Infection Control in Healthcare Personnel Workgroup

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Disclaimer

- The findings and conclusions herein are **draft** and have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.

Declarations of Interest

- None of the Workgroup members reported financial or intellectual interests related to the topics in this guideline update except for the following:
  - Speaker and consultant for Pfizer; speaker for Sanofi Pasteur; consultant for Medscape; speaker and workgroup member of the Gerontological Society iCAMP workshop committee; recipient of research award from Pfizer and research subaward from CDC (via Catholic Charities).
  - Scientific advisor for Seres Therapeutics; consultant for Rebiotix, Inc.; and participant on a scientific advisory board for Vendanta Biosciences.
  - Consultant for Global Life Technologies, which includes education.
  - Spouse receives research support from Sanofi Pasteur, Medimmune, and Gilead and serves on advisory committee for Novartis.
  - Consultant and speaker for Pfizer and Merck
  - Liaisons to the HICPAC committee for:
    - The Society of Healthcare Epidemiology of America (SHEA), but on this Workgroup, serves as a subject matter expert and does not represent the views of SHEA
    - The American College of Occupational and Environmental Medicine (ACOEM), but on this Workgroup, serves as a subject matter expert and does not represent the views of ACOEM

Infection Control in Healthcare Personnel Workgroup: Goal & Charge

- **Update:**
  - *Guideline for Infection Control in Healthcare Personnel, 1998*
- **Goal:**
  - To provide updated information on Infection Control in Healthcare Personnel (HCP), Section 2
- **Workgroup Charge:**
  - The Workgroup will focus on pathogen-specific issues for Infection Control in Healthcare Personnel. Where information is out of date, the Workgroup will make updates using evidence-based methods *where evidence is available*.

Guideline for infection control in healthcare personnel, 1998

- Audience
  - Occupational health providers working in healthcare facilities
- Focus
  - Infrastructure needed for Occupational Health Services (OHS) to deliver occupational infection prevention and control services to healthcare personnel (HCP)
  - Prevention of pathogens known to be transmitted in healthcare settings
- Recommendations for
  - Establishment and maintenance of an occupational health program
  - Prevention of transmission of pathogens among HCP and patients, such as
    - Management of HCP exposures to infections or illness
      - Postexposure prophylaxis
      - Work/patient care restrictions

Work Restrictions Definition

- Work restrictions are
  - Limitations placed on HCP related to being at work or performing certain job tasks
    - In healthcare settings, aimed at safeguarding HCP and patient health and safety
    - A mainstay of preventing transmission in healthcare
    - An integral component of the hierarchy of controls (e.g., ventilation, masking)
  - Implemented when HCP may be potentially infectious to others or when HCP are at increased risk for acquiring infection
    - May be based on a standardized timeframe or until the results of an evaluation determine clearance to return to work, depending on the infection

Update Status Report

- Section 1: *Infrastructure and Routine Practices for Occupational Infection Prevention and Control Services* published October 2019:
  - https://www.cdc.gov/infection-control/hcp/healthcare-personnel-infrastructure-routine-practices/index.html
- Section 2: *Epidemiology and Control of Selected Infections Transmitted Among HCP and Patients*:
  - Cytomegalovirus, Diphtheria, Group A *Streptococcus*, Measles, Meningococcal Disease, Mumps, Pertussis, Pregnant Healthcare Personnel, Rabies, Rubella, and Varicella-Zoster Virus are complete and published to the CDC website:
    - https://www.cdc.gov/infection-control/hcp/healthcare-personnel-epidemiology-control/index.html

Status Report: Section 2 Progress

- In progress:
  - Viral Respiratory Infections: draft recommendations and literature review data will be presented today for an initial vote.
  - Gastroenteritis: The Workgroup has performed background research and drafted initial recommendations to be presented at a future meeting.
- Pending literature review:
  - *Staphylococcus aureus*
- Approved by HICPAC and due to enter initial CDC clearance:
  - Conjunctivitis: pending update of literature review
- Completed initial CDC clearance and the Federal Register 60-day public comment period:
  - Parvovirus B19: Updated draft recommendations will be presented at a future meeting
- "On Deck:"
  - Scabies/Pediculosis
  - Hepatitis A
  - Herpesviruses

Section Update: Viral Respiratory Infections

1998 Guideline, I.E.22. Viral Respiratory Infections Section

- Narrative provided information on the epidemiology and transmission prevention of respiratory viruses in healthcare settings and focused upon 2 pathogens
  - Influenza
  - Respiratory Syncytial Virus (RSV)

- Provided 3 recommendations

1998 Guideline, II.G.22. Viral Respiratory Infections

- Recommendations
  a. Administer influenza vaccine annually to all personnel, including pregnant women, before the influenza season, unless otherwise contraindicated
  b. Consider the use of antiviral postexposure prophylaxis for unvaccinated health care personnel during institutional or community outbreaks of influenza for the duration of influenza activity, or consider giving vaccine to unvaccinated personnel and providing them with antiviral postexposure prophylaxis for 2 weeks after vaccination
  c. Consider excluding personnel with acute febrile respiratory infections or with laboratory evidence of epidemiologically significant viruses from the care of high-risk patients (e.g., neonates, young infants, patients with chronic obstructive lung disease, and immunocompromised patients) during community outbreaks of influenza or RSV infections
- Categorization
  – Category 1B: Strongly recommended for all hospitals and reviewed as effective by experts in the field and a consensus of Hospital Infection Control Practices Advisory Committee members on the basis of strong rationale and suggestive evidence, even though definitive scientific studies have not been done.

1998 Guideline, II.G.22. Viral Respiratory Infections (cont.)

- Recommendations
  - ~~a. Administer influenza vaccine annually to all personnel, including pregnant women, before the influenza season, unless otherwise contraindicated~~ Maintained by ACIP
  - ~~b. Consider the use of antiviral postexposure prophylaxis for unvaccinated health care personnel during institutional or community outbreaks of influenza for the duration of influenza activity, or consider giving vaccine to unvaccinated personnel and providing them with antiviral postexposure prophylaxis for 2 weeks after vaccination~~ Addressed in other CDC guidance
  - c. Consider excluding personnel with acute febrile respiratory infections or with laboratory evidence of epidemiologically significant viruses from the care of high-risk patients (e.g., neonates, young infants, patients with chronic obstructive lung disease, and immunocompromised patients) during community outbreaks of influenza or RSV infections
- Categorization
  - Category 1B: Strongly recommended for all hospitals and reviewed as effective by experts in the field and a consensus of Hospital Infection Control Practices Advisory Committee members on the basis of strong rationale and suggestive evidence, even though definitive scientific studies have not been done.

Workgroup Discussion: Section Update Scope

- Section to include individual pathogens based on
  - Epidemiologic importance in healthcare settings
  - Available data to inform recommendation updates
- Pathogens to include/discuss in the section
  - Influenza
  - RSV
  - SARS-CoV-2
- Updated recommendations preferably to address both exposed and ill HCP
  - Ideally, updated recommendations preferably take a singular approach for all respiratory viruses
- Reviewed current CDC viral respiratory pathogen recommendations
  - Facility, Health Department, and Workgroup feedback suggest challenges in implementing current SARS-CoV-2 work restrictions

Current Viral Respiratory Infection Guidance: SARS-CoV-2 & Influenza

Pathogen	SARS-CoV-2			Influenza			
Population	Healthy adults with mild to moderate illness						
Current Recommendation	Interim Guidance for Managing Healthcare Personnel with SARS-CoV-2 Infection or Exposure to SARS-CoV-2 (2022)			Infection Prevention and Control Strategies for Seasonal Influenza in Healthcare Settings (2021)			
Infection Status	Exposed	Infected	Infected	Exposed	Suspected or Unknown	Suspected or Unknown	Infected
Symptom Status	Asymptomatic	Symptomatic	Asymptomatic	Asymptomatic	Symptomatic with fever and respiratory symptoms	Symptomatic with acute respiratory symptoms without fever	Asymptomatic
Duration of Work Restrictions	None required; series of 3 viral tests typically at day 1 (day of exposure is day 0), day 3 and day 5	10 days if testing not performed or positive test at day 5-7 OR ≥7 days since symptoms appeared if negative viral test obtained within 48 hr prior to return to work AND	10 days if testing not performed or if positive test at day 5-7 OR ≥7 days since date of first positive viral test if negative viral test obtained within 48 hrs prior to return to work	N/A	Duration of fever plus 24 hrs	N/A	N/A
Fever Based Return to Work	N/A	≥24 hrs since last fever without use of fever-reducing medications AND	N/A		≥24 hrs after fever cessation without use of fever-reducing medicines	N/A	
Symptom Based Return to Work	N/A	Symptoms improved	N/A		Ongoing respiratory symptoms should be considered for evaluation by occupational health	N/A	
Duration of Masking	Duration not specified; instructed to wear well-fitting source control	N/A	N/A		While symptoms such as cough and sneezing are present	While symptoms such as cough and sneezing are present	
Duration of Monitoring	Duration not specified; instructed to monitor for fever or symptoms	N/A	N/A		N/A	N/A	
HCP returning to a Protective Environment	N/A	N/A	N/A		Consider temporary reassignment or work exclusion for 7 days from symptom onset or until resolution of symptoms (whichever is longer)	Consider for temporary reassignment or work exclusion for 7 days from symptom onset or until resolution of all non-cough symptoms (whichever is longer)	

Current Viral Respiratory Infection Guidance: SARS-CoV-2

- Interim Guidance for Managing Healthcare Personnel with SARS-CoV-2 Infection or Exposure to SARS-CoV-2 (2022), Return to Work Criteria for HCP with SARS-CoV-2 Infection
  - Severe to critical illness AND *not* moderately to severely immunocompromised
    - At least 10 days and up to 20 days have passed since symptoms first appeared, **and**
    - At least 24 hours have passed since last fever without the use of fever-reducing medications, **and**
    - Symptoms (e.g., cough, shortness of breath) have improved.
    - The test-based strategy, as is used for moderately to severely immunocompromised HCP, can be used to inform the duration of work restrictions
  - Moderately to severely immunocompromised
    - Use of test-based strategy
    - Consultation with an expert and occupational health specialist

Interim Guidance for Managing Healthcare Personnel with SARS-CoV-2 Infection or Exposure to SARS-CoV-2 | COVID-19 | CDC

Workgroup Discussion: Scoping

- Goal:
  - Use evidence-based methods to determine the duration of work restrictions for potentially contagious HCP that diminishes transmission risk while minimizing unintended health/safety consequences for HCP and patients
- Focus:
  - Influenza, RSV, SARS-CoV-2 (omicron variants) in previously healthy adults with mild to moderate symptomatic illness
- Considerations:
  - Benefits and potential consequences of restricting potentially contagious HCP from work
    - Protects patients/residents and healthcare personnel by eliminating a source for transmission
    - Has the potential to cause staffing shortages that can result in lapses in both HCP and patient safety[1-4]

Initial Key Question for SARS-CoV-2, Influenza, and RSV Risk for Transmission

Reporting for these rapid reviews followed PRISMA-ScR standards.[5]

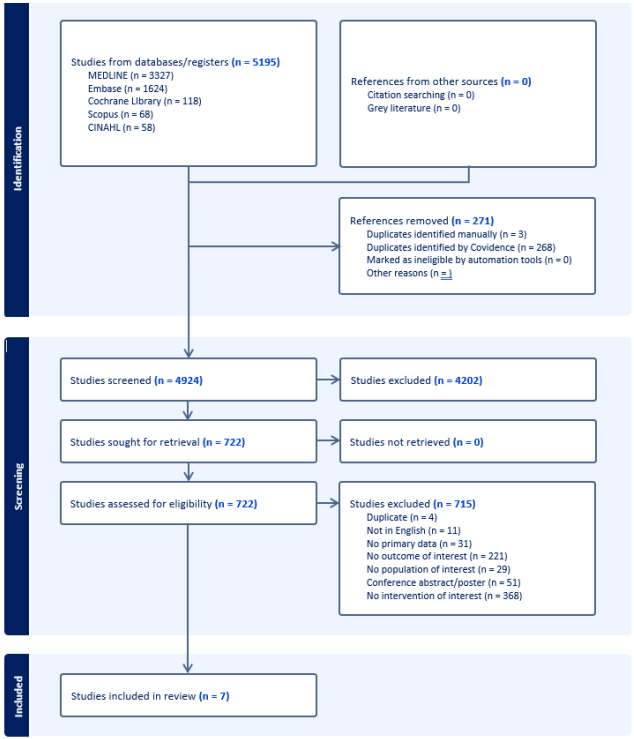
Key Question

1. What is the duration of viral shedding measured from symptom onset or diagnosis using culture or RT-qPCR?

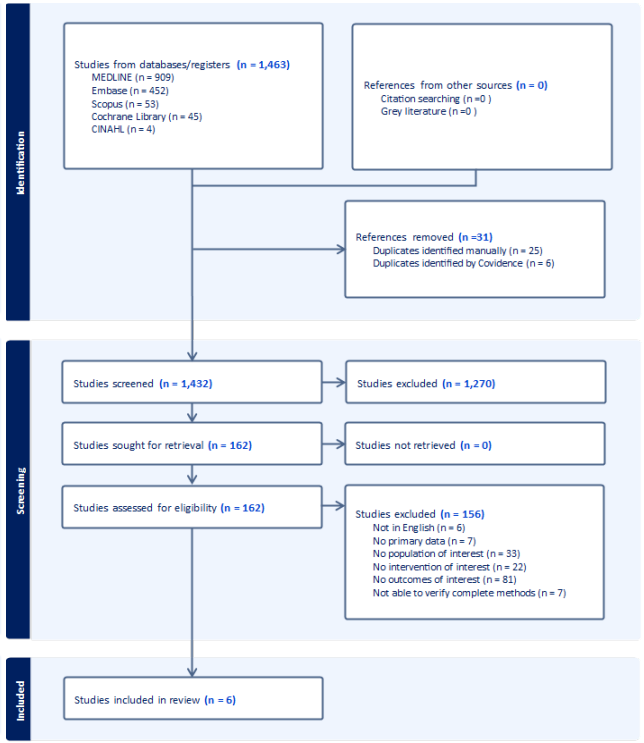
	SARS-CoV-2 Omicron	Influenza A	RSV
Studies screened	4,924	1,432	160
Studies included	7	6	1

Key Question 1 PRISMA Diagrams

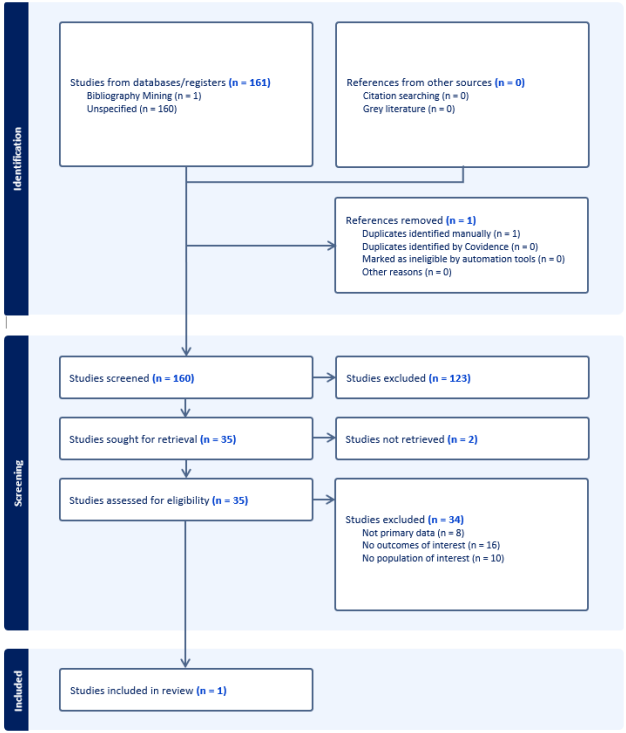
SARS-CoV-2 Omicron



Influenza A



RSV



Key Question 1 Results

Cumulative proportion (%) of participants whose shedding resolved, measured in days from symptom onset, diagnosis, or inoculation

1.A. Omicron	N	Subtype	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Study (Natural Infection: shedding measured from symptom onset unless noted)																		
Jang 2022	9	NR	Dec 2021	0	0	0	0	11	11	33	67	100						
Boucau 2022^	34	BA.1	Jul 2021 - Jan 2022	3	14	29	47	50	64	73	73	82	94	94	94	97	97	
Kang 2023 (JOMV)	34	NR	Sep 1, 2021 - May 31, 2022	12	32	38	50	62	71	74	79	88	97	100				
Bouton 2023^	75	NR	Nov 2021 - NR	0	38	45	60	72	86	92	96	99	99	100				
Kang 2023 (JOI)^	82	BA.1, BA.2, BA.5	Jan 14 - Aug 2, 2022	1	5	37	65	79	89	99	100							
Jung 2023	32	BA.1, BA.2	Mar 14 - Apr 3, 2022	12	32	25	47	69	84	97	100							
Smith-Jeffcoat 2024^#	236	NR	Nov 2022 - May 2023	50	49	57	62	69	78	84	89	89	92	98	97	98	99	100

1.B. Influenza	N	Subtype	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Study (Natural Infection: shedding measured from symptom onset)																		
Killingley 2016#	39	H1N1	Sep 2009 - Jan 2011	0	0	10	34	70	82	89	89	94	94	100				
Killingley 2010	4	H1N1	Sep 14, 2009 - Jan 25, 2010	0	0	0	25	50	75	75	75	100						
Han 2019*	16	H3N2	Dec 2015 - Jul 2017	0	44	81	88	94	100									
Study (Challenge Study: shedding measured from inoculation)																		
Doyle 1998	42	H1N1	NR	0	22	35	43	55	76	96								
Hooker 2021	12	H1N1	Jun - Jul 1997	0	0	8	17	33	75	92	100							
Memoli 2015#	20	H1N1	Apr 2012 - Jun 2013	0	5	5	30	30	40	60	75	95	100					

1.C. RSV	N	Subtype	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Study (Natural Infection: shedding measured from symptom onset)																		
Bagga 2018	4		NR	0	0	0	0	0	0	50	100							

^: Shedding measured from symptom onset or diagnosis; #: Shedding measured using RT-qPCR; *: Challenge study reporting duration of shedding in days from first positive viral load; NR: Not reported

Legend: Colors Every 10%	0	10	20	30	40	50	60	70	80	90	100

Key Question 1 GRADE Table

Table 1. Summary of findings table: Shedding measured via culture or RT-qPCR from diagnosis, symptom onset, or inoculation.

Outcome	Summary	Studies	Validity	Imprecision	Inconsistency	Indirectness	Confidence
Omicron Mixed Subvariant	For all studies, results indicate that omicron shedding ends among ≥70% and ≥80% of all participants on day 9, ≥90% on day 10 and 100% on day 15 post symptom onset or diagnosis.	7 Studies (N = 502)	No concerns	No concerns	No concerns[1]	No concerns	High confidence
Influenza Mixed Subtype	For all studies, results indicate that influenza shedding ends among ≥70% of participants on day 8, ≥80% and ≥90% on day 9, and 100% on day 11 post symptom onset, diagnosis, or inoculation.	6 Studies (N = 133)	No concerns	No concerns	No concerns	No concerns	High confidence

[1] Some inconsistency may be explained by the longer duration of shedding that may be seen with earlier subvariants.

GRADE handbook

Key Question 1 Summary

- RSV (not GRADE-ed)
  - 1 study reported resolution of shedding in 4/35 by the end of day 8 after inoculation.
    - Data not provided for 31/35
- Influenza A (High confidence)
  - All studies reported resolution of shedding among ≥90% of participants by the end of day 9 after symptom onset, inoculation, or diagnosis
  - No included studies reported comparisons of shedding among unvaccinated/vaccinated individuals
- SARS CoV-2 Omicron (High confidence)
  - All studies reported resolution of shedding among ≥90% of participants by the end of day 10 after symptom onset, inoculation, or diagnosis
  - 3 studies reported daily shedding among unvaccinated/vaccinated individuals
    - 2 suggested unvaccinated persons shed longer, but unclear # of days (range 1-3)

Key Question 1 Workgroup Discussion Summary

- Influenza A and SARS-CoV-2 Omicron
  - Viral shedding (primarily measured by culture) for most infected healthy individuals extends to day 9-10
    - Some healthy individuals shed longer
  - Limited data suggests vaccination may decrease shedding duration, the amount of decrease is unclear
- Additional key questions developed to investigate:
  - Is there a relationship between the duration of symptoms and the duration of shedding?
  - What is the risk for transmission from a potentially contagious individual over time?

Additional Key Question Development

Key Questions

1. What is the duration of viral shedding measured from symptom onset or diagnosis using culture or RT-qPCR?
2. What is the association between the resolution of symptoms, specifically fever, and the resolution of viral shedding measured using culture, RT-qPCR, or RT-PCR?

	SARS-CoV-2 Omicron	Influenza A	RSV
Studies screened	793	977	No search
Studies included	1	3	conducted

PRISMA diagrams included in extra slides

Key Question 2 Results

Cumulative proportion (%) of participants with resolution of shedding and resolution of symptoms or improvement in symptom score

Study (Virus, subvariant/ subtype)	N	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A. Resolution of shedding measured from disappearance of symptoms																	
Jang 2022 (Omicron, BA.1)	8	Fever	38	75	75	75	100										
Jia 2011 (Influenza, H1N1)[#]	67	Fever	--	18	45	64	76	82	91	97	100						
Jia 2011 (Influenza, seasonal)[#]	37	Fever	--	--	30	83	97	97	100								
Memoli 2015 (Influenza, H1N1)[#,$]	19	Any symptom	95	95	100												
B. Resolution of shedding and resolution of any symptoms																	
Han 2019 (Influenza, H3N2, 10^6+10^7TICD$_{50}$)[*,$]	16	Resolution of shedding	0	44	81	88	94	100									
	21	Resolution of symptoms	7	7	14	24	33	67	86	90	90	90	90	100			

#: Shedding measured using RT-qPCR; *: Challenge study reporting duration of shedding in days from first positive viral load; $: only 2 participants developed fever

Legend: Colors Every 10%	0	10	20	30	40	50	60	70	80	90	100

Key Question 2 GRADE Table

Summary of findings table: Duration of Shedding and Symptoms measured from diagnosis or symptom onset.

