



## A living review examining the impact of COVID-19 pandemic on Influenza and Respiratory Syncytial Virus activity

Week 23.08.2021 to 29.08.2021

Contributing authors: Durga Kulkarni, Thulani Ashcroft, Bohee Lee, Madhurima Nundy, Karen Hartnup, Evropi Theodoratou, Ruth McQuillan, Ting Shi and Emilie McSwiggan for the USHER Network for COVID-19 Evidence Reviews (UNCOVER)

Corresponding authors: Evropi Theodoratou ([e.theodoratou@ed.ac.uk](mailto:e.theodoratou@ed.ac.uk)), Ruth McQuillan ([ruth.mcquillan@ed.ac.uk](mailto:ruth.mcquillan@ed.ac.uk))

Date of review: 7<sup>th</sup> September 2021

### Purpose of the review

The aim of this review was to examine the impact of a novel virus, SARS-CoV-2, on the activity of Influenza virus and Respiratory Syncytial Virus (RSV) in the human population. Understanding their co-existence will help inform clinical guidelines and public policy to protect public health and prevent health services from becoming overwhelmed.

### Key themes

We used the following four themes to synthesise the available literature regarding influenza and RSV:

- 1) [Seasonality](#): The seasonality and circulating strains of influenza virus and RSV.
- 2) [Epidemiology/ surveillance](#): The epidemiology and surveillance activity of influenza virus and RSV. This includes disruptions to and adaptations for end-to-end integrated influenza/RSV and COVID-19 surveillance, change in surveillance standards (type of specimens processed, sampling strategy, testing algorithms, data reporting) and lessons from sentinel surveillance for SARS-CoV-2.
- 3) [Public health measures and COVID-19 vaccinations](#): Effect of COVID-19 related public health measures and availability of COVID-19 vaccines on influenza and RSV activity.
- 4) [Health Systems](#): The health systems, the reallocation of health resources such as poor availability of flu vaccines due to prioritization of health resources for COVID.

Table 1: Summary table of study characteristics and main findings

Themes	<a href="#">Quality of evidence</a> *	Study	Study type	Country (WHO region)	Data sources	Time period for data collection	Main findings
Seasonality	Low-moderate	<a href="#">Avadhanula and Piedra, 2021</a>	Commentary	Australia (WPR)	<a href="#">Yeoh et al., 2021</a>	January 2012 (date not presented) to 30th August 2020	<ul style="list-style-type: none"> <li>• <i>Hypotheses</i>: none specified</li> <li>• An obvious reduction in influenza and RSV circulation during the winter of 2020 was followed by an unusual spike of RSV infections in the summer in Western Australia.</li> </ul>
		<a href="#">Ippolito et al., 2021</a>	Retrospective cohort study	Italy (EUR)	A tertiary care Hospital in the Center of Milan, Italy	Winter: from the 1st of November to the last day of February (1) 2018-2019, (2) 2019-2020 (3) 2020-2021	<ul style="list-style-type: none"> <li>• <i>Hypotheses</i>: Influenza virus infection during the pandemic will decrease compared to previous years</li> <li>• When comparing to the pre-pandemic, there were substantial reductions in RSV, Influenza A and B infections during the COVID-19 season (2020/2021).</li> <li>• RSV was the most common virus in the pre-pandemic (70% in 2018/2019; 65% in 2019/2020), but during the COVID-19 season, Rhinovirus was the most common (87% in 2020/2021).</li> </ul>

Themes	<a href="#">Quality of evidence</a> *	Study	Study type	Country (WHO region)	Data sources	Time period for data collection	Main findings
		<a href="#">Rodgers et al., 2021</a>	Ecological	USA (AMR)	Medical records from emergency department (ED) and results of laboratory tests	(1) 05 <sup>th</sup> March 2017 to 30 <sup>th</sup> December 2017 (2) 04 <sup>th</sup> March 2018 to 29 <sup>th</sup> December 2018 (3) 03 <sup>rd</sup> March 2019 to 28 <sup>th</sup> December 2019 (4) 10 <sup>th</sup> March 2020 to 26 <sup>th</sup> December 2020	<ul style="list-style-type: none"> <li>• <i>Hypotheses:</i> The ongoing COVID-19 pandemic will lead to a change in the seasonality of other respiratory viruses.</li> <li>• The study compared changes in seasonality of respiratory pathogens in the pre-pandemic and pandemic period.</li> <li>• Between August 2020 and end of 2020, the percentage of visits to ED with influenza and RSV was consistently lower than the latter half of the pre-pandemic period.</li> <li>• The percentage of positivity of influenza and RSV declined in early 2020 and remained suppressed without seasonal increase that occurred in 2019.</li> <li>• The study surmised that public health interventions decreased respiratory pathogens affecting seasonality.</li> </ul>
<b>Epidemiology / surveillance</b>	Low-moderate	<a href="#">Venkatram et al., 2021</a>	Retrospective cohort	USA (AMR)	Community teaching hospital, South and Central Bronx	(1) 01 <sup>st</sup> October 2017 to 30 <sup>th</sup> April 2018. (2) 01 <sup>st</sup> October 2018 to 30 <sup>th</sup> April 2019 (3) 01 <sup>st</sup> October 2019 to 30 <sup>th</sup> April 2020 (4) 01 <sup>st</sup> October 2020	<ul style="list-style-type: none"> <li>• <i>Hypotheses:</i> The number of influenza cases in the pandemic period will be fewer compared to previous years.</li> <li>• The study compared incidence and outcomes of influenza related hospitalisations before and during the COVID-19 pandemic.</li> <li>• Influenza cases in 2020–2021 declined in comparison to other time periods (<math>p &lt; 0.001</math>) although the number of influenza tests conducted were similar in the pre-pandemic and 2020-2021 period.</li> <li>• A higher number of African Americans and asthmatics were hospitalised for influenza</li> </ul>

Themes	<a href="#">Quality of evidence*</a>	Study	Study type	Country (WHO region)	Data sources	Time period for data collection	Main findings
						to 30 <sup>th</sup> April 2021	<p>during the influenza and COVID-19 overlapping season period.</p> <ul style="list-style-type: none"> <li>• Among 394 confirmed influenza cases, dual infection with influenza and COVID-19 was reported in 14 patients during the 2019–2020 season and four patients during the 2020–2021 season.</li> <li>• Co-infection with COVID-19 did not increase mortality in hospitalised patients with influenza.</li> </ul>
		<a href="#">Heshmat-Ghahdarijani et al., 2021</a>	Retrospective cohort	Iran (EMR)	Covid-19 registry (I-core)	Feb 2020 – 26 Mar 2020	<ul style="list-style-type: none"> <li>• <i>Hypotheses:</i> Influenza and COVID-19 co-infections can occur.</li> <li>• This study reported co-infection rates of influenza and Covid-19 in Ishfahan, Iran.</li> <li>• Among 1639 patients of COVID-19, two were found to have influenza virus type-B co-infection. Both patients had pneumonia and subsequently had no complaints at 3-month follow-up.</li> </ul>

Themes	<a href="#">Quality of evidence</a> *	Study	Study type	Country (WHO region)	Data sources	Time period for data collection	Main findings
<b>Public health measures and COVID-19 vaccinations</b>	Low	<a href="#">Avadhanula and Piedra, 2021</a>	Commentary	Pooled data from several countries	( <a href="#">Groves et al., 2021</a> , <a href="#">Olsen et al., 2021</a> , <a href="#">Yeoh et al., 2021</a> )	2012 to 2021	<ul style="list-style-type: none"> <li>• <i>Hypotheses:</i> NPIs will influence the RSV and influenza activity.</li> <li>• A near absence of the influenza virus (types A and B), and RSV epidemics was noted in Canada in the 2020-2021 season when NPIs were in place compared to the previous five seasons (2014-2019).</li> <li>• A similar finding was observed in USA so that few common respiratory virus cases were reported during the 2020-2021 respiratory virus season when NPIs were in place. But a summer surge of RSV was noticeable after NPIs were lifted.</li> <li>• Dramatic reductions in influenza and RSV virus circulation were observed in Western Australia during the winter of 2020 followed by an intense RSV infection spike in the summer when NPIs were relaxed.</li> </ul>

