

Airborne Precautions in Operating Rooms

Note: These recommendations are intended to be used with, and to supplement the Healthcare Facility Design Recommendations.
If you have any questions or comments contact IPC at ipcsurvstdadmin@ahs.ca.

Best practice recommendations

Purpose

This infection prevention and control (IPC) best practice recommendation (BPR) for Airborne Precautions in the Operating Room was developed to:

- reduce the risk of staff or patient airborne exposure to communicable diseases during surgical procedures (Refer to Appendix A) and
- describe best practice for managing patients with a suspected or confirmed diagnosis of an airborne illness who require surgery (Refer to Appendix B and Appendix C).

Application

This recommendation applies to all Alberta Health Services (AHS) staff, medical staff, volunteers, students and other persons acting on behalf of AHS.

Recommendations

1. General infection prevention and control principles

- 1.1 [Routine Practices](#) are a standard of care used for all clients, at all times, to reduce the risk of infection.
- 1.2 Additional Precautions (Airborne, Contact, Droplet) are put in place to prevent transmission of specific organisms or infections that may not be fully prevented by Routine Practices. Routine Practices continue even with the application of Additional Precautions.
 - 1.2.1 [Airborne Precautions](#) are put in place for microorganisms transmitted through the air over extended time and distance by small particles (Refer to Appendix A).
 - 1.2.2 Some infections, e.g., disseminated shingles, need a [combination of Additional Precautions](#), since some microorganisms can be transferred by more than one route.
- 1.3 OR and peri-operative staff should know their immunity status regarding airborne communicable diseases, e.g., [Measles - only immune people should enter the room](#), and must have current N95 fit testing.
- 1.4 If possible, delay elective surgical procedures on patients requiring Airborne Precautions until the patient is no longer infectious or determined not to have an airborne infection. Consult with Infection Prevention and Control or an Infectious Disease Physician as needed.
- 1.5 If surgery is required for patients with any of the airborne communicable diseases (Refer to Appendix A); consult an Infectious Disease physician or Medical Officer of Health and for Tuberculosis (TB) cases, the TB Services Physician on call.
 - In Edmonton Zone TB Services Physician on call can be paged via the switchboard at the University of Alberta Hospital (780 407-8822).
 - In Calgary Zone call the TB Physician on call at (403 212-8223), and enter pager number 00388.

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- In South, Central and North Zones, Central TB services is in charge of TB care (Provincial TB Program) and the Provincial TB Physician on call can be contacted at (780 735-1464) or can be paged after hours via the switchboard at the University of Alberta Hospital (780 407-8822).

1.6 If surgery cannot be delayed notify the OR manager or designate, surgeon and anaesthesiologist of the suspected or confirmed diagnosis and requirement for surgery. The manager or designate should ensure that (Refer to Appendix B):

1.6.1 an operating room is available as outlined in Section 2, Facility Infrastructure Requirements.

1.6.2 all staff members assigned to the case, including the anaesthesia team, are notified of the suspected or confirmed diagnosis and the need to implement Airborne Precautions.

1.6.3 the case is scheduled as the last case of the day. If the case cannot be scheduled as the last of the day consult Facilities Maintenance and Engineering (FME) to ensure adequate air clearance/settle times. (Refer to Appendix E)

2. Facility infrastructure requirements

1.1 Use an OR theatre with an attached anteroom. Refer to Appendix C for additional information and consult with site FME.

1.2 If an OR theatre with an attached anteroom is not available, transfer the patient to a facility with a proper OR theatre and anteroom for this purpose. Refer to Appendix C.

1.3 If transfer is not possible and surgery cannot be postponed, consult with site FME to select an OR theatre for use that is negatively pressurized to the corridor/adjacent spaces and provides at least ≥ 15 total air exchanges per hour. Refer to Appendix D.

3. Preoperative considerations

3.1 If possible, intubate the patient in an airborne isolation room. A disposable bacterial filter should be placed on the patient's anaesthesia breathing circuit at the endotracheal tube or expiratory side of the circuit.

3.2 If not intubated, ensure the patient is wearing a surgical mask during transport.

3.3 If the patient is not intubated and cannot tolerate a mask, staff accompanying must wear an N95 fit tested respirator during [transport](#).

