

Infection prevention and control during health care for probable or confirmed cases of Middle East respiratory syndrome coronavirus (MERS-CoV) infection

Interim guidance

Updated October 2019

WHO/MERS/IPC/15.1 Rev 1



Introduction

The World Health Organization (WHO) has updated the interim guidance that was published on 6 May 2013 and updated in June 2015 to meet the urgent need for up-to-date information and evidence-based recommendations for the safe care of patients with probable or confirmed Middle East respiratory syndrome coronavirus (MERS-CoV) infection. The interim recommendations are informed by evidence-based guidelines WHO have published, including the *Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care. WHO Guidelines*¹ and review of current evidence on MERS-CoV infection. The recommendations have been reviewed by experts in infection prevention and control (IPC) and other technical areas (see Acknowledgements for names and affiliations).

This guidance reflects current understanding of IPC related to MERS-CoV² and uses revised case definitions³. Key changes in these guidelines include the following:

- Updates on air exchanges required for patients with clinically suspected and confirmed MERS-CoV
- Harmonization on wording around IPC measures throughout document (recommendations have not changed however wording is more nuanced)
- PAPR use for airborne isolation is included as an alternative to particulate respirator at least as protective as a NIOSH-certified N95, EU FFP2 or equivalent
- Updated guidance on duration of specific IPC measures recommended for MERS-CoV patients.

This guidance is intended for health-care workers (HCWs), health-care managers, and IPC teams. Specific WHO interim guidance on [Clinical Management of severe acute respiratory infection when Middle East respiratory syndrome coronavirus \(MERS-CoV\) infection is suspected and Management of asymptomatic persons with MERS-CoV](#) has also been published^{4,5}. WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication. Links are given here to additional sources and evidence. If you have further questions, send an e-mail message to: outbreak@who.int with "MERS IPC question" in the subject line.

MERS-CoV is a zoonotic virus, with evidence to date indicating that dromedary camels are the main source of infection to humans. Human-to-human transmission occurs mostly in health-care settings and, to a more limited extent,

within communities, mainly in households. Close unprotected contact is needed for transmission which occurs via contact and droplet transmission. There is no evidence of sustained, human-to-human transmission to date however clusters in healthcare settings have been reported^{6,7} and nosocomial transmission is an important characteristic of MERS-CoV infection^{8,9}. MERS-CoV superspreading events have also been reported in the literature¹⁰. Further studies are underway to better understand the risk factors for animal-to-human and human-to-human transmissions.

The successful prevention of spread of MERS-CoV infections in health care settings depends on the existence of an effective IPC program that includes the WHO IPC Core Components¹¹. Most transmissions occur due to lack of application of standard IPC precautions during routine care before a specific case is confirmed. The routine application of measures to prevent spread of acute respiratory infections (ARI)¹ when caring for symptomatic patients is essential to reduce spread of any ARI in health-care settings. Additional precautions when caring for patients with [probable or confirmed infection with MERS-CoV](#) (see section 2.3) should be applied to further reduce the risk of transmission. Health-care institutions are advised to consider establishing or reinforcing existing services for the oversight of HCWs' health to ensure a safe environment for patients and HCWs. It is crucial that HCWs are provided with training and the best locally available protection for caring for MERS-CoV-infected patients and are followed up if exposure has occurred.

This guidance summarizes:

- Principles of IPC strategies associated with health care
- IPC precautions:
 - for providing care to all patients
 - for providing care to ARI patients, and
 - for providing care to patients with probable or confirmed MERS-CoV infection
 - for preventing and controlling transmission of MERS-CoV to caregivers of the patients in hospital settings

1. Principles of infection prevention and control strategies associated with health care

IPC strategies to prevent or limit infection transmission in health-care settings include the following: early recognition and source control, administrative controls, environmental and engineering controls, and personal protective equipment (PPE)¹.

To be effective, IPC measures must anticipate the flow of patients (and thus the potential risks of infection spread)

from the first point of encounter until discharge from the facility.

