



# PPE: Safety, Evidence and Guidelines

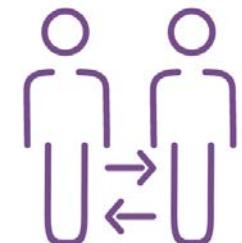
04.17.2020

# Overview

**Safe clinical practice: Utilizing The Right PPE *Every Time***



**Transmission of SARS-CoV-2: Science and Literature**

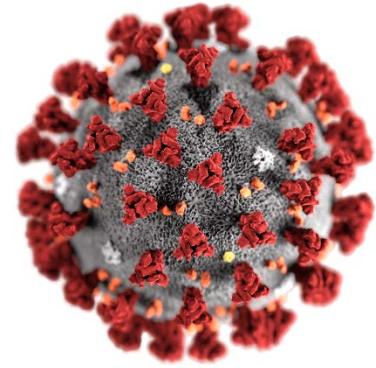


**PPE Guidelines: Evidence based; CDC and Local Health  
Departments Recommendation**



# Transmission of SARS-CoV-2

Severe Acute Respiratory Syndrome Coronavirus 2



- Early during the outbreak, this organism was first thought to spread via the airborne route
- After subsequent research, it was found that this virus spreads similar to influenza, through droplets and contact with contaminated surfaces and fomites
- Wearing a procedural mask, eye protection, gown and gloves while caring for suspect/confirmed COVID-19 patients provides adequate protection from the virus
- N95s and PAPRs provide additional protection against this virus during aerosol-generating procedures
- Frequent hand hygiene and disinfection of surfaces is also important to stop the spread of this virus

# SARS-CoV-2: Science of Aerosol vs Droplet

## What We Know

- PPE is only one part of an overall infection prevention strategy
- A successful strategy includes a 3-tiered approach:
  - ✓ **Reduce:** enact visitor restrictions, cancel or delay visits and elective procedures, implement telemedicine, control entry points, limit HCW visits, control testing sites
  - ✓ **Protect:** universal source control (masking), hand hygiene, PPE, environmental cleaning, engineering controls
  - ✓ **Detect:** universal source control (symptom and temperature screening), laboratory testing
- The type of PPE used should match the mode of transmission
- SARS-CoV-2 is transmitted primarily through droplets and contact.
- Aerosol-generating procedures (AGPs) are considered high-risk for SARS-CoV-2 transmission
- PPE is a much talked about and emotional issue

### Where everyone agrees:

- Gloves, Gown, Eye protection
- Some sort of respiratory protection



# SARS-CoV-2: Aerosol

> *N Engl J Med.* 2020 Apr 16;382(16):1564-1567. doi: 10.1056/NEJMc2004973. Epub 2020 Mar 17.

## Aerosol and Surface Stability of SARS-CoV-2 as Compared With SARS-CoV-1

Neeltje van Doremalen <sup>1</sup>, Trenton Bushmaker <sup>1</sup>, Dylan H Morris <sup>2</sup>, Myndi G Holbrook <sup>1</sup>, Amandine Gamble <sup>3</sup>, Brandi N Williamson <sup>1</sup>, Azaibi Tamin <sup>4</sup>, Jennifer L Harcourt <sup>4</sup>, Natalie J Thornburg <sup>4</sup>, Susan I Gerber <sup>4</sup>, James O Lloyd-Smith <sup>5</sup>, Emmie de Wit <sup>6</sup>, Vincent J Munster <sup>6</sup>

- Early studies biased against detection of small airborne particles
- Even if aerosols present, unknown if the virions are infectious
- Experimental study evaluated virus stability in aerosols and on surfaces
  - Virus remained viable in aerosols for 3 hours
  - Virus remained viable on surfaces for up to 3 days
- Provides theoretical evidence virus can survive in droplet nuclei after AGP
- Department of Homeland Security:
  - Aerosolized virus detected in patient rooms; infectious virus not found in air samples; concluded plausible but unconfirmed
- Cruise ships—virus found up to 17 days after ship vacated, ? Infectious
- Limited data that virus may be spread by conversation and exhalation without cough
- CDC and ECDC hedge: N95 or equivalent during AGP; N95 preferred, surgical mask acceptable



