Strategies to Reduce Ventilator-Associated Pneumonia Incidence in Mechanically Ventilated Pediatric Critical Care Patients: A Scoping Review

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PURPOSE

To evaluate how compliance with prevention bundles and/or utilization of a HEPA filter affects ventilator-associated pneumonia incidence among mechanically ventilated pediatric patients.

SPECIFIC AIMS

- To contribute a consolidated resource that evaluates how compliance with VAP bundles affects the incidence of VAP.
- To offer a holistic understanding of the role and impact of ventilator filters in the context of VAP among pediatric patients, specifically regarding VAP occurrence, length of hospital stays, duration of mechanical ventilation, mortality rates, economic costs, and infection cross-contamination.
- To guide further research in currently unexplored areas.

BACKGROUND

- Critically ill pediatric patients face the dual threat of their primary health condition and secondary complications, such as hospital-acquired infections (HAIs).
- VAP ranks as the second-highest HAI in the pediatric ICU.
- VAP can lead to increased morbidity, mortality, prolonged hospitalization, and increased healthcare costs.
- Current preventative measures
  - Implementation of and compliance with VAP prevention bundles
    - Evidence-based guidelines that reduce risk of infection and improve patient outcomes.
  - Application of ventilator filters to eliminate bacterial and viral agents.
- After the COVID-19 outbreak, the need for HEPA filters (versus standard bacterial filters) on ventilator circuits and their significance for preventing VAP and cross-contamination has gained increasing attention.

Figure 1: Ventilated at risk patient

METHODS

- Eligibility criteria
  - Critically ill pediatric patients of all races and genders requiring mechanical ventilation.
  - Articles for scoping review were required to meet appraisal criteria for consideration.
- Data Collection
  - CINAHL and PubMed were the primary databases.
  - Outcomes evaluated:
    - Duration of mechanical ventilation
    - Mortality rates
    - Hospital length of stay
    - Economic cost
    - VAP incidence rates
    - Cross contamination incidence

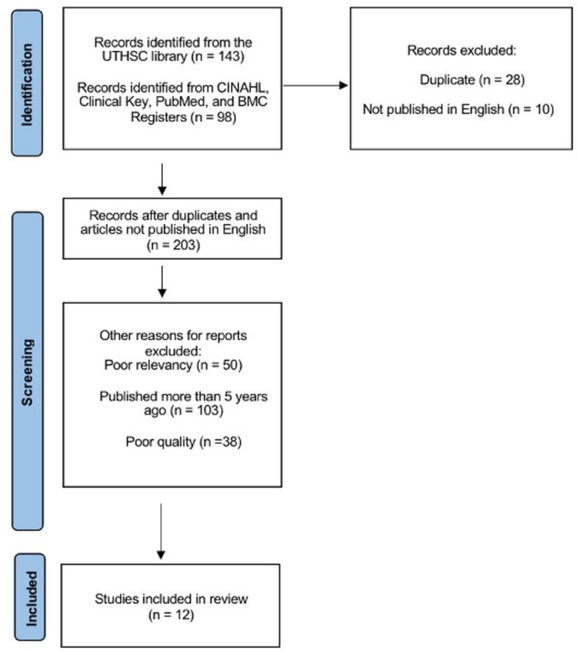

Figure 2: Article Selection Process

HYPOTHESES

1. VAP prevention bundles decrease the incidence of VAP.
2. With the addition of a HEPA filter to the VAP prevention bundle, VAP incidence will decline.

RESULTS

- 7 studies demonstrated decreased incidence of VAP
- 3 studies demonstrated decrease in hospital stay
- 4 studies demonstrated decrease in length of mechanical ventilation
- 4 studies demonstrated decreased mortality rates
- 4 studies demonstrated positive impact on cost
- 1 study demonstrated decrease incidence of cross-contamination

OUTCOMES	1	2	3	4	5	6	7	8	9	10	11
VAPI	↓	↓	↓	↓	↓	↓	NE	NE	↓	NE	—
LOS	↓	NR	—	↓	NE	NE	NR	—	↓	NE	—
DMV	↓	NE	↓	↓	NE	NR	NE	NE	↓	NE	—
MT	↓	↑	↓	—	NE	NE	NE	↓	↓	NE	NR
EC	NE	NE	NE	↓	↓	NE	↓	—	↓	NE	NE
CCI	NE	NE	NE	NE	NE	NE	NE	NE	NE	↓	NE

SYMBOL KEY
↑ = Increased, ↓ = Decreased, — = No Change, NE = Not Examined, NR = Not Reported

LEGEND
VAPI: Ventilator-Associated Pneumonia Infection Rates
LOS: Length of Hospital Stay
DMV: Duration of Mechanical Ventilation
MT: Mortality Rates
EC: Economic Cost
CCI: Cross Contamination Incidence

Figure 3: Results Synthesis

RESULTS SUMMARY

- Implementation and compliance with VAP bundles positively affect measured outcomes.
- HEPA filters have exceptional efficacy in serving as an anti-viral measures.
- Ventilator filters cannot be considered sole significant factor in prevention of VAP.

IMPLICATIONS FOR PRACTICE

- Comprehensive, multifaceted preventative approach ensures a decreased incidence of VAP.
- Bundled interventions demonstrate a significant reduction in VAP.
- HEPA filters present a promising avenue for intercepting pathogenic transmission.
- Need for further tailored, context-specific studies.
- Absence of a gold standard for pediatric VAP diagnosis and prevention impedes the comparison of current approaches and preventative strategies.

REFERENCES: