IMPLICATIONS FOR INFLUENZA CONTROL MEASURES IN COMMUNITY AND HEALTHCARE SETTINGS

Lessons learned and Impact on Outbreaks

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Icahn School of Medicine at Mount Sinai

DISCLOSURES

Nothing to disclose

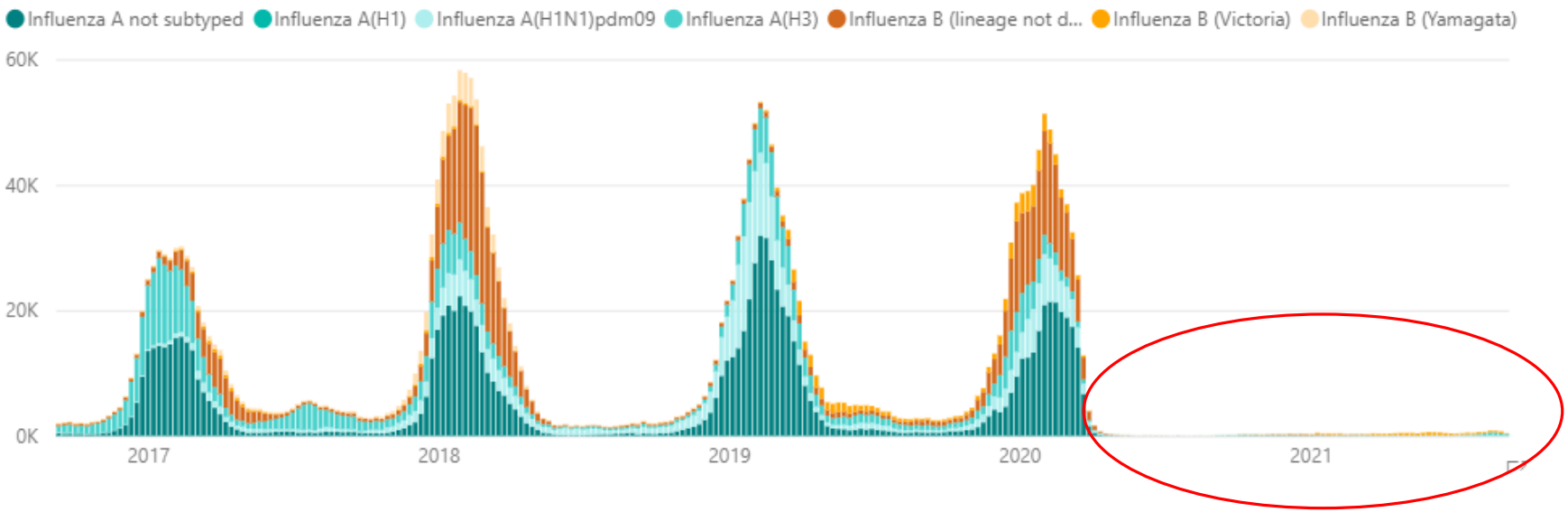
BACKGROUND

WHO select data

CDC select data

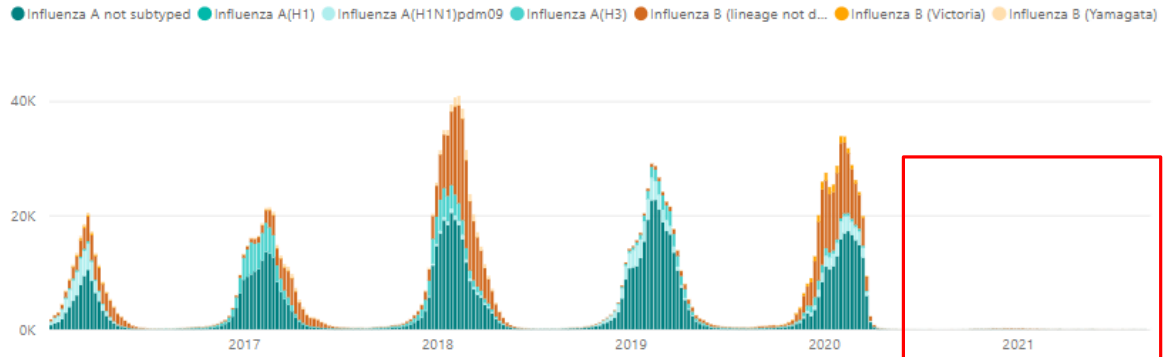
DISAPPEARING INFLUENZA

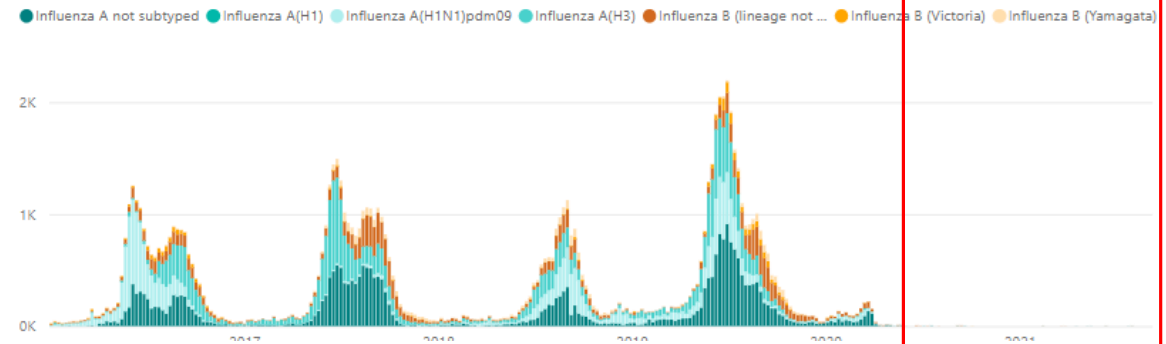
WHO DATA – ALL ZONE, COUNTRIES, AREA, TERRITORY COMPARISON OF NUMBER OF INFLUENZA DETECTIONS BY SUBTYPE



