

Infection control in paediatric office settings



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ABSTRACT

Transmission of infection in the paediatric office is of increasing concern. The present document discusses routes of transmission of infection and the principles of current infection control measures. Prevention includes appropriate office design and administrative policies, triage, routine practices for the care of all patients (eg, hand hygiene; use of gloves, masks, eye protection and gowns for specific procedures; adequate cleaning, disinfection and sterilization of surfaces and equipment including toys, and aseptic technique for invasive procedures), and additional precautions for specific infections. Personnel should be adequately immunized, and those infected should follow work-restriction policies.

Key Words: *Ambulatory; Infection control; Infection transmission; Paediatric office*

INTRODUCTION

Young children readily acquire and transmit infections. They frequently harbour infectious organisms and may shed pathogens, especially respiratory and gastrointestinal viruses, even if asymptomatic. In places where young children gather, close proximity of large numbers of infectious and susceptible hosts favours transmission. Behavioural characteristics such as incontinence or inadequate hygiene, frequent mouthing of hands and toys or other objects, drooling and direct contact among children during play facilitate the spread of infection.

Prevention of transmission of infection in the physician's office is an important component of patient care and is of concern to health care providers, patients and parents. There is a large body of data on infections acquired by children admitted to hospital, and there are established infection control protocols to reduce the risk of infection in hospital. However, the risk of acquiring infection in ambulatory care settings, and the efficacy and feasibility of infection control measures in these settings are unknown. Published recommendations specific to physicians' offices are sparse, imprecise in some areas and may be difficult to implement (1-6).

The present statement will discuss published recommendations and areas of controversy, and will provide suggestions and recommendations based on professional opinion. The statement is directed to physicians who care for children

in general office practice. Specialty ambulatory care settings where invasive procedures, such as dialysis, parenteral therapy, endoscopy, or outpatient surgery or dentistry are routinely performed, may require additional measures.

Balancing priorities

Infection control programs are designed to reduce the risk of transmission so that it is at an acceptable level. The consequences of transmission in terms of infection severity and outcome must be weighed against the consequences of preventive measures taken. Practices must be tailored to the level of care being provided and the patient population served (1).

Prevention of transmission of infection and maintaining a child-friendly office may be opposing goals. Physicians must decide whether the benefits of an office in which children are free to play with each other, share toys, and generally have fun and practice their social skills, outweigh the risks of the infections that may be acquired there.

BACKGROUND

Transmission of infection in paediatric ambulatory care settings

Most reported infections acquired in ambulatory care have been the result of procedures performed there – abscesses after injection of contaminated vaccines or medications, viral conjunctivitis from contaminated ophthalmic equipment, transmission of blood-borne viruses from inadequately sterilized equipment, infections complicating outpatient surgery, and infections related to inadequate decontamination of endoscopes (7,8). Hepatitis B and C viruses have been transmitted by contamination of multi-dose vials or due to the use of the same physical space to prepare, dismantle and dispose of injection equipment (9).

Measles has been transmitted in paediatricians' offices. In the 1980s, a large proportion of all cases of measles in the United States were acquired in ambulatory care settings (7,8). Transmission by contaminated air alone was documented in two paediatric office outbreaks (10,11). There are reports of transmission of tuberculosis from physicians to patients in paediatricians' offices (12,13).

Transmission of infections common in the community, such as varicella, pertussis, and viral respiratory and gastrointestinal infections, almost certainly occur in

physicians' offices but has not been reported, perhaps because of the difficulty in distinguishing between office and community exposures. Young children have four to 10 respiratory infections and up to four episodes of gastroenteritis per year (14,15). They may acquire infection in day care, school, crowded shopping malls or recreational centres, or from siblings, parents, other family contacts, friends or caregivers. Only one published study has assessed risk of infection after a visit to a paediatric office. Rates of respiratory and gastrointestinal infections in healthy children younger than three years of age who had visited the office over the preceding week were compared with infection rates in control children from the same paediatric practice who had not visited the office over the preceding week. There was no increased risk of infection; 30% of those who had visited the office and 32% of those who had not visited, developed an infection (16). A pilot study (17) at the Montreal Children's Hospital (Montreal, Quebec) did not find a significant difference in rates of new infections between children who had visited the emergency room over the previous week (17.5%) and those who had not (22.1%).

Factors influencing the risk of transmission

Young children and others who are unable to appropriately handle their respiratory secretions, children with diarrhea who are in diapers or incontinent, and those with infected open wounds or skin lesions are likely to be sources of infection (18).

Organisms that can survive on patient care equipment, environmental surfaces or toys are likely to be passed between patients. Heavy environmental contamination enhances transmission potential, as does a low infective dose. Respiratory viruses and rotavirus have low infective doses and persist for prolonged periods on inanimate objects (19-24). Methicillin-resistant *Staphylococcus aureus* (MRSA) (25) and respiratory syncytial virus (RSV) (26) survive on stethoscope diaphragms. Transmission of RSV from the inanimate environment has been demonstrated (27). Contaminated electronic thermometer bases and blood pressure cuffs have been implicated in the transmission of *Clostridium difficile* and vancomycin-resistant enterococcus (VRE) (28-30).

