IPAC BEST PRACTICES GUIDELINE Aerosol Generating Medical Procedures	**DATE:** June 15, 2017 **REVISED DATE:** July 2, 2020 **REVIEWED DATE:** July 2, 2020

PURPOSE

To prevent transmission of infection associated with aerosols produced by aerosol generating medical procedures.

BACKGROUND

- Aerosol generating medical procedures (AGMP) are any procedure carried out on a patient/resident/client[1] that can induce the production of aerosols of various sizes, including droplet nuclei.
- Medical procedures that generate aerosols or droplet nuclei in high concentration present a risk for opportunistic airborne transmission of pathogens not otherwise not spread by the airborne route (e.g., SARS, influenza) and increase the risk for transmission of organisms known to spread by the airborne route (e.g., TB).

PROCEDURE

1. **Healthcare worker (HCW) to use an N95 respirator when performing or assisting with AGMP in the following circumstances:**
    - **Note: Only essential AGMP should be performed on the following infection cases.**
    - Patients with known or suspected infection transmitted by the airborne route (tuberculosis, varicella zoster virus, measles).
    - Patients with known or suspected viral hemorrhagic fever (e.g., Ebola)
    - Patients with known or suspected influenza-like illness, novel respiratory pathogen, or for whom status of respiratory infection is unknown (including: novel/pandemic influenza, seasonal influenza, COVID-19, MERS and SARS coronavirus).
        - At minimum a procedure mask is required for non-influenza respiratory viruses, but an N95 respirator is recommended to reduce aerosol exposure (including but not limited to: RSV, adenovirus, parainfluenza, entero/rhinovirus, human metapneumovirus and bocavirus)
        - Due to a heightened risk for unplanned AGMPs, IPAC recommends all ventilated patients with influenza-like illness are placed on Airborne & Contact Precautions, refer to the Diseases and Conditions Table for duration of precautions
    - Irrigation of wounds with confirmed or suspected extra-pulmonary TB

[1] Referred to as 'patient' for the remainder of the document

- All bronchoscopy and sputum induction procedures
- Patients undergoing CPR or endotracheal intubation for acute respiratory failure
- Autopsy of lung tissue

2. Aerosol Generating Medical Procedures include:

- High risk
    - Endotracheal intubation & extubation
    - High frequency oscillatory ventilation
    - Bag mask ventilation
    - Bronchoscopy and bronchoalveolar lavage
    - Laryngoscopy
    - Positive pressure ventilation (BiPAP & CPAP)
    - Autopsy of lung tissue
    - Nasopharyngeal washing, aspirate, and scoping
    - Sputum induction
- Other
    - Airway suctioning
    - High-flow oxygen (including single and double O2 set ups, Optiflow and Airvo)
    - Breaking closed ventilation system, intentionally (e.g., open suctioning), unintentionally (e.g., patient movement)
    - Cardio-pulmonary resuscitation (CPR)
    - Tracheostomy care
    - Chest physiotherapy (manual and mechanical cough assist device (MI-E))
    - Administration of aerosolizing or nebulizing medications
    - Abscess/wound irrigation (non-respiratory TB)[2]

3. Special Considerations for AGMP in all Health Care Settings

- All HCW should perform a point of care risk assessment (PCRA) prior to an AGMP to select the appropriate personal protective equipment (PPE) and environmental controls.
    - At minimum, eye protection and a surgical or procedure mask is required for any staff member within two meters of procedures generating aerosols, regardless of the patient's infection status.
- Patients should be carefully assessed for signs and symptoms of airborne infection and acute respiratory infection prior to performing an AGMP. In an emergency situation where this assessment is not possible, the highest level of protection (N95 respirator) should be used.
- Limit the number of HCW in the room or patient care area (privacy curtains) to only those necessary for the procedure
- HCWs should perform hand hygiene before donning and after removing PPE and on leaving the room/area

[2] Consult IPAC for extrapulmonary TB cases with drains

- Eye and face protection should be removed **after** leaving the room/area and disposed of in either a hands-free waste receptacle (if disposable) or in a separate receptacle to go for reprocessing (if reusable).

