The relationship between air and surface microorganisms in hospital wards: a systematic review

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Motivation

- Total UK hospital admissions were about 16 million patients in 2015/2016; 162,000 of them acquired infections, these healthcare-associated infections (HAIs) cost NHS £3 billion per year [1, 2, 3].
- The hospital environment is thought to be responsible for up to 20% of all HAIs, acting as a reservoir for pathogens [4, 5].
- Exposure to airborne pathogens is a particular challenge, especially in respiratory wards [6]; immunocompromised patients are at crucially raised risk.
- The relationship between airborne pathogens, surface contamination and HAIs remains undiscovered [7].

Aim

To explore the gaps in knowledge on the influence of the environment on airborne pathogens in hospitals.

Research questions

<table>
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<tr>
<th>Does the study...</th>
<th>Conduct air sampling?</th>
<th>Carry out surface sampling?</th>
<th>Record physical environmental factors?</th>
<th>Observe staff or patients’ activities?</th>
<th>Correlate air sampling to surface sampling?</th>
<th>Correlate air sampling to the activities?</th>
<th>Correlate air sampling to the physical environmental factors?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
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Mechanisms

- Airborne pathogens
- Surface contamination
- Physical environmental factors
- Staff or patients’ activities
- Immediate re-aerolisation

Methodology

- Case study
- Systematic review
- Searches on Medline, Cochrane, EMBASE, Fungi, and other databases
- Title, abstract and full text screening
- Risk of bias
- Exclusion criteria
- Operating rooms and other sensitive surfaces
- Reばかり普及と耐性の環境、時間、空間的影響
- Infection control

Results

Reviewing previous work reveals the following points:

- Bacteria show the highest percentage of studied organisms in comparison with fungi and viruses.
- The most studied bacteria, fungi and virus were Staphylococcus aureus, Aspergillus fumigatus and Torque teno virus respectively.
- No studies correlated the microorganism load in the air to those on surfaces over short continuous periods of time (e.g. an 8 hour day). Study sampling generally occurs within a time “snapshot” and/or presents data for microorganisms as a percentage of positive results rather than quantitative values.
- The effect of air temperature, relative humidity, type of ventilation system, ventilation rate, size of room, layout of room and human activities on survival rate and spatial deposition rate of airborne pathogens over time is currently very limited.

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