WHO/HSE/GCR/2016.12

Report of the WHO Ad-hoc Advisory Group on aircraft disinsection for controlling the international spread of vector-borne diseases

Geneva, Switzerland

21-22 April 2016

Global Capacities
Alert and Response

World Health Organization

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Context

On 1 February 2016, WHO declared the clusters of microcephaly and other neurological disorders, and their potential link with Zika virus outbreaks in Brazil and French Polynesia, to be a public health emergency of international concern (PHEIC). Following the advice of the first meeting of the Emergency Committee under the International Health Regulations (2005) (IHR (2005)), WHO issued several temporary recommendations concerning specific actions for vector control and related issues[1]. Given the potential causal relationship between the neurological disorders and Zika virus infection, these recommendations included specific mention of disinsection as a precautionary measure. The temporary recommendations stated that "standard WHO recommendations regarding disinsection of aircraft and airports should be implemented". The second meeting of the Emergency Committee recommended that "Standard WHO recommendations regarding vector control at airports should be implemented in keeping with the IHR (2005). Countries should consider the disinsection of aircraft" [2].

The requirements of the IHR (2005) include several provisions for vector control measures, including disinsection, relating to aircraft and other conveyances, as well as measures to maintain airports free from sources of infection[3].

However, there is persistent controversy around aircraft disinsection. Given the rapid spread of Zika virus infection in Latin America and other countries, and the mounting evidence on the potential causal link between the Zika virus infection and the occurrence of neurological complications, WHO convened an ad-hoc advisory group to provide further advice to the Organization on the role of aircraft disinsection for preventing the international spread of vector-borne diseases, including Zika virus. The 15 members of the advisory group covered a wide range of expertise, including entomology, virology, vector control, infectious diseases surveillance, chemical safety, mathematical modelling, travel medicine, border security, and aviation operations.

The group met on 21-22 April 2016 in Geneva, Switzerland, and discussed the following three questions:

1. What is the effectiveness of disinsection of aircraft, with currently available agents, on controlling the international spread of mosquito-borne diseases, such as malaria, chikungunya, dengue, yellow fever, and in particular the Zika virus disease?
2. What are the methods and products that should be recommended for controlling the international spread of mosquito-borne diseases?

[1] First meeting (1 February 2016): "Vector control measures and appropriate personal protective measures should be aggressively promoted and implemented to reduce the risk of exposure to Zika virus" ; second meeting (8 March): "Vector surveillance, including the determination of mosquito vector species and their sensitivity to insecticides, should be enhanced to strengthen risk assessments and vector control measures. Vector control measures and appropriate personal protective measures should be aggressively promoted and implemented to reduce the risk of exposure to Zika virus. Countries should strengthen vector control measures in the long term and the Director-General of WHO should explore the use of IHR mechanisms, and consider bringing this to a forthcoming World Health Assembly, as means to better engage countries on this issue." (http://www.who.int/mediacentre/news/statements/2016/1st-emergency-committee-zika/en/)

[2] See: http://www.who.int/mediacentre/news/statements/2016/2nd-emergency-committee-zika/en/

[3] Relevant provisions include articles 1, 19-28, 33, 34, 38, 41, 42, 43 and Annexes 4, 5 and 9. Appendix 1 of this document presents a summary of these key requirements. For details on the specific requirements under the IHR (2005), see "International Health Regulations (2005), second edition". WHO, 2008. Available at: http://www.who.int/ihr/publications/9789241596664/en/.

3. What are the possible recommendations, including further research, for the control of international spread of mosquito-borne diseases through air traffic, as they relate to disinsection?

In addition to existing WHO guidance and technical background documentation, the advisory group also took into account views from a wide range of stakeholders, representing industry manufacturers, airline operators, and representatives of civil society and unions. A full list of participants and the meeting agenda are in appendices 2 and 3, respectively.

This document presents the outcome of the group deliberations and its recommendations.

Findings and recommendations

The advisory group were in consensus that mosquito vectors travel on aircraft and other conveyances, and that a small proportion of those may carry pathogens.

From a public health perspective, the group was also in agreement that the ultimate goal of the IHR (2005) is the prevention of international spread of vector-borne diseases. The role of aircraft disinsection for this purpose was discussed at length.

The group noted that pathogen importation in mosquito vectors has a low probability compared to introduction of pathogens by infected human travellers. Currently, there are some documented cases of malaria ("airport malaria") and dengue caused by mosquitoes carried on an international flight, no documented cases for yellow fever (although the concerns with regards to potential consequences of its introduction in non-endemic areas are very high) and no documented cases for Zika virus to date.

The following section presents the outcome of the deliberations for each of the three questions.

Question 1 – effectiveness of disinsection

Disinsection was considered to be an **effective and important** measure for the avoidance/reduction of importation of new mosquito vectors to a country or region. This was seen as important preventive strategy for countries (particularly islands) where the relevant mosquito vector is not present. Aircraft disinsection is in fact systematically and effectively carried out in Australia and New Zealand where increased numbers of imported vectors have been recorded in recent years. It was also noted that in areas where the relevant mosquito vector is already established, the risk of importing insecticide-resistant strains is an additional concern. It was noted that cargo compartments and other conveyances may be more relevant than aircraft cabins for importation of some mosquito vectors.