Clinical triage including early recognition and immediate placement of patients in separate areas (source control)¹ is an important measure for rapid identification and appropriate isolation and care of patients with ARI including those with suspected MERS-CoV infection, as well as limiting spread of infection particularly in areas associated with higher rates of nosocomial transmission in high traffic areas such as the emergency departments, and other specific locations in the hospital such as intensive care departments and dialysis units where MERS-CoV cases have shown to spread. Identified ARI patients should be placed in an area separate from other patients, and additional IPC precautions promptly implemented as appropriate (see section 2.2). Clinical and epidemiological aspects of the cases should be evaluated as soon as possible (see WHO recommendations¹²) and should be complemented by laboratory evaluation to confirm diagnosis.

Administrative controls.

Administrative controls and policies that apply to ARI include establishment of sustainable IPC infrastructures and activities; HCW training; patients' care givers education; clear policies on early recognition of ARIs of potential concern, access to prompt laboratory testing for identification of the etiologic agent; prevention of overcrowding especially in the Emergency department; provision of dedicated waiting areas for symptomatic patients and appropriate placement of hospitalized patients promoting an adequate patient-to-staff ratio; provision and use of regular supplies; IPC policies and procedures for all facets of healthcare provisions - with emphasis on surveillance of ARIs among HCWs and the importance of seeking medical care; and monitoring of HCW compliance, along with mechanisms for improvement as needed.

Environmental and engineering controls. These include basic health-care facility infrastructures¹³. These controls address ensuring adequate environmental ventilation¹⁴ in all areas within a health-care facility, as well as adequate environmental cleaning. Spatial separation (social distancing) of at least 1m should be maintained between each ARI patient and others, including HCWs (when not using PPE). Both controls can help reduce the spread of many pathogens during health care¹⁵.

Personal protective equipment. Rational, correct, and consistent use of available PPE and appropriate hand hygiene¹⁶ also help to reduce the spread of the pathogens. Although use of PPE is the most visible control used to prevent transmission, it is the last and weakest in the hierarchy of IPC measures and should not be relied upon as a primary prevention strategy. PPE effectiveness depends on adequate and regular supplies, adequate staff training, proper hand hygiene and in particular, appropriate human behaviour¹. In the absence of effective administrative and engineering controls, PPE has limited benefit.

2. Infection prevention and control precautions

In summary the following steps in Table 1 should be followed:

Table 1. How to implement infection control measures in health care setting

When caring for ALL patients	Apply standard precautions routinely in all health-care settings for all patients. Standard precautions include: hand hygiene; use of personal protective equipment (PPE) to avoid direct contact with patients' blood, body fluids, secretions (including respiratory secretions) and non-intact skin. Standard precautions also includes: prevention of needle-stick or sharps injury; safe waste management; cleaning and disinfection of equipment; and cleaning of the environment ¹⁷ .
When caring for patients with cough or other respiratory symptoms (ARI)	Droplet precautions prevent large droplet transmission of respiratory viruses. At triage, recognize patient with ARI, give the patient a medical mask and place the patient in separate area. Use a medical mask if working within 1-metre of the patient. Place patients in single rooms, or group together those with the same etiological diagnosis. If an etiological diagnosis is not possible, group patients with similar clinical diagnosis and based on epidemiological risk factors, with a spatial separation of at least 1 metre between individuals not wearing appropriate PPE. When providing care in close contact with a patient with respiratory symptoms (e.g. coughing or sneezing), use eye protection (face-mask or goggles), because sprays of secretions may occur. Limit patient movement within the institution and ensure that patients wear medical masks when outside their rooms for source control and to diminish potential for environmental decontamination ¹⁷ . Ensure that triage and waiting areas are adequately ventilated.
When caring for patients with clinically suspected MERS-CoV	For patients with suspected MERS-CoV infection that require hospitalization, place patient in an adequately ventilated single room away from other patient care areas. Droplet and Contact precautions prevent direct or indirect transmission from contact with contaminated surfaces or equipment (i.e. contact with contaminated oxygen tubing/interfaces). Use PPE (a disposable medical mask, eye protection, gloves and gown) when entering room and remove it when leaving. If possible, use either disposable or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers). If equipment needs to be shared among patients, clean and disinfect it between each patient use. Ensure that health care workers refrain from touching their eyes, nose or mouth with potentially contaminated gloved or ungloved hands. Avoid contaminating environmental surfaces that are not directly related to patient care (e.g. door handles and light switches). Ensure adequate room ventilation. Avoid movement of patients or transport. Perform hand hygiene ¹⁷ . Do not place suspect patients in

the same area or room as those who are confirmed MERS-CoV cases. Limit the number of people entering the assigned area to the minimum number required for patient care.

