Infection prevention and control in the context of coronavirus disease (COVID-19): a living guideline

9 October 2023

World Health Organization

WHO/2019-nCoV/IPC/guideline/2023.3

Suggested citation. Infection prevention and control in the context of coronavirus disease (COVID-19): a living guideline, 9 October 2023. Geneva: World Health Organization; 2023 (WHO/2019-nCoV/IPC/guideline/ 2023.3). Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

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Sections

1. Executive summary

Version 6.0 Infection prevention and control in the context of coronavirus disease 2019 (COVID-19): a living guideline

Updated sections: Part 1: Health-care settings: 1) IPC principles, 2) IPC measures for patients with suspected or confirmed COVID-19, 3) Water, sanitation, hygiene and waste management, and 4) Safe dead body management. Part 2: Community Settings: Mask use (one good practice statement).

About this guideline

The *Infection prevention and control in the context of coronavirus disease 2019 (COVID-19): a living guideline* consolidates infection prevention and control (IPC) technical guidance developed and published during the COVID-19 pandemic into evidence-informed recommendations for IPC. Part 1 presents IPC recommendations in the context of health-care settings, while Part 2 presents recommendations in the community settings. The methodology section describes the methodological approach used to develop the guideline. The living guideline is written, disseminated and updated on an online platform (MAGICapp). It has a user-friendly format and easy-to-navigate structure that accommodates the changing evidence and recommendations. This structure focuses on what is new while keeping existing recommendations updated within the guideline.

This living guideline considers the current and evolving epidemiological trends for COVID-19 and the emergence of new variants of concern (VOCs), and factors such as population immunity, availability and uptake of vaccines, and other contextual factors of the COVID-19 pandemic. The target audiences of these guidelines are policy- and decision-makers, public health professionals, IPC professionals and focal points for occupational health and safety of health and care workers at the national, subnational and facility levels, health-care facility administrators, managers and other health and care workers.

Understanding the updated section

The updated recommendations consider the current context of COVID-19, including the 2023-2025 COVID-19 Strategic Preparedness and Response Plan. COVID-19 is now an established and ongoing health issue, though is no longer considered a public health emergency of international concern (PHEIC). While the global risk assessment remains high, there is evidence of reduced risks to human health driven mainly by high population-level immunity from infection, vaccination, or both; consistent virulence of currently circulating SARS-CoV-2 Omicron sub-lineages compared to previously circulating Omicron sub-lineages; and improved clinical case management. These factors have contributed to a significant global decline in the weekly number of COVID-19-related deaths, hospitalizations, and admissions to intensive care units since the beginning of the pandemic. While SARS-CoV-2 continues to evolve, the currently circulating variants do not appear to be associated with increased severity *[1]*.

The updates consider the transition from critical emergency-response activities to longer-term, sustained COVID-19 disease prevention, control and management, and a shift towards integration of IPC activities into routine systems and practices. This includes a return to standard and transmission-based precautions in health-care settings, and the adoption of public health measures for community settings *[2]*. Updated recommendations for health-care facilities include a focus on the hierarchy of control measures, environmental cleaning, transmission-based precautions and appropriate selection and use of PPE. Prevention of infections in the health-care setting involves a multi-pronged and multi-factorial approach that includes IPC and occupational health and safety (OHS) measures.

Guideline development

To develop the guidelines, WHO convened a Guideline Development Group (GDG) to consider current scientific evidence while assessing factors such as the relative benefits and harms, values and preferences, resource implications, availability and feasibility issues. This guideline was developed using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) process and the Evidence to Decision framework and in accordance with WHO norms and standards for guideline development *[3][4]*.

The GDG membership comprises of health-care providers and experts in IPC, epidemiology, infectious diseases, paediatrics, water, sanitation and hygiene, engineering and aerobiology. Balance was sought on the GDG with regard to geographical and gender representation. WHO convened the GDG to address specific settings or populations. A methodologist with expertise in guideline development assisted the GDG in formulating the recommendations. While the GDG takes an individual patient perspective in making recommendations, it also considers resource implications, acceptability, feasibility, equity and human rights. The WHO Quality Assurance for Norms and Standards Department helped to identify rapid reviews of the evidence. Where required, WHO staff or commissioned external review teams conducted systematic reviews to address specific questions to inform recommendations.

Updates and access

This guideline and its previous versions are available through the WHO website and MAGICapp (online and PDF outputs for readers with limited internet access).

1.1 Summary of new and updated statements

New statements

1. A respirator or a medical mask should be worn along with other PPE – a gown, gloves and eye protection – by health and care workers providing care to a patient with suspected or confirmed COVID-19. *(Strong recommendation, based on low certainty of evidence)*
2. Suggested factors for informing the choice of the type of mask include a risk assessment and health and care workers' values and preferences. WHO suggests respirators be used in care settings where ventilation is known to be poor or cannot be assessed, or the ventilation system is not properly maintained. *(Conditional recommendation, based on low certainty of evidence)*
3. WHO suggests using airborne precautions while performing aerosol-generating procedures (AGPs) and, based on a risk assessment, when caring for patients with suspected or confirmed COVID-19. *(Conditional recommendation, very low certainty of evidence)*
4. The WHO recommends adhering to the ventilation rate requirements for health-care facilities in the context of COVID-19. *(Strong recommendation, very low certainty of evidence)*
5. Maintain a physical distance of at least one metre between and among patients, staff and all other persons in health-care settings, when feasible. When possible, increase this distance. *(Good practice statement)*
6. WHO suggests that physical barriers such as glass or plastic windows may be considered for areas where patients first present, such as screening and triage areas, the registration desk at the emergency department and the pharmacy window. *(Conditional recommendation, very low certainty of evidence)*
7. For COVID-19, health care settings should use standard precautions for the cleaning and disinfection of the environment and other frequently touched surfaces. *(Good practice statement)*
8. Health-care facilities should follow standard precautions for handling, transporting, sorting and laundering of linens of patients with suspected or confirmed COVID-19. *(Good practice statement)*
9. Health-care waste generated from care provided to suspected or confirmed COVID-19 patients should be segregated according to existing guidelines (e.g. non-infectious, infectious, sharps) for disposal and, where necessary, treated per national/subnational/local regulations and policies. *(Good practice statement)*
10. Health and care workers and other persons involved in handling the deceased should follow standard precautions according to risk assessment and existing national/subnational/local protocols for handling the bodies of deceased persons infected with COVID-19. *(Good practice statement)*
11. When wearing masks in community settings, individuals should use well-fitting masks with full coverage of the nose and mouth. *(Good practice statement)*

Updated statements

1. WHO recommends universal masking in health-care facilities when there is a significant impact of COVID-19 on the health system. *(Strong recommendation, based on very low certainty of evidence)*
2. WHO suggests targeted continuous medical mask use in health-care facilities in situations with minimum to moderate impact of COVID-19 on the health system. *(Conditional recommendation, based on very low certainty of evidence)*
3. Appropriate mask fitting should always be ensured (for respirators, through fit testing and a user seal check when a filtering facepiece respirator is put on; and for medical masks, through methods to reduce air leakage around the mask) as well as compliance with appropriate use of PPE and other standard and transmission-based precautions. (*Good practice statements)*
4. A respirator should always be worn along with other PPE by health workers performing aerosol-generating procedures (AGP) and by health workers on duty in settings where AGP are regularly performed on patients with suspected or confirmed COVID-19, such as intensive care units, semi-intensive care units or emergency departments. *(Strong recommendation, based on low certainty of evidence)*

1.2 Definitions

A child	Any person under the age of 18 years *[5]*.
Active screening	This involves actively looking for signs and symptoms either by asking the health or care worker questions regarding their symptoms through a questionnaire, electronic format or verbally. It involves actively asking about or assessing health workers' health status (through temperature checks, testing) to identify signs and symptoms of infection. This mode of screening could be

	considered, if human resources and logistics permit, when the health-care facility finds itself in an active outbreak or when there is heightened transmission in the health-care facility or in the community where the health facility is located. Health workers should be screened after any potential exposure risks before or on arrival for their shift – either through questionnaires (online or in-person) or through testing (Antigen detection rapid diagnostic tests (Ag-RDT) or real-time reverse-transcription polymerase chain reaction (rt-PCR)) *[6]*. The signs or symptoms to be monitored should include fever, cough, general weakness, fatigue, headache, myalgia, sore throat, coryza, dyspnoea, nausea, diarrhoea and anorexia) *[7]*.
Adequately ventilated patient room or area	Adequate ventilation in health facilities can be assessed where a natural or mechanical ventilation system is available *[8][9]*. The ventilation rate should be 6-12 air changes per hour (e.g. equivalent to 40-80 L/s/patient for a 4x2x3 m3 room) and ideally 12 air changes per hour for new constructions, with a recommended negative pressure differential of ≥2.5Pa (0.01-inch water gauge) to ensure that air flows from the corridor into patient rooms *[9]*.
Aerosol generating procedures (AGP)	Aerosol-generating procedures (AGPs) are defined as any medical procedures that can induce the production of aerosols of various sizes (e.g. tracheal intubation, non-invasive ventilation [e.g. bilevel positive airway pressure, continuous positive airway pressure], tracheostomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy, dental procedures, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, sputum induction by using nebulized hypertonic saline, dentistry and autopsy procedures. In oral health care, the following are considered AGPs: all clinical procedures that use spray-generating equipment such as three-way air/water spray, dental cleaning with ultrasonic scaler and polishing; periodontal treatment with ultrasonic scaler; any kind of dental preparation with high- or low-speed hand pieces; direct and indirect restoration and polishing; definitive cementation of crown or bridge; mechanical endodontic treatment; surgical tooth extraction and implant placement *[10]*.
Airborne transmission[1]	Airborne transmission refers to the spread of an infectious agent caused by the dissemination of droplet *nuclei* that remain infectious when suspended in air over long distances and long periods of time. Airborne transmission can be further categorized into obligate or preferential airborne transmission *[10]*. • Obligate airborne transmission refers to pathogens that are transmitted only by deposition of droplet *nuclei* under natural conditions (e.g. pulmonary tuberculosis) *[10]*. • Preferential airborne transmission refers to pathogens that can initiate infection by multiple routes but are predominantly transmitted by droplet *nuclei* (e.g. measles and chickenpox) *[10]*. • Opportunistic airborne transmission refers to agents that naturally cause disease through other routes, but under special circumstances may be transmitted via fine particle aerosols *[10]*.
Airborne precautions	Airborne precautions prevent the spread of an infectious agent caused by the dissemination of droplet nuclei that remain infectious when suspended in air over long distances and long periods of time. Health workers should wear a respirator (e.g. N95, FFP2, etc.) before entering the room and remove it after exiting the room. The patient should be placed in an airborne infection isolation room (AIIR) *[11]*.
Cleaning	Cleaning is the physical removal of foreign material, including dust, soil and organic material such as blood, secretions, excretions and microorganisms. It physically removes rather than kills microorganisms with water, detergents and mechanical action. Cleaning is always essential prior to disinfection or sterilization. A surface that has not been cleaned effectively cannot be properly disinfected or sterilized. Organic material left on a surface or medical device can protect microorganisms or neutralize the action of disinfectants *[12][13]*.
Contact transmission	Contact transmission is the spread of an infectious agent caused by physical contact of a susceptible host with people or objects *[10]*. • Direct contact transmission involves both a direct body-surface-to-body-surface contact and

	physical transfer of microorganisms between an infected or colonized person and a susceptible host *[10]*. • Indirect contact transmission involves contact of a susceptible host with a contaminated intermediate object (e.g. contaminated hands) that carries and transfers the microorganisms *[10]*.
Contact precautions	Contact precautions prevent the spread of an infectious agent caused by physical contact of a susceptible host with people or objects. Health workers should wear a gown and put on gloves before entering a patient's room and remove them prior to exit. The patient should be placed in a single room; if a single room is not available, cohort patients with similar symptoms and diagnosis. Avoid having patients share a toilet if they are in a shared room *[11]*
Disinfection	Disinfection is a thermal or chemical process for inactivating microorganisms on inanimate objects *[12][13]*.
Droplet transmission	Droplet transmission is the spread of an infectious agent caused by the dissemination of droplets. Droplets are primarily generated from an infected (source) person during coughing, sneezing and talking. Transmission occurs when these droplets that contain microorganisms are propelled (usually < 1 metre) through the air and deposited on the conjunctivae, mouth, nasal, throat or pharynx mucosa of another person. Most of the volume (>99%) comprises large droplets that travel short distances (< 1 metre) and do not remain suspended in the air. Thus, special air handling and ventilation are not required to prevent droplet transmission *[10]*.
Droplet precautions	Droplet Precautions prevent the spread of an infectious agent caused by the dissemination of droplets. Health workers should put on a medical mask and wear additional PPE if indicated (based on a risk assessment) before entering the patient room. The patient should be placed in a single room. Consider the following when single-patient rooms are not available: 1) Prioritize any single-patient rooms for patients with excessive cough and sputum production; 2) Cohort patients with the same symptoms; 3) Physically separate patients by at least 1 metre, and draw privacy curtains *[11]*.
Filtering facepiece respirators (FFR or respirators)	Filtering facepiece respirators (FFRs or respirators) offer a balance of filtration, breathability and fit. Whereas medical masks filter 3-micrometre droplets, “N95” and “FFP2” rated FFRs must filter more challenging 0.075-micrometre particles or particulates and do so across the entire surface of the respirator as a result of the fitted design. European “FFP2” FFRs, according to EN 149 standard, filter at least 94% Sodium Chloride (NaCl) salt particles and paraffin oil droplets. The United States of America “N95” FFRs, according to National Institute for Occupational Safety and Health (NIOSH) NIOSH 42 CFR Part 84, filter at least 95% NaCl salt particles. Certified FFRs must ensure unhindered breathing by meeting inhalation and exhalation breathing resistances below the maximum thresholds. Another important difference between FFRs and other masks is how filtration is tested. Medical mask filtration is assessed by testing filtration over a cross-section of the masks. In contrast, FFRs are tested for filtration across the entire surface. Most importantly, “FFP2” FFRs are fit-tested on a sample of human participants and the FFRs are measured for leaks as part of product certification. Similarly, for “N95” FFRs, individual workers are fit tested for specific FFRs at the workplace and typically on an annual basis. Therefore, in both cases, by ensuring the outer edges of the FFR seal around the wearer’s face, the FFRs filtration is closer to the actual filtration of inhaled air. Other FFR performance requirements include being within specified parameters for maximum CO_2 build-up *[14]*.

Hand hygiene	Hand hygiene is a general term referring to any action of hand cleansing. **Antiseptic hand rubbing** refers to applying an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices. **Handwashing** refers to washing hands with plain or antimicrobial soap and water *[15]*.
Health-care facility	Health-care facilities include primary, secondary, tertiary-care levels, outpatient care, and long-term care facilities.
Hazardous waste	Hazardous waste can harm people and the environment. The types of hazardous waste in a facility vary according to the size of the facility and the services offered. Examples of hazardous waste are listed below *[16]*. **Examples of infectious waste:** • Sharps waste is used or unused sharp items that could cause cuts or puncture wounds that can lead to infection. Examples include instruments (such as scalpels and blades), needles, syringes and broken glass or ampoules. • Pathological waste (anatomical waste). Examples include human tissues or fluids (such as blood and body fluids), organs (body parts), placentas and fetuses and unused blood products. • Other infectious waste. Examples include soiled gloves, gauze or bandages contaminated with blood, body fluids, viruses or parasites *[16]*. **Examples of other hazardous waste:** • Pharmaceutical waste is used, expired, or no longer needed pharmaceutical products (such as vaccines and drugs). • Chemical waste. Examples include chemical substances (such as laboratory reagents or film developer), disinfectants, solvents, and waste with high heavy-metal content (such as batteries, broken thermometers, and blood pressure gauges). • Genotoxic (harmful to human genes) and cytotoxic (harmful to human cells) waste isn't common unless the facility treats cancer patients. It includes drugs used in cancer treatment, body fluids from patients exposed to chemotherapy or cytotoxic drugs and other material contaminated by these agents. • Radioactive waste: radioactive substances (such as unused liquids from radiotherapy or laboratory research), glassware, packages, or absorbent paper contaminated with radioactive substance, urine and excreta from patients treated or tested with radionuclides and sealed sources (containers in which radioactive substances are stored and sealed) *[16]*.
Health workers/ health and care workers	Health and care workers are all people from in the community to hospitals who are primarily engaged in actions with the primary intent of enhancing health. This includes health-service providers, such as doctors, nursing and midwifery professionals, public health professionals, technicians (laboratory, health, medical and non-medical), personal care workers, healers and practitioners of traditional medicine. It also includes health management and support workers, such as cleaners, drivers, hospital administrators, district health managers, social workers, and other occupational groups in health-related activities. This group includes those who work in acute care facilities and long-term care, public health, community-based care and other occupations in the health and social care sectors. Health and care workers may provide direct personal care services in the home, in health care and residential settings, while assisting with routine tasks of daily life and while performing a variety of other tasks of a simple and routine nature *[17]*.

High-risk exposures	High-risk exposures in the health-care facility occur when health and care workers provide direct care to a patient with an infectious disease without any, or with inappropriate PPE, or experience a breach in PPE integrity or a lapse in IPC measures (i.e. hand hygiene not performed as per the WHO 5 moments, lack of cleaning and disinfection of surface/environment); or when a health and care worker present during an AGP, is wearing inappropriate PPE or when there is a breach in PPE integrity, or other IPC measures are not followed; or when an exposure occurs due to a splash or spray of body fluids/blood and/or a puncture/sharp injury *[18]*.
Medical masks	Medical masks are surgical or procedure masks that are flat or pleated and are affixed to the head with straps around the ears, the head or both. Their performance standards are tested according to a set of standardized test methods (American Society for Testing Materials (ASTM) F2100, EN 14683, or equivalent) that aim to balance high filtration, adequate breathability and, optionally, fluid penetration resistance *[14]*.
Non-hazardous waste	Non-hazardous waste does not pose biological, chemical, radioactive, or physical risk to people or the environment, and can be disposed of as municipal waste*. Examples include paper, boxes, bottles, plastic containers, and personal protective equipment (PPE) that have not been contaminated with bodily fluids or used in an isolation area *[13]*. **Municipal waste is general waste generated mainly by households and commercial activities, and ideally collected by municipalities (e.g. local villages or cities) for disposal. Municipal waste should not contain untreated health-care waste [13]*.
Non-medical masks	Non-medical masks are a type of facial covering of the mouth and nose of the wearer that are used to mitigate the spread of respiratory infections but do not meet the performance standards of medical or surgical masks. Their primary purpose is for source control and to provide a degree of particulate filtration to reduce the amount of inhaled particulate matter. Essential parameters for the performance and safety of non-medical masks have been advocated during the COVID-19 Public Health Emergency of International Concern (PHEIC) through several existing international guidelines and one international standard for non-medical masks (ASTM F3502-21)*[14][19][20][21]*. Non-medical masks that are self-made or commercially produced and do not meet guideline-supported essential parameters are permitted in areas that have not mandated minimum performance requirements for non-medical masks prior to sale and for use by the general public.
Occupational health and safety	Occupational health and safety is a multidisciplinary area of work aiming at the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention among workers of effects on health from their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; and the placing and maintenance of the workers in an occupational environment adapted to their physiological and psychological capabilities *[18]*.
Passive screening (self-reporting)	In contrast to active surveillance, passive screening (self-reporting) entails the self-reporting by health and care workers of symptoms of illness to an appropriate occupational health and safety or other designated officer in the facility before, during or after their shift. This may be the most suitable option in countries where human, financial and technical resources are limited. It is the most common type of surveillance in humanitarian emergencies *[22][23][24]*.
Standard precautions	Standard precautions aim to protect health and care workers and patients by reducing the risk of transmission of microorganisms from both recognized and unrecognized sources. They are the minimum standard of IPC practices that should be used by all health-care workers, during the care of all patients, at all times, in all settings. When applied consistently, standard precautions can prevent the transmission of microorganisms between patients, health and care workers and the environment. Key elements of standard precautions include: 1) risk assessment, 2) hand hygiene, 3) respiratory hygiene and cough etiquette, 4) patient placement, 5) personal protective equipment,

	6) aseptic technique, 7) safe injections and sharps injury prevention, 8) environmental cleaning, 9) handling of laundry and linen, 10) waste management, and 11) decontamination and reprocessing of reusable patient-care items and equipment *[12]*.
Syndromic screening	Syndromic screening is the near real-time collection, analysis, interpretation and dissemination of health-related data to enable the early identification of the impact (or absence of impact) of potential health threats that may require public health action *[22][23][24]*.
Targeted continuous medical mask use	Targeted continuous medical mask use is the practice of wearing a medical mask by all health workers and caregivers working in clinical areas during all routine activities throughout the entire shift.
Transmission based precautions	Transmission-based precautions are used in addition to standard precautions for patients with known or suspected infection or colonization with transmissible and/or epidemiologically significant pathogens. The type of transmission-based precautions assigned to a patient depends on the transmission route of the microorganism: contact, droplet or airborne. Transmission-based precautions must be started as soon as a patient presents with symptoms (e.g. fever, new cough, vomiting, diarrhoea). There is no need to wait for test results *[11]*.
Universal masking	Universal masking is the requirement for all persons (staff, patients, visitors, service providers and others) in health facilities to wear a mask at all times except when eating or drinking.

[1] *Definition from the WHO Guidelines on "Infection prevention and control of epidemic-and pandemic-prone acute respiratory infections in health care" (2014) [10]. WHO has hosted expert global consultations in 2022 and in 2023 to further review and plans to update the definition of airborne transmission. For the latest information on how COVID-19 is transmitted, please see "Coronavirus disease (COVID-19): How is it transmitted?".*

1.3 Abbreviations

ARO	antibiotic-resistant organisms
AIIR	airborne infection isolation room
AGP	Aerosol generating procedure
Ag-RDT	Antigen-detection rapid diagnostic tests
ASTM	American Society for Testing Materials
aOR	Adjusted odds ratio
CASP	Critical appraisal skills programme
COVID-19	Coronavirus disease 2019
CI	Confidence interval
CT	Community transmission
DOI	Declaration of interest
EtD	Evidence to decision
FFR	Filtering facepiece respirator
GDG	Guideline development group
GPS	Good practice statement
GRADE	Grading of recommendations, assessment, development and evaluation
GRADE-CERQual	Confidence in the evidence from reviews of qualitative research
HAI	Healthcare-associated infection
HEPA	High-efficiency particulate air filters
HR	Hazards ratio
HVAC	Heating, ventilation and air conditioning
ICUs	Intensive care units

ILI	Influenza-like illness
IPA	International Paediatric Association
IPC	Infection prevention and control
NAAT	Nucleic acid amplification tests
NIOSH	National Institute for Occupational Safety and Health
MDRO	multidrug-resistant organisms
MMAT	Mixed methods appraisal tool
OHS	Occupational health and safety
OR	Odds ratio
PICO	Population, Intervention, Comparator, Outcome
PHEIC	Public health emergency of international concern
PHSM	Public health and social measures
PPE	Personal protective equipment
ROBINS-I	Risk of bias in non-randomised studies - of interventions
RCT	Randomized control trial
rRT-PCR	Real -time reverse-transcription polymerase chain reaction
SARS-CoV-1	Severe acute respiratory syndrome coronavirus
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SPICE	Setting, Perspective, Intervention, Comparison, Evaluation
UNICEF	United Nations Children's Fund
US CDC	United States Centers for Disease Control and Prevention
UVGI	Ultraviolet germicidal irradiation
WHO	World Health Organization
VE	Vaccine effectiveness
VOC	Variant of concern

2. Methodology

Guideline Development Groups (GDGs) and External Review Groups
The IPC recommendations, good practice statements (GPSs) and implementation considerations included in this document were developed in accordance with WHO methodology, including a review of available evidence by the Guideline Development Group (GDG). The establishment of the GDG considered representation of members with a broad expertise spanning multiple specialties, across all WHO regions, and was gender balanced. A consensus was sought for recommendations and GPS. When consensus was not achieved, approval of a recommendation or GPS required a supermajority (≥ 70%) of the GDG voting members.

The technical officer responsible for the collection and review of the required declaration of interest (DOI) from GDG members assessed the DOIs for any potential conflicts. If a conflict of interest was identified, appropriate management actions were taken in accordance with the WHO Handbook for guideline development and WHO Guidelines for DOI (for WHO Experts) *[25][3]*.

External review group members were also identified for specific technical areas and provided additional review of the guidelines. External review groups do not change the recommendations made by the GDG; however, any major concerns are brought back to the GDG for additional discussion. For more information on authorship, contributions, and DOI, please refer to the acknowledgement section.

Evidence synthesis and assessment
As noted in the Executive Summary, with support from the WHO Quality Assurance for Norms and Standards Department, rapid systematic reviews of published literature were commissioned for review. The literature for each identified topic is assessed using Grading of Recommendations, Assessment, Development and Evaluation (GRADE) to determine the certainty of the evidence (Table 1) based on the presence of risk of bias/study limitations, inconsistency, imprecision, indirectness and publication/reporting biases.

Table 1. Determining the Quality of Evidence in Grading of Recommendations, Assessment, Development and Evaluation (GRADE)

Quality level	Definition
High	The Group is very confident in the estimate of effect and considers that further research is very unlikely to change this confidence.
Moderate	The Group has moderate confidence in the estimate of effect and considers that further research is likely to have an important impact on that confidence and may change the estimate.
Low	The Group has low confidence in the estimate of effect and considers that further research is very likely to have an important impact on that confidence and is likely to change the estimate.
Very low	The Group is very uncertain about the estimate of the effect.

Rapid reviews
To provide timely, evidence-informed recommendations, there was a need to review multiple questions within a limited time frame. Rapid reviews of the evidence were commissioned to external groups (e.g. clinical effectiveness of mask use in health care and use of airborne precautions in the context of COVID-19) or conducted by WHO staff (e.g. ecological studies on mask effectiveness). Reviews were conducted using standardized methods for systematic reviews, including searching multiple electronic databases, use of pre-defined inclusion/exclusion criteria, risk of bias assessment, and synthesis (using GRADE); noting that some used rapid-review methods and some were living reviews. Furthermore, non-commissioned and previously published reviews supplemented the decision-making process. Some of the reviews have been published and updated to identify emerging evidence that informed deliberations by the GDG *[26][27]*. Some of the rapid reviews have been published to identify any emerging evidence that may inform deliberations by the GDG *[26][27]*; details about search strategies can be found within these reviews. Evidence from randomized controlled trials (RCTs) has been limited; therefore, the reviews included non-randomized studies, cohort, case-control, and ecological studies.

Airborne precautions, ventilation, dead body management, waste management and laundry rapid review
The rapid reviews on airborne precautions, physical barriers, ventilation, dead body management, waste management, and laundry were informed by the approach for rapid reviews developed by Tricco et al.,*[28]*. Search strategies were tested and designed in conjunction with the WHO secretariat. Final searches were conducted in Medline, Elsevier Embase, medRxiv preprint server, and Google Scholar.

Documents were selected through pre-set inclusion and exclusion criteria. The study design, population, setting, and methodology were extracted from the included articles for synthesis. All data were analysed using framework analysis *[29]* and assessed for quality using the Mixed Methods Appraisal Tool (MMAT). When the search yielded studies answering the PICO (**P**opulation, **I**ntervention, **C**omparator, **O**utcome) question, a summary of findings or GRADE tables was presented to the GDG.

Universal masking and targeted continuous masking rapid review

The rapid review for universal masking was conducted through a rapid, living review approach. A medical librarian searched PubMed, MEDLINE, and Elsevier Embase, WHO COVID-19 database and the medRxiv preprint server. Studies were selected by using predefined criteria. One investigator extracted study data (e.g. study author, year, population characteristics and results) and a second investigator verified data; odds ratios were calculated as needed. A formal risk-of-bias assessment was not done, though key limitations were narratively noted. Results were synthesized, though quantitative synthesis was not possible due to methodological limitations; study design variability; and heterogeneity in populations, comparisons, and analytic methods. The results and the certainty of evidence were presented to the GDG using GRADE, including GRADE Evidence Profiles and Summary of Findings tables. Contextual data on cost-effectiveness, equity, acceptability, resources required, and feasibility were captured and summarized narratively. Since the completion of the published rapid review *[30][31]*, the WHO secretariat has been receiving quarterly updates from the author group on the topic to inform evidence-based recommendations.

Mask type rapid review

Evidence for mask effectiveness and type is continuously reviewed through a rapid, living review approach *[26][27]*. A medical librarian searched PubMed, MEDLINE, and Elsevier Embase, WHO COVID-19 database and the medRxiv preprint server. Studies were selected by using predefined criteria. The population was health and care workers with interventions of disposable N95 filtering facepiece respirators, surgical masks, and cloth masks. One investigator extracted study data (e.g. study author, year, setting, population characteristics, mask intervention, and results) into standardized tables, and a second investigator verified data. Relative risks were calculated for randomized trials and odds ratios for observational studies. Available data on RCTs were assessed by using criteria adapted from the U.S. Preventive Services Task Force. For observational studies, key limitations of each study, such as potential recall, selection, or participation bias, were noted and results were synthesized narratively. Risk estimates adjusted for cluster effects and unadjusted and adjusted risk estimates were presented for RCTs and observational studies, respectively. The results and the certainty of evidence were presented using GRADE, including GRADE Evidence Profiles and Summary of Findings tables. Contextual data on cost-effectiveness, equity, acceptability, resources required, and feasibility were captured and summarized narratively. Additional details on the study methodology can be found in the published article or its frequent updates *[26][27]*.

Cleaning and disinfection, spraying versus wiping, physical distance rapid review

The rapid reviews on cleaning and disinfection, spray versus wiping and physical distance were performed by an external team. Search strategies were tested and designed in conjunction with the WHO secretariat. Final searches were conducted in Cochrane Library, Cochrane Database for Systematic Reviews, Central, Elsevier Embase, and PubMed. Documents were selected through pre-set inclusion and exclusion criteria. The study design, population, setting and methodology were extracted from the included articles for synthesis. Three authors independently screened the search output (for both title and abstract and full-text eligibility screening) using distiller & MS Excel. Any discrepancies were resolved by discussion within the review team. Assessment of the risk of bias in included studies was with ROBINS-I (Risk of bias in non-randomised studies - of interventions). GRADE profile was prepared by one author and cross-checked by other members of the review team, and a summary of findings or GRADE tables were presented to the GDG.

Evidence review for the chapter on management, identification and prevention of infections in health and care workers

A systematic review was conducted by the WHO Quality Assurance for Norms and Standards Department to assess the latest evidence on the prevention, identification and testing and management of infected health and care workers. The search strategy for this review was designed in conjunction with the IPC team and conducted by the librarian and members of the IPC team. The PICOs were developed in conjunction with the GDG chairs, methodologists and secretariat to examine research not yet evaluated to provide the basis for an evidence-based decision. The WHO COVID-19 Research Database, which includes results from several databases, was searched from January 2020 up to June 2022. Full details can be found in Annex 3.

Evidence from RCTs has been limited during the pandemic. Therefore, the reviews included mostly non-randomized studies, cohort, case-control and ecological studies. The systematic reviews were presented in GDG meetings and were supplemented by other (non-systematically reviewed) data presented by WHO staff. Such presentations informed considerations regarding contextual factors on testing health and care workers; their recommended isolation period; when to return to work after an infection; and under which conditions. The GDG also received regular updates on SARS-CoV-2 epidemiology and transmission from the WHO epidemiology team. In addition, the WHO Clinical Management team for COVID-19 presented a systematic review on the period of infectiousness, which influenced the GDG's recommendations on the duration of isolation needed for a positive COVID-19 case. Some members of the IPC GDG participated in the development of this recommendation by the Clinical Management GDG, and the recommendation was also adopted for health and

care workers.

Qualitative reviews and grey literature searches
In addition to the rapid reviews, other data were presented by WHO staff, Member States, and partner organizations. Such presentations were used to inform considerations regarding contextual factors on mask use, physical barriers and distancing, and cleaning and disinfection. These presentations included desk reviews of other prominent guidelines, information on mask filtration properties, technical specifications on ventilation and periodic updates on the ever-changing epidemiology of COVID-19.

The WHO also commissioned a qualitative review of the literature (reports, qualitative studies and related systematic reviews) to understand the perceptions of health and care workers on mask use and other PPE and to better inform the GDG in the evidence-to-decision-making process. The review question was articulated using the SPICE (**S**etting, **P**erspective, **I**ntervention, **C**omparison, **E**valuation) framework and the protocol was registered on PROSPERO. The review utilized a structured database search on MEDLINE (Ovid) and study selection and data extraction were conducted using pre-piloted tools. Methodological quality was assessed using the modified CASPS (Critical appraisal skills programme) tool and data were synthesized using the thematic synthesis approach. Such an approach generated descriptive and analytical themes, using the GRADE-CERQual (Confidence in the evidence from reviews of qualitative research) tool to assess confidence in the review finding. Findings were presented to the GDG to help inform the evidence-to-decision framework.

Rapid reviews of the evidence for mask use in the community.
Systematic reviews are commissioned to external groups *[26][27]* or conducted by WHO staff *[32]*.

The evidence review for mask use in the community is continuously reviewed through a rapid, living review approach. A medical librarian searched PubMed, MEDLINE, and Elsevier Embase, the WHO COVID-19 Research Database and the medRxiv preprint server. Studies were selected by using predefined criteria. One investigator extracted study data (e.g. study author, year, population characteristics, setting) into standardized tables, and a second investigator verified data (study author, year, setting, mask interventions and results). Relative risks were calculated for randomized trials and odds ratios for observational studies. Available data on RCTs were assessed by using criteria adapted from the U.S. Preventive Services Task Force. For observational studies, key limitations of each study, such as potential recall, selection, or participation bias, were noted and results were synthesized narratively. Risk estimates adjusted for cluster effects and unadjusted and adjusted risk estimates were presented for RCTs and observational studies, respectively. The results and the certainty of evidence were presented using GRADE, including GRADE Evidence Profiles and Summary of Findings tables. Contextual data on cost-effectiveness, equity, acceptability, resources required, and feasibility were captured and summarized narratively. This review has been published and is regularly updated to identify any emerging evidence that may inform deliberations by the GDG.

The systematic review on mask fit was informed by guidance for rapid evidence reviews developed by Tricco et al. *[28]* Search strategies were tested and designed in conjunction with the WHO secretariat. Final searches were conducted in Medline, Elsevier Embase, medrxiv preprint server, and Google Scholar. Documents were selected through pre-set inclusion and exclusion criteria. The study design, study population, study setting, and study methodology were extracted from the included articles for synthesis. All data were analysed using framework analysis *[29]* and assessed for quality using the MMAT. The results and the certainty of evidence were presented using GRADE, including GRADE Evidence Profiles and Summary of Findings tables. Due to a lack of data that would enable pooling, a descriptive summary of the patient characteristics, study characteristics, and risk of bias/methodological quality results was presented.

Process for developing recommendations
Once the balance of benefits to harms and certainty of the evidence was determined (based on the systematic reviews described above), the GDG, with the guidance of the methodologist, determined if a recommendation (strong or conditional) or a GPS was warranted. GRADE evidence profiles describe the GDG's assessment of the balance of benefits to harms, the certainty of the evidence, and a summary of findings for each critical outcome and each key question. The GDG used these summaries as the basis for discussions and formulation of recommendations.

The Evidence to Decision (EtD) framework was used by the GDG to support the formulation of the recommendation or GPS. In addition to the magnitude of benefits relative to harms and the certainty of the evidence, the strength of recommendations (strong or conditional) was informed by values and preferences, resource allocation (costs), equity, feasibility and acceptability (Table 2).

