

Good Nebulization Practice in current **pandemic Do's and Don'ts**



Dr. Binod Kumar Singh

Professor & Head

Dept. of Pediatrics, NMCH, Patna

IAP State President, Bihar- 2019

CIAP Executive board member-2015

NNF State president, Bihar- 2014

IAP State secretary, Bihar-2010-2011

NNF State secretary, Bihar-2008-2009

Fellow of Indian Academy of Pediatrics (FIAP)

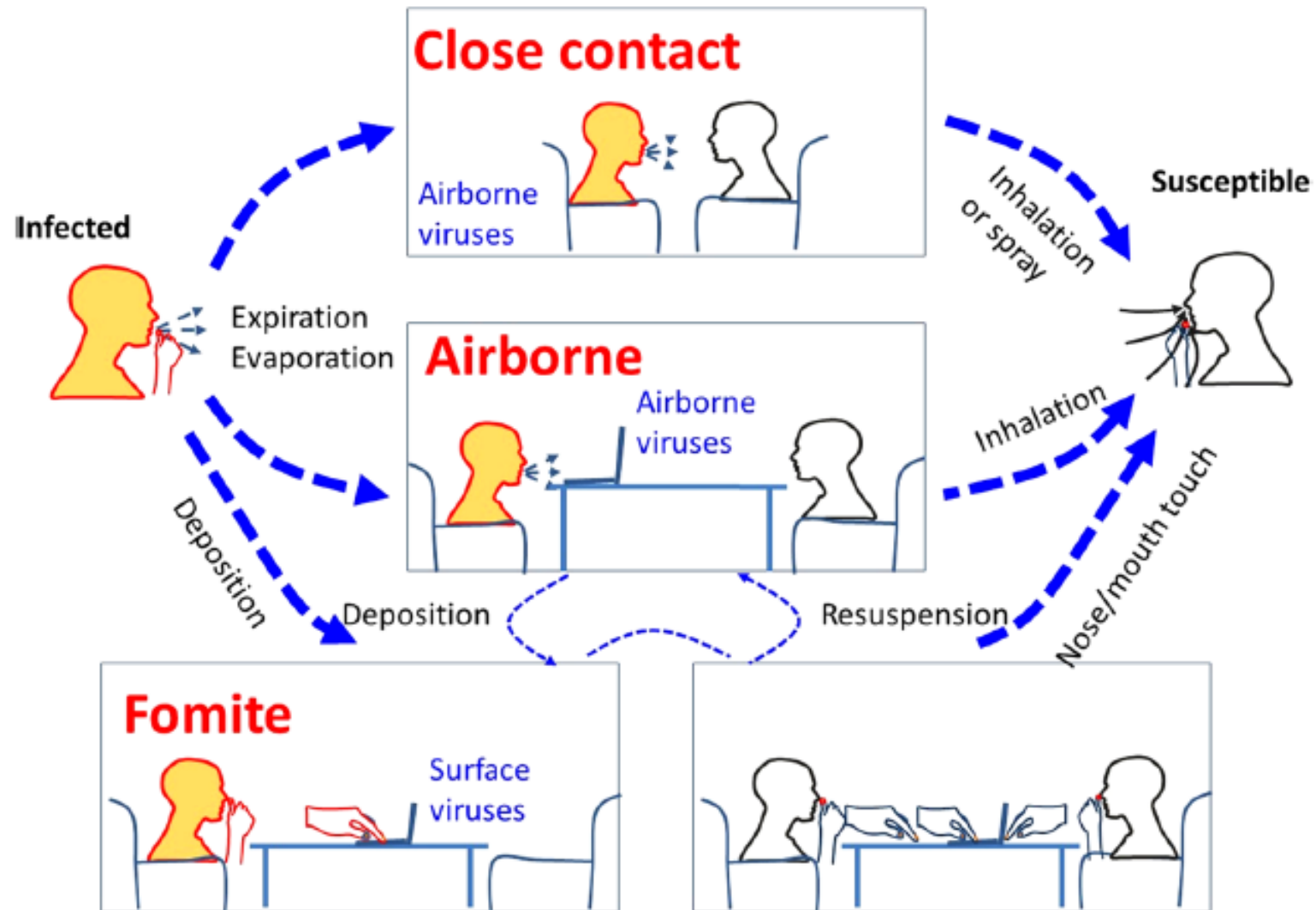
- Consultant Neonatologist & Pediatrician

Shiv Shishu Hospital :K-208, P.C Colony, Hanuman Nagar,

Patna - 800020

Web site : www.shivshishuhospital.com

Possible transmission routes of respiratory infection between an infected and a susceptible individual



When is aerosol generated?