Themes	<a href="#">Quality of evidence</a> *	Study	Study type	Country (WHO region)	Data sources	Time period for data collection	Main findings
		<a href="#">Huppertz et al., 2021</a>	Consensus paper	Pooled from different countries	( <a href="#">Arbeitsgemeinschaft Influenza, 2021</a> , <a href="#">Foley et al., 2021</a> )	2012 to 2021	<ul style="list-style-type: none"> <li>• <i>Hypotheses:</i> Non-pharmaceutical interventions (NPIs) will influence RSV and influenza activity.</li> <li>• A fall in almost all respiratory virus cases including notifiable influenza since March 2020 was recorded.</li> <li>• The number of children and adolescents presenting with respiratory diseases in the practices of paediatricians and in paediatric hospitals dropped significantly in 2020.</li> <li>• The NPIs implemented against COVID-19 served as exposure prophylaxis against nearly all respiratory pathogens except the rhinoviruses.</li> <li>• These respiratory viruses are likely to reappear with the lifting of NPIs.</li> <li>• RSV infections can be expected in the older age groups after the lifting of NPIs.</li> <li>• The number of RSV cases increased significantly and surpassed the median cases reported in the 2012-2019 seasons in Australia after the lifting of NPIs. The age of the affected children was also much higher .</li> </ul>
<b>Health Systems</b>	Not applicable	No studies identified	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
<b>Abbreviation:</b> WPR= Western Pacific region EUR= European region AMR= Region of the Americas EMR= Eastern Mediterranean region NPI= Non-pharmaceutical interventions							

## Summary of findings

A total of six studies were included in this rapid review (week 23.08.2021 to 29.08.2021). Of these six studies, the commentary by [Avadhanula and Piedra \(2021\)](#) had data on seasonality ([theme 1](#)) and public health measures ([theme 3](#)). Two other studies ([Ippolito et al., 2021](#), [Rodgers et al., 2021](#)) focussed on seasonality while two more ([Heshmat-Ghahdarijani et al., 2021](#), [Venkatram et al., 2021](#)) explored the epidemiology/ surveillance theme ([theme 2](#)). We identified one additional paper ([Huppertz et al., 2021](#)) that focussed on the effect of COVID-19 related public health measures ([theme 3](#)). Our search did not identify any studies focusing on health system changes ([theme 4](#)). [Table 1](#) summarises the study characteristics and findings of each study by themes, with [Table 2](#) providing quality assessment of the included studies.

### 1. Seasonality

A commentary ([Avadhanula and Piedra, 2021](#)) reported data from Australia that demonstrated a rise in RSV cases during the summer of 2020 after a decline in the winter period. An ecological study ([Rodgers et al., 2021](#)) from USA used data from emergency departments to compare visits across four time periods, three pre-pandemic and one pandemic period. There was a sharp decline in respiratory diseases and percentage positivity of tests for influenza and RSV pathogens from mid to late March 2020. The regular seasonal patterns were also disrupted in 2020 as compared to 2019. Another single centre retrospective cohort study ([Ippolito et al., 2021](#)) found a substantial reduction of RSV, Influenza A and B during the COVID-19 season compared to the pre-pandemic. In addition, RSV was the most prevalent virus in the pre-pandemic period, while Rhinovirus was the most common virus during the COVID-19 pandemic period.

### 2. Epidemiology/ surveillance

Two retrospective cohort studies, one conducted in USA ([Venkatram et al., 2021](#)) and the other in Iran ([Heshmat-Ghahdarijani et al., 2021](#)) studied co-infection rates of influenza and COVID-19 in specified time periods. The latter study identified hemoptysis as a presenting symptom in co-infected patients, which as per the authors has been noted in prior studies. Therefore, evaluation for co-infection with influenza in COVID-19 patients in specific settings is needed. The former study ([Venkatram et al., 2021](#)) reported a significant decline in influenza cases in 2020-2021 as compared to the pre-pandemic period. It was suggested that this may be due to NPIs for COVID-19, which would have prevented the spread of influenza

due to similar modes of transmission as also due to reduced health seeking behaviour among influenza patients. However, they did not attribute to the decline of reduced influenza testing as reported in previous studies.