Children who lack immunity to the infecting agent and those who are ill, debilitated or immunocompromised are at increased risk for disease.

The risk of transmission between patients may be less in an office than on a hospital ward. In offices, the duration of contact between individuals is shorter, patients are generally in better health and fewer invasive procedures are performed. However, patients may remain in crowded common waiting areas for prolonged periods of time; it may not be immediately recognized that a patient has a contagious illness and the need for short turnaround time for examination rooms may hamper cleaning (4). Some practices have chosen to eliminate waiting rooms and place patients directly into examination rooms on arrival (31).

Principles of current infection control guidelines

The current guidelines for the prevention of transmission of infection are based on the following principles:

- Certain measures referred to as **Routine Practices** in Canada (1) and Standard Precautions in the United States (4) are required for the care of all patients regardless of diagnoses and are determined by the task performed. The goal is to prevent transmission from any patient, whether symptomatic or not, assuming that blood, body fluids, excretions and secretions of any patient could contain pathogens.
- Further measures called **Additional Precautions** in Canada (1) and Transmission-based Precautions in the United States (4) are required for patients with specific infections based on clinical presentation, and determined by the methods of transmission of the microorganisms expected or known to be involved. Screening for clinical manifestations of infection is essential in identifying patients for whom Additional Precautions are warranted (Table 1).
- Concern about transmission of respiratory pathogens in ambulatory care settings came to the forefront during the 2003 severe acute respiratory syndrome (SARS) epidemic. This resulted in the recommendation for a new standard of patient behaviour, '**Respiratory Etiquette**', in ambulatory care. Outpatient settings are being urged to implement source containment measures to prevent transmission of respiratory infections beginning at the point of initial patient encounter (2,4,32,33).

Routes of transmission of infection (1,2,4,18)

Contact transmission is the most frequent route and includes direct contact (physical contact between infected and susceptible patients) and indirect contact (via contaminated intermediate surfaces such as hands, equipment and toys). Appropriate routine patient care practices should prevent most transmission by this route. Additional Contact Precautions (wearing gloves and gowns, and disinfection of equipment and surfaces) are warranted for infectious agents of low infective doses (eg, rotavirus) and for situations in which extensive contamination of the patient's environment is expected (eg, watery diarrhea which cannot be contained within a diaper, or a young child with respiratory infection and copious respiratory tract secretions).

Droplet transmission refers to transmission by large droplets that are expelled from the respiratory tract during coughing and sneezing, and inhaled by or deposited onto the respiratory mucous membranes of persons close to the infected child. Special ventilation is not required because the large droplets do not stay suspended in the air, but settle on surfaces close to the source patient. Surgical or procedure masks are recommended for those within 1 m of the patient. Some organisms transmitted by this route (eg, *Haemophilus influenzae* type b, *Neisseria meningitidis* and *Bordetella pertussis*) are very fragile and do not survive in the environment or on hands.

TABLE 1
Illnesses warranting Additional Precautions*

Infection	Precautions	Duration of precautions
Antibiotic-resistant organisms (infection or colonization)	Contact	If patients assessed as at risk to transmit (see text)
Avian influenza [†]	Droplet plus Contact	To 14 days from onset
Enteroviral infection (diagnosed or suspected)	Contact	Duration of illness
Gastroenteritis	Contact	Duration of symptoms or until infectious cause ruled out
Hepatitis, viral (types A and E, diagnosed or suspected)	Contact	Until viral infection ruled out; to 7 days after onset if hepatitis A
Measles (diagnosed or suspected)	Airborne	To 4 days after onset of rash (duration of illness if immunocompromised)
Measles contact, nonimmune, in incubation period	Airborne	From 5 days after the first day of exposure to 21 days after the last day of exposure
Meningitis (diagnosed or suspected)	Droplet plus Contact	
Bacterial	Droplet	Until 24 h of appropriate antibiotic received
Viral	Contact	Duration of illness
Mumps	Droplet	To 9 days after onset of swelling
Mumps contact, nonimmune, in incubation period	Droplet	From 10 days after the first day of exposure to 26 days after the last day of exposure
Pertussis (diagnosed or suspected)	Droplet	Until 5 days of appropriate antibiotic received or pertussis ruled out
Petechial or ecchymotic rash with fever (suspected meningococemia)	Droplet	Until 24 h of appropriate antibiotic received or meningococcus ruled out
Rubella	Droplet	To 7 days after onset of rash
Rubella contact, nonimmune, in incubation period	Droplet	From 7 days after the first day of exposure to 21 days after last day of exposure
SARS [†]	Droplet plus Contact plus N95 masks	10 days after resolution of fever
Scabies (diagnosed or suspected)	Contact	Until initial therapy applied
Skin infection (extensive lesions, abscess or infected wound if drainage or exudate not covered or contained by dressing)	Contact	Duration of drainage or until lesions healed
Streptococcus group A impetigo not covered by dressing	Contact	Until 24 h of appropriate therapy received
Streptococcus group A invasive disease, pharyngitis, pneumonia, scarlet fever	Droplet	Until 24 h of appropriate antibiotic received
Tuberculosis (diagnosed or suspected) infectious form [‡]	Airborne	Until assessed as not infectious
Varicella (diagnosed or suspected)	Airborne plus Contact	Until lesions crusted or varicella ruled out
Varicella contact, nonimmune, in incubation period	Airborne	From 8 days after the first day of exposure to 21 days after the last day of exposure; to 28 days if given varicella zoster immune globulin
Viral respiratory tract infection (diagnosed or suspected – bronchiolitis, cold, croup, pneumonia, pharyngitis)	Droplet plus Contact	Duration of illness or until viral infection ruled out
Zoster (diagnosed or suspected) – not covered	Airborne and Contact	Until lesions crusted or zoster ruled out