3.4 [Aerosol generating medical procedures \(AGMP\)](#), e.g., suctioning, should not be performed en route.

3.5 Transport the patient directly into the OR theatre and bypass the holding area.

4. Perioperative considerations

4.1 All of the healthcare team in the OR theatre should follow [Airborne Precautions](#) (staff wear fit tested N95 respirators).

4.2 Post an [Airborne Precautions sign](#) on every door into the theatre.

4.3 If a portable HEPA filtered air scrubber is available it may be used during intubation and extubation (turned off during the case).

4.4 Strictly control traffic into and out of the theatre (doors to the operating room should be kept closed except when moving patients and supplies in or out) so adequate air exchange is maintained.

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4.5 A disposable anaesthesia circuit should be used to minimize the risk of contaminating anaesthesia equipment. If a disposable circuit is not available, the entire circuit should be changed after the surgery is complete and reprocessed according to the manufacturer's instructions.

5. Postoperative considerations refer to Appendix B

5.1 Extubate and recover the patient in the OR theatre unless there is an airborne isolation room in the Post Anaesthetic Care Unit (PACU).

5.2 Staff not required for extubation or postoperative recovery should leave the theatre before extubation and should not re-enter.

5.3 Doors to the operating room should be kept closed except when moving patients and supplies in or out to ensure adequate air exchanges are maintained.

5.4 If not intubated, ensure the patient is wearing a surgical mask during transport to an airborne isolation room (AIR) on an inpatient unit.

5.5 After the patient is discharged from the OR:

- keep the OR theatre door closed to allow airborne particles to clear/settle;
- consult FME as air clearance/settle times will vary based on facility air exchanges (See Appendix D and E);
- any staff entering room before complete air clearance should wear an N95 respirator;
- the room may be entered for discharge cleaning after air clearance time has lapsed. If cleaning staff must enter the room to do discharge cleaning before air clearance time has lapsed, the cleaning staff must wear an N95 respirator.

5.6 Clean room according [OR Theatre Cleaning \(end of day\)](#).

5.7 Send instruments to Medical Device Reprocessing in the routine manner.

5.8 Handle all laundry and garbage following Routine Practices.

6. Monitoring of pressure differential, alarms and testing

6.1 Room pressurization alarms for the OR should be incorporated into a central monitoring system to verify the alarms are working at all times through manual test or alarm and subsequent verification.

6.2 Testing and calibration should be set up in the facility maintenance and engineering's preventative maintenance program to be done quarterly. Test results should be recorded.

Definitions

Additional Precautions means the use of extra measures for contact with a patient known to or suspected to be infected or colonized with certain micro-organisms and based on the potential for transmission of the micro-organism.

Airborne exposure may occur if small particles (i.e. aerosols containing droplet nuclei) with viable microorganisms are generated, propelled over short or long distances and inhaled.

Airborne isolation room (AIR) is a room that is designed to maintain negative pressurization relative to adjacent areas; and is constructed and well ventilated to limit the spread of microorganisms from an infected occupant to the surrounding areas of the health care facility.

Air exchange means the ratio of the airflow in volume units per hour to the volume of the space under consideration in identical volume units, usually expressed in air exchanges per hour (ACH).

Air clearance time means the time in minutes needed (in minutes), based on the number of air exchanges per hour to reduce airborne contaminants in the room by 99% or 99.9%.

Anteroom means a small room or space at the entrance to an airborne isolation room that is separated by doors from both the outside and the main space in the airborne isolation room.

Fit testing means the use of a qualitative or quantitative method to evaluate the fit of a specific make, model and size of respirator on an individual.

HEPA filtration (high-efficiency particulate air filter) means an air filter that is certified to remove $\geq 99.97\%$ of particles $0.3 \mu\text{m}$ in size. The filter can be either portable or stationary.

Negative pressure means special ventilation to create inward directional airflow to the room, relative to the adjacent area. Negative pressure keeps air from flowing out of the room and into adjacent rooms or areas.