For mask use in children, these additional EtD domains were informed by five consultation sessions conducted by the United Nations Children's Fund (UNICEF) with members of the International Pediatric Association (IPA), and members from different geographical regions, in multiple languages, regarding paediatric health professionals' children's field experiences (including acceptability and feasibility) with the implementation of previous WHO guidance on masks.

For recommendations on mask use in health and care workers, the EtD domains were informed by presentations from stakeholders from individual countries regarding acceptability and feasibility, regarding mask availability and costs globally. The GDG also received regular updates on SARS-CoV-2 epidemiology and transmission from the WHO epidemiology team. Otherwise, the EtD domain assessments (including values/preferences and equity) were based on the collective input and experience of the GDG, which comprised members (including persons in the community, clinicians, and policymakers) who represented all WHO regions and ranged from low- to very high-income countries, supplemented by key studies suggested by GDG members when available. Results from the qualitative review on PPE and masks were also used to inform the evidence to decision tables for mask use by health and care workers.

The GDG graded recommendations as strong or conditional. Strong recommendations are supported when benefits clearly outweigh harms with at least moderate certainty; other factors that support strong recommendations are non-sensitivity to variability in preferences/values regarding outcomes, wide feasibility and acceptability, cost savings or cost-effectiveness, and likely positive impacts on improving equity. When certainty is low or very low, strong recommendations require a strong rationale for potential net benefits despite important uncertainty and strong support from the other EtD domains. Alternatively, a good practice statement (GPS) may be considered if the certainty of benefits is high based on indirect evidence, despite no direct evidence or low/very low certainty based on direct evidence (see the section on GPS). In some cases, after determining that the benefits of intervention do not outweigh the harms and considering EtD domains (Table 2), the GDG may make a recommendation against an intervention. The GRADE tables used in this living guideline can be found in the Evidence section of this living guidance.

Table 2. Evidence to decision making domains

Domain	Favours strong recommendations	Favours conditional recommendations
Balance of benefits and harms	Benefits highly outweigh harms	Benefits and harms more closely balanced
Quality of evidence	Higher certainty	Lower certainty
Values/preferences regarding outcomes	Benefits-to-harms assessment not impacted by variability in values/preferences	Variability in values/preferences would impact benefits to harms assessment
Acceptability	Highly acceptable	Low or variable acceptability
Costs/resources	Cost saving/cost effective	Costly/cost ineffective
Feasibility	Feasible in intended settings	Unfeasible or feasibility varies in intended settings
Equity	Increased equity	Decreased equity or effect on equity variable

Good practice statements and implementation considerations

GPS are suitable when benefits are large and harm very small; the certainty of benefits and harms are great; the values and preferences are clear; the intervention is cost saving; and the intervention is clearly acceptable, feasible, and promotes equity *[33][34][35][36]*. GPS characteristically represent situations in which a large and compelling body of indirect evidence, made up of linked evidence including several indirect comparisons, strongly supports the net benefit of the recommended action *[33][34][35][36]*. GPS are generally issued for various reasons - including the process, priorities, timeline, resources or nature of the evidence being assessed - but they are rooted in the fact that answers are obvious. GPS are not "GRADEd" statements *[33][34][35][36]*.

On multiple occasions, the GDG elected for a GPS instead of a strong or conditional recommendation. These GPS are part of an overall

evidence-based process, and often a systematic review was commissioned to determine whether direct evidence was available. Consistent with the methodology for developing GPS, an assessment by the GDG judged that the indirect evidence provided high certainty of benefit despite the insufficient evidence/very low-quality evidence to qualify it as a recommendation.

Implementation considerations are critical elements that facilitate the appropriate use of recommendations and GPS but are not assessed using the GRADE methodology. They may be actionable and relevant to implementing one of the intervention options and may include information to enhance implementation *[33][34][35][36]*.

Readership cues for statements

Table 3 presents the readership cues used for the statements in this living guideline. The green checkmark and red X symbols reflect statements that are developed using the GRADE evidence assessment methodology and the use of the evidence to decision framework to inform a recommendation or a GPS. The grey bar refers to implementation considerations that support statements through practical advice and are the product of expert consensus.

Table 3. Readership cues used for statements in the living guideline

	The GREEN checkmark symbol denotes a recommendation or a good practice statement in favour of an intervention.
	The RED X denotes a recommendation or good practice statement against an intervention.
	The GREY bar denotes an implementation consideration supporting the practical implementation of the statement.

Periodicity of the guideline revision and updates

Rapid reviews were conducted by WHO staff, and a systematic review was commissioned to monitor emerging evidence on the use of masks in the context of the COVID-19 pandemic. New evidence identified in these reviews informed revisions or new recommendations by the GDG. Furthermore, as the pandemic evolves, including changes in transmission intensity, circulation of new variants of concern (VOCs), and health systems' capacities to respond to new epidemiological scenarios, the GDG will review the current evidence on IPC and public health and social measures (PHSMs) to determine the need for updating of recommendations.

3. Part 1: Health-care settings

This section provides an overview of concepts in infection prevention and control to be applied in health-care settings for the mitigation and containment and control of infectious agents. These principles include infection prevention and control (IPC), preparedness and response, COVID-19-specific IPC measures, water, sanitation, hygiene, and waste management, safe management of dead bodies, and special settings.

Multiple subsections of the technical guidance related to *Part 1: Health-care settings* are currently under review. Links to the most recent publication of the technical guidance are available in the sections that follow. Updated guidelines on health-care settings will be available in this living guideline in the near future.

3.1 IPC principles

IPC is a practical, evidence-informed approach to preventing patients and health and care workers from being harmed by avoidable infections *[38]*. Implementation of IPC measures is based on a risk-assessment approach and established practices (i.e. standard and transmission-based precautions). This section provides an overview of IPC programmes, principles and precautions.

3.1.1 What is an IPC programme?

What is an infection prevention and control programme?
IPC is a practical, evidence-informed approach to preventing patients and health and care workers from being harmed by avoidable infections. Healthcare-associated infections (HAIs) are among the most common adverse events in care delivery and a major public health problem affecting morbidity, mortality and quality of life. On average, 7% of patients in developed countries and 15% of patients in developing countries will acquire at least one HAI *[37]*. These infections also impose a significant economic burden on society. A large proportion of them are preventable through effective IPC measures.

Establishing an infection prevention and control programme at national and acute health care facility levels
The *WHO Guidelines on core components of infection prevention and control programmes at national and acute health care facility levels [38]* are the foundation of WHO strategies to prevent current and future threats from infections and antimicrobial resistance in health care. The core components constitute a framework of recommendations and good practices statements distributed into eight areas: 1) infection prevention and control programmes, 2) national and facility-level infection prevention and control guidelines, 3) IPC education and training, 4) health care-associated infections surveillance, 5) multimodal strategies for implementing infection prevention and control activities, 6) monitoring and evaluation and feedback, 7) workload, staffing and bed occupancy at the facility level and, 8) built environment, materials and equipment for IPC at the facility level. Ensuring adequate clinical staffing levels is recommended as a core component to prevent the transmission of HAI and multidrug-resistant organisms (MDROs); limit human-to-human transmission; reduce secondary infections; and prevent transmission through amplification and super-spreading events.

Implementation of an IPC programme requires a stepwise approach to achieve its full potential *[38]*. Minimum requirements as identified by WHO support the strengthening of IPC in countries where IPC is limited or nonexistent *[39][40]*. In this regard, a facility-level IPC programme with a dedicated and trained IPC team, or at minimum, an IPC focal point, should be in place and supported by national-level and facility-level senior management. Achieving the IPC minimum requirements (and more robust and comprehensive IPC programmes in all countries) is essential to being able to control the COVID-19 pandemic, other emerging and re-emerging pathogens and MDROs. Finally, WHO has also developed guidance on the core competencies *[41]* required for infection prevention and control professional staff, which can be used for developing curricula for IPC specialists.

3.1.2 IPC principles

IPC practices should be followed by all health and care workers during the care of all patients, at all times, in all settings. These practices are known as standard and transmission-based precautions.

IPC principles
Well-established IPC practices in applying standard and transmission-based precautions emphasize rapid identification and

implementation of control measures, such as isolation of suspect or confirmed cases *[11]*.

This section describes core elements of IPC, including the chain of transmission, the hierarchy of control measures and the implementation of standard and transmission-based precautions.

Understanding the chain of infection

Epidemiology aids in the understanding of infectious diseases; the distribution of illness; and the identification of modifiable factors that affect occurrence and outcomes. The spread of microorganisms occurs within a community or health-care setting through a sequence of events described as a chain of interrelated steps. The chain of infection is a model used to understand the infection process *[42]*.

Transmission of microorganisms may result in a transient carriage or long-term colonization, asymptomatic infection, or clinical disease. The presence of microorganisms in or on a host, with growth and multiplication but without tissue invasion or cellular injury, is referred to as colonization *[43]*. Infection is the condition in which microorganisms multiply within the body and respond to the host's immune defenses. Infection may or may not lead to clinical disease (symptomatic infection) *[43]*.

Certain conditions must be met for a microbe or infectious particle to be spread from person to person. The establishment of infection involves a set of complex interrelationships among the source of the infectious agent (microorganism), the susceptible host and the environment, and requires the transmission of microorganisms from the source to a susceptible host.

The chain of infection includes six links: the infectious agent, reservoir, portal of exit, mode of transmission, portal of entry and susceptible host. If this chain is broken at any of the links, the process is interrupted and the infection is prevented from occurring *[42]*.

Infection prevention and control (IPC) measures are informed by a risk-assessment approach that assesses and analyses the potential for exposure to infectious disease. When applied consistently, IPC precautions (i.e. standard and transmission-based precautions) can prevent or reduce the risk of exposure and transmission of health care-associated and occupational infections.

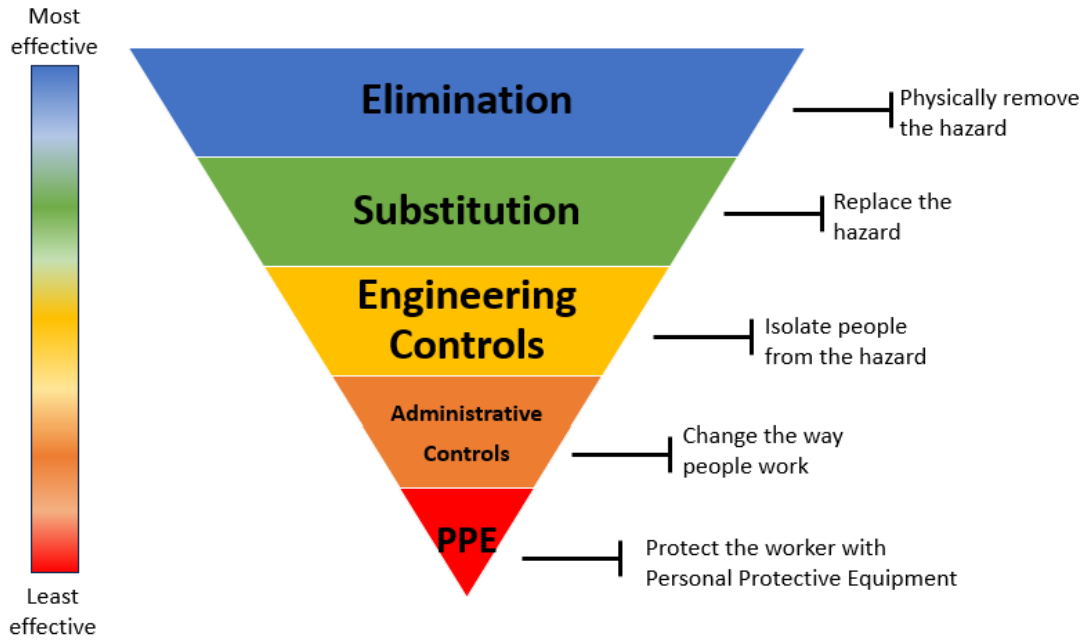
Hierarchy of occupational safety and health control measures

The hierarchy of controls describes measures that can be taken to minimize exposure and subsequent transmission of infectious diseases *[44]*.

The hierarchy of occupational safety and health control framework includes five levels of actions to reduce or remove hazards:

1. Elimination
2. Substitution
3. Engineering controls
4. Administrative controls
5. Personal protective equipment (PPE)

Figure 1. Hierarchy of occupational safety and health controls *[45]*



Principles can be applied in health-care settings to reduce or mitigate the hazard. Control measures listed at the top of the hierarchy are more protective than those at the bottom. If a combination of measures are implemented at each level, the risk of transmission is reduced. The hierarchy applies to a broad range of work environments, and potential hazards including pathogens, other particles and chemicals. Elimination and substitution are not always possible in health-care settings and in the context of infectious diseases *[44][45]*.

In the framework above, the two first tiers, elimination and substitution, are more challenging actions to reduce or remove hazards in health-care settings, as it may not be feasible to eliminate or substitute the hazard (ie. patients with suspected or confined infection).

Infection prevention and control mitigation measures focus on three of these tiers: engineering controls, administrative controls, and the selection and use of PPE for health and care workers to mitigate the risk of potential hazards in the workplace *[44][45]*.

- ***Engineering controls***

Engineering controls reduce or prevent hazards from coming into contact with workers. Examples include health-care facility design, ventilation; modification of equipment or the workspace, availability of airborne infection isolation room (AIIR) or other designated isolation room; use of protective and physical barriers; designation of handwashing sinks for use by health and care workers; creation of signage to direct patients.

Engineering controls do not depend on an individual's compliance with exposure-prevention strategies. These controls are usually established and controlled within the building structure, thereby eliminating choice about their application, and reducing the opportunity for individual error. As such, they provide more effective protection *[44][45]*.

- ***Administrative controls***

Administrative controls are measures taken to reduce the risk of transmission of infections to health and care workers and patients through the implementation of policies, procedures, training, monitoring and support of IPC practices. Examples include support for effective IPC programmes; IPC policies, procedures, and resources (i.e. patient placement, symptom screening, visitor management, sick-leave policies); occupational health and safety policies, including preplacement assessment, work restrictions, respiratory protection programmes, sharps safety and other practices that prevent exposure to bloodborne pathogens; vaccination programs; training and education of workers; monitoring of IPC practices, HAIs and occupational infections *[44][45]*.

To be effective in preventing the transmission of microorganisms and/or detecting cases of infection, administrative controls are best implemented at the point of first encounter with an infected source and continued until the infected source leaves the health-care setting or is no longer infectious. Inherent in the development of administrative controls to prevent transmission of infection is

the commitment by the health-care organization to provide the necessary resources to implement the controls *[44][45]*.

- ***Personal protective equipment***

Although the use of PPE controls is often the most visible in the hierarchy of controls, PPE controls are considered the lowest level of the control measures and should not be relied on as the primary or stand-alone prevention intervention. A singular focus on the availability and use of various PPE to the exclusion of other tiers in the hierarchy of controls will result in suboptimal protection of all people in the health-care setting *[44][45]*.

The PPE tier refers to the availability and appropriate use of barriers that a susceptible host may wear to provide a barrier to protect from an infectious agent/infected source. This includes the use of gloves, gowns, masks, facial protection, eye protection (including face shields or masks with visor attachments) and FFP/respirators, when indicated *[44][45]*.

The health-care organization plays a critical role in ensuring the availability of appropriate PPE for use by patients and health and care workers to prevent exposure to an infectious agent/infected source. Staff should perform proper fit testing and receive PPE training on use. Selection of PPE is based on the route of transmission of the pathogen, the level of exposure anticipated, the appropriateness for the task, and fit.

The effective and appropriate use of PPE is the measure that is most reliant on the user's adherence and competence and, therefore, the control level most easily compromised (resulting in ineffective protection from an infectious agent/infected source). The use of PPE is the last tier in the hierarchy of controls to minimize exposure and subsequent transmission *[44][45]*.

3.1.3 Standard precautions

Standard precautions aim to reduce the risk of transmission of pathogens in the health-care setting from recognized and unrecognized sources and are the basic level of IPC precautions that should be always used in the care of all patients *[12]*

- **Standard precautions include, but are not limited to:**
  - risk assessment
  - hand hygiene
  - respiratory hygiene and cough etiquette
  - patient placement
  - personal protective equipment
  - aseptic technique
  - safe injections and sharps injury prevention
  - environmental cleaning
  - handling of laundry and linen
  - waste management
  - decontamination and reprocessing of reusable patient-care items and equipment *[12]*.

For additional information on standard precations see Standard precautions for the prevention and control of infections: aide-memoire *[12]*.

3.1.4 Transmission-based precautions

Transmission-based precautions are used in addition to standard precautions for patients with known or suspected infection or colonization with transmissible and/or epidemiologically significant pathogens. The type of transmission-based precautions assigned to a patient depends on the transmission route of the microorganism: contact, droplet or airborne.

Screening and application of transmission-based precautions are to be started as soon as a patient presents at a health facilty with symptoms (e.g. fever, new cough, vomiting, diarrhoea). For additional information on transmission precautions see Transmission-based precautions for the prevention and control of infections: aide-memoire *[11]*.

3.2 IPC measures for patients with suspected or confirmed COVID-19

WHO recommends that COVID-19 care pathways be established at local, regional and national levels. COVID-19 care pathways are for persons with suspected or confirmed COVID-19. A person enters the COVID-19 care pathway after screening, which includes an assessment of symptoms and meeting the criteria of the standardized case definition *[46][47]*.

Early recognition of SARS-CoV-2 infections and timely implementation of IPC measures are instrumental in preventing onward transmission in health-care settings. The following section outlines the key infection prevention and control measures that should be implemented in the health-care facility when caring for patients with suspected or confirmed COVID-19 *[46][47]*.

3.2.1 Screening and patient placement

The following section describes IPC measures that should be implemented in the health-care facility for patients presenting with suspected or confirmed COVID-19.

Identify and manage individuals with suspected or confirmed COVID-19

Health facilities should follow key WHO-recommended IPC measures adhering to respiratory and hand-hygiene best practices; appropriate selection and use of PPE; contact, droplet, and airborne precautions, where applicable; isolation of COVID-19 patients; adequate environmental cleaning and disinfection; and, where feasible, maintaining a physical distance of at least one metre.

Environmental and engineering controls play a key role in reducing the concentration of infectious respiratory particles in the air and the contamination of surfaces and other inanimate objects in the environment. Adequate ventilation rates within defined spaces in health facilities are generally addressed by national regulations *[19]*.

- **Apply standard precautions for all patients at all times** *[12]*
  - Apply standard precautions according to risk assessment for all patients when providing diagnostic and care services.
- **Screen for early recognition of suspected or confirmed COVID-19 patients and rapid implementation of source control measures**
  - Prompt identification of all individuals (including patients) with signs or symptoms of acute respiratory infection should occur via active screening *[46]*. It is important that all persons are screened at the first point of contact in health facilities to allow for early recognition, followed by immediate isolation/separation *[47]* when appropriate.
- **Apply transmission-based precautions** *[11]*
  - In addition to standard precautions, apply transmission-based precautions (contact, droplet and/or airborne precautions) with appropriate selection and use of PPE when providing direct care for patients with suspect or confirmed COVID-19.
- **Patient placement for those with suspected or confirmed COVID-19**
  - Isolation is used to separate people with confirmed or suspected COVID-19 from those without COVID-19. A patient with suspected or confirmed COVID-19 should be cared for in a separate, well-ventilated area, preferably in an isolation room, area or single-patient room, if available. Maintain a physical distance of at least one metre between patients, increasing that distance where feasible.
  - When making decisions about patient placement, health and care workers may consider factors that include the availability of single rooms and anticipated requirements for procedures or situations that may increase risk and/or likelihood of transmission. Cohorting patients confirmed to have COVID-19 in the same room is a consideration when other options are not available. Patients should stay in their rooms, with restrictions to movement or transport to essential activities.
  - Instruct suspected or confirmed COVID-19 patients to wear a medical mask when near others (provided they are able to tolerate the mask and there are no contraindications) and sanitize their hands, and practice respiratory hygiene (i.e. cover nose and mouth during coughing or sneezing with a tissue or flexed elbow; dispose of tissues safely immediately after; and perform hand hygiene after contact with respiratory secretions).

3.2.2. Ventilation

Strong recommendation for , Very low certainty evidence

New

The WHO recommends adhering to the ventilation rate requirements for health-care facilities in the context of COVID-19:

- 160 l/s/patient for airborne precaution rooms
- 60 l/s/patient for general wards and outpatient departments

Published 09 October 2023

Practical info

Implementation considerations

- The airflow direction should be from clean to less clean areas.
- Air should be exhausted directly to the outside away from air-intake vents, people and animals.
- Heating, Ventilation and Air Conditioning (HVAC) systems should be operated continuously when people are in the building and should be regularly inspected, maintained and cleaned.
- AGPs should be performed in rooms equipped with negative-pressure ventilation systems, in keeping with airborne precautions.
- If no other strategy can be adopted to meet the ventilation rate minimum requirements, consider using a stand-alone air cleaner equipped with High-Efficiency Particulate Air (HEPA) filters.
- For additional information on implementing ventilation standards and strategies to improve a health-care facility's ventilation, see *Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 [9]*.

Evidence to decision

Benefits and harms

Small net benefit, or little difference between alternatives

No studies investigated ventilation standards versus suboptimal compliance with existing standards. Although there was no direct evidence on the harms of adherence to ventilation standards, the GDG judged harms to be trivial or none.

Certainty of the Evidence

Very low

The quality of evidence is indirect and *very low.*

Values and preferences

Substantial variability is expected or uncertain

It was not possible to assess values and preferences as there is a lack of evidence on the effects that adherence to ventilation standards may have on SARS-CoV-2 infection.

Resources

Important issues, or potential issues not investigated

Current ventilation standards are the standard of care, though not all facilities are compliant with ventilation standards and costs to implement likely vary.

Equity

Important issues, or potential issues not investigated

Given the lack of evidence on benefits and harms, the GDG judged no negative impacts on equity if ventilatory standards are adhered to.

Acceptability

No important issues with the recommended alternative

Ventilation standards already exist and are widely accepted.

Feasibility

No important issues with the recommended alternative

GDG members noted that existing ventilation standards have been enforced for many years without issue. However, GDG members noted harm when ventilation systems are not up to standard, as there is a correlation between non-compliance and HAIs other than SARS-CoV-2.

The feasibility of implementing airborne current ventilation standards likely varies in different countries and settings and is dependent on whether standards are currently being followed properly.

Justification

No studies compared the effects of non-compliance with existing ventilation standards to compliance with ventilation standards and risk of SARS-CoV-2 infection. However, health-care facilities are subject to national, subnational or local regulations for ventilation requirements; ventilation standards are necessary for control of infections other than SARS-CoV-2, and laboratory and epidemiological studies demonstrate the association between inadequate ventilation and increased risk of respiratory infections. The above-mentioned standards are pre-existing WHO recommendations for ventilation requirements *[9][10]*. Therefore, the GDG members agreed that these existing standards should also be utilized in the context of COVID-19.

Clinical question/ PICO

Population: Health care settings

Intervention: Ventilation standards for health care (all health care spaces have variations of their own ventilation standards, but specifically ANSI/ASHRAE/ASHE Standard 170-2017 Ventilation of Health Care Facilities - Addendum, vol. 2017)

Comparator: Ventilation standards for healthcare settings are not met (non-compliance with all requirements)

Summary

No studies evaluated impacts on risk of SARS-CoV-2 infection.

Outcome Timeframe	**Study results and measurements**	**Comparator** Ventilation standards for healthcare settings are not met (non-	**Intervention** Ventilation standards for health care (all health care spaces h	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 Infection				Very low	No studies were found that looked at SARS-CoV-2 infection

Outcome Timeframe	**Study results and measurements**	**Comparator** Ventilation standards for healthcare settings are not met (non-	**Intervention** Ventilation standards for health care (all health care spaces h	**Certainty of the Evidence** (Quality of evidence)	**Summary**

3.2.3 Physical barriers

Conditional recommendation for , Very low certainty evidence

New

WHO suggests the use of physical barriers such as glass or plastic windows may be considered for areas where patients first present, such as screening and triage areas, the registration desk at the emergency department and the pharmacy window.

Published 09 October 2023

Practical info

Implementation considerations

- Physical barriers are thought to provide some level of protection for individuals sharing a space, first by preventing people from getting too close, and as a partition to potentially prevent or decrease respiratory particle movements .
- Physical barriers are used with other infection prevention and control measures, including environmental cleaning, hand hygiene, respiratory hygiene, and mask use (source control).
- Physical barriers in health-care settings should be installed according to facility requirements and part of engineering control measures, including ventilation standards.
- Those installing and using partitions should consider best practices in the design, installation and maintenance of physical barriers, in consultation with public health and industry standards, to ensure they are most protective.
  - Consider the dimensions of the physical space, the intended use of barriers, types of activities, occupancy and ventilation.
  - The dimensions should not exceed the breathing zone of users; the height should consider the tallest user and the breathing zone of a seated person.
  - Transparent barriers often need openings; these slots should be as small as possible, depending on the activity. There should be adequate space to pass the required documents, cash, etc., without touching the barrier, otherwise, there can be cross-contamination through the barrier. A slider door or flap is considered a high-touch surface for cleaning and disinfection purposes.
  - A surface-mounted barrier or free-standing partition is preferable to a hanging partition, keeping safety in mind.
  - It is unknown what the optimal material (e.g. plexiglass) and design (i.e. shape, size) are best suited for the construction of physical barriers *[49]*.

Evidence to decision

Benefits and harms

Important harms

One before-after study found the implementation of universal masking and physical barriers was associated with decreased SARS-CoV-2 infection incidence in most facilities *[48]*. GDG members noted potential harms associated with barriers and their effect on ventilation systems.

Certainty of the Evidence

Very low

As the evidence base is a single before-after study in which it is impossible to separate the effects of universal masking and physical barriers, the certainty of evidence has been assessed as *very low.*

Values and preferences

No substantial variability expected

Physical barriers are probably not associated with significant individual harms; therefore, the decision to use physical barriers is probably not preference sensitive.

Resources

Important issues, or potential issues not investigated

Research evidence
The cost and resource considerations likely vary depending on the setting, type of barrier, existing infrastructure and other factors.

Summary
The cost and resource considerations likely vary depending on the setting, type of barrier, existing infrastructure and other factors.

Equity

No important issues with the recommended alternative

The GDG did not identify negative impacts on equity, assuming that implementation is consistent across different settings.

Acceptability

Important issues, or potential issues not investigated

The acceptability of physical barriers may vary depending on costs and other factors (e.g. convenience, etc.) as well as the size, layout and type of barrier.

Feasibility

Important issues, or potential issues not investigated

The feasibility of implementing physical barriers likely varies in different settings. GDG members noted the importance of consulting with HVAC/engineers prior to installation. There may be factors impacting feasibility, for example, size, layout, design and type of barrier.

Justification

The evidence is very low since it was only one study; it used a before-after design; and it wasn't possible to separate the effects of barriers from those of masking. Despite the limitations in the evidence, the GDG judged that physical barriers could potentially reduce risk of infection in high-traffic areas with trivial or no harms, without specifying optimal barrier type and design (i.e. materials, shape, dimensions)

After reviewing the evidence, GDG members elected a conditional recommendation on physical barriers. GDG members noted that the location of these barriers was imperative, as improperly placed glass or plastic screens can disrupt the flow of air and reduce the effectiveness of the ventilation system.

GDG members felt these barriers would be most useful in triage and reception areas, pharmacies, and other locations that have patient contact but are not considered clinical areas. GDG members also noted that physical barriers are not a substitute for PHSMs or IPC practices.

Clinical question/ PICO

Population: Health-care
Intervention: Physical barriers
Comparator: No physical barriers

Summary

One study compared the use of physical barriers to no use of physical barriers; however, this study was an observational study out of a meat processing facility in the United States of America *[48]*. The purpose of this study was to detail the demographics and outcomes of SARS-CoV-2 infections among workers in Nebraska meat processing facilities and determine the effects of initiating universal mask policies and installing physical barriers at thirteen meat processing facilities. This was a pre-post comparative study, dating from April to July 2020 with 2600 participants. Results showed that ten days after interventions, eight of the thirteen facilities saw a statistically significant reduction in cases *[48]***.** Three of the thirteen facilities saw a nonsignificant reduction; however, one facility saw a statistically significant increase and another one saw a nonsignificant. The use of physical barriers can reduce SARS-CoV-2 transmission, but this study did not separate the effect from other interventions *[48]*.

Outcome Timeframe	**Study results and measurements**	**Comparator** No physical barriers	**Intervention** Physical barriers	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection				Very low	There were too few who experienced the SARS-CoV-2 infection, to determine whether physical barriers made a difference

3.2.4 Physical distancing

Good practice statement

New

Maintain a physical distance of at least one metre between and among patients[1], staff and all other persons in health-care settings, when feasible. When possible, increase this distance.

[1]Health and care workers providing direct patient care should wear appropriate PPE.

Published 09 October 2023

Justification

WHO previously advised to maintain physical distance of at least one metre in health-care settings. This recommendation was based on a review that primarily included studies of other infections and that had methodological limitations. For this update, the GDG commissioned a review to determine whether there was evidence to support increasing physical distance to >1 metre. Only one study compared distances (1 metre vs. 2 metres) and reported similar rates *[50]*. Therefore, the GDG found insufficient evidence to support increasing the recommended minimum physical distance.

The GDG elected to keep the minimum distance of 1 metre based on indirect evidence showing high certainty of benefit and trivial harms. However, based on data indicating that transmission can occur at distances of 1 metre or greater, the GDG suggested increasing the minimum physical distance, when possible, to potentially reduce risk.

After extensive deliberation, the GDG decided to maintain its previous guidance on physical distancing. As only one study addressed the PICO question *[50]*, the GDG elected for a good practice statement. The lone study had few events and estimates were imprecise.

The WHO commissioned a qualitative review of the literature (reports, qualitative studies, and related systematic reviews) to better understand the perceptions of health and care workers on physical distance and to better inform the GDG in the evidence to the decision-making process, which highlighted compliance and feasibility issues.

Many GDG members noted that maintaining a physical distance of 1 metre or more is not feasible for health and care workers when they are providing direct care to patients with suspected or confirmed COVID-19. When unable to maintain a distance of at least 1 metre, health and care workers should ensure the proper use of PPE (a mask, gown, gloves, and eye protection) considering the risk when in close proximity. This good practice statement is informed by established IPC principles and practices.

Clinical question/ PICO

Population: Health and care workers
Intervention: 1 metre of physical distance
Comparator: More than 1 metre of physical distance; less than 1 metre

Summary

One study addressed the PICO question, in which SARS-CoV-2 cases were similar irrespective of the physical distance (1 metre vs 2 metre) between participants *[50]*. Importantly, this study had estimates that were very imprecise due to very few events. The environment in which this study was performed had concurrent policies for universal masking and influenza vaccination, thus potentially affecting the outcome *[50]*. Further studies are required to increase the certainty of the evidence around the effectiveness of a physical distance of 1 metre compared to distances greater or less than 1 metre, in reducing and mitigating the transmission of SARS-CoV-2.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** More than 1 metre of physical distance; less than 1 metre	**Intervention** 1 metre of physical distance	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection					There were too few who experienced SARS-CoV-2 infection, to determine whether 1 metre of physical distance made a difference

3.2.5 Mask use for source control

Background

Source control measures prevent infections from spreading by stopping them at the source; they are important tools to reduce the transmission of COVID-19 and other respiratory infections *[52]*.

Source control refers to engineering, environmental and administrative-control measures such as screening for early identification of COVID-19; use of protective barriers; and placement of patients, aimed at reducing and preventing the dissemination of infectious agents. In health-care settings, this protects those in the facility, including the health-care worker and those at increased risk of becoming severely ill.

Source control also includes wearing well-fitting medical masks to cover a person's nose and mouth to prevent respiratory secretions from spreading when breathing, talking, singing, sneezing or coughing.

Published 09 October 2023

Targeted continuous masking

Conditional recommendation for , Very low certainty evidence

Updated

WHO suggests targeted continuous medical masking in health-care facilities when there is a minimum to moderate impact of COVID-19[1] on the health system.

Remarks:

- Targeted continuous masking is the practice of wearing a medical mask by all health and care workers and caregivers in clinical areas during all routine activities throughout the entire shift[2].
- In non-patient areas, staff are not required to wear a medical mask during routine activities if they have no patient contact.
- If caring for COVID-19 patients, please see the recommendation on mask type for health and care workers when caring for a suspected or confirmed COVID-19 patient.

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[1] Situational level up to 2 (as defined in the latest PHSM document *[51]*):

- Situational Level 0: corresponds to a situation with no known transmission of SARS-CoV-2 in the preceding 28 days. The health system and public health authorities are ready to respond, but there are no restrictions needed on daily activities, and only core PHSM (e.g. respiratory etiquette) are needed.
- Situational Level 1 is a situation with minimal transmission, morbidity, and health system impact of SARS-CoV-2, with only basic ongoing PHSM needed.
- Situational Level 2 represents a situation where there is moderate impact of COVID-19, although there may be higher impact in specific sub-populations. Additional measures may be required to reduce transmission; however, disruptions to social and economic activities can still be limited, particularly if PHSM can be targeted strategically to more impacted settings.

[2] unless otherwise specified (e.g. when performing AGP).

Published 09 October 2023

Practical info

Implementation considerations

Targeted continuous masking is the practice of wearing a medical mask by all health and care workers and caregivers in clinical areas during all routine activities throughout the entire shift.

When adopting targeted continuous masking within a health facility, it is essential for health and care workers to follow proper mask-wearing procedures and practices. For additional information, review the implementation considerations on mask management for health and care workers.

The WHO recommendation on mask fitting should be followed, including the related considerations on this critical aspect.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

No studies were identified on targeted continuous mask use/universal masking compared to no mask use in low to moderate impact settings. However, implementation of universal masking is associated with decreased risk of acquiring SARS-CoV-2 infection among health and care workers in several studies. Although studies suggest benefits of universal masking, they were all conducted in settings experiencing significant impact of COVID-19 *[53][54][55][57][56]*.

Studies of universal masking in settings experiencing mild to moderate impact of COVID-19 are not available. However, the GDG determined that the benefits of universal masking did not support universal masking in these mild to moderate impact settings; rather, targeted continuous masking was suggested *[53][54][55][56][57]*.

If caring for COVID-19 patients, please see the recommendation on mask type for health and care workers caring for a patient with suspected or confirmed COVID-19.

Certainty of the Evidence

Very low

No studies compared targeted continuous masking/universal masking in settings with mild or moderate impact of SARS-CoV-2. The evidence is indirect and based on evidence on universal masking in settings experiencing high impact of SARS-CoV-2; therefore, the certainty of the evidence is rated as *very low*.

Other indirect evidence on medical mask use in the community supports benefits of mask use in preventing SARS-CoV-2 infection but is also indirect *[26][27]*.

Values and preferences

No substantial variability expected

Given the protective effects of mask use, health and care workers, including community health and care workers and caregivers, would likely favour targeted continuous masking in health facilities. The qualitative review suggests health and care workers value the protection PPE provides to them and to their patients. Furthermore, health and care workers were reported to be anxious about the level of risk associated with COVID-19; the review noted that PPE associated with higher levels of protection relieved anxiety and insecurities, in particular when health and care workers were providing patient care *[59][60][62][63][65]*.

