Containing Covid: Reducing Risk through Layered Nonpharmaceutical Interventions

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Risk Assessment

RISK OF INTRODUCTION ONTO THE AIRCRAFT

- Function of community prevalence
- Modifiable through testing; otherwise largely immutable
- Difficult to fully estimate due to heterogeneity in source markets

RISK OF ONWARD TRANSMISSION

- Whether a case becomes a cluster
- Modifiable through nonpharmaceutical interventions
- Effectiveness of interventions + compliance is key

Risk of Introduction

Based on current prevalence, on a flight with 100 people the chance that at least one person is infected:

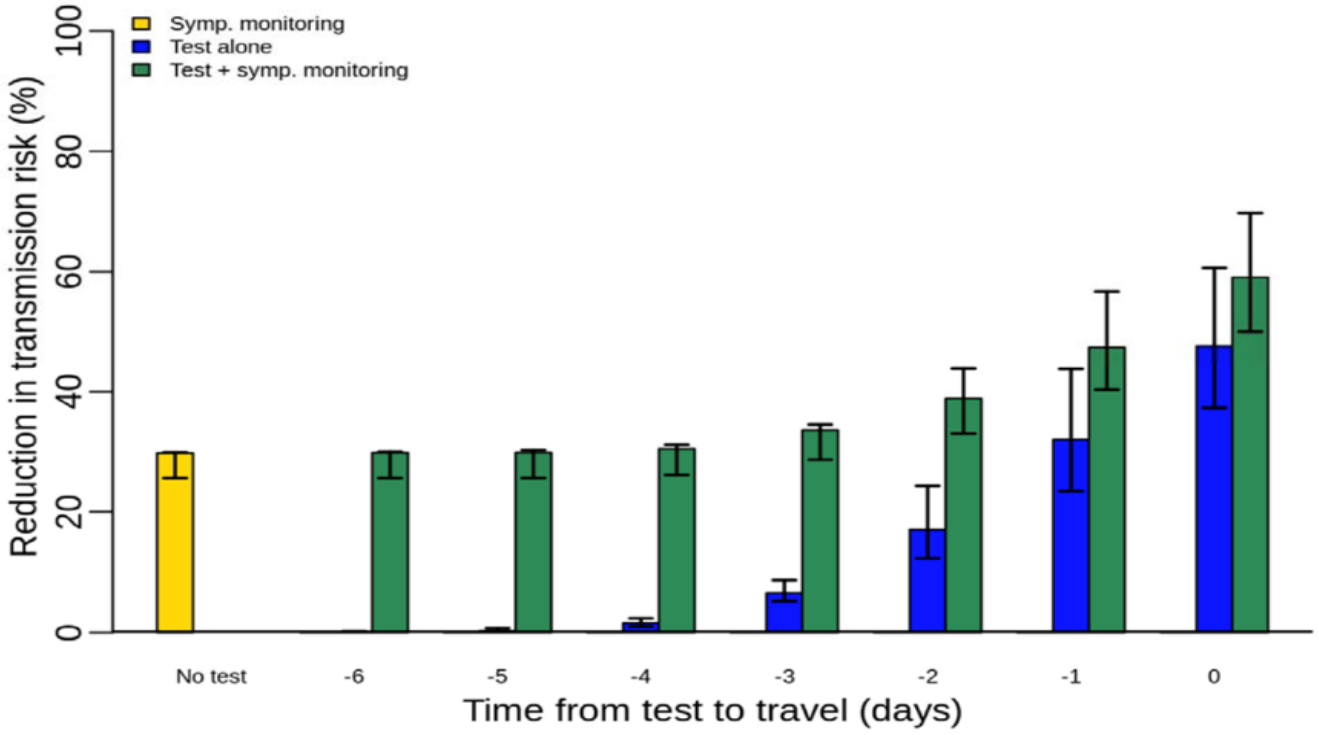
State (cases per 100k per day)	Assuming no missed cases	5x underascertainment
Hawaii (7)	7%	31%
New Mexico (32)	27%	79%
Texas (73)	46%	96%