*This list is not exhaustive. For infections not listed here, see tables in references 1 and 4; [†]These recommendations may be revised as more information becomes available. Local, provincial or federal authorities should be consulted; [‡]Tuberculosis should be considered to be contagious in those with untreated cavitary pulmonary disease, laryngeal disease, smear-positive sputum, extensive lung involvement or disseminated congenital infection. Young children with tuberculosis are rarely infectious, but adult family members may be and should be assessed for cough. SARS Severe acute respiratory syndrome. Data from references 1,4,38,55-57

Other organisms such as RSV, influenza, parainfluenza, rhinovirus, adenovirus and SARS coronavirus survive long enough on surfaces to be picked up on hands of patients or personnel. For these, droplet and contact transmission occurs. Thus, respiratory viruses may be transmitted by inhalation, by deposition of large droplets onto mucous membranes or by inoculation of nasal mucosa or conjunctiva by contaminated hands. Surgical or procedure masks protect personnel from acquisition by deposition of droplets, and may also help to keep the hands away from the nose and mouth. Eye shields give added protection against infection via the conjunctiva. Face shields or goggles have been shown to prevent RSV infection in health care personnel (34,35). RSV transmission

to personnel was also reduced by the use of gloves in the absence of masks and eye protection, probably because personnel were less likely to touch their noses or eyes with gloved hands, suggesting that for RSV, contact transmission may be more important than droplet transmission (36,37).

Airborne transmission occurs when infectious particles survive in aerosols of small desiccated droplets from the respiratory tract or from skin squames which remain suspended in the air and are dispersed over large distances by air currents. Control requires a negative-pressure room with air exhausted outside the building or passed through a high-efficiency particulate air (HEPA) filter before recirculation. Special tight-fitting masks with built in filters that

TABLE 2
Sterilization and disinfection requirements

Instrument	Level of disinfection	Products
Critical items – items that enter sterile tissue (eg, needles)	Sterilization	Steam, dry heat, chemical sterilants
Semicritical items – items that contact mucous membranes or nonintact skin but do not enter tissue (eg, laryngoscopes, specula)	Sterilization or high-level disinfection	Pasteurization, 2% glutaraldehyde, 0.55% orthophthalaldehyde, 6% to 7.5% hydrogen peroxide with or without peracetic acid, immersion in sodium hypochlorite 5.25% diluted 1:50 for ≥ 20 min, immersion in boiling water for 20 min
Noncritical items* – items that touch only intact skin (eg, stethoscopes or blood pressure cuffs)	Intermediate- or low-level disinfection. Detergent and water considered sufficient by some authorities	70% to 90% ethyl or isopropyl alcohol, sodium hypochlorite 5.25% diluted 1:500, 3% hydrogen peroxide, quaternary ammonium products, iodine, iodophors, 0.5% accelerated hydrogen peroxide, phenolics [†]
Environmental surfaces – doorknobs, table tops, carts, floors	Low-level disinfection or detergent and water	

*If visibly contaminated with blood, use sodium hypochlorite diluted 1:10 to 1:100 or 70% to 90% alcohol; [†]Phenolics should not be used for items that will be in direct contact with the skin of newborns. Data from references 2,3,5,6,40,41,59

remove particles down to 1 μ diameter at a 95% efficacy (N95) are recommended for susceptible persons who must enter the room. Airborne transmission is uncommon but important because varicella, measles, tuberculosis and smallpox are spread by this route. Although evidence suggests that SARS coronavirus is transmitted by large droplet and contact spread, it is thought that small particle aerosols may be generated during certain procedures such as intubation or bronchoscopy (4,38).

N95 masks are rarely needed in paediatricians' offices. Personnel should be immune to varicella and measles; tuberculosis in children is rarely contagious (2). Tuberculosis should be considered contagious in those with untreated cavitary pulmonary disease, laryngeal disease, smear-positive sputum, extensive lung involvement or disseminated congenital infection (39). In the event of an outbreak of a new pathogen such as SARS, or a re-emergence of smallpox, N95 masks may be indicated.

The inanimate environment and infection

Prevention of acquisition of infection from the inanimate environment involves appropriate disinfection and sterilization of equipment and other items, cleaning of surfaces and maintenance of ventilation and plumbing.