Disinsection is also **important** for countries determined to avoid importation of specific infected mosquito vectors (for example, for yellow fever importation into non endemic countries/areas with established mosquito vectors)**.** Countries should develop risk assessment models and may require aircraft disinsection based on the results of such risk assessment.

Effectiveness of disinsection was considered **low** for preventing pathogen importation, as there is a low risk of importation by mosquito vectors compared to infected travellers.

Question 2 – methods and products

Controlling mosquito vectors and disease at source, when implemented well, is the best way to avoid the international spread of pathogens. Institutionalized mosquito vector control in airports and nearby urban areas is a priority intervention to prevent international spread of mosquito vectors. Surveillance and mosquito vector control must be implemented effectively in all international airports in compliance with the requirements of the IHR (2005).

The WHO Vector Control Advisory Group (VCAG) recently reviewed the vector control tools for use in the context of the response to the Zika virus outbreak, and recommended improved implementation of current vector control interventions and better data-gathering on the pilot deployment of new tools[4].

WHO has provided guidelines on methods and products for aircraft disinsection[5].

Specifications for aircraft disinsection products have been established by the WHO Pesticide Evaluation Scheme[6] (WHOPES), including:

- d-Phenothrin technical grade material[7]
- 1R-trans-phenothrin technical grade material[8]
- Permethrin technical grade material[9].

A risk assessment model to ensure that products and methods used for disinsection do not give rise to unacceptable risks of health effects in passengers, aircrew or ground staff has also been published in 2013[10]and can be accessed at http://www.who.int/ipcs/publications/ehc/ehc243.pdf.

"Guidelines for testing the efficacy of insecticide products used in aircraft" have been published by WHO and can be accessed at http://www.who.int/ihr/publications/aircraft_insecticides/en/.

The guidelines include four recommended techniques for aircraft disinsection:
1) Pre-flight;
2) Blocks away;
3) Top-of-descent; and
4) Residual treatment (see Annex 1[11]).

WHO has recently published a handbook on vector surveillance and control[12] and this document should be used for capacity building.

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[4] http://who.int/neglected_diseases/news/mosquito_vector_control_response/en/
[5] WHO Report of the informal consultation on aircraft disinsection WHO/HQ Geneva, 6-10 November 1995 : http://apps.who.int/iris/bitstream/10665/59700/1/WHO_PCS_95.51_Rev.pdf
[6] http://www.who.int/whopes/en/
[7] http://who.int/whopes/quality/en/dPhenothrin_Spec_Eval_Oct_2004.pdf?ua=1
[8] http://who.int/whopes/quality/1R-trans-phenothrin_spec_eval_Sep_2015.pdf?ua=1
[9] http://www.who.int/whopes/quality/en/Permethrin_40-60_spec_eval_WHO_Sep_2015.pdf?ua=1
[10] WHO. IPCS Environmental health criteria 243. Aircraft disinsection insecticides. WHO 2013. http://www.who.int/ipcs/publications/ehc/ehc243.pdf
[11] http://www.who.int/ihr/ports_airports/aircraft_insecticides_annex1.pdf?ua=1
[12] Handbook. Vector surveillance and control at ports, airports , and ground crossings. WHO, 2016. http://apps.who.int/iris/bitstream/10665/204660/1/9789241549592_eng.pdf

Methods

It was noted that the presence of mosquito vectors is not just limited to aircraft cabins, as they can hide in overhead lockers, baggage and cargo holds. The current practice of applying aerosols in aircraft cabins after overhead lockers have been closed is not a good practice. This method excludes the disinsection of cargo/baggage holds and is therefore not effective in keeping the baggage and cargo containers in passenger aircrafts free of mosquito vectors.

Disinsection products

Several concerns were noted regarding the products currently used for aircraft disinsection:

- Only certain pyrethroids have been recommended in technical publications by WHO;
- Only certain chemicals have been approved by the main aircraft manufacturers (Airbus and Boeing) as technically acceptable and compatible with the specialised materials used in aircraft; this information should be made readily accessible;
- There is widespread and increasing resistance of mosquito vectors to many insecticides, in particular to pyrethroids, so the pyrethroid-based disinsection products may not provide the desired efficacy against them;
- There are regulatory restrictions on the use of certain pyrethroids in some Member States and it is possible that certain pyrethroids could be banned by some Member States. Coupled with the lack of suitable alternatives, there is a real risk of having no effective and acceptable products for disinsection available in some regions or countries in the near future; and
- There are substantial regulatory hurdles/barriers to introducing new products on the market.

Question 3 - recommendations

The group agreed on the following recommendations for Member States, for the WHO Secretariat, and for future research.

Recommendations for Member States

1) Member States must prioritize achievement of the required International Health Regulations core capacities for surveillance and response, and at designated points of entry under Annex 1 of IHR (2005), as well as capacities necessary to implement all of the many other provisions of the IHR directly relevant to disinsection and vector control.

2) Member States should undertake a risk assessment relating to the probability of the importation