Resources

No important issues with the recommended alternative

Research evidence

The GDG considered the potential issues with supply availability, particularly medical masks for both low-resource and higher-resource areas. The GDG noted that supply chains have improved since the beginning of the COVID-19 pandemic, and therefore, judged that implementation of targeted continuous masking is likely to have a low to moderate impact on resources.

Summary

The GDG considered the potential issues with supply availability, particularly medical masks for both low-resource and higher-resource areas. The GDG noted that supply chains have improved since the beginning of the COVID-19 pandemic, and therefore, judged that implementation of targeted continuous masking is likely to have a low to moderate impact on resources.

Equity

No important issues with the recommended alternative

The GDG judged that implementing targeted continuous masking will likely have no adverse impact on equity, so long as masks are provided in health-care settings and are readily available to those for whom they are indicated.

Acceptability

No important issues with the recommended alternative

Targeted continuous masking is less burdensome than universal masking and was judged by the GDG to be generally acceptable.

Some health and care workers expressed concerns about the quality of the PPE, including masks, provided throughout the COVID-19 pandemic *[59][62][63]*.

Feasibility

No important issues with the recommended alternative

Many health-care facilities have transitioned from universal masking to targeted continuous mask use, indicating general feasibility, though the GDG noted that clear policies and training may be required.

Justification

In response to the shift in epidemiology and WHO terminology classifying community transmission levels, the GDG re-assessed the recommendation within the current context of COVID-19, previously published in April 2022.

No studies were identified on targeted continuous mask use/universal masking compared to no mask use in low to moderate impact settings. Studies of universal masking were conducted only in settings experiencing significant COVID-19 impact. The GDG judged that, in settings experiencing mild or moderate COVID-19 impact, the benefits of universal masking were unclear but likely smaller than in settings experiencing significant COVID-19 impact.

Given the potential discomfort, and other harms of universal masking, such as impact on communication, and resource costs, the GDG judged that evidence was insufficient to support universal masking in this setting. However, the GDG felt that targeted, continuous mask based on the degree of exposure to SARS-CoV-2 was warranted to reduce the risk of infection.

The GDG judged that targeted continuous mask use would be feasible and more acceptable than universal masking and would require fewer resources. The recommendation is conditional because of very limited evidence with high uncertainty.

Clinical question/ PICO

Population: Health and care workers
Intervention: Targeted continuous masking/universal masking
Comparator: No mask use

Summary

No studies have been conducted of targeted continuous mask use vs. other strategies, or universal mask use in settings experiencing low or moderate COVID-19 impact (see universal masking PICO question for with summary of evidence on universal masking in high COVID-19 impact settings.) The universal use of masks probably decreases the risk of SARS-CoV-2 infection slightly.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** No mask use	**Intervention** Targeted continuous masking/ universal masking	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection				Very low	There were too few who experienced the SARS-CoV-2 infection, to determine whether targeted continuous masking/universal masking in low-impact settings made a difference.

Universal masking

Strong recommendation for , Very low certainty evidence

Updated

WHO recommends universal masking in health-care facilities when there is a significant impact of COVID-19 on the health system[1].

Remarks:

- Universal masking is the practice of all health and care workers and other staff, caregivers, visitors, outpatients and service providers wear a well-fitted medical mask[2] at all times within the health facility and in any common area (e.g. cafeteria, staff rooms).
- Inpatients are not required to wear a well-fitted medical mask unless physical distancing of at least one metre cannot be maintained (e.g. during examinations or bedside visits) or when outside of their care area (e.g. when being transported), provided the patient is able to tolerate the mask and there are no contraindications.
- If caring for suspected or confirmed COVID-19 patients, please see the recommendation on mask type for health and care workers.

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[1]Situational levels 3 & 4 (as defined in the latest PHSM document *[51]*):

- Situational Level 3 is a situation with significant impact on the health system and a risk of health services becoming overwhelmed, or unacceptably high morbidity and mortality despite sufficient remaining health system capacity. A larger combination of PHSM may need to be put in place to limit transmission, manage morbidity, and avoid overwhelming the health system.
- Situational Level 4 corresponds to an uncontrolled epidemic with very high morbidity/mortality and limited or no additional health system response capacity available, thus requiring extensive PHSM to avoid overwhelming health services and substantial excess morbidity and mortality

[2] Unless otherwise specified, (e.g. when performing AGP).

Published 09 October 2023

Practical info

Implementation considerations

When implementing universal masking, health facilities should:

- Ensure well-fitted medical masks are available for all health and care workers, caregivers, visitors, service providers, outpatients and inpatients.
  - See the WHO recommendation on mask fitting including the related considerations on this critical aspect.
- Ensure there are areas for disposal of medical masks after use, including at the entrances/exits to the facility, with waste bins for disposal.
- Ensure sufficient hand hygiene stations where masks are provided for use and at areas for removal (e.g. entrance and exit areas)
- Health and care workers, patients, family and visitors should follow proper mask-wearing procedures and practices as per facility policy. For additional information, review the implementation considerations on mask management for health and care workers.
- As the use of PPE, in particular the use of masks, during care activities increased throughout the COVID-19 pandemic,

awareness of unintended consequences, such as increases in health-care waste and impact on the environment must be taken into consideration. For additional information on the environmental impact of mask use (and other PPE), please see WHO's Global analysis of health care waste in the context of COVID-19 *[66]*.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

Implementation of universal masking is associated with decreased risk of acquiring SARS-CoV-2 infection among health and care workers in several studies conducted in settings significantly affected by SARS-CoV-2. However, these studies were noted to have methodological limitations, including utilization of before-after study design and lacking or limited controls for confounders such as the use of other personal protective equipment and exposures; in addition, most studies were conducted in the United States of America *[53][54][55][56][57]* which could reduce applicability to other countries/ settings.

In areas where there is community transmission of COVID-19, universal masking reduces potential transmission between health and care workers and other staff, patients and those entering the facility. Literature provides limited insight into the harms of universal masking; however, evidence on mask use, in general, indicates bothersome but non-serious harms *[26][27]*.

A qualitative review suggests there may be communication constraints (both verbal and facial communication) associated with the use of a mask, as it covers the face. Health and care workers also report issues related to hearing, such as muffled words and the inability to read others' lips. This potentially affects communication, and groups such as the elderly may be more affected.

Despite the limitations in the evidence, the GDG judged that the available evidence suggests that the benefits of implementing universal mask use in health-care facilities outweigh the potential harm in settings experiencing a significant impact of COVID-19.

If caring for COVID-19 patients, please see the recommendation on mask type for health and care workers when caring for a patient with suspected or confirmed COVID-19.

Certainty of the Evidence

Very low

Given the limited number and type of evidence available (i.e. before-after studies) investigating the implementation of universal masking to prevent transmission or infection, the certainty of the evidence is rated as *very low*.

Values and preferences

No substantial variability expected

In the context of universal masking, some health and care workers may prefer to wear a respirator instead of a medical mask, based on their perception of what offers the better protection against COVID-19.

A qualitative review of the literature reports that health and care workers often feel that masks and PPE provides health and care workers with peace of mind and thereby create a climate of safety *[58][59]*. Furthermore, health and care workers were reported to be anxious about the level of risk associated with COVID-19 and to feel that PPE that offered higher levels of protection relieved their anxiety and insecurity *[60]*. In many settings with low impact of COVID-19, in contrast, PPE has been shown to be uncomfortable and to add to the stress and discomfort felt by health and care workers, especially if worn for prolonged periods *[61][62][63][64][65]*.

Resources

Important issues, or potential issues not investigated

Research evidence

The increased need for PPE caused by the COVID-19 pandemic has caused PPE shortages and use of optimization

strategies when supplies were low. This includes measures that may be used temporarily during periods of anticipated PPE shortages. While current supply may be adequate, there may be uncertainty about the adequacy of future supplies, which may pose clinical and operational challenges, particularly in low- and middle-income countries. The use of PPE requires an additional investment of financial and logistical resources to provide the best protection possible to health and care workers.

As supply chains have improved in the current context of COVID-19, the GDG judged that implementing universal masking is likely to have a low to moderate impact on resources, assuming facilities use medical masks. This does not take into consideration the availability of respirators, when indicated, and resources required for fit testing.

Summary

The increased need for PPE caused by the COVID-19 pandemic has caused PPE shortages and use of optimization strategies when supplies were low. This includes measures that may be used temporarily during periods of anticipated PPE shortages. While current supply may be adequate, there may be uncertainty about the adequacy of future supplies, which may pose clinical and operational challenges, particularly in low- and middle-income countries. The use of PPE requires an additional investment of financial and logistical resources to provide the best protection possible to health and care workers.

As supply chains have improved in the current context of COVID-19, the GDG judged that implementing universal masking is likely to have a low to moderate impact on resources, assuming facilities use medical masks. This does not take into consideration the availability of respirators, when indicated, and resources required for fit testing.

Equity

No important issues with the recommended alternative

The GDG determined no adverse impacts on equity when universal masking is implemented in both low- and higher-resource settings, and there is availability of medical masks for all heath and care workers, staff, visitors and patients.

Acceptability

No important issues with the recommended alternative

The qualitative review found that some health and care workers indicated that the use of masks gave them peace of mind and created a safe climate in which to deliver optimal care *[58][59]*.

A qualitative review of the evidence also noted health and care workers reporting some symptoms, such as headaches, feelings of being hot or overheating, and excessive sweat *[59][65][60][62][63]*.

In the context of universal masking, some health and care workers may prefer to wear a respirator instead of a medical mask, based on their perception of what offers better protection to prevent SARS-CoV-2 infection.

Overall, the GDG judged that universal masking was probably acceptable in health-care facilities, given the protective effects for health and care workers, other staff, visitors and patients.

Feasibility

No important issues with the recommended alternative

The universal use of masks in health-care facilities as an intervention was widely implemented in many high-resource settings throughout the COVID-19 pandemic, indicating that it is feasible in those settings.

Many reports suggest that universal masking is likely feasible in health-care facilities, as long as PPE is available and health and care workers have proper institutional support and training *[58]*. Therefore, the GDG judged that universal masking was probably feasible.

Supply chain and availability of PPE such as masks may also be an issue *[64]*.

Justification

In response to the shift in epidemiology and WHO terminology classifying community transmission, the GDG re-examined this recommendation, first published in April 2022. Since that time, WHO commissioned a qualitative review of the literature (reports, qualitative studies and related systematic reviews) to examine the perceptions of health and care workers on mask use and other PPE use in health-care settings. The GDG agreed that the wording of this recommendation would be amended to reflect the institutional change in terminology and classification of situational levels; otherwise, the GDG did not make other changes to the content of this recommendation.

Despite the very low certainty of the evidence for the implementation of universal masking, the GDG judged that the evidence indicates benefits without significant harm in settings experiencing significant impact from COVID-19; in addition, the GDG members judged that universal masking could prevent health and care worker infections and further transmission within the health-care setting. Members also felt that, based on their own professional experience or that of colleagues, universal masking in health settings was routinely implemented in most countries; therefore, the acceptability and feasibility favoured a strong recommendation, as well.

Additionally, the GDG reviewed the mask type to be used universally in health-care facilities; considering variants of interest and variants ofconcern and the subsequent need to protect health and care workers and their patients, GDG members felt the exclusive use of medical masks was justified. If caring for suspected or confirmed COVID-19 patients, please see the recommendation on mask type for health and care workers. .

Given the available evidence on the effectiveness of medical masks and established industry standards for production, a majority of members felt the universal use of medical masks in the healthcare setting would provide better protection for staff, caregivers, patients, and visitors.

Clinical question/ PICO

Population: Health and care workers
Intervention: Universal masking
Comparator: No universal masking

Summary

A systematic review included four studies on the effects of hospital universal masking policies on risk of SARS-CoV-2 infections in HCWs. The studies were conducted in the United States and used a before-after design and had other methodological limitations, including failure to control for other factors (e.g. other PPE use or infection-control measures or exposures) that could result in changes in SARS-CoV-2 infection, and failure to measure mask use or adherence *[53][54][55][57]*.

Studies found a decline in health-care acquired SARS-CoV-2 infections during and after the intervention. Hospitals continued to see a decrease in SARS-CoV-2 infections within the hospital when there was an increased rate of infection within the community. While universal masking was the main intervention, hospitals also implemented other IPC measures such as physical distancing, increased access to hand-hygiene stations, and strict adherence to a quarantine regime for those health and care workers who were exposed. All of the studies were conducted in settings experiencing significant SARS-CoV-2 impact.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** No universal masking	**Intervention** Universal masking	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection		4 before-after studies		Very low All studies used before-after design and had	There were too few who experienced the SARS-CoV-2 infection, to determine whether

Outcome Timeframe	**Study results and measurements**	**Comparator** No universal masking	**Intervention** Universal masking	**Certainty of the Evidence** (Quality of evidence)	**Summary**
				serious methodological limitations.	universal masking made a difference

Mask management

Good practice statement

Updated

Appropriate mask fitting should always be ensured (for respirators, through fit testing and a user seal check when a filtering facepiece respirator is put on; and for medical masks, through methods to reduce air leakage around the mask) as well as compliance with appropriate use of PPE and other standard and transmission-based precautions.

Published 09 October 2023

Practical info

Implementation considerations

- When adopting a mask policy, it is essential that health and care workers follow proper mask-wearing procedures and practices.
- Health and care workers should also comply with appropriate use of PPE and other standard and transmission-based precautions.
- For additional information, review the implementation considerations on mask management for health and care workers.

Methods to improve the fit of respirators or medical masks

Respirators

- Filtering facepiece respirators (FFRs) vary for their measurement of fit, either through maximum allowable leak tightness or minimum fit factor. For European certified FFRs, the maximum leakage varies from:
  - FFP1 (maximum 22% leakage)
  - FFP2 (maximum 8% leakage) and
  - FFP3 (maximum 2% leakage)
- European certified FFRs (EN 149) are subject to testing for leakage with human participants as part of the product's certification.
- For NIOSH, N-type FFRs (minimum fit factor of 100) are certified according to OSHA 29 CFR 1910.134 for each wearer prior to use *[67]*.
- At a minimum, FFRs that meet FFP2 and N95 performance levels are recommended to be worn by health workers in areas where AGPs are performed *[25]*.

- Ensure a range of FFR sizes are available to accommodate different face shapes and sizes, especially for those with small faces.
- Qualitative or quantitative fit testing should be performed annually and for new staff at the employer's expense to ensure that the respirator model fits each health worker's unique facial features and provides a consistent seal *[68]*.
- A seal check should be performed on FFRs whenever donned by a health worker to determine if an adequate fit is achieved by the specific FFR they have donned. See WHO guidance on how to perform a particulate respirator seal check for additional details.

Two methods can be used for fit testing FFRs
1) qualitative fit test (health worker reports taste of an ambient aerosol) and 2) quantitative fit test *[68]*

Table 4. FFRs fit testing parameters

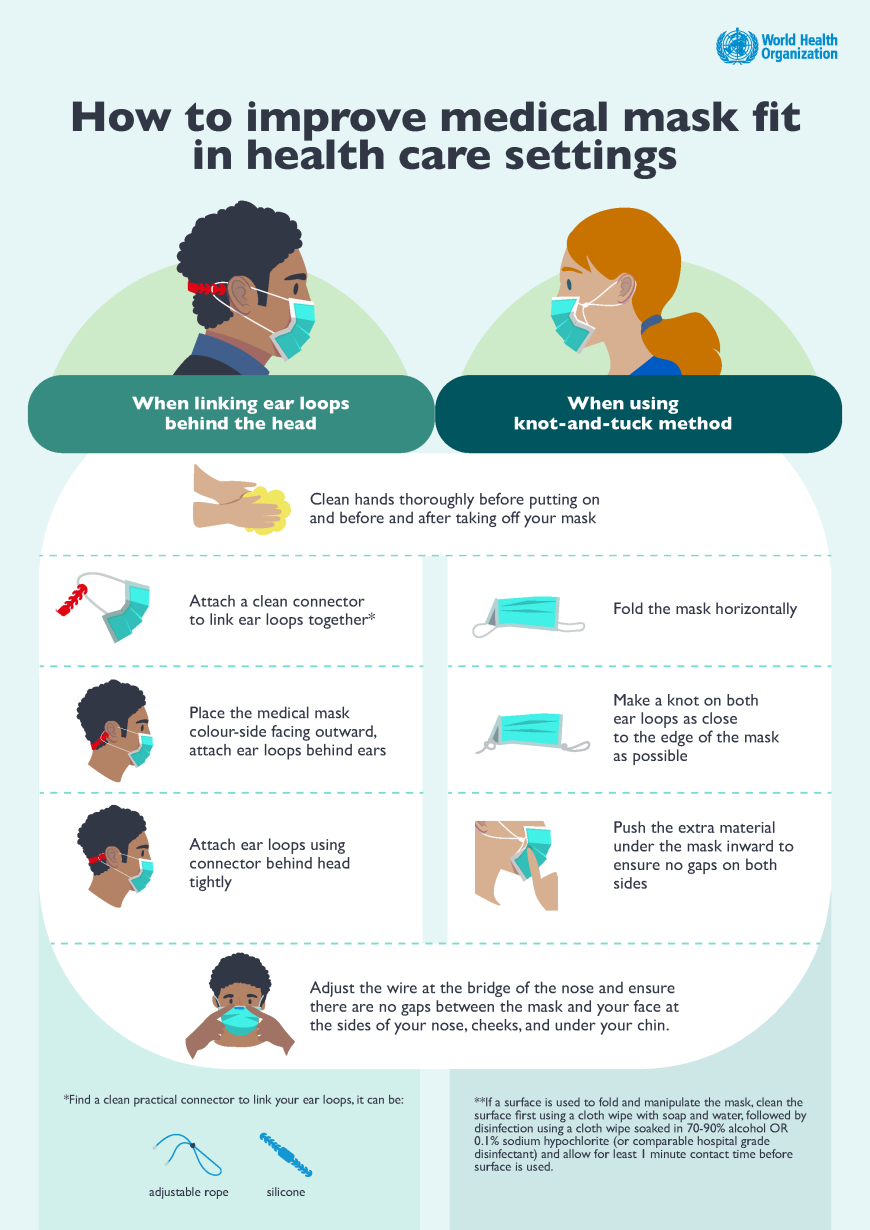
	Qualitative Fit Testing	Quantitative Fit Testing
Standard test methods	OSHA 29 CFR 1910.134 Appendix A (for N95)	EN 149, Clause 7.9.1 (EN-type, e.g. FFP2) OSHA 29 CFR 1910.134 Appendix A (e.g. N95)
Equipment	Hood and sweet/bitter aerosol	Ambient aerosol condensation nuclei counter
Pass/Fail Criteria	Wearer report tasting aerosol	>8% leakage (for FFP2) <100 fit factor (for N95)

Medical masks
Improving the fit of medical masks with techniques such as the “knot-and-tuck” and “linking-ear-loops-behind-the-head” reduces gaps on the sides of medical masks with ear loops. Such gaps allow air leakage (potentially containing infectious particles) to bypass the filtration layers of the medical mask when the wearer inhales or exhales.

Considerations on the use of linking-ear-loops-behind-the-head techniques to improve medical mask fit

- Always use a clean, unused, rectangular, pleated medical mask meeting the minimum performance standards (or equivalent) *[25]*.
- Always clean hands thoroughly (per WHO guidance) prior to putting on, taking off and/or manipulating a mask *[15]*.
- Where connectors are used to link ear loops behind the head, ensure that these connectors are clean for use upon donning (either new, cleaned and disinfected or laundered, depending on the connector and local implementation strategy). When connectors are doffed, they should be treated as potentially contaminated. A local strategy should be in place to manage used connectors thorough cleaning and disinfection processes, laundering or discarding used connectors through standard waste management.

Figure 2. How to improve medical mask fit in healt care settings



Justification

GDG members agreed that having practical advice on improving medical mask fit would be useful. After reviewing many methods to improve mask fit, the GDG decided that the use of ear loops linked behind the head and the tie-and-tuck method were retained as advisable methods to improve the fit of masks; additional details can be found in the practical information section.

GDG members reported that the evidence available on improving the fit of medical masks to reduce the transmission risk of SARS-CoV-2 is in the form of laboratory-based studies with limited field and clinical investigations *[69][70][71][72]*.

Research needs

Clinical question/ PICO

Population: Health and care workers
Intervention: Methods to improve mask fitting
Comparator: An ill-fitting mask (does not fit snugly, has gaps)

Summary

The research of the included studies had been conducted over a large range of countries, with the most frequent research coming from the USA *[69][70][71][72]*.

Studies aimed to evaluate:

- modifications to improve the fit to reduce the number of expelled particles
- amount of leakage associated with double masking
- fitted filtration efficiency of consumer-grade masks
- aerosol particle leaking/leakage and standard surgical mask fitting with 3 elastomeric harness designs.

Studies found that crossing ear loops or using mask brackets made no significant improvement. However, modifications such as knot-and-tuck methods did improve the fit, blocking particles from the wearer and reducing exposure. Furthermore, increasing the tension through a brace, connector, “ear-guards”, etc. did improve fit and protection. Lastly, an elastomeric harness may improve the fit and protection of a standard surgical mask.

Outcome Timeframe	**Study results and measurements**	**Comparator** An ill-fitting mask (does not fit snugly, has gaps)	**Intervention** Methods to improve mask fitting	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection				Evidence was not GRADE’ d as all studies were performed in the laboratory setting	There were too few who experienced SARS-CoV-2 infection, to determine whether methods to improve mask fitting made a difference.

Updated

Implementation considerations

Health and care workers should comply to the following procedures and practices when wearing a mask for an extended period in health-care settings.

- Medical masks should be combined with other measures, including frequent hand hygiene and physical distancing of at least 1 metre among health workers in shared and crowded places such as cafeterias, break rooms and dressing rooms.
- Medical masks must be changed when wet, soiled or damaged or if the health worker or caregiver removes the mask for any reason (e.g. for eating or drinking or caring for a patient who requires droplet/contact precautions for reasons other than COVID-19).
- Used medical masks should be disposed of properly.
- The medical mask should not be touched to adjust it or if it is displaced from the face for any reason. If this happens, the mask should be safely removed and replaced and hand hygiene performed.
- The medical mask (as well as other PPE) should be discarded and replaced after caring for any patient who requires contact/droplet precautions for other pathogens, followed by hand hygiene.
- Under no circumstances should a medical mask be shared between health workers.
- During extended use, medical masks can become displaced from their optimal placement, over the mouth and nose, which creates gaps for respiratory particles to bypass the filtration layers on inhalation and exhalation. The WHO recommendation on mask fitting should be followed, including the related considerations on this critical aspect.

Published 09 October 2023

3.2.6 PPE selection and use

Strong recommendation for , Low certainty evidence

Updated

A respirator or a medical mask should be worn along with other PPE – a gown, gloves and eye protection – by health and care workers providing care to a patient with suspected or confirmed COVID-19.

Note: This recommendation applies to any setting where regular care is provided to patients with suspected or confirmed COVID-19, including home care, long-term care facilities and community care settings. For settings where AGPs are performed on patients with suspected or confirmed COVID-19, see the AGP recommendation.

Published 09 October 2023

Practical info

Implementation considerations

When adopting a mask policy within a health facility, it is essential that health and care workers follow appropriate mask-wearing procedures and practices. For additional information, review the implementation considerations on mask management for health and care workers.

The WHO recommendation on mask fitting should be followed, including the related considerations on this critical aspect, like the type of FFR that should be used by health and care workers.

Implementation considerations and contextual factors that may influence the overall risk of transmission, including general PPE use, PPE training, fit testing, ventilation and behavioural factors (including compliance) and transmission of SARS-CoV-2 among health and care workers appear to occur mostly in community settings *[26][27]*.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

Evidence comparing the effectiveness of respirators versus medical masks for SARS-CoV-2 in health-care settings is limited to five observational studies *[73][74][75][76][77]*, and one randomized controlled trial *[78]*. The five observational studies were conducted prior to the emergence of the Delta, Omicron and other variants and before widespread vaccination in health-care settings. These five observational studies reported inconsistent findings regarding the risk of SARS-CoV-2 infection between the use of respirators versus medical masks and had methodological limitations (for example, recall bias, low participation, and limited measurement of exposures). One study showed a reduction of risk with respirator use *[75]*, while in two other studies the use of respirators was not significantly associated with risk reduction *[74][77]*. One study showed no association *[77]*, and another found respirators were associated with increased risk (OR 7.1), likely related to confounding factors *[74]*. In the intention-to-treat analysis, the randomized control trial found that RT-PCR-confirmed COVID-19 occurred in 52 of 497 (10.46%) participants in the medical mask group versus 47 of 507 (9.27%) in the N95 respirator group (hazard ratio [HR], 1.14 [95% CI, 0.77 to 1.69]) *[78]*. Results were within the pre-specified, non-inferiority threshold (HR <2.00), but do not rule out a protective effect of N95 respirators. Furthermore, the length of RCT transcends across various VoC (Delta and Omicron).

The following side effects have been reported with respirators: discomfort, headaches, possible development of facial skin lesions and irritant dermatitis or worsening acne when used frequently for long hours *[26][27]*.

Medical masks are typically associated with fewer discomforts and side effects than respirators, given their reduced seal, although this has not been quantified. Undesirable outcomes from the prolonged use of respirators were noted, including general discomfort, headaches and the development of facial skin lesions, irritant dermatitis, and worsening acne *[26][27]*. The fitting process for respirators is burdensome, and issues with achieving it have been well described.

Certainty of the Evidence

Low

The certainty of the evidence is low, primarily based on a single RCT with some imprecision and methodological limitations. The observational studies were inconsistent and had important methodological limitations. Most studies were conducted before the emergence of the Delta variant and few were conducted in the Omicron era; studies included other respiratory infections but were not specific to the outcome for SARS-CoV-2 transmission *[26][27]* and the certainty of the evidence for particulate respirators compared to medical masks was rated as low.

Given similar effects of respirators vs. medical masks when providing routine patient care, decisions about whether to use a respirator or medical mask could be sensitive to variability in preferences regarding perceptions of the potential increased prevention of SARS-CoV-2 infection with respirators versus increased discomfort or other harms.

Values and preferences

Substantial variability is expected or uncertain

Given similar effects of respirators vs. medical masks when providing routine patient care, decisions about whether to use a respirator or medical mask could be sensitive to variability in preferences regarding potential increased prevention of SARS-CoV-2 infection with respirators vs. increased bothersome and other harms.

Resources

Important issues, or potential issues not investigated

Research evidence

The use of respirators for the care of all patients with suspected or confirmed COVID-19 in health-care facilities requires additional investment of financial and logistical resources (including fit testing), particularly in low- and middle-income countries. However, scaling up the market for respirators could lead to cost reduction.

Summary

The use of respirators for the care of all patients with suspected or confirmed COVID-19 in health-care facilities requires additional investment of financial and logistical resources (including fit testing), particularly in low- and middle-income countries. However, scaling up the market for respirators could lead to cost reduction.

Equity

Important issues, or potential issues not investigated

Given the limited global supply of respirators and their higher cost compared to medical masks, recommending the use of respirators for all COVID-19 cases in health-care settings could result in inequity in resource limited settings. However, it is also expected that the widespread use of respirators (if available) will reduce inequities related to COVID-19 exposure risk. There is an additional equity issue around medical masks, which may not be available in sufficient quantities and of adequate quality in low-resource settings.

Acceptability

No important issues with the recommended alternative

The current recommendation provides the option of using either respirators or medical masks, except for specific circumstances when a respirator is required. Those specific circumstances are covered by other recommendations. Given this flexibility, the GDG judged that the recommendation would be acceptable to stakeholders and policymakers.

Feasibility

No important issues with the recommended alternative

The current recommendation provides the option of using either respirators or medical masks, except for specific circumstances when a respirator is required. Those specific circumstances are covered by other recommendations. Given this flexibility and based on current availability of respirators and medical masks, the GDG judged that the recommendation would be feasible for implementation in various settings.

Justification

The GDG considered the evidence for particulate respirators versus medical masks and agreed that the strength of this evidence was insufficient to recommend one type of mask versus the other, except in some specific conditions (see conditional recommendation).

The only RCT of medical masks vs. respirators indicated similar effects with regard to the risk of SARS-CoV-2 infection when providing routine care. Therefore, the GDG recommended use of either respirators or medical masks when providing routine care.

Decisions to use respirators or masks may be based in part on one's values and preferences, especially in regard to the weight placed on the potential benefits of respirators in preventing SARS-CoV-2 infection. Furthermore, GDG members noted that the perceived discomfort of respirators may also play a critical role in a health and care workers' choice to wear medical masks or respirators.

Given the potential protective effects of respirators, some GDG members felt that respirators may be superior to medical masks in preventing SARS-CoV-2 infection and their use should be encouraged when the health-care worker delivers care while in close contact with the patient and/or when ventilation is inadequate. If respirators are used, there needs to be appropriate fit testing and training on use.

The GDG members advised that, irrespective of the mask type (medical mask or respirator), health and care workers should

wear a mask along with other PPE when caring for those with suspected or confirmed COVID-19 infection. The GDG noted that the core elements of IPC include the implementation of standard and transmission-based precautions.

The GDG considered serious concerns about the limited availability of respirators in low-resource settings and the resource implications associated with more widespread use of respirators.

Clinical question/ PICO

Population: Health and care workers
Intervention: disposable filtering facepiece respirators
Comparator: surgical masks, and cloth masks

Summary

Evidence comparing the effectiveness of respirators versus medical masks for SARS-CoV-2 in health-care settings is limited to five observational studies *[73][74][75][76][77]*, and one randomized controlled trial *[78]*. The five observational studies were conducted prior to the emergence of the Delta, Omicron and other variants and before widespread vaccination in health-care settings. These five observational studies reported inconsistent findings regarding the risk of SARS-CoV-2 infection between the use of respirators versus medical masks and had methodological limitations (for example, recall bias, low participation, and limited measurement of exposures). One study showed a reduction of risk with respirator use *[75]*, while in two other studies the use of respirators was not significantly associated with risk reduction *[74][77]*. One study showed no association *[77]*, and another found respirators were associated with increased risk (OR 7.1), likely related to confounding factors *[74]*. In the intention-to-treat analysis, the randomized control trial found that RT-PCR-confirmed COVID-19 occurred in 52 of 497 (10.46%) participants in the medical mask group versus 47 of 507 (9.27%) in the N95 respirator group (hazard ratio [HR], 1.14 [95% CI, 0.77 to 1.69]) *[78]*. Results were within the pre-specified, non-inferiority threshold (HR <2.00), but do not rule out a protective effect of N95 respirators. Furthermore, the length of RCT transcends across various VoC (Delta and Omicron). Overall, inconsistent findings for N95 vs surgical masks and risk of SARS-CoV-2 infection in health and care workers.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** surgical masks, and cloth masks	**Intervention** disposable filtering facepiece respirators	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection				Low	Inconsistent findings for N95 vs surgical masks and risk of SARS-CoV-2 infection in health and care workers.

Conditional recommendation for , Low certainty evidence

New

Suggested factors for informing the choice of the type of mask include a risk assessment[1] and health and care workers' values and preferences.

WHO suggests respirators be used in care settings where ventilation is known to be poor[2] or cannot be assessed, or the ventilation system is not properly maintained.

[1] The risk assessment should consider the following factors: the activity (procedure), the setting (patient care environment) and the patient.

[2] Ventilation in a health-care setting is considered to be poor when the requirements established for these settings are not in place (see "Definitions" section).

Note: This recommendation applies to any setting where regular care is provided to patients with suspected or confirmed COVID-19, including home care, long-term care facilities and community care settings. For settings where AGPs are regularly performed on patients with suspected or confirmed COVID-19, see the AGP recommendation.

Published 09 October 2023

Practical info

Implementation considerations

When adopting a mask policy within a health facility, it is essential that health and care workers follow proper mask-wearing procedures and practices. For additional information, review the implementation considerations on mask management for health and care workers.

The WHO recommendation on mask fitting should be followed, as should the related considerations on this critical aspect, like the type of FFR that health and care workers should use.

Evidence to decision

Benefits and harms

Small net benefit, or little difference between alternatives

Evidence comparing the effectiveness of respirators versus medical masks for SARS-CoV-2 in health-care settings is limited to five observational studies *[73][74][75][76][77]*, and one randomized controlled trial *[78]*. The five observational studies were conducted prior to the emergence of the Delta, Omicron and other variants and before widespread vaccination in health-care settings. These five observational studies reported inconsistent findings regarding the risk of SARS-CoV-2 infection between the use of respirators versus medical masks and had methodological limitations (for example, recall bias, low participation, limited measurement of exposures). One study showed a reduction of risk with respirator use *[75]*, while in another two studies the use of respirators was not significantly associated with risk reduction *[74][77]*. One study showed no association *[77]*, and another found respirators were associated with increased risk (OR 7.1), likely related to confounding factors *[74]*. In the intention-to-treat analysis, the randomized control trial found that RT-PCR-confirmed COVID-19 occurred in 52 of 497 (10.46%) participants in the medical mask group versus 47 of 507 (9.27%) in the N95 respirator group (hazard ratio [HR], 1.14 [95% CI, 0.77 to 1.69]) *[78]*. Results were within the pre-specified, non-inferiority threshold (HR <2.00), but do not rule out a protective effect of N95 respirators. Furthermore, the length of RCT transcends across various VoC (Delta and Omicron). The following side effects have been reported with respirators: discomfort, headaches, possible development of facial skin lesions, irritant dermatitis and worsening acne

when used frequently for long hours *[26][27]*.

Medical masks are typically associated with fewer discomforts and side effects than respirators, given the medical masks' decreased thickness and reduced seal, although this has not been quantified. Undesirable outcomes from the prolonged use of respirators included general discomfort, headaches and the development of facial skin lesions, irritant dermatitis, and worsening acne *[26][27]*. The fitting process for respirators is burdensome, and issues with achieving it have been well described.

Certainty of the Evidence

Low

Given the methodological limitations of the evidence, notably inconsistency and indirectness (e.g., most studies conducted before the emergence of the Delta variant and few in the Omicron era), evaluation of non-SARS-CoV-2 infections or assessment of non-clinical outcomes *[26][27]*, the certainty of the evidence for particulate respirators versus medical masks was rated as low.

Values and preferences

Substantial variability is expected or uncertain

There is substantial variability in preferences related to the use of respirators in preventing HAI. In the context of the increased transmissibility of variants of concern, some health and care workers may value the wider use of respirators to potentially reduce their risk, despite the limited evidence. Others may prefer not to wear a respirator for the duration of their shift because of discomfort or potential side effects.

Local values, preferences and practicalities should play an important role in directing choices on respirators. Furthermore, other factors may influence the overall risk of transmission, including general PPE use, PPE training, fit testing, ventilation and behavioural factors (including compliance) as well as the fact that transmission of SARS-CoV-2 among health and care workers appears to mostly occur in community settings.

Resources

Important issues, or potential issues not investigated

Research evidence

The use of respirators for the care of all patients with suspected or confirmed COVID-19 in health-care facilities requires an additional investment of financial and logistical resources, which could be challenging, particularly in low-resource settings. There is also the need for fit testing for all staff, requiring additional investments and expertise; however, scaling up the market for respirators could lead to cost reduction.

Summary

The use of respirators for the care of all patients with suspected or confirmed COVID-19 in health-care facilities requires an additional investment of financial and logistical resources, which could be challenging, particularly in low-resource settings. There is also the need for fit testing for all staff, requiring additional investments and expertise; however, scaling up the market for respirators could lead to cost reduction.

Equity

Important issues, or potential issues not investigated

Given the limited global supply of respirators and their higher cost compared to medical masks, a recommendation to use respirators for all COVID-19 cases in health-care settings could result in inequity in resource-limited settings. There is an additional equity issue around medical masks, which may not be available in sufficient quantities and of adequate quality in low-resource settings.