For purposes of processing, medical equipment is classified into three groups. Items that are introduced into sterile body spaces (critical) must be sterile. Items in contact with mucous membranes or nonintact skin or through which inspired air flows (semicritical) require high-level disinfection designed to inactivate all microorganisms except bacterial spores. Items that are only in contact with intact skin (noncritical) require low-level disinfection designed to remove most microorganisms and bring contamination to an acceptable level (2-5,40,41).

Most examination equipment in an office setting is in contact with only the intact skin of the patient. Some experts have suggested that cleaning with detergent and water is sufficient for noncritical equipment (6,40,42). A disinfectant should be used if the equipment is contaminated with blood or body fluid. Ideally, all such equipment should be cleaned between patients (1,2,6). If this is not feasible, daily cleaning

may suffice, but equipment must be cleaned before reuse if it is contaminated with patient secretions or excretions or if visibly soiled (1-3). Equipment that does not have direct patient contact should be cleaned on a routine basis and if soiled.

Environmental surfaces should be cleaned on a routine basis, with a low-level disinfectant or detergent (2,3,5,40,41). Frequently touched surfaces should be cleaned daily (2,3). Cleaning with detergent and water may suffice, unless surfaces are contaminated with blood or body fluids (2,40,41) (Table 2).

Toys and transmission of infection

Playing together and sharing of toys contribute to the child's development of social skills. Toys may be considered as part of the equipment of a paediatrician's office, but sharing of toys poses a potential health risk. Microbial contamination of toys has been documented in hospitals, physician's offices and day care centres (43-45). Fecal coliforms and rotavirus have been found on toys in day care centres and in hospital (46,47).

In one study (48) in doctors' offices, toys in waiting rooms were tested at least one week after the last cleaning. Coliforms were found on 90% of soft toys and 13.5% of hard toys. Hard toys that had been cleaned regularly every one to two weeks had lower counts than those from offices with no routine cleaning, while soft toys cleaned every one to two weeks had similar counts to those not cleaned. Hard toys were effectively decontaminated by cleaning and soaking for 1 h in a bleach solution. Soft toys washed in a washing machine remained contaminated, but soaking in bleach for 30 min before washing was effective. By one week of use, soft toys were again contaminated with coliforms, whereas hard toys were not. The authors concluded that soft toys were unsuitable for doctors' waiting rooms (48).

In the guidelines published in 2000 (42), the American Academy of Pediatrics recommended cleaning of toys in offices. In response to these recommendations, some paediatricians eliminated toys from their waiting rooms, finding the cleaning and monitoring of toy use too arduous (49). Physicians must consider the needs of children when weighing the risks and benefits of having toys in their offices.

Toy manufacturers have incorporated antiseptics into plastic toys. There is no evidence that this practice has an impact on contamination of toys with microorganisms or on transmission of infection, nor is there any theoretical basis to support such effects (2,41).

Hand hygiene

Hand hygiene is a crucial element in infection control. Traditionally this has been performed with soap and water. Alcohol-based hand rinses and gels have been shown to be more effective than soap and water for removing microorganisms from hands, and they also save time (1,2,50). Small containers which may be carried in the pocket or clipped to the clothing are readily available for use when needed.

RECOMMENDATIONS

In the absence of data from paediatric office settings, all recommendations are based on expert opinion and extrapolations from other health care settings, with level of evidence rating of B-III (51).

Administrative policies

- Policies and procedures for infection control and prevention should be developed and implemented (2,3). Policies should be reviewed at least every two years (2).
- Ongoing education should be provided for all office personnel and should include how infections are transmitted, infection control measures, recognition of symptom complexes, prevention and management of potential exposures to blood-borne viruses, and cleaning and disinfection of equipment, toys and surfaces (2,4,6).
- A system of communication with local public health authorities should be established and maintained to facilitate systematic reporting of reportable diseases and exchange of information about suspected outbreaks (2).

Office design

- Infection control needs should be considered in office planning (eg, layout, sinks and materials used) (3-6).
- Handwashing sinks with adjacent soap and disposable towel dispensers, as well as waterless hand hygiene products should be available in all patient care areas (2,5,6,40,50).
- Plans should include specific spaces to display signs and place materials for Respiratory Etiquette.
- Carpeting should be avoided in examination and waiting rooms (2,5,6).
- Ventilation for new or renovated medical offices should provide a minimum of six air exchanges per hour (1,2,41).

Triage

Triage should be performed by telephone at the time the appointment is made or as soon as possible after arrival (2-6).

- Immunocompromised children need protection from exposure to patients with transmissible infections, especially respiratory viral infections. They should not wait in a waiting room but should be placed into an examination room on arrival.
- Children with transmissible infections:
 - Parents should be advised to inform the receptionist immediately on arrival if they suspect their child has a contagious illness.
 - Signs should be posted in appropriate locations reminding parents and patients to do this.
 - Children with symptomatic infections should be segregated from well children as quickly as possible. Ideally, those with any contagious illness should not wait in a waiting room but should go to an examination room immediately. As a minimum, children with suspected or diagnosed airborne infections (eg, varicella and measles) should be quickly removed from a common waiting area.
 - In the event of a travel alert concerning a respiratory pathogen, children with respiratory infections should be assessed for possible imported infection by:
 1. Asking about travel outside Canada in the 10 to 14 days before onset of symptoms (time interval may vary depending on the presumed incubation period of the infection) (38).
 2. Asking whether there are any persons in the same household who have a respiratory illness and have travelled in the 10 to 14 days before onset of their illness.
 3. If so, the family should be placed in an examining room immediately.

Waiting rooms

- Patient visits should be scheduled so as to minimize crowding and shorten waiting time (2,6).
- Facilities for hand hygiene (eg, waterless hand hygiene products, or sinks with soap and disposable towels) should be available in the waiting room (2,4).
- Toys in the waiting room
 - Sharing of toys by infants and young children should be minimized (2). Options include:
 1. Consider removing toys from waiting rooms unless use can be supervised and appropriate cleaning is feasible.

2. Ask parents to bring the child's personal toys designed for individual play and avoid sharing these with other children.
3. If toys are provided for infants and young children, they should be easily cleaned (2,5,6). Choose toys with smooth solid surfaces and avoid toys with small pieces and crevices, stuffed toys and toys made of fabric or plush.
4. Ask parents to supervise their child's use of office toys, not to permit toy sharing and to place toys in a designated used toy container when finished. Used toys should be removed from circulation until cleaned.
5. Consider the use of disposable books and disposable toys designed for individual child play.
 - Older children who are mature enough to have appropriate hygienic practices (eg, hand hygiene and handling of respiratory secretions) may share toys, books, puzzles and computer games.
- Contact between children with contagious illnesses and other children should be minimized (2,5,6).
 - Visits should be scheduled for different times of the day, or separate time periods reserved for drop-in visits and for routine appointments (6).
 - Children with vomiting, diarrhea, fever, cough or open skin lesions should remain in the waiting room for as short a time as possible and should not be allowed in common play areas or to handle toys or other shared items.

Routine Practices for care of all patients

Hand hygiene

- All health care personnel should perform hand hygiene with alcohol-based waterless hand rinses or with soap and water (1-6,50).
 - Before and after contact with each patient.
 - After contact with blood, body fluids, secretions, excretions or objects contaminated with these.
 - Before invasive procedures (use antiseptic soap or antiseptic hand rinse).
 - Before preparing or handling sterile medications or other sterile products.
 - After removing gloves.
- Alcohol-based hand rinses should contain 60% to 90% isopropyl or ethyl alcohol (50).
- Soap and water should be used if hands are visibly soiled (2,50).
- Parents and children should be taught the importance of hand hygiene (1,2,6).

- Alcohol-based hand rinses for patient use should be placed out of reach of children, and parents should be advised to supervise their children to avoid accidental ingestion or splashes into the eyes.
- Hand cleansing towelettes are an alternative to soap and water (50).

Personal protective equipment

- Gloves should be worn (1-6):
 - If anticipating direct hand contact with blood, body fluids, secretions or excretions, or items contaminated with these substances.
 - For direct hand contact with mucous membranes or nonintact skin.
 - For direct hand contact with the patient when the health care worker has open lesions on the hands.
- Gloves are not needed for routine child care such as wiping a nose or changing a diaper, if these can be done without direct hand contamination (1,2). Gloves are not routinely required for administering vaccines (2).
- A surgical mask and eye protection (eg, goggles or face shield) should be worn during procedures in which splashing of blood, body fluids, respiratory secretions, or other secretions or excretions into the face is anticipated. A mask should be used only once and changed when wet or soiled. (1-6).
- A gown should be worn to protect clothing during procedures likely to generate splashes of blood, body fluids, secretions or excretions (1-6).

Policies regarding blood-borne pathogens

- Needles and other sharp instruments should be handled with care during use and disposal. Puncture-proof, impermeable, approved sharps disposal containers should be available at the point-of-use where injections or venipunctures are performed. The containers should be kept out of the reach of young children and should not be overfilled (1-3,5,6).
- Spills of blood or bloody body fluids should be contained promptly and cleaned with detergent followed by bleach (1:10 to 1:100 dilution of household bleach using the higher concentration for larger spills). Gloves should be worn during cleaning of blood spills. (2,6,40).
- Mouthpieces, resuscitation bags or other ventilation devices should be provided for use in areas where the need to resuscitate may be required (1,4,6).
- Personnel with potential exposure to body fluids should receive hepatitis B vaccine, be tested for

antihepatitis B antibody after vaccination and be informed of their hepatitis B immune status (52).

- Policies and protocols for management of injuries with used needles or other sharp objects, or other potential exposure to blood-borne viruses, should be available and implemented (2,6,52,53). These should include procedures for injured personnel to obtain immediate advice, clinical assessment and access to postexposure prophylaxis including hepatitis B vaccine, hepatitis B immune globulin, antiretroviral medications and laboratory testing if indicated (2,53).