When performing an aerosol-generating procedure in patient with MERS-CoV	Ensure that healthcare workers performing aerosol-generating procedures (i.e. aspiration or open suctioning of respiratory tract specimens, intubation, cardiopulmonary resuscitation, bronchoscopy) use PPE, including gloves, long-sleeved gowns, eye protection, and particulate respirators (N95 or equivalent, or higher level of protection). Whenever possible, use adequately ventilated single rooms when performing aerosol-generating procedures. This means negative pressure rooms with minimum of 12 air changes per hour or 160 liters/second/patient in facilities with natural ventilation. Avoid unnecessary individuals in the room ¹⁷ .
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2.1 Standard Precautions

Standard Precautions¹⁸, a cornerstone for providing safe health care, reducing the risk of further infection and protecting HCWs, should always be applied in all health-care settings for all patients. Standard Precautions include hand hygiene and use of relevant PPE depending on risk of direct contact with patients' blood, body fluids, secretions (including respiratory secretions) and non-intact skin, prevention of needle-stick or sharps injury; safe waste management; cleaning, disinfection and, where applicable, sterilization of patient-care equipment and linen, and cleaning and disinfection of the environment.

Use of respiratory hygiene in anyone with respiratory symptoms should be encouraged.

- Cover nose and mouth during coughing or sneezing with medical mask, cloth mask, tissue, or flexed elbow;
- Followed by hand hygiene after contact with respiratory secretions.

HCWs should apply WHO "My 5 moments for hand hygiene": before touching a patient; before any clean or aseptic procedure; after body fluid exposure risk; after touching a patient; and after touching a patient's surroundings.

- Hand hygiene includes either cleansing hands with soap and water or the use of an alcohol-based hand rub (ABHR);
- ABHR are preferred if hands are not visibly soiled;
- Wash hands with soap and water when they are visibly soiled;
- The use of PPE does not eliminate the need for hand hygiene. Hand hygiene is also necessary prior to putting on and after taking off PPE.¹⁹

The use of PPE should be guided by a risk assessment concerning anticipated contact with blood, body fluids,

secretions and non-intact skin for routine patient care. When there is a risk of contamination of the face and/or body, PPE should include the use of:

- Facial protection by means of either a medical mask²⁰ and eye-visor or goggles; or a face shield;
- A gown; and
- Clean gloves.

HCWs should avoid self-contamination from touching their eyes, nose or mouth with potentially contaminated gloved or ungloved hands.

Ensure that cleaning and disinfection procedures are followed consistently and correctly. Cleaning environmental surfaces with water and detergent and applying commonly used hospital disinfectants (such as sodium hypochlorite) is an effective and sufficient procedure. Manage laundry, food service utensils and medical waste in accordance with safe routine procedures¹.

2.2. Additional infection prevention and control precautions when caring for patients with acute respiratory infection (ARI)

- In addition to **Standard Precautions**, all individuals, including visitors and HCWs, in contact with patients with ARI should apply **Droplet** precautions:
- Place patient in a separate area;
- Use a medical mask (for specifications please see¹);
- Use eye protection (i.e. goggles or a face shield) when in close contact (i.e. within 1m). For practical purposes it is advisable to use medical mask upon entering the room or cubicle of the patient;
- Follow [WHO guidance for steps of donning and doffing PPE](#). Perform hand hygiene before and after contact with the patient and his or her surroundings and immediately after removal of PPE.

Detailed precautions are described in published [WHO guidelines](#)¹ and should be applied when providing care to patients with ARI.

