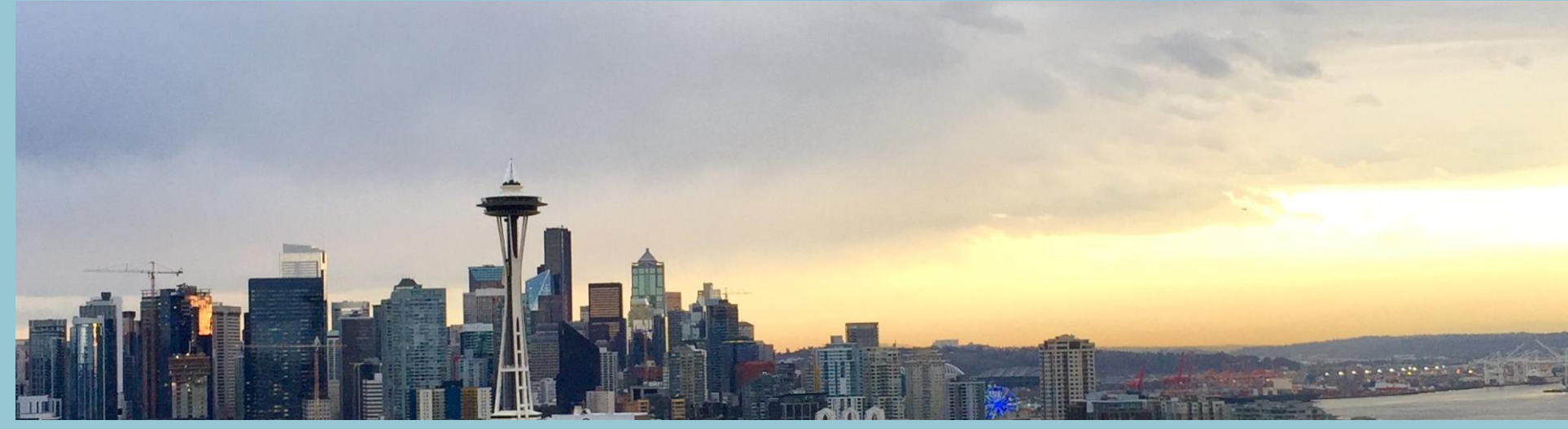


Aerosol-Generating Medical Procedures: Transmission of SARS-CoV-2 and Emerging Viruses

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Introduction

Early on during the pandemic of coronavirus disease 2019 (COVID-19), many questions arose regarding risks for hospital-acquired or nosocomial transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹ Aerosol generating medical procedures (AGMPs), techniques that can generate infectious, virus-laden aerosols, could potentially amplify transmission among healthcare workers (HCWs).² Thus, it was widely recommended that HCWs use airborne precautions when performing AGMPs. However, in clinical settings it is often unclear what procedures constitute AGMPs and how the risk varies by procedure or pathogen. We set out to further define AGMPs and assess the risk for nosocomial transmission of SARS-CoV-2 and other high-risk viruses via AGMPs.³