Disinfection, sterilization and cleaning of equipment and surfaces

- Written policies and protocols for disinfection, sterilization and cleaning should be in place and followed (2,6,40,41).
- Disinfectants approved for health care should be used. (Table 2).
- Level of disinfection required for medical equipment (Table 2) (2,6,40,41):
 - Items entering sterile body spaces (eg, needles) should be disposable or sterilized before re-use.
 - Items in contact with mucous membranes or nonintact skin (eg, thermometer, suture cutter and vaginal speculum) should be disposable or undergo high-level disinfection or sterilization before re-use.
 - Items in contact with intact skin only (eg, stethoscope, otoscope, blood pressure cuff and infant scales) should undergo low-level disinfection (2,3,5,6,40,41) or cleaning with detergent and water (6,40,42). Items contaminated with blood or body fluids should undergo disinfection.
 1. Optimally, these should be cleaned after each use (1,2,6). If this is not feasible, clean daily and if soiled (1-3,6).
 2. Clean bell and diaphragm of stethoscopes, handle and body of otoscopes and ophthalmoscopes, and reusable ear cures with alcohol or disinfectant wipes (2,6) or with soap and water (6,40). Disinfect if contaminated with blood.
 3. Items designed for single-patient use should not be used for more than one patient (3,5,6).
- Clean equipment should be stored where it will not become contaminated (2,6).
- Measures should be taken to avoid contamination of the housing of electronic thermometers, pulse oxymetry and tympanometry equipment, and other frequently handled devices with body fluids, excretions or secretions. Clean daily and when soiled (2,6).

- Frequently touched office items which are difficult to clean (eg, pens, charts, computer keyboard and mouse, personal digital assistant devices and pagers) should be considered as always contaminated; hand hygiene should be performed before patient contact after contact with these items. Computer mice and keyboards should be cleaned daily (2). Use of covers on computer keyboards may facilitate cleaning (5).
- Cleaning of surfaces:
 - The examining table should be covered with disposable paper or cloth which is changed between patients. Clean the table between patients if soiled. If soiled with body fluids or stool, clean and disinfect with bleach (1:100) (2,3,5,6,40).
 - Examination tables, treatment chairs, sinks and other frequently touched surfaces (eg, light switches, door knobs and telephones) should be cleaned daily (1,2,3,6).
 - Washrooms should be cleaned daily and when soiled. Provide a diaper changing area with disposable paper covers and receptacles for used diapers (2,3,6).
 - Surfaces such as countertops, chairs and floors are usually not an infection risk and should be cleaned weekly or on a routine basis and when soiled (2,3,6,40). Other surfaces, including cupboards, walls, windows and air vents, should be cleaned at least annually and as needed to maintain appropriate standard of cleanliness (3).
 - Surfaces may be cleaned with a low-level disinfectant/detergent (2,5,6,40,41) or with a detergent (2,40,41).

Cleaning of toys

- Toys used by infants and young children should optimally be cleaned between use by different patients (2). If this is not possible, toys should be cleaned at the end of the day (5). Toys soiled by body fluids should be removed from use until cleaned (2,5,6).
- Disinfect with 1:100 bleach solution, wash with soap and water and air dry. Alternatively, toys may be cleaned in a dishwasher (2).
- Toys, puzzles and computer games which are used by older children should be cleaned or discarded when soiled. Frequently touched surfaces (eg, knobs, buttons, handles and joy-sticks) should be cleaned daily.
- Large toys which may be considered as part of office furniture and which are frequently touched should be cleaned daily and if soiled.

Aseptic technique and injection safety

- Antiseptic technique should be maintained for immunization, venipuncture, suturing, incision, or

other invasive procedures and for accessing or manipulation of intravascular catheters (2).

- Skin should be prepared with an antiseptic. The preferred agent for venipuncture or immunization is 70% alcohol. For insertion of intravascular catheters and other invasive procedures and for obtaining blood cultures, 2% chlorhexidine, chlorhexidine in 70% alcohol, 10% povidone-iodine or alcoholic tincture of iodine should be used. Povidone-iodine should be left to dry for 2 min (2,6,32).
- Because antiseptics may become contaminated, single-use products are preferable. If multiple-use containers are used, they should be labelled with the date and discarded after 28 days of use (2).
- Multidose medication vials should be avoided if possible. If used: (9)
 - Handle and store with care to maintain sterility of contents and comply with expiry dates.
 - Restrict use to a centralized medication area.
- Separate surfaces should be reserved for the assembly of clean equipment (eg, syringes, needles) or preparation of medications and for the handling of contaminated equipment (9).
- Equipment contaminated with blood or body fluids should be handled in a way that prevents transfer of organisms to other patients and surfaces (9).
- Physical barriers (eg, disposable paper or plastic pads) should be used to prevent surfaces from blood contamination during blood sampling (9).

Respiratory Etiquette

Respiratory Etiquette refers to measures designed to minimize the transmission of respiratory pathogens via the droplet route in health care settings, using source containment beginning at the point of initial patient encounter (2,4,5,54). These measures include:

- Early identification of all persons (patients, parents and others) with febrile respiratory illness in outpatient areas.
- Posting signs at the entrance to the facility or at the reception or registration desk with instructions for patients and those accompanying them to:
 - Inform the receptionist promptly if symptoms of a respiratory infection are present.
 - Cover the mouth and nose with tissues during coughing and sneezing, or if necessary, sneeze or cough into the elbow rather than the hand.
 - Dispose of used tissues in a no-touch receptacle promptly.
 - Perform hand hygiene after hand contact with respiratory secretions.