N95 respirator means a disposable particulate respirator that is $\geq 95\%$ efficient at removing $0.3 \mu\text{m}$ particles (the most penetrating particle size) and is not resistant to oil.

Pressure differential means a measurable difference in air pressure that creates a directional airflow between adjacent compartmentalized spaces. For older rooms (e.g., designed before 2010) the pressure value (Pascal) negative pressure is a minimum 2.5 Pascal negative pressure of the room to the corridor. For new rooms (e.g. designed after 2010) it is minimum 7.5 Pascal negative pressure of the room to the corridor. (See Appendix C)

References

1. Alberta Health Services (2013, updated 2020). Infection Prevention and Control Health care facility design guidelines, preventative measures for construction, renovation and maintenance activities.
2. Alberta Health Tuberculosis Prevention and Control Guidelines for Alberta. (2010). Retrieved from <https://open.alberta.ca/publications/tuberculosis-prevention-and-control-guidelines-for-alberta>.
3. Canadian Standards Association (2019). Z317.2-19. Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities. CSA.
4. Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC). (2003). Guidelines for Environmental Infection Control in Health-Care Facilities. Pages 18, 37, 38 and 39. Retrieved from http://www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf.
5. Centers for Disease Control and Prevention (CDC). (2005). Morbidity and Mortality Weekly Report (MMWR). Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings. Reprint. Vol.54/No.RR-17. Retrieved from: <http://www.cdc.gov/tb/publications/guidelines/infectioncontrol.htm>.

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6. Operating Room Nurses Association of Canada. (2017). Standards for Perioperative Nursing Practice. Section 2. Page 188.
7. Public Health Agency of Canada. (2014). Canadian Tuberculosis Standards. 7th Edition. Chapter 15. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5864480/>.
8. Public Health Agency of Canada. (2012). Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Healthcare Settings. Retrieved from <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/routine-practices-precautions-healthcare-associated-infections/routine-practices-precautions-healthcare-associated-infections-2016-FINAL-eng.pdf>

This document was:

- based on a Central Zone IPC Best Practice Guideline for Airborne Precautions and the Patient Requiring Surgery
- developed by an AHS IPC working group with representation from each zone, Surgical Services, Facilities Maintenance and Engineering (FME), and Covenant Health.
- reviewed by representatives from Covenant Health and AHS IPC Physicians, Workplace Health and Safety, TB Program, Respiratory Therapy, OR Managers, IPC Clinical Practice Leads, and frontline infection control professionals.