Outcome	Summary	Studies	Validity	Imprecision	Inconsistency	Indirectness	Confidence
SARS-CoV-2 and Influenza, mixed subvariant and fever	Limited data from two studies suggests fever resolves before shedding.	2 Studies (N = 112)	No concerns	Some concerns[2]	Some concerns[2]	No concerns	Low confidence[2]
Influenza, mixed subtype and symptoms	Two studies suggest that resolution of shedding occurs before resolution of symptoms in 63-70% of participants.	2 Studies (N = 57)	No concerns	Some concerns[2]	Some concerns[2]	No concerns	Low confidence[2]

[2] Limited data from two small studies may be insufficient to make decisions.

GRADE handbook

Key Question 2 Summary

- RSV (No search conducted)
  - Only 1 study had reported adult shedding data
- Influenza A (Low confidence)
  - Most study participants had positive indicators of viral shedding after fever resolution
  - Symptoms tended to persist after resolution of viral shedding
- SARS CoV-2 Omicron (Low confidence)
  - Most study participants had positive viral cultures after fever resolution (>24 hours)

Key Question 2 Workgroup Discussion Summary

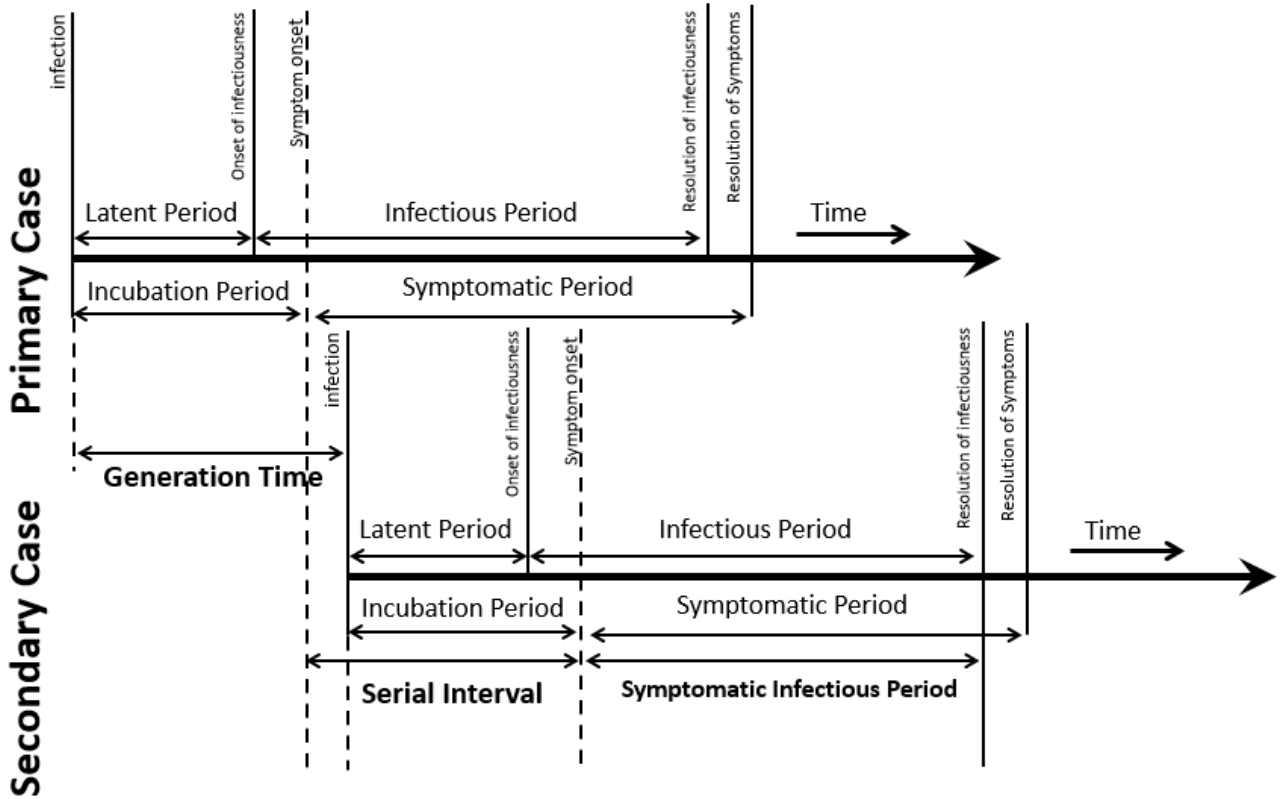
- Data are limited and symptom data may be difficult to interpret due to variability in how shedding and symptoms were measured between studies
- For both SARS-CoV-2 omicron and influenza A, if fever is present, individuals are likely to be shedding
  - Resolution of fever did not reliably align with resolution of viral shedding
- For influenza A, respiratory symptoms tended to persist longer than viral shedding

Workgroup Discussion About Information Desired from Transmission Studies

- The Workgroup wanted to determine the time from onset to resolution of infectiousness (infectious period) in an individual, to inform the duration of work restrictions
- Reviewed data on transmission of SARS-CoV-2 omicron and influenza A to better understand the daily risk for transmission from a contagious individual
- Available data in literature: generation interval versus serial interval

Viral Respiratory Infections Literature Reviews

Transmission Parameters (adapted from Kim et al. 2023)[6]



Generation Interval & Serial Interval Definitions

- **Generation interval**: time from the moment of infection in a primary case to infection in a secondary case
  - Identifies when transmission occurred to a secondary case
    - Hence, identifies when the primary case was contagious
  - Impractical to accurately measure in a study

- **Serial interval**: time from symptom onset in a primary case to symptom onset in a secondary case
  - Identifies when a secondary case is symptomatic
  - Can be measured in a study
  - Most individuals with a respiratory virus realize they are infected/contagious upon symptom onset (although their infectious period may begin prior)

Additional Key Question Development (cont.)

Key Questions

1. What is the duration of viral shedding measured from symptom onset or diagnosis using culture or RT-qPCR?
2. What is the association between the resolution of symptoms, specifically fever, and the resolution of viral shedding measured using culture, RT-qPCR, or RT-PCR?
3. What is the pair-level serial interval, defined as the number of days between symptom onset in primary and secondary cases?