- Place a surgical or procedure mask on the coughing person if tolerated and if the patient is old enough to wear it.
- Instructing family members with febrile respiratory illnesses to not accompany the patient to the office unless it is essential, in which case they should take the same measures.
- Provision of tissues, no-touch waste receptacles, masks and hand hygiene products.
- Where sinks are placed, ensure that supplies of soap and towels are available.
- Where space permits, place a coughing patient and accompanying persons at least 1 m away from others in common waiting areas.

Additional Precautions (Table 1)

Airborne Transmission Precautions

- Physicians should be aware of the airflow patterns in their offices (2,6).
- If feasible, patients with known or suspected airborne infections should be scheduled at a time that minimizes exposure of other patients (eg, at the end of the day) (1,2,5,6).
- Patients with known or suspected measles, varicella, disseminated zoster or infectious tuberculosis should be placed directly into an examining room (1,2,5,6).
 - Ideally, this should be a negative-pressure room with air vented directly outside or filtered through a HEPA filter before recirculation. Because such rooms are usually unavailable in physician's offices, a single room, as far away as possible from other patients, may be used (1,2).
 - The examination room door should be kept closed (1,2,5,6).
 - Offices in which many patients with infectious tuberculosis are seen should consider having a portable HEPA filtration unit (5).
- The patient should be examined and discharged as quickly as possible (1,2).
- The patient should wear a surgical or procedure mask if possible when not in a negative-pressure room. For younger infants, the nose and mouth should be covered with a tissue (1,2,5).
- Masks for personnel (1,5,6):
 - For measles or varicella – personnel should be immune; nonimmune persons should not enter the examination room unless absolutely necessary, in which case a N95 mask should be worn.
 - For suspected or known infectious tuberculosis, N95 masks are recommended for all personnel entering the room. In offices in which patients with infectious

tuberculosis are likely to be seen, personnel should be fit tested to select the model with the best fit, and should perform a fit check (forceful inspiration to determine whether the mask seals tightly to the face) each time a N95 mask is applied (5). If tuberculosis is rarely seen and N95 masks are not available, patients with suspected contagious tuberculosis should be referred as quickly as possible to an appropriately equipped clinic or hospital for assessment (1,2,4).

- After the patient has left, sufficient time should be allowed for the air to be free of aerosolized particles before using the room for any other patient (if infection is tuberculosis) or for a nonimmune patient (if infection is measles or varicella) (1,5). At six air exchanges per hour, the time required is approximately 70 min (41). If the number of air exchanges is not known, it may be prudent to avoid using the room for nonimmune patients for the rest of the day.
- Determine whether any exposed persons require postexposure prophylaxis such as immune globulin or vaccine (1).

Droplet Transmission Precautions

- If feasible, the patient should be placed directly into an examining room, especially if he or she is suspected of having pertussis, rubella, mumps, meningitis or meningococcal infection (1,4,5).
 - If this is not possible, the patient should be separated from other patients by at least 1 m, and the time spent in the waiting room should be kept to a minimum.
- If feasible, the patient should wear a surgical or procedure mask when out of the room. For younger infants, cover the nose and mouth with a tissue (1,4,5).
- Personnel within 1 m of the patient should wear a surgical or procedure mask (unless immune if rubella or mumps) (1,4,6).
- Eye protection (goggles or face shield) should be considered if splashes of respiratory secretions are anticipated (1,5,6).
- Eye protection should be used if SARS or avian influenza is suspected (4,6,38,55,56).
- For SARS coronavirus or avian influenza, current recommendations are for personnel to wear a N95 mask (4,38,55,56). For pandemic influenza, a N95 mask is recommended only for personnel performing certain aerosol-generating procedures (54). These recommendations may be revised as more information becomes available. Local, provincial or federal authorities should be consulted.

Contact Precautions

- Contact Precautions should be taken for conditions in which heavy contamination of the environment is anticipated, including: (1,4)

- Infectious diarrhea.
- Extensive skin lesions which are not covered (including varicella and zoster), or wound drainage not contained by dressings.
- Selected patients colonized with antibiotic-resistant organisms (AROs), such as MRSA and VRE (below).
- Children with documented or suspected viral respiratory tract infections with inadequate control of respiratory secretions.
- Patient should be placed in an examining room as soon as possible (1,2,5).
- Gloves should be worn on entry to the room (1) or for contact with the patient's intact skin or with surfaces or items in close proximity to the patient (4,5,6).
- A gown should be worn if clothing will have direct contact with the patient or with potentially contaminated surfaces or items. Remove the gown before leaving the room (1,4,5,6).
- Hands should be cleansed with antiseptic soap or antiseptic hand rinse after removing gloves, or after direct hand contact with the patient or with contaminated items (1,4).
- Equipment and surfaces in direct contact with the patient or with infective material (eg, respiratory secretions, stool or skin exudates) should be cleaned before use for another patient (1,4,5).
- If the patient is likely to cause extensive environmental contamination (eg, diarrhea or fecal incontinence not contained by diapers, copious wound drainage, and copious uncontrolled respiratory secretions or sputum), all horizontal surfaces and frequently touched surfaces should be cleaned before the room is used for another patient (1,5).