Acceptability

No important issues with the recommended alternative

Discussion with the GDG suggests that this recommendation is likely acceptable for health and care workers, policymakers and hospital administrators.

Feasibility

Important issues, or potential issues not investigated

Although WHO unpublished modelling data indicated an inadequate supply of respirators to replace medical masks in all COVID-19 health-care settings, policies advising respirators in all COVID-19 settings would likely lead to increased investments and production. Furthermore, a strong supply distribution and logistics system is needed to ensure efficient procurement and reach across the whole health system. However, inefficiencies in the distribution of supplies and supply chain problems have been reported. The adequate fit of the device is correlated with the effectiveness of the respirators, but fit testing may not be feasible in all regions.

Justification

The GDG considered the evidence for particulate respirators versus medical masks and agreed that the strength of this evidence was insufficient to recommend one type of mask versus the other, except in some specific conditions.

Given the protective effects of respirators, several GDG members were of the opinion that respirators may be superior to medical masks in preventing SARS-CoV-2 infection and their use should be encouraged when the health and care worker delivers care in close contact with the patient and when ventilation is inadequate.

The previous recommendation considered serious concerns about the limited availability of respirators in low-resource settings and the resource implications of more widespread use of respirators. The GDG voting on this recommendation considering Omicron was based on the very low certainty of the evidence for particulate respirators versus medical masks, given the methodological limitations of the evidence, as well as the previously noted concerns about respirators' availability.

Given the limitations described, the deliberations of the GDG and their decision-making process were also informed by the perspectives and experiences of experts who were on the panel.

Research needs

More research is needed to investigate the risks associated with medical masks and respirators and adverse events (including self-contamination) during extended and repeated use. Other gaps include studies on simpler, faster and less costly methods, or alternative methods, to determine respirator fit and seal. Further data a needed regarding compliance with appropriate the use of PPE, including masks, and appropriate techniques for putting on and taking off PPE in COVID-19 and non-COVID-19 units.

Clinical question/ PICO

Population: Health and care workers
Intervention: disposable filtering facepiece respirators
Comparator: surgical masks, and cloth masks

Summary

Evidence comparing the effectiveness of respirators versus medical masks for SARS-CoV-2 in health-care settings is limited to five observational studies *[73][74][75][76][77]*, and one randomized controlled trial *[78]*. The five observational studies were conducted prior to the emergence of the Delta, Omicron and other variants and before widespread vaccination in health-care settings. These five observational studies reported inconsistent findings regarding the risk of SARS-CoV-2 infection between the use of respirators versus medical masks and had methodological limitations (for example, recall bias, low participation, and limited measurement of exposures). One study showed a reduction of risk with respirator use *[75]*, while in two other studies the use of respirators was not significantly associated with risk reduction *[74][77]*. One study showed no association *[77]*, and another found respirators were associated with

increased risk (OR 7.1), likely related to confounding factors *[74]*. In the intention-to-treat analysis, the randomized control trial found that RT-PCR-confirmed COVID-19 occurred in 52 of 497 (10.46%) participants in the medical mask group versus 47 of 507 (9.27%) in the N95 respirator group (hazard ratio [HR], 1.14 [95% CI, 0.77 to 1.69]) *[78]*. Results were within the pre-specified, non-inferiority threshold (HR <2.00), but do not rule out a protective effect of N95 respirators. Furthermore, the length of RCT transcends across various VoC (Delta and Omicron). Overall, inconsistent findings for N95 vs surgical masks and risk of SARS-CoV-2 infection in health and care workers.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** surgical masks, and cloth masks	**Intervention** disposable filtering facepiece respirators	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection				Low	Inconsistent findings for N95 vs surgical masks and risk of SARS-CoV-2 infection in health and care workers.

3.2.6.1 PPE technical specifications

Pertinent sections of the technical guidance, "Technical specifications of personal protective equipment for COVID-19", published 13 November 2020, will soon be incorporated in this living guidance.

Table 5. Technical specifications for medical masks *[14]*

Item	Characteristics	Performance standards (or alternative equivalent)
Medical mask for a health care worker	Medical mask, good breathability, internal and external faces should be clearly identified, 98% droplet filtration, preferably fluid resistance.	Always use a clean, unused rectangular pleated medical mask meeting the following minimum performance standards (or equivalent): • EN 14683 (Type II or Type IIR); • ASTM F2100 (Level 1, 2 or 3); or • YY 0469 OR YY/T 0969 (with at least 98% bacterial filtration efficiency).
Medical mask for patient	Medical mask, good breathability, internal and external faces should be clearly identified	• EN 14683 (Type I); • YY 0469 or YY/T 0969, if bacterial droplet filtration is below 98% • Or alternative equivalent standard

Published 09 October 2023

3.2.6.1.1 Rational use of PPE and considerations during severe shortages

The technical guidance for Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages was published on 23 December 2020. This guidance is under review and is pending integration into Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline.

3.2.7 Aerosol generating procedures (AGPs)

Airborne precautions during AGPs

Conditional recommendation for , Very low certainty evidence

New

WHO suggests using airborne precautions while performing aerosol-generating procedures (AGPs) and, based on a risk assessment[1], when caring for patients with suspected or confirmed COVID-19.

[1] The risk assessment should consider the following factors: the activity (procedure), the setting (patient care environment) and the patient.

Published 09 October 2023

Practical info

Implementation considerations

- **When caring for someone on airborne precautions, health and care workers should:**
  - place the patient in an AIIR
  - Wear a respirator (e.g. N95, FFP2, etc.) before entering the room and remove it after exiting the room;
    - Perform a respirator seal-check;
    - Perform hand hygiene before and after the use of respirators.
  - use disposable or dedicated patient-care equipment (e.g. stethoscopes) and clean and disinfect equipment before use on other patients
  - instruct the patient to wear a medical mask and follow respiratory hygiene and cough etiquette when transport is necessary.
- **For airborne precautions, place the patient in an AIIR.**
  - An AIIR includes a ventilation rate of 6-12 air changes/hour (i.e. equivalent to 40-80 L/second/patient for a 4x2x3 m^3 room) and ideally 12 air changes per hour for new constructions, with a recommended negative pressure differential of ≥2.5Pa (0.01-inch water gauge).
  - Direct exhaust of air to the outside, away from places where people walk or congregate, and any air intake openings;
  - Keep door kept when not required for entry and exit.
  - If an AIIR is not available, use a well-ventilated, single-patient room with doors closed.
- **The following actions may be taken to optimize natural ventilation when an AIIR is not available:**
  - Use a room that has good cross-ventilation (two or more windows that open) to the outdoors;
  - Use an exhaust fan in one window to assist in moving room air to the outdoors, making sure the exhaust window is away from people and any air intake opening;
  - Turn off air conditioning and open windows to enhance ventilation if an independent air supply is not available;
  - Keep the door to the hallway closed, except for when health and care workers enter and exit the room.

For additional information on transmission-based precautions, including airborne precautions see Transmission-based precautions for the prevention and control of infections: aide-memoire *[11]*.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

No studies evaluated the effects of airborne precautions compared to droplet or contact precautions. However, the evidence does suggest that health and care workers are at higher risk of SARS-CoV-2 exposure when performing intubations or other AGPs *[30][31]*.

No evidence was found on harms related to the use of airborne precautions vs. droplet or contact precautions.

Given the evidence on the increased risk of SARS-CoV-2 infection when performing intubations or other AGPs, the GDG judged that airborne precautions may reduce the risk of SARS-CoV-2 infection in this situation.

Certainty of the Evidence

Very low

The certainty of evidence was rated as *very low* given the absence of direct evidence on airborne versus droplet or contact precautions.

Values and preferences

Substantial variability is expected or uncertain

The GDG was unable to determine whether decisions to utilize airborne precautions would be preference-sensitive, due to the lack of evidence on the benefits and harms of airborne precautions versus droplet or contact precautions.

Resources

Important issues, or potential issues not investigated

Research evidence
GDG members judged that implementing airborne precautions is associated with significant cost and resource implications that are warranted when risk of acquiring airborne infection is increased.

Summary
GDG members judged that implementing airborne precautions is associated with significant cost and resource implications that are warranted when risk of acquiring airborne infection is increased.

Equity

Important issues, or potential issues not investigated

Many GDG members noted that AIIRs (which are preferable for the implementation of airborne precautions) may not be available in low- and middle-income countries and some facilities may face challenges in trying to accommodate patients when such rooms are limited or not available. There are, however, strategies available for improving natural ventilation that countries may be able to implement (see implementation considerations).

The GDG judged that the impact on equity was uncertain, given the lack of evidence.

Acceptability

Important issues, or potential issues not investigated

Acceptability of intervention likely varies.

Feasibility

Important issues, or potential issues not investigated

Given resource limitations, implementation likely varies.

Justification

Airborne precautions are a bundle of measures (see practical info for full details) *[11]*. No studies were found that investigated the risk of SARS-CoV-2 infections when implementing airborne precautions compared to droplet and contact precautions. However, other evidence does suggest that health and care workers are at higher risk of SARS-CoV-2 exposure when performing intubations or other AGPs *[30][31]*. Therefore, the GDG judged that the benefits of implementing airborne precautions in these situations has potential benefits in reducing the risk of SARS-CoV-2 infection that likely outweigh the harm.

The GDG discussed the use of airborne precautions within the context of the care environment and resources. For example, there are practical considerations regarding the availability of airborne infection isolation rooms (AIIRs), which are also referred to as a negative pressure rooms. It was also noted that improving ventilation may be a challenge in some low- and middle-income countries. There is guidance for health facilities on the use of natural ventilation, although achieving negative pressure may not be reasonable, or may not meet the definition of an AIIR *[8]*.

WHO published a list of AGPs in 2014, prior to the onset of the COVID-19 pandemic *[10]*. However, the GDG members noted that an important challenge in implementing airborne precautions when performing AGPs for patients with suspected or confirmed COVID-19 is a continued lack of consensus and available evidence for defining AGPs.

Within the context of COVID-19, the GDG considered that some procedures have been found to be associated with an increased risk of aerosol generation and transmission of respiratory particles, but also noted that these particles can be produced during other activities such as talking, coughing, sneezing, or singing..

Clinical question/ PICO

Population: Health and Care Workers
Intervention: Airborne Precautions
Comparator: Droplet/Contact precautions

Summary

A systematic review found no studies comparing the use of airborne precautions versus droplet and contact precautions when conducting intubations or other AGPs.

Outcome Timeframe	**Study results and measurements**	**Comparator** Droplet/Contact precautions	**Intervention** Airborne Precautions	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection					No studies were found that looked at SARS-CoV-2 infection.

PPE use during AGPs

Strong recommendation for , Very low certainty evidence

Updated

A respirator should always be worn along with other PPE[1] by health and care workers performing aerosol-generating procedures (AGPs) and by health and care workers on duty in settings where AGPs are regularly performed on patients with suspected or confirmed COVID-19, such as intensive care units (ICU), semi-intensive care units or emergency departments.

[1]PPE includes gown, gloves, eye protection.

Published 09 October 2023

Practical info

When adopting a mask policy within a health facility, it is essential health workers follow proper mask-wearing procedures and practices. For additional information review the section on mask management for health workers.

The WHO recommendation on mask fitting should be followed, including the related considerations on this critical aspect.

Evidence to decision

Benefits and harms

Small net benefit, or little difference between alternatives

No studies have compared respirators vs. other masks in health and care when performing AGPs or in settings in which AGPs are regularly performed. However, exposure to an AGP such as tracheal intubation was associated with a higher risk of infection with SARS-CoV-1, the most closely related human coronavirus to SARS-CoV-2 *[79]*. Furthermore, a living rapid review showed that certain exposures such as involvement in intubations are significantly associated with SARS-CoV-2 infections *[30][31]*.

Respirators have higher filtration efficiency standards and demonstrate better fit with fewer air gaps allowing bypass of the filter media than medical masks, if they are appropriately fit tested and worn. The living review on masks found bothersome but no serious harms of respirators. Therefore, the GDG judged that respirators may be superior in preventing transmission of SARS-CoV-2 during AGPs *[30][31]*.

Certainty of the Evidence

Very low

Given the absence of direct evidence on the effect of respirators versus medical masks for preventing SARS-CoV-2 infection when performing AGPs or in settings in which AGPs are frequently performed, the certainty of the evidence was rated as very low.

Values and preferences

No substantial variability expected

Given increased risk of SARS-CoV-2 infection when conducting AGPs or in settings in which AGPs are frequently performed, potential moderate or large benefits of respirators in preventing SARS-CoV-2 infection in this setting, and small and trivial harms, the GDG judged that decisions regarding use of respirators to prevent SARS-CoV-2 would not be preference-sensitive.

Resources

Important issues, or potential issues not investigated

Research evidence

The use of respirators requires an additional investment of financial and logistical resources, including the need for fit testing for all staff, requiring additional investments and expertise [51]. Some clinical and operational challenges may be experienced, particularly in low- and middle-income countries, and investments are needed to provide the best protection possible during AGPs.

Summary

The use of respirators requires an additional investment of financial and logistical resources, including the need for fit testing for all staff, requiring additional investments and expertise [51]. Some clinical and operational challenges may be experienced, particularly in low- and middle-income countries, and investments are needed to provide the best protection possible during AGPs.

Equity

Important issues, or potential issues not investigated

The GDG judged that the recommendation could have negative impacts on equity if the global supply of respirators is limited and availability is restricted/limited in resource-poor settings.

Acceptability No important issues with the recommended alternative

Stakeholders and policymakers will likely accept the recommended use of respirators during procedures that produce aerosols as this is the policy currently in place in most countries and is one that is historically integrated into a conditional recommendation by the WHO for acute (non-SARS-CoV-2) respiratory infections *[10]*.

Feasibility No important issues with the recommended alternative

The use of respirators during the performance of an AGP is feasible and has been standard practice.

Justification

No trials of respirators vs. medical masks have been conducted in this setting. A majority of GDG members noted that, despite the very low certainty of evidence, a strong recommendation to use respirators when conducting AGPs or in settings in which AGPs are frequently performed was justified based on increased risk of exposure and acquiring infection; importance of preventing iatrogenic infections; superior filtration properties of respirators; small or trivial potential harms relative to benefits; and high acceptability and feasibility of implementation. Other factors informing the strong recommendation were the increased, widespread transmission of Omicron, its immune escape, and still limited vaccination coverage in health and care workers worldwide.

Based on these factors, the GDG upgraded the strength of this recommendation from a conditional recommendation to a strong recommendation *[10]*. The GDG acknowledged costs associated with utilizing respirators but judged the costs as being justified and noted the importance of ensuring adequate supply of respirators to meet needs globally.

3.3 Water, sanitation, hygiene, and waste management

3.3.1 Environmental cleaning

Good practice statement New

For COVID-19, health care settings should use standard precautions for the cleaning and disinfection of the environment and other frequently touched surfaces.

Published 09 October 2023

Practical info

Implementation considerations

- **Considerations for environmental cleaning:**
  - Provide a clean and hygienic environment, including water, sanitation and hygiene infrastructure and adequate ventilation (natural or mechanical).
  - Provide efficient environmental cleaning and disinfectant products.
  - Train cleaning staff on the principles and practices of environmental cleaning, including how to prepare and use cleaning and disinfection products.
  - Cleaning (with soap and water or one-step cleaner/disinfection) needs to come before disinfection.
  - Cleaning should progress from the least-soiled (cleanest) to the most-soiled (dirtiest) areas, and from the higher to lower levels so that debris may fall to the floor and is cleaned last in a systematic manner to avoid missing any areas.

When cleaning and disinfecting, concentrate on frequently touched surfaces.
    - Use products approved for health-care settings and apply according to the manufacturer's instructions.
    - Follow the manufacturer's instructions to ensure that disinfectants are prepared and handled safely, wearing the appropriate PPE to avoid chemical exposure.
    - Emphasis for cleaning and disinfection should be placed on surfaces that are most likely to become contaminated with pathogens, including clinical contact surfaces and frequently touched surfaces (such as light handles, bracket trays, switches on dental units, and computer equipment) in the patient-care environment.
    - Wiping is the preferred method for the application of a product. Ensure that the coverage and coating of the disinfectant is applied liberally so that the surface is wet.
    - Spraying may be considered as an alternative but may be associated with potential harms. Appropriate PPE should be worn. If utilizing a spraying method, ensure it is done away from other persons, preferably when others are not present.
    - **UVGI (Ultraviolet Germicidal Irradiation) may be a potentially useful technology, but it is associated with potential harms.**

- Environmental cleaning health and care workers should:
    - clean and disinfect patient-care areas at least once a day, paying particular attention to frequently touched surfaces;
    - deal with spills of blood and body fluid/substance as soon as possible, in accordance with local protocols.

Justification

Rapid reviews exploring cleaning and disinfection methods found no evidence of impacts on SARS-CoV-2 infection between the various cleaning modalities. Therefore, the GDG determined that there was insufficient evidence to suggest additional precautions are needed for environmental cleaning in the context of COVID-19.

The GDG recommended that health-care facilities follow their existing procedures for cleaning and disinfection, emphasizing the need to follow Standard Precautions. WHO commissioned a qualitative review of the literature (reports, qualitative studies, and related systematic reviews) to further understand the perceptions of health and care workers on cleaning and disinfection and to better inform the GDG in the evidence to decision-making process. The GDG members reviewed the outcomes and discussed the need for human resources and clear and consistent guidelines for cleaning and disinfection to implement a proper cleaning and disinfection regime.

Clinical question/ PICO

Population: Health-care settings
Intervention: Differential cleaning measures beyond standard environmental cleaning
Comparator: Standard precautions for environmental cleaning

Summary

No studies compared more intensive cleaning measures vs. standard measures and risk of SARS-CoV-2 infection.

Three studies were found and included in the narrative syntheses that compared standard cleaning to differential cleaning. The evidence was inconclusive, as surface contamination varied greatly by the health care facility, the disinfectant used and the cleaning regime.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** Standard precautions for environmental cleaning	**Intervention** Differential cleaning measures beyond standard environmental cl	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection				Very low	There were no studies looking at impact on SARS-CoV-2 infection, Evidence was insufficient to determine impacts on risk of infection.

Clinical question/ PICO

Population: Health-care settings
Intervention: Spraying
Comparator: Mechanical cleaning (wiping, brushing, scrubbing)

Summary

No studies evaluated the effects of SARS-CoV-2 infection. Three studies were found and included in the narrative syntheses that compared spraying versus wiping. The evidence was inconclusive as surface contamination varied greatly by the health-care facility, the disinfectant used and the cleaning regime.

A qualitative synthesis was also performed on this topic, for results see the Annex.

Outcome Timeframe	**Study results and measurements**	**Comparator** Mechanical cleaning (wiping, brushing, scrubbing)	**Intervention** Spraying	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection					Few studies looked at the outcome of SARS-CoV-2 infection. Evidence was inconclusive.

3.3.2 Waste management

Good practice statement

New

Health-care waste generated from care provided to suspected or confirmed COVID-19 patients should be segregated according to existing guidelines (e.g. non-infectious, infectious, sharps) for disposal and, where necessary, treated per national/subnational/local regulations and policies.

Published 09 October 2023

Practical info

Implementation considerations

To ensure the proper handling and disposal of waste, health-care facilities should:

- assign responsibility, and adequate human and material resources for the collection, segregation and disposal of waste;
- minimize the amount of waste produced by the health-care facility;
- treat waste preferably on-site, and then safely dispose of it;
- understand where and how waste moved off-site will be treated and disposed of;
- prepare for increases in the volume of infectious waste during the COVID-19 outbreak, especially with the use of PPE and in the context of COVID-19 vaccination delivery;
- ensure staff use appropriate PPE (boots, long-sleeved gown, heavy-duty gloves, mask, and goggles or a face shield) while managing infectious waste and performing hand hygiene after taking off PPE;
- treat waste contaminated with blood, body fluids, secretions and excretions as hazardous infectious waste, in accordance with local regulations;
- consider environmentally friendly treatment methodologies and solutions to minimize both general and medical waste at points of use, segregation, disposal, and collection; and,
- treat human tissue and laboratory waste that is directly associated with specimen processing as hazardous infectious waste.

Note:
The WHO description of hazardous waste in health care *[16]* is as follows: Hazardous waste can harm people and the environment. The types of hazardous waste in a facility vary according to the size of the facility and the services offered. Examples of hazardous waste are listed below.

- **Examples of infectious waste:**
  - **Sharps waste** is used or unused sharp items that could cause cuts or puncture wounds that can lead to infection. Examples include instruments (such as scalpels and blades), needles, syringes and broken glass or ampoules.
  - **Pathological waste** (anatomical waste). Examples include human tissues or fluids (such as blood and body fluids), organs (body parts), placentas and fetuses and unused blood products.
  - **Other infectious waste**. Examples include soiled gloves, gauze or bandages contaminated with blood, body fluids, viruses, or parasites.
  - **Other hazardous waste** includes pharmaceutical waste, chemical waste, genotoxic and radioactive waste.

As the use of PPE, in particular the use of masks, during care activities increased throughout the COVID-19 pandemic, awareness of unintended consequences, such as increases in health-care waste and the impact on the environment must be taken into consideration. For additional information on the environmental impact of mask use and other PPE, see the WHO global analysis of health-care waste in the context of COVID-19 *[66]*.

For additional information on Waste Management see the OpenWHO course Standard Precautions: Waste management *[16]*.

Justification

A systematic review found no study comparing the handling of COVID-19-related waste as infectious versus non-infectious and the GDG found no evidence to support handling COVID-19-related waste differently from other health-care-related waste.

Upon review of the evidence, the GDG determined waste produced from SARS-CoV-2 was not particularly hazardous and did not require special handling beyond what was currently the standard advised through national, subnational, or local policies for handling health-care waste. Few GDG members noted varying regional definitions for infectious waste; thus, the importance of following one's local, national or subnational policy. Members noted that there is nothing particularly different about COVID-19 when compared to other respiratory pathogens that would require policies above and beyond the standard.

Clinical question/ PICO

Population: Personnel handling waste in health-care facilities
Intervention: Infectious waste
Comparator: Noninfectious waste

Summary

No studies evaluated impacts on risk of SARS-CoV-2 infection.

Outcome Timeframe	**Study results and measurements**	**Comparator** Noninfectious waste	**Intervention** Infectious waste	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection					No studies were found that looked at SARS-CoV-2 infection.

3.3.3 Handling of linens and laundry

Good practice statement

New

Health-care facilities should follow standard processes for handling, transporting, sorting and laundering of linens for patients with suspected or confirmed COVID-19.

Remark: This process should adhere to national/subnational/local policies as well as ensure the implementation of standard precautions.

Published 09 October 2023

Practical info

Implementation considerations

- Handle soiled linen and waste carefully (with minimal manipulation or agitation) to prevent personal contamination and transfer to another patient.
- Remove heavily soiled material (e.g. faeces) from linen, while wearing appropriate PPE, before placing the linen in a laundry bag.
- Store clean linen in a manner that protects it from environmental contaminants.
- Perform hand hygiene frequently and at critical access points *[15]*.
- All individuals in charge of environmental cleaning, laundry and dealing with soiled bedding, towels and clothes from patients with SARS-CoV-2 infection should wear appropriate PPE, including heavy-duty gloves, a mask, eye protection (goggles or a face shield), a long-sleeved gown, and boots or closed shoes. They should perform hand hygiene after exposure to blood or body fluids and after removing PPE.

Justification

The GDG found insufficient evidence to support additional measures and precautions in the context of COVID-19 in regard to handling, transporting, sorting and laundering of linens. The evidence on the effects of SARS-CoV-2 infection was limited to one study *[80]*.

The GDG advised that health-care facilities follow their existing procedures when partaking in these duties. The GDG members emphasized the importance of adhering to standard precautions when handling linens and laundry. The GDG elected for a Good Practice Statement, based on established IPC practices for handling linen.

Clinical question/ PICO

Population: Personnel handling linens in health-care facilities
Intervention: Above standard
Comparator: Standard precautions for routine handling of linens and laundry

Summary

One study addressed the PICO question, reporting that SARS-CoV-2 RNA was not detected in rinse water after washing with tap water, disinfecting with sodium hypochlorite, or disinfecting with 80 °C water *[80]*. However, SARS-CoV-2 was detected in one of five samples after washing with laundry detergent and in one of six samples after washing with fabric softener *[80]*.

Outcome Timeframe	**Study results and measurements**	**Comparator** Standard precautions for routine handling of linens and laundry	**Intervention** Above standard	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection					There were too few who experienced the SARS-CoV-2 infection to determine a difference between standard versus above-standard cleaning.

3.4 Safe dead body management

Good practice statement

New

Health and care workers and other persons involved in handling the deceased should follow standard precautions according to risk-assessment[1] and existing national/subnational/local protocols for management and handling the bodies of deceased persons infected with COVID-19.

[1] The risk assessment should consider the following factors: the activity (procedure), the setting (patient care environment) and the patient.

Published 09 October 2023

Practical info

Implementation considerations

Health care facility

If the body of a person with suspected or confirmed COVID-19 is selected for autopsy, health-care facilities must ensure that safety measures are in place to protect those performing the autopsy, including:

- appropriate PPE must be available, including a scrub suit, a long-sleeved fluid-resistant gown, gloves (either two pairs or one pair of autopsy gloves), particulate respirator (N95 or FFP2 or its equivalent, eye protection (face shield or goggles), and boots/footwear protection.
- autopsies must be performed in adequately ventilated rooms.

Mortuary staff/Funeral home

Mortuary staff or funeral home workers preparing the body (i.e. washing the body, tidying/shaving hair, or trimming nails) should wear appropriate PPE according to standard IPC precautions and risk assessment, including gloves, impermeable gown or gown with impermeable apron, medical mask, eye protection (face shield or goggles) and closed footwear or footwear protection.

- To avoid excessive manipulation of the body, embalming is not recommended. However, if embalming is done, it should be performed by trained, experienced staff following standard IPC precautions.
- If the family wishes to view the body, allow them to do so, but instruct them not to touch or kiss the body, to maintain at least 1 metre distance from one another and any staff during the viewing and to perform hand hygiene after the viewing.
- Identify local alternatives to kissing and touching the dead body in settings where such contact is traditionally part of funeral procedures.

Justification

There was no evidence to support additional precautions; therefore, the GDG unanimously agreed that the use of standard precautions with a risk assessment and following national, subnational and local protocols is a sufficient protocol for handling dead bodies infected with COVID-19. Members noted that there is nothing particularly different about COVID-19 when compared to other respiratory pathogens that would require policies above and beyond the standard. GDG members noted that a health and care worker's risk assessment may lead one to determine that adhering to contact and droplet or airborne precautions is necessary.

Clinical question/ PICO

Population: Healthcare workers, mortuary staff, those working with a decedent with a COVID-19 infection
Intervention: PPE (Mask, gown, gloves, face shield), body bag
Comparator: No PPE, Limited PPE, no body bag/covering

Summary
No studies evaluated impacts on risk of SARS-CoV-2 infection.

Outcome Timeframe	**Study results and measurements**	**Comparator** No PPE, Limited PPE, no body bag/ covering	**Intervention** PPE (Mask, gown, gloves, face shield), body bag	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 infection					No studies were found that looked at SARS-CoV-2 infection.

3.5 Special settings

3.5.1 IPC principles and procedures for COVID-19 vaccination activities

The guidance for Aide-memoire: infection prevention and control (IPC) principles and procedures for COVID-19 vaccination activities was published 15 January 2021. This guidance is under review and is pending integration into Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline.

3.5.2 Home care for patients

The guidance for Homecare for patients with suspected or confirmed COVID-19 and management of their contacts: interim guidance was published 12 August 2020. This guidance is under review and is pending integration into Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline.

3.5.3 Long term care facilities

The guidance for Infection prevention and control guidance for long-term care facilities in the context of COVID-19: interim guidance was published 21 March 2020. This guidance is under review and is pending integration into Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline.

3.6 Prevention, identification and management of SARS-CoV-2 infections in health and care workers

Background
The COVID-19 pandemic has placed a large burden on health systems worldwide and, in turn, affected hospital-acquired infections and health and care workers *[81]*. Health and care workers are at higher risk than the general public of being infected with SARS-CoV-2 *[82]*.

Prevention of infections in the health care setting requires a multi-pronged and multi-factorial approach that includes IPC and

occupational health and safety (OHS) measures as well as adherence to public health and social measures in the community by the health workforce. In hospitals, this involves the hierarchy of controls (hazard elimination, engineering/environmental controls, administrative controls, and the optimal use of PPE) and, for IPC and OHS staff, to work collaboratively to implement these protocols. See the section on Basic IPC Principles and section on Introduction to public health and social measures for additional information.

This updated section of the WHO guidelines on Infection Prevention and Control in the Context of COVID-19 provides guidance to health managers and OHS teams on the following topics:

- how COVID-19 infections in the health-care setting or during the provision of care can be prevented;
- how COVID-19 infections can be identified;
- once they occur, how COVID-19 infections can be managed safely to prevent onward transmission to other health and care workers or patients in the health-care setting.

The underpinning basis for all these statements is the notion that the early identification, and thus testing and quarantining of health and care workers and/or other control measures aim to decrease the risk of nosocomial infection *[83]*.

This version of the living guideline (version 5.0) supersedes the previous guidance on the prevention, identification and management of health and care worker infections in the context of COVID-19, issued in October 2020.

Published 10 August 2023.

3.6.1 Identification of health and care workers infections in the health care setting

Good practice statement

Countries should have national and subnational testing strategies for the detection of SARS-CoV-2 infections in health and care workers.

Published 10 August 2023.

Practical info

Implementation considerations

When considering a national testing strategy, the following contextual factors should be considered:

- Strategies outlined in the OHS and/or IPC national policies should include implementation plans that ensure health and care worker testing is prioritized and made available in health care facilities. This should include laboratory testing and self-testing kits for SARS-CoV-2 infections *[84]*.
- OHS and IPC programmes should include a committee of multidisciplinary experts to guide policies and protocols implemented by employers/management teams and demonstrate through staff adherence.
- The local situation should be evaluated by considering dynamic indicators: SARS-CoV-2 epidemic trends, transmissibility, the seriousness of COVID-19 and the impact on the health system.

Practical impacts and consequences of identifying positive COVID-19 cases in health and care workers (including potential absences due to sick leave, or isolation, as well as the absence of the health workforce) and the ability to manage infections and a safe return to work need to be considered. Furthermore, health care facilities may consider providing self-testing kits to health and care workers; testing free of charge on-site; testing health and care workers post-exposure; testing in settings with vulnerable patients (e.g. ICUs and transplant units); and testing all health and care workers who have signs or symptoms

suggestive of COVID-19. These testing strategies for the health workforce population should consider the availability of testing kits and the feasibility of carrying out testing, as well as the impact on health systems and services
of detecting active infections and having those workers stop working while they isolate (see section on duration of isolation).

For guidance on testing strategies for SARS-CoV-2, refer to *Use of SARS-CoV-2 antigen-detection rapid diagnostic tests for COVID-19 self-testing [6]*.

Justification

GDG members noted the importance of having national and subnational testing strategies for SARS-CoV-2, including in the health workforce. Having testing mechanisms in place allows for the quick identification and swift removal from work and isolation of health and care workers with SARS-CoV-2 infections, thus decreasing the risk of nosocomial transmission.

Good practice statement

Passive screening of symptoms for SARS-CoV-2 and other respiratory infections should be performed based on self-monitoring and reporting of symptoms by health and care workers.

Published 10 August 2023.

Practical info

Implementation considerations

The GDG members recommended that passive screening for SARS-CoV-2 should be combined with screening for other respiratory viruses (e.g. influenza). Early detection of COVID-19 infection among health and care workers can be achieved through passive syndromic screening when combined with laboratory testing, to confirm infection. Surveillance is generally seen as a best practice in the field of IPC as a key to preventing secondary transmission (otherwise referred to as nosocomial transmission) to patients, between health and care workers and throughout health care settings.

Syndromic screening can be conducted using passive or active methods. The selection of the appropriate method depends on the health care facility's capacities and the levels of local circulation of the virus. In passive screening, health and care workers self-screen for symptoms and are required to report any concerning symptoms. Active screening includes others screening the health and care workers for symptoms, this process demands a heavy use of resources, which often only yield a low number of positive cases.

The key objectives of screening in the current context are:

- to identify possible cases and clusters of infections;
- to implement containment measures to prevent onward transmission, such as quarantine or isolation and IPC measures;
- to identify the source of infection (whether hospital-acquired or community-acquired).

Definitions of syndromic screening, passive screening, and active screening can be found in the definitions section.

Health and care workers who report any of the symptoms associated with COVID-19 or other acute respiratory illnesses should contact their local OHS service or IPC department for guidance on testing and quarantine/isolation processes. Health care facilities should ensure that employment policies be in place, such as paid sick leave, having the ability to stay home, work from home or rest. These policies should guarantee confidentiality and be non-punitive for health and care workers who become infected with SARS-CoV-2 or contacts of a case.

Justification

GDG members discussed that surveillance of health and care worker infections is a best practice in any health care setting, even outside SARS-CoV-2. They noted the importance of having a system established and policies allowing health and care workers to report any symptoms suggestive of respiratory infections, including SARS-CoV-2, to be referred for testing and abstain from physical presence in the workplace without onus.

There is evidence that symptoms of COVID-19[1] are the best indicators of active infection and indicate that the symptomatic person is in the most infectious period of the course of the disease *[85][86][87][88]*.

Thus, identifying these health and care workers early and testing them and/or preventing them from attending their shift can break the transmission chain and limit the nosocomial transmission of SARS-CoV-2 *[89][90][91]*.

The term passive screening was proposed by the GDG as a method for health workers to self-screen for symptoms and potentially identify infections in the health setting. They agreed that screening refers to the identification of unrecognized SARS-CoV-2 infections using tests, self-examinations, or related procedures. Screening of health and care workers should identify risk factors and prodromal symptoms for early evidence of infection *[82]*. GDG members concurred that passive screening, versus active screening, was preferred. Their justification was the potential cost savings and reduced burden on health administration and health and care workers by allowing them to perform their own syndromic surveillance and control their own health and well-being.

They noted the importance of establishing policies that would allow health and care workers to report any symptoms suggestive of respiratory infections, including SARS-CoV-2, to be referred for testing and to abstain from physical presence in the workplace without onus.

Information on screening, triage and early recognition of patients with COVID-19 can be found in section 6 of the clinical management of COVID-19: living guideline *[47]*.

[1] Refer to WHO COVID-19 Case Definition for the most up-to-date list of COVID-19: fever, cough, general weakness/fatigue, headache, myalgia, sore throat, coryza, dyspnoea, nausea, diarrhoea, anorexia. Symptoms may be non-specific to COVID-19 and may also indicate other influenza-like illnesses for which health and care workers should be referred to their local guidance on those diseases *[7]*.

Good practice statement

Health and care workers should be prioritized for SARS-CoV-2 testing. In the context of COVID-19 testing policies for both the community and health-care facilities.

Reference can be made to *WHO's Recommendations for national SARS-CoV-2 testing strategies and diagnostic capacities* *[97]* and *WHO's Antigen-detection in the diagnosis of SARS-CoV-2 infection interim guidance* *[6]*.

Published 10 August 2023.

