A Systematic Review of Aircraft Disinsection and Mosquitoes Aboard International Conveyances: Operational, Public Health and Systems-level Secondary Outcomes

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Introduction

Background: Aircraft disinsection, which entails spraying insecticide in aircraft is regarded as an important measure to prevent the spread of vector-borne diseases.

Rationale: Disinsection is both a controversial public health tool and potential international trade policy barrier.

Despite some reviews evaluating disinsection efficacy, few have considered outcomes beyond efficacy and safety, such as feasibility, user acceptability, operational efficiencies, or public health outcomes—all of which are critical to decision-making.

Methods

A systematic review was conducted according to PRISMA guidelines

Outcomes synthesized include a range of unintended consequences of disinsection on different modes of international conveyance (air, marine, and land)

Inclusion	Exclusion
• Studies related to the disinsection of international travel carriers, such as passenger areas, cargo spaces, and containers across air, water, and land transport. • Studies involving chemical disinsection agents (like DDT, d-phenothrin, and permethrin) as well as non-chemical methods targeting mosquitoes.	• Studies that only used in vitro data. • Studies that used non-representative models of conveyance environments (e.g., non-pressurized sheds as aircraft cabins or carpet pieces treated in labs as residual disinsection models).

Table 1: Inclusion and exclusion criteria

Databases Searched:

PubMed	Embase	Medline
Scopus	LILACS	CINAHL

Results

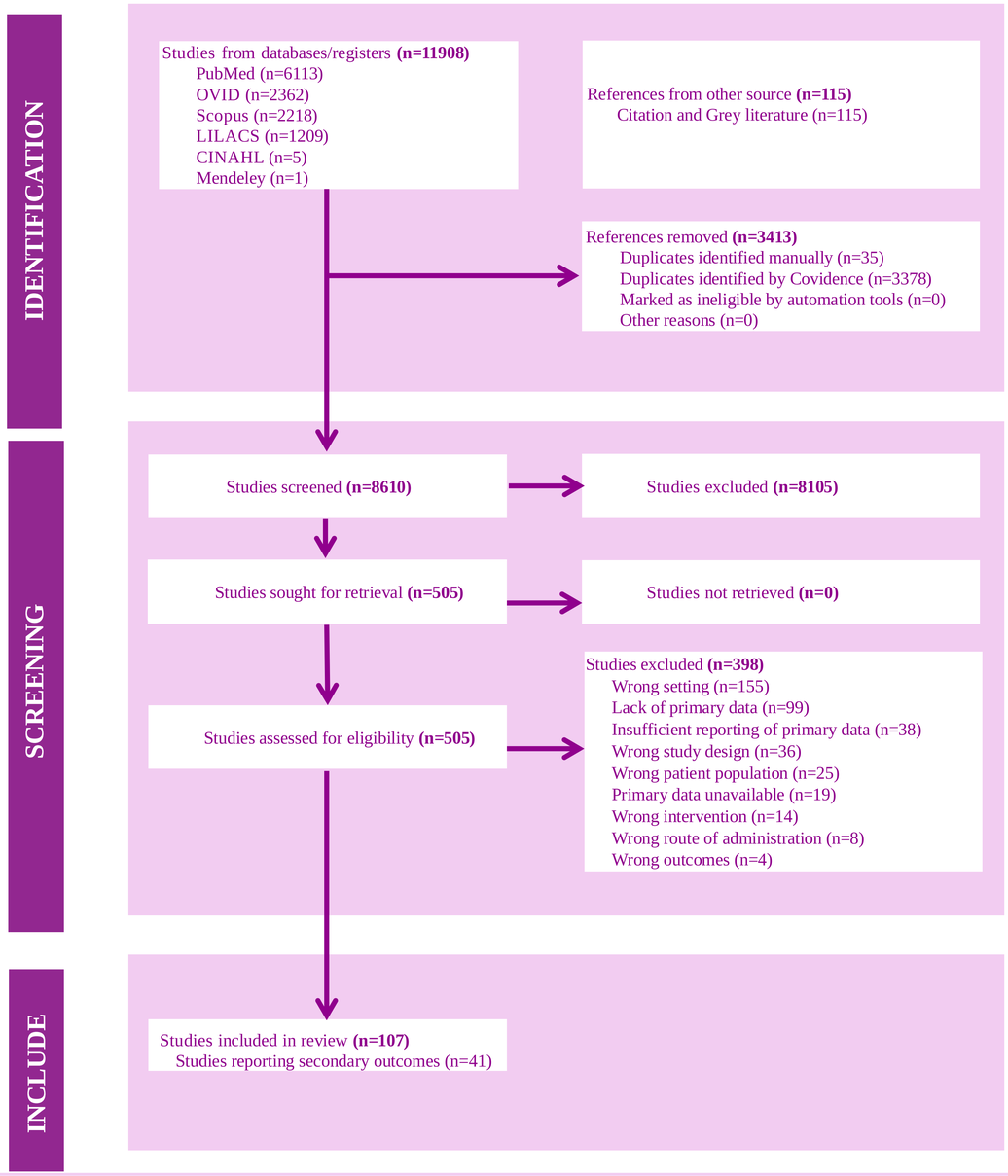

Figure 1: PRISMA Flow Chart

Key Findings

1. **Operational Challenges:** 16 studies reported that disinsection techniques encounter considerable operational difficulties, such as limitations in staff training, delays, and disruptions to flight schedules. Problems with application techniques (e.g., "Top of Descent" spraying) diminish acceptance due to noticeable passenger exposure and discomfort.
2. **User Acceptability:** 19 studies confirmed mixed reactions from passengers and crew, mostly stemming from discomfort, odour, and irritation, and underscore the necessity for less invasive approaches. Significantly, elevated insecticide concentrations correlated to greater negative responses.
3. **Equipment Impact:** Disinsection residue may influence aircraft interiors, with documented instances of residue buildup, interference with electronic devices, and surface damage, highlighting the importance of for careful application.
4. **Financial Burden:** The expenses associated with disinsection affect airlines and health authorities, indicating the economic advantages of implementing preventative measures at borders rather than post-entry of mosquitoes into conveyances.
5. **Mosquito Pathogen Carriage:** Surveillance for pathogens in mosquitoes on conveyances is limited; results thus far indicate no pathogen carriage in tested mosquitoes, although West Nile virus was detected in a few instances, highlighting the necessity for expanded pathogen surveillance.
6. **Public Health and Safety:** Disinsection is essential in preventing the transmission of mosquito-borne diseases; nonetheless, concerns persist regarding the health of passengers and crew if protocols are not followed regularly.
7. **Legal and Sociocultural Considerations:** Legal frameworks are present but limited, with minimal rules governing mosquito importation. Cooperative initiatives among countries, exemplified in the Indian Ocean region, are essential for minimizing vector risks.
8. **Insecticide Resistance:** Resistance to common insecticides is increasing, which compromises the efficacy of disinsection strategies and necessitates the exploration of alternate methods or products.

Conclusions

- Disinsection is a strategy for controlling vector-borne disease spread but faces challenges in efficiency, user comfort, and safety.
- Growing insecticide resistance signals the need for sustainable alternatives.
- Enhanced pathogen surveillance on conveyances and at entry points can strengthen public health security.
- Collaborative global efforts and research into non-toxic methods will improve health protection, balancing effectiveness with passenger comfort.

References

1. WHO aircraft disinsection methods and procedures, 2nd ed. Geneva: World Health Organization; 2023 (https://iris.who.int/handle/10665/374318)