Testing to Reduce Introduction

- Intended to identify people with active infections, prevent them from boarding and traveling.
- Protective of voyage and receiving community
- Will not identify people incubating; may identify people who are not infectious
- Currently, CDC requires a viral test within 3 days of departure is required for air passengers entering the US
- No requirement for domestic travelers or at land borders

Modeled Risk Reduction of Testing Policy

Figure 3a. Reductions in SARS-CoV-2 transmission risk during a 1-day trip assuming a 7-day exposure window prior to travel, stratified by method of risk reduction. Individuals developing symptoms are assumed to be isolated and therefore do not travel.



Testing alone within 3 days of departure can reduce risk approximately 10% - 40%. Adding symptom monitoring improves modeled risk reduction.

Reducing travel-related SARS-CoV-2 transmission with layered mitigation measures: Symptom monitoring, quarantine, and testing

Michael A. Johansson[1], Hannah Wolford[1], Prabasaj Paul[1], Pamela S. Diaz[1], Tai-Ho Chen[1], Clive M. Brown[1], Martin S. Cetron[1], Francisco Alvarado-Ramy[1]

[1]COVID-19 Response, Centers for Disease Control and Prevention*

Symptom or Temperature Screening

Relatively low-cost intervention, but evidence suggests it is not particularly effective.

A review of airport screening measures found that capture was functionally zero.

With asymptomatic and presymptomatic transmission, this is likely true of SARS-CoV-2 also

Pathogen	Date	Location	Direction	Screened	Detained	Positive	Source
Influenza A/H1N1p	27 April–22 June 2009	Auckland, New Zealand	Inbound	456,518	406	4	(Hale et al., 2012)
	28 April–18 June 2009	Sydney, Australia	Inbound	625,147	5845	3	(Gunaratnam et al., 2014)
	28 April–18 June 2009	Tokyo, Japan	Inbound	471,733	805	15	(Nishiura and Kamiya, 2011)
SARS Co-V	5 April–16 June 2003	Australia	Inbound	1,840,000	794	0	(Samaan et al., 2004)
	31 March–31 May 2003	Singapore	Inbound	442,973	176	0	(Wilder-Smith et al., 2003)
	14 May–5 July 2003	Toronto, Canada	Inbound	349,754	1264	0	(St John et al., 2005)
	14 May–5 July 2003	Toronto, Canada	Outbound	495,492	411	0	(St John et al., 2005)
MERS Co-V	24 September 2012–15 October 2013	England	Inbound	NR	77	2	(Thomas et al., 2014)
Ebola virus	August–September 2014	Guinea, Liberia, Sierra Leone	Outbound	36,000	77	0	(Centers for Disease Control and Prevention, 2014a)
	11 October–22 October 2014	United States	Inbound	762	3	0	(Apuzzo and Fernandez, 2014; CBS, 2014)