Appendices

APPENDIX A: Airborne Communicable Diseases

APPENDIX B: Algorithm for Implementing Airborne Precautions in the OR

APPENDIX C: Selecting an Operating Room (OR) Theatre

APPENDIX D: Ventilation Recommendations for Operating Rooms

APPENDIX E: Air Settle/Clearance Times

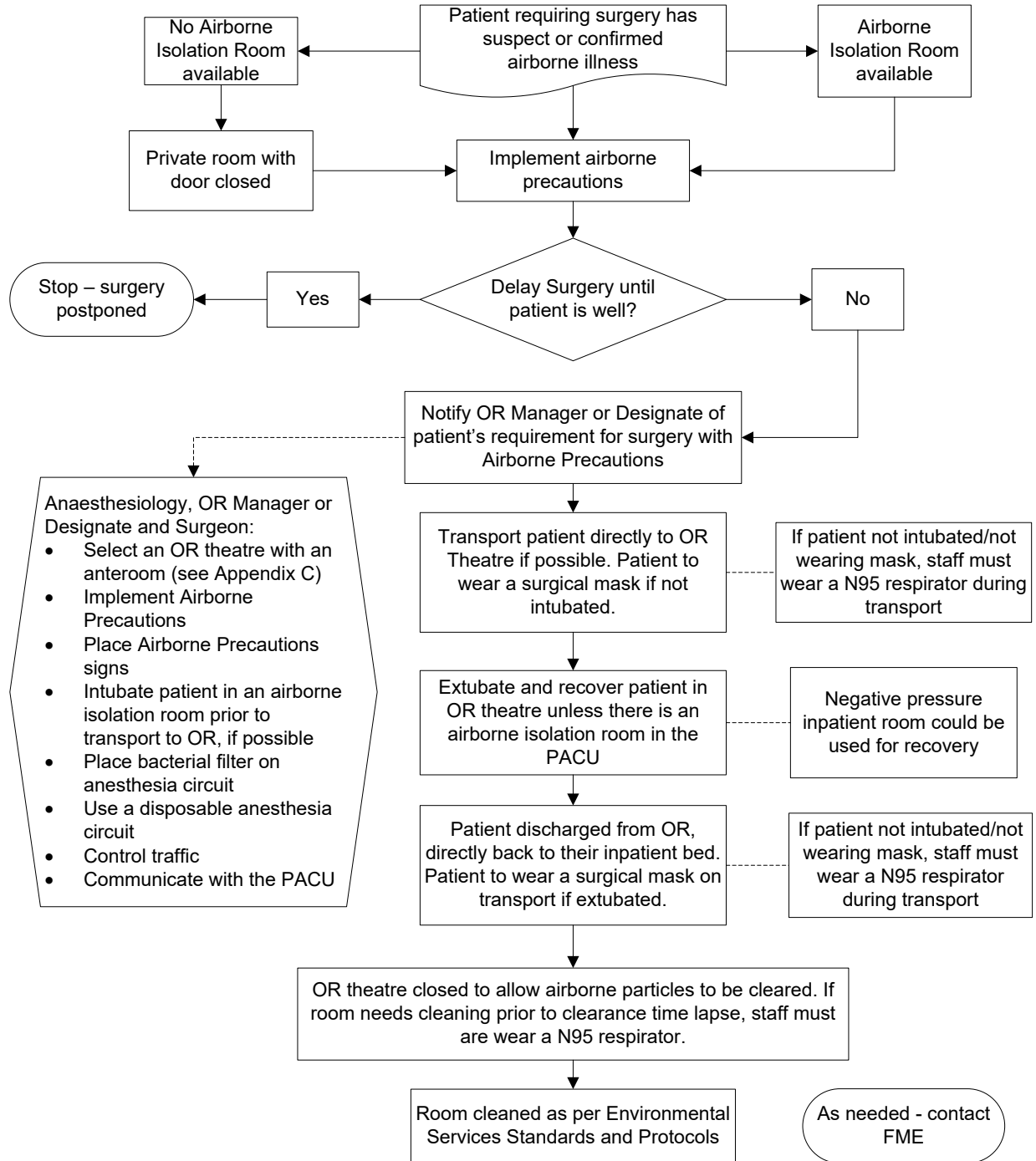
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Appendix A: Airborne communicable diseases

- Airborne communicable diseases include, but are not limited to:
- Tuberculosis:
 - Potential for transmission is generally limited to cases with respiratory forms of the disease (i.e., pulmonary, laryngeal or miliary tuberculosis)
 - Airborne precautions are required for extra pulmonary or non-respiratory TB only if draining lesions present or if there is suspicion of miliary tuberculosis with pulmonary involvement.
- Rubeola (measles)
- Varicella zoster virus (chickenpox) - includes exposed and susceptible individuals who are in the incubation period of the disease.
- Disseminated herpes zoster virus (shingles)
- Localized shingles that cannot be covered in an immunocompromised patient
- Less commonly found diseases such as:
 - monkeypox
 - smallpox
- Some emerging respiratory pathogens or novel viruses (e.g., pandemic influenza)
- An AIR should also be used for performing AGMPs on patients with TB, SARS, viral hemorrhagic fever and respiratory infection with an emerging pathogen for which transmission routes are not yet fully known (follow PHAC Guidance <http://www.phac-aspc.gc.ca/eri-ire/index-eng.php>)

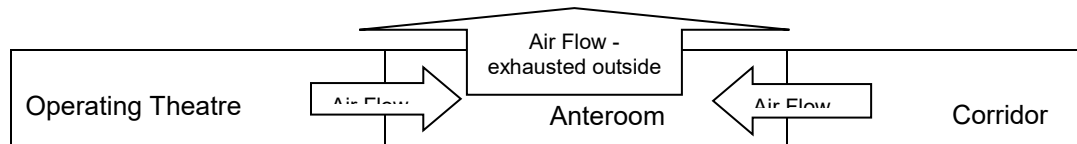
Appendix B Algorithm for Implementing Airborne Precautions in the OR