Practical info

Implementation considerations

Health and care workers should be included in the health-care facility testing strategy. For example, testing could occur as a follow-up to signs or symptoms of COVID-19 following a high-risk exposure to a patient or colleague positive for SARS-CoV-2, or for routine testing. WHO's guidance on testing for SARS-CoV-2 stresses that health and care workers who work in COVID-19 services or facilities have the highest priority, followed by health and care workers prioritized by risk in other clinical areas *[93]*.

Testing for health and care workers can be done using PCR or antigen-based testing for SARS-CoV-2. Additional

implementation considerations can be found in WHO's Antigen-detection in the diagnosis of SARS-CoV-2 infection guidance *[94]*.

Justification

Health and care workers are considered a priority group for testing, according to key WHO documents on testing strategies and diagnosis of SARS-CoV-2 infection *[94]*. Based on these WHO guidance documents, the decision to formalize the above statement as a GPS was reached through discussions with the GDG and online voting. GDG members noted that health and care workers should constitute a priority population since they are at high risk of SARS-CoV-2 acquisition due to the nature of their work and their interaction with infected patients. Furthermore, if infected, they represent a risk for patients, especially those at risk for COVID-19 complications. Prioritizing health and care workers for SARS-CoV-2 testing allows for their quick identification and exclusion from in-person work; thus, preventing onward transmission to high-risk patients or other health and care workers.

Good practice statement

Health-care facilities should have protocols for reporting and managing health and care workers' occupational and non-occupational high-risk exposures to COVID-19.

Published 10 August 2023.

Practical info

Implementation considerations

Health and care workers should be encouraged to report both occupational and non-occupational exposures to COVID-19 to OHS or an equivalent department.

OHS teams, along with IPC focal points, should create comprehensive and clear protocols so that health and care workers are able to quickly report high-risk exposures. These protocols should provide details on the essential information to include in the report (such as situational events, symptoms, contacts and exposures) and the mechanism for submitting the report, including next steps and follow-up actions.

The protocols should include instructions for health and care workers to wear a medical mask as soon as they recognize they are symptomatic; refrain from their work activities; and report to their OHS/IPC focal point. The focal point should suggest that the symptomatic health and care workers quarantine in a designated setting until testing is carried out; they know what their status is; and can determine how to move forward.

The OHS team or the IPC focal point should:

- meet with the health or care worker to assess their symptoms and record exposure history (where resources permit);
- ask the health or care worker to complete and submit the form for the WHO Risk assessment and management of exposure of health care workers in the context of COVID-19;
- identify a risk categorization based on the risk assessment tool for a health or care worker who has had an exposure without proper use of PPE and determine appropriate management, including the health or care worker's ability to continue working or to be excluded from in-person activities;
- arrange for testing following a high-risk exposure (see section 6.3).

Strategies to mitigate workforce shortages should be in place in the event that health and care workers are required to remain off work due to quarantine or isolation.

Justification

GDG members discussed the importance of having protocols in place to facilitate the reporting of high-risk exposures to SARS-CoV-2 and their rapid and appropriate management. Referral to OHS and/or IPC services after high-risk exposures to SARS-CoV-2 is critical for early diagnosis of the infection in health and care workers and for minimizing the spread of infections to other colleagues and patients in a health-care setting. The WHO COVID-19: Occupational health and safety for health and care workers interim guidance *[18]* advises that workplace risk assessments be carried out by OHS and IPC to determine which roles are at high risk for exposure in health care facilities, how well health and care workers are to return to work; and how health and care workers can conduct their tasks safely upon their return. High-risk exposures are largely avoidable in health-care settings where protocols and best practices are adhered to by all. If they do occur, they need to be followed up and learned from. High-risk exposure definitions can be found in the definitions section of this guideline.

Preventing hospital-acquired infections requires a multi-pronged, comprehensive approach that involves a hierarchy of controls (hazard elimination, engineering/environmental controls, administrative controls and optimal use of PPE) and for IPC and OHS staff to work collaboratively to implement these protocols *[18]*.

Good practice statement

Any health or care worker who has signs or symptoms[1] of SARS-CoV-2 infection[2] should be excluded from their activities at work that require providing in-person care to patients or other activities in the health-care facility where they are in contact with other health and care personnel.

They should furthermore consult with their occupational health and safety department and plan for isolation in a designated setting for the duration of the required period of isolation outlined by their local policy[3].

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[1] Signs or symptoms of COVID-19 include: cough, general weakness/fatigue, headache, myalgia, sore throat, coryza, dyspnoea, nausea, diarrhoea, anorexia *[7]*.

[2] For active infection definition, refer to Public Health Surveillance for COVID-19: Interim guidance *[95]*.

[3] WHO recommendations for the duration of isolation can be found here *[47]*.

Published 10 August 2023.

Practical info

Implementation considerations

Identifying health workers positive for SARS-CoV-2 infection can be achieved through nucleic acid amplification tests (NAATs), such as real-time reverse-transcription polymerase chain reaction (rRT-PCR) tests, which are the most sensitive and specific tests for diagnosing COVID-19. Otherwise, antigen-detection rapid diagnostic tests (Ag-RDTs) are recommended as a viable alternative to confirm SARS-CoV-2 infection, especially in settings where NAAT is not available or results are not timely. Facilities can follow the WHO guidance for testing or WHO policy brief: COVID-19 testing (14 September 2022)*[96]*.

Health and care workers who are positive for SARS-CoV-2 infection should isolate themselves at home (if they are able to safely isolate and their clinical condition) or in a designated setting such as a health-care facility or non-traditional isolation facility, depending on the country's approach. This decision of where to isolate should be made in conjunction with local public health policies and with their health care practitioner.

Health and care workers are required to isolate for the duration of time outlined in their local public health policies or they can follow WHO recommendations for the duration of isolation, which can be found under section 4 (COVID-19 care pathway) and

include options for using testing as a tool to enable an earlier return-to-work *[47]*.

High-case load scenarios
Health-care facility administrators will need to balance the risk of excluding essential health and care workers, which may contribute to facility-wide shortages, against the risks of possible onward transmission to patients and other health and care workers according to the transmission scenarios in the facility and community. They may do this by choosing to assess infected health and care workers on a case-by-case basis and assess their infectiousness based on symptoms and test results for earlier return-to-work options and select appropriate units in which these health and care workers may work. For example, high-risk units such as ICUs, transplant units and oncology units may need to be excluded.

Health care facility administrators should ensure adequate supplies of PPE are available for health and care workers and that processes are in place for monitoring and evaluating IPC procedures, including fit testing, and correct donning and doffing of PPE and its disposal.

OHS Follow up
Focal points for occupational health and safety should perform workplace risk assessments to determine if an infection was acquired in the health care facility. If it is related to an occupational exposure such as a breach in IPC practices, appropriate corrective measures, such as refresher training on IPC measures, should be put in place to address breaches.

Return to work
Upon return to work after an infection, health and care workers should continue to follow strict IPC measures; hand hygiene practices; wearing a mask when indicated; wearing of PPE when indicated; and other practices outlined in this guideline. The length of isolation should be determined by the health facility and local guidance for the period of infectiousness. Alternatively, administrators can refer to the section on Duration of Isolation.

In this context, SARS-CoV-2 infection are defined in Public Health Surveillance for COVID-19: Interim guidance *[95]*.

Justification

The decision to formalize the above statement as a good practice statement was reached through in-depth GDG discussions and online voting. Many GDG members noted that health and care workers who have symptoms of SARS-CoV-2 infection pose a high risk of being infectious and thus transmitting the virus to patient populations most at risk of developing complications (those with co-morbidities, of older age or with compromised immune systems).

Testing after high-risk exposures and recommendations for quarantine duration for health and care workers

Refer to the WHO Contact tracing and quarantine in the context of COVID-19: interim guidance for recommendations on testing after a high-risk exposure and the length of quarantine for contacts of COVID-19 cases which may be applied to the health and care worker population *[93]*. WHO advises that identification, contact, quarantine and follow-up of individuals at high risk of acquiring SARS-CoV-2 infection who have been in contact with a confirmed or probable case of SARS-CoV-2 infection should be prioritized rather than targeting all contacts.

Health and care workers are a priority population. They should receive support regarding quarantine measures and access to free or affordable and reliable testing (including self-tests).

Table 6 presents a summary of the quarantine scenarios for health and care workers according to vaccination status.

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*Extracted from the **WHO Contact tracing and quarantine in the context of COVID-19: interim guidance** for recommendations on testing after a high-risk exposure and the length of quarantine for contacts of COVID-19 cases which may be applied to the health and care worker population [93].*

Published 10 August 2023.

Practical info

Implementation considerations

Quarantine arrangements can be implemented at home or in another designated setting where the contact can be regularly monitored for signs and symptoms. During quarantine, adequate ventilation and IPC measures should be implemented and maintained.

Quarantined individuals must be supported with adequate food, water, protection, hygiene, and communication provisions, including access to education, paid leave or remote work options. In addition, they need to regularly monitor their health status for symptoms and receive clear instructions on what to do in case they develop signs and symptoms of COVID-19. The instructions need to include referrals to call centres, health care centres or medical staff in case of need as well as testing facilities or self-testing options for the contacts.

All contacts in quarantine who develop signs and symptoms need to undergo testing. Staff supporting contacts in quarantine, either through in-person visits or through call centres, need to be trained to assess and manage them or refer the contacts to needed support.

If other people enter the room of a contact in quarantine, physical contact should be avoided, and face masks should be worn by all parties, unless contraindicated (e.g. in infants). Quarantined individuals should avoid contact with people at high risk of detrimental COVID-19 outcomes.

More implementation considerations can be found at the WHO Contact tracing and quarantine in the context of COVID-19: interim guidance *[93]*.

Table 6. Quarantine scenarios for health and care workers according to vaccination status

Status	Quarantine scenario
Vaccinated/infected within the last <90 days	**No quarantine required.** If, in the last 90 days, a vulnerable contact or someone in a priority setting has been vaccinated (i.e. has completed the primary series and/or received a booster dose) or has experienced a confirmed SARS-CoV-2 infection, this contact is not considered to be at high risk of infection or further transmission.
Vaccinated/infected more than >90 days	**Quarantine for 10 days** **Quarantine for 5 days plus negative test**
High case load scenarios	**No quarantine required** When the case load is high, and many health and care workers and essential workers are off work due to exposure or infection, health systems may be overstretched. In that context, vaccinated health and care workers and other essential workers who are asymptomatic contacts may have a shortened quarantine or continue to work without quarantine. Daily Ag-RDT testing may be performed up to day 5 after exposure.

*Extracted from the **WHO Contact tracing and quarantine in the context of COVID-19: interim guidance** for recommendations on testing after a high-risk exposure and the length of quarantine for contacts of COVID-19 cases which may be applied to the health and care worker population [93].*

Published 10 August 2023.

3.6.2 Duration of isolation for COVID-19 cases in health and care workers

Conditional recommendation for , Very low certainty evidence

We suggest 10 days of isolation for individuals who are symptomatic due to SARS-CoV-2 infection (very low certainty evidence).

We suggest 5 days of isolation for individuals who are asymptomatic with SARS-CoV-2 infection (very low certainty evidence).

We suggest the use of rapid antigen testing to reduce the period of isolation (very low certainty evidence).

For the most up-to-date evidence-based recommendations on the length of isolation for positive COVID-19 cases see the WHO Clinical Management of COVID-19: living guideline, which has been directly applied to the health and care worker population; recommendations remain the same for anyone who becomes a COVID-19 case.

The current version was updated in January 2023: https://app.magicapp.org/#/guideline/6668/section/118562.

Published 10 August 2023.

Practical info

Implementation considerations

It is advised that health facilities have local protocols to advise on the required duration of isolation, testing options and for return-to-work management.

Upon termination of the isolation period, it is advised that health and care workers have a medical assessment in conjunction with OHS and IPC services to determine whether the individual is fit to return to work safely. These should include factors such as (but not limited to):

- their work setting (dedicated to COVID-19 patients, ICU, or long-term care versus direct patient care or non-patient-facing care)
- clinical conditions of the patients (e.g. immunocompromised) for whom the health and care worker may provide care
- health facility IPC measures and use of universal masking as per WHO Advice on the use of masks in the context of COVID-19 guidance
- the health and care worker’s general health and severity of previous illness with COVID-19.

Testing to reduce the length of isolation is dependent on local policies and could be used during an outbreak or high health workforce absenteeism, based on availability, feasibility, and economic abilities of the health care facility to provide testing to staff. In scenarios where health care facilities choose to accept that health and care workers return to work before the recommended timelines and the conclusion of the period of infectiousness, health and care workers should strictly adhere to standard and transmission-based precautions and consider working on COVID-19 wards or non-high-risk wards to reduce any

risk of onward transmission to patients and staff.

There should also be occupational health policies in place to ensure health and care workers who are off work for isolation purposes, have covered sick leave and are not penalized or negatively impacted by their infection. This will ensure that health and care workers report infections and do not attend work when sick. OHS and IPC staff will need to balance the risk of essential health and care worker shortages against the risks of exposure and implementation of work restrictions according to the transmission scenarios in the facility and community.

Health and care workers should adhere to the following recommendations when returning to work after a COVID-19 infection:

- Attend refresher training on IPC practices such as hand and respiratory hygiene, fit test and fit check of respirators, PPE use, masking policies and safe physical distancing.
- Continue to follow public health and social measures in their home and community settings *[51]*.
- Continue to self-monitor for symptoms suggestive of COVID-19 and immediately stop working, report to their OHS department and self-isolate if new or worsening symptoms develop/re-appear.
- Health and care workers should receive ongoing support and monitoring from OHS for longer-term health complications and potential psychological implications.

Evidence to decision

Benefits and harms

See below for a copy of the evidence to decision table, for source and any other information see Clinical Management of COVID-19. The current version has been published in January 2023: https://app.magicapp.org/#/guideline/6668/section/118562

Isolation Period: The benefits outlined by the GDG relate to the impact on subsequent hospitalization and mortality across contacts (very low certainty evidence) of a 10-day, compared with a 5-day, isolation period for symptomatic individuals. **Symptomatic individuals are much more likely to test positive than asymptomatic individuals and thus much more likely to transmit SARS-CoV-2.** This provides the rationale, despite the very low certainty evidence on the impact of isolation on subsequent transmission, hospitalization, and mortality, for the suggestion for 10 days in symptomatic and 5 days in asymptomatic cases. A shortened isolation period, where safe, was agreed-upon as preferable as part of the values and preferences, which further informed the recommendation for 5 days of isolation for asymptomatic individuals.

Harms of varying periods of isolation, such as mental health, financial or social impacts, were not formally incorporated into the evidence review, given the uncertainty involved.

Antigen testing: The possible benefit is on average a reduction of 3 days of isolation period by using rapid tests to determine the period of isolation (very low certainty evidence).

There are minimal harms of employing rapid tests to determine the period of isolation.

Certainty of the Evidence

Very low

Isolation Period: The evidence reviewed to inform this recommendation was deemed to be of very low certainty, rated down due to the high degree of uncertainty in the parameters that inform the model and the indirectness of the data. Specifically, there is a great deal of uncertainty across the following assumptions: i) the infectivity of individuals with positive rapid antigen test; ii) the effective reproduction number; iii) the assumed hospitalization rate of infected individuals; and iv) the assumed case-fatality rate of infected individuals. Additional sources of uncertainty lie in understanding the contributing role of different public health measures in place in different regions of the world, vaccination status, history of prior infection and the infecting SARS-CoV-2 VoC and resultant changes to infectivity and severity. Evidence was reviewed regarding the duration of viral culture positivity and PCR positivity, which were in both cases deemed to be of very low certainty.

A large source of uncertainty, as voiced by the GDG and not consistently defined in the available evidence, was the definition of what constituted symptomatic infection. From clinical experience, noted by the GDG, classifying patients as

either symptomatic or asymptomatic was not always straightforward.

Antigen testing: The evidence was of very low certainty, rated down for indirectness and uncertainty in the included model parameters. Additional sources of uncertainty from the above recommendations that were not formally evaluated included evaluations of the sensitivity and specificity of various types of rapid tests, the swab technique employed, vaccination status, history of prior infection and the infecting variant, leading to greater uncertainty as assessed by the GDG.

Values and preferences

Isolation Period:

- Given anticipated strong preferences in most individuals for shorter periods of isolation, and its positive social and economic consequences, the Clinical Management GDG placed a high value on shorter periods of isolation.
- Despite the very low certainty evidence, the Clinical Management GDG placed a high value on the possible increase, in symptomatic patients, of transmission and resulting hospitalization in secondary infections resulting from a shorter period of isolation.
- The GDG nevertheless acknowledged the substantial variability in these values and preferences that are likely to exist.

Antigen Testing: Given anticipated strong preferences in most individuals for shorter periods of isolation, and the positive social and economic consequences of shorter periods of isolation, the Clinical Management GDG placed a high value on shorter periods of isolation.

The Clinical Management GDG nevertheless acknowledges the substantial variability in these values and preferences that are likely to exist.

Resources and other considerations

Isolation Period: The GDG emphasized that there are substantial resource considerations in asking individuals with mildly symptomatic disease to isolate for 5 days. These resource considerations should be incorporated into policies to ensure that the impact of periods of isolation on individuals is minimized as it relates to financial, social, or mental health-specific impacts.

Antigen Testing: The GDG acknowledged that the resource implications of prolonged periods of isolation may be considerable and reach beyond the individual, with varying social, economic, and mental health impacts. Implementation of the above recommendations should incorporate policies to ensure those considerations are addressed.

Justification

The clinical management team and respective GDG assessed the evidence and determined the updated recommendations for the suggested duration of isolation timelines. They then were asked to then present their findings and summary of evidence to the IPC GDG, who agreed that due to limited evidence on the risks of onward infection transmission among different populations, such as health and care workers, there was no need to make different recommendations for health and care workers.

The Clinical Management GDG reviewed the evidence for onward transmission that may lead to hospitalization or death following contact with persons isolated for five days versus 10 for both symptomatic and asymptomatic cases and found there were differences between symptomatic and asymptomatic individuals and therefore decided to make separate recommendations for these two groups, although it may be initially difficult to classify cases into these categories. The Clinical Management GDG discussed that hospitalization and mortality among contacts remain the crucial outcomes for consideration.

Clinical question/ PICO

Population: Asymptomatic COVID-19 patients
Intervention: Isolation for 5 days after positive test
Comparator: Isolation for 10 days after positive test

Outcome Timeframe	**Study results and measurements**	**Comparator** Isolation for 10 days	**Intervention** Isolation for 5 days	**Certainty of the Evidence** (Quality of evidence)	**Summary**
Onward transmission leading to hospitalization (28 days) [1]		9 per 1000 Difference:	11 per 1000 **2 more per 1000** (CI 95% 2 more — 3 more)	Very low Due to certainty of parameters in the model and indirectness.	Whether isolation for 5 days would increase onward transmission leading to hospitalization of secondary cases is very uncertain compared with isolation for 10 days.
Onward transmission leading to death (90 days) [2]		2 per 1000 Difference:	3 per 1000 **1 more per 1000** (CI 95% 0 more — 1 more)	Very low Due to certainty of parameters in the model and indirectness.	Whether isolation for 5 days would increase onward transmission leading to mortality of secondary cases is very uncertain compared with isolation for 10 days.

Clinical question/ PICO

Population: Symptomatic COVID-19 patients
Intervention: Isolation for 5 days after symptom onset
Comparator: Isolation for 10 days after symptom onset plus 3 additional days without symptoms

Outcome Timeframe	**Study results and measurements**	**Comparator** Isolation for 10 days	**Intervention** Isolation for 5 days	**Certainty of the Evidence** (Quality of evidence)	**Summary**
Onward transmission leading to hospitalization (28 days) [1]		9 per 1000 Difference:	28 per 1000 **19 more per 1000** (CI 95% 14 more — 24 more)	Very low Due to certainty of parameters in the model and indirectness.	Whether Isolation for 5 days would increase onward transmission leading to hospitalization of secondary cases is very uncertain compared with isolation for 10 days.
Onward transmission leading to death		2 per 1000	7 per 1000	Very low Due to certainty of parameters in	Whether Isolation for 5 days would increase onward transmission

Outcome Timeframe	**Study results and measurements**	**Comparator** Isolation for 10 days	**Intervention** Isolation for 5 days	**Certainty of the Evidence** (Quality of evidence)	**Summary**
(90 days) [2]		Difference:	**5 more per 1000** (CI 95% 4 more — 6 more)	the model and indirectness.	leading to death of secondary cases is very uncertain compared with isolation for 10 days.

Clinical question/ PICO

Population: Patients with COVID-19
Intervention: Remove isolation based on negative antigen test after Isolation 5 days
Comparator: Isolation for 10 days

Outcome Timeframe	**Study results and measurements**	**Comparator** Isolation for 10 days	**Intervention** Remove isolation based on negative antigen test	**Certainty of the Evidence** (Quality of evidence)	**Summary**
Onward transmission leading to hospitalization (28 days)		9 per 1000	9 per 1000	Very low Due to parameters in the model and indirectness.	Whether removing isolation based on the negative antigen test would increase or decrease onward transmission leading to hospitalization of secondary cases is very uncertain compared with isolation for 10 days.
Onward transmission leading to death (90 days)		2 per 1000	2 per 1000	Very low Due to parameters in the model and indirectness.	Whether removing isolation based on the negative antigen test would increase or decrease onward transmission leading to mortality of secondary cases is very uncertain compared with isolation for 10 days.
Average isolation period (days)	Lower better	10 Days (Mean)	7 Days (Mean) CI 95%	Moderate Due to parameters in the model.	Removing isolation based on the negative antigen test probably decreases average isolation compared with isolation for 10 days.

3.6.3 Risk assessment and management of exposure

The most up-to-date technical guidance for Risk assessment and management of exposure of health care workers in the context of COVID-19: interim guidance was published 19 March 2020. This guidance is under review and is pending integration into Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline.

4. Part 2: Community settings

Many of the existing technical guidance documents that will be integrated into this section are under review. Updated versions will be available in future versions. This section includes updated guidelines for mask use by the general public in community settings and mask use by children. Sections that are pending updates have links to the most recent iteration of relevant IPC guidance published online.

4.1 Introduction to public health and social measures

What are PHSM?
PHSM have been implemented worldwide over the course of the pandemic to suppress SARS-CoV-2 transmission and reduce mortality and morbidity from COVID-19. PHSM include the following: personal protective measures (for example, physical distancing, avoiding crowded settings, hand hygiene, respiratory etiquette, mask-wearing); environmental measures (for example, cleaning, disinfection, ventilation); surveillance and response measures (for example, testing, genetic sequencing, contact tracing, isolation, and quarantine); physical distancing measures (for example, regulating the number and flow of people attending gatherings, maintaining distance in public or workplaces, domestic movement restrictions); and international travel-related measures. In this context, it does not include medical countermeasures such as drug administration or vaccination. PHSMs act in concert and a combination of measures is required to ensure adequate control. Measures should be implemented by the lowest administrative level for which situational assessment is possible and tailored to local settings and conditions. For more information, please refer to the *Considerations for implementing and adjusting public health and social measures in the context of COVID-19 [51]*.

Adjusting PHSM
As the pandemic continues to evolve, PHSM should be regularly reviewed and adjusted according to the local epidemiology and its impact on the health system, including the community and the overall economy and society. This requires agile decision-making based on ongoing situational assessments at the most local administrative level possible in a coherent and coordinated manner with neighbouring areas at the sub-national and national levels. Such assessments should be based on available data and a risk/benefit approach considering the local epidemiology, the health system's capacity to respond and other contextual considerations (such as upcoming mass gathering events that may alter transmission or the health system's capacity). The choice of epidemiological indicators and their thresholds will depend on a country's data collection capacity, vaccination strategy and coverage, and the overall COVID-19 response strategy *[51]*. Important dynamic indicators to be considered to determine the local situation are SARS-CoV-2 transmissibility, the seriousness of COVID-19, and the impact on the health system. Assessments based on these key indicators (transmissibility, seriousness of disease, and impact) need to be tailored to the local context. As a general principle, core PHSM (for example, mask use, physical distancing) should be maintained in priority groups, settings and situations, even during periods of low transmission. By combining data regarding the above-mentioned three key indicators, the following situation levels can be identified to describe the local situation.

Situational level 0: A situation with no known transmission of SARS-CoV-2 in the preceding 28 days. The health system and public health authorities are ready to respond, but there are no restrictions needed on daily activities.

Situational level 1: A situation with minimal transmission, morbidity and health system impact of SARS-CoV-2, with only basic ongoing PHSM needed.

Situational level 2: A situation where there is a moderate impact of COVID-19, although there may be a higher impact in specific subpopulations. Additional measures may be required to reduce transmission. However, disruptions to social and economic activities can still be limited, particularly if PHSM can be targeted strategically to more impacted settings.

Situational level 3: A situation with a significant impact on the health system and a risk of health services becoming overwhelmed, or unacceptably high morbidity and mortality, despite sufficient remaining health system capacity. A broader combination of PHSM may need to be put in place to limit transmission, manage morbidity, and avoid overwhelming the health system.

Situational level 4: An uncontrolled epidemic with very high morbidity/mortality and limited or no additional health system response capacity available, thus requiring extensive PHSM to avoid overwhelming of health services and substantial excess morbidity and mortality.

Who are these recommendations intended for?
These guidelines are intended for policy- and decision-makers, public health professionals, and IPC professionals at national, sub-national, and facility levels.

Published 13 January 2023

4.2 Mask use

4.2.1 Mask use in the community

Background

To assist national and global efforts to end the acute phase of the COVID-19 pandemic emergency worldwide, WHO published the 2022 COVID-19 Strategic Preparedness, Readiness and Response plan outlining strategic interventions to support these efforts. The first objective is to reduce and control the incidence of SARS-CoV-2 infections. This is essential to protect individuals from exposure, especially vulnerable individuals at risk of severe disease or occupational exposure to the virus, reduce the probability that future variants will arise, and reduce pressure on health systems. While the second objective is to prevent, diagnose and treat COVID-19 to reduce mortality, morbidity, and long-term sequelae *[99]*. These actions may reduce pressure on the virus to evolve and the potential that future variants will emerge while simultaneously reducing the burden on the health system *[98]*.

Masks are one component of a comprehensive package of prevention and control measures to limit the spread of SARS-CoV-2. When aiming to reduce community transmission and mitigate the impact of COVID-19 outbreaks on health and social services, policies developed for mask use should be included as one element of a comprehensive package of preventive measures to reduce transmission (physical distancing, ventilation, mask use, hand hygiene, respiratory etiquette, and vaccination).

Considering the current stage of the pandemic, the GDG considered all available evidence on the effectiveness of mask-wearing *[27]*, the epidemiology of current VoC, transmission (data or patterns where available), the severity of disease and impact on health systems, vaccine efficacy, access, uptake, and potential immune evasion *[92]*. The complementary strong and conditional recommendations on mask use in the community outline possible scenarios in which mask use may be of benefit.

Published 13 January 2023

Strong recommendation for

Strong recommendation for, low-to-moderate certainty of evidence

WHO recommends the use of a mask for the prevention of SARS-CoV-2 transmission in the community in the following situations:

- when in crowded, enclosed, or poorly ventilated spaces[1] *[9]*;
- following a recent exposure to COVID-19 (according to the WHO definition[2]) when sharing a space with others;
- when sharing a space with a person who displays signs or symptoms of COVID-19[3] or is COVID-19- positive;
- for individuals at high risk[4] of severe complications from COVID-19.

[1] For example, a setting in which it is not possible to physically distance at least 1 metre.

[2] Exposure: contact with a probable or confirmed case or linked to a COVID-19 cluster *[7][93]*.

[3] Signs or symptoms of COVID-19 include: cough, general weakness/fatigue, headache, myalgia, sore throat, coryza, dyspnoea, nausea/diarrhoea/anorexia *[7]*

[4] High risk is defined as: people aged ≥60 years; or those with underlying comorbidities, such as cardiovascular disease or diabetes mellitus, chronic lung disease, cancer, cerebrovascular disease, immunosuppression, obesity, or asthma *[47]*.

Published 13 January 2023

Practical info

Implementation considerations

The implementation and adjustment of policies on mask use should be based on available scientific data and a risk/benefit approach considering the local epidemiology, the health system's capacity to respond, and other contextual considerations (events that may alter community transmission or the health system's capacity to respond to the resurgence of cases). The local situation can be determined based on the above-mentioned criteria related to the transmissibility of SARS-CoV-2, the seriousness of the disease, and the impact of the virus.

The evidence available on mask use in the community setting is based on the use of medical masks. Fabric (non-medical) masks can be used when access to medical masks is limited. While filtering facepiece respirators have demonstrated a higher filtration level, there is limited evidence to suggest that filtering facepiece respirators should be used in community settings.

Exhalation valves on respirators and non-medical masks are discouraged as they do not allow for adequate source control from the wearer. Exhalation valves permit a bypass of the filtration layers when the wearer exhales, thus potentially allowing infectious particles to pass through.

Face shields are considered to provide a level of eye protection only and should not be considered as an equivalent to masks with respect to respiratory protection and/or source control. Current laboratory testing standards only assess face shields for their ability to provide eye protection from chemical splashes *[91]*.

Additional details

For additional information on the environmental impact of mask use (and other PPE), please see the WHO's Global analysis of health care waste in the context of COVID-19*[92]*.

For information on assessing and improving indoor ventilation, please see WHO's Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 *[16]*.

For additional information on contact tracing and quarantine, please see Contact tracing and quarantine in the context of COVID-19: interim guidance, 6 July 2022 *[84]*.

For the essential parameters concerning fabric (non-medical) and medical masks, see the following implementation consideration.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

The utilization of masks in community settings is associated with a decreased risk of SARS-CoV-2 infections compared with no mask-wearing. Despite the low-to-moderate certainty of the evidence, GDG members agreed that WHO should issue recommendations as the net benefits of mask use by the public outweigh the potential harms. The situations outlined above have been identified by consensus as settings and conditions in which masks should always be utilized.

Available evidence includes two open-label RCTs and ten observational studies. A large (n=342,183) cluster RCT found a mask promotion intervention associated with decreased risk of symptomatic SARS-CoV-2 seroprevalence (adjusted prevalence ratio 0.91, 95% CI 0.82 to 1.00) *[93]*. An individually randomized RCT (n=6,024) found a recommendation to use masks associated with decreased risk of SARS-CoV-2 infection, though the difference was not statistically significant (odds ratio 0.82, 95% CI 0.54 to 1.23); this trial was not designed to evaluate effects of masks as source control *[94]*. The RCTs had methodological limitations, including open-label design, attrition, incomplete outcome assessment, variable adherence, and differential recruitment. The RCTs were consistent and were not downgraded for imprecision (due to the very large total sample size [greatly exceeding any optimum information size threshold] with a precise estimate from one of the trials). Only one trial evaluated a mask recommendation directly *[94]*. The other evaluated a mask promotion intervention and did not evaluate mask use or a mask recommendation directly *[93]*; this resulted in suboptimal uptake of make use and would underestimate the effects of mask use. Therefore, the RCTs were not downgraded for indirectness (See Annex 2).

The observational studies were generally consistent with the RCTs, but had some imprecision, inconsistency and methodological limitations *[95][96][97][98][99][100][101][102][103][104]*. Although the estimates of the ten available observational studies were imprecise and had a degree of variability, in addition to other biases intrinsic to observational studies, overall, mask use was associated with a decreased risk of SARS-CoV-2 infection compared to no mask use *[95][96][97][98][99][100][101][102][103][104]*. Ecological studies identified an association between a reduced number of confirmed cases of COVID-19 and policies requiring the use of masks. No studies assessed the effectiveness of mask use in specific settings (for example, indoor, outdoor, or ventilation status). Overall, the certainty of the evidence (based primarily on the two RCTs, and supplemented by the ten observational studies) is assessed as *low-to-moderate.*

Certainty of the Evidence

Available evidence includes two open-label RCTs and ten observational studies. The cluster RCT explored the use of mask promotion *[93]*, while the other RCT presented an imprecise estimate and was not designed to assess the effectiveness of source control *[94]*. The observational studies had some imprecision, inconsistency and methodological limitations. Therefore, the certainty of the evidence is reported as *low-to-moderate.*

Values and preferences

No substantial variability expected

Discussions with GDG members indicated a general preference towards favouring mask use in community settings, although the values and preferences of individuals may vary. Many members indicated that those at high risk of severe disease may find more value in the use of masks compared to other individuals.

Resources

No important issues with the recommended alternative

Research evidence

GDG members indicated that the global supply chain for mask manufacturing has improved and would not pose a severe obstacle to community masking. The cost of both medical masks and non-medical masks is relatively low and does not pose a substantial barrier for low- and middle-income countries. However, medical masks should not be reused and should be changed when wet or soiled, potentially requiring the use of multiple masks per day, leading to additional resource implications, such as cost, availability and access. Additionally, there are environmental impacts associated with disposable masks, such as additional waste and litter. Additional considerations are needed for proper disposal.

Gaps in knowledge and research needs

Investigations on the benefits and harms of masks and their utilization in the community setting are ongoing and published work has identified this need for continued research. Well-conducted, observational studies and/or RCTs exploring the use of masks versus no masks in various settings (for example, indoor, outdoor, ventilation status) would further clarify outstanding questions concerning mask use in community settings. In addition, research investigating the use of masks (including the type of mask and transmission scenarios) in the context of the emerging variants of concern would provide powerful evidence for future recommendations. However, GDG members discussed the challenges associated with obtaining compelling evidence from a RCT on behavioural interventions. Furthermore, with the availability of SARS-CoV-2 immunization and increased natural immunity, further research will be needed to reinforce the impact of vaccination and, consequently, the effect that immunization status will have on mask utilization in community settings. Additional research and innovation is needed in the area of reusable and recyclable medical masks that comply with existing standards.

Summary

GDG members indicated that the global supply chain for mask manufacturing has improved and would not pose a severe obstacle to community masking. The cost of both medical masks and non-medical masks is relatively low and does not pose a substantial barrier for low- and middle-income countries. However, medical masks should not be reused and should be changed when wet or soiled, potentially requiring the use of multiple masks per day, leading to additional resource implications, such as cost, availability and access. Additionally, there are environmental impacts associated with disposable masks, such as additional waste and litter. Additional considerations are needed for proper disposal.

Gaps in knowledge and research needs

Investigations on the benefits and harms of masks and their utilization in the community setting are ongoing and published work has identified this need for continued research. Well-conducted, observational studies and/or RCTs exploring the use of masks versus no masks in various settings (for example, indoor, outdoor, ventilation status) would further clarify outstanding questions concerning mask use in community settings. In addition, research investigating the use of masks (including the type of mask and transmission scenarios) in the context of the emerging variants of concern would provide powerful evidence for future recommendations. However, GDG members discussed the challenges associated with obtaining compelling evidence from a RCT on behavioural interventions. Furthermore, with the availability of SARS-CoV-2 immunization and increased natural immunity, further research will be needed to reinforce the impact of vaccination and, consequently, the effect that immunization status will have on mask utilization in community settings. Additional research and innovation is needed in the area of reusable and recyclable medical masks that comply with existing standards.

Equity

No important issues with the recommended alternative

No issues were documented regarding inequities. Using masks as a preventative measure for SARS-CoV-2 infection may reduce the burden of infection, especially for those at high risk of severe disease *[105]*. Studies did not examine equity issues, such as providing information on race, gender, or vulnerable populations. More studies addressing these aspects should be carried out to inform the decision-making process.