	SARS-CoV-2 Omicron	Influenza A	RSV
Studies screened	269	3,248	37
Studies included	14	14	0

PRISMA diagrams included in extra slides

Key Question 3 Results: SARS-CoV-2 Omicron

Cumulative proportion (%) of symptom onset in secondary cases measured in days from symptom onset in the primary case with SARS-CoV-2

A. Omicron

Study (Mixed Subvariant)	Pairs (N)	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Shim 2022	202	Nov 25, 2021 - Jan 8, 2022	24	51	71	84	93	100									
Weil 2022	37	Dec 9, 2021 - 14 Feb 2022	29	55	79	88	88	93	95	100							
Guo 2023 (JOMV)	248	Jan 1 - Feb 15, 2022	25	51	69	81	88	92	95	97	98	99	99	99	100		
an der Heiden 2022	≥11,512	Jan 10 - Apr 18, 2022	21	43	61	74	82	88	92	94	96	98	98	99	100		
Li 2024	48	Mar 5- Apr 25, 2022	8	56	75	90	90	94	96	96	96	98	100				
Guo 2023 (IORV)	104	May 1 - Jul 17, 2022	28	47	72	87	92	96	99	99	100						
Study (BA.1 only)																	
Song 2022	12	Nov - Dec 2021	20	47	67	87	93	100									
Kremer 2022	1,788	Nov 20 - Dec 31, 2021	15	37	58	75	85	91	95	97	98	99	100				
Del Aguila-Mejia 2022	443	Dec 1-31, 2021	7	22	39	57	71	79	85	90	93	95	97	98	100		
Zeng 2023	72	Dec 9, 2021 - Jan 2, 2022	0	49	68	83	83	95	98	98	100						
Backer 2022	221	Dec, 13-19 2021	14	34	54	74	84	89	95	98	99	100					
Bendall 2023	11	Dec 21, 2021 -Jan 18, 2022	27	55	73	82	91	91	100								
Guo 2023 (JOVM)	15	Jan 1 - Feb 15, 2022	14	22	50	50	72	94	94	100							
Xin 2023	113	Jan 19 - Feb 4, 2022,	5	19	42	59	73	80	87	92	96	98	100				
Liu 2023	10	Jan 1 - Mar 26, 2022	35	53	59	75	85	94	100								
Study (Later Subvariants)																	
Zeng 2023 (BA.2)	38	Dec 9, 2021 - Jan 2, 2022	8	45	84	95	97	97	97	97	97	100					
Guo 2023 (JOMV) (BA.2)	254	Jan 1 - Feb 15, 2022	24	46	59	71	79	85	91	100							
Liu 2023 (BA.2)	14	Jan 1 - Mar 26, 2022	46	60	71	80	86	91	96	97	100						
Guo 2023 (IORV) (BA.2)	45	May 1 - Jul 17, 2022	28	54	72	82	92	92	97	97	100						
Guo 2023 (IORV) (BA.4)	8	May 1 - Jul 17, 2022	29	29	71	100											
Guo 2023 (IORV) (BA.5)	51	May 1 - Jul 17, 2022	27	43	73	89	91	98	100								

Legend: Colors Every 10 %	0	10	20	30	40	50	60	70	80	90	100

Key Question 3 Results: Influenza A

Cumulative proportion (%) of symptom onset in secondary cases measured in days from symptom onset in the primary case with influenza

B. Influenza A

Study (Mixed Subtypes)	Pairs (N)	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cowling 2009	14	Jan 2 - Sep 30, 2008	7	29	43	71	93	93	100								
Eibach 2014	5	Jan 20 - Apr 6, 2012	40	40	60	80	100										
Luvira 2022	5	Feb 22 - 28, 2013	0	20	60	80	80	100									
Iyengar 2015	8	May - Oct 2013	0	88	100												
Cohen 2019	30	2013 - 2014	20	60	87	87	93	100									
Study (H1N1 only)																	
Mcbryde 2009	37	May 16 - Jun 3, 2009	16	43	68	86	97	100									
Morgan 2010	11	Apr 10 - May 8, 2009	18	45	55	82	91	91	100								
Ghani 2010	58	Apr 27 - Jun 10, 209	8	35	50	72	85	91	98	98	100						
Suess 2010	8	Apr - Aug 2009	13	25	100												
Komiya 2010	14	May 17 - Jul 24, 2009	7	36	71	79	86	93	93	100							
Roll 2011	51	Apr 26 - Jul 7, 2009	12	43	59	73	78	86	90	92	94	96	96	98	98	98	100
Archer 2012	19	Jun 14 - July15, 2009	37	63	74	95	100										
teBeest 2013	37	Jun 2009	14	35	70	86	97	100									
Thai 2014	6	Jun 2009 - Apr 2010	33	67	100												

Legend: Colors Every 10 %	0	10	20	30	40	50	60	70	80	90	100

Key Question 3 GRADE Table: SARS-CoV-2 Omicron

Summary of findings table: Day of symptom onset in secondary cases, measured from symptom onset in the primary case.

Outcome	Summary	Studies	Validity	Imprecision	Inconsistency	Indirectness	Confidence
Omicron Any Subvariant	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 5, ≥80% on day 7, ≥90% on day 8 and 100% on day 13 post symptom onset or diagnosis.	14 Studies (N ≥ 15,361)	No concerns	No concerns	No concerns[3]	No concerns	High confidence
Omicron Mixed Subvariants	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 4, ≥80% on day 5, ≥90% on day 7 and 100% on day 13 post symptom onset or diagnosis.	6 Studies (N ≥ 11,512)	No concerns	No concerns	No concerns	No concerns	High confidence
Omicron BA.1 Subvariant	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 5, ≥80% on day 7, ≥90% on day 8 and 100% on day 13 post symptom onset or diagnosis.	9 Studies (N ≥ 2,696)	No concerns	No concerns	No concerns	No concerns	High confidence
Omicron BA.2 Subvariant	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 4, ≥80% and ≥90% on day 6, on day 7 and 100% on day 9 post symptom onset or diagnosis.	2 Studies (N ≥ 890)	No concerns	No concerns	No concerns	No concerns	High confidence

[3] Some inconsistency may be explained by the longer duration of shedding that may be seen with different subvariants or subtypes.

GRADE handbook

Key Question 3 GRADE Table: Influenza A

Summary of findings table: Day of symptom onset in secondary cases, measured from symptom onset in the primary case.

Influenza Any Subtype	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 4, ≥80% on day 6, ≥90% on day 7, and 100% on day 15 post symptom onset or diagnosis.	14 Studies (N = 308)	No concerns	No concerns	No concerns[3]	No concerns	High confidence
Influenza Mixed Subtype	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 4, ≥80% and ≥90% on day 5 and 100% on day 7 post symptom onset or diagnosis.	5 Studies (N = 62)	No concerns	No concerns	No concerns	No concerns	High confidence
Influenza H1N1	For all studies, results indicate that secondary case symptom onset occurs among ≥70% of all participants on day 4, ≥80% on day 6, and ≥90% on day 7 and 100% on day 15 post symptom onset or diagnosis.	9 Studies (N = 241)	No concerns	No concerns	No concerns	No concerns	High confidence

[3] Some inconsistency may be explained by the longer duration of shedding that may be seen with different subvariants or subtypes.

GRADE handbook

Viral Respiratory Infections Literature Reviews (cont.)

Cumulative number of studies reaching cumulative participant thresholds of pairs with symptom onset in secondary cases measured in days from primary case symptom onset

Virus, N Studies (N pairs)	Cumulative Participant Threshold (%)	Cumulative number of studies (Pairs in study)						
		Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Omicron, 14 (≥15,361 pairs)*	≥70	12 (≥14,805)	14 (≥15,361)					
	≥80	9 (≥1,284)	12 (≥14,805)	13 (≥14,918)	14 (≥15,361)			
	≥90	1 (48)	5 (377)	10 (≥3,072)	12 (≥14,805)	14 (≥15,361)		
	≥100	0	0	2 (214)	3 (225)	4 (262)	7 (≥988)	8 (≥1,209)
Influenza, 14 (314 pairs)	70	14 (314)						
	80	10 (177)	13 (263)	14 (314)				
	90	4 (52)	11 (186)	13 (263)	14 (314)			
	100	3 (33)	5 (57)	9 (166)	11 (191)	12 (205)	13 (263)	13 (263)

*2 studies reported the denominator in households or cases

Key Question 3 Summary

- RSV
  - No studies identified
- Influenza A
  - Symptom onset occurred in at least 80% of secondary cases by the end of day 6 in all studies
- SARS-CoV-2 Omicron
  - Symptom onset occurred in at least 80% of secondary cases by the end of day 7 in all studies

Workgroup Discussion About Information Desired from Transmission Studies (cont.)