"Influenza Surveillance Outputs." World Health Organization. World Health Organization. Accessed September 7, 2021. https://www.who.int/teams/global-influenza-programme/surveillance-and-monitoring/influenza-surveillance-outputs.

WHO SELECT DATA





selected countries

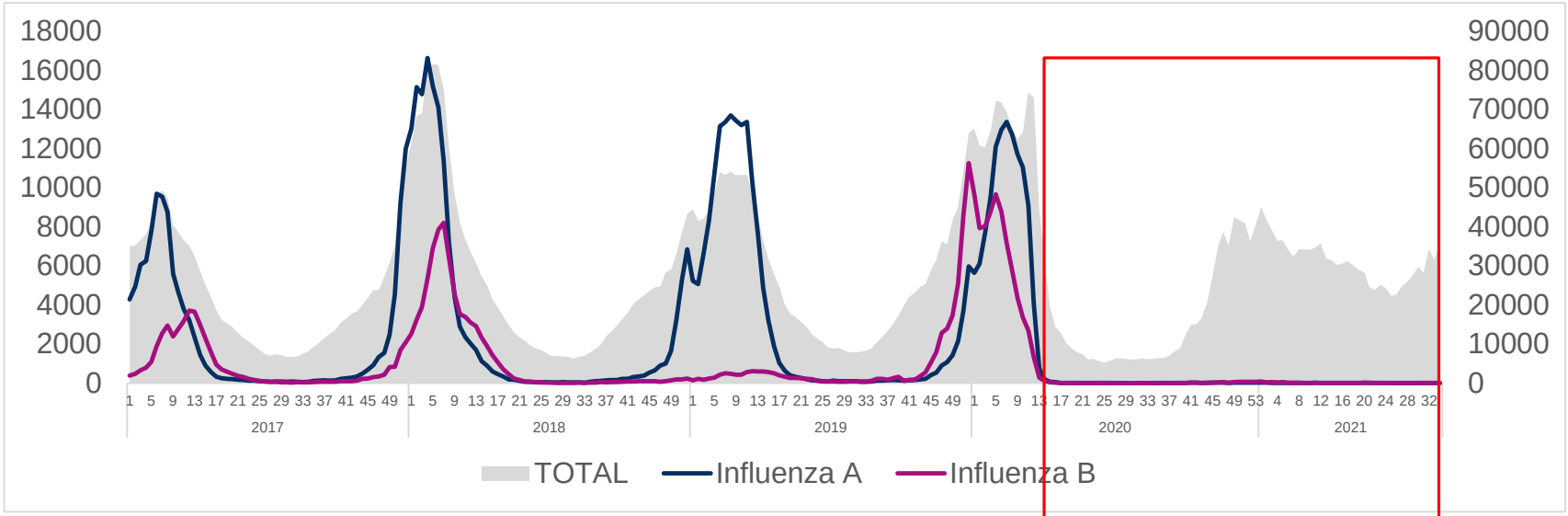
Canada, Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, United Kingdom of Great Britain and Northern Ireland, United States of America, Bermuda, Saint Pierre and Miquelon, United Kingdom, Wales, United Kingdom, Northern Ireland, United Kingdom, Scotland, Faroe Islands, Greenland, United Kingdom, England