Acceptability

Important issues, or potential issues not investigated

Complex issues arise when examining the acceptability of mask use in communities. These include the type of mask recommended, personal preference, possible local economic and procurement constraints and the ecological impact

(environmental impact and waste management) *[106][107][108]*. Members indicated that those at high risk of severe sequelae might find more benefit in mask-wearing compared to other individuals. Furthermore, members of the general public may not deem mask use as an acceptable public health intervention and thus, demonstrate resistance towards masking policies. However, the evidence points to the benefits outweighing the harms. Variability exists in the published studies examining mask compliance.

Feasibility Important issues, or potential issues not investigated

Given the current availability of masks, community masking is likely feasible, despite the acceptability issues mentioned above.

Justification

In response to the shift in the epidemiology of COVID-19, GDG members reformulated the recommendations to no longer rely on the local transmission scenario of SARS-CoV-2. Given the sustained SARS-CoV-2 transmission globally, a majority of GDG members agreed that a situational approach to mask use is more appropriate than the previous transmission-based approach. GDG members indicated that the benefits of mask use outweigh the potential harms as masks are an effective mitigation tool, especially in crowded, enclosed, and poorly ventilated settings such as public transportation, busy storefronts, and crowded workplaces and educational centres. The GDG decided for this strong recommendation in conjunction with the conditional to ensure coverage across all situations where masking may be beneficial.

Conditional recommendation for

Conditional recommendation for, low-to-moderate certainty of evidence

In situations not addressed by the strong recommendation, WHO suggests a risk-based approach to inform the decision to use a mask for the prevention of SARS-CoV-2 transmission in the community.

Factors that favour mask use:

- COVID-19 epidemiological trends at the community level indicating high or rising transmission or hospitalizations;
- low coverage of COVID-19 vaccination;
- low levels of population immunity to SARS-CoV-2;
- a greater degree of crowding[1], poorer indoor ventilation, and/or the presence of individual risk factors[2].

[1] The degree of crowding for the conditional recommendation refers to distances >1 metre, for which there is likely some association between greater distancing and decreased risk.

[2] For the conditional recommendation, in the absence of clear risk factors, one may consider whether one's overall status of health may contribute to an increased risk of severe disease.

Published 13 January 2023.

Practical info

Implementation considerations

Practical considerations for policy-makers:

The potential advantages of mask use by healthy people in the general public include:

- reduced spread of potentially infectious aerosols or droplets from exhaled breath, including from infected people before they develop symptoms *[117]*;
- encouraging concurrent transmission prevention behaviours such as washing hands and not touching the eyes, nose and mouth *[118][119][120]*; and
- preventing transmission of other respiratory illnesses such as tuberculosis and influenza and reducing the burden of these diseases during the pandemic *[121]*.

The potential disadvantages of mask use by healthy people in the general public include:

- Adverse events include: headache and/or breathing difficulties, depending on the type of mask used *[122][123]*; potential physiological changes *[124]*; development of facial skin lesions, irritant dermatitis or worsening acne when used frequently for long hours*[123][125][126][127][128]*;
- difficulty with communicating clearly, especially for persons who are deaf or have poor hearing or use lip reading *[129][130]*;
- poor compliance with mask-wearing, in particular by young children *[125][131][132][133][134]*;
- waste management issues; improper mask disposal leading to increased litter in public places and environmental hazards *[135][66]*; and
- further disadvantages for, or difficulty wearing masks by, certain members of the population, especially: children; developmentally challenged people; those with mental illness or cognitive impairment; those with asthma, chronic respiratory or breathing problems; those who have had facial trauma or recent oral maxillofacial surgery; and those living in hot and humid environments *[122][125][132]*.

Additional details

For additional information on the environmental impact of mask use (and other PPE), please see the WHO's Global analysis of health care waste in the context of COVID-19*[66]*.

For information on assessing and improving indoor ventilation, please see WHO's Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 *[9]*.

For additional information on contact tracing and quarantine, please see Contact tracing and quarantine in the context of COVID-19: interim guidance, 6 July 2022 *[93]*.

For the essential parameters concerning fabric (non-medical) and medical masks, see the following implementation consideration.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

The utilization of masks in community settings is associated with a decreased risk of SARS-CoV-2 infections compared with no mask-wearing. Despite the low-to-moderate certainty of the evidence, GDG members agreed that WHO should issue recommendations as the net benefits of mask use by the public outweigh the potential harms. The situations outlined above have been identified by consensus as settings and conditions in which masks should always be utilized.

Available evidence includes two open-label RCTs and ten observational studies. A large (n=342,183) cluster RCT found a mask promotion intervention associated with decreased risk of symptomatic SARS-CoV-2 seroprevalence (adjusted prevalence ratio 0.91, 95% CI 0.82 to 1.00) *[101]*. An individually randomized RCT (n=6,024) found a recommendation to use masks associated with decreased risk of SARS-CoV-2 infection, though the difference was not statistically significant (odds ratio 0.82, 95% CI 0.54 to 1.23); this trial was not designed to evaluate effects of masks as source control *[102]*. The

RCTs had methodological limitations, including open-label design, attrition, incomplete outcome assessment, variable adherence, and differential recruitment. The RCTs were consistent and were not downgraded for imprecision (due to the very large total sample size [greatly exceeding any optimum information size threshold] with a precise estimate from one of the trials). Only one trial evaluated a mask recommendation directly *[102]*. The other evaluated a mask promotion intervention and did not evaluate mask use or a mask recommendation directly *[101]*; this resulted in suboptimal uptake of make use and would underestimate the effects of mask use. Therefore, the RCTs were not downgraded for indirectness (See Annex 2).

The observational studies were generally consistent with the RCTs, but had some imprecision, inconsistency and methodological limitations *[103][104][105][106][107][108][109][110][111][112]*. Although the estimates of the ten available observational studies were imprecise and had a degree of variability, in addition to other biases intrinsic to observational studies, overall, mask use was associated with a decreased risk of SARS-CoV-2 infection compared to no mask use *[103][104][105][106][107][108][109][110][111][112]*. Ecological studies identified an association between a reduced number of confirmed cases of COVID-19 and policies requiring the use of masks. No studies assessed the effectiveness of mask use in specific settings (for example, indoor, outdoor, or ventilation status). Overall, the certainty of the evidence (based primarily on the two RCTs, and supplemented by the ten observational studies) is assessed as *low-to-moderate.*

Certainty of the Evidence

Available evidence includes two open-label RCTs and ten observational studies. The cluster RCT explored the use of mask promotion *[101]*, while the other RCT presented an imprecise estimate and was not designed to assess the effectiveness of source control *[102]*. The observational studies had some imprecision, inconsistency and methodological limitations. Therefore, the certainty of the evidence is reported as *low-to-moderate.*

Values and preferences

Substantial variability is expected or uncertain

Discussions with GDG members indicated a general preference towards favouring mask use in community settings, although the values and preferences of individuals may vary. Many members indicated that those at high risk of severe disease might perceive the benefits of mask use to be greater compared to other individuals.

Resources

No important issues with the recommended alternative

Research evidence

Many GDG members noted that the global supply chain for mask manufacturing has improved and would not pose a severe obstacle to community masking. The cost of both medical and non-medical (fabric) masks is relatively low and does not pose a substantial barrier for low- and middle-income countries. However, medical masks should not be reused and changed when wet or soiled, potentially requiring the use of multiple masks per day, leading to additional resource implications, such as cost, availability and access. Additionally, there are environmental impacts associated with disposable masks, such as additional waste and litter. Additional considerations are needed for proper disposal.

Gaps in knowledge and research needs

Investigations on the utilization of masks in the community setting are ongoing, but published work has identified this need for continued research. Observational studies and/or RCTs designed and conducted with rigorous scientific methods exploring the use of masks versus no masks in various settings (for example, indoor, outdoor, ventilation status) would further clarify outstanding questions concerning mask use in community settings. In addition, research investigating the use of masks (including the type of mask and transmission scenarios) in the context of VoC would provide powerful evidence for future recommendations. However, GDG members discussed the challenges associated with obtaining compelling evidence from an RCT on behavioural interventions. Furthermore, with the availability of SARS-CoV-2 immunization and increases in natural immunity, further research will be needed to reinforce the impact of vaccination and; consequently, the effect

immunization status will have on mask utilization in community settings. Additional research and innovation is needed in the area of reusable and recyclable medical masks that comply with existing standards.

Summary

Many GDG members noted that the global supply chain for mask manufacturing has improved and would not pose a severe obstacle to community masking. The cost of both medical and non-medical (fabric) masks is relatively low and does not pose a substantial barrier for low- and middle-income countries. However, medical masks should not be reused and changed when wet or soiled, potentially requiring the use of multiple masks per day, leading to additional resource implications, such as cost, availability and access. Additionally, there are environmental impacts associated with disposable masks, such as additional waste and litter. Additional considerations are needed for proper disposal.

Gaps in knowledge and research needs

Investigations on the utilization of masks in the community setting are ongoing, but published work has identified this need for continued research. Observational studies and/or RCTs designed and conducted with rigorous scientific methods exploring the use of masks versus no masks in various settings (for example, indoor, outdoor, ventilation status) would further clarify outstanding questions concerning mask use in community settings. In addition, research investigating the use of masks (including the type of mask and transmission scenarios) in the context of VoC would provide powerful evidence for future recommendations. However, GDG members discussed the challenges associated with obtaining compelling evidence from an RCT on behavioural interventions. Furthermore, with the availability of SARS-CoV-2 immunization and increases in natural immunity, further research will be needed to reinforce the impact of vaccination and; consequently, the effect immunization status will have on mask utilization in community settings. Additional research and innovation is needed in the area of reusable and recyclable medical masks that comply with existing standards.

Equity

No important issues with the recommended alternative

No important issues were documented regarding inequities, although this arena would benefit from further investigation.

Acceptability

Important issues, or potential issues not investigated

Complex issues arise when examining the acceptability of mask use in communities. These include the type of mask recommended, personal preference and ecological impact (environmental impact and waste management) *[113][114][115][66]*. Members indicated that those at high risk of severe sequelae might find more benefit in mask-wearing compared to other individuals. Furthermore, it has been indicated that members of the general public may not deem mask use as an acceptable public health intervention and, thus, demonstrate resistance towards masking policies. However, the evidence points to the benefits outweighing the harms. Variability exists in the published studies examining mask compliance.

Feasibility

Important issues, or potential issues not investigated

Given the availability of masks, community masking is likely feasible.

Justification

GDG members decided for this conditional recommendation in conjunction with the aforementioned strong recommendation. In addition to situations where masks are strongly advised (when in crowded, enclosed, or poorly ventilated spaces; following recent exposure to COVID-19; when sharing a space with a person who displays symptoms of COVID-19 or is COVID-19-positive; and for individuals at high risk of severe complications from COVID-19), there are additional times where wearing a mask may be beneficial. Although there are limited data on the effectiveness of a risk-based approach and implementation may be a challenge, the benefits of mask wearing outweigh the risks.

Members indicated that masks should be considered when there are high-to-moderate levels of community transmission (situational levels 2 to 4) and low-to-moderate vaccination coverage while taking into consideration individual risk factors in addition to personal values and preferences based on the perception of the risk and the potential harm and consequences of being affected by COVID-19.

Implementation considerations

Mask management

For any type of mask, appropriate use, storage, cleaning or disposal are essential to ensure that they are as effective as possible and to avoid any increased risk of transmission. Adherence to correct mask management practices varies, reinforcing the need for appropriate messaging *[116]*. WHO provides the following guidance on the correct use of masks:

- Wash hands thoroughly before putting on the mask.
- Inspect the mask for tears or holes, and do not use a damaged mask.
- Place the mask carefully, ensuring it covers the mouth and nose, adjust to the nose bridge and tie it securely to minimize any gaps between the face and the mask. If using ear loops, ensure these do not cross over as this widens the gap between the face and the mask.
- Avoid touching the mask while wearing it. If the mask is accidently touched, wash hands thoroughly.
- Remove the mask using the appropriate technique. Do not touch the front of the mask; rather, untie it from behind.
- Replace the mask as soon as it becomes damp with a new, clean and dry mask.
- Either discard the mask or place it in a clean plastic resealable bag where it is kept until it can be washed and cleaned. Do not store the mask around the arm or wrist or pull it down to rest around the chin or neck.
- Wash hands immediately after discarding a mask.
- Do not reuse single-use masks.
- Discard single-use masks after each use and properly dispose of them immediately upon removal.
- Do not remove the mask to speak.
- Do not share your mask with others.
- Wash fabric masks in soap or detergent and preferably hot water (at least 60° Centigrade/140° Fahrenheit) at least once a day. If it is not possible to wash the masks in hot water, then wash the mask in soap/detergent and room-temperature water, followed by boiling the mask for 1 minute.
- A mask should be changed to a clean mask at least once daily.

For more information on mask technical specifications, review the following technical document - "Technical specifications of personal protective equipment for COVID-19", published 13 November 2020

Published 13 January 2023.

Good practice statement

Individuals with any signs or symptoms[1] suggestive of COVID-19 or who test positive for COVID-19 should wear a medical mask, when sharing a space with others, until it is resolved or the isolation period is complete.

[1] Signs or symptoms of COVID-19 include: cough, general weakness/fatigue, headache, myalgia, sore throat, coryza, dyspnoea, nausea/diarrhoea/anorexia *[7]*.

Published 13 January 2023.

Practical info

Implementation considerations

- Individuals should self-isolate and seek medical advice as soon as they start to feel unwell with potential COVID-19 symptoms (even if symptoms are mild).
- Instructions on how to put on, take off and dispose of medical masks, and how to adequately perform hand hygiene *[136]* should be followed.
- All additional measures should be followed, particularly respiratory hygiene, frequent hand hygiene, and maintaining a physical distance of at least one metre from other persons *[137]*.
- If a medical mask is not available for individuals with suspected or confirmed COVID-19, a fabric mask with fit, filtration and breathability assessed to meet WHO's essential parameters for non-medical masks should be worn by patients as a source control measure, pending access to a medical mask. The use of a non-medical mask can minimize the projection of respiratory particles from the user *[138][139]*.
- Persons with suspected COVID-19 or mild COVID-19 symptoms should wear a medical mask as much as possible, especially when there is no alternative to being in the same room with other people.
- Caregivers or those sharing living space with people with suspected COVID-19 or mild COVID-19 symptoms should wear a medical mask when in the same room as the affected person.

Justification

GDG members agreed that if an individual has confirmed or suspected COVID-19 needs to interact with others in or outside of their household, they should wear a medical mask. Members also noted that individuals who have confirmed or suspected COVID-19 should self-isolate for the duration of their isolation period and/or until symptoms resolve. For additional information on contract tracing and quarantine, please see Contact tracing and quarantine in the context of COVID-19: interim guidance, 6 July 2022 (who.int) *[93]*.

Good practice statement

Policies aimed at reducing the transmission of SARS-CoV-2 in the community should be revisited, strengthened, and updated according to the most recent scientific evidence.

Published 13 January 2023.

Practical info

Policies may include a package of interventions such as vaccination, ventilation, physical distance, hand hygiene, respiratory etiquette, and mask adherence by the general public. Please refer to the document on IPC in the event of surge or resurgence in cases of COVID-19 *[142]*.

Justification

GDG members agreed that national and subnational policy-makers should revisit, strengthen and update local policies according to the most recent scientific evidence to mitigate SARS-CoV-2 transmission in the community settings. These policies should be able to be quickly scaled up should COVID-19 incidence increase in the community and if healthcare systems are at risk of becoming overwhelmed. Policies should be reviewed as necessary to account for any changes in the local context or new VoC.

4.2.1.1 Type of mask used by the general public

Implementation consideration for policy-makers, when providing guidance, or setting standards for manufacturers on type of mask used by the general public

Implementation considerations

The following mask types are acceptable options for use by the general public:

- disposable medical masks, if the availability of medical masks meeting minimum performance criteria for health workers has been assured[1];
- non-medical masks that comply with standards for safety and efficacy[2] and can be washed prior to reuse;
- if the above options are not available, other types of well-fitting non-medical masks[3] are an acceptable option (according to local policies).

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[1] Complying with medical mask standards (at minimum) EN 14683 type I, ASTM F2100 level 1, YY/T 0969, YY 0469 (or equivalent). For requirements for health workers, please see PPE technical specifications.

[2] Complying with the ASTM F3502-22a Standard Specification for Barrier Face Coverings, standard or a non-medical mask meeting WHO essential parameters (see *Practical information* for more information).

[3] Including homemade, multi-layered masks (see *Practical information* for more information).

Published 13 January 2023.

Practical info

Table 2. Essential parameters (minimum and preferred thresholds) for manufactured non-medical mask

Essential Parameters	Minimum threshold	Preferred threshold
1. Filtration*		
1.1 Filtration efficiency	70% at 3 µm	>50% at 0.3 µm, without compromising breathability
1.2. Challenge particle	*Solid*: sodium chloride (NaCl), Talcum powder, Holi powder, dolomite, Polystyrene Latex spheres *Liquid*: DEHS Di-Ethyl-Hexyl-Sebacat, paraffin oil	Solid: sodium chloride (NaCl), Polystyrene Latex spheres
1.3. Particle size	Choose either size: 3 µm, 1 µm, or smaller	0.3 µm
2. Breathability		
2.1. Breathing resistance**	≤70 Pa/cm^2	*Adult*: ≤ 40 Pa/cm^2 *Children*: ≤ 20 Pa/cm^2
2.2 Exhalation valves	Not recommended	N/A

3. Fit		
3.1. Coverage	Full coverage of nose and mouth, consistent, snug perimeter fit at the nose bridge, cheeks, chin and lateral sides of the face; adequate surface area to minimize breathing resistance and minimize side leakage	Same as current requirements
3.2 Face seal	Not currently required	Seal as good as FFR (respirator) Fit factor of 100 for N95 Maximum Total Inward Leakage of 25% (FFP1 requirement) OR Leakage ratio of ≥5
3.2. Sizing	Adult and child	Should cover from nose bridge to below the chin and cheeks on either side of the mouth Sizing for adults and children (6-9, 10-12, >12)
3.3 Strap strength		> 44.5 N

* Smaller particles may result in lower filtration.

** High resistance can cause bypass of the filtration layers of the mask. Unfiltered air will leak out the sides or around the nose on the path of least resistance.

Table 3. Additional (optional) parameters for manufactured non-medical masks

Additional parameters	Minimum thresholds
If reusable, the number of wash cycles	5 cycles
Disposal	If majority of mask is compostable, as per EN 13432, EN 14995, ASTM D5511 or other similar standards mimicking landfill or marine environments
Antimicrobial (bacteria, virus, fungus) performance	ISO 18184 (virus) ISO 20743 (bacteria) ISO 13629 (fungus) AATCC TM100 (bacteria)
Chemical safety	Comply with REACH regulation, including inhalation safety

Standards organizations' performance criteria

Manufacturers producing masks with consistent standardized performance can adhere to published, freely available

guidance from several organizations including those from, ASTM International, the French Standardization Association (AFNOR Group), The European Committee for Standardization (CEN), Swiss National COVID-19 Task Force, the South Korean Ministry of Food and Drug Safety (MFDS), the Italian Standardization Body (UNI) and the Bangladesh Directorate General of Drug Administration (DGDA).

Additional criteria:

- The non-medical mask, including all components and packaging, must be non-hazardous, non-toxic and child-friendly (no exposed sharp edges, protruding hardware or rough materials).
- Factory-made EN Type I, ASTM Level 1 medical masks or non-medical masks must be made using a process that is certified to a quality management system (e.g., ISO 13485, ISO 9001).
- Social accountability standards (e.g., SAI SA8000) for multiple aspects of fair labour practices, health and safety of the workforce and adherence to UNICEF's Children's Rights and Business Principles are strongly encouraged.

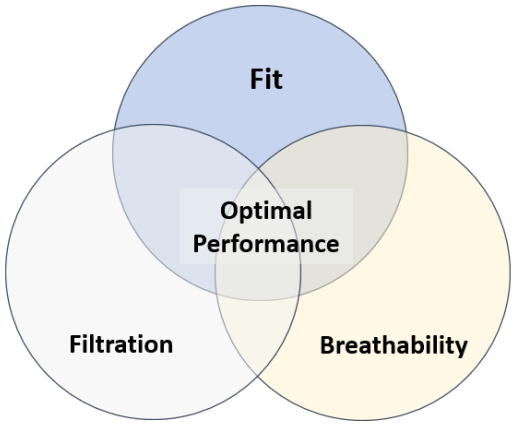

Figure 1. Illustration of the three essential parameters of filtration, breathability and fit.

Filtration and breathability

Filtration depends on the filtration efficiency (in %), the type of challenge particle (oils, solids, droplets containing bacteria) and the particle size (see Table 2). Depending on the fabrics used, filtration and breathability can complement or work against each other. Filtration is dependent on the tightness of the weave, fibre or thread diameter. Non-woven materials used for disposable masks are manufactured using processes to create polymer fibres that are thinner than natural fibres such as cotton, and that are held together by partial melting. Breathability is the difference in pressure across the mask and is typically reported in millibars (mbar) or Pascals (Pa) or normalized to the cm^2 in $mbar/cm^2$ or Pa/cm^2. Non- medical fabric masks consisting of two layers of polypropylene spunbond, and two layers of cotton have been shown to meet the minimum requirements for droplet filtration and breathability of the CEN/TS 17553:2022 guidance. It is preferable not to select elastic material to make masks as the mask material may be stretched over the face, resulting in increased pore size and lower filtration through reuse. Additionally, elastic fabrics are sensitive to washing at high temperatures and may therefore degrade over time.

Coating the fabric with compounds such as wax may increase the barrier and render the mask fluid-resistant; however, such coatings may inadvertently block the pores completely and make the mask difficult to breathe through. In addition to decreased breathability, unfiltered air may more likely escape from the sides of the mask on exhalation. The coating is therefore not recommended.

Fit: shape and sizing

Fit is the third essential parameter, and takes into consideration coverage, seal, sizing and strap strength. Fit of masks is currently not defined by any standard except for the anthropometric considerations of facial dimensions (ISO/TS 16976-2) or simplified to height mask (South Korean standard for KF-AD). Ideally, the mask should not have contact with the lips,

unless hydrophobic fabrics are used in at least one layer of the mask *[143]*. Leaks where unfiltered air moves in and out of the mask may be attributed to the size and shape of the mask *[144]*.

Optional parameters for consideration

If reusable:

- the biodegradability;
- antimicrobial performance (where applicable); and
- chemical safety (see Practical Info section).

Non-medical masks intended to be reusable should include instructions for washing and must be washed a minimum of five cycles, implying initial performance is maintained after each wash cycle. Advanced fabrics may be biodegradable or compostable at the end of service life, according to a recognized standard process (e.g., UNI EN 13432, UNI EN 14995 and UNI/PdR 79).

Manufacturers sometimes claim their non-medical masks have antimicrobial performance. Antimicrobial performance may be the result of coatings or additives to the fabric fibres. Treated fabrics must not come into direct contact with mucous membranes; the innermost fabric should not be treated with antimicrobial additives, only the outermost layer. In addition, antimicrobial fabric standards (e.g., ISO 18184, ISO 20743, AATCC TM100, AATCC 100) are generally slow acting. The inhibition on microbial growth may not take full effect until after a contact time of 2–24 hours, depending on the standard. The standards have generally been used for athletic apparel and to substantiate claims of odour control performance. These standards are not appropriate for non-medical cloth masks and may provide a false sense of protection from infectious agents. If claims are made, manufacturers should specify the standard that supports antimicrobial performance, the challenge organism and the contact time.

Volatile additives are discouraged as these may pose a health risk when inhaled repeatedly during wear. Certification according to organizations including OEKO-TEX (Europe) or SEK (Japan), and additives complying with REACH (Europe) or the United States Environmental Protection Agency (EPA), indicate that textile additives are safe and added at safe levels.

Justification

GDG members agreed with standardizing recommendations for the utilization and specifications of masks for the general public. GDG members expressed concern of being overly prescriptive while the current state of evidence on the quality and effectiveness of non-medical masks continues to evolve, as this may limit the social enterprise of homemade mask production, a standard practice within many WHO Member States. However, GDG members agreed with laboratory evidence confirming that non-medical masks without standardized quality control processes can have large variabilities in their key parameters (see p*ractical information* for information on essential parameters for non-medical masks). Members also conveyed the importance of specifying the use of well-fitting masks, as the fit may be an essential parameter for effective source control and protection. In addition, GDG members discussed the potential harms associated with limited resources and lack of personnel to test the essential parameters of masks in various low-income settings, together with expressing concerns regarding waste disposal.

Adaptation

Homemade non-medical masks made from household fabrics (e.g. cotton, cotton blends and polyesters) should ideally have a three-layer structure, with each layer providing a function (see Figure 1) *[83]*.

1. an innermost layer (that will be in contact with the face) of a hydrophilic material (e.g. cotton or cotton blends of terry cloth towel, quilting cotton and flannel) that is non-irritating against the skin and can contain droplets *[143]*;
2. a middle hydrophobic layer of synthetic breathable non-woven material (spunbond polypropylene, polyester and polyaramid), which may enhance filtration, prevent permeation of droplets or retain droplets *[143][84]*; and
3. an outermost layer made of hydrophobic material (e.g. spunbond polypropylene, polyester or their blends), which may limit external contamination from penetrating through the layers to the wearer’s nose and mouth and maintains and prevents water accumulation from blocking the pores of the fabric *[143]*.

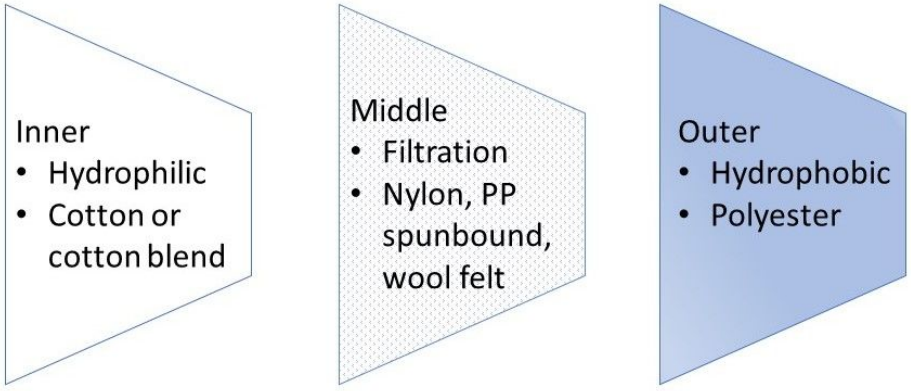

Figure 1. Non-medical mask construction using breathable fabrics such as cotton, cotton blends, polyesters, nylon and polypropylene spunbond that are breathable may impart adequate filtration performance when layered. Single- or double-layer combinations of advanced materials may be used if they meet performance requirements *[85]*

Although a minimum of three layers is recommended for non-medical masks for the most common fabric used, single, double or other layered combinations of advanced materials may be used if they meet performance requirements.

Assumptions regarding homemade masks are that individual makers only have access to common household fabrics and do not have access to test equipment to confirm target performance (filtration and breathability). Figure 1 illustrates a multi-layer mask construction with examples of fabric options. Very porous materials, such as gauze, even with multiple layers, may provide very low filtration efficiency *[86]*. Fabrics with higher thread count offer improved filtration performance *[87]*. Coffee filters, vacuum bags and materials not meant for clothing should be avoided, as they may contain injurious content when breathed in. Microporous films such as Gore-Tex are not recommended *[88]*.

Good practice statement

New

When wearing a mask in community settings, individuals should use a well-fitting mask with full coverage of the nose and mouth.

- *Ensure a snug fit at the nose bridge, cheeks, chin and lateral sides of the face*
- *The "knot-and-tuck" and "linking-ear-loops-behind-the-head" techniques improve medical mask fit by reducing gaps on the sides of medical masks with ear loops*

Published 06 October 2023

Practical info

Implementation considerations

Medical masks

Improving the fit of medical masks may not always be possible in low resource settings, given the resource requirements. However, techniques such as the "tie-and-tuck" method may benefit low- and middle-income countries since they do not require additional materials. The "knot-and-tuck" and "linking-ear-loops-behind-the-head" techniques improve medical mask fit by reducing gaps on the sides of medical masks with ear loops. Such gaps allow air leakage (potentially containing infectious particles) to bypass the filtration layers of the medical mask when the wearer inhales or exhales.

Considerations on the use of linking-ear-loops-behind-the-head techniques to improve medical mask fit

- Always use a clean, unused rectangular pleated medical mask meeting the minimum performance standards (or equivalent) *[14]*.
- Always clean hands thoroughly (per WHO guidance) prior to donning, doffing and/or manipulating a mask.
- Where connectors are used to link ear loops behind the head, ensure that these connectors are clean for use upon donning (either new, cleaned and disinfected or laundered, depending on the connector and local implementation strategy). When connectors are doffed, they should be treated as potentially contaminated. A local strategy should be in place to manage used connectors thorough cleaning and disinfection processes, laundering or discarding used connectors through standard waste management.

Justification

GDG members unanimously agreed that mask fit was amongst the most important considerations for choosing a mask. If a mask does not snugly fit an individuals face, there are techniques (ie *"knot-and-tuck" and "linking-ear-loops-behind-the-head")* that can improve the fit of a medical mask.

Clinical question/ PICO

Population:	Community
Intervention:	Methods to improve mask fitting
Comparator:	An ill-fitting mask (does not fit snuggly, gaps)

Summary

The research of the included studies had been conducted over a large range of countries, with the most frequent research coming from the USA

Studies aimed to evaluate:

- modifications to improve fit to reduce the number of expelled particles.
- amount of leakage associated with double masking.
- fitted filtration efficiency of consumer grade masks.
- aerosol particle leaking/leakage and standard surgical mask fitting with 3 elastomeric harness designs

Studies found that crossing ear loops or using mask brackets made no significant improvement . However, modifications such as knot-and-tuck methods and double masking did improve the fit, blocking of particles from the wearer and reducing exposure Furthermore, increasing the tension through a brace, connector, 'ear-guards', etc. did improve fit and protection. Lastly, an elastomeric harness may improve the fit and protection of a standard surgical mask.

Outcome Timeframe	**Study results and measurements**	**Comparator** An ill-fitting mask (does not fit snuggly, gaps)	**Intervention** Methods to improve mask fitting	**Certainty of the Evidence** (Quality of evidence)	**Summary**
SARS-CoV-2 Infection				Evidence was not GRADE' d as all studies were performed in the laboratory setting	There were too few who experienced SARS-CoV-2 infection, to determine whether methods to improve mask fitting made a difference.

4.2.1.2 Mask use during physical activity

In review

WHO advises that people should not wear masks during vigorous-intensity physical activity *[140]* because masks may reduce the ability to breathe comfortably. The most important preventive measure is to maintain physical distancing of at least 1 metre and to ensure good ventilation when exercising.

Extracted from the guidance titled "Mask use in the context of COVID-19", published 1 December 2020.

Practical info

When community or cluster transmission of SARS-CoV-2 is experienced in local context, particular attention should be paid to ensuring physical distancing of at least 1 metre between persons outside of their households and frequent cleaning and disinfection of any public environment in which exercise is performed, especially high-touch surfaces. As well, if the activity takes place indoors, adequate ventilation (e.g. 10 litres of air exchange per second, per person occupying an indoor space) should be ensured at all times through natural ventilation or a properly functioning and maintained ventilation system *[147]*. If all the above measures cannot be ensured, consider temporary closure of public indoor exercise facilities (e.g. gyms).

Evidence to decision

Benefits and harms

There are limited studies on the benefits and harms of wearing medical masks, respirators and non-medical masks while exercising. Several studies have demonstrated statistically significant deleterious effects on various cardiopulmonary physiologic parameters during mild to moderate exercise in healthy subjects and in those with underlying respiratory diseases *[141][145][146][148][149][150]*. The most significant impacts have been consistently associated with the use of respirators and in people with underlying obstructive airway pulmonary diseases such as asthma and chronic obstructive pulmonary disease (COPD), especially when the condition is moderate to severe *[146]*. Facial microclimate changes with increased temperature, humidity and perceptions of dyspnoea were also reported in some studies on the use of masks during exercise *[145][151]*. A recent review found negligible evidence of any negative effects of mask use during exercise but noted concern for individuals with severe cardiopulmonary disease *[152]*.

4.2.2 Mask use by children

Guiding Principles

Given the limited evidence on the use of masks by children in the context of COVID-19, including limited evidence on transmission of SARS-CoV-2 in children at specific ages, policy formulation by national authorities should be guided by the following overarching principles.:

- Do no harm: the best interest, health and well-being of the child should be prioritized.
- The application of these guidelines should not impact development or learning outcomes, including access to education.
- The guidelines should consider the feasibility of implementing recommendations in different social, cultural and geographic contexts, including limited resource and humanitarian settings, and among children with disabilities or specific health conditions.
- Any recommendation for mask use for children should encompass needed flexibility to enable children to maintain their rights to play, to education and ability to engage in everyday activities *[5]*.
- National policies on the use of masks for children should be adapted based on social, cultural and environmental considerations, including in settings with limited resources and humanitarian settings.

4.2.2.1 Introduction

Introduction
WHO guidance on the use of masks for children in the community was first published in August 2020 as an annex to the document Mask use in the context of COVID-19 *[154][153]*. In December 2021, it was incorporated into the online version 1.0 of the WHO IPC COVID-19 living guideline published using the MAGICapp platform *[155]*. This updated version includes new recommendations for mask use by children of different ages, accommodations for children living with disabilities and updated implementation considerations, including for school settings.

WHO and UNICEF jointly developed this guideline. A guideline development group, the *WHO-UNICEF GDG for the use of masks by children in the context of COVID-19*, was established. Details on the composition of the GDG and the retrieval, synthesis and assessment of evidence can be found in the methods and acknowledgements sections of the document.

When aiming to reduce community transmission and mitigate the impact of COVID-19 outbreaks on health and social services, policies developed for mask use should be included as one element of a comprehensive package of preventive measures to reduce transmission (ventilation, physical distance, hand hygiene, and respiratory etiquette). In any decision being made related to the use of masks by children, the guiding principles for the best interest of children and a “do no harm” approach should prevail.

Each country is facing a different situation in the pandemic depending on a number of factors including the intensity of SARS-CoV-2 circulation, amount of population level immunity, capacities to respond and agility to adjust measures. As the pandemic continues and the virus evolves, changes in transmission intensity, the circulating variant of concern, and the capacities for health systems to respond based on the situation will result in need for policy adjustments related to IPC and PHSM. National policies should be evidence based, agile and adjusted as needed taking into consideration these and other factors. Countries should conduct an assessment of the transmission scenario and the health system response capacity – and assign a situational level to a geographic area. The assessment should examine quantitative and qualitative information from available sources, and can refer to the situational and community transmission (CT) Levels CT1-CT4 as described in, *Considerations for implementing and adjusting public health and social measures in the context of COVID-19 [51].* Additional factors, including population level immunity, will need to be taken into account when setting national and sub-national policies, as outlined above.

This section of the guideline focuses on the use of masks in children in the context of COVID-19 in community settings, such as schools and recreational areas. Children spend a considerable portion of their time in schools, which may have indoor and outdoor areas, and there are existing specific guidance documents available that address school-related public health measures.

Recommendations on types of masks can be found in the mask use in community settings section of the document.

There are five statements for the use of masks by children, including three recommendations by age group (≤ 5, 6-11, 12 and over), and two good practice statements.