https://elifesciences.org/articles/05564

Risk of Onward Transmission

Onward transmission is a function of mitigation measures

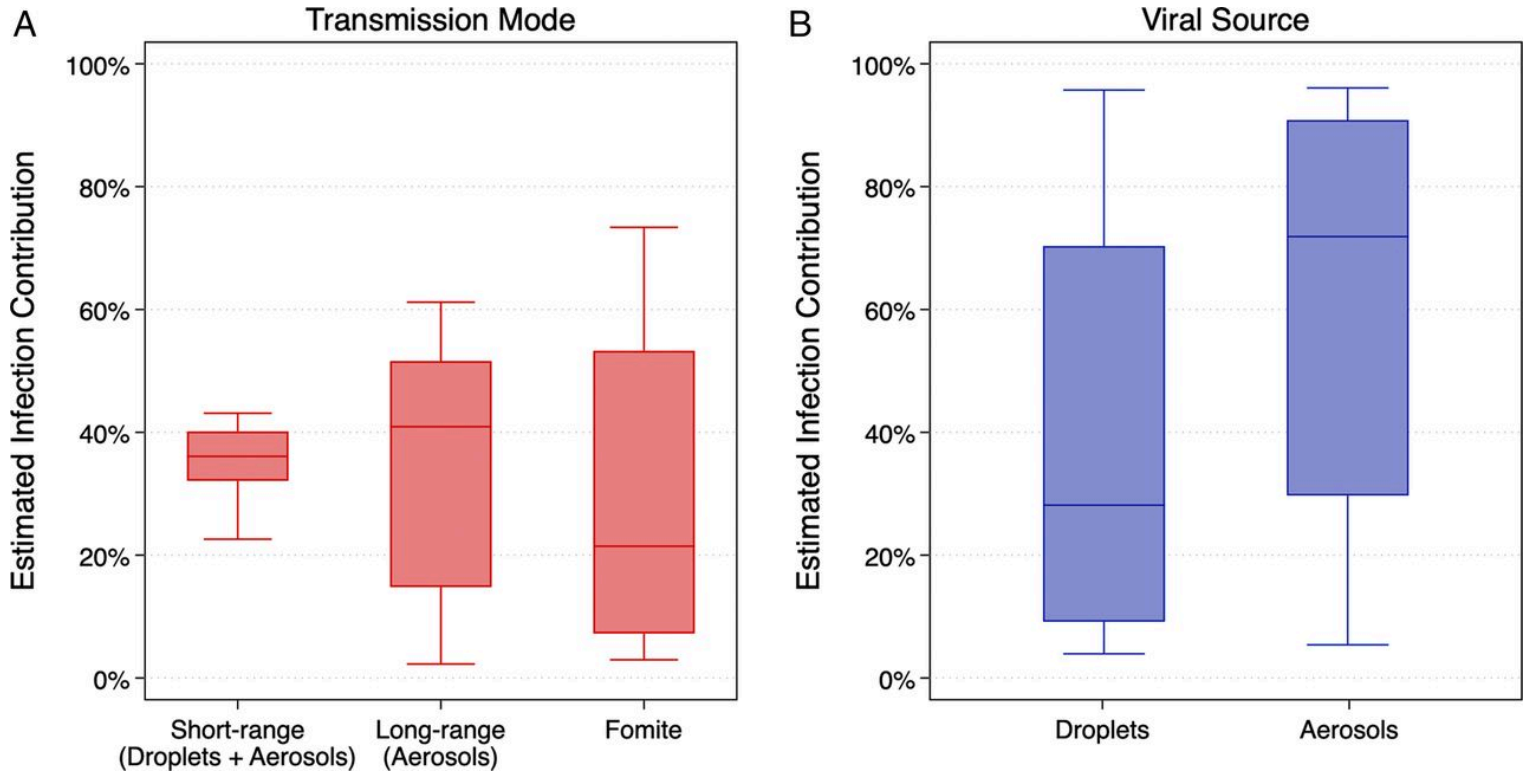
Layering mitigation measures will improve effectiveness

Marginal value of each mitigation measure is not clear

Primary Modes of Transmission

Mechanistic transmission modeling of COVID-19 on the *Diamond Princess* cruise ship demonstrates the importance of aerosol transmission

