that increase the risk of infection in patients.

The areas of focus are:

- Airflow systems
- Operating room traffic volumes
- Surgical attire

Methodology

- The integrative approach was chosen as this included studies used a wide range of research designs: randomized controlled trials, cohort studies, cross sectional observational studies and experimental studies in simulated environments
- The study population observed were patients undergoing joint replacement surgery.
- The intervention/exposure included studies evaluating: Operating room foot traffic and air filtration systems used
- Study outcome measures were: airborne particles and microbial load, compliance with infection prevention guidelines and staff behavior to change

Search strategy

- The 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' and alternatives

Inclusion / exclusion criteria

- 1) Report published between 2000 to July 2017; (2) Published in the English language;

Identification of Periprosthetic risk factors

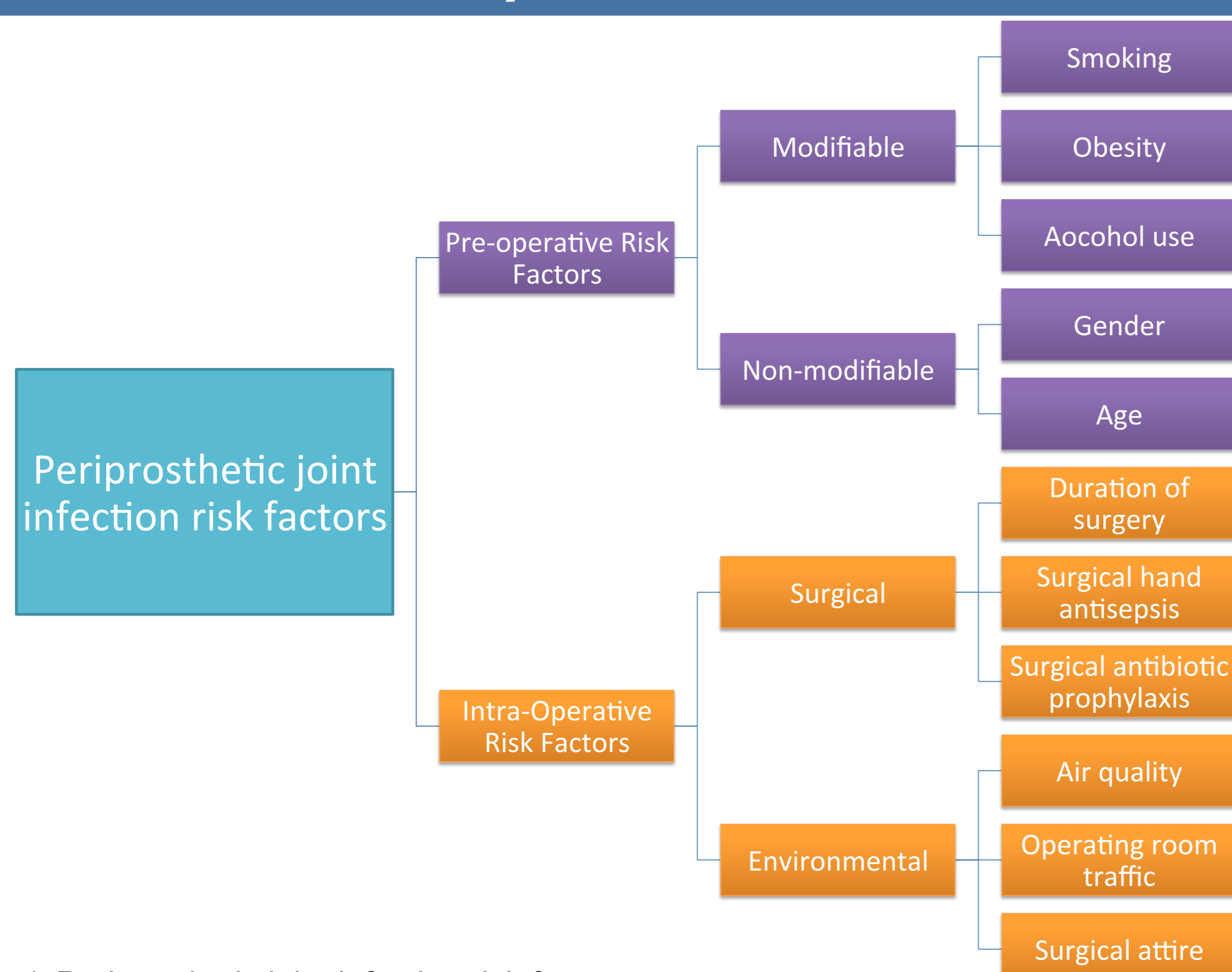


Figure 1. Periprosthetic joint infection risk factors

Outcome of literature Search

The primary search yielded 428 articles (Fig 2).

Articles were screened based on title and abstract (n=99), and were then divided into three themes:

- air quality (n=47),
- operating room traffic (n=21)
- surgical attire (n= 31).

44 articles were retained for full-text review.

- 17 articles were included in the integrative review:
- air quality (n=6),
- operating room traffic (n=7),
- surgical attire (n=4).