Three Jet Collision Nebulizer

# SARS-CoV-2: Droplet

## Much criticism of New England Journal of Medicine study

- Device does not simulate real life, replicate human cough
- Assumes patients generate aerosols equivalent to those of a highly efficient 3 jet collision nebulizer, no room air exchanges, no surgical mask efficacy
- SARS-CoV-1 not found in air samples in rooms of infected patients
- Small studies so far show SARS-CoV-2 not found in hospital rooms of COVID-19 patients
- SARS-CoV-2 not transmitted to 35 HCWs wearing surgical masks during AGPs in severely ill patients with COVID-19
- Evidence for environmental cleaning and HH, NOT aerosol transmission

# SARS-CoV-2: Droplet



- **World Health Organization recommends surgical masks:**

- Analyzed 75,465 cases of COVID-19 in Wuhan and found no aerosol transmission

- **Public Health Agency of Canada recommends surgical masks:**

- Loeb, et. al. compared medical masks vs. N95 in HCWs in meta analysis
  - No difference in lab confirmed viral infection OR 1.06 (95% CI 0.9-1.25)
  - No difference in clinical respiratory viral illness OR 1.49 (95% CI 0.98-2.28)

- **Public Health England:**

- Recommends N95 in “hot spots” where AGPs regularly performed if COVID and/or ROCOVID pts present (ICU, OR, ED resuscitation bays, L&D during 2<sup>nd</sup> and 3<sup>rd</sup> stage of labor)
  - Opinion: “Using a higher level of PPE than is required is a form of misuse”

- **Iran**

- Collected air samples on 44 COVID pts (22 intubated, 22 on O2 masks) with air impingers located 2-5 meters from patient’s bed
  - 10 samples per pt room; performed RT-PCR; all air samples negative

- WHO/2019-nCoV/Sci\_Brief/Transmission\_modes/2020.2
- <https://www.ncbi.nlm.nih.gov/pubmed/32246890>
- <https://onlinelibrary.wiley.com/doi/abs/10.1111/anae.15071>

# SARS-CoV-2: Droplet

- Singapore (JAMA study): all air samples negative; 87% of surfaces positive for patient C

Table 1. Sampling Time Points in Relation to Patient Illness and Clinical Cycle Threshold Values

Patient	Days of illness when samples were collected	Presence of symptoms during sampling	Symptoms	Disease severity <sup>a</sup>	Before/after routine cleaning	Cycle threshold value from clinical samples <sup>b</sup>
A	4, 10	Yes, both days	Cough, fever, shortness of breath	Moderate	After	31.31 (day 3); 35.33 (day 9)
B	8, 11	Yes on day 8; asymptomatic on day 11	Cough, fever, sputum production	Moderate	After	32.22 (day 8); not detected (day 11)
C	5	Yes	Cough	Mild	Before	25.69 (day 4)