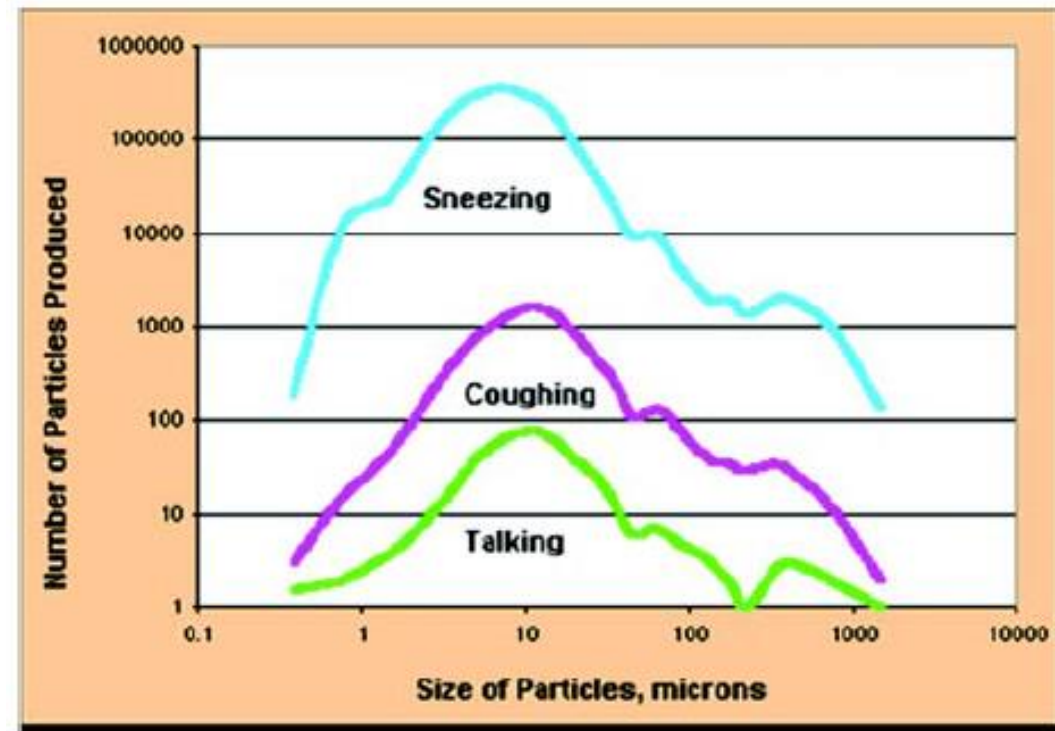


Figure 1 Particle generation by sneezing, coughing and during talking.

- Coughing, sneezing, talking, or breathing

Respiratory droplets are generated when an infected person coughs, sneezes, or talks, or during procedures such as suctioning, endotracheal intubation, cough induction by chest physiotherapy, nebulization.



Who are at risk?



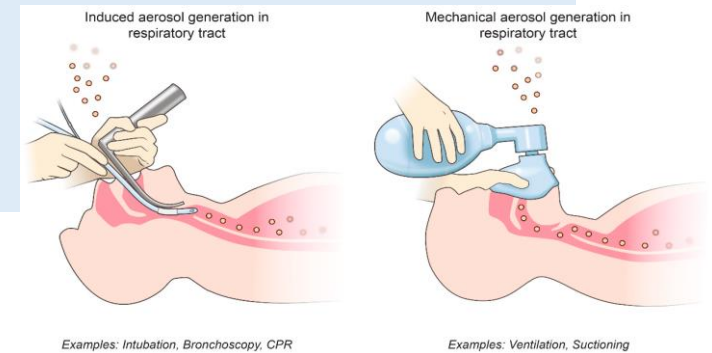
- Health care workers- Doctors, paramedic staff and workers
- Non-infected bystander- People in vicinity, house members

What are considered as aerosol generating procedures?