- The vast majority of secondary case symptom onset for both pathogens occurred in the first few days from primary case symptom onset
  - Despite persistent viral shedding (Key Question 1) for 9-10 days, most transmissions seemed to occur earlier in primary case course of illness
    - Work exclusions may be more impactful earlier in the course of illness
- Developed a process to better estimate when *transmission* to secondary cases occurred

Workgroup Discussion About Information Desired from Transmission Studies (cont.)

- Serial interval encompasses:
  - Primary case
    - Begins at symptom onset (may miss the beginning of their infectious period)
  - Secondary case
    - Infection
    - Incubation period
    - Ends at symptom onset
- Subtracting the incubation period from a serial interval approximates the moment of transmission to that secondary case

Example: Estimate proportion of transmissions from primary case

Cumulative proportion (%) of symptom onset in secondary cases measured in days from symptom onset in the primary case with influenza

B. Influenza A

Study (Mixed Subtypes)	Pairs (N)	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cowling 2009	14	Jan 2 - Sep 30, 2008	7	29	43	71	93	93	100								
Eibach 2014	5	Jan 20 - Apr 6, 2012	40	40	60	80	100										
Luvira 2022	5	Feb 22 - 28, 2013	0	20	60	80	80	100									
Iyengar 2015	8	May - Oct 2013	0	88	100												
Cohen 2019	30	2013 - 2014	20	60	87	87	93	100									
Study (H1N1 only)																	
Mcbryde 2009	37	May 16 - Jun 3, 2009	16	43	68	86	97	100									
Morgan 2010	11	Apr 10 - May 8, 2009	18	45	55	82	91	91	100								
Ghani 2010	58	Apr 27 - Jun 10, 209	8	35	50	72	85	91	98	98	100						
Suess 2010	8	Apr - Aug 2009	13	25	100												
Komiya 2010	14	May 17 - Jul 24, 2009	7	36	71	79	86	93	93	100							
Roll 2011	51	Apr 26 - Jul 7, 2009	12	43	59	73	78	86	90	92	94	96	96	98	98	98	100
Archer 2012	19	Jun 14 - July15, 2009	37	63	74	95	100										
teBeest 2013	37	Jun 2009	14	35	70	86	97	100									
Thai 2014	6	Jun 2009 - Apr 2010	33	67	100												

Legend: Colors Every 10 % — 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100

Influenza A incubation period: 1.3-1.5 days (95% CI) [7]

- All studies reported symptom onset in ≥80% of secondary cases by the end of day 6
- If the incubation period of 1 day is subtracted, it will conservatively estimate the latest likely day of transmission
- Hence, suggests that at least 80% of transmissions from the primary case are estimated to have occurred by the end of day 5

Example: Estimate proportion of transmissions from primary case (cont.)

Cumulative proportion (%) of symptom onset in secondary cases measured in days from symptom onset in the primary case with SARS-CoV-2

A. Omicron

Study (Mixed Subvariant)	Pairs (N)	Dates	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Shim 2022	202	Nov 25, 2021 - Jan 8, 2022	24	51	71	84	93	100									
Weil 2022	37	Dec 9, 2021 - 14 Feb 2022	29	55	79	88	88	93	95	100							
Guo 2023 (JOMV)	248	Jan 1 - Feb 15, 2022	25	51	69	81	88	92	95	97	98	99	99	99	100		
an der Heiden 2022	≥11,512	Jan 10 - Apr 18, 2022	21	43	61	74	82	88	92	94	96	98	98	99	100		
Li 2024	48	Mar 5- Apr 25, 2022	8	56	75	90	90	94	96	96	96	98	100				
Guo 2023 (IORV)	104	May 1 - Jul 17, 2022	28	47	72	87	92	96	99	99	100						
Study (BA.1 only)																	
Song 2022	12	Nov - Dec 2021	20	47	67	87	93	100									
Kremer 2022	1,788	Nov 20 - Dec 31, 2021	15	37	58	75	85	91	95	97	98	99	100				
Del Aguila-Mejia 2022	443	Dec 1-31, 2021	7	22	39	57	71	79	85	90	93	95	97	98	100		
Zeng 2023	72	Dec 9, 2021 - Jan 2, 2022	0	49	68	83	83	95	98	98	100						
Backer 2022	221	Dec, 13-19 2021	14	34	54	74	84	89	95	98	99	100					
Bendall 2023	11	Dec 21, 2021 -Jan 18, 2022	27	55	73	82	91	91	100								
Guo 2023 (JOVM)	15	Jan 1 - Feb 15, 2022	14	22	50	50	72	94	94	100							
Xin 2023	113	Jan 19 - Feb 4, 2022,	5	19	42	59	73	80	87	92	96	98	100				
Liu 2023	10	Jan 1 - Mar 26, 2022	35	53	59	75	85	94	100								
Study (Later Subvariants)																	
Zeng 2023 (BA.2)	38	Dec 9, 2021 - Jan 2, 2022	8	45	84	95	97	97	97	97	97	100					
Guo 2023 (JOMV) (BA.2)	254	Jan 1 - Feb 15, 2022	24	46	59	71	79	85	91	100							
Liu 2023 (BA.2)	14	Jan 1 - Mar 26, 2022	46	60	71	80	86	91	96	97	100						
Guo 2023 (IORV) (BA.2)	45	May 1 - Jul 17, 2022	28	54	72	82	92	92	97	97	100						
Guo 2023 (IORV) (BA.4)	8	May 1 - Jul 17, 2022	29	29	71	100											
Guo 2023 (IORV) (BA.5)	51	May 1 - Jul 17, 2022	27	43	73	89	91	98	100								

Legend: Colors Every 10 % — 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100

SARS-CoV-2 Omicron incubation period: 2.01-5.61 days (95% CI)[8]

- All studies reported symptom onset in ≥80% of secondary cases by the end of day 7
- If the incubation period of 2 days is subtracted, it will conservatively estimate the latest likely day of transmission
- Hence, suggests that at least 80% of transmissions from the primary case are estimated to have occurred by the end of day 5

Key Question 3 Workgroup Discussion Summary

- Used the daily cumulative proportion (%) of secondary cases with symptom onset AND subtracted the pathogens incubation period to estimate the daily progression of risk for transmission from symptomatic HCP
  - Used the daily progression of risk for transmission to inform when HCP could return to working in a healthcare facility

- Identified and discussed additional factors that might reduce or extend the duration of work restrictions

Discussion about factors that might affect the duration of HCP work restrictions

- Are additional work restrictions indicated for HCP recovering from influenza or SARS-CoV-2 who returned to work to avoid persons at risk for severe disease?
  - Persons at risk for severe disease from influenza or SARS-CoV-2 include
    - Those over the age of 65
    - Those with medical comorbidities (e.g., asthma, blood disorders, cardiovascular disease, cerebrovascular disease, chronic lung diseases, endocrine disorders, liver disorders, renal disease)
  - Reliably restricting HCP from interacting with patients or coworkers at risk for severe disease is not feasible in most situations, hence, the Workgroup proposed not tying additional HCP work restrictions to patients or coworkers at risk for severe disease
    - Work restrictions would adequately protect all populations in healthcare

People at Increased Risk for Flu Complications | Influenza (Flu) | CDC
Underlying Conditions and the Higher Risk for Severe COVID-19 | COVID-19 | CDC

Discussion about factors that might affect the duration of HCP work restrictions (cont.)

