Face Shields

Michael Edmond, MD, MPH, MPA, MBA
Chief Quality Officer
Clinical Professor of Infectious Diseases

UNIVERSITY OF IOWA HOSPITALS & CLINICS
University of Iowa Health Care

@mike_edmond
michael-edmond@uiowa.edu

PPE Practices at UIHC in the COVID-19 Era

Date	Situation	Work type	Recommended PPE		
			Medical mask (N95 for AGP)	Face shield	Gowns & gloves
3/9	• First COVID-19 patient admitted • Concerns regarding face mask supply	COVID care (suspect or confirmed)	●		●
		Non-COVID care[1]			
		Non-clinical work			
3/18	• Began providing face shields (3-week implementation, clinical workers first)	COVID care (suspect or confirmed)	●	●	●
		Non-COVID care[1]		●	
		Non-clinical work		●[2]	
4/20	• Face mask inventory significantly improved	COVID care (suspect or confirmed)	●	●	●
		Non-COVID care[1]	●	●	
		Non-clinical work		●[2]	

[1]patient not requiring transmission-based precautions
[2]may wear cloth mask under face shield

Face shield

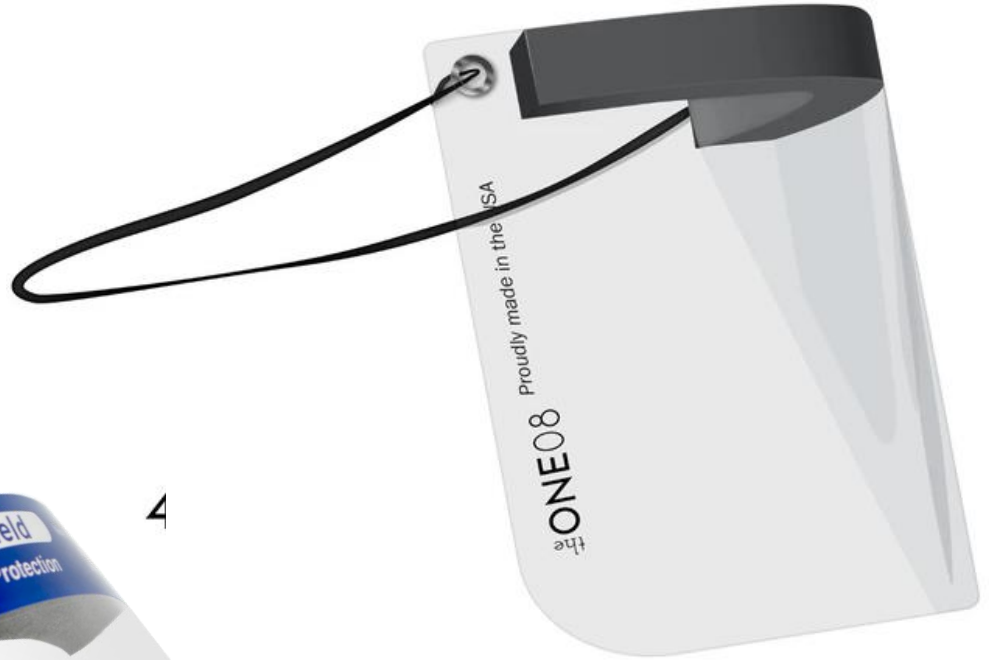
Anatomy

Face shield

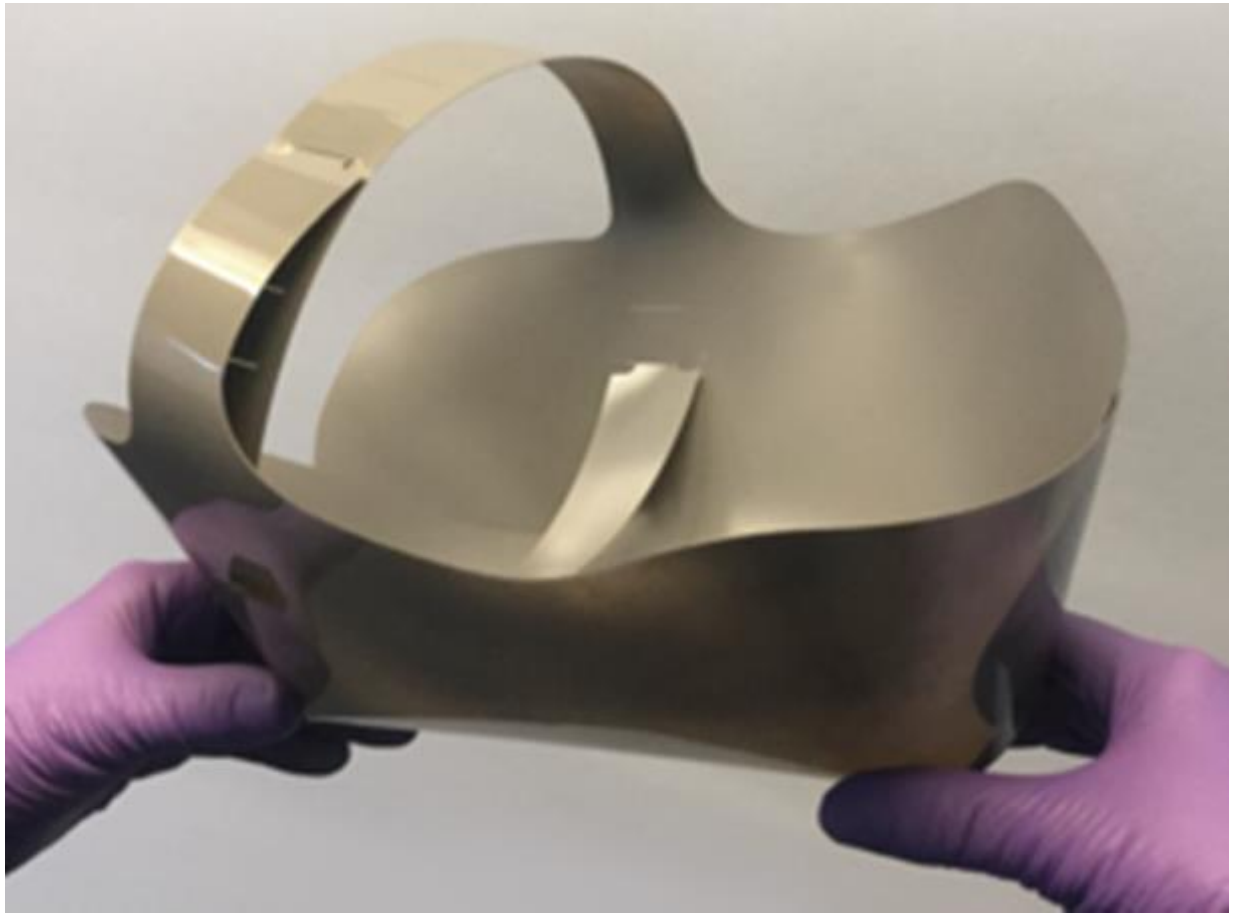
Optimal Design

- Anteriorly: extends below the level of the chin
- Laterally: extends nearly to the ear
- No gap at the forehead or the gap is covered
- Enough clearance to wear mask, respirator or eyeglasses


PHOENIX


the ONE08
Proudly made in the USA


Face Shield
Direct Splash Protection
Please gently remove protective film before using.




FLAT
THE CUR


FREEDOM OF CHOICE
DEVO

Surgical mask with integrated visor

Face Shields

Advantages

- More comfortable
- Less retained heat
- Less claustrophobic
- No impact on breathing resistance
- Easily disinfected
- Protects eyes
- No impact on vocalization
- Do not impede facial nonverbal communication
- Reduced patient anxiety
- Protects against touching face

Disadvantages

- Glare
- Optically imperfect
- Bulky
- Peripheral fit poorer than facemasks

Adapted from: Roberge RJ et al. J Occup Environ Hyg 2016;13:235-42.