selected countries

Argentina, Australia, Chile, Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Paraguay, Samoa, Solomon Islands, Tonga, Tuvalu, Uruguay, Vanuatu, Falkland Islands, Guam, French Polynesia, New Caledonia, American Samoa, Tokelau, Northern Mariana Islands, Pitcairn Islands, Wallis and Futuna Is, Norfolk Island

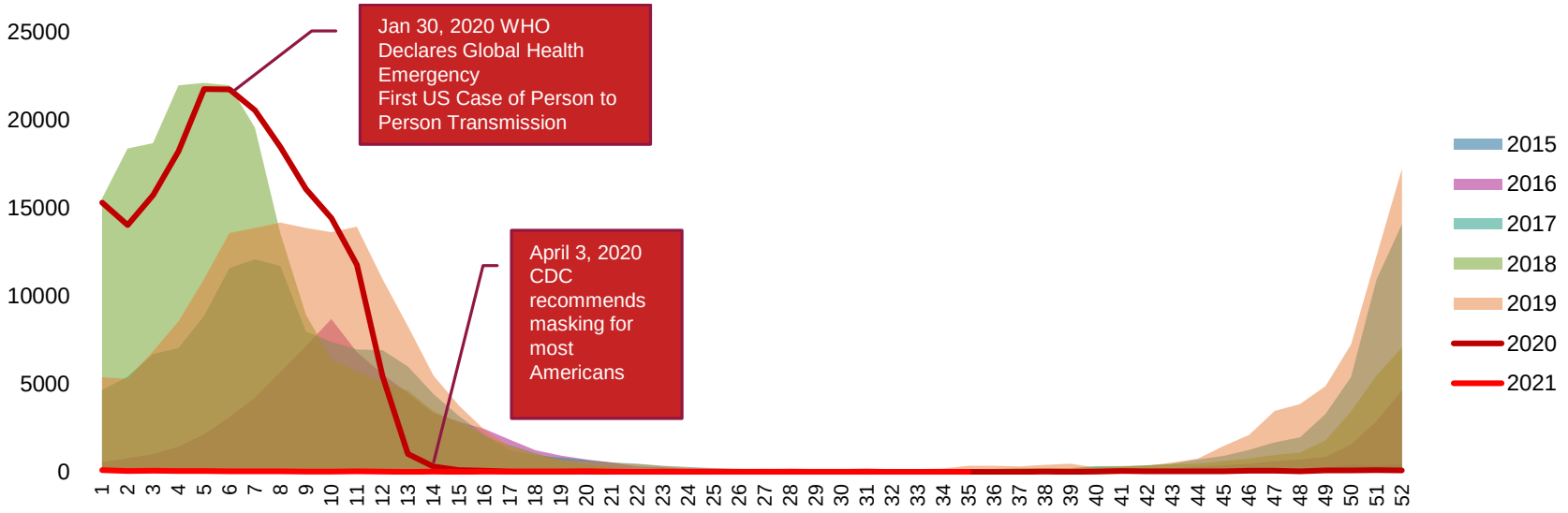
"Influenza Surveillance Outputs." World Health Organization. World Health Organization. Accessed September 7, 2021. https://www.who.int/teams/global-influenza-programme/surveillance-and-monitoring/influenza-surveillance-outputs.

