

# Relative contributions of transmission routes for COVID-19 among healthcare personnel providing patient care

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Rachael M. Jones (2020) Relative contributions of transmission routes for COVID-19 among healthcare personnel providing patient care, *Journal of Occupational and Environmental Hygiene*, 17:9, 408-415, DOI: [10.1080/15459624.2020.1784427](https://doi.org/10.1080/15459624.2020.1784427)

# Background

- Routes of COVID-19 exposure remain uncertain
- Transmission routes are key to protect healthcare workers (HCW) from exposure
- Increasing support for transmission via inhalation of viral aerosols



# Study Purpose

- Explore contributions of 3 transmission routes to the risk of COVID-19 exposure
  - Contact
  - Droplet
  - Inhalation
- Uses quantitative risk microbial assessment and exposure model used previously to characterize influenza

# Methods: Exposure Model

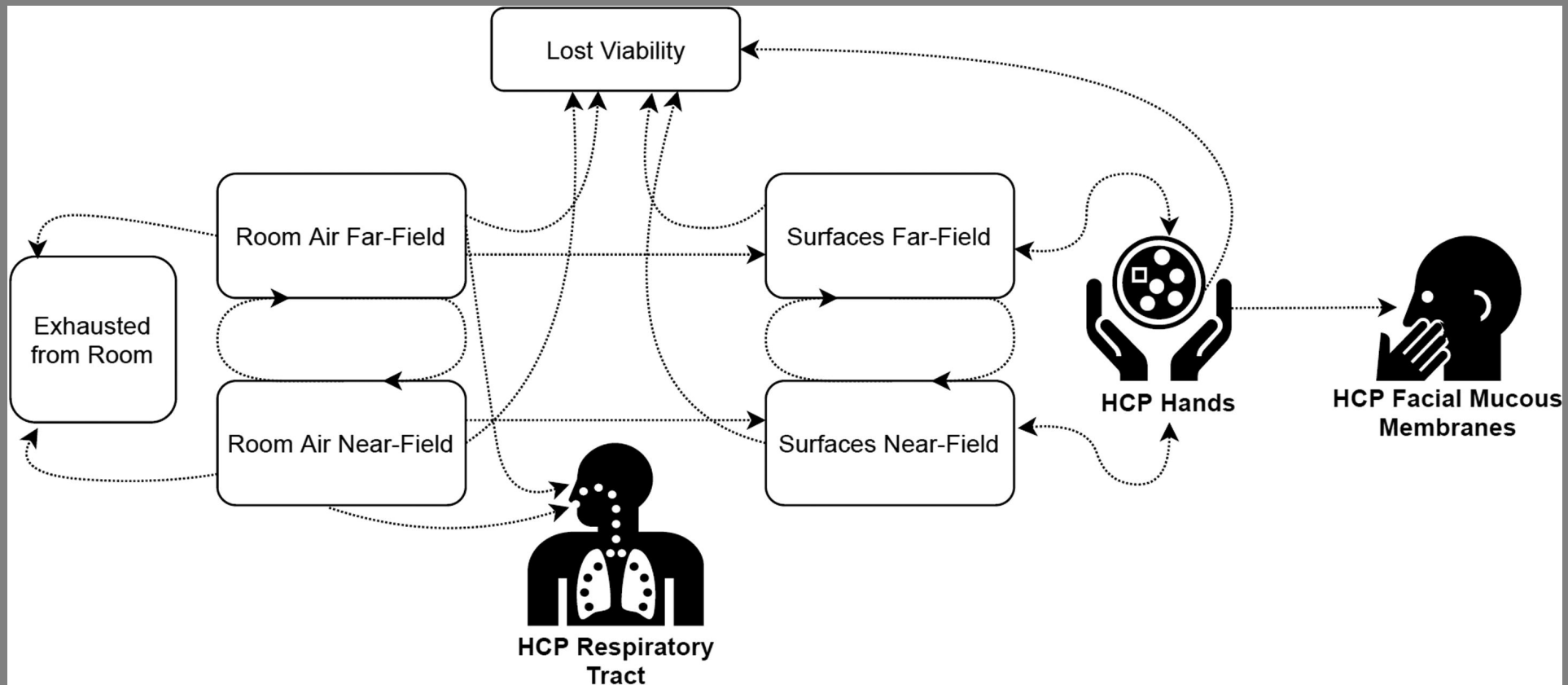


Figure 1. Compartments and pathways for virus transport in the exposure model. Contact and inhalation measured using a compartmental model of virus transport/fate using Markov Chain