Healthcare Personnel Perceptions

Face mask

- Better visibility (+23%)
- Less difficulty hearing others (+36%)
- Less interference with work (+22%)

Face shield

- Easier to breathe (+50%)
- Less claustrophobic (+5%)
- Requires less adjustment after donning (+8%)
- Better temperature regulation (+21%)
- Less skin irritation (+15%)
- More likely to be disinfected/washed after use (+22%)
- Less face touching (+14%)

U of Iowa Hospitals & Clinics Employee Survey
July 2020, N=1,109

Reducing Community Transmission of COVID-19 with Face Shields

Universal adoption of face shields added to testing, contact tracing and hand hygiene should drive $R_0<1$

Rationale:

- Primary mode of transmission is infectious droplets emitted within 6 feet, landing on eyes, nose or mouth
- Influenza virus exposure reduced by 96% when face shield worn within 18 inches of a cough

Source: Lindsley WG et al. J Occup Environ Hyg 2014;11:509-18.

Evaluating Face Shields

- ✓ Full barrier protection including **eyes**
- ✓ Prevent face touching
- ✓ Reusable, cleanable
- ✓ Better speech perception
- ✓ Comfortable
- ✓ Healthy supply chain
- ✗ Source control not validated

Perencevich EN, Diekema DJ, Edmond MB. JAMA 2020 Apr 29. [Epub ahead of print]

@eliowa
@dan_diekema
@mike_edmond

University of Iowa Carver College of Medicine

VIEWPOINT

Airborne Transmission of SARS-CoV-2
Theoretical Considerations and Available Evidence

Michael Klompas, MD, MPH
Harvard Medical School and Harvard Pilgrim Health Care Institute, Department of Population Medicine, Boston, Massachusetts; and Department of Medicine, Brigham and Women's Hospital, Boston, Massachusetts.

Meghan A. Baker, MD, ScD
Harvard Medical School and Harvard Pilgrim Health Care Institute, Department of Population Medicine, Boston, Massachusetts; and Department of Medicine, Brigham and Women's Hospital, Boston, Massachusetts.

Chanu Rhee, MD, MPH
Harvard Medical School and Harvard Pilgrim Health Care Institute, Department of Population Medicine, Boston, Massachusetts; and Department of Medicine, Brigham and Women's Hospital, Boston, Massachusetts.

The coronavirus disease 2019 (COVID-19) pandemic has reawakened the long-standing debate about the extent to which common respiratory viruses, including the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), are transmitted via respiratory droplets vs aerosols. Droplets are classically described as larger entities (>5 µm) that rapidly drop to the ground by force of gravity, typically within 3 to 6 feet of the source person. Aerosols are smaller particles (≤5 µm) that rapidly evaporate in the air, leaving behind droplet nuclei that are small enough and light enough to remain suspended in the air for hours (analogous to pollen).

Determining whether droplets or aerosols predominate in the transmission of SARS-CoV-2 has critical implications. If SARS-CoV-2 is primarily spread by respiratory droplets, wearing a medical mask, face shield, or keeping 6 feet apart from other individuals should be adequate to prevent transmission. If, however, SARS-CoV-2 is carried by aerosols that can remain suspended in the air for prolonged periods, medical masks would be inadequate (because aerosols can both penetrate and circumnavigate masks), face shields would provide only partial protection (because there are open gaps between the SARS-CoV-2, but what is less clear is the extent to which these characteristics lead to infections. Demonstrating that speaking and coughing can generate aerosols or that it is possible to recover viral RNA from air does not prove aerosol-based transmission; infection depends as well on the route of exposure, the size of inoculum, the duration of exposure, and host defenses.

> Demonstrating that speaking and coughing can generate aerosols or that it is possible to recover viral RNA from air does not prove aerosol-based transmission...

Notwithstanding the experimental data suggesting the possibility of aerosol-based transmission, the data on infection rates and transmissions in populations during normal daily life are difficult to reconcile with long-range aerosol-based transmission. First, the reproduction number for COVID-19 before measures were taken to mitigate its spread was estimated to be about 2.5, meaning that each person with COVID-19 infected an average of 2 to 3 other people. This reproduction number is similar to influenza and quite different from that of viruses that are well known to spread via aerosols such as measles, which has a reproduction number closer to 18. Considering that most people with COVID-19 are contagious for about 1 week, a reproduction number of 2 to 3 is quite small given the large number of interactions, crowds, and personal contacts that most people have under normal circumstances within a 7-day period. Either the amount of SARS-CoV-2 required to cause infection is much larger than measles or aerosols are not the dominant mode of transmission.