- Per CDC guidance, the following procedures should be considered AGPs, due to the creation of uncontrolled respiratory secretions:

- Open suctioning of airway secretions
- Sputum induction
- Cardiopulmonary resuscitation
- Endotracheal intubation and extubation

- Noninvasive positive pressure ventilation (NIPPV)
(e.g., BiPAP, CPAP)
- Bronchoscopy
- Manual ventilation



- **There are limited data on whether other procedures may generate infectious aerosols and represent a transmission risk.**

- These may include but are not limited to:

- Nebulizer administration
- High-flow oxygen delivery
- Tracheostomy
- Nasal endoscopy or endoscopic sinus surgery

- Flexible laryngoscopy
- Transsphenoidal surgeries
- Nasogastric or naso-jejunal tube placement

Guideline recommendations?

- Most of the guidelines consider following procedures such as **cardiopulmonary resuscitation, intubation, extubation, bronchoscopy, nebulization** to have **high risk potential** of spreading infection.
- Recommendations to follow droplet and contact precautions
- If bronchodilators are indicated, metered-dose inhaler with spacer or a dry powder inhaler should be preferred over nebulizers.



Centers for Disease
Control and Prevention



GLOBAL INITIATIVE
FOR ASTHMA



WFSA
WORLD FEDERATION OF SOCIETIES OF
ANAESTHESIOLOGISTS



World Health
Organization



BTS guidelines not in agreement...



COPD and COVID-19 for Healthcare Professionals

Nebulisers - Advice from PHE and HPS is that **nebulisation is not a VIRAL droplet generating** procedure. The droplets are from the machine (liquid bronchodilator drug particles), not the patient. Nebulisation is not therefore considered a 'viral' aerosol generating procedure.



Ministry of Health
and Family Welfare
Government of India

सत्यमेव जयते

Recommendations from INDIAN GOVERNMENT

“Because of uncertainty around the potential for aerosolization, highflow nasal oxygen (HFNO), NIV, including bubble CPAP, should be used with airborne precautions until further evaluation of safety can be completed. **There is insufficient evidence to classify nebulizer therapy as an aerosol-generating procedure that is associated with transmission of COVID-19. More research is needed.**”

<https://www.mohfw.gov.in/pdf/ClinicalManagementProtocolforCOVID19dated27062020.pdf>

Aerosol-Generating Procedures and Patients with Suspected or Confirmed COVID-19

Nebulizers and Infection Transmission Risk

1. One study has demonstrated **aerosol stability of SARS-CoV-2** in a laboratory setting, but whether this is applicable **to clinical situations outside of laboratory conditions is unknown.**
2. A 2012 review article on **aerosol-generating procedures** concluded that there was **no significant evidence of transmission risk related to nebulizers**, utilizing evidence from the SARS outbreak.
3. A 2004 study performing polymerase chain reaction (PCR) **air sampling around a patient with SARS undergoing nebulizer treatment found no evidence of virus**



Patient Profiles who may continue to need nebulization

- Patients who are already using nebulization at home
- Patients in acute severe exacerbation with inability to use hand held devices
- Patients needing nebulized antibiotics



Areas of application of nebulization

1.Acute management : Clinics, emergency department, hospitals

2.Emerging Home Nebulization therapy – chronic management

“...[for] unspecified numbers of pulmonary patients who cannot adequately use an MDI, or are too ill to do so, there are sound clinical reasons for Medicare to continue covering adequately the use of [a] nebulizer”*

*American Association for Respiratory Care (AARC) Comments to CMS (9/24/04, 9/28/05)



Good nebulization practices

The need of the hour!

- In hospital /clinic settings
- Home settings



Practical precautionary measures during COVID-19

Pre-neb

- Washing hands
- Ensure the device is clean
- Ensure adequate protection for Health care workers (HCWs)

During neb

- Mouthpiece preferred over face mask
- Separate room (home nebulization) or negative pressure room (hospital/clinic)

Post- neb

- Cleaning and disinfection of nebulizer.
- Cleaning of the surface and areas of nebulization.