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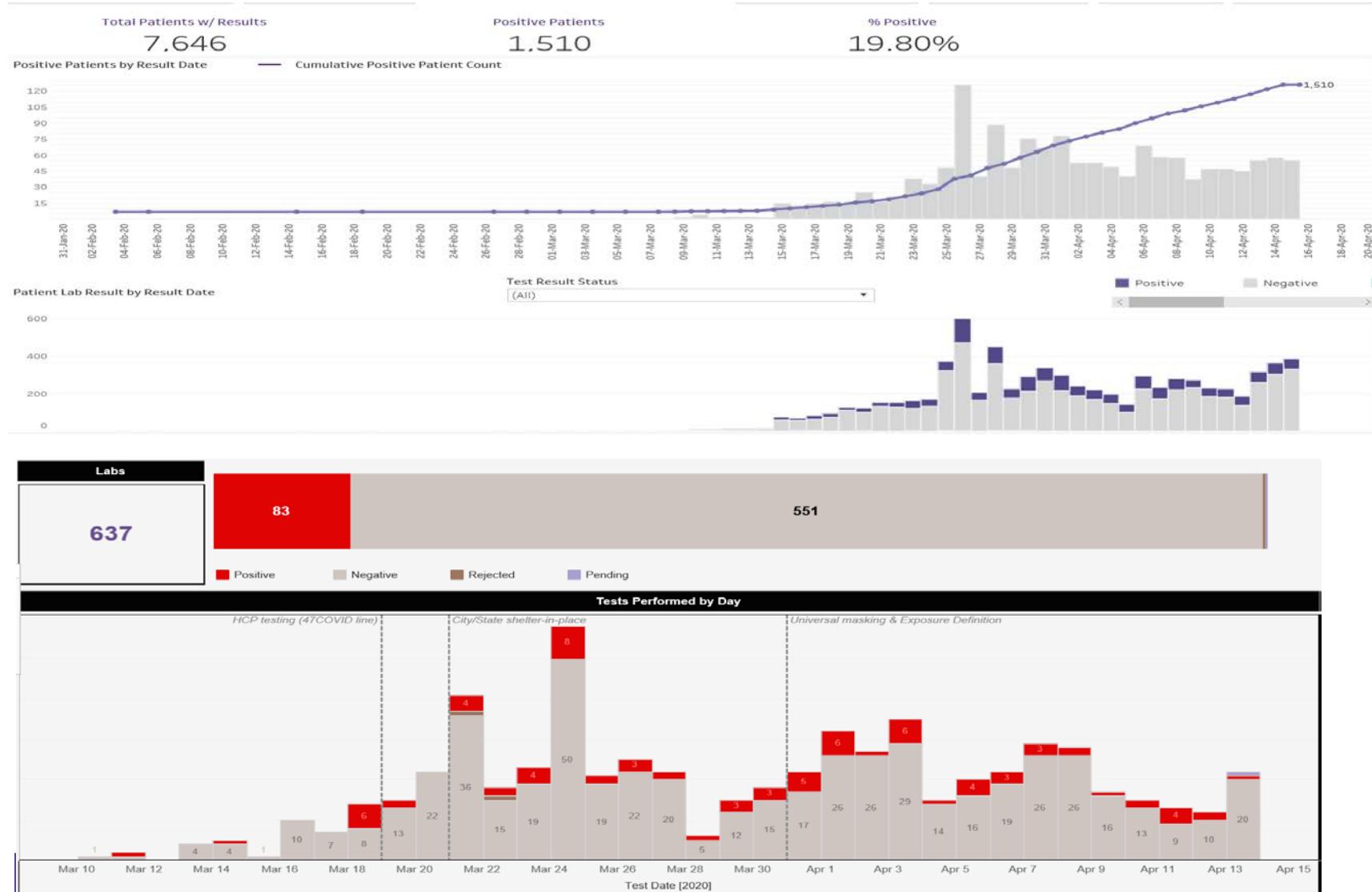
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## What do we do at NM?

- Gloves, Gown, Eye protection, Surgical mask for care of COVID and ROCOVID patients not requiring AGPs
- Same but N95 if COVID or ROCOVID patient on a unit where AGPs regularly performed

# SARS-CoV-2: Aerosol vs Droplet

Is our strategy working?



# Aerosol-Generating Procedure (AGP)

## What is an Aerosol-Generating Procedure?

- Any medical or patient care procedure that results in the production of airborne particles (aerosols)
- AGPs can produce airborne particles <5 microns ( $\mu\text{m}$ ) in size which can remain suspended in the air, travel over a distance and may cause infection if they are inhaled
- AGPs create the potential for airborne transmission of infections that may otherwise only be transmissible by the droplet route
- AGPs lead to a greater risk of transmission for HCW

## How to reduce the risk of AGPs?

- Avoid performing
- Limit Health Care Workers present
- Perform in an Airborne Infection Isolation Room (AIIR)
  - If not available, perform in a room with the door closed
  - All entry into the room requires indicated PPE for the next 70 minutes
- Wear appropriate PPE
  - N95/PAPR
  - Gown, gloves, eye protection



# Aerosol-Generating Procedure (AGP)

## Process for generating list of AGPs:

- Referenced CDC & WHO guidance
- Solicited opinion of national IP experts
- Solicited opinion of local experts in Pulmonary/Critical Care and Anesthesia
- Ongoing review and consideration based on input from local leaders