Published 7 March 2022

SARS-CoV-2 Transmission in Children

Disease severity and mortality due to COVID-19 including infections with VOCs increases with age, and children tend to present with a milder course of illness than older population groups *[156][92][157]*. The transmission characteristics among children need to be interpreted in light of new VOC's, in particular, Omicron; vaccination strategies and age-specific vaccination coverage and changes in mixing patterns as a result of the implementation of PHSM. Evidence early in the pandemic from household, serological and infection prevalence studies suggested that young children may be at lower risk of infection than adolescents and adults and potentially transmit SARS-CoV-2 less *[156][157][159][160][161][162][163][164][165][166][167][168][169]*. However, more recent epidemiological trends seem to indicate that children contribute to transmission similarly to adults, due to their social mixing patterns in some settings and in light of emerging VOC's such as Omicron *[170][171][172][173][174][175]*. This has been well documented in settings where extensive community testing has been undertaken (e.g. the REACT study in the United Kingdom) *[176]*. The European Centre for Disease Prevention and Control (ECDC) reported the age distribution of COVID-19 among children, as of July 2021, in the European Union (EU), European Economic Area (EEA) and the United Kingdom. They found that children made up an increasing proportion of weekly case numbers, with the most noticeable increase among those aged 5-11 years. These findings should be interpreted in light of the proportion of vaccinated adolescents, social mixing patterns by age and adults in those countries at the time *[157][171]*

Studies from high-income countries have also shown that in some settings, children tend to have more extensive social mixing patterns than adults and consequently more contacts than adults *[173]*. Thus even though the propensity to transmit may be lower for children, in some settings, they may be contributors to transmission as a consequence of their social mixing patterns, especially if PHSMs have been relaxed *[170][161][162][169][177][178][179]*.

The Omicron variant has resulted in very high levels of incidence in most countries, across all age groups, with higher incidence levels than observed earlier in the pandemic *[170]*. There is currently limited evidence to suggest a difference in transmission risk of Omicron according to age group, other than that modulated by vaccination, but more data are required. In the context of the Delta and Omicron VOC increased transmission and growth rates have been documented *[170]*.

Published 7 March 2022

Figure 1. When should children wear masks?

Published 25 April 2022

4.2.2.2 Age specific recommendations

Recommendation for children 5 years of age and under

Conditional recommendation against , Very low certainty evidence

Masks are not required for children 5 years of age and under

Published 7 March 2022

Practical info

Implementation considerations

As mask use is not recommended in this age group, IPC and public health and social measures should be prioritized to minimize the risk of SARS-CoV-2 transmission.

- Adults and staff working with children should follow national guidelines for vaccination against COVID-19.
- Adequate ventilation* should be in place and maintained in settings where children are congregating or cared for.
- Adults and staff working with children should wear masks (see WHO recommendations for mask use in adults).
- Adequate sanitation and hygiene requirements and a regimen for environmental cleaning and disinfection should be in place in settings where children congregate or are cared for.
- Children should be taught to perform frequent hand hygiene and respect respiratory etiquette using an age-appropriate approach and materials.

In the event that policymakers decide to adjust the age range for mask recommendations (i.e. children under the age of five years would utilize a mask), relevant settings should have adequate human resources to ensure safe mask use. Adoption of the mask recommendation should include appropriate and consistent supervision by an adult and the ability to ensure mask compliance and adherence, especially if mask-wearing is expected for an extended period. The guiding principles of the best interest of children and a “do no harm” approach should prevail.

**For adequate ventilation refer to regional or national institutions or heating, refrigerating and air-conditioning societies implementing ventilation requirements. If recommendations are not in place, a recommended ventilation rate of 10l/s/ person should be met (except in healthcare facilities which have specific requirements). For more information, consult Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 [9].*

Evidence to decision

Benefits and harms

Uncertain benefits and harms

The wearing of a well-fitted mask is associated with a decrease in SARS-CoV-2 transmission in the community and provides protective benefits to the individual *[32][26]*. A systematic review on the clinical effectiveness of masks included two RCT and three observational studies in adult populations, which provided some evidence that mask-wearing in the community is associated with decreased risk of COVID-19 infection *[26][?][104][111][112][101][102]*. The systematic review found inconsistent effects of masks on reducing the risk of influenza-like illness (ILI) in community settings, although a cluster RCT found that hand hygiene and face masks may prevent household transmission of influenza if applied early after symptom onset in an index case *[131]*. A systematic review evaluating 21 ecological studies in adults reports that mask use is associated with reducing mortality, the incidence of disease, and hospitalization in the community in the context of COVID-19 *[32]*. Studies from the United States, Spain, Germany and

the United Kingdom looked at the effectiveness of mask use in ages 4-18; and eleven studies reported an association between mask use and decreased COVID-19 incidence in children *[180][181][182][183][184][185][186][187][188][189][190].* , These studies were generally observational and ecological with important shortcomings including limited reporting of other infection control measures and exposures.

The systematic review did not find evidence of serious harms with masks in adults in community settings, although bothersome harms were common. Evidence on potential harms, specifically in children aged five years or younger, is limited. Parents who completed an online survey conducted in France reported behavioural and mood changes (e.g. anxiety, sadness, anguish), headaches, speaking difficulties and breathing discomfort attributed to mask-wearing *[191]*. There is currently no evidence on the long-term impact of mask use on the physical and mental health, development and wellbeing of children.

Given the lack of direct evidence in this age group, evidence was extrapolated from adults. The GDG found that evidence from adults is less applicable (more indirect) to children five and under compared to older children due to lower COVID-19 incidence and severity. Even if masks are associated with the same relative reduction in COVID-19 incidence in children five and under as in adults, the absolute benefits would be smaller due to lower incidence and severity. Furthermore, benefits in children five and under are likely further reduced due to suboptimal adherence.

Additionally, despite the limited/lack of evidence on harms in this age group, there were concerns regarding potential greater harms with regard to childhood development. The GDG, therefore, determined that given the above information, the benefits of mask-wearing in children aged five and under are trivial to none and do not outweigh potential harms.

Certainty of the Evidence

Very low

The evidence certainty is very low due to the limited evidence in this age group and lower applicability of evidence in adults to this age group compared to older children.

Values and preferences

Substantial variability is expected or uncertain

The GDG determined that given the close balance of benefits and harms, different preferences (e.g. focusing on potential benefits in terms of reducing infection risk versus focusing on potential developmental harms) could change the decision. Therefore, variability in preferences/values could impact judgments about mask use in this population.

Resources

No important issues with the recommended alternative

Research evidence

Given that masks are not recommended for this age group, minimal resource implications are anticipated.

Summary

Given that masks are not recommended for this age group, minimal resource implications are anticipated.

Equity

Effect on equity variable

Risk factors that increase the likelihood of contracting COVID-19 include race, ethnicity, and community-level socioeconomic status *[192][193].*

The GDG assessed effects on equity as uncertain or variable, because masks are not required in this age group, but

would depend upon how mask use is implemented. If masks are widely available, using masks could improve equity by reducing the risk of transmission overall, including among socioeconomically disadvantaged groups more impacted by COVID-19. However, there is a need to ensure that lack of access to masks does not negatively impact children (which would decrease equity) and that certain populations (such as disabled individuals) are not adversely impacted.

Acceptability

There is a significant lack of evidence as to the acceptability of mask use for children in this age group across different contexts*[194][180]*. Additionally, despite limited evidence on harms in this age group, there are concerns regarding potential greater harms with regard to childhood development.

The GDG felt that the acceptability of mask use in children under five years of age is variable.

Feasibility

The GDG judged that use of masks is less feasible in this age group since it requires more supervision and children may have more difficulty wearing masks for prolonged periods and during certain activities.

Justification

The GDG determined that benefits of masks in children <5 years did not outweigh harms. This was based on the low certainty evidence and the lower incidence (and severity) of SARS-CoV-2 transmission in this age group relative to older children and adults. The GDG also considered the low acceptability and preference for mask use and agreed that a recommendation for the use of masks for this age group was not appropriate.

Decisions for children under the age of five years to wear masks may be informed by factors such as contact with high-risk individuals, local incidence of COVID-19, ability to adhere to and tolerate mask-wearing, local vaccination rates and parental preferences. There was agreement among the GDG members that in settings where children of this age group are congregating – for example, childcare settings – it is important to adhere to PHSM and IPC measures including adequate ventilation, hand hygiene and environmental hygiene measures, regardless of whether or not masks are used.

Recommendation for children 6 - 11 years of age

Conditional recommendation for , Low certainty evidence

In areas where there is known or suspected community transmission[1] of SARS-CoV- 2, masks are recommended for use in children ages 6-11 years in the following settings:

- in indoor settings where ventilation is known to be poor or cannot be assessed, or the ventilation system is not properly maintained[2], regardless of whether physical distancing of at least 1 metre can be maintained[3]
- in indoor settings that have adequate ventilation** if physical distancing of at least 1 metre cannot be maintained

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[1] Details on the levels of community transmission (CT1-CT4) can be found in *Considerations for implementing and adjusting public health and social measures in the context of COVID-19 [51].*Countries should regularly assess the intensity of spread and health systems capacities at the most localized levels possible.

[2] *For adequate ventilation refer to regional or national institutions or heating, refrigerating and air-conditioning societies implementing ventilation requirements. If regulations are not in place, a recommended ventilation rate of 10l/s/person should be met (except in healthcare facilities which have specific requirements). For more information, consult Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 [9].*

[3] *Physical distance should be increased beyond 1 metre whenever feasible.*

Published 7 March 2022

Practical info

Implementation considerations

Countries should regularly assess the intensity of spread and health systems capacities at the most localized levels possible. The assessment should examine the quantitative and qualitative information from available sources and can refer to the situational level (S0-S4) and community transmission (CT) Levels CT1-CT4 as described in *Considerations for implementing and adjusting public health and social measures in the context of COVID-19 [51]* Additional factors, including population level immunity, will need to be taken into account when setting national and sub-national policies.

Policy and decision-makers are encouraged to ensure the following considerations are addressed when implementing the use of masks in this age group.

- Factors that can influence the decision on implementing the use of masks include the age range in this group, the impact on education and development, routine activities, equity and the general health and wellbeing of children.
- Masks should be made accessible (free of charge) to children in schools, health care settings and any setting where they congregate (e.g. recreational areas), to ensure all children – including those living in households or geographic areas with social vulnerabilities and limited resources – have equitable access. No child should be denied access to these activities for not wearing a mask.
- Efforts should be made to accommodate children who do not have access to masks or are unable to tolerate a mask so they can participate in activities involving face-to-face gatherings. No child should be denied access to these activities for not wearing a mask.
- Routine mask breaks should be implemented when children are expected to wear masks for a longer duration.
- The child's capacity to adhere to correct mask use and availability of appropriate supervision should be addressed, especially in younger children within this age group.

- Age-appropriate communication should aim to help the child understand the purpose and proper use of mask-wearing.
- The design of masks for children should take into consideration the safety and overall quality of the material and ensure a proper fit without compromising breathability, comfort and child-friendliness (appropriate size, colours, patterns).
- Key stakeholders should develop and implement strategies for ensuring that each reusable mask is worn by one child and stored safely, for disposal of soiled masks (e.g. in dedicated bags or containers) and addressing the need for masks to be changed when soiled or wet.
- The use of masks is part of a comprehensive package of preventive measures to reduce transmission including ventilation, physical distance, hand hygiene and respiratory etiquette.

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

The wearing of a well-fitted mask is associated with a decrease in SARS-CoV-2 transmission in the community and provides protective benefits to the individual *[32][26]*. A systematic review on the clinical effectiveness of masks included two RCT and three observational studies in adult populations that provided some evidence that mask-wearing in the community is associated with decreased risk of COVID-19 infection *[26]*. The systematic review found inconsistent effects of masks on reducing the risk of ILI in community settings, though a cluster RCT found that hand hygiene and face masks may prevent household transmission of influenza if applied early after symptom onset in an index case *[131]*. A systematic review evaluating 21 ecological studies in adults report that mask use is associated with reducing mortality, the incidence of disease, and hospitalization in the community *[32]*. Studies from the United States, Spain, Germany and the United Kingdom looked at the effectiveness of mask use in ages 4-18. Ten studies reported an association between mask use and decreased COVID-19 incidence in children. However, these studies were generally observational and ecological with several limitations, including limited reporting of other control measures *[181][182][183][184][185][186][187][188][189][190]*. Furthermore, two studies of influenza (one RCT and one observational study) found a reduced incidence with mask-wearing in households and school settings *[131][134]*.

The systematic review did not find evidence of serious harms with masks in adults in community settings, although bothersome harms were common. Evidence on potential harms, specifically in children aged 6-11, is limited. Parents who completed an online survey conducted in France - among whom only 9% had children over the age of 11-reported behavioural and mood changes (e.g. anxiety, sadness, anguish), headaches, speaking difficulties and breathing discomfort attributed with mask-wearing *[191]*. There is currently no evidence on the long-term impact of mask use on the physical and mental health, development and wellbeing of children.

The GDG previously determined that in adults, mask use in community settings is likely associated with a decreased risk of SARS-CoV-2 infections compared with no mask-wearing. The evidence is indirect since it is from adults. Emerging variants such as SARS-CoV-2 B.1.617.2 (Delta) and SARS-CoV-2 B.1.1.529 (Omicron) have been reported to have increased transmissibility *[26]*. The GDG judged that the benefits in this group are smaller than in adolescents 12 years and older, given lower incidence/severity and reduced adherence (at least in the younger children in this age range).

Evidence on the harms in this age group is also limited. An online survey conducted in France amongst parents of children in a wide age range (<6 years to >11 years) found that parents attributed behavioural change and mood changes (e.g. anxiety, sadness, anguish) headaches, speaking difficulties and breathing discomfort to mask-wearing *[191]*. However, another study in the United States of America found no apparent adverse biological effects (e.g. impacts on memory, heart rate, oxygen saturation, and emotional state) after mask wearing for at least 30 minutes in elementary school children *[195]*. There is currently no evidence on the long-term impact of mask use on the physical and mental health, development and wellbeing of children.

The evidence is indirect since it is from adults; the GDG judged that the benefits in this age group are smaller than in adolescents under 12, given lower incidence/severity and reduced adherence (at least in younger children in this age range). Therefore the GDG judged that the benefits of mask-wearing slightly outweigh the harms. Benefits are likely to be larger in situations in which the risk of infection are higher, e.g. poor ventilation and/or unable to physical distance.

Certainty of the Evidence

Low

There is limited evidence on the benefits and harms of mask-wearing in this age group. Although ecological studies that include children aged 4-18 years have reported an association between mask mandates and a reduced incidence of infection these studies were judged to be low quality, with few studies available from low and middle-income countries *[181][182][183][184][185][186][188][189][190][198][199]*. Even though this evidence is largely indirect, it was judged by the GDG to have applicability, especially to older children in this group.

Values and preferences

Substantial variability is expected or uncertain

Substantial variability in preferences, ideas and values is expected regarding the potential outcomes of mask use (prevention of SARS-CoV-2 infection, side effects). Such differences could have an impact on the decision to use masks in this age group.

The GDG determined that given the close balance of benefits and harms, different preferences (e.g., focusing on potential benefits in terms of reducing infection risk versus focusing on potential harms.) could change the decision. Consequently variability in preferences/values could impact judgments about mask use in this population.

Resources

No important issues with the recommended alternative

Research evidence

There is no formal data available on costs. Given the widespread availability and relatively low costs of non-medical and medical masks, the GDG judged costs and resource availably to be low.

Summary

There is no formal data available on costs. Given the widespread availability and relatively low costs of non-medical and medical masks, the GDG judged costs and resource availably to be low.

Equity

Effect on equity variable

Risk factors that increase the likelihood of contracting COVID-19 include race, ethnicity, and community-level socioeconomic status *[192][193]*.

The GDG assessed effects on equity as uncertain or variable as it depends on mask use is implemented. If masks are widely available using masks could improve equity by reducing the risk of transmission overall, including among socioeconomically disadvantaged groups more impacted by COVID-19. However, there is a need to ensure that lack of access to masks does not negatively impact children (which would decrease equity) and that certain populations (disabled individuals) are not adversely impacted.

Acceptability

The limited evidence available indicates variability in the acceptance of masks in children aged 6 to 11. One online study found that parents were generally opposed to children between the ages of 6-10 wearing masks, especially in school settings. Other studies reported that children in this age group demonstrated good adherence to mask-wearing, in particular in school settings *[180][188][196]*.

The GDG decided to make a conditional recommendation despite the low certainty evidence because the benefits of mask-wearing – reduction of SARS-CoV-2 transmission and access to schools – outweigh potential harms, and preferences and values and acceptability generally all favour mask-wearing.

Feasibility

Adherence is generally feasible in this age group, though there may be some issues in younger children within this range *[180][197]*.

Justification

Although there may be a net benefit in mask wearing, this was judged to be small. After reviewing the limited evidence available on the effectiveness of mask use in this age group, a survey was completed by GDG members, among whom 80% voted in favour of a conditional recommendation for mask use. Other factors informing the conditional recommendation were low certainty of evidence, variability in preferences and values that could impact decisions and some variability in acceptability and feasibility.

Settings in which the recommendation applies were also discussed, and members voted 70% in favour of applying the recommendation to indoor settings where ventilation is known to be poor or cannot be assessed or the ventilation system is not adequate and where a distance of at least 1 metre cannot be maintained. The GDG acknowledged the importance of the guiding principles noted earlier, including the right to play and the importance of children continuing to attend school in the context of the COVID-19 pandemic.

Recommendation for adolescents 12 years of age or older

Strong recommendation for , Low certainty evidence

Adolescents 12 years or older should follow the same WHO recommendations for mask use as adults.

Published 7 March 2022

Practical info

Implementation considerations

Policy and decision-makers are encouraged to ensure the following considerations are addressed when implementing the use of masks in this age group, irrespective of vaccination status.

- Even where national guidelines apply, additional considerations and adaptations for special settings such as schools, during sports or for children with disabilities or underlying medical conditions will need to be specified.
- Masks should be made accessible free of charge to children in schools, health care settings and any setting where they congregate (such as recreational areas) to ensure all children – including those living in households or geographic areas with social vulnerabilities and limited resources – have equitable access. No child should be denied access to these activities for not wearing a mask.
- Efforts should be made to accommodate children who do not have access to masks or are unable to tolerate a mask so they can participate in activities involving face-to-face gatherings. No child should be denied access to these activities for not wearing a mask.
- Routine mask breaks should be implemented when children are expected to wear masks for a longer duration.
- Age-appropriate communication should aim to help the child understand the purpose and proper use of mask-wearing.
- Key stakeholders should develop and implement strategies for ensuring each reusable mask is worn by one child and stored safely, for disposal of soiled masks (e.g. in dedicated bags or containers) and for addressing the need for masks to be changed when soiled or wet.
- The use of masks is part of a comprehensive package of preventive measures to reduce transmission, including ventilation, physical distance, hand hygiene and respiratory etiquette.

Evidence to decision

Benefits and harms

Small net benefit, or little difference between alternatives

The wearing of a well-fitted mask is associated with a decrease in SARS-CoV-2 transmission in the community and provides protective benefits to the individual *[32][26]*. A systematic review on the clinical effectiveness of masks included two RCT and three observational studies in adult populations that provided some evidence that mask-wearing in the community is associated with decreased risk of COVID-19 infection *[26]*. The systematic review found inconsistent effects of masks on reducing the risk of ILI in community settings, though a cluster RCT found that hand hygiene and face masks may prevent household transmission of influenza if applied early after symptom onset in an index case *[131]*.

A systematic review evaluating 21 ecological studies reports that mask use is associated with reducing mortality, the incidence of disease, and hospitalization in the community *[32]*.Studies from the United States, Spain, Germany and the United Kingdom looked at the effectiveness of mask use in ages 4-18; twelve studies reported an association between mask use and decreased COVID-19 incidence *[181][182][183][184][185][186][187][188][189][190][198][199]*. However, these studies were generally observational and ecological with important shortcomings including limited reporting of other infection control measures and exposures.

The systematic review did not find evidence of serious harms with masks in adults in community settings, although bothersome harms were common. Evidence on potential harms specifically in adolescents 12-18 years of age is limited. Parents who completed an online survey conducted in France-among whom only 9% had children over the age of 11-reported behavioural and mood changes (e.g. anxiety, sadness, anguish), headaches, speaking difficulties and breathing discomfort attributed with mask-wearing *[191]*.

The GDG previously determined that in adults, the use of masks in community settings is likely associated with a decreased risk of SARS-CoV-2 infections compared with no mask-wearing. The GDG found that evidence on the use of masks in community settings in adults is likely applicable to adolescents 12 and older due to the similarity in the incidence of SARS-CoV-2 infection (compared with young adults) and ability to adhere to mask-wearing. Emerging variants such as SARS-CoV-2 B.1.617.2 (Delta) and SARS-CoV-2 B.1.1.529 (Omicron) have been reported to have increased transmissibility *[26]*.

The GDG judged the benefits, such as reduced transmission and facilitating increased access to schools/in-person learning, in adolescents to be small but agreed that in the context of the Delta and Omicron variants, the benefits of mask-wearing in the community setting outweigh potential harms.

Certainty of the Evidence

Low

There is limited evidence on the benefits and harms of mask-wearing in this age group. Although ecological studies that include children aged 4-18 years have reported an association between mask mandates and a reduced incidence of infection these studies were judged to be low quality with few studies available from low and middle-income countries *[181][182][183][184][185][186][187][188][189][190][198][199]*. Evidence on the effectiveness of masks in adolescents can also be extrapolated from adults. Even though this evidence is indirect, it was judged by the GDG to be more applicable to this age group due to the similarity in incidence and severity of SARS-CoV-2 infection in young adults and adolescents.

Values and preferences

No substantial variability expected

There is limited data available on adolescents' perception of the value and benefits or harms of wearing masks. Some studies conducted in European settings looking at parental perceptions, showing mixed results but generally favouring mask use in children over the age of 12 *[196][200][201]*. Given the potential benefits of masks for preventing infections and considering the presence of bothersome but non-serious harms, the GDG determined that differences in values/ preference regarding outcomes would not impact the decision to wear masks. This supports a strong recommendation, despite the low certainty of evidence.

Resources

No important issues with the recommended alternative

Research evidence

There is no formal data available on costs. Given the widespread availability and relatively low costs non-medical and medical masks, the GDG judged the impact of costs and resource availably to be low.

Summary

There is no formal data available on costs. Given the widespread availability and relatively low costs non-medical and medical masks, the GDG judged the impact of costs and resource availably to be low.

Equity

Important issues, or potential issues not investigated

Risk factors that increase the likelihood of contracting COVID-19 include race, ethnicity, and community-level low socioeconomic status *[192][193].*

The GDG assessed effects on equity as uncertain or variable as it depends on how mask use is implemented. If masks are widely available using masks could improve equity by reducing the risk of transmission overall, including among socioeconomically disadvantaged groups more impacted by COVID-19. However, there is a need to ensure that lack of access to masks does not negatively impact children (which would decrease equity) and that certain populations (such as disabled individuals) are not adversely impacted.

Acceptability

No important issues with the recommended alternative

This recommendation was assessed by the GDG as likely acceptable in this age group. Studies on the perception of the effectiveness of mask use are limited and generally focused on European countries for children over the age of 10. The GDG considered the limited evidence and discussed knowledge of practice in their respective countries, including the evolution of acceptance of mask use as the pandemic has continued and the emergence of VOC. The GDG agreed that for children over the age of 10mask-wearing was generally regarded as useful *[196][200][201]*.

Feasibility

No important issues with the recommended alternative

GDG members noted that masks are widely recommended and used in many contexts throughout the world in this age group. The feasibility of implementing this recommendation was judged to be acceptable and feasible given low concerns about tolerance and likely higher adherence to mask-wearing in older age groups *[180]*.

Justification

The GDG considered the low certainty of evidence and, although the majority of the evidence was in the adult population, felt it was reasonable to extrapolate from (young) adults. The GDG noted that the benefits of mask use, such as potential reduction in transmission and ability to keep schools functioning, outweighed any potential bothersome harms and considered other factors (not preference-sensitive, low costs, acceptability, feasibility) and believed that this supported a strong recommendation.

4.2.2.3 Special populations

Good practice statement

Children with cognitive or respiratory impairments, developmental disorders, disabilities[1] or other specific health conditions who experience difficulties wearing a mask or have health conditions that interfere with mask-wearing should not be required to wear a mask.

[1]*According to the Convention on the Rights of persons with disabilities, children with disabilities "include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis" [202].*

Published 7 March 2022

Practical info

Implementation considerations

- The individual decision for a child to wear a mask should be discussed in consultation with the child's medical provider when possible.
- A safe environment should be created for children who are not able to tolerate a mask, including requirements for caregivers, teachers or other adults interacting with the child to wear a mask when interacting with the child and to be vaccinated against COVID-19 according to national vaccination policies.
- The use of masks with a transparent component may be considered for children with hearing impairment and people who interact with them, where available. These masks should meet approved regulatory standards, if available.

Justification

The GDG acknowledged that children with several health conditions may experience difficulties or harm while wearing a mask. Despite little direct evidence but considering equity and ethical issues, the GDG determined that a good practice statement was justified.

Good practice statement

The use of a medical mask is recommended for children with a higher risk[1] of severe complication from COVID-19 but should be assessed in consultation with the child's medical provider.

[1]This includes paediatric patients with underlying non-communicable diseases (for example, diabetes, cardiac disease, chronic lung disease, chronic kidney disease, immunosuppression, obesity, mental disorders and cancer) and those living with HIV *[47]*.

Published 7 March 2022

Justification

The GDG noted that in some low-resource settings there may be challenges for families to access medical masks or have access to a health care provider. It was proposed that in some circumstances it may be more appropriate for caregivers to wear a mask when interacting with the child. In conclusion, the GDG agreed that while there is no direct evidence, a good practice statement was justified due to this population's higher risk of COVID-19 complications.

4.2.2.4 Implementation considerations for use of masks in schools

Implementation considerations

Policy and decision-makers are encouraged to consider the following when implementing mask-wearing by children in school settings.

- Policies should be evidence based, agile and adjusted as needed taking into consideration factors such as changes in transmission intensity, the circulating variant of concern and the capacities for health systems to respond based on the situation.
- No child should be denied access to education because of mask-wearing or the lack of a mask due to low resources or unavailability.
- The views of teachers and educators on risks and time burden required to ensure mask adherence by children should be considered while ensuring that national policies are followed.
- Situations where wearing a mask can significantly interfere with the learning process or have a negative impact on critical school activities such as physical education,or sports and recreation (during which they may reduce ability to breathe comfortably) and meal programmes, require special consideration.
- Specific instructions and supplies should be provided for the availability, safe handling and storage of masks.
- A sufficient supply of appropriate masks should be ensured.
- Masks should not increase social inequalities in access to schools, especially for marginalized communities. No child should be denied access to these activities for not wearing a mask
- Basic water, sanitation, hygiene, ventilation, and space requirements should be met in the school building so that IPC and PHSMs can be implemented.
- If disposable masks are used, a system for waste management of used masks needs to be established to reduce the risk of contaminated masks being disposed of in the classroom and recreational or sports settings.

The recommendations for wearing masks in the different age groups of children in this document supersede those existing in other WHO documents published prior to this update. The following guidance documents can be used to inform policy making and programming for a comprehensive school safety strategy when re-opening or during normal operations in the context of COVID-19:

- WHO considerations for school-related public health measures in the context of COVID-19
- WB/WFP/UNESCO/UNICEF framework for school reopening
- WHO/UNICEF/IFRC Interim Guidance for COVID-19 Prevention and Control in Schools

Published 7 March 2022

Justification

GDG members agreed that the recommendations on mask-wearing in this document should be implemented in the context of school settings. They also noted the importance of applying existing public health and social measures and infection prevention and control measures in schools, in addition to mask-wearing.

4.3 Home care for patients

The guidance for "Home care for patients with suspected or confirmed COVID-19 and management of their contacts: interim guidance" was published 12 August 2020. This guidance is under review and is pending integration into "Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline".

4.4 Water, sanitation, hygiene, and waste management

The guidance for "Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19" was published 29 July 2020. This guidance is under review and is pending integration into "Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline".

4.5 Safe dead body management

The guidance for "Infection prevention and control for the safe management of a dead body in the context of COVID-19: interim guidance" was published 4 September 2020. This guidance is under review and is pending integration into "Infection prevention and control in the context of coronavirus disease (COVID-19): A living guideline".

5. Acknowledgements

5.1 Part 1: Health care setting authorship, acknowledgement and contributions

Authorship, contributions, and acknowledgments
WHO would like to thank the collaborative efforts of all those involved to make this process rapid, efficient, trustworthy, and transparent.

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Declaration of conflicts of interest
Researchers may be eligible to sit on GDGs. However, the participation of researchers who have been involved in any ‘major academic programme of work that concerns the intervention, approach, or exposure under consideration in the guideline, including conducting trials or systematic reviews and publishing conclusions or opinion on the benefits and/or harms’ should be carefully considered and managed by the Responsible Technical Officer and director of the relevant technical unit. In most cases, such involvement would constitute a conflict of interest, and should be appropriately managed by limiting their participation in the process (i.e. provide specific information but be excluded from the formulation of recommendations and/or discussion), or if significant interests are identified, full recusal. As an observer, a member can follow the discussions and may be permitted by the Chair to speak and/or to respond to technical questions the other GDG members may have.

Disclosures of interests for all members are reviewed by the WHO secretariat in consultation with the Ethics Office, prior to deliberations. The following conflicts of interest were reviewed and managed accordingly:

Dr J. Conly is an author of a randomized controlled trial used as one piece of evidence to determine the type of mask to use while caring for a suspected or confirmed COVID-19 patient. Given his role as a researcher, he has recused himself from discussions and development of the recommendation for health and care workers on masks and respirator use.

Dr Y. Li is an author involved in various research studies and in particular opinion papers concerning the use of N95 and medical masks. His participation was restricted to observing the GDG meeting on this topic without being involved in the discussion and/or formulation of recommendations.

Dr T. Okwor partook as a member of the rapid review team for the reviews on cleaning and disinfection in the community. Dr. Okwor recused themselves from the decision-making process.

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Declaration of conflicts of interest
Dr R. Chou is an author on some of the evidence used to inform some recommendations. However, as a methodologist, he provided guidance to the GDG on methodologic issues and is not a voting member of the GDG. In some meetings, he presented evidence and provided clarification on methods to guide discussions regarding the EtD tables; however, all decisions were made by voting members of the GDG.

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Declarations of interest of external reviewers were collected and assessed, and no conflict of interest was identified for these thematic areas.

Published 09 October 2023

5.2 Part 2: Community settings authorship, acknowledgements and contributions

5.2.1 Mask use in the community authorship, acknowledgements and contributors

Authorship, contributions and acknowledgments
WHO would like to thank the collaborative efforts of all those involved to make this process rapid, efficient, trustworthy and transparent.

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Declaration of conflicts of interest
Dr R. Chou is an author on some of the evidence used to inform some recommendations. However, as a methodologist, he provided guidance to the GDG on methodologic issues and is not a voting member of the GDG. In some meetings, he presented evidence and provided clarification on methods to guide discussions regarding the EtD tables; however, all decisions were made by voting members of the GDG.

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Published 13 January 2023

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Declaration of conflicts of interest

***R. Chou* is an author on some of the evidence used to inform some recommendations. However, as a methodologist, he provided guidance to the GDG on methodologic issues and is not a voting member of the GDG. In some meetings, he presented evidence and provided clarification on methods to guide discussions regarding the EtD tables; however, all decisions were made by voting members of the GDG**

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Declaration of conflicts of interest

Dr F. Lessa reported she is an employee of the United States CDC who provided funding towards the development of this guideline. After consulting with the WHO Ethics Committee, it was determined Dr Lessa could contribute to discussions as she brings significant technical and field expertise to the discussions but would be recused from voting on recommendations

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Declarations of conflicts of interest

- *J. Klein* reported receipt of a grant from the International Pediatric Association and UNICEF for contribution of child health and COVID -19 information to pediatric societies. No actions were required.
- *E. Maughan* reported she is also a member of the WHO Technical Advisory Group of Experts on Educational Institutions and COVID-19. No actions were required.
- *Professor F. Russell* declared receipt of funds for research to study school outbreak data and develop mitigation strategies for return to school from the Department of Health, Victoria. No actions were required.

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Published 7 March 2022

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Published 09 October 2023

6. Annexes

6.1 Annex 1. Evidence tables for mask use in the community

This section contains a table highlighting the application of GRADE to the available literature reviewed for mask use in community settings.

Table 2.1 GRADE table for assessment of mask versus no mask use in the community setting

Outcome	**SARS-CoV-2 infection**
Number and type of studies	2 RCTs *[101][102]*and 10 observational studies *[103][104][105][106][107][108][109][110][111][112]*.
Study limitations	Serious
Consistency	No serious inconsistency
Precision	No seriousimprecisions*
Directness	Direct
Strength of evidence	Low-to-moderate
Main findings	2 RCTs: adjusted prevalence ratio 0.90 (95% CI 0.82 to 0.995) for symptomatic SARS-CoV-2 seroprevalence and OR 0.82 (95% CI 0.52 to 1.23) for SARS-CoV-2 infection. 10 observational studies: OR/HR/RR estimates ranged from 0.04 to 0.86 in 8 studies *[103][104][105][106][107][108][109][110][111][112]*; One additional study of health workers reported an imprecise estimate for mask use outside work (yes vs. no; OR 2.35; 95% CI 0.67 to 8.25) *[111]* and one study found mask use in a household with an index case of SARS-CoV-2 infection associated with a decreased risk of secondary infection of family members (all family members using mask all the time vs. no family members [OR 0.20; 95% CI 0.07 to 0.60])*[112]*.

RCT, randomized controlled trial; OR, odds ratio; HR, hazard ratio; RR, relative risk; CI, confidence interval.

*The RCTs had methodological limitations, including open-label design, attrition, incomplete outcome assessment, variable adherence, and differential recruitment. The RCTs were consistent and were not downgraded for imprecision (due to the very large total sample size [greatly exceeding any optimum information size threshold] with a precise estimate from one of the trials). One trial evaluate a mask recommendation directly; although the other evaluated a mask promotion intervention and did not evaluate mask use or a mask recommendation directly, this resulted in suboptimal uptake of make use and would underestimate the effects of mask use. Therefore, the RCTs were not downgraded for indirectness.

Published 13 January 2023

6.2 Annex 2. Evidence tables for mask use by children

This section contains two tables highlighting the application of GRADE to available literature reviewed for mask use by children.

Table 3.1. GRADE table for assessment of masks versus no mask use in community settings

Outcome	SARS-CoV-2 infection
Number and type of studies	2 RCT and 3 observational studies*[104][111][112][101][102]*
Consistently	Moderate

Precision	Some imprecision*
Directness	Some indirectness*
Strength of evidence	Low-to-moderate
Main findings	RCT1 (cluster): Mask promotion intervention associated with increased mask use and decreased risk of symptomatic SARS-CoV-2 seroprevalence; adjusted prevalence ratio of 0.91, 95% CI 0.82 to 1.00 *[101]* RCT 2: OR 0.82, 95% CI 0.52 to 1.23 *[102]* Two observational studies reported inconsistent and imprecise estimates for mask use vs no mask use in community settings outside the home *[111][112]*. One observational study found mask use by all members of a household or prior to index case illness onset associated with decreased risk of secondary infection vs no mask use *[104]*.

Note: All studies were conducted in settings without widespread delta variant. Also, ecological studies were not included in this table but consistently found policies requiring masks were associated with decreased risk of SARS-CoV-2 infection.

