



### Letter to Editor



# The Underestimated Risk: Insects as Carriers of Superbugs in Hospitals

Swathi Gurajala\*

Department of Respiratory Care, College of Applied Medical Sciences in Jubail, Imam Abdulrahman Bin Faisal University, Dammam, Kingdom of Saudi Arabia.

\* **Corresponding author:** Swathi Gurajala, Department of Respiratory Care, College of Applied Medical Sciences in Jubail, Imam Abdulrahman Bin Faisal University, Dammam, Kingdom of Saudi Arabia.

**Email:** drswathi.gurajala@gmail.com

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Dear Editor,

Hospital-acquired infections (HAIs) cause morbidity, death, and economic burden in healthcare systems globally. The usual transmission routes of these HAIs include patient-to-patient transmission and contaminated surfaces or medical devices. Still, recent evidence suggests that insects are an underestimated but significant vector of superbugs in hospitals.<sup>1,2</sup> The intricate organisation of patient rooms, surgery suites, and dining facilities in modern hospitals provides numerous opportunities for insects to act as vectors.<sup>3</sup> Their mobility, biological traits, and frequent contact with polluted and clean environments make them ideal carriers of pathogens.

**Table 1** - Common vectors that spread superbugs within hospital environments.

| S. no. | Insects                    | Superbugs transmitted                                                                                                                                                     |
|--------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | Flies <sup>1</sup>         | <ul style="list-style-type: none"><li>• Staphylococcus aureus</li><li>• Escherichia coli</li><li>• Salmonella.</li></ul>                                                  |
| 2.     | Cockroaches <sup>2,3</sup> | <ul style="list-style-type: none"><li>• E. coli</li><li>• Klebsiella pneumoniae</li><li>• Enterococcus</li><li>• Bacillus spp</li><li>• Pseudomonas aeruginosa.</li></ul> |

|    |                        |                                                                                                              |
|----|------------------------|--------------------------------------------------------------------------------------------------------------|
| 3. | Ants <sup>4,8</sup>    | <ul style="list-style-type: none"><li>• Clostridium difficile,</li><li>• MRSA</li><li>• VRE</li></ul>        |
| 4. | Bed Bugs <sup>9</sup>  | <ul style="list-style-type: none"><li>• Staphylococcus aureus and</li><li>• Streptococcus pyogenes</li></ul> |
| 5. | Mosquito <sup>10</sup> | <ul style="list-style-type: none"><li>• Plasmodium spp</li><li>• Dengue virus</li></ul>                      |
| 6. | Rats <sup>11</sup>     | <ul style="list-style-type: none"><li>• Salmonella spp</li><li>• Listeria spp</li></ul>                      |
| 7. | Moths <sup>12</sup>    | <ul style="list-style-type: none"><li>• MDR Pathogens</li></ul>                                              |
| 8. | Spiders <sup>13</sup>  | <ul style="list-style-type: none"><li>• MDR Pathogens</li></ul>                                              |

\* MRSA- Methicillin-resistant *Staphylococcus aureus*, VRE- Vancomycin-resistant *Enterococci*, MDR-Multi drug-resistant pathogens

Table 1 depicts the list of common vectors and superbugs they transmit within hospital environments. Superbug-carrying insects threaten hospital patients, especially those with impaired immune systems, open wounds, or invasive operations by extended hospital stays and death. Continuing insect pest infestations in healthcare settings could result in new infections after patients recover.<sup>4</sup>