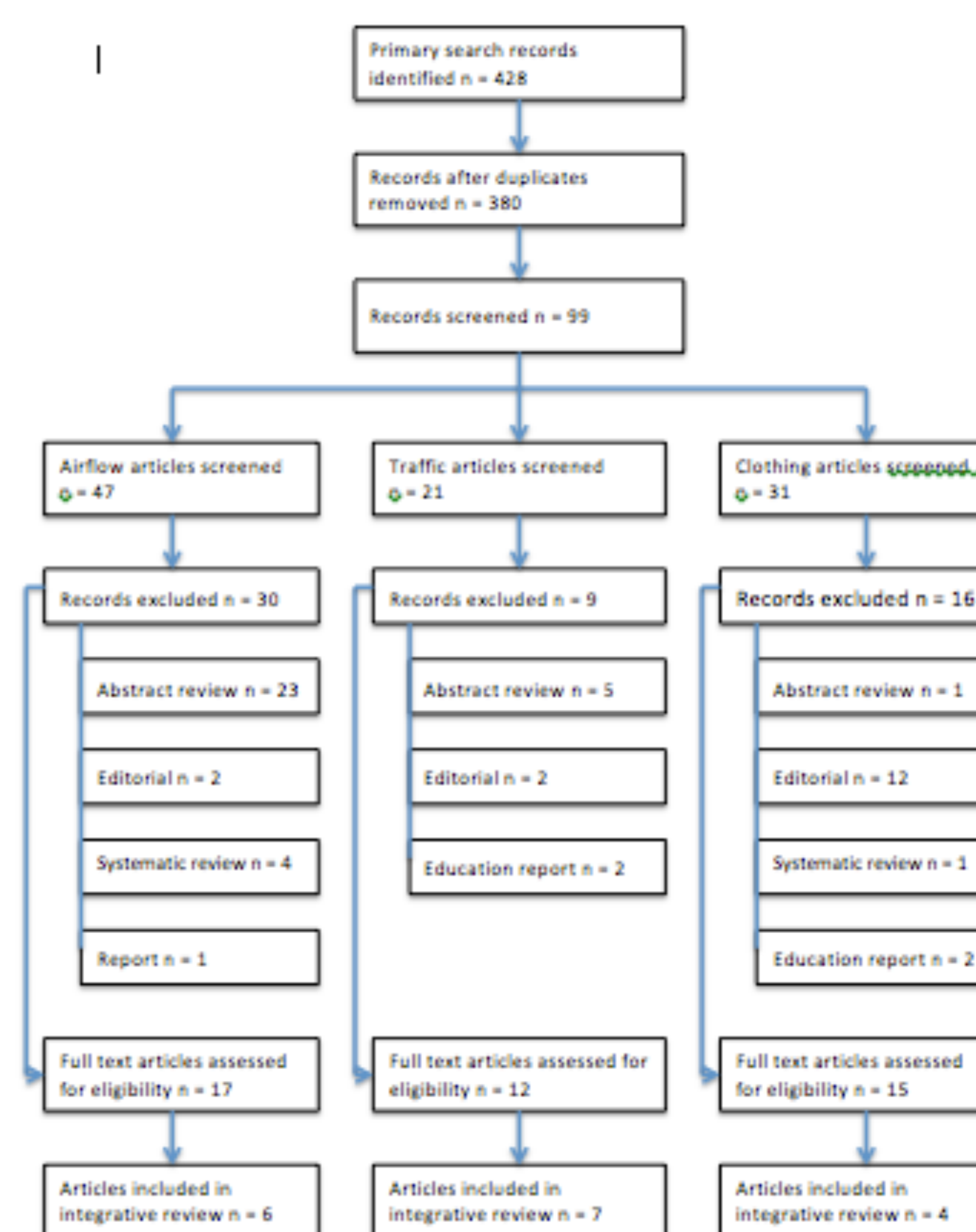


Figure 2. PRISMA flowchart

Results

Results were presented in two parts:

1. Studies evaluating air quality in the operating room, the effects of different air handling systems and the effect of surgical attire worn by operating room personnel has on air quality

Key Findings;

- Laminar airflow (LAF) units are able to decrease air contamination measured near the patient wound (colony forming units and particle counts)
- LAF units are able to decrease the level of surface contamination measured on the surgical field
- Studies evaluating the use of LAF were unable to demonstrate a reduction in surgical site infection rates
- Airborne contamination was higher when bouffant hats were worn compared to skull caps

2. Studies evaluating the effects of staff traffic in the operating room

Key Findings;

- Door openings are higher in revision and more complex cases
- A strong correlation was found between air quality measured in colony forming units and the total traffic rate per operation
- Mean door openings during arthroplasty surgery was 71-83 door openings per case or 0.64-0.39 door opening events per minute

Author	No of operations	Total door openings	Duration of surgery (Mean)	No door openings (Mean)	Total door rate Event/minute
Bedard et al.	100	7110	111.9	71.1	0.64
Panahi et al.	116	9657	119.5	83.2	0.69

Table 1. Door opening rate in arthroplasty surgery

Conclusion

- Outcomes of this review identified that evaluating of LAF using surgical site infections (SSI) as the primary outcome measure were unable to demonstrate effectiveness.
- Studies measuring the impact of LAF systems using air quality as the outcome, demonstrated improvements in ambient particle counts and surface contamination of the instrument table.
- Factors that had a negative impact on air quality included OR foot traffic measured via door openings and staff volume in the OR.

References:

Bedard et al. Traffic in the operating room during joint replacement is a multidisciplinary problem. *Canadian Journal of Surgery*, 58 (4), 232-236
Panahi et al. Operating room traffic is a major concern during total joint arthroplasty. *Clinical Orthopaedics And Related Research*, 470 (10), 2690-2694