- Should potentially contagious HCP be routinely tested for SARS-CoV-2 or influenza to facilitate returning to work sooner?
  - Recommended in Interim Guidance for SARS-CoV-2; not historically done for influenza
  - Literature review suggested infected persons are contagious earlier in disease course, so shorter durations of work restrictions are not likely to be further reduced by 2 negative test results (at least 48 hours apart)
    - Relationship between positive tests and transmissibility is unclear
  - Routine lab processes for testing are challenging to implement
    - Home testing may lack objectivity/accuracy/documentation
  - The Workgroup did not propose a strategy for using SARS-CoV-2 testing to facilitate returning HCP to work sooner

Interim Guidance for Managing Healthcare Personnel with SARS-CoV-2 Infection or Exposure to SARS-CoV-2 | COVID-19 | CDC

Discussion about factors that might affect the duration of HCP work restrictions (cont.)

- Should the vaccination status of infected HCP alter the duration of recommended work restrictions?
  - Limited data (Key Question 1) suggested vaccination may reduce duration of viral shedding in mild to moderately ill adults with omicron
    - Results not consistent between all studies
  - The Workgroup did not propose different work restrictions for vaccinated and unvaccinated HCP

Discussion about factors that might affect the duration of HCP work restrictions (cont.)

- Could use of antivirals reduce the duration of work restrictions?
  - Antivirals are not routinely indicated for reducing the risk for transmission to others
  - Influenza A
    - Neuraminidase inhibitors have been shown to reduce viral shedding by 1-2 days for influenza and may reduce risk for transmission[9-10]
  - SARS-CoV-2, omicron variants
    - Nirmatrelvir/ritonavir has been shown to decrease viral shedding in adults, though the risk for rebound viremia may negate potential for decreasing risk of transmission[11-13]
  - The Workgroup did not propose reducing the duration of HCP work restrictions if antivirals were taken

Discussion about factors that might affect the duration of HCP work restrictions (cont.)

- Could potentially contagious HCP return to work sooner if a source control device is used for the remainder of that time?
  - Laboratory-based articles report
    - Particle reductions in air samples from masked individuals[14]
    - Viral RNA reductions in air samples taken near masked individuals[15]

Discussion about factors that might affect the duration of HCP work restrictions (cont.)

- Could potentially contagious HCP return to work sooner if a source control device is used for the remainder of that time?
  - A limited number of articles reported transmissions from contagious, masked HCP in a healthcare setting
    - Example: Letter to the editor[16]
      - 2 masked HCP worked while pre-symptomatic or symptomatic with SARS-CoV-2
        - » 33 exposed patients
          - None developed symptoms
          - 22 were tested for SARS-CoV-2 at some point while asymptomatic and were negative

Discussion about factors that might affect the duration of HCP work restrictions

- Could potentially contagious HCP return to work sooner if a source control device is used for the remainder of that time?
  - A limited number of articles reported searching for transmissions from contagious, masked HCP in a healthcare setting
    - Example: Multifacility prospective cohort study[17]
      - 116 acute care, 26 LTC, 67 rehab patients received care from a masked HCP with lab-confirmed SARS-CoV-2 during period of communicability
        - » 42 HCP worked during period of communicability
          - 29 (69%) HCP asymptomatic, 13 (31%) symptomatic when providing care
      - 133 patients (64%) with at least 14 days prospective symptom surveillance
        - » Included day 5 and 10 SARS-CoV-2 testing if remained asymptomatic
      - 3 became positive for SARS-CoV-2 (presumed from HCP)
        - » Alternate source of SARS-CoV-2 could not be excluded
      - Authors conclusion: wearing a surgical mask for source control is highly protective against transmission

Discussion about factors that might affect the duration of HCP work restrictions (cont.)

- Could potentially contagious HCP return to work sooner if a source control device is used for the remainder of that time?
  - Masking for source control reduces risk for transmission, but some risk may still be present
    - Difficult to quantify the transmission risk reduction provided
    - Source control devices must be used consistently and correctly to be effective for preventing transmission
  - The Workgroup proposed the use of source control devices to diminish some possible residual transmission risk in recovering HCP returning to work

Section Update: Viral Respiratory Infections, Proposed Draft Recommendation Updates

Evidence to Decision Framework

Component	Clinical Recommendations: Individual Perspective	Clinical Recommendations: Population Perspective	Coverage Decisions	Health System & Public Health Recommendations
Priority of the problem	*Is the problem a priority?* Yes, according to all perspectives.			
Test accuracy	Not applicable			
Benefits & Harms	*How substantial are the desirable anticipated effects?* There may be a hypothetical reduction in influenza transmission due to the addition of masking upon return to work. Additionally, decreased work restriction duration may lead to a decrease in presenteeism among ill HCP, possibly reducing SARS-CoV-2 transmission. There may also be a hypothetical reduction in work safety risks due to decreased understaffing.[18-19] *How substantial are the undesirable anticipated effects?* There may be a hypothetical increase in SARS-CoV-2 transmission due to the decrease in work restriction duration, however this increase is potentially reduced by masking upon return to work and other elements of the hierarchy of controls.			
Certainty of the evidence	*What is the overall certainty of the evidence of effects?* There is high certainty in the evidence for the duration of transmission risk based on serial interval pair data.			
Outcome importance: Is there important uncertainty about or variability in how much people value the main outcomes?	Individuals will place a high value on no change in transmission, increased availability of staff, and increased patient and HCP safety.	Society will place a high value on no change in transmission and increased patient and HCP safety.	Reimbursement entities will place a high value on no change in transmission and increased patient and HCP safety.	Healthcare systems and facilities will place a high value on no change in transmission, increased availability of staff, and increased patient and HCP safety.
Balance	*Does the balance between desirable and undesirable effects favor the intervention or the comparison?* Favors the recommendation as the prevention of transmission of respiratory viral illness is anticipated to be similar, while undesirable effects due to understaffing are expected to decrease.			

Evidence to Decision Framework (cont.)

Component	Clinical Recommendations: Individual Perspective	Clinical Recommendations: Population Perspective	Coverage Decisions	Health System & Public Health Recommendations
Resource use		*How large are the resource requirements?* No cost-effectiveness analysis was conducted. However, the Workgroup discussed the potential for the recommendation to reduce costs associated with work restrictions such as work loss[20] and understaffing, which can lead to increased hospital-acquired infections (HAIs)[21] and direct costs to hospitals.[22] The recommendation may potentially maintain desirable health outcomes, thereby reducing costs to reimbursement entities that would then be passed to patients, healthcare systems, or providers. *What is the certainty of the evidence of resource requirements costs?* Unclear, so the Workgroup did not weight this heavily.		
Equity: What would be the impact on health equity?	The recommendation potentially improves staffing levels, especially in facilities with limited staffing resources, may minimize HCP burnout, and could potentially ameliorate inequities that result from limited sick leave.	The recommendation potentially improves staffing levels, maintains desirable health outcomes, and may minimize HCP burnout.	Unclear	The recommendation may potentially maintain desirable health outcomes, thereby ensuring all patients and providers have the opportunity to maintain optimal health.
Acceptability: Is the intervention acceptable to key stakeholders?	No assessment of knowledge, attitudes and practices was performed. However, overall Workgroup conclusion is that this recommendation would be acceptable.			
Feasibility: Is the intervention feasible to implement?	No implementation assessment was conducted. However, the Workgroup assumes this recommendation is feasible.			