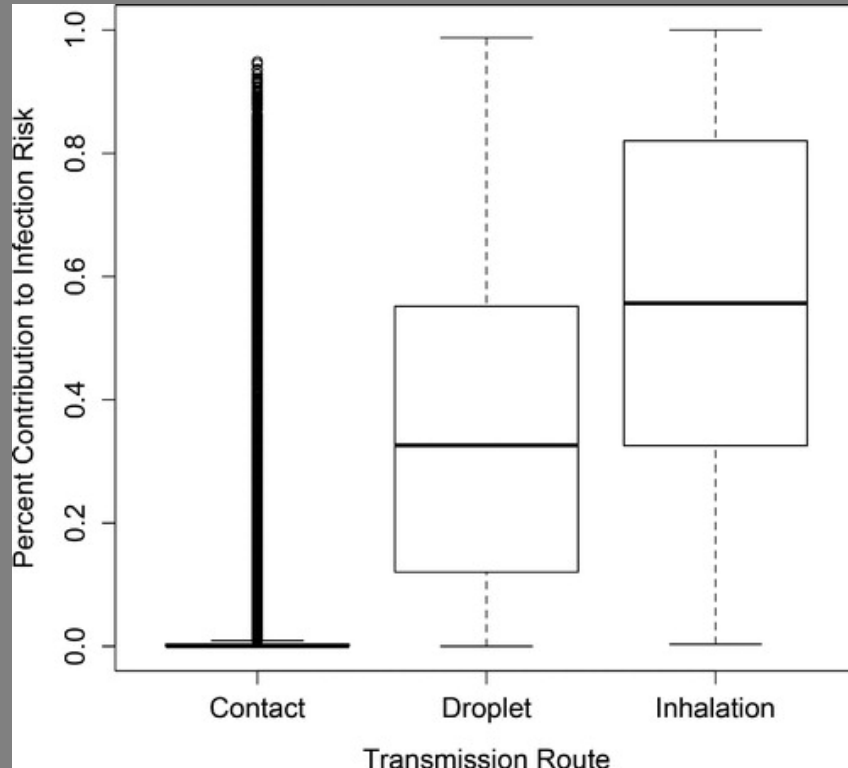
# Methods: Parameters

- Virus concentration in droplets based on virus concentration measured in early morning saliva sample from COVID-19 patients
- Rate of aerosol inactivation based on half-life of virus in aerosol and on plastic surfaces

## 3 PPE Scenarios

1. No PPE
  2. Barrier precautions (eye protection and surgical masks)
  3. Inhalation and barrier precautions (N95 mask)
- Gloves and hand hygiene not considered

# Results: Infection Routes



Contribution of routes to overall infection risk:

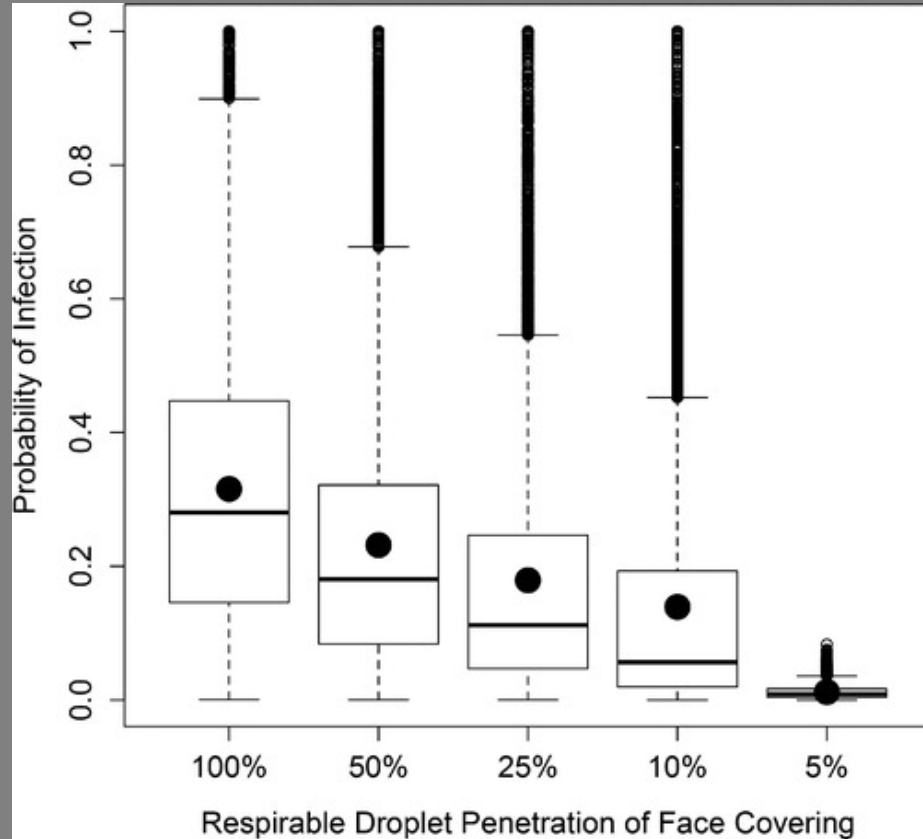
Contact: 8.2%

Droplet: 35%

Inhalation: 57%

Figure 2. Contribution of contact, droplet, and inhalation transmission routes to SARS-CoV-2 infection risk among healthcare personnel during a patient care activity without use of personal protective equipment.

# Results: PPE



- N95 allows for 5-10% penetration
- Surgical masks 25-50% penetration
- No covering 100% penetration

Figure 3. Probability of infection among healthcare personnel wearing barrier precautions and face coverings of varied protection against respirable droplets.



# Discussion

- Inhalation and spray transmission routes contribute most to infection risk; contact less risky
- PPE should be worn whenever HCW is in room with patient regardless of distance



# Strengths & Weaknesses

- Strengths:
  - Model adapted from one previously used to characterize risk of influenza
  - Parameters based on existing literature for SARS-CoV and SARS-CoV-2
  - Considered 3 PPE scenarios
- Weaknesses:
  - Emission rates of virus during breathing, talking, and coughing remains uncertain
  - Unclear distribution of virus across respiratory droplets
  - Model not completely predictive due to lacking data

# Discussion Questions

- How should occupational health and safety professionals use these findings?
- What follow-up studies might be useful?
- What advantages do modeling studies like these have?
- What other occupational populations might benefit from this study?