CDC SELECT DATA (CLINICAL LABS)



"National, Regional, and State Level Outpatient Illness and Viral Surveillance." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention. Accessed September 7, 2021. https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html.

CDC SELECT DATA (CLINICAL LABS)

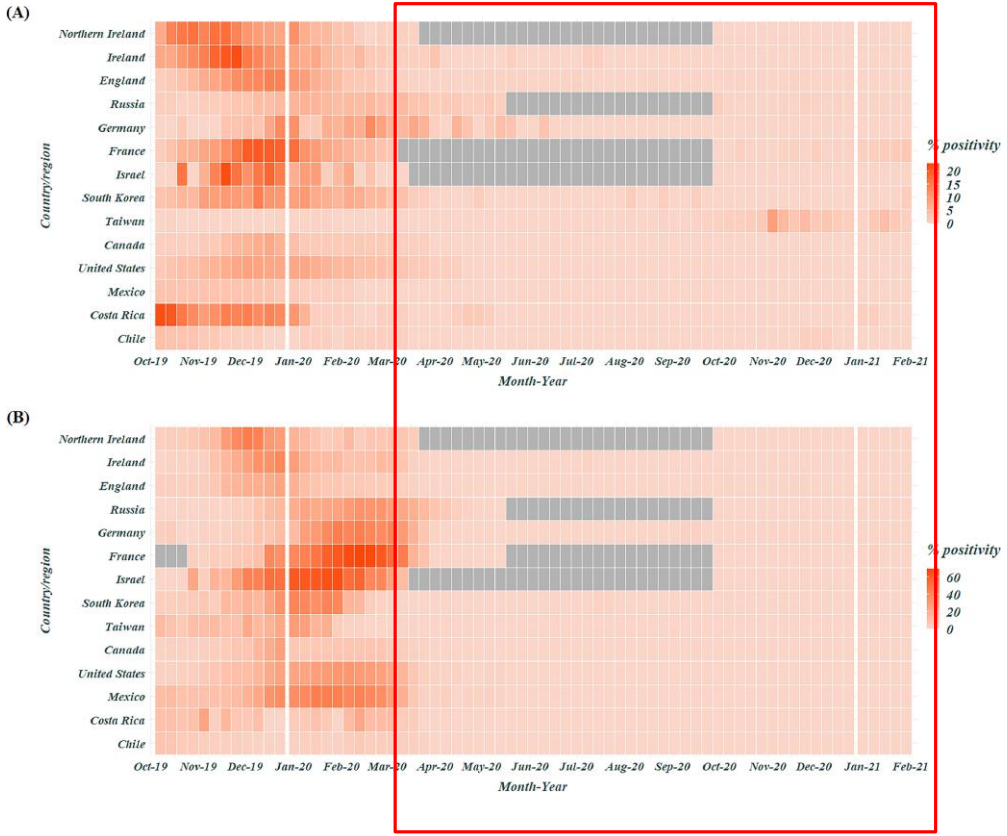


"National, Regional, and State Level Outpatient Illness and Viral Surveillance." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention. Accessed September 7, 2021. https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html.