Appendix C: Selecting an operating room (OR) theatre

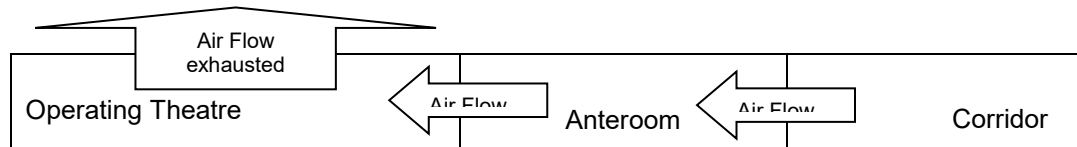
- Use an OR with an anteroom (as described in 1 and 2). Consult with FME if necessary.
- Positive and negative pressures refer to a pressure differential between two adjacent air spaces. Air flows away from areas or rooms with positive pressure (pressurized), while air flows into areas with negative pressure (depressurized).
- If an OR with an anteroom is not available in the facility; transfer the patient to a facility that has an OR theatre with an anteroom.
- If the patient cannot be transferred and OR theatre with an anteroom is not available, see 3.

1. Positive Pressure OR Theatre with Negative Pressure Anteroom



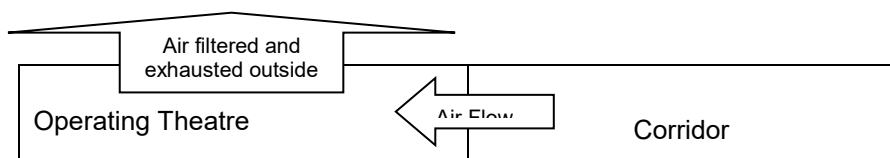
- OR theatre is positively pressured to the anteroom (air flows from OR into the anteroom)
- Corridor is positively pressured to anteroom (air flows from corridor into anteroom)
- Anteroom is negatively pressured to OR theatre and corridor with air being discharged to the outside (air flows into the anteroom and is exhausted outside)
- Anteroom **is not** to be used for donning and removal of personal protective equipment (infectious organisms are drawn into the anteroom before being discharged outside).

2. Negative Pressure OR Theatre with Positive Pressure Anteroom



- OR theatre negative to anteroom (air flows from anteroom into OR theatre)
- Anteroom positively pressured to OR theatre (air flows into OR from anteroom)
- Corridor positively pressured to anteroom (air flows from corridor into anteroom).

3. If patient transfer is not possible ensure



- Corridor positively pressured to OR theatre
- OR theatre negatively pressured with air flow to the outside
- High Efficiency Particulate Air (HEPA) filtration required (may be a portable unit)

Appendix D: Ventilation recommendations for operating rooms

ORs within older AHS facilities (designed before 2010) should have a minimum of 15 air exchanges and any newly built (designed after 2010) ORs should have a minimum of 20 air exchanges with HEPA filtered supply.

Recommending Agency	Number of mechanical air exchanges per hour
Canadian TB Standard (2013)	15
Canadian Standards Association (2010)	20
CDC (2005)	15
AHSRAE (2007)	20

Appendix E: Air settle/clearance times

[AHS IPC Resource Manual for Acute Care TB recommendations](#) for air settle/clearance times are as follows:

Non-negative pressure rooms

- Do not admit a new patient into this room for at least 2 hours. If entering room before 2 hours and non-immune, wear an N95 respirator.

Negative pressure rooms:

- Do not admit a new patient into this room for at least 45 minutes. If entering room before 45 minutes, and non-immune, wear an N95 respirator.

Alternatively, if specific air exchange rates for the room are known, refer to the air clearance rates to determine air clearance times.

Time in Minutes Needed (by number of air exchanges per hour) to Reduce Airborne Contaminants by 99% or 99.9%. (Adapted from CDC MMWR, 2005)

Air exchanges per hour	99%	99.9%
12	23	35
15	18	28
20	14	21