



CONSIDERATIONS RELATED TO EYE PROTECTION AND DROPLET PRECAUTIONS

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Bourouiba and Bush (2014)

Outline

- Question: Should eye protection be included in droplet precautions for seasonal influenza and other respiratory viruses?
- Guideline review
 - HICPAC 2007 Guideline for Isolation Precautions
 - CDC Interim Guidelines
- Literature review
 - Consideration for RSV, Adenovirus, and Rhinovirus
 - Influenza-based studies

GUIDELINE SUMMARY

Isolation Guideline, Recommendations

- IV.B.4.a. Mouth, nose, eye protection: Use **PPE** to protect the **mucous membranes of the eyes, nose and mouth** during procedures and patient-care activities that are likely to **generate splashes or sprays** of blood, body fluids, secretions, and excretions (IB/IC)
- IV.B.5. During **aerosol-generating procedures** (e.g., bronchoscopy, suctioning of the respiratory tract [if not using in-line suction catheters], endotracheal intubation) in patients who are not suspected of being infected with an agent for which respiratory protection is otherwise recommended (e.g., MTB, SARS), **wear** one of the following: a **face shield** that fully covers the front and sides of the face, a **mask with attached shield**, or a **mask and goggles** (in addition to gloves and gown; IB)

Isolation Guideline, Recommendations

- V.A.1. In addition to **Standard Precautions**, use **Transmission-Based Precautions** for patients with documented or suspected infection or colonization with **highly transmissible** or **epidemiologically-important** pathogens for which additional precautions are needed to prevent transmission (1A)
- V.C.2.b. Droplet precautions, use of PPE: No recommendation for routinely wearing eye protection (e.g., goggle or face shield), in addition to a mask, for close contact with patients who require droplet precautions (*unresolved issue*).
- Droplet precautions (*without specific guidance about eye protection other than standard precautions*) are recommended for
 - Seasonal influenza: standard + droplet
 - Adenovirus pneumonia: standard + droplet + contact

Supporting discussion about eye protection as part of face protection for respiratory droplets (discussion, section II.E.3)

- Earlier studies associated eye protection with reduced transmission of RSV (respiratory syncytial virus); unknown if this represented hand-eye contact vs. respiratory droplet contact
- Subsequent studies showed that goggles were not a necessary part of standard + contact precautions for RSV
- At time of guideline development, not studied for other respiratory viruses

Summary of CDC Interim Guidance

- **Public Health Guidance for Community-Level Preparedness and Response to SARS:** Routinely wear eye protection when within 3 feet of a patient with SARS-CoV. If splash or spray of respiratory secretions or other body fluids is likely, protect the eyes with goggles or a face shield, as recommended for Standard Precautions. The face shield should fully cover the front and wrap around the side of the face.
- **Interim Guidance on IPC Measures for 2009-2010 H1N1:** Use gowns along with eye protection for any activity that might generate splash.
- **Interim IPC Guidance for MERS:** Put on eye protection (e.g., a disposable face shield) upon entry to the patient room or care area. Remove and discard eye protection immediately upon leaving the patient room or care area.
- **Interim IPC Guidance for Novel Influenza A Viruses Associated with Severe Disease:** Put on eye protection (i.e., goggles or face shield) upon entry to the patient room or care area. Remove and discard eye protection immediately upon leaving the patient room or care area.

Prevention Strategies for Seasonal Influenza in Healthcare Settings (Current)

- **Adhere to Standard Precautions**
- **Adhere to Droplet Precautions**
- **Use Caution when Performing Aerosol-Generating Procedures**
 - HCP should adhere to standard precautions, including wearing gloves, a gown, and either a face shield that fully covers the front and sides of the face or goggles.