LITERATURE REVIEW

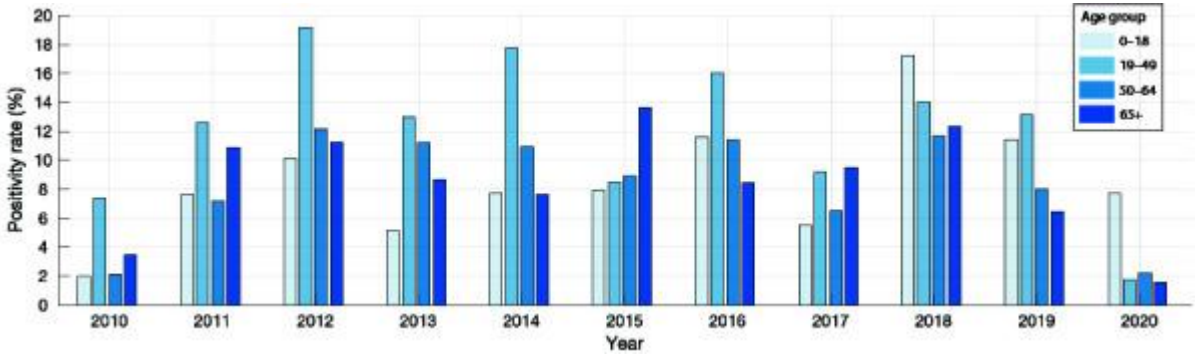
International

National

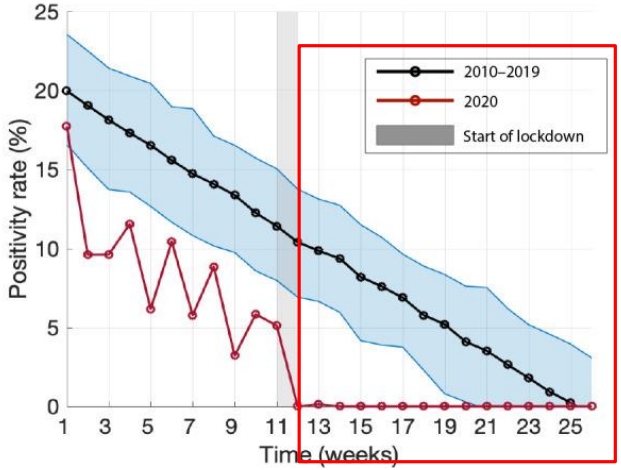


Heatmap of positive rates of
(A) Respiratory syncytial virus and
(B) Influenza virus in the national sentinel surveillance of 14 countries/regions

Respiratory syncytial virus and influenza epidemics disappearance in Korea during the 2020–2021 season of COVID-19
Jong-Hun Kim, MD, Yun Ho Roh, Jong Gyun Ahn, Min Young Kim, RN, Kyungmin Huh, MD, Jaehun Jung, MD, Ji-Man Kang, MD
International Journal of Infectious Diseases
Volume 110 Pages 29-35 (September 2021)
DOI: 10.1016/j.ijid.2021.07.005



Positivity rates of influenza A and B in 2010–2020 for different age groups in Hamilton, Ontario

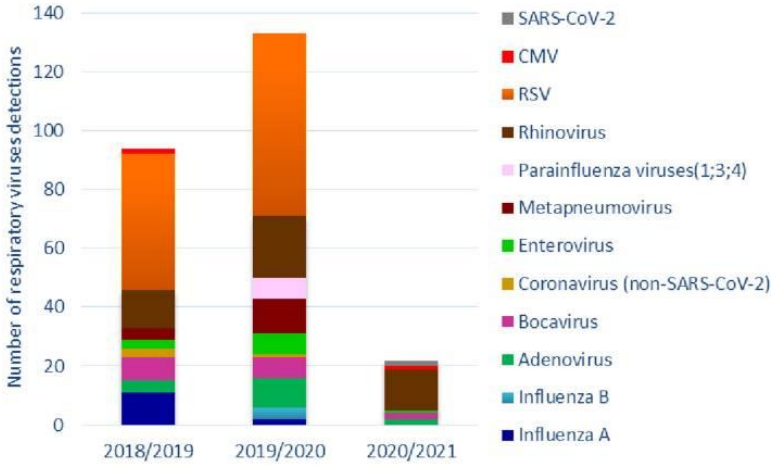


Bayesian inference for the mean positivity rate and its 95% credible interval of influenza A and B for the first 26 weeks in 2010–2019