Pre-neb


- Washing hands
- Ensure the device is clean
- Ensure adequate protection for Health care workers (HCWs)






Place aerosol generating procedure sign on the door

**Aerosol-
Generating
Procedure
In Progress**

DO NOT ENTER 

**AUTHORIZED TRAINED
PERSONNEL ONLY**

- P APR or N95 + Eye Protection Required During Procedure and 1 Hour Post-Procedure
- Keep Door Closed



TIME PROCEDURE ENDED: TIME ROOM IS AVAILABLE:
(60 Minutes Post-Procedure)



Hand Hygiene

- CDC recommends the use of alcohol-based hand sanitizers **with greater than 60% ethanol or 70% isopropanol**, based upon greater access to hand sanitizer
- This should take **around 20 seconds**
- Surgical hand antisepsis using an antimicrobial soap, scrub - hands and forearms - **2–6 minutes.**
- **Avoid contact with eyes, nose and mouth**
- Wear a **surgical mask**
- Keep a **distance of at least 1 m** from patients with respiratory symptoms





Hand Hygiene

- Hand hygiene should be performed at all five moments, including before putting on PPE and after removing it, when changing gloves, after any contact with a patient with suspected or confirmed.
- COVID-19 infection or their waste, after contact with any respiratory secretions, before eating, and after using the toilet.

Ensure the accessories are clean and dry



WHO interim guidance :Water, sanitation, hygiene, and waste management for the COVID-19 virus

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html>

Hospital/InClinic Precautions before nebulization

- HCWs should wear a facemask/ **N95 respirators, FFP2, or equivalent/respirator**¹ and facial protection when the patient is being nebulized with signs and symptoms and exposure criteria consistent with COVID-19. (Use PPE; eye protection, gloves and a gown) during treatment if a respirator is unavailable.²



COVID-19 Personal Protective Equipment (PPE) for Healthcare Personnel

Preferred PPE – Use	N95 or Higher Respirator	Acceptable Alternative PPE – Use	Facemask
<p>Face shield or goggles</p> <p>One pair of clean, non-sterile gloves</p> <p>Isolation gown</p> <p>N95 or higher respirator When respirators are not available, use the best available alternative, like a facemask.</p>	<p>Face shield or goggles</p> <p>One pair of clean, non-sterile gloves</p> <p>Isolation gown</p> <p>Facemask N95 or higher respirators are preferred but facemasks are an acceptable alternative.</p>		

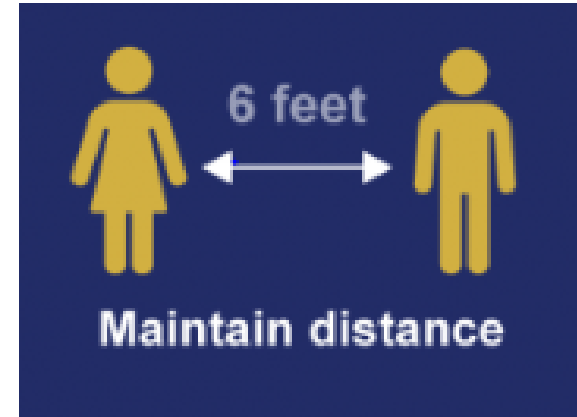
cdc.gov/COVID19

¹Minnesota-CDC guidelines: www.health.state.mn.us, April 2020, ² Govt of Canada: Infection prevention and control for coronavirus disease(COVID-19), ³ CDC.gov



Precautions before nebulization

- Close patient's door when providing nebulizer treatment. ²
- Upon set-up of nebulizer, have HCWs maintain a safe distance (6 feet or greater), possibly outside the door. ²
- The number of HCP present during the procedure should be limited to only those essential for patient care and procedure support.
- Visitors should not be present for the procedure.
- Patients do not need to be transferred to a higher level of care solely for the purpose of providing nebulizer treatment. ²
- Change nebulizers between patients by using sterilization or high-level disinfection or use single-use nebulizers, if possible⁴



Practical Aspects : Pre-Neb

Before starting: Filling the medication



Practice	Rationale
Fill volume should <u>not be less than 2 ml</u>	Residual volume cannot be nebulised and therefore is not available for the patient. Hence initial fill volume >2 ml to 4 ml ensures more drug availability to the patient. ¹
Dilution if required should be done with <u>normal saline</u> and not with water	Dilution with water may cause paradoxical bronchospasm. Saline lowers the viscosity of mucus and increases clearance. ² Respules do not require dilution. Respiratory solutions need to be diluted.
Dose per session should be <u>as per the prescribing information</u>	The dose should be strictly followed as per prescribing information, to prevent overdosing or under-dosing.
Drug combination should be <u>as per compatibility</u> [#]	Incompatibility and/or instability of the medication mixtures can lead to impaired drug safety and/or reduced efficacy up to treatment failure. ³

