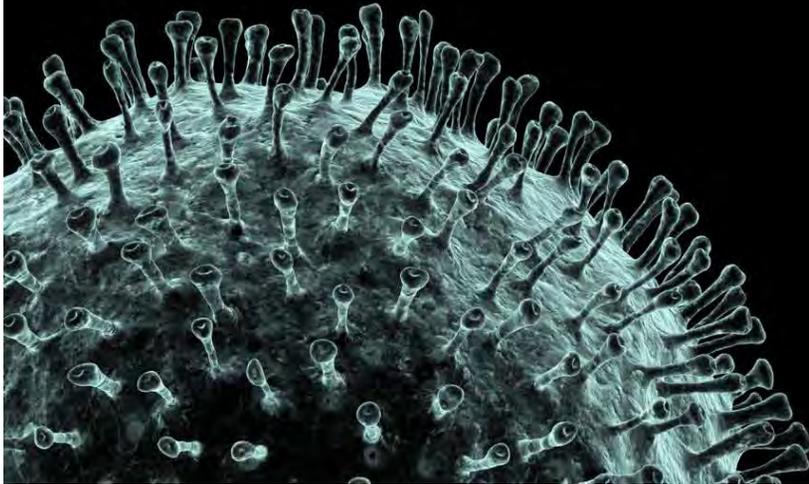


COVID-19 Conversations



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COVID19Conversations.org

#COVID19Conversations



AMERICAN PUBLIC HEALTH ASSOCIATION
For science. For action. For health.



Surface and aerosol stability and transmission

John-Martin J. Lowe presenting on behalf of study team:

Joshua Santarpia, Danielle Rivera, Vicki Herrera, Jane Morwitzer, Hannah Creager, George Santarpia, Kevin Crown, David Brett-Major, Elizabeth Schnaubelt, Jana Broadhurst, James Lawler, St. Patrick Reid

Context matters

Significant debate about transmission routes of SARS-CoV-2 since its emergence in late 2019.

Initial reports from China, indicated that it may have been spread via the airborne route,

Evolving guidelines from WHO and U.S. CDC around airborne, droplet and contact precautions in the face of limited resources considered the disease to be spread via droplet transmission through March of 2020.



February 7, 2020

doi:10.1001/jama.2020.1585

JAMA | **Original Investigation** | **CARING FOR THE CRITICALLY ILL PATIENT**

Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China

Dawei Wang, MD; Bo Hu, MD; Chang Hu, MD; Fangfang Zhu, MD; Xing Liu, MD; Jing Zhang, MD; Binbin Wang, MD; Hui Xiang, MD; Zhenshun Cheng, MD; Yong Xiong, MD; Yan Zhao, MD; Yirong Li, MD; Xinghuan Wang, MD; Zhiyong Peng, MD

Nosocomial transmission of SARS-CoV-2 has been reported

Role of aerosol transmission and environmental contamination unclear



Diamond Princess Cruise Ship



Jae C. Hong/AP Feb 15, 2020



James Lawler/ Feb 14, 2020



Cruise Ship Hazard

Diamond Princess-

With incomplete testing (best estimate 83% of passengers/crew) had over 750 documented cases (20% community attack rate) – estimate true attack rate > 40%

SS Greg Mortimer 128/217 (59%) positive (Australia -> Uruguay, March)

Bottom Line – Cruise ships appear to be uniquely permissive environments for SARS-CoV-2 spread

Considerations:

- close quarters/high density and frequent contact
- key crew (food service) as vectors
- air handling systems and airborne spread
- waste water symptoms and fecal contamination



March 4, 2020 JAMA | **Original Investigation**

Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient

Sean Wei Xiang Ong, MBBS¹; Yian Kim Tan, PhD²; Po Ying Chia, MBBS¹; [et al](#)



March 9, 2020

The NEW ENGLAND JOURNAL of MEDICINE

CORRESPONDENCE

**Aerosol and Surface Stability of SARS-CoV-2
as Compared with SARS-CoV-1**

Neeltje van Doremalen, Trenton Bushmaker, Dylan Morris, Myndi Holbrook, Amandine Gamble, Brandi Williamson, Azaibi Tamin, Jennifer Harcourt, Natalie Thornburg, Susan Gerber, Jamie Lloyd-Smith, Emmie de Wit, Vincent Munster



March 9-23, 2020

This preprint was not peer-reviewed and has granted medRxiv a license to display the preprint.

medRxiv



BMJ Yale

THE PREPRINT SERVER FOR HEALTH SCIENCES

Transmission Potential of SARS-CoV-2 in Viral Shedding Observed at the University of Nebraska Medical Center

Joshua L Santarpia, Danielle N Rivera, Vicki Herrera, M. Jane Morwitzer, Hannah Creager, George W. Santarpia, Kevin K Crown, David Brett-Major, Elizabeth Schnaubelt, M. Jana Broadhurst, James V. Lawler, St. Patrick Reid, John J. Lowe

doi: <https://doi.org/10.1101/2020.03.23.20039446>

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice.