Note: The red curve shows the positivity rate of influenza A and B for 2020, with the shaded grey bar indicating the start of COVID-19 lockdown

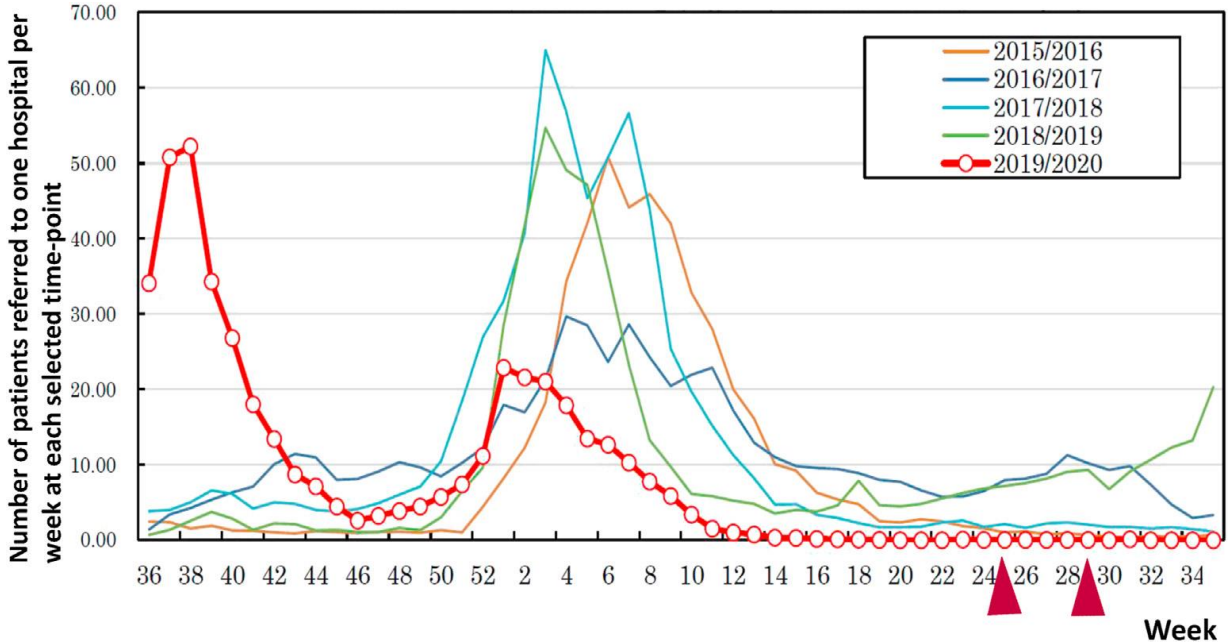
Zhang K, Misra A, Kim PJ, Moghadas SM, Langley JM, Smieja M. Rapid disappearance of influenza following the implementation of COVID-19 mitigation measures in Hamilton, Ontario. Can Commun Dis Rep. 2021 May 7;47(4):202-209. doi: 10.14745/ccdr.v47i04a04. PMID: 34035666; PMCID: PMC8127684.

DISAPPEARANCE OF SEASONAL RESPIRATORY VIRUSES IN CHILDREN UNDER TWO YEARS OLD DURING COVID-19 PANDEMIC: A MONOCENTRIC RETROSPECTIVE STUDY IN MILAN, ITALY