AROs in ambulatory care

- There are few data concerning transmission of AROs, such as MRSA and VRE, in ambulatory settings (1,4).
- Systems should be in place to readily identify patients known to be colonized with AROs (4).
- Consistent use of Routine Practices, especially hand hygiene, should suffice for management of most patients colonized with ARO (1,2,4,57).
- The need for Contact Precautions should be assessed on a case-by-case basis, considering the nature of the interaction with the patient (eg, procedures to be performed) and the potential for environmental contamination (eg, active infection versus colonization, uncontrolled respiratory secretions, stool incontinence and colonized ostomy sites) (4,57).
- Antibiotics should be used judiciously, to prevent or delay emergence and spread of antimicrobial resistance (4,57).

TABLE 3
Work restrictions for health care providers

Infection	Restriction	Duration
Blood-borne viruses: (Hepatitis B and C, HIV)	From performing specific exposure-prone procedures at high risk of transfer of blood (59)	As per local public health policy (viremia resolved or blood viral load controlled)
Colds, other viral upper respiratory tract infections	From direct care of high-risk patients*. For other patients, wear surgical or procedure mask during care and perform hand hygiene after any contact with nasal or respiratory secretions and before any patient contact	Until symptoms resolved
Conjunctivitis	From direct patient care	Until exudate resolved
Gastroenteritis†	From direct patient care	Until symptoms resolved or illness deemed noncontagious
Hepatitis A	From direct patient care	Until one week after onset of jaundice
Herpes simplex, orofacial	From direct care of newborns and nonimmune immunocompromised patients if lesions not covered‡	Until lesions dry
Herpetic whitlow	From direct patient care	Until lesions dry
Influenza	From office	Until symptoms resolved
Measles	From office	Until four days after onset of rash
Mumps	From office	Until nine days after onset of parotitis
Pediculosis	From direct patient care	Until one treatment completed (<24 h)
Pertussis	From office	Until five days of appropriate antibiotic
Rubella	From office	Seven days after onset of rash
Scabies	From direct patient care	Until one treatment completed (<24 h)
Staphylococcal skin infection (MSSA)	From direct patient care if Lesions on hands Lesions elsewhere with exudates or drainage that cannot be effectively contained by dressing	Until lesions on hands are healed Until lesions elsewhere can be covered by dressings
Staphylococcal skin infection (MRSA)	From direct patient care	Until lesions healed and assessed for risk of transmission
Streptococcus group A infection	From direct patient care	Until treated for 24 h
Tuberculosis, active pulmonary	From office	Until assessed as noninfectious
Varicella	From office	Until lesions crusted
Zoster	From direct patient care if not covered. If covered: From care of newborns and nonimmune immunocompromised patients and pregnant women	Until lesions crusted

*Patients with hemodynamically significant congenital heart disease or chronic lung disease, neonates and immunocompromised patients; †Clinically significant diarrhea or vomiting; ‡If working, keep lesions covered, avoid touching face during patient care, wear surgical or procedure mask during care and wash hands after touching lesions and before touching any patient or patient care equipment. MRSA Methicillin-resistant *Staphylococcus aureus*; MSSA Methicillin-susceptible *S aureus*. Data from references 2,5,6,52

Health of personnel

- Vaccines:
 - All personnel should receive influenza vaccine annually (2,52).
 - All personnel should be immune to measles, rubella, mumps, varicella, hepatitis B and polio, and should receive at least one adult dose of acellular pertussis vaccine (2,6,52).
 - Personnel should also receive tetanus and diphtheria vaccines and any other vaccines indicated by their health status.
 - Immunization records should be maintained for all personnel (2).
- Personnel should undergo pre-employment tuberculin testing and if negative, repeat testing after any significant exposure (2,5,6,52).
- Policies should be in place for work restrictions for personnel with communicable diseases and measures to prevent transmission while working with an infection (2,5,6,52) (Table 3).
 - Colds and other minor respiratory tract infections are not criteria for exclusion from work but personnel should not have direct contact with high-risk patients; should contain coughs and respiratory secretions using surgical or procedure masks and tissues; and should perform hand hygiene after each contact with nasal or other respiratory tract

secretions and before every contact with a patient or patient care equipment (2,5,52).

- Personnel with blood-borne viral infections (eg, hepatitis B virus, hepatitis C virus and HIV) should not perform procedures with a high risk for transmission of blood from the health care worker to a patient (2,51,58). Such procedures are mainly surgical and are unlikely to be performed in the routine office setting.

Medical waste

- Regulated medical waste should be disposed of according to local legislation. Nonanatomical medical waste includes: (2-6,40).
 - Liquid or semiliquid blood and blood products.

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INFECTIOUS DISEASES AND IMMUNIZATION COMMITTEE

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The recommendations in this statement do not indicate an exclusive course of treatment or procedure to be followed. Variations, taking into account individual circumstances, may be appropriate. Internet addresses are current at time of publication.