### 3. Public health measures and COVID-19 vaccinations

A commentary ([Avadhanula and Piedra, 2021](#)) and a consensus paper ([Huppertz et al., 2021](#)), suggested that a drop in influenza and RSV cases that coincided with the implementation of NPIs was observed in several countries. However, a rise in infections caused by respiratory viruses, including influenza and RSV has been noted in some countries and can be expected in other countries after the relaxation of NPIs. The authors of these papers have quoted data from USA, Australia, Canada, and Germany. Several factors that are likely to be contributing to this surge were identified: the opening of schools, removal of restrictions, waning immunity, a larger RSV naïve population, a lack of natural boosting due to reduced immunity and the reduction in dose of the pathogens necessary for infection ([Huppertz et al., 2021](#)).

### 4. Health Systems

Our search did not identify any studies presenting data on health systems changes in response to the COVID-19 pandemic that may have impacted influenza or RSV activity.

Table 2: Quality of evidence from the included studies

Theme	Number of studies	Quality of evidence*	Comments
Seasonality	N = 3 ( <a href="#">Avadhanula and Piedra, 2021</a> , <a href="#">Ippolito et al., 2021</a> , <a href="#">Rodgers et al., 2021</a> )	Low-moderate	<p><b>Commentary (N= 1):</b> <a href="#">Avadhanula and Piedra, 2021</a></p> <ul style="list-style-type: none"> <li>Does not provide conclusive evidence that can be generalisable to all settings and populations</li> <li>Published in German but translated to English using Microsoft translator.</li> </ul> <p><b>Cohort study (N= 1):</b> <a href="#">Ippolito et al., 2021</a></p> <ul style="list-style-type: none"> <li>Generalisability of findings to other settings and age groups difficult.</li> </ul> <p><b>Ecological study (N= 1):</b> <a href="#">Rodgers et al., 2021</a></p> <ul style="list-style-type: none"> <li>Some clinical codes during early pandemic may be COVID-19 infections rather than other respiratory pathogens.</li> <li>Ascertainment bias likely as testing for viral pathogens was done by clinical staff and different hospitals had different protocols for testing.</li> <li>Reported data from as many as 70% of ED facilities across the USA (49 states)</li> </ul>



Theme	Number of studies	Quality of evidence*	Comments
<b>Epidemiology/ Surveillance</b>	N = 2 ( <a href="#">Heshmat-Ghahdarjani et al., 2021</a> , <a href="#">Venkatram et.al,2021</a> )	Low - moderate	<a href="#">Venkatram et.al,2021</a> ; <a href="#">Heshmat-Ghahdarjani et al., 2021</a> <ul style="list-style-type: none"> <li>Retrospective design of the studies with one being single centre study and the other based on records from a single province.</li> <li>Poor generalisability to other settings.</li> </ul>
<b>Public Health measures and COVID-19 vaccine availability</b>	N = 2 ( <a href="#">Avadhanula and Piedra, 2021</a> , <a href="#">Huppertz et al., 2021</a> )	Low	<a href="#">Avadhanula and Piedra, 2021</a> , <a href="#">Huppertz et al., 2021</a> <ul style="list-style-type: none"> <li>These were commentaries or consensus papers and do not provide conclusive evidence.</li> <li>Did not estimate the effect of specific NPIs on influenza and RSV activity.</li> <li>The consensus paper was published in German and was translated using Microsoft translator.</li> </ul>
<b>Health systems</b>	N = 0	Not applicable	Not applicable

\*Quality appraisal tool not used

## Limitations of the review

We identified a few limitations in this review. There might be some levels of risk of bias because data were extracted, and quality assessment of the studies were conducted by a single reviewer. The six studies included in this review were reported from different countries and regions of the world and at variable time points. The heterogeneity across the included studies does not enable us to generalise the findings to all populations and settings.