<https://doi.org/10.1101/2020.03.23.20039446>



February 18, 2020

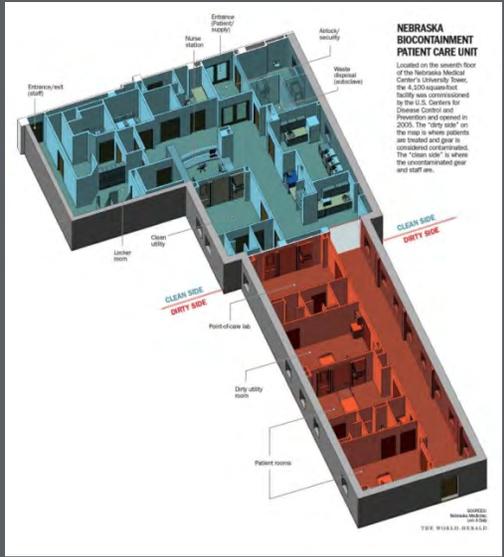
- 13 Repatriated from cruise ship, eventually 15 total
- Range of illness representing mildly ill to severely ill
- Home or cared for in highly controlled environments



Source: CNN



Nebraska Biocontainment Unit



- 10 bed critical care unit
- Negative pressure
- Enhanced engineering, administrative controls
- Highly strained and equipped staff
- 1 of 10 U.S. Regional Special Pathogen Treatment Centers

National Quarantine Unit

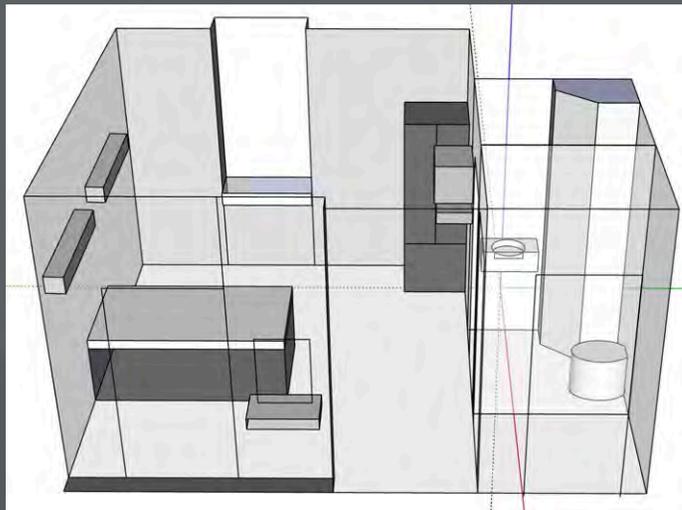


- 20 residential units
- Negative pressure
- Enhanced engineering, administrative controls
- Highly strained and equipped staff
- Established by HHS ASPR



Nebraska Biocontainment Unit

- 3 critical care isolation rooms sampled
- Hospitalized ill individuals
- Rooms sampled on
 - day 10 of admission
 - day 10 of admission
 - day 4 of admission



National Quarantine Unit

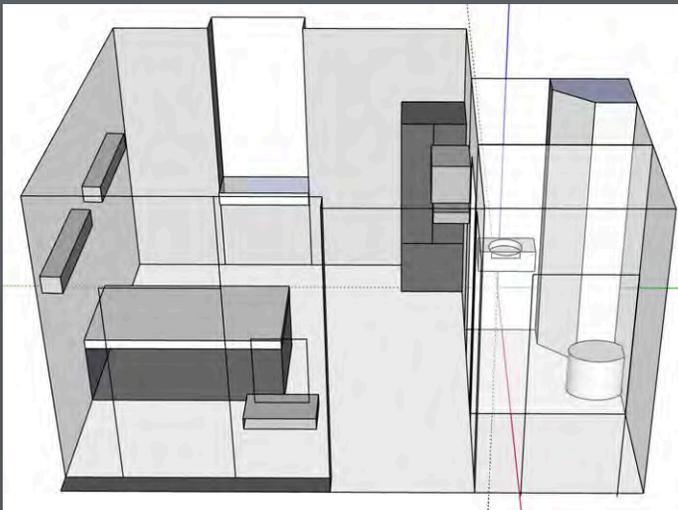
- 9 residential rooms sampled
- Mildly symptomatic or asymptomatic individuals
- Days 5-9 of admission





Surface Samples

- room surfaces
 - ventilation grates
 - tabletops
 - window ledges
- personal items
 - cellular phones
 - exercise equipment television
 - remotes
 - medical equipment
- toilets