## NM List of AGPs

- Intubation and extubation
- Airway exchange
- Non-invasive ventilation, exchange and removal of an artificial airway
- Tracheotomy, bedside tracheostomy, and tracheostomy care
- Cardiopulmonary resuscitation (CPR) and ambu resuscitation
- Mechanical ventilation, Manual ventilation before intubation
- Bronchoscopy
- Non-bronchoscopic bronchoalveolar lavage (NB-BAL)
- Open airway suctioning (no risk if in-line suctioning)
- Autopsy
- Non-invasive ventilation:
  - Continuous positive airway pressure (CPAP)
  - Bi-level positive airway pressure(BiPAP)
  - High-flow nasal cannula
- Obstetrics and Neonatology
  - Obstetrics 2nd stage of labor through delivery
  - Neonatal L&D emergency response

### Respiratory therapy procedures:

- Nebulizer treatments (no risk if in-line) – albuterol, Duoneb®, 3% saline
- Metaneb®
- Sputum induction
- Penatmidine

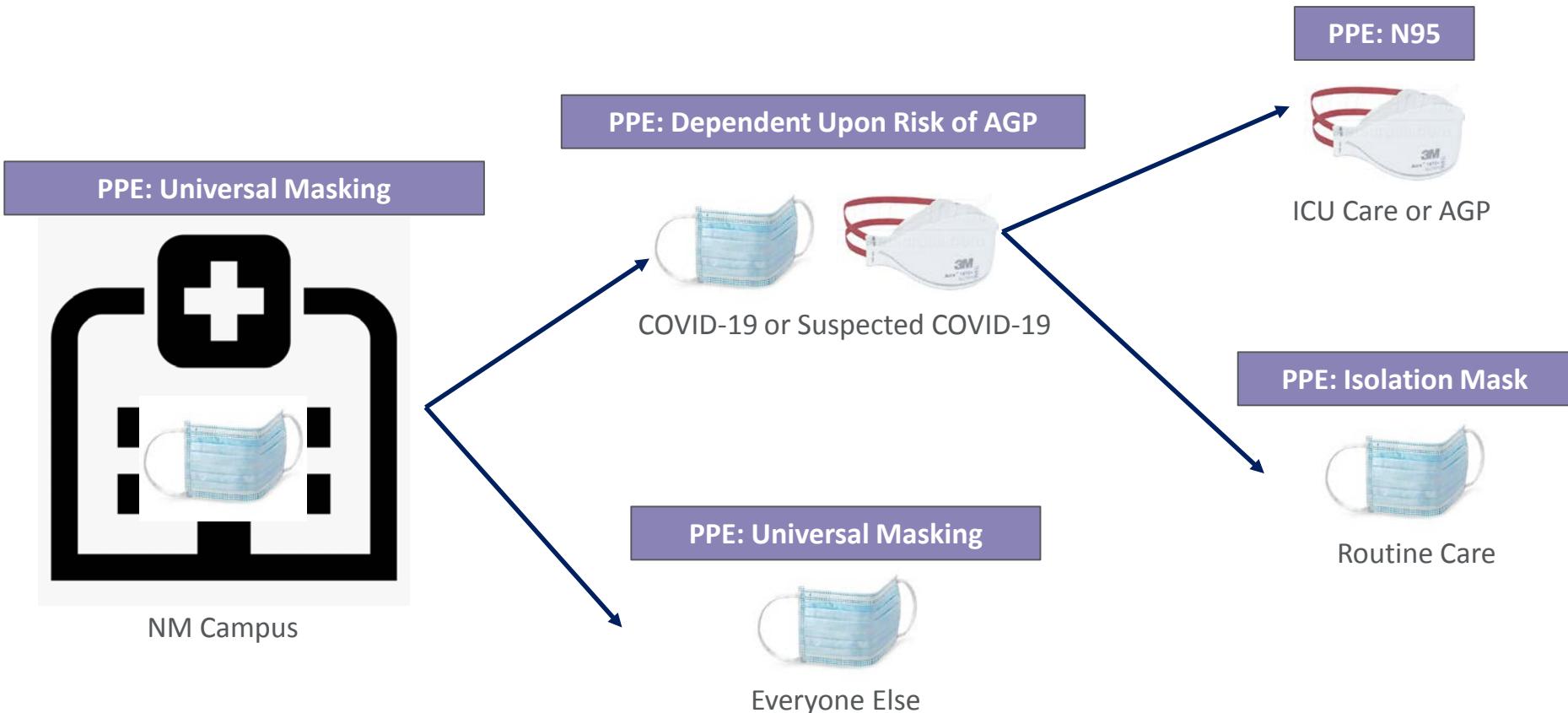
### Endoscopic procedures:

- Laryngoscopy
- Transesophageal echocardiogram (TEE)
- Fiberoptic endoscopic evaluation of swallowing (FEES)
- Esophagogastroduodenoscopy (EGD)
- Upper GI endoscopy, including endoscopic retrograde cholangiopancreatography (ERCP)

### Surgical procedures:

- Transection of airway
- Laryngeal procedures

# NM Personal Protective Equipment (PPE) Guidelines



# NMI > COVID > PPE Resources

**NMI**nteractive

APPLICATIONS DEPARTMENTS POLICIES A

Home > Coronavirus > PPE Resources

## PPE Resources

► Clinical Guidelines

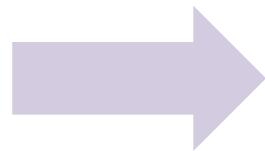
► Employee Resources

**PPE Resources**

► Command Center Updates

► FAQs

By the Numbers



- PPE Guidelines – What to Use and When to Use It - April 13
- PPE Frequently Asked Questions – April 7
- Safe PPE Use and Re-use – April 13
- PPE Donning and Doffing Instructions
- N95 Respirator Seal Testing - April 9
  - N95 Respirator Donning and Seal Testing – Specific Models
    - 3M Aura 1870+ N95 Respirator – April 1
    - 3M Aura 1860\_1860S N95 Respirator – April 1
    - 3M Aura 8210 N95 Respirator – April 1
    - Halyard (Formerly Kimberly-Clark) N95 Respirator – April 1
  - Universal Masking - Overview – April 3
  - IDPH - Guidance on the Use of Masks by the General Public – April 9

**Northwestern Medicine**

Always follow CDC Donning and Doffing PPE Guidelines so as not to contaminate yourself

Last Updated: 4/10/20

Inpatient and ED PPE Recommendations  
Clinical Care of the ROCOVID or COVID patient

Usual COVID PPE = Procedural mask, gown, gloves, face shield (preferred) or goggles  
N95 COVID PPE = N95 or PAPR at all times + gown, gloves, face shield (preferred) or goggles

Clinical Scenario	Usual COVID PPE	N95 COVID PPE	Procedural / Surgical Mask & Gloves	Other
Medical team transporting patient - Patient not intubated	X			- Patient should don a mask - Patient should wear a clean gown or cover with a clean sheet - May continue to wear N95 if donned prior to patient transport

# NMI > COVID > PPE Resources



## Video

- Personal Protective Equipment for COVID Patient: ICU to OR Transport - April 15
- Donning and Checking the Seal Patency on an N95 Respirator - April 6
- English/Spanish Transcript: Donning and Checking the Seal Patency on an N95 Respirator - April 15
- Putting on PPE with a New Surgical Mask or N95 Respirator Mask - March 30
- English/Spanish Transcript: Putting on PPE with a New Surgical Mask or N95 Respirator Mask - April 15
- Putting on PPE with a Used N95 Respirator Mask - March 30
- English/Spanish Transcript: Putting on PPE with a Used N95 Respirator Mask - April 15
- Removing PPE - March 30
- English/Spanish Transcript: Removing PPE Transcript - April 15
- Putting on PPE while Wearing a Continuous Use Surgical Mask or N95 Respirator Mask and Goggles or Face Shield - March 30
- English/Spanish Transcript: Putting on PPE while Wearing a Continuous Use Surgical Mask or N95 Respirator Mask and Goggles or Face Shield - April 15
- Removing PPE while Wearing a Continuous Use Surgical Mask or N95 Respirator and Goggles or Face Shield - March 30
- English/Spanish Transcript: Removing PPE while Wearing a Continuous Use Surgical Mask or N95 Respirator and Goggles or Face Shield - April 15
- Universal masking: wearing, discarding and storage - April 1
- English/Spanish Transcript: Universal masking: wearing, discarding and storage - April 15



## Guidelines for Safe Use and Re-Use of PPE

The top priorities for your safety and that of our patients is to conserve and use the right PPE at the right time so that we have enough for weeks and months to come.