4. **AGMP Environmental Controls**
    - Whenever possible, AGMP should be performed in a private or procedure room with the door closed.
    - When an N95 respirator is indicated (see #1 above), priority placement for a private or procedure room must be assessed prior to non-emergent AGMPs
        - Private room priority should consider: infection status, risk and frequency of AGMP indicated, and patient immune status.
        - To establish private room priority, refer to:
            - **Appendix A: IPAC Considerations for AGMP**
            - IPAC Private Room Priority Patient Placement Algorithm
            - VRI Patient Placement Algorithm
        - When a private or procedure room is not available and the priority placement assessment has determined the AGMP will occur in place, draw the privacy curtains and remove any shared equipment, supplies or linens from the immediate vicinity prior to performing an AGMP.
    - If the priority placement assessment selected for an Airborne Infection Isolation Room (AIIR) or a private/procedure room, the room should remain vacant or an N95 respirator should continue to be worn until the air settle/clearance time has lapsed (**Appendix B**).

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Appendix A: IPAC Considerations for AGMP

Known or Suspected Infection	Facial Protection	Environmental Controls[1]
Tuberculosis Measles VZV	N95 respirator and eye protection (e.g., goggles, face shield)	• Airborne Infection Isolation Room required (negative pressure)
VHF (e.g., Ebola) SARS, MERS COVID-19 Novel or Pandemic Influenza		• Airborne Infection Isolation Room preferred • Private or procedure room with the door closed required
Seasonal Influenza	N95 respirator and eye protection (e.g., goggles, face shield)	• Private or procedure room preferred • If private room unavailable, perform AGMP in patients care space with privacy curtains drawn[2]
Non-influenza Respiratory Viruses	Procedure mask with eye protection N95 respirator recommended to reduce the risk of aerosol exposure	• Private or procedure room preferred for AGMP whenever possible[2] • All HCW within 2 meters to use facial protection • 2 meter separation from other patients during AGMP, if not available, draw privacy curtain • Select procedures require N95 respirator for patients on Routine Practices[3]
Droplet Precautions		
Contact Precautions Contact Plus Precautions Routine Practices[3]	Procedure mask with eye protection	

[1]**Refer to** IPAC Private Room Placement Algorithm

[2]**For placement priority, consider risk level & frequency of AGMP, acuteness of patient infection, and patient immune status**. Consult Infection Prevention and Control as needed. Remove any shared equipment or supplies from care area prior to AGMP.

AGMP considered **high risk** for private room placement priority (when indicated) include: Endotracheal intubation**,** high frequency oscillatory ventilation , bronchoscopy, laryngoscopy**,** positive pressure ventilation (BiPAP & CPAP)**,** sputum induction and autopsy of lung tissue

[3]N95 indicated in all cases for the following AGMPs: Irrigation of wounds with confirmed or suspected extra-pulmonary TB, all bronchoscopy and sputum induction procedures, patients undergoing CPR or endotracheal intubation for acute respiratory failure, autopsy of lung tissue

Appendix B: Air Settle/Clearance Times

The table below was adapted from a 1973 NIOSH article where a mathematical formula was devised for clearance of particles in enclosed spaces. It has been used since then as a guideline for room clearance with no updates. As such, it is a general guideline only particularly as air handling systems have become more sophisticated since the formula on which this table was predicated was developed.
In general, a clearance of between 90% and 95% would be in alignment with the goal of N95s which are designed to filter 95% of aerosolized particles.

Table 1. Air changes per hour and time in minutes required for removal efficiencies of 90%, 99% or 99.9% of airborne contaminants

Air exchanges per hour	90%	99%	99.9%
1	138	276	414
2	69	138	207
3	46	92	138
4	35	69	104
5	28	55	83
6	23	46	69
7	20	39	59
8	17	35	52
9	15	31	46
10	14	28	41
11	13	25	38
12	12	23	35
13	11	21	32
14	10	20	30
15	9	18	28
16	9	17	26
17	8	16	24
18	8	15	23
19	7	15	22
20	7	14	21
25	6	11	17
30	5	9	14
40	3	7	10
45	3	6	9
50	3	6	8

This table is prepared according to the formula t = (in C2/C1)/(Q/V) = 60, which is an adaptation of the formula for the rate of purging airborne contaminants (100-Mutchler 1973) with t1 = 0 and C2/C1 = 1 – (removal efficiency/100). Adapted from CDC Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care facilities 1994

Please refer to VCH's IPAC Bioaerosol Management Guideline for more details.