Data on file

1: *Respiratory Medicine* (1995) 89, 157- 159., 2: *J. Royal Soc of Med.* 2011;104: S2-S5., 3: *J. Cystic Fibrosis* 13 (2014) 243–250

During neb

- Separate room or negative pressure room (hospital/clinic)
- Mouthpiece preferred over face mask





Precautions during nebulization in clinic/hospital

- Ideally, nebulization should be performed in an Airborne Infection Isolation Room (AIIR) whenever feasible¹ or in portable anteroom².
- If AIIR is not available, or a room from which air does not circulate to other areas and minimizes the exposure risk for HCWs. (e.g. single room with door closed and away from high-risk patients).³
- In all cases, leave the room vacant with the door closed for 30 minutes after the procedure and the patient has vacated the room.³

Portable Anteroom



¹Minnesota-CDC guidelines: www.health.state.mn.us, April 2020,

²<https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf>

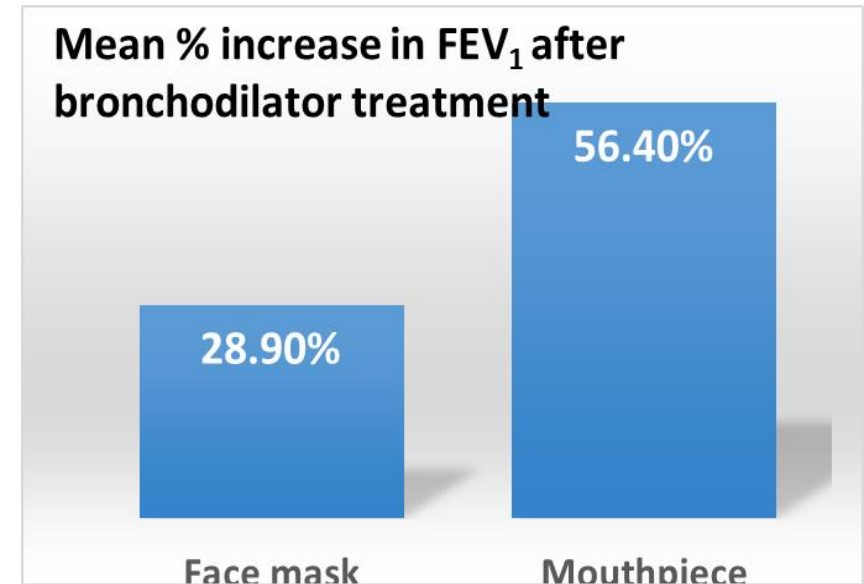
³ https://www.health.qld.gov.au/_data/assets/pdf_file/0038/939656/qh-covid-19-Infection-control-guidelines.pdf

Mouthpiece preferred over facemask

Inhalation via a facemask may be less effective than via a mouthpiece

18 children (aged 8-15 years) with mild to moderate asthma exacerbations.

J Asthma 2002; 39(4): 337-339



Mouthpiece combinations resulted in reduced exhaled aerosol concentrations compared with the facemask.

Pharmaceutics 2019, 11, 75; doi:10.3390/pharmaceutics11020075

Table 2. Thirty-minute averaged aerosol concentration during each nebulisation event (using different facemasks and mouthpieces); mean and standard deviations over the three events.

Nebuliser Type	Facemask (mg m ⁻³)	Unfiltered Mouthpiece (mg m ⁻³)	Filtered Mouthpiece (mg m ⁻³)
Jet Nebuliser	0.072 ± 0.001	0.039 ± 0.004	0.009 ± 0.001
Vibrating Mesh Nebuliser	0.022 ± 0.001	0.017 ± 0.002	0.004 ± 0.001