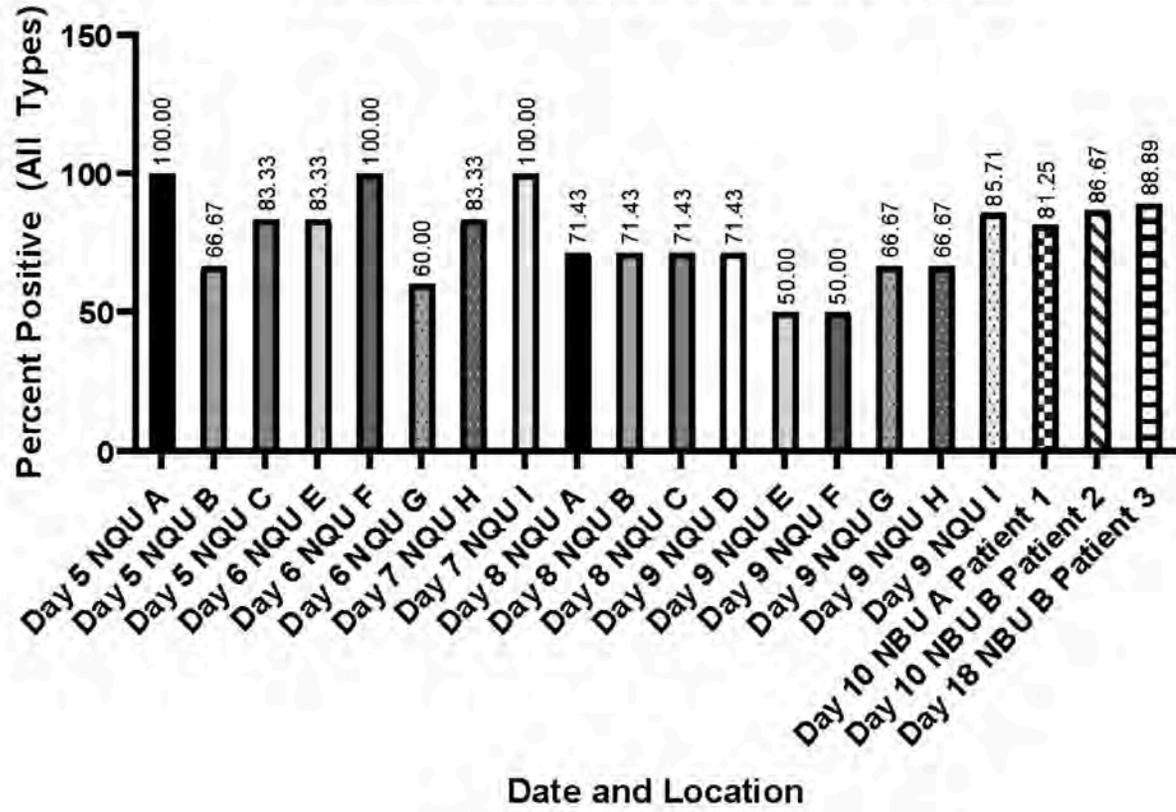


Air Samples

- High volume
 - next to bed
 - hallway adjacent to door
- Low volume
 - on sampling personnel



Percent Positive Samples of All Types



Percent positive by sample type

Sample	% Positive by PCR	N
Bedside Table	75%	24
Air Handling Grate	80%	5
Floor Under Bed	100%	5
Window Ledge	82%	24
Personal Items	81%	15
Phone	83%	18
Remote	65%	18
Toilet	81%	21
Air Samples	63%	19



Figure 2. B. Results of hallway air samples and personal air samples.

Location	Day	Hallway Air Samples (copies/L of air)		Personal Air Samples (copies/L of air)	
NQU	5	UND	NC		
	5	UND	NC		
	6	5.757	5.096		
	6	6.004	5.902		
	7	2.077	3.597		
	7	UND	NC		
	8	8.688	3.688		
	8	2.361	4.090		
	8	2.294	3.972		
	9				
			5.366	7.150	
NBU	10	UND	NC		
	10	2.994	5.186		
	10	0.979	1.695		
	18				
			48.216	67.164	
Percent Positive		66.7%		100.0%	



Figure 2. A. Results of all in-room samples collected in this study.