*Not all eye protection appears the same*

- Eye protection may be worn continuously.
- Full face shields are preferred, as they provide mask and N95 respirator protection.
- Disinfect face shield or goggles whenever removed, using gloves and approved hospital-grade wipe. Allow surface of eye protection to dry. A film may be left on surface; rinse with a wet paper towel. Dispose if no longer clear, or if cracked, or damaged.



*Not all respirators appear the same*

- User must perform a seal check (see instructions below) upon donning an N95 respirator.
- N95 respirators are reserved for specific patient care. See PPE guidelines [What to use and when to use it](#) for details.
- N95 respirators may be used continuously by the same healthcare worker for multiple patients for multiple days, and stored in a labeled paper bag.
- Wear a full face shield to reduce N95 contamination.
- Replace N95 respirator after performing any aerosol generating procedure (AGP)\*, even if full face shield is worn.
- Facial hair should be shaved in order to fit an N95 respirator.
- Replace N95 if it becomes contaminated, soiled, damaged, wet and/or hard to breathe through.

**Positive pressure seal check:** Place both hands completely over the respirator being careful not to disturb the position of the mask and ensure no air can enter. Exhale forcefully. You should not feel any air leaking if the fit is successful.

**Negative pressure seal check:** Inhale quickly while pressing down on the sides of the respirator to prevent air from entering. Pouch-style respirators should collapse slightly when negative pressure is created.



**Mask**

- Procedure masks may be used continuously by the same healthcare worker for multiple patients, and may be usable beyond one day. If removed during the day, store in a clean, dry paper bag, do not touch surface and re-apply carefully with hand hygiene.
- Wear a full face shield to reduce mask contamination.
- If procedure mask becomes contaminated, soiled, damaged, torn or wet, it should be disposed of and replaced with a clean mask.
- Masks may not be pulled down and worn below nose/mouth or on forehead.



**PAPR**

- PAPR use is reserved for aerosol generating procedures for staff who cannot wear an N95.
- PAPR hoods may be worn continuously by the same person for a shift for multiple patients, then disinfected and stored in the appropriate location.
- Hood should be replaced if any damage is detected.



**Gown**

- Follow contact isolation sign.
- Remove gown and dispose after each patient's care.
- Take care with removal to not contaminate yourself. Perform hand hygiene.

Your safety depends on careful attention to doffing and hand hygiene. Take your time.

\*See [COVID FAQs "What are Aerosol Generating Procedures"](#) for list of AGPs. Includes Labor & Delivery.

# Frequently Asked Questions

- Why do guidelines keep changing?
- Should I cover my N95 with a surgical mask?
- Will we test all patients coming to the hospital as part of their standard of care?
- How long can I wear the N95? How long can I wear the procedure mask?
- Why are we asking all visitors and staff to be masked all the time ?
- Can we transfer COVID patients to Marianjoy and other rehab and post-acute settings



# Open Forum

IP On-Call Pager 24/7	IP Directors & Medical Directors System Director – Christina Silkaitis
Central Region: 312.695.9196	<b>Central:</b> Gina Dolgin (director) - Dr. Teresa Zembower & Dr. Maureen Bolon
West Region: 630.255.1293	<b>West:</b> Anessa Mikolajczak (director) - <b>CDH:</b> Dr. Luis Manrique - <b>Delnor/Marianjoy:</b> Dr. Steven Lewis - <b>Kish/VW:</b> Dr. Bob Manam
North/Northwest Region: 312.695.9483	<b>North and Northwest:</b> Heather Voss (director) - <b>LFH:</b> Dr. Stephen Grohmann - <b>Northwest Region:</b> Dr. Irfan Hafiz

## Ask the Experts...