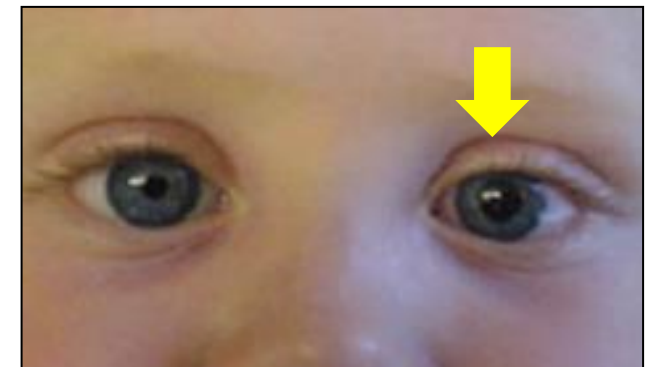
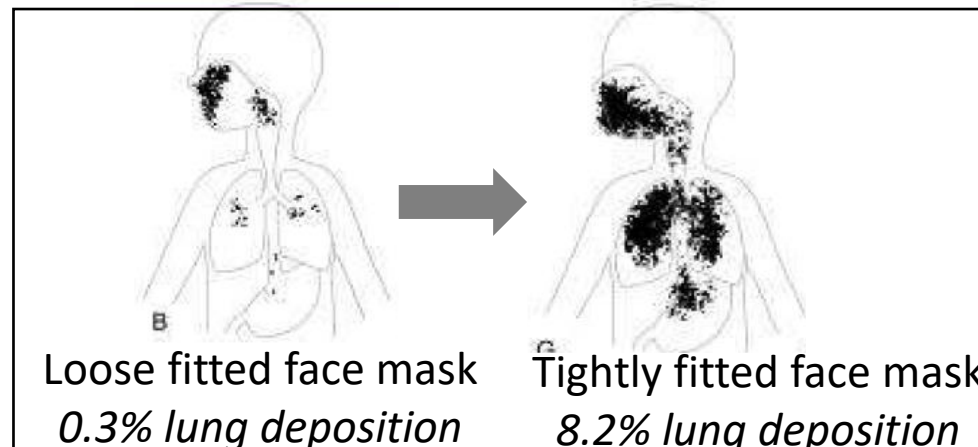
Practical aspects during nebulization

Practice	Rationale
Posture - sit upright and hold the medication cup upright comfortably	This ensures maximum drug delivery and effective nebulization
Breathing deep and holding breath whenever possible	This facilitates better lung distribution
Stop the nebulizer if patient needs to cough or take out phlegm	This prevents the wasting of medication and unwanted skin and eyes exposure
Occasional tapping of medication chamber	Helps to bring down bigger droplets sticking to the walls, increasing availability of drug for nebulization



Practical Aspects during neb

Practice	Rationale
Face mask should be tightly fitting	Reduces drug loss and prevents side effects due to exposure of the drug to skin and eyes
Mouth piece should be recommended especially for steroids, anticholinergics and antibiotics	Maximizes drug delivery to lungs and prevents loss of drug due to nasal filtration. Prevents exposure to skin and eyes.
Oxygen should be used only when indicated (hypoxia or respiratory distress)	Not to be used on COPD patients (unless indicated) as it may increase carbon dioxide retention