We did not exclude any papers because of their study designs or on the grounds of poor quality as we were keen on providing a maximally inclusive synthesis of available evidence. However, this may have reduced the quality of evidence generated from this review. Microsoft translator tool was used to translate one paper ([Huppertz et al., 2021](#)) from German to English. The accuracy of translation is, therefore, contentious.

Importantly, this should not be considered a comprehensive literature review of the effect of the ongoing COVID-19 pandemic on influenza and RSV activity since our literature search was restricted to dates from 23.08.2021 to 28.08.2021.

However, this review was planned and undertaken as a rapid review with a quick turnaround to provide a quick summary of the literature for the week between 23.08.2021 to 28.08.2021. We aim to update this review and summarise the existing literature weekly.

## Conclusions

A change in seasonality patterns of influenza and RSV was observed in different countries in the context of the COVID-19 pandemic. During the COVID-19 pandemic, a decline in number of influenza cases was reported. Atypical presentations of influenza have been observed in co-infections with COVID-19. Public health measures implemented against COVID-19 seem to be effective in reducing the transmission of influenza and RSV.

However, a rise in influenza and RSV cases with a change in their epidemiology can be expected after the relaxation of these public health measures. There was limited evidence regarding the impact of changes in health system changes on influenza and RSV activity. Heterogeneity across available studies does not allow further generalisation of findings.

## Methods

This rapid review was guided by the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA-2020) protocols statement (Page et al., 2021) and a study protocol was developed (see appendices). We designed a search strategy by developing a search string that included terms related to influenza and RSV (shown in appendices). The COVID-19 literature database was searched on 1<sup>st</sup> September 2021 for studies published between 23<sup>rd</sup> August 2021 and 29<sup>th</sup> August 2021, and results were imported to Covidence (COVIDENCE, 2021) after deduplication in EndNote. Within Covidence we then performed a further deduplication. Two reviewers from the review team performed independent screening of the titles and abstracts of all the records followed by independent screening of full-texts of the studies selected for full-text review. Disagreements at any stage were reconciled by discussion within team members. A single reviewer performed data extraction for each included study. Figure 1 illustrates the flow of study selection at each stage.

We extracted data regarding study type and methods, country and WHO region, sources of data, period of data collection, and study findings. Four themes were used to synthesise the available literature on influenza virus and RSV:

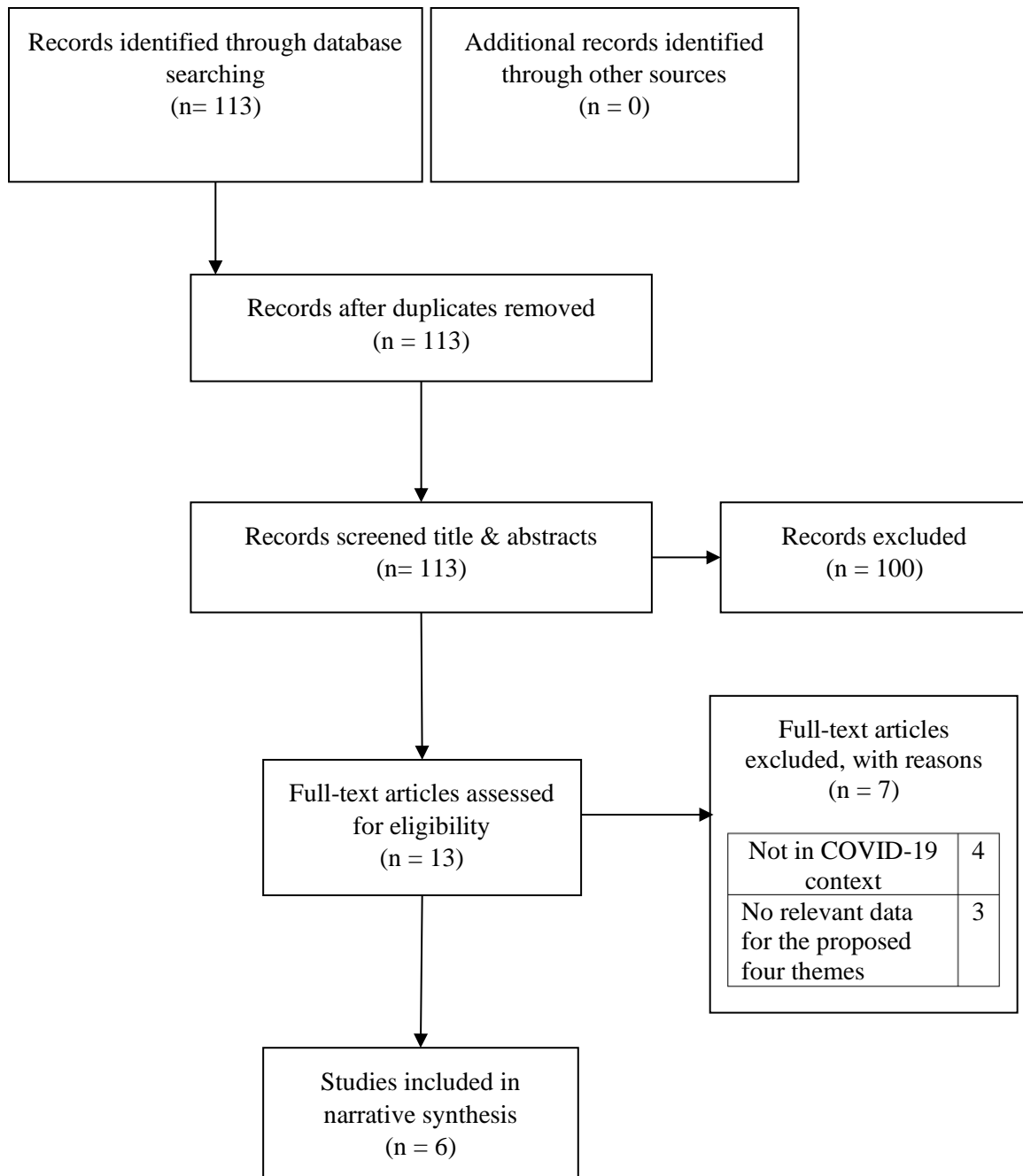
- 1) [The seasonality and circulating strains of influenza virus and RSV.](#)
- 2) [The epidemiology and surveillance activity of influenza virus and RSV.](#) This includes disruptions to and adaptations for end-to-end integrated influenza/RSV and COVID-19 surveillance, change in surveillance standards (type of specimens processed, sampling

strategy, testing algorithms, data reporting) and lessons from sentinel surveillance for SARS-CoV-2.

- 3) [Effect of COVID-19 related public health measures and availability of COVID-19 vaccines on influenza and RSV activity.](#)
- 4) [The health systems, the reallocation of health resources](#) such as poor availability of flu vaccines due to prioritization of health resources for COVID.

We were unable to conduct a formal quality assessment of individual studies, owing to time constraints. However, we commented on the general quality of evidence available for each theme.