LITERATURE REVIEW

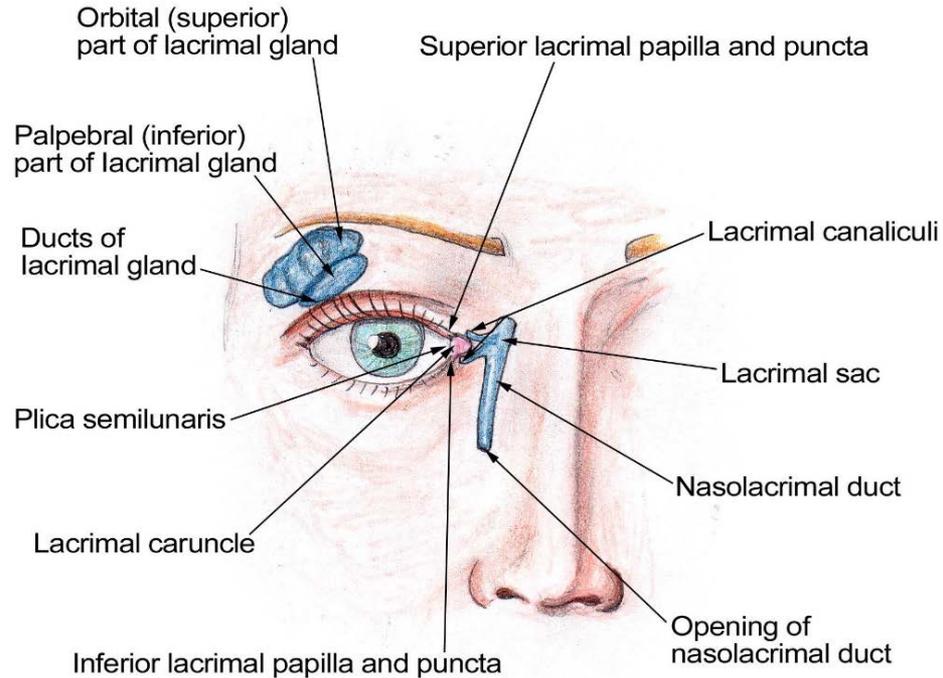
Issues to consider while reviewing the literature

- Respiratory virus transmission
 - Aerosols, droplets, fomites
- Nasolacrimal duct
- Transocular transmission of respiratory viruses
 - RSV, adenovirus, pandemic influenza strains
- Self-inoculation

Respiratory viruses

- Capable of using the eye as both:
 - Site of virus replication
 - Portal of entry
- Transmitted by any of 3 possible mechanisms:
 - Small-particle aerosols (<10 μm mass median diameter): usually generated by coughing or sneezing and may traverse distances > 6 ft
 - Droplets or large particles (> 10 μm mass median diameter): require close person-to-person contact, usually at a distance of 3 – 9 ft
 - Fomites: must be able to remain infectious on environmental surfaces, to be transferred to the skin, and to remain infectious for a time sufficient to allow self-inoculation into the respiratory tract

Nasolacrimal duct



Droplet → Eye → Nasolacrimal Duct → Respiratory Tract

Respiratory viruses known to cause ocular disease in humans

Virus	Subtype(s) ^a	Tropism in humans	Ocular disease in humans
Adenovirus	Species D Species B, C, E	Ocular Respiratory	Frequently associated with epidemic keratoconjunctivitis Occasional simple acute follicular conjunctivitis or pharyngeal conjunctival fever
Influenza virus	H7 H1, H3, H5	Ocular Respiratory	Conjunctivitis Rare but documented ocular complications
Respiratory syncytial virus	NA	Respiratory	Occasional reports of conjunctivitis concurrent with respiratory illness
Coronavirus	NL63 SARS	Respiratory Respiratory	Rare reports of conjunctivitis Not reported
Rhinovirus	NA	Respiratory	Rare but documented ocular complications
Human metapneumovirus	NA	Respiratory	Rare but documented ocular complications

^a NA, not applicable (indicates that there is no association with any given subtype/serotype with ocular complications in humans).

Belser JA, Rota PA, Tumpey TM. Ocular tropism of respiratory viruses. Microbiol Mol Biol Rev 2013;77:144–156.

Respiratory syncytial virus (RSV)

- Inoculation occurs mainly through the eye and nose, rather than the mouth via large-particle aerosols or droplets, requiring close contact
- Able to remain infectious on various environmental surfaces, suggesting fomites as a source of spread
- Gloves may be effective in the control of RSV because few persons will touch their noses or rub their eyes while gloved, and therefore the chance for self-inoculation is diminished
- Masks, if appropriately used, may act as a barrier for 1 of the 2 most effective sites for inoculation of RSV

Hall CB. Respiratory syncytial virus: its transmission in the hospital environment. Yale J Biol Med 1982;55:219–223.

Hall CB. Nosocomial respiratory syncytial virus infections: the “Cold War” has not ended. Clin Infect Dis 2000;31:590–596.