*Of 2 RCTs, one reported an imprecise estimate while the other evaluated an indirect intervention (mask promotion)

Table 3.2 GRADE assessment of observational and ecological studies on mask effectiveness

	Adult Studies	**Ecological Studies**	**Influenza Studies**
Outcome	SAR-CoV-2 infection	SARS-CoV-2 infection	SARS-CoV-2 infection
Number of studies	2 RCTs and 3 observational studies *[104][111][112][101][102]*	13 *[181][182][183][184][185][186][187][188][189][190][196][198][199]*.	1 RCT *[131]*and 1 observational study *[134]*.
Risk of bias	Moderate	High [2]	Moderate
Consistency	Consistent	Consistent	Consistent
Precision	Some imprecision	Some imprecision	Some imprecision [4]
Directness	Serious indirectness [1]	Serious indirectness [3]	Serious indirectness [5]
Strength of evidence	Low	Very low	Very Low

1 Different population, adult evidence strength rated as moderate. Rated down 1 for children.

2 Studies did not control for the effect of concurrent interventions.

3 Different interventions. Studies did not assess actual mask-wearing or adherence to the intervention

4 RCT outcomes had wide confidence intervals (0.31 - 0.087)

5 Different outcomes were measured. Different population. RCT was a cluster household trial including adults and children. Differences in the intervention: RCT randomized households to facemasks plus ‘enhanced hand hygiene’ (educational materials provided).

Published 07 March 2022

6.3 Annex 3. Systematic review for prevention, identification, management of COVID-19 in health and care workers

PICO Questions

The PICO questions included in this systematic review were:

1. ***Should health and care workers be tested following a high-risk exposure to SARS-CoV-2?***
2. ***Should routine testing of asymptomatic health and care workers for COVID-19 surveillance be conducted?***
3. ***Should health and care workers who have had a positive test or have indication of active SARS-CoV-2 infection be excluded from work (isolate in designated setting) versus continuing to work?***
4. ***What should be the duration of exclusion from work/isolation for health and care workers (infectious period)?***

Q1. Should health workers be tested following a high-risk exposure to SARS-CoV-2?	
Setting	Health care facilities
Background interventions	Defining high risk exposures (breaches in PPE, inappropriate PPE) Review evidence to determine if testing is still needed
Population	Health workers
Intervention	Continue with normal duties (no testing) or proceed to quarantine
Comparator(s)	Not being tested and continuing to provide care • NB To compare groups, there would need to be some metric reported of positive testing, either detected by the testing intervention protocol, or health workers calling in sick, or reporting a positive home test)
Outcome	Infection with SARS-CoV-2 following an exposure • Suggest reporting findings in the manner of Blazeby et al. 2021 https://www.comet-initiative.org/Studies/Details/1594) and possibly also including (if available) severity of disease, missed days at work/ loss of income/ staffing shortages).
Potential effect modifiers	As above

Q2. Should routine testing of asymptomatic health workers for COVID-19 surveillance be conducted?	
Setting	Health care facilities
Background interventions	Standard of care
Population	Health workers
Intervention	Periodic testing of health workers (at what intervals, and in what type of transmission scenario (community, or sporadic, low case risk)?)
Comparator(s)	Testing according to need when a known exposure occurs, or when

	symptomatic
Outcome	Percentage of study population testing positive by (PCR) compared to the percentage with self-reported infection
Potential effect modifiers	As above

Q3. Should health workers who have had a positive test or have indication of SARS-CoV-2 infection be excluded from work (isolate in designated setting) versus continuing to work? **Sub-question: what should be the duration of exclusion from work/isolation for health workers (infectious period)?**	
Setting	Health care facilities
Background interventions	Current standard of care
Population	Health workers
Intervention	Excused from work (for X days)
Comparator(s)	Continue with normal duties (no work exclusion)
Outcome	Reduction in secondary transmission from infected health workers in specific facilities
Potential effect modifiers	As above

Q4. What should be the duration of exclusion from work/isolation for health workers (infectious period)? **Sub question: symptomatic versus asymptomatic (different types of symptoms reporting and testing to be considered)** **Sub question: test versus no test**	
Setting	Health care facilities
Background interventions	Standards of care
Population	Health workers
Intervention	Returning to work after SARS-CoV-2 infection recovery
Comparator(s)	10+3 days is current guidance
Outcome	Infectious period of SARS-CoV-2 (we can draw from literature which was included in the evidence for the Contact Tracing guidance update)
Potential effect modifiers	As above

Search terms

"health personnel"~3 OR "healthcare personnel"~3 OR "health provider"~3 OR "health providers"~3 OR "healthcare provider"~3 OR "healthcare providers"~3 OR "health worker"~3 OR "health workers"~3 OR "healthcare worker"~3 OR "healthcare workers"~3 OR "health proffessional"~3 OR "health proffesionals"~3 OR "healthcare professional"~3 OR "healthcare professionals"~3 OR "healthcare staff" OR "health care staff" OR "healthcare staffs" OR "health care staffs" OR "health workforce"~3 OR "healthcare assistant" OR

"healthcare assistants" OR "health assistant"~3 OR "health assistants"~3 OR "Community Health Aides" OR "Community Health Aide" OR "Family Planning Personnel" OR "Village Health Workers" OR "Village Health Worker" OR "Barefoot Doctors" OR "Barefoot Doctor" OR "Family Planning Personnel" OR "Dental Auxiliary" OR "Dental Receptionist" OR "Dental Receptionists" OR "Dental hygienist" OR "Dental hygienists" OR "Emergency Medicine Technicians" OR "Emergency Medicine Technician" OR Paramedic* OR "Emergency Medical Technician" OR "Emergency Medical Technicians" OR "Home Health Aide" OR "Home Health Aides" OR "Home Care Aides" OR "Home Care Aide" OR "care home staff"~3 OR nurse* OR "advanced practice provider" OR "advanced practice providers" OR "Nursing Assistant" OR "Nurses' Aides" OR "Nurse's Aides" OR "Nurses Aides" OR "Nurses' Aide" OR "Nursing Auxiliaries" OR "Nursing Auxiliary" OR "Nurse Aide" OR "Nurse Aides" OR "Operating Room Technician" OR "Operating Room Technicians" OR "surgical technician" OR "Surgical technicians" OR "Scrub technicians" OR "Scrub Technician" OR "Surgical staff" OR "Surgical staffs" OR "Pharmacy Technician" OR "Pharmacists' Aides" OR "Pharmacist Aides" OR "Pharmacist's Aides" OR "Pharmacists Aides" OR "Pharmacists' Aide" OR "Physical Therapist Assistant" OR "Physical Therapy Assistants" OR "Physical Therapy Assistant" OR "Doctor's Assistant" OR "Doctor Assistant" OR "Doctors Assistant" OR "Physicians' Extender" OR "Physician Extender" OR "Physician's Extender" OR "Physicians Extender" OR "Physicians' Extenders" OR "Physician Extenders" OR "Physician's Extenders" OR "Doctor's Assistants" OR "Doctor Assistants" OR "Physicians' Assistants" OR "Physician's Assistants" OR "Physicians Assistants" OR "Physicians' Assistant" OR "Physician Assistant" OR Feldsher* OR Anesthesiologist* OR anesthetist* OR "Anaesthesiology assistant" OR perfusionist* OR Caregiver* OR Carer* OR "Care Givers" OR "Care Giver" OR "Case Manager" OR "Case Managers" OR "Care Manager" OR "Care Managers" OR Coroner* OR "Medical Examiner" OR "Medical Examiners" OR "mortuary staff" OR mortition* OR "autopsy technician" OR "autopsy technicians" OR "Dental Staff" OR "Dental staffs" OR "dental practitioner" OR "dental practitioners" OR Dentist* OR *dontist* OR "Dentofacial Orthopedists" OR "Dentofacial Orthopedist" OR Doula* OR "Labor Coaches" OR "Labor Coach" OR "Labour Coach" OR "Labour Coaches" OR Midwife OR Midwives OR "Maternity staff" OR "Maternity Staffs" OR "Emergency Medical Dispatchers" OR "911 Dispatcher" OR "911 Dispatchers" OR "9-1-1 Dispatcher" OR "9 1 1 Dispatcher" OR "9-1-1 Dispatchers" OR "Emergency dispatcher" OR "Emergency dispatchers" OR Epidemiologist* OR "Dental Faculty" OR "Dental Faculties" OR "Medical Faculties" OR "Medical Faculty" OR "Nursing Faculties" OR "Nursing Faculty" OR "Health Educator" OR "Health Educators" OR "Health Facility Administrator" OR "Health Facility Administrators" OR "Hospital Administrator" OR "Hospital Administrators" OR "Infection Control Practitioner"~3 OR "Infection Control Practitioners"~3 OR "infection prevention staff"~3 OR "infection prevention staffs"~3 OR "Laboratory Personnels" OR "Laboratory Personnel" OR "Laboratory Scientists" OR "Laboratory Scientist" OR "Medical Technologists" OR "Medical Technologist" OR "Laboratory Technicians" OR "Laboratory Technician" OR "Laboratory Assistants" OR "Laboratory Assistant" OR microbiologist* OR "Medical Staff" OR "Medical Staffs" OR "medical personnel" OR "medical practitioner" OR "Medical practitioners" OR Physician* OR "Hospital Registrar" OR "Hospital Registrars" OR "hospital staff" OR "hospital staffs" OR "hospital Personnel" OR nurse* OR "nursing personnel" OR "Patient tehnician"~3 OR "Emergency room Technician" OR "Emergency department technician" OR "Health Visitors" OR "Health Visitor" OR "nursing staff" OR "nursing staffs" OR "Occupational Therapist" OR "Occupational Therapists" OR Pathologist* OR Optometrist* OR "Hospital Administrator" OR "Hospital Administrators" OR "Hospital Volunteer" OR "Hospital Volunteers" OR pharmacist* OR "Physical Therapist" OR "Physical Therapists" OR Physiotherapist* OR physician* OR doctor* OR Allergist* OR immunologist* OR Anesthesiologist* OR Cardiologist* OR Dermatologist* OR Endocrinologist* OR "Medical Graduate" OR "Medical Graduates" OR "Medical resident" OR "Medical residents" "Medical students" OR "medical student" OR "Gastroenterologist" OR "Hepatologists" OR "Hepatologist" OR "General Practitioner" OR "General Practitioners" OR "Medical Practioner"~2 OR "Medical Practioners"~2 OR "Geriatrician" OR "Gerontologists" OR "Gerontologist" OR *Gynecologist* OR Obstetrician* OR *Gynaecologist* OR Hospitalist* OR internisit OR internist OR internists OR Intensivist* OR Nephrologist* OR Neurologist* OR Haematologist* OR hematologist* OR Oncologist* OR Opthalmologist* OR Optometrist* OR Osteopath* OR Otolaryngologist* OR Otologist* Or rhinologist* "ENT specialist" OR Pathologist* OR "Pathology assistant" OR "Pathology Assistant" OR Pediatrician* OR Neonatologist* OR Physiatrist* OR Podiatrist* OR Toxicologist* OR Pulmonologist* OR Radiologist* OR Rheumatologist* OR *Surgeon* OR Orthopedist* OR exodontist* OR Urologist* OR Psychotherapist* OR psychologist* OR *Therapist* OR "Social workers" OR "Social Workers" OR healer* OR "practitioners medicine"~3 OR "Respiratory technician" OR Radiographer* OR "radiology technician" OR "MRI technician" OR sonographer*

Search output using health worker terms

#	Search	Results (review filter)	MESH	results(all)

1	"health personnel"~3 OR "healthcare personnel"~3 OR "health provider"~3 OR "health providers"~3 OR "healthcare provider"~3 OR "healthcare providers"~3 OR "health worker"~3 OR "health workers"~3 OR "healthcare worker"~3 OR "healthcare workers"~3 OR "health proffessional"~3 OR "health proffesionals"~3 OR "healthcare professional"~3 OR "healthcare professionals"~3 OR "healthcare staff" OR "health care staff" OR "healthcare staffs" OR "health care staffs" OR "health workforce"~3	2107	**Health Personnel**	**30,865**
2	"healthcare assistant" OR "healthcare assistants" OR "health assistant"~3 OR "health assistants"~3 OR paramedic*	55	**Allied health professional**	1751
4	"Community Health Aides" OR "Community Health Aide" OR "Family Planning Personnel" OR "Village Health Workers" OR "Village Health Worker" OR "Barefoot Doctors" OR "Barefoot Doctor" OR "Family Planning Personnel"	7	Community Health Workers	
5	"Dental Auxiliary" OR "Dental Receptionist" OR "Dental Receptionists" OR "Dental hygienist" OR "Dental hygienists"	0	Dental Auxiliaries	11
6	"Emergency Medicine Technicians" OR "Emergency Medicine Technician" OR Paramedic* OR "Emergency Medical Technician" OR "Emergency Medical Technicians"	1	Emergency Medical Technicians	29
7	"Home Health Aide" OR "Home Health Aides" OR "Home Care Aides" OR "Home Care Aide" OR "care home staff"~3	0	Home Health Aides	25
8	nurse* OR "advanced practice provider" OR "advanced practice providers"	513	Licensed Practical Nurses	11176
9	"Nursing Assistant" OR "Nurses' Aides" OR "Nurse's Aides" OR "Nurses Aides" OR "Nurses' Aide" OR "Nursing Auxiliaries" OR "Nursing Auxiliary" OR "Nurse Aide" OR "Nurse Aides"	2	Nursing Assistants	

10	"Operating Room Technician" OR "Operating Room Technicians" OR "surgical technician" OR "Surgical technicians" OR "Scrub technicians" OR "Scrub Technician" OR "Surgical staff" OR "Surgical staffs"	0	Operating Room Technicians	
11	"Pharmacy Technician" OR "Pharmacists' Aides" OR "Pharmacist Aides" OR "Pharmacist's Aides" OR "Pharmacists Aides" OR "Pharmacists' Aide"	1	Pharmacy Technicians	
12	"Physical Therapist Assistant" OR "Physical Therapy Assistants" OR "Physical Therapy Assistant"	0	Physical Therapist Assistants	
13	"Doctor's Assistant" OR "Doctor Assistant" OR "Doctors Assistant" OR "Physicians' Extender" OR "Physician Extender" OR "Physician's Extender" OR "Physicians Extender" OR "Physicians' Extenders" OR "Physician Extenders" OR "Physician's Extenders" OR "Doctor's Assistants" OR "Doctor Assistants" OR "Physicians' Assistants" OR "Physician's Assistants" OR "Physicians Assistants" OR "Physicians' Assistant" OR "Physician Assistant" OR Feldsher*	3	Physician Assistants	
14	Anesthesiologist* OR anesthetist* OR "Anaesthesiology assistant" OR perfusionist*	41	**Anaesthetists**	
17	Caregiver* OR Carer* OR "Care Givers" OR "Care Giver"	306	**Caregivers**	5204
18	"Case Manager" OR "Case Managers" OR "Care Manager" OR "Care Managers"	1	**Case Managers**	
19	Coroner* OR "Medical Examiner" OR "Medical Examiners" OR "mortuary staff" OR mortition* OR "autopsy technician" OR "autopsy technicians"	0	**Coroners and Medical Examiners**	
20	"Dental Staff" OR "Dental staffs" OR "dental practitioner" OR "dental practitioners"	16	**Dental Staff**	
21	Dentist* OR *dontist*	225	**Dentists**	
23	"Dentofacial Orthopedists" OR "Dentofacial Orthopedist"	1	Orthodontists	

24	Doula* OR "Labor Coaches" OR "Labor Coach" OR "Labour Coach" OR "Labour Coaches" OR Midwife OR Midwives OR "Maternity staff" OR "Maternity Staffs"	0	**Doulas**	
25	"Emergency Medical Dispatchers" OR "911 Dispatcher" OR "911 Dispatchers" OR "9-1-1 Dispatcher" OR "9 1 1 Dispatcher" OR "9-1-1 Dispatchers" OR "Emergency dispatcher" OR "Emergency dispatchers"	0	**Emergency Medical Dispatcher**	
26	Epidemiologist*	31	**Epidemiologists**	
27	"Dental Faculty" OR "Dental Faculties"	0	**Faculty, Dental**	
28	"Medical Faculties" OR "Medical Faculty"	5	**Faculty, Medical**	
29	"Nursing Faculties" OR "Nursing Faculty"		**Faculty, Nursing**	
30	"Health Educator" OR "Health Educators"		**Health Educators**	
31	"Health Facility Administrator" OR "Health Facility Administrators"	1	**Health Facility Administrators**	
32	"Hospital Administrator" OR "Hospital Administrators"	2	Hospital Administrators +	
33	"Infection Control Practitioner"~3 OR "Infection Control Practitioners"~3 OR "infection prevention staff"~3 OR "infection prevention staffs"~3	3	**Infection Control Practitioners**	45
35	"Laboratory Personnels" OR "Laboratory Personnel" OR "Laboratory Scientists" OR "Laboratory Scientist" OR "Medical Technologists" OR "Medical Technologist" OR "Laboratory Technicians" OR "Laboratory Technician" OR "Laboratory Assistants" OR "Laboratory Assistant" OR microbiologist*		**Medical Laboratory Personnel**	
36	"Medical Staff" OR "Medical Staffs" OR "medical personnel" OR "medical practitioner" OR "Medical practitioners"	210	**Medical Staff**	**3828**
37	Physician* OR "Hospital Registrar" OR "Hospital Registrars" OR "hospital staff" OR "hospital staffs" OR "hospital Personnel"	691	Medical Staff, Hospital +; Personnel, Hospital	**14,555**
38	nurse* OR "nursing personnel" OR "Patient tehnician"~3 OR "Emergency room Technician" OR "Emergency department technician"	486	**Nurses**	

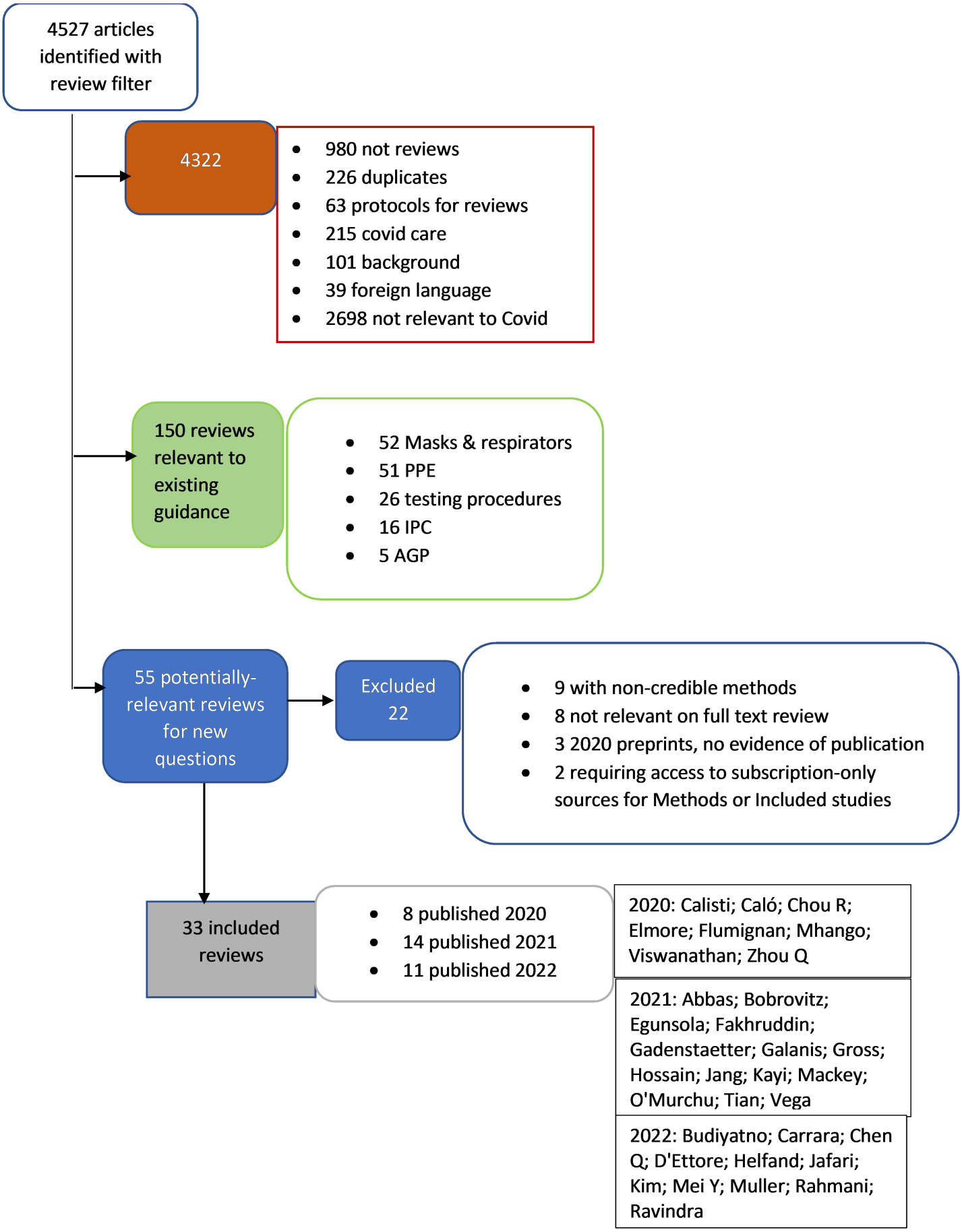
42	"Health Visitors" OR "Health Visitor"	0	Nurses, Community Health	
46	"nursing staff" OR "nursing staffs"	43	Nursing Staff	
49	"Occupational Therapist" OR "Occupational Therapists" OR Pathologist*	7	**Occupational Therapists**	
50	Optometrist*	0	**Optometrists**	
53	"Hospital Administrator" OR "Hospital Administrators"	2	Hospital Administrators +	
54	"Hospital Volunteer" OR "Hospital Volunteers"	0	Hospital Volunteers	
56	pharmacist*	73	Nursing Staff, Hospital	
58	"Physical Therapist" OR "Physical Therapists" OR Physiotherapist*	34	**Physical Therapists**	
60	physician* OR doctor*	903	**Physicians**	20354
61	Allergist* OR immunologist*	11	Allergists	
62	Anesthesiologist*	33	Anesthesiologists	
63	Cardiologist*	12	Cardiologists	
64	Dermatologist*	35	Dermatologists	
65	Endocrinologist*	4	Endocrinologists	
66	"Medical Graduate" OR "Medical Graduates" OR "Medical students" OR "medical student"	9	Foreign Medical Graduates	
67	"Gastroenterologist" OR "Hepatologists" OR "Hepatologist"	3	Gastroenterologists	
68	"General Practitioner" OR "General Practitioners" OR "Medical Practioner"~2 OR "Medical Practioners"~2	46	General Practitioners	1132
69	"Geriatrician" OR "Gerontologists" OR "Gerontologist"	3	Geriatricians	
	Gynecologist OR Obstetrician* OR *Gynaecologist*			
70	Hospitalist* OR internisit OR internist OR internists OR Intensivist*	4	Hospitalists	
71	Nephrologist*	13	Nephrologists	
72	Neurologist*	32	Neurologists	
	Haematologist* OR hematologist*			
74	Oncologist*	33	Oncologists +	
75	Opthalmologist* OR Optometrist*	42	Ophthalmologists	
76	Osteopath*	5	Osteopathic Physicians	
77	Otolaryngologist* OR Otologist* Or rhinologist* "ENT specialist"	40	Otolaryngologists	
78	Pathologist* OR "Pathology assistant" OR "Pathology Assistant"	22	Pathologists	
79	Pediatrician* OR Neonatologist*	31	Pediatricians +	
80	Physiatrist* OR Podiatrist*	1	Physiatrists	
	toxicologist*			
84	Pulmonologist*	9	Pulmonologists	

85	Radiologist*	40	Radiologists +	
86	Rheumatologist*	27	Rheumatologists	
87	*Surgeon* OR Orthopedist* OR exodontist*	205	Surgeons +	
88	Urologist*	34	Urologists	
89	Psychotherapist* OR psychologist* OR *Therapist* OR "Social workers" OR "Social Workers"	5	Psychotherapists	
90	healer* OR "practitioners medicine"~3		Practitioners of Traditional Medicine	
91	"Respiratory technician"			
92	Radiographer* OR "radiology technician" OR "MRI technician" OR sonographer*		Imaging	

Stratification issues relevant to synthesizing and reporting the literature for each question

Element	Stratification issues
Setting	Definition/ description of health care facilities (e.g. acute care hospitals – various units such as ER, ICU, community care, primary care). Risk stratification of infection potential in settings
Population	Health workers - suggest reporting findings in a similar manner to Nguyen et al (34). Include all health workers in an overview, and then report by sub-groups to account for risks within the facility. Health worker demographics (age, gender, health status, etc.). Stratification of health worker risk of infection by role, tasks and settings
Potential effect modifiers	Vaccination status, health worker's health status, health worker settings and duties, health worker knowledge about risk minimization, contact 'dose' (amount of time spent in close contact with potential source), dose-response risk of infection, circulation of variants of concern, availability of PPE, correct use of PPE.
Implementation considerations	• COVID-19 infection risk stratification according to settings. • COVID-19 infection risk stratification according to health worker roles / responsibilities. • vaccination status of health workers and risk of reinfection in those who have been vaccinated versus those who have not (35). • type of testing (PCR, rapid antigen, self-testing), sensitivity/ specificity, how it is administered (by professional or self-collected), costs • behaviours, perspectives, availability and use of PPE • PPE cost, acceptability, waste disposal

PRISMA Flowchart for included studies



Studies characteristics

Table 1. Author, year, preliminary critical appraisal score, study aim

Author	Year	Aim
Abbas	2021	explore current literature in Hospital-onset COVID-19 infections surveillance
Bobrovitz	2021	synthesize seroprevalence data to better estimate the level and distribution of SARS-CoV-2 infection among health workers? identify high-risk groups, and inform public health decision making
Caló	2020	critically analyze the evidence on surveillance and risk to support public health strategies that protect health workers in hospital settings
Carrara	2022	test asymptomatic individuals, including health and care workers? OR test asymptomatic health and care workers?
Chen	2022	describe COVID-19 reinfection in health and care workers?
Chou	2020	examine the burden of SARS-CoV-2 on health and care workers and risk factors for infection
D'Ettore	2022	evaluate the literature and discover what are the latest developments about the management of the occupational health surveillance of HCWs during COVID-19 pandemic.
Egunsola	PP 2021	identify comparative observational studies and randomized controlled trials (RCTs) evaluating the efficacy and effectiveness of COVID-19 vaccination in reducing forward transmission from vaccinated people (health and care workers and the general population), and studies examining the biological plausibility of vaccination-induced transmission reduction.
Elmore	2020	generate a rapid evidence map of risk and protective factors to comprehensively inform areas that impact COVID-19 outcomes for different sub-populations to better protect the public.
Fakhruddin	2021	is SARS-CoV-2 detectable in the saliva of asymptomatic individuals?
Flumignan	2020	identify and summarize the evidence from Cochrane systematic reviews regarding measures for controlling the dissemination of COVID-19 infection.
Gadenstaedter	2021	provide an overview of nasal specimen collection methods for SARS-CoV-2 detection in various populational groups, including HW
Galanis	2021	determine the seroprevalence of SARS-CoV-2 antibodies among HW, and identify the factors associated with this seroprevalence.
Gross	2021	examine health risks at workplaces regarding COVID-19, and effectiveness of preventative recommendations.
Helfand	2022	synthesize evidence on protection against reinfection after SARS-CoV-2 infection in various population groups, including health workers.
Hossain	2021	determine seroprevalence of SARS-CoV-2 IgG antibodies over geographic regions among health workers.
Jafari	2021	identify evidence on IPC practices/measures adopted by hospitals
Jang	2021	review whether national and international guidelines provide recommendations for infection prevention and control to prevent the spread of COVID-19 in hospitals.
Kayi	2021	investigate the seroprevalence of SARS-CoV-2 among health and care workers and related risk factors by including studies published in 2020 which were conducted before the unpredictable effects of highly spreading new variants appeared and vaccination programmes put in place in 2021.
Kim	2022	evaluate the diagnostic utility of self-collected saliva in coronavirus desease-19 (COVID-19) screening procedures
Mackey	2021	synthesize evidence on the prevalence, levels, and durability of the antibody response to SARS-CoV-2 infection among adults and how antibodies correlate with protective immunity.

Mei	2022	identify optimal health and care workers monitoring mechanisms and provide practical recommendations for administrators, leaders, policy makers.
Mhango	2020	identify risk factors for COVID-19 in health and care workers.
Muller	2022	review and appraise the evidence of SARS-CoV-2 seroprevalence and its risk factors in health and care workers in Africa to inform response and preparedness strategies during the SARS-CoV-2 pandemic..
O'Murchu	2021	evaluate the risk and relative risk of SARS-CoV-2 reinfection over time, comparing previously infected individuals to those without evidence of prior infection.
Rahmani	2022	synthesize the available evidence for the duration of SARS-CoV-2 infectivity of working age populations
Ravindra	2022	investigate the role of asymptomatic infection and transmission reported in family clusters, adults, children, and health and care workers.
Tian	2021	investigate risk factors for health and care worker infection in viral respiratory pandemics.
Vegas	2021	analyze evidence concerning the risks of occupational illnesses to which health and care workers providing care to patients infected with COVID-19 are exposed.
Viswanathan	2020	assess (1) the effectiveness of universal screening for SARS-CoV-2 infection compared with no screening and (2) the accuracy of universal screening in people who have not presented to clinical care for symptoms of COVID-19.
Zhou	2021	compares the incidence of nosocomial infections during the COVID-19, SARS and MERS epidemics and analyzes the characteristics of the nosocomial infections.

Table 2. Description of included reviews

Author	Year	Type of paper	Category	Setting
Chen	2022	SR & MA	Antibody protection against reinfection	any healthcare setting
Chou	2020	Living Rapid Review	Burden of disease	any healthcare setting
Budiyatno	2022	SR	Comparative testing procedures	any healthcare setting
Gadenstaetter	2021	SR	Comparative testing procedures	hospital
Kim	2022	SR & MA	Comparative testing procedures	any healthcare setting
Flumignan	2020	Narrative review	Controlling disease transmission (including quarantine, PPE)	hospital
Jafari	2021	SR	Infection control procedures	any healthcare setting
Jang	2021	SR & analysis of guidelines	Infection control procedures	any healthcare setting
Zhou	2020	Rapid review & MA	Nosocomial infection	hospital
Elmore	2020	Rapid Evidence Map	Risk factors for disease	any healthcare setting
Calisti	2020	SR	Risk factors for infection	hospital
Gross	2020	Rapid SR	Risk factors for infection	any healthcare setting
Mhango	2020	rapid review	Risk factors for infection	any healthcare setting
Tian	2021	SR & MA	Risk factors for infection	hospital
Vega	2021	integrative review	Risk factors for infection	any COVID-19 care setting
Helfand	2022	Living Rapid Review	Risk of reinfection	any healthcare setting
O'Murchu	2021	SR	Risk of reinfection	hospitals and LTCF

Fakhruddin	2022	SR & MA	Saliva as SARS-CoV-2 source	dentists
Bobrovitz	2021	SR & MA	Seroprevalence / sero-surveillance	any healthcare setting
Galanis	2021	SR & MA	Seroprevalence / sero-surveillance	hospital, primary healthcare facilities
Kayi	2021	SR & MA	Seroprevalence / sero-surveillance	any healthcare setting
Mackey	2021	Rapid Living Review	Seroprevalence / sero-surveillance	any healthcare setting
Muller	2022	Scoping review, appraisal of existing evidence	Seroprevalence / sero-surveillance	any healthcare setting) African countries)
Hossain	2021	SR & MA	Seroprevalence prior to vaccination	any healthcare setting
Abbas	2021	SR	Surveillance	hospital
Calo	2020	scoping review	Surveillance	hospital
D'Ettore	2022	Narrative review	Surveillance	any healthcare setting
Mei	2022	SR & MA	Surveillance	hospital
Viswanathan	2020	Rapid review	Surveillance	ED
Ravindra	2022	SR & MA	Surveillance of asymptomatic Transmission in clusters	any healthcare setting
Carrara	2022	guidelines	Testing asymptomatic individuals	any healthcare setting
Egunsola	2021 PP	Rapid Literature Review update #1	Vaccination in reducing risk	hospital
Rahmani	2022	SR & MA	Viral shedding and infectivity in workers	any healthcare setting

Published 10 August 2023

6.4 Annex 4: Results of rapid qualitative evidence synthesis

Summary of qualitative evidence synthesis (QES) findings - PPE/Masks (Health and care workers)

Analytical themes	Descriptive themes (review findings)
Health and care workers valued the use of masks and PPE in patient care	PPE gave peace of mind
	Masks create a safety climate to deliver optimal care
Masks and PPE cause physical discomfort to health and care workers	Health and care workers experience physical discomfort wearing masks and PPE
Masks and PPE challenge effective communication	Masks and PPE compromise communication with colleagues
	Masks and PPE affect communication and relationship with patients
	Learning to communicate effectively with patients while wearing a mask
Familiarity with masks and PPE helped health and care workers adapt for COVID-19	Already familiar with PPE pre-pandemic (varies)
	Progressive adaptation over time occurs with masks (varies)
Health and care workers in care homes experienced unequal access to PPE	Inequality in access to PPE
Individual health and care worker factors affecting PPE use	Donning PPE takes time and affects ability to carry out clinical procedures
	PPE design and fit influence risk of contamination

	Questions about the effectiveness of PPE
Health-system factors that prevented PPE use	Availability and supply of PPE (varies)
	Gap between guidelines and protocols and implementation of PPE
Facility-level factors that affected PPE use	Institutional support and role modelling helped PPE use (varies)
	Layout of health facility affected PPE use
Health and care workers were anxious about being put at risk	Anxiety and insecurity about the level of protection
	Perception of susceptibility and risk
Health and care workers responded creatively to the lack of masks/PPE	Re-using, rationing, and improvising with PPE/masks
	Procurement and quality control of masks

Summary of QES findings – Cleaning and Disinfection

Analytical themes	**Descriptive themes (review findings)**
Cleaning is a cornerstone of patient care	Importance of cleaning recognized
Organizational culture affects cleaning practices	Cleaning practices are undervalued (by management)
Individual judgement influences uptake	Differential disinfection practices in risk areas of facility
Historic standards, norms and practices influence uptake	COVID exposed/cracked open poor cleaning practices and standards
Pivoting practice quickly as guidance changed	Lack of clear guidance/changing guidance
Resource considerations for cleaning uptake	Resources required for disinfecting and cleaning
No studies reported on equity and cleaning/disinfecting	

Summary of QES findings – Physical distance (Health and care workers)

Analytical themes	**Descriptive themes (review findings)**
Beliefs and cultural norms compete with the logic of physical distancing	Changing perception of susceptibility and risk
	Community distrust of health professionals and disbelief in COVID-19
	People value cultural norms and beliefs that preclude physical distancing
	Security is a greater priority than physical distancing
Solidarity in not physically distancing	Peer and social pressure to comply (or not) with physical distancing (varies)
	Difficulty complying with physical distancing among friends and family
Physical distancing is a barrier to relational patient care	Physical distancing affects relationships with patients
Difficult to challenge those higher up the hierarchy	Workplace hierarchy influences social distancing
Physical infrastructure prevents physical distancing	Health-facility infrastructure prevents physical distancing
	Infrastructure in IDP camps/ informal settlements influences physical distancing
Service delivery presents barriers to distancing	Clinical workflows require health and care workers to gather in proximity
Social and political factors and physical distancing	Social space supports or discourages physical distancing
	Confusing and contradictory messaging from government /regulatory agencies
No studies reported on costs or resource requirements for physical distancing	

Published 09 October 2023

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