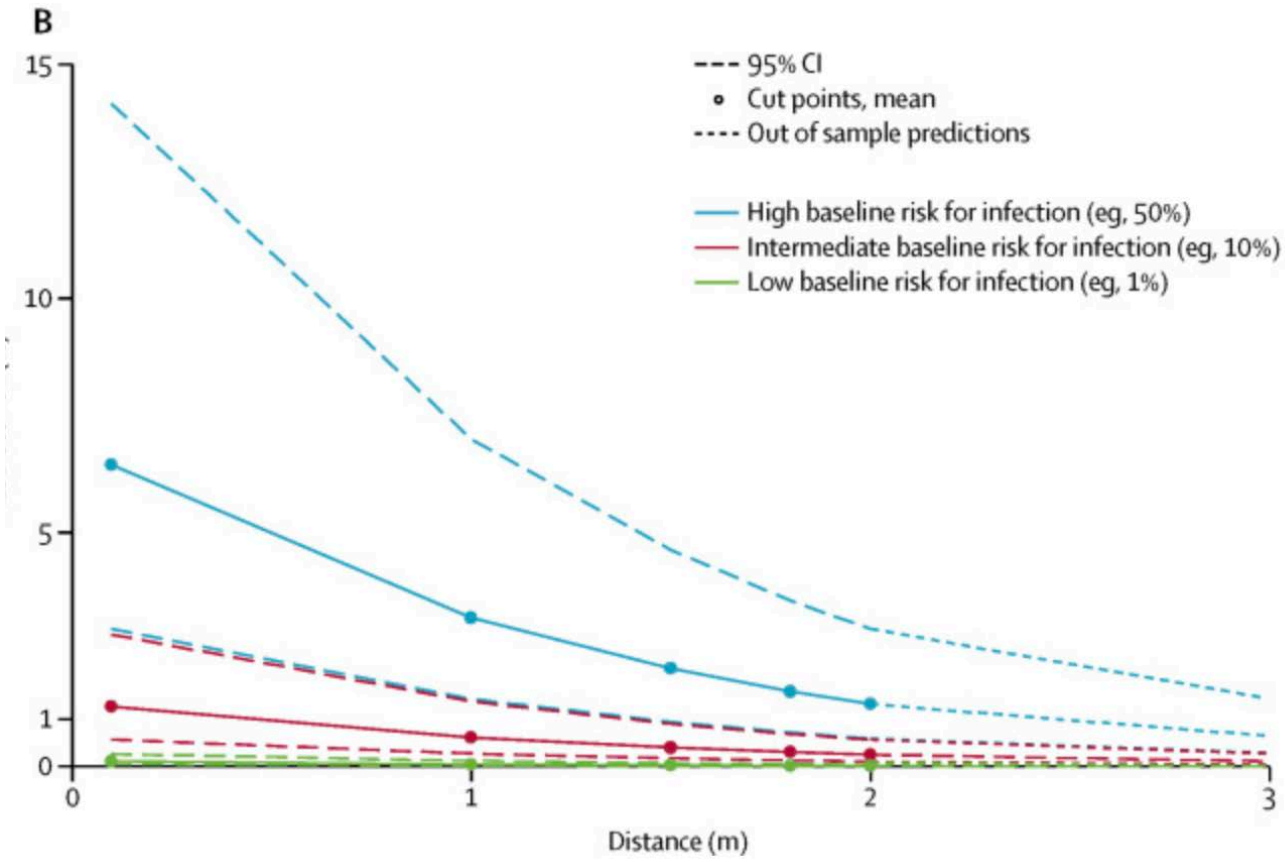
Dr. Allen – up next!



Masks

- Several lines of evidence support masks as an important intervention
- Source control – protecting others
  - Cloth masks can block 50-70% of fine particles (<10 microns) and upwards of 80% of large droplets (>20-30 microns) per CDC review.
- Protection for the wearer
  - N95 masks highly effective at protecting the wearer; surgical masks also effective. Cloth face coverings less effective but still confer some protection. Cloth masks with multiple layers and snug fit are better.
- Eye protection likely useful additional measure

https://www.cdc.gov/coronavirus/2019-ncov/more/masking-science-sars-cov2.html



https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31142-9/fulltext

Distancing

RULE OF THUMB: MORE IS BETTER

Surface Cleaning

- Fomites not thought to be a primary driver of transmission; fomite transmission hard to study
- My suspicion is that risk calculus is substantially higher in airports and airplanes; extremely high touch surfaces + cool, dry air.
- Frequent cleaning and disinfection of high touch surfaces is sensible.

Ventilation

Recommended strategies

- Increase outdoor ventilation
- Create directional airflow
- Adding or improving filters
- ultraviolet germicidal irradiation

ACH § ¶	Time (mins.) required for removal 99% efficiency	Time (mins.) required for removal 99.9% efficiency
2	138	207
4	69	104
6+	46	69
8	35	52
10+	28	41
12+	23	35
15+	18	28
20	14	21
50	6	8

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