Effect of anticholinergics: Pupil dilation

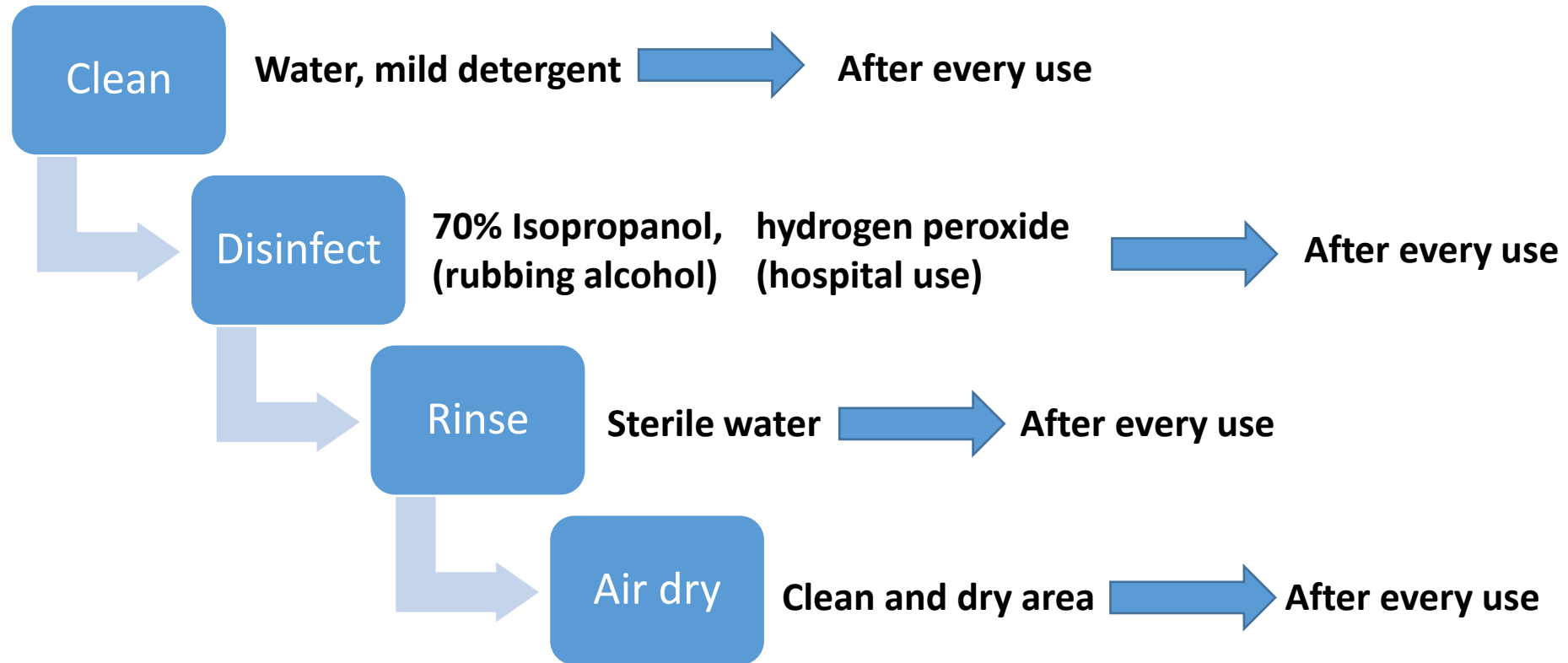
Post- neb

- Cleaning and disinfection of nebulizer.
- Cleaning of the surface and areas of nebulization.





Precautions post- nebulization- Cleaning of nebulizer/accessories





Precautions post- nebulization- common areas and surfaces

Cleaning and disinfection of common areas and surfaces

- Hospital-grade cleaning and disinfecting agents are recommended for all horizontal and frequently touched surfaces.
- Visibly dirty surfaces should first be cleaned with a detergent (commercially prepared or soap and water) and then a hospital-grade disinfectant should be applied. After the contact time has passed, the disinfectant may be rinsed with clean water.
- Many disinfectants are active against enveloped viruses, such as the COVID-19 virus, including commonly used hospital disinfectants. Currently, WHO recommends using:
 - **70% ethyl alcohol** to disinfect small areas between uses, such as reusable dedicated equipment
 - **sodium hypochlorite at 0.5%** (equivalent to 5000 ppm) for disinfecting surfaces.



Precautions post- nebulization- common areas and surfaces

Cleaning and disinfection of common areas and surfaces

Agent	Concentration	Contact time required
Sodium hypochlorite	0.1%*	1 min
Ethanol	62-71%	1 min
Hydrogen peroxide	0.5%	1 min
Povidone iodine	0.23%-7.5%	1 min

Table 7. Effective disinfectants against coronavirus (37, 38).

In hospital /clinic settings: Dos and Don'ts

DO wash hands thoroughly as per CDC guidelines. With soap for at least 20 seconds.

Alcohol-based hand sanitizers with greater than 60% ethanol or 70% isopropanol or use an anti-microbial soap.²

DO wear appropriate **PPE safety accessories** like mask, hand gloves, face-shield and gown

Perform Nebulization in an Airborne Infection Isolation Room (AIIR) commonly called as Negative Pressure Room whenever feasible.

Never perform nebulization in a closed room

Maintain distance of at least 6 feet from the patient undergoing nebulization.

Leave the room vacant with the door closed for **30** post-nebulization.

Sanitize the room after nebulization before letting

Disinfect and wash the equipment with hospital grade disinfectants like Isopropanol (70%) or Hydrogen Peroxide (3%).

¹<https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf>

²<https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html>

³Minnesota-CDC guidelines: www.health.state.mn.us, April 2020,

⁴Govt of Canada: Infection prevention and control for coronavirus disease(COVID-19),

⁵https://www.health.qld.gov.au/_data/assets/pdf_file/0038/939656/qh-covid-19-infection-control-guidelines.pdf



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