Similarly, the secondary attack rate for SARS-CoV-2 is low. Case series that have evaluated close contacts of patients with confirmed COVID-19 have re-

JAMA, July 13, 2020.

COVID-19 epidemiology is not consistent with long-range aerosol-based transmission

- R0 = 2.5
- Secondary attack rate
  - Overall = 5%
  - Passing interactions via shopping = 0.5%
  - Sharing a meal = 7%
  - Household contacts = 10-40%

Klompas M et al. JAMA, July 13, 2020.

Face Shields

Simulation Experiments

Ref	Device	Experiment	Outcomes
1	Face shield	Cough aerosol simulator w/ influenza virus	8.5 µm aerosol: 96% ↓ at 18”; 92% ↓ at 72” 3.4 µm aerosol: 68% ↓ at 18”; 23% ↓ 1-30 min
2		Fluorescent dye spray (5 µm)	No contamination of eyes, nose, mouth at 20”
3		Simulated dental procedure on mannequin	Did not prevent contamination of surgical mask under face shield
4	Surgical mask w/ visor	Femoral osteotomy	Mannequin eye contamination 30%
5		Simulated surgery w/ water spray	40% contamination of inner surface of mask; 6% contamination of face

1. Lindsley WG et al. J Occup Environ Hyg 2014;11:509-18.
2. Shoham S et al. http://www.medonyx.com/media/MedStarFull ClinicalPoster.pdf
3. Bentley CD et al. J Am Dent Assoc 1994;125:579-84.
4. Mansour AA et al. J Bone Surg Am 2009;91:1050-4.
5. Loveridge JM et al. J Hosp Infect 1991;62:251-3.

Face Shields

Observational Study

- Case control study of 133 medical ward nurses in a 1,350-bed hospital in Hong Kong
- Wearing a face shield during aerosol-generating procedures was protective against developing ILI (OR 0.12, P<.001)

Ng TC et al. Infect Control Hosp Epidemiol 2009:30:292-5.