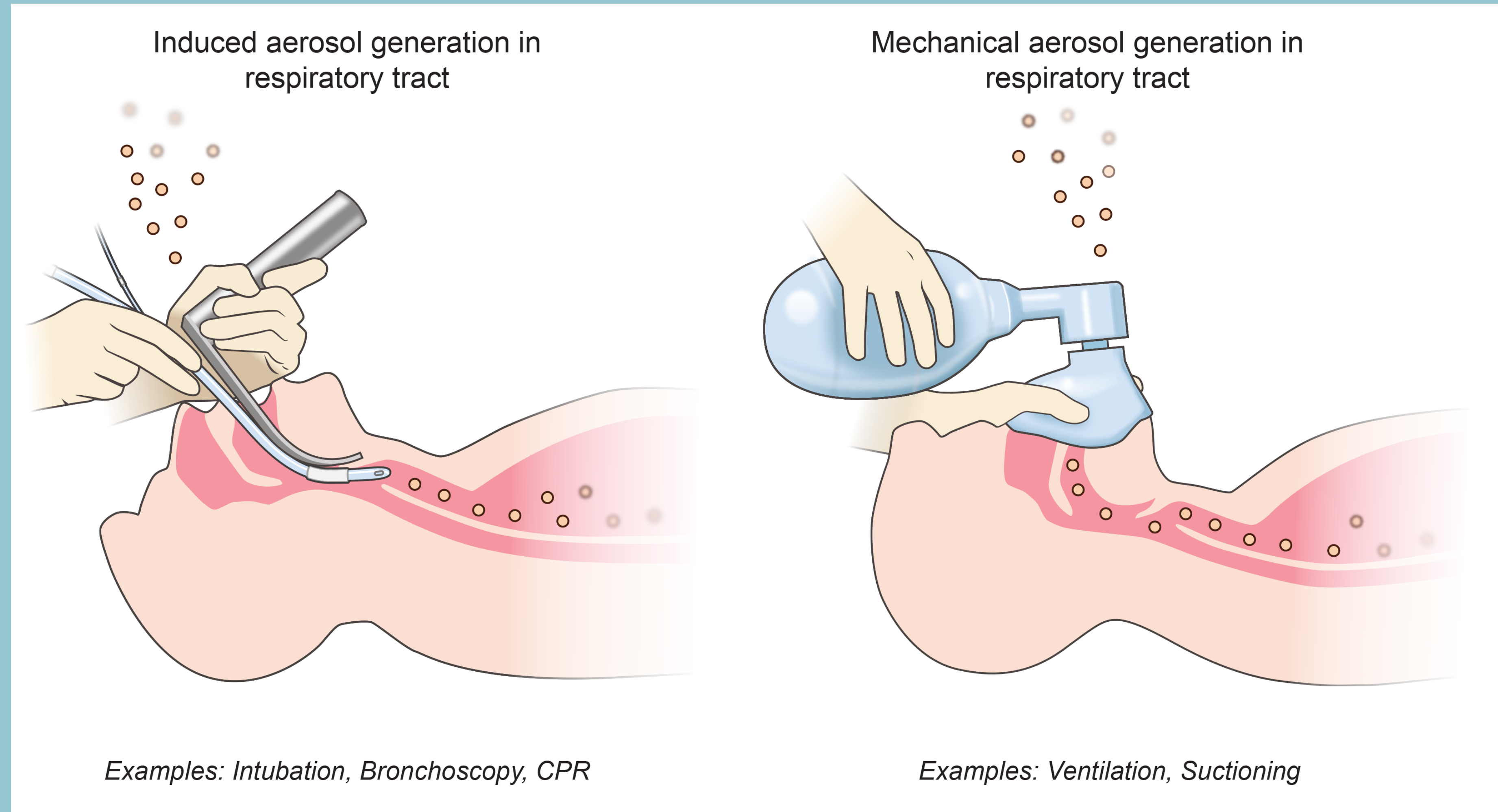
Methods

We identified potential AGMPs and emerging viruses that were high-risk for nosocomial transmission through reviewing experimental and clinical data. Potential AGMPs were those associated with previous virus transmission or mechanically capable of transmission. High-risk viruses were defined as those that cause severe disease in humans for which limited therapies or interventions exist, are infectious via aerosols in humans or non-human primates (NHPs), found in the respiratory tract of infected humans or NHPs, and had previous evidence of nosocomial transmission.³

Conclusions

1. Viruses from eight families are high-risk for nosocomial transmission via aerosol-generating medical procedures. All of these viruses are emerging zoonotic RNA viruses.
2. There are many potential aerosol-generating medical procedures, which can be divided into those that induce a patient to form aerosols and those that generate aerosols.
3. Aerosol-generating medical procedures pose a risk for SARS-CoV-2 transmission given similar aerosol stability to SARS-CoV-1 and increased risk of SARS-CoV-1 transmission with procedures such as intubation.

Results



Virus	Detection in Upper Respiratory Tract	Detection in Lower Respiratory Tract	Infection via Aerosols	Evidence of Transmission
MERS-CoV	Human icon	Human icon	Human icon	Nosocomial transmission
SARS-CoV-1	Human icon	Human icon	Human icon	Likely association with AGMPs
SARS-CoV-2	Human icon	Human icon	Human icon	Likely association with AGMPs
Junin virus	Monkey icon		Monkey icon	
Lassa virus	Human icon	Human icon	Human icon	Nosocomial transmission
Machupo virus			Monkey icon	Nosocomial transmission
Crimean-Congo hemorrhagic fever virus	Monkey icon		Human icon	Possible association with AGMPs
Hantaviruses	Human icon	Human icon	Human icon	Nosocomial transmission
Rift valley fever virus	Monkey icon		Human icon	
Ebolaviruses	Human icon	Human icon	Human icon	Possible association with AGMPs
Marburg virus	Monkey icon		Human icon	
Influenza A virus (H5N1, H7N9, H1N1)	Human icon	Human icon	Human icon	Nosocomial transmission
Hendra virus		Human icon	Human icon	Nosocomial transmission
Nipah virus	Human icon	Human icon	Human icon	Nosocomial transmission

Virus isolated or viral RNA/antigen in human samples. Humans infected via aerosols in laboratory or health settings
 Virus isolated or viral RNA found in experimentally infected nonhuman primates (NHPs). NHPs infected via aerosols

Aerosol Generating Procedure	How/Where Aerosols May Be Generated
Bronchoscopy *	Induced cough, respiratory tract
Cardiopulmonary resuscitation *	Induced cough, respiratory tract
Noninvasive ventilation * (BiPAP, CPAP, HFOV, Trach collar)	Possible mechanical dispersal of aerosols, respiratory tract
Tracheal intubation *	Induced cough, respiratory tract
Manual ventilation *	Possible mechanical dispersal of aerosols, respiratory tract
Surgery (tracheostomy)	Cutting bone and tendon, and irrigation aerosolize blood
Sputum induction	Induced cough, respiratory tract
Nebulizer treatment	Possible mechanical dispersal of aerosols, respiratory tract
Airway Suctioning	Possible mechanical dispersal of aerosols, respiratory tract
Laser plume	Mechanical dispersal of aerosols
Chest physiotherapy	Induced cough, respiratory tract
Nasogastric tube insertion	Induced cough, respiratory tract
Endoscopy procedures (ERCP, Transesophageal Echocardiogram)	Induced cough, respiratory tract

* Possible association with SARS-CoV-1 transmission

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2. Judson, S. D., van Doremalen, N., Munster, V. J. (2020). Stability and Viability of SARS-CoV-2. *The New England Journal of Medicine*. <http://doi.org/10.1056/NEJMc2007942>
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