2.3. Infection prevention and control precautions when caring for patients with clinically suspected or probable/confirmed MERS-CoV infection

In addition to **Standard Precautions**, all individuals, including family members, visitors, private medical attendants and HCWs, in close contact (within 1m) or for practical purposes entering the room or cubicle of the patient with clinically suspected or probable/ confirmed MERS-CoV infection should always apply **Contact and Droplet precautions**

- Place patients with clinically suspected or probable/ confirmed MERS-CoV infection in adequately ventilated single rooms. For naturally ventilated general ward rooms this is considered to be 60L/second per patient²¹;
- When single rooms are not available, cohort MERS-CoV patients together;
- Always place patient beds at least 1m apart;
- To the extent possible, assign a specific group of skilled HCWs to exclusively care for probable or confirmed cases both for continuity of care and to

reduce opportunities for inadvertent infection control breaches that could result in unprotected exposure;

- Use a medical mask (for specifications please see ^{1,22});
- Use eye protection (i.e. goggles or a face shield);
- Use a clean, non-sterile, long-sleeved fluid resistant gown (if gown is not fluid resistant, wear a waterproof apron on top of the gown if splashing or spraying of potentially infectious material is anticipated);
- Use gloves (some procedures may require sterile gloves);
- Follow [WHO guidance for steps of donning and doffing PPE](#). Perform hand hygiene before and after contact with the patient and his or her surroundings and immediately after removal of PPE;
- Use either single use disposable equipment or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers). If equipment needs to be shared among patients, clean and disinfect it after each patient use (e.g. ethyl alcohol 70%);
- Refrain from touching their eyes, nose or mouth with potentially contaminated hands, whether gloved or ungloved;
- Avoid touching and contaminating surfaces not involved with direct patient care, i.e. door knobs, light switches, mobile phones;
- Avoid the movement and transport of patients out of the room or area unless medically necessary. The use of designated portable X-ray equipment and other important diagnostic equipment may make this easier. If transport is required, use routes of transport that minimize exposures to staff, other patients and visitors and apply medical mask to patient;
- Notify the receiving area of the patient's diagnosis and necessary precautions as soon as possible before the patient's arrival;
- Clean and disinfect patient-contact surfaces (e.g. bed) after use²³;
- Ensure that HCWs who are transporting patients wear appropriate PPE as described in this section and perform hand hygiene;
- Limit the number of HCWs, family members and visitors in contact with a patient with clinically suspected or probable/ confirmed MERS-CoV infection;
- Family members, visitors, private medical attendants and others who come into contact with a patient should be limited to those essential for patient support and maintain contact and droplet precautions when providing this support. They should be educated on the risk of transmission and the appropriate use of the same infection control precautions to prevent infection transmission described in this section;
- A record of all persons that enter the patient's room should be kept by hospital staff;

2.4. Infection prevention and control precautions for aerosol-generating procedures for patients with clinical suspected or probable/confirmed MERS-CoV infection

An aerosol-generating procedure is defined as any medical procedure that can induce the production of aerosols of

various sizes, including small ($\leq 5 \mu\text{m}$) particles over a long distance ($> 1\text{m}$).

Some aerosol generating procedures have been associated with increased risk of transmission of coronavirus (SARS-CoV) such as tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation and bronchoscopy^{8,20}. Increased risk of SARS-CoV transmission was also reported when performing non-invasive ventilation, tracheotomy and manual ventilation before intubation; however, these findings were identified from a limited number of very low-quality studies^{24,25}.

Though definitive evidence is lacking, non-invasive ventilation, high-flow nasal cannula, aerosolized nebulizer treatments, chest physiotherapy also have the potential to general aerosols and facilitate transmission of certain respiratory viruses. When performing these treatments, it is prudent to implement airborne precautions.

Advise visitors and family members about risk of transmission. Instruct them on PPE use and hand hygiene. Evaluate visitors for symptoms of ARI (and MERS) before visit. Limit visitors to those essential for support. Advise that anyone who is at increased risk of severe disease does not care for the ill person.