Viral Respiratory Infections *DRAFT* recommendation options

- For asymptomatic healthcare personnel who have an exposure to influenza or SARS-CoV-2 viruses
  - Work restrictions are not necessary
  - Wear a source control device from the day of first exposure through the 5th day after last exposure
  - Monitor for development of signs or symptoms of a viral respiratory infection for 5 days after their last exposure

Viral Respiratory Infections *DRAFT* recommendation options

- For healthcare personnel who are *not* moderately to severely immunocompromised with mild to moderate suspected or confirmed influenza or SARS-CoV-2 infections:
  - Restrict from work until
    - At least (3-5) days have passed from symptom onset* (first day of symptoms = day 0) AND
    - They are fever free for at least 24 hours without the use of antipyretics AND
    - Symptoms are improved
  - Wear a source control device, upon return to work, until the end of day 7 from the first day of symptoms

*Or from their first positive SARS-CoV-2 test, if asymptomatic

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Discussion/Comments/Questions

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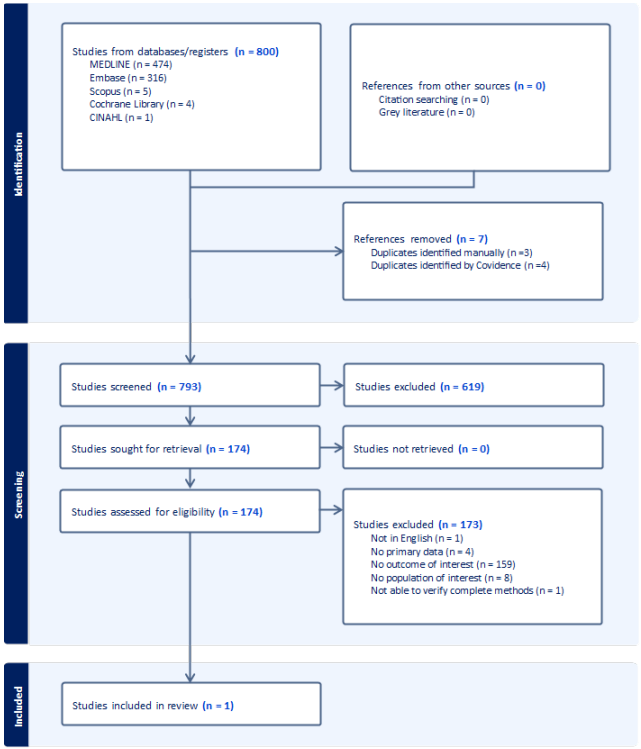
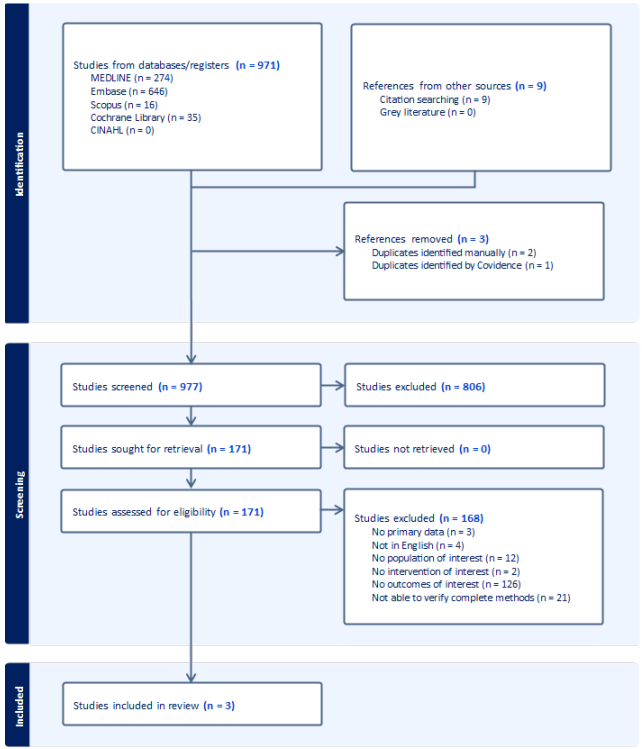
Extra Slides

Key Question 2 PRISMA Diagrams

SARS-CoV-2 Omicron

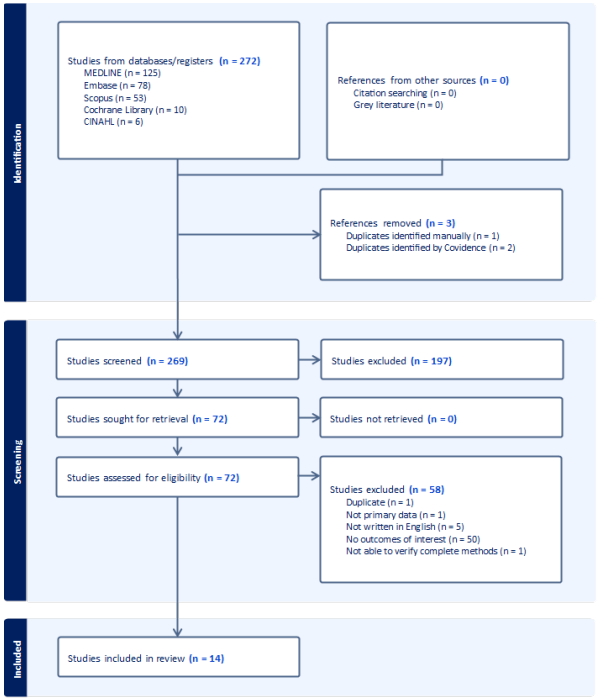


Influenza A

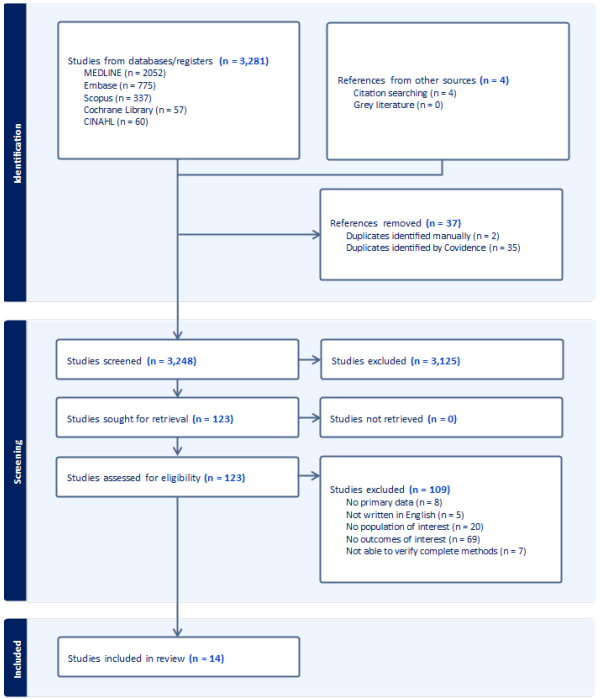


Key Question 3 PRISMA Diagrams

SARS-CoV-2 Omicron



Influenza A



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