Rates of nosocomial RSV infections in staff according to IPC techniques

Year	Techniques	Infants		Staff	
		No.	No. (%) With Nosocomial RSV Infection	No.	No. (%) With RSV Infection
1975	Hand washing, gowns, open ward	44	14 (32)	24	10 (42)
1976	Hand washing, cohorting, gowns, isolation of infected infants	42	8 (19)	43	24 (56)
1977	Hand washing, cohorting, gowns	66	23 (35)	53	18 (34)
1980 (Period 1)	Hand washing, cohorting, isolation of infected infants, IFA testing*, gowns, paper face masks	25	8 (32)	30	10 (33)
1980 (Period 2)	Hand washing, cohorting, isolation of infected infants, IFA testing	27	11 (41)	26	11 (42)
1984 (Period 1)	Hand washing, cohorting, isolation of infected infants, IFA testing, eye-nose goggles	17	1 (6)	40	2 (5)
1984 (Period 2)	Hand washing, cohorting, isolation of infected infants, IFA testing	21	9 (43)	39	11 (28)

RSV infection in rate in personnel caring for children with RSV infections

- Patients with RSV infections were assigned to one of two isolation categories:
 - 1st Category : healthcare workers did wear masks and goggles
 - 2nd Category: healthcare workers entering did not wear masks and goggles
- 5% RSV illness rate in mask/goggle category
- 61% RSV illness rate in no mask/goggle group
 - RSV illness rates in the health care workers correlated directly with the number of exposures
- Use of masks and goggles was associated with a significant reduction of RSV illnesses in pediatric health care workers

Rhinovirus

- From estimates of virus titers in nasal washings and on fingers and amounts transferred by rubbing, it was concluded that spread of colds is unlikely to occur via objects contaminated by the hands of the virus-shedder
- However, a recipient might pick up enough virus on his fingers by direct contact with heavily infected skin or secretions to constitute a risk of self-inoculation via the conjunctiva or nostril

Reed SE. An investigation of the possible transmission of rhinovirus colds through indirect contact. J Hyg (Lond) 1975;75:249–258.

Adenovirus

- Adenoviruses and avian influenza viruses
 - Exploit the presence of α 2-3-linked sialic acids present on the ocular epithelium for receptor-dependent entry into this tissue
- Similarities in the elicitation of host responses to influenza, RSV, and adenovirus infection of corneal and conjunctival epithelial cells
 - Insight into potential shared mechanisms of inflammation following virus infection

Live Attenuated Influenza Virus (LAIV) Exposure

Intervention group	Participant number	Age	Gender	PCR and cell culture	
				Preexposure nasal wash	Postexposure nasal wash
1. LAIV transmission	1	27	M	Neg.	Pos.
	2	27	F	Neg.	Pos.
	3	45	F	Neg.	Pos.
	4	29	F	Neg.	Pos.
2. Transocular transmission	5	31	M	Neg.	Neg.
	6	39	F	Neg.	Pos.
	7	25	F	Neg.	Pos.
3. SM w/o eye protection	8	21	F	Neg.	Pos.
	9	34	F	Neg.	Pos.
	10	34	M	Neg.	Pos.
	11	24	M	Neg.	Pos.
4. SM with eye protection	12	40	F	Neg.	Pos.
	13	22	M	Neg.	Pos. ^a
	14	26	M	Neg.	Pos.
	15	28	F	Neg.	Pos.
5. N95 w/o eye protection	16	32	F	Neg.	Pos.
	17	19	M	Neg.	Pos.
	18	21	F	Neg.	Pos. ^a
	19	48	F	Neg.	Pos.
6. N95 with eye protection	20	24	F	Neg.	Neg.
	21	20	F	Neg.	Neg.
	22	36	F	Neg.	Pos.
	23	55	M	Neg.	Pos.
	24	23	F	Neg.	Neg.
	25	24	F	Neg.	Neg.
	26	31	F	Neg.	Pos.
	27	45	M	Neg.	Neg.
	28	20	F	Neg.	Neg.

Bischoff, et al. Transocular Entry of Seasonal Influenza—Attenuated Virus Aerosols and the Efficacy of N95 Respirators, Surgical Masks, and Eye Protection in Humans. *JID* 2011;204:193-199.

Summary and Discussion

- Respiratory viruses are unlikely to be transmitted exclusively by aerosol, droplet or contact
- Literature suggests eye protection could be beneficial in preventing respiratory virus transmission
- Should eye protection be included in droplet precautions for seasonal influenza and other respiratory viruses?
- Is additional information or research needed?

Thank you!

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