Additional **Airborne precautions** when performing aerosol-generating procedures includes the use of:

- A particulate respirator at least as protective as a NIOSH-certified N95, EU FFP2 or equivalent^{1,22}; when putting on a disposable particulate respirator, always check the seal²³;
- Note that if the wearer has facial hair (beard) this can prevent a proper respirator fit²⁶
- In some countries where available powered air-purifying respirator (PAPR) is utilized instead of a respirator²⁷
- Eye protection (i.e. goggles or a face shield);
- Clean, non-sterile, long-sleeved gown and gloves (some of these procedures require sterile gloves);
- If gowns are not fluid resistant, use a waterproof apron for some procedures with expected high fluid volumes that might penetrate the gown¹;
- Perform procedures in an adequately ventilated room; i.e. at least natural ventilation with at least 160l/s/patient air flow or negative pressure rooms with at least 12 air changes per hour and controlled direction of air flow when using mechanical ventilation
- Limit the number of persons present in the room to the absolute minimum required for the patient's care and support; and
- Follow [WHO guidance for steps of donning and doffing PPE](#). Perform hand hygiene before and after contact with the patient and his or her surroundings and after PPE removal.

2.5. Duration of contact and droplet precautions for MERS-CoV infection

The duration of infectivity of MERS-CoV infected patients has been evaluated in several countries including the Kingdom of Saudi Arabia, United Arab Emirates and the Republic of Korea^{28,29,30}. From these studies, lower

respiratory tract samples are of higher diagnostic value³¹ and tend to be PCR positive longer compared to upper respiratory tract samples and typically, patients with more severe disease shed virus longer than laboratory confirmed cases with mild or no symptoms. Contact tracing during health care associated outbreaks have identified secondary cases who have no symptoms (i.e., are asymptomatic) but can shed virus for up to two weeks^{28,32}. One study reported prolonged nasal virus RNA detection of more than 5 weeks in an asymptomatic HCW.

Standard Precautions should always be applied at all times. Additional contact and droplet precautions should be continued until the patient is asymptomatic and has two consecutive upper respiratory tract samples (e.g. nasopharyngeal [NP] and/or oropharyngeal [OP] swabs) taken at least 24 hours apart test negative on RT-PCR. Given that limited information is currently available on viral shedding and the potential for transmission of MERS-CoV, testing for viral shedding should assist decision-making when available. Important patient factors such as age and immune status may contribute to prolonged shedding of virus (>1 month)²⁸ and thereby prolong the necessity for contact and droplet precautions.

2.6. Collection and handling of laboratory specimens from patients with ARIs of potential concern (including MERS-CoV)

All specimens collected for laboratory investigations should be regarded as potentially infectious, and HCWs who collect or transport clinical specimens should adhere rigorously to Standard Precautions to minimize the possibility of exposure to pathogens.

- Ensure that HCWs who collect specimens use appropriate PPE (eye protection, medical mask, gown, gloves).
- Ensure that personnel who transport specimens are trained in safe handling practices and spill decontamination procedures.
- Place specimens for transport in leak-proof specimen bags (secondary container) that have a separate sealable pocket for the specimen (i.e. a plastic biohazard specimen bag), with the patient's label on the specimen container (primary container), and a clearly written request form.
- Ensure that health-care facility laboratories adhere to appropriate biosafety practices and transport requirements according to the type of organism being handled.
- Deliver all specimens by hand whenever possible. Do not use pneumatic-tube systems to transport specimens.
- State the full name, date of birth of the (suspected) ARI of potential concern clearly on the accompanying request form. Notify the laboratory as soon as possible that the specimen is being transported.

For further information on specimen handling in the laboratory and laboratory testing for novel coronavirus, see [Laboratory biorisk management for laboratories handling human specimens suspected or confirmed to contain novel coronavirus: Interim recommendations](#) and the [Laboratory Testing for Middle East Respiratory Syndrome Coronavirus: Interim guidance](#). For further information on laboratory

biosafety guidelines, see the *WHO Laboratory Biosafety Manual, 3rd edition*³³.