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**Table 2** - Studies reporting the spread of HAI by insects

| Authors                         | The main findings of the study                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oliveira PS et al <sup>6</sup>  | 95% of <i>Staphylococcus aureus</i> strains isolated from insects, from two public hospitals were oxacillin-sensitive. Among these isolates, 27.58% were biofilm producers and were resistant to 70% alcohol but vulnerable to other disinfectants.                                                                                                                                                                                                                                  |
| Rupprecht T et al <sup>12</sup> | In the hospital sewage system, moth flies proliferate and transmit multidrug-resistant germs. Biofilm removal and mothfly elimination procedures were only partially successful.                                                                                                                                                                                                                                                                                                     |
| Dunbar JP et al <sup>13</sup>   | Bites from the false widow spider( <i>Steatoda nobilis</i> ) can cause antibiotic-resistant bacterial illnesses. 16S rRNA sequencing detected 11 species of bacteria from <i>S. nobilis</i> body surfaces and chelicerae, as well as two native spiders, <i>Amaurobius similis</i> and <i>Eratigena atrica</i> . The pathogens isolated from them were <i>Staphylococcus epidermidis</i> , <i>Khuyvera intermedia</i> , <i>Rothia mucilaginosa</i> , and <i>Pseudomonas putida</i> . |
| Boiocchi F et al <sup>14</sup>  | Diptera (flies) were the most common flying insects in the sampled UK hospitals. They carried a variety of opportunistic human pathogens, few of which were antibiotic-resistant.                                                                                                                                                                                                                                                                                                    |
| Kappel HB et al <sup>15</sup>   | Most hospital-collected flying insects (86.4%) had harmful germs on their surfaces. Gram-positive bacilli (68.2%), Gram-positive cocci (40.9%), and Gram-negative bacilli (18.2%) were identified.                                                                                                                                                                                                                                                                                   |
| Hassan B et al <sup>16</sup>    | <i>E. coli</i> (14.3%), <i>K. pneumoniae</i> (10.9%), and <i>E. cloacae</i> (16.3%) were the primary MDRE species isolated from arthropod vectors. The most frequent resistance gene was blaNDM carbapenemase, found in 15.5% of SSIs, 15.1% of HSs, and 13.3% of arthropod samples. The genetic links between MDRE isolates from SSIs, HSs, and arthropods support a One Health approach to infection control and AMR in LMICs.                                                     |

\*HS- Hospital sepsis, LMIC- Low- and middle-income countries, MDRE- Multi-drug resistant Enterobacterales, SSI-Surgical site infections.

Table 2 illustrates a few case studies reiterating documented outbreaks of HAI due to insect activity. Integrated Pest Management (IPM) strategies can be employed to prevent and control insects in hospital environments.<sup>5</sup> IPM reduces hospital pest populations using multiple methods:

1. IPM programs use regular monitoring and inspections to spot insect infestations early.
2. Hospitals must adhere to strict sanitary regulations concerning waste disposal and food service. This involves regularly cleaning food preparation and serving areas, disposing of rubbish appropriately, and deep-cleaning insect-prone locations like storage rooms and laundry facilities.

3. Sealing cracks, maintaining window screens, and utilising automatic door-closing mechanisms can keep insects out of hospitals.
4. Insecticides can be an effective IPM strategy in non-patient regions.

The following challenges may be encountered in implementing the IPM strategies.

1. Addressing insects transporting superbugs is essential, but enhanced antibiotic stewardship programs are needed to restrict their spread. Antibiotics should only be provided when necessary and monitored to minimise abuse, which can promote drug resistance.<sup>6</sup>
2. Emerging technologies may help hospitals reduce insect populations. Existing pest management solutions can include UV light systems that kill insects or pheromone traps that keep pests away from patient care areas. Research is also investigating chemical-free pest control using biological controls like bacteria or fungi that target pest insects.<sup>7</sup>
3. Hospital insects and superbug transmission require further research. Hospital insect-vectored illnesses are an increasing hazard, and governments and public health organisations must adopt regulations to address ecological and medical concerns.

Superbugs transmitted by insects are an increasing menace to healthcare systems worldwide. Insects, often overlooked potential HAI sources, can carry and transmit MRSA, VRE, and resistant Gram-negative bacteria. These insects are potent infection carriers because they can move between polluted and sterile habitats. Integrated pest management, strict environmental cleanliness, and increased pest and disease surveillance can mitigate this threat. We must address antibiotic misuse in healthcare settings to reduce antibiotic-resistant microorganisms. Hospitals must identify insects' role in superbug transmission and adopt prompt preventive actions.

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