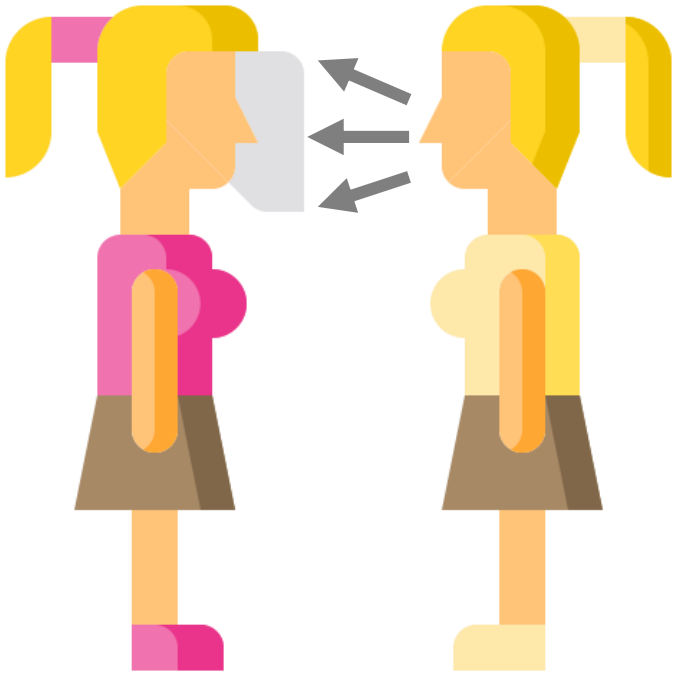
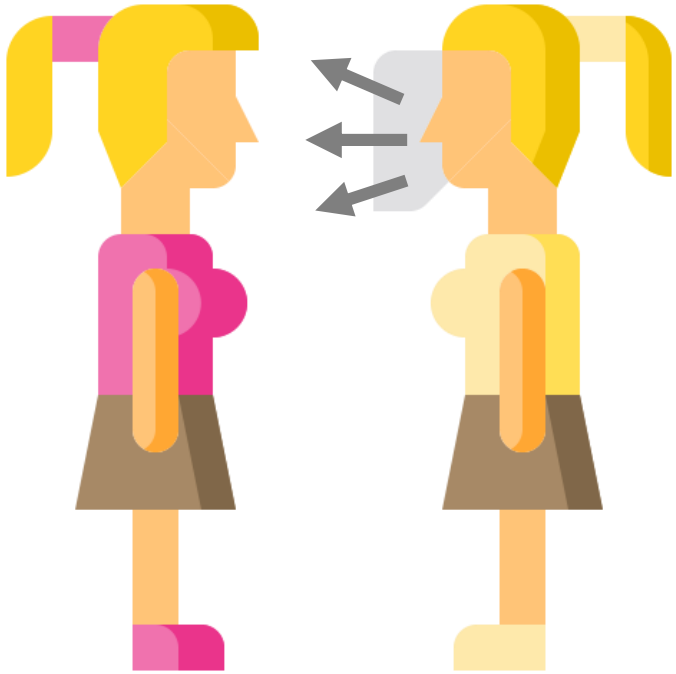
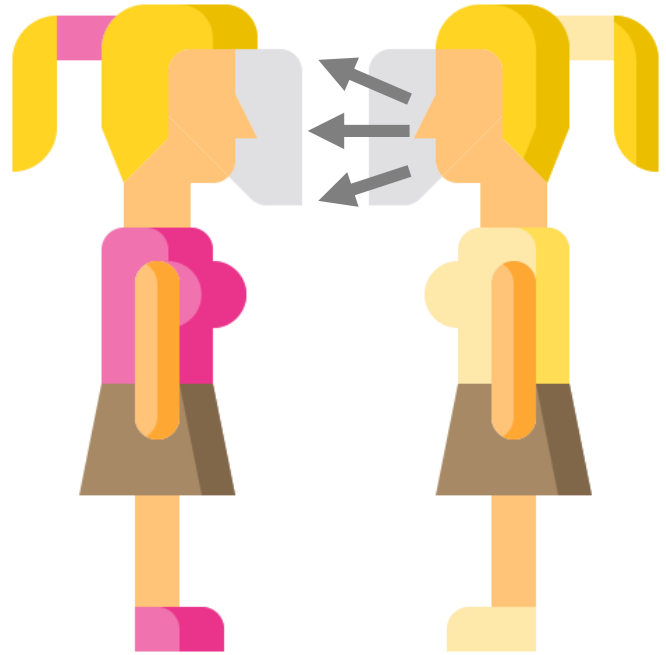
Face Shields

Human Challenge Transmission Study

127 volunteers randomized to:		
Donors	**Recipients**	
52 persons underwent intranasal inoculation with influenza A → 42 infected	Intervention group *Face shields + hand hygiene q15 min + no face touching* **Aerosol transmission**	0 infected
	Control group *No face shield + no hand hygiene + allowed to touch face* **Contact + droplet transmission**	1 infected

Nguyen-Van-Tam JS et al. PLoS Pathog 16(7):e1008704.

Current State of the Science

Shield on exposed	Shield on source	Universal shields (source & exposed)
		

Some data | **No data**

Frameworks: Transmission Mitigation

Occupational Health

- Risk tolerance: very low
- Goal: reduce risk to the irreducible minimum
- Focus is on efficacy: how do we provide ideal protection?
- Individual perspective

Public Health

- Risk tolerance: somewhat greater
- Goal: reduce R0 <1
- Focus is on effectiveness: how well does the intervention work in the real world?
    - Factors in adherence
- Utilitarian perspective

Conclusions

- In the hospital setting, face shields should be used with face masks (or N95s if AGP)

- In the community…

The best face covering is the one that people will wear.

michael-edmond@uiowa.edu
@mike_edmond

Photo by cottonbro at Pexels.com