Room	Day	Air Samples (gc/L of air)		Oral Temp. (°F)	Other Sym?
		Average	Stand. Dev		
NQU A	5	4.001	6.931	102.3	Y
NQU B	5	2.793	4.838	98.2	Y
NQU C	5	8.339	7.246	99.1	N
NQU E	6	2.704	4.683	100.5	Y
NQU F	6			98.6	Y
NQU G	6			99.1	N
NQU H	7	3.304	5.722	98.5	Y
NQU I	7	8.224	8.266	99.1	N
NQU A	8	4.736	4.128	100.4	Y
NQU B	8	UND	NC	97.9	N
NQU C	8	5.685	9.846	99.5	N
NQU D	9	UND	NC	ND	ND
NQU E	9	UND	NC	99	Y
NQU F	9	UND	NC	98.8	Y
NQU G	9	UND	NC	99.1	N
NQU H	9	4.223	7.314	98.7	N
NQU I	9	UND	NC	98.5	N
NBU A Patient 1	10	>6ft from patient		98.3	Y
		3.760	3.435		
NBU B Patient 2	10	>6ft from patient		99.2	Y
		UND	NC		
NBU B Patient 3	18	Near Patient		99.1	Y
		4.074	7.057		
		>6ft from patient			
		2.485	4.303		
Percent Positive		63.2%		57.9%	57.9%
R ² to Fever		0.06			



Conclusions



Ubiquitous environmental contamination not linked to symptoms



PCR positive air samples outside of 6ft provides additional evidence of aerosol transmission

Does not establish particle size or distribution potential



Value of strategies for environmental disinfection



Limitations and further study



Presence of Infectious virus



Determine particle size for carriage of RNA and infectious virus



Infectious dose



Longitudinal study of routes of viral shedding over course of infection



Role of oxygen delivery systems in aerosol generation



March 29, 2020

medRxiv



BMJ Yale

THE PREPRINT SERVER FOR HEALTH SCIENCES

Detection of Air and Surface Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in Hospital Rooms of Infected Patients

Po Ying Chia, Kristen K Coleman, Yian Kim Tan,  Sean Wei Xiang Ong, Marcus Gum, Sok Kiang Lau, Stephanie Sutjipto, Pei Hua Lee, Than The Son, Barnaby E. Young, Donald K. Milton, Gregory C. Gray, Stephan Schuster, Timothy Barkham, Partha Prathim De, Shawn Vasoo, Monica Chan, Brenda Sze Peng Ang, Boon Huan Tan, Yee Sin Leo, Oon-Tek Ng, Michelle Su Yen Wong, Kalisvar Marimuthu

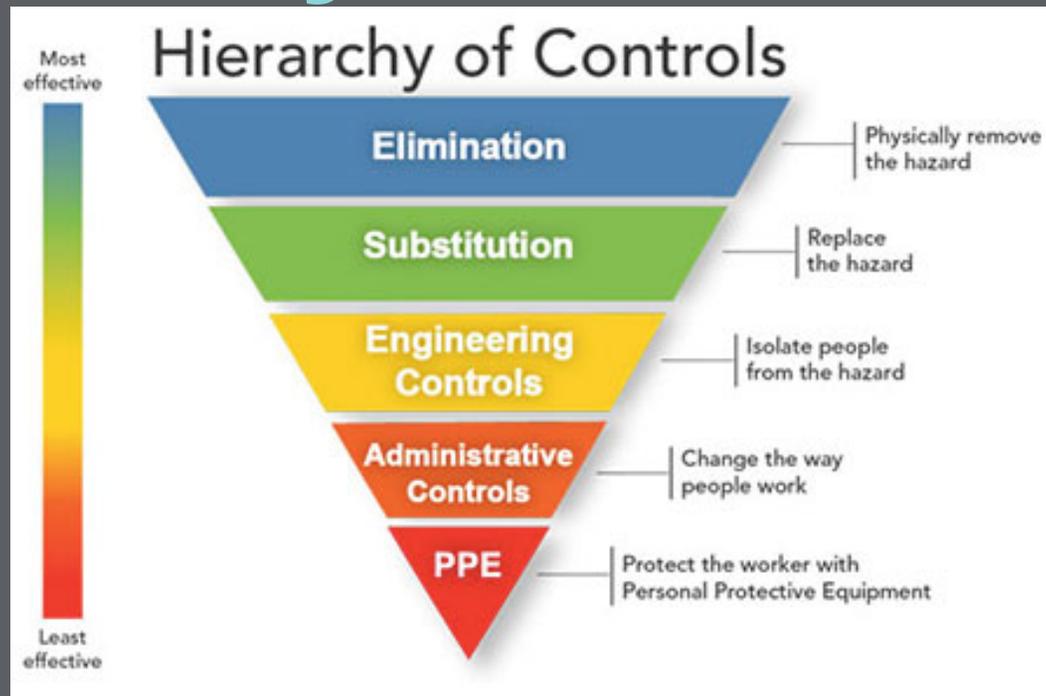
doi: <https://doi.org/10.1101/2020.03.29.20046557>

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice.

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Hierarchy of Controls



<https://www.cdc.gov/niosh/topics/hierarchy/>