Acknowledgements

This document was developed in consultation with the WHO Global Infection Prevention and Control Network and Emerging Disease Clinical Assessment and Response Network and other international experts. WHO thanks the following individuals for providing review (in alphabetical order):

- APIC Practice Guidance Committee Review
- Abdullah Assiri, Director General, Infection Control, Ministry of Health, Saudi Arabia
- Michael Bell, Deputy Director of Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention
- Barry Cookson, Division of Infection and Immunity, University College, London, United Kingdom
- John M Conly, Departments of Medicine, Microbiology, Immunology and Infectious Diseases, Calvin, Phoebe and Joan Synder Institute for Chronic Diseases, Faculty of Medicine, University of Calgary, Calgary, Canada
- Niklas Danielsson, Senior expert communicable diseases, Vaccine preventable diseases, Surveillance and Response Support unit, European Centre for Disease Prevention and Control
- Katherine Defalco, Nurse Consultant, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, Ottawa, Canada
- Elaine Furukawa, Director of Training, Infection Control, Ministry of Health, Saudi Arabia
- Susan I. Gerber, Team Lead, Respiratory Viruses/Picornaviruses, Division of Viral Diseases/Epidemiology Branch, Centers for Disease Control and Prevention, Atlanta, GA, USA
- Ahmad Mohammad Hakawi, Director-General, General Directorate of Infectious Diseases Control, Ministry of Health, Saudi Arabia
- Benedikt Huttner, Infection Control Program and WHO Collaborating Center on Patient Safety, University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland
- M Mushtuq Husain, Coordinator, Coordinator and Support Centre, Directorate General of Health Services and Former Principal Scientific Officer & Head, Department of Medical Social Science, Institute of Epidemiology, Disease Control & Research (IEDCR), Dhaka, Bangladesh
- David Hui, Chairman, Department of Medicine & Therapeutics, Stanley Ho Professor of Respiratory Medicine, Director of Stanley Ho Center for Emerging Infectious Diseases, Director of SH Ho Sleep Apnoea Management Center, The Chinese University of Hong Kong
- Souha S Kanj, Professor and Head of Infectious Diseases and Chairperson of the Infection Control and Prevention Program at the American University of Beirut Medical Center, Beirut, Lebanon
- David T. Kuhar, Medical Officer, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, GA, USA

- Moi Lin Ling, Director, Infection Control Department, Singapore General Hospital, Singapore and President of Asia Pacific Society of Infection Control (APSIC)
- Anna-Pelagia Magiorakos, Senior Expert, Antimicrobial Resistance and Healthcare-Associated Infections, European Centre for Disease Prevention and Control
- Shaheen Mehtar, Extraordinary Professor, Unit for Infection Prevention and Control, Faculty of Medicine and Health Sciences, Stellenbosch University, Tygerberg, South Africa and Chair, Infection Control African Network
- Ziad A Memish, Professor, College of Medicine, Alfaisal University & Prince Mohammed Bin Abdulaziz Hospital, Ministry of Health, Riyadh, Kingdom of Saudi Arabia
- Nico T. Mutters, Specialist for Infection Control and Environmental Health, Specialist for Clinical Microbiology, Master of Public Health, Scientific Coordinator EUCIC
- Babacar N Doye, Board Member, Infection Control African Network, Dakar, Senegal
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- Fernando Otaiza O'Ryan, Head, National IPC Program, Ministry of Health, Santiago, Chile
- Maria Clara Padoveze, School of Nursing, University of São Paulo, Brazil
- Nick Phin, Preparedness and Response Section, Respiratory Diseases Department, HPA Colindale, London, United Kingdom
- Didier Pittet, Director, Infection Control Program and WHO Collaborating Center on Patient Safety, University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland
- Natalia Pshenichnaya, Professor, Rostov State Medical University, Rostov, Russian Federation
- Wing Hong Seto, Department of Community Medicine, School of Public Health, University of Hong Kong, Hong Kong, People's Republic of China
- Nandini Shetty, Consultant Microbiologist, Reference Microbiology Services, Colindale, Health Protection Agency, United Kingdom
- Nalini Singh, Professor of Pediatrics, Global Health, Epidemiology, The George Washington University, Washington, DC, USA
- Thomas Weaver, Director, Professional Practice, APIC and the Association for Professionals in Infection Control and Epidemiology

WHO Health Emergencies Programme: Janet Diaz, Devika Dixit, Amgad Elkholy, Mamun Malik, Dina Pfeifer, Maria Van Kerkhove.

The reviewers were required to sign a declaration of interests, and no conflicts of interest were identified.

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