**Figure 1: PRISMA flow chart**



## References

- ARBEITGEMANSCHAFT INFLUENZA. 2021. Germany (total). [online] Available at: <<https://influenza.rki.de/Diagrams.aspx?agiRegion=0>> [Accessed 06 September 2021].
- AVADHANULA, V. & PIEDRA, P. A. 2021. The Prevention of Common Respiratory Virus Epidemics in 2020-21 during the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Pandemic: An Unexpected Benefit of the Implementation of Public Health Measures. *Lancet Regional Health. Americas*, 100043-100043.
- COVIDENCE. 2021. Covidence - Better systematic review management. [online] Available at: <<https://www.covidence.org/>> [Accessed 22 August 2021].
- FOLEY, D. A., YEOH, D. K., MINNEY-SMITH, C. A., MARTIN, A. C., MACE, A. O., SIKAZWE, C. T., LE, H., LEVY, A., MOORE, H. C. & BLYTH, C. C. 2021. The interseasonal resurgence of respiratory syncytial virus in Australian children following the reduction of coronavirus disease 2019–related public health measures. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*.
- GROVES, H. E., PICHE-RENAUD, P.-P., PECI, A., FARRAR, D., BUCKRELL, S., BANCEJ, C., SEVENHUYSEN, C., CAMPIGOTTO, A., GUBBAY, J. & MORRIS, S. 2021. The impact of the COVID-19 pandemic on influenza, respiratory syncytial virus, and other seasonal respiratory virus circulation in Canada. *medRxiv*.
- HESHMAT-GHAHDARIJANI, K., VASEGHI, G., NASIRIAN, M. & JAVANMARD, S. H. 2021. Co-infection between the severe acute respiratory syndrome coronavirus 2 and the influenza Type B in Isfahan, Iran. *Journal of research in medical sciences : the official journal of Isfahan University of Medical Sciences*, 26, 51-51.
- IPPOLITO, G., LA VECCHIA, A., UMBRELLO, G., DI PIETRO, G., BONO, P., SCALIA, S., PINZANI, R., TAGLIABUE, C., BOSIS, S., AGOSTONI, C. & MARCHISIO, P. G. 2021. Disappearance of Seasonal Respiratory Viruses in Children Under Two Years Old During COVID-19 Pandemic: A Monocentric Retrospective Study in Milan, Italy. *Frontiers in Pediatrics*, 9.
- OLSEN, S. J., WINN, A. K., BUDD, A. P., PRILL, M. M., STEEL, J., MIDGLEY, C. M., KNISS, K., BURNS, E., ROWE, T. & FOUST, A. 2021. Changes in Influenza and Other Respiratory Virus Activity During the COVID-19 Pandemic—United States, 2020–2021. *Morbidity and Mortality Weekly Report*, 70, 1013.
- PAGE, M. J., MCKENZIE, J. E., BOSSUYT, P. M., BOUTRON, I., HOFFMANN, T. C., MULROW, C. D., SHAMSEER, L., TETZLAFF, J. M., AKL, E. A. & BRENNAN, S. E. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Bmj*, 372.
- RODGERS, L., SHEPPARD, M., SMITH, A., DIETZ, S., JAYANTHI, P., YUAN, Y., BULL, L., WOTIZ, S., SCHWARZE, T., AZONDEKON, R., HARTNETT, K., ADJEMIAN, J., KIRKING, H. L. & KITE-POWELL, A. 2021. Changes in Seasonal Respiratory Illnesses in the United States During the Coronavirus Disease 2019 (COVID-19) Pandemic. *Clinical Infectious Diseases*, 73, S110-S117.
- VENKATRAM, S., ALAPATI, A., DILEEP, A. & DIAZ-FUENTES, G. 2021. Change in patterns of hospitalization for influenza during COVID-19 surges. *Influenza and other respiratory viruses*.
- YEOH, D. K., FOLEY, D. A., MINNEY-SMITH, C. A., MARTIN, A. C., MACE, A. O., SIKAZWE, C. T., LE, H., LEVY, A., BLYTH, C. C. & MOORE, H. C. 2021. Impact of coronavirus

disease 2019 public health measures on detections of influenza and respiratory syncytial virus in children during the 2020 Australian winter. *Clinical Infectious Diseases*, 72, 2199-2202.

## Appendices

### Appendix 1- Study protocol

#### Review title

A living review examining the impact of the COVID-19 pandemic on influenza and respiratory syncytial virus (RSV) activity in the human population

#### Rationale

Since its emergence in December 2019, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has heavily impacted influenza and respiratory syncytial virus (RSV) activity. Non-pharmaceutical interventions (NPIs) implemented to prevent SARS-CoV-2 transmission might have affected transmission dynamics of influenza and other respiratory viruses due to commonality in modes of transmission. Also, widespread lockdowns and restriction of movement may have increased virus–virus interactions. Moreover, there might have been a reduction in healthcare seeking behaviour for respiratory viruses among the general population. Furthermore, lifting restrictions might result in a surge of cases or alteration of seasonality.

#### Research Questions

How has the COVID-19 pandemic affected influenza and RSV activity in the human population in terms of-

- a) The seasonality and circulating strains of the influenza virus and RSV
- b) The epidemiology of the influenza virus and RSV
- c) The surveillance activity of the influenza virus and RSV (disruptions, adaptations for end-to-end integrated influenza/RSV and COVID-19 surveillance, change in surveillance standards – type of specimens processed, sampling strategy, testing algorithms, data reporting, lessons from sentinel surveillance for SARS-CoV-2)
- d) Effect of COVID-19 related public health measures on influenza and RSV activity
- e) The health systems (reallocation of health resources- poor availability of flu vaccines due to prioritization of health resources for COVID)
- f) The impact of availability of COVID-19 vaccines on influenza and RSV activity

#### Methods

##### Eligibility criteria

##### Inclusion

- **Population-** Individuals of all age groups
- **Exposure -** RSV or Influenza in the context of the COVID-19 pandemic
- **Diagnosis-** RSV or influenza infections diagnosed with standard, valid laboratory based, or laboratory confirmed tests (for example, reverse transcriptase-polymerase chain reaction (RT-PCR), antigen testing, viral culture, serology, immunofluorescence assays, influenza nucleic acid amplification etc.) or ICD-9 or ICD-10 codes
- **Comparator-** Studies comparing different time points (pre-pandemic vs post pandemic) or studies comparing different health systems or epidemiological features by regions /countries.

- **Outcome-** Reporting data on at least one of our research questions
- No geographical restrictions
- **Language-** Studies published in English language
- **Publication type**
  - Academic literature published in peer-reviewed journals
  - Pre-prints
- **Study design**
  - Observational studies
  - Modelling studies
  - Publication date: 1<sup>st</sup> December 2019 onwards

### **Exclusions**

- Studies that focus on clinical features or immunology
- Interventional studies such as drug or vaccine trials
- Environmental studies (transmission dynamics in different environments)
- Studies not reporting data for the pandemic period and only reporting data for the period before 31<sup>st</sup> December 2019 (pre-COVID-19 pandemic)
- Studies published in languages other than English

### **Search strategy**

Database searches will be conducted in the WHO COVID-19 database to identify studies investigating influenza or RSV related activity during the COVID-19 pandemic period to-date.

Searches will be conducted weekly using a pre-designed search strategy for weekly updates.

Search terms- We will include two main strings comprising influenza and RSV, and COVID related terms.

(Influenza OR RSV) AND COVID

We will not apply any language restrictions for searches. However, considering time constraints, translations may not be possible for every non-English paper.

### **Study selection and data extraction**

This study will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 checklist. Studies retrieved from searches will be imported into Covidence after deduplication in Endnote. Studies retrieved will be screened for eligibility using pre-defined inclusion/ exclusion criteria independently by pairs of reviewers for both title and abstract screening as well as full-text screening. Any disagreement will be resolved by mutual discussion, however, if unresolved a third reviewer will assess the final decision. Information from included studies will be extracted into a pre-piloted excel extraction sheet and the following variables will be extracted: the name of the author, publication year, study site, setting, WHO region, aims and objectives, study design and methods, sample description/population, outcome measures, main finding, method of assessment of quality and quality score.



The risk of bias and quality of individual studies will be assessed using JBI critical appraisal tools appropriate for each type of study included in the review. Two reviewers will independently assess the risk of bias and quality of included studies.

### **Data synthesis**

We will synthesise the available data narratively. However, if comparable data emerge, we will consider undertaking a meta-analysis to report pooled estimates (for example, odds ratios or incidence rates).

## Appendix 2- Search strategy

The search covers the week 23/08/2021 - 29/08/2021 inc.

("respiratory virus" OR "respiratory viruses" OR "acute respiratory infection" OR "acute respiratory infections" OR "respiratory tract infection" OR "respiratory tract infections" OR "respiratory tract disease" OR "respiratory tract diseases" OR "respiratory distress syndrome" OR influenza OR influenza OR flu OR grippe OR ili OR rsv OR "Respiratory Syncytial Virus" OR "Respiratory Syncytial Viruses" OR alphainfluenzavirus) AND (entry\_date:20210823 OR entry\_date:20210824 OR entry\_date:20210825 OR entry\_date:20210826 OR entry\_date:20210827 OR entry\_date:20210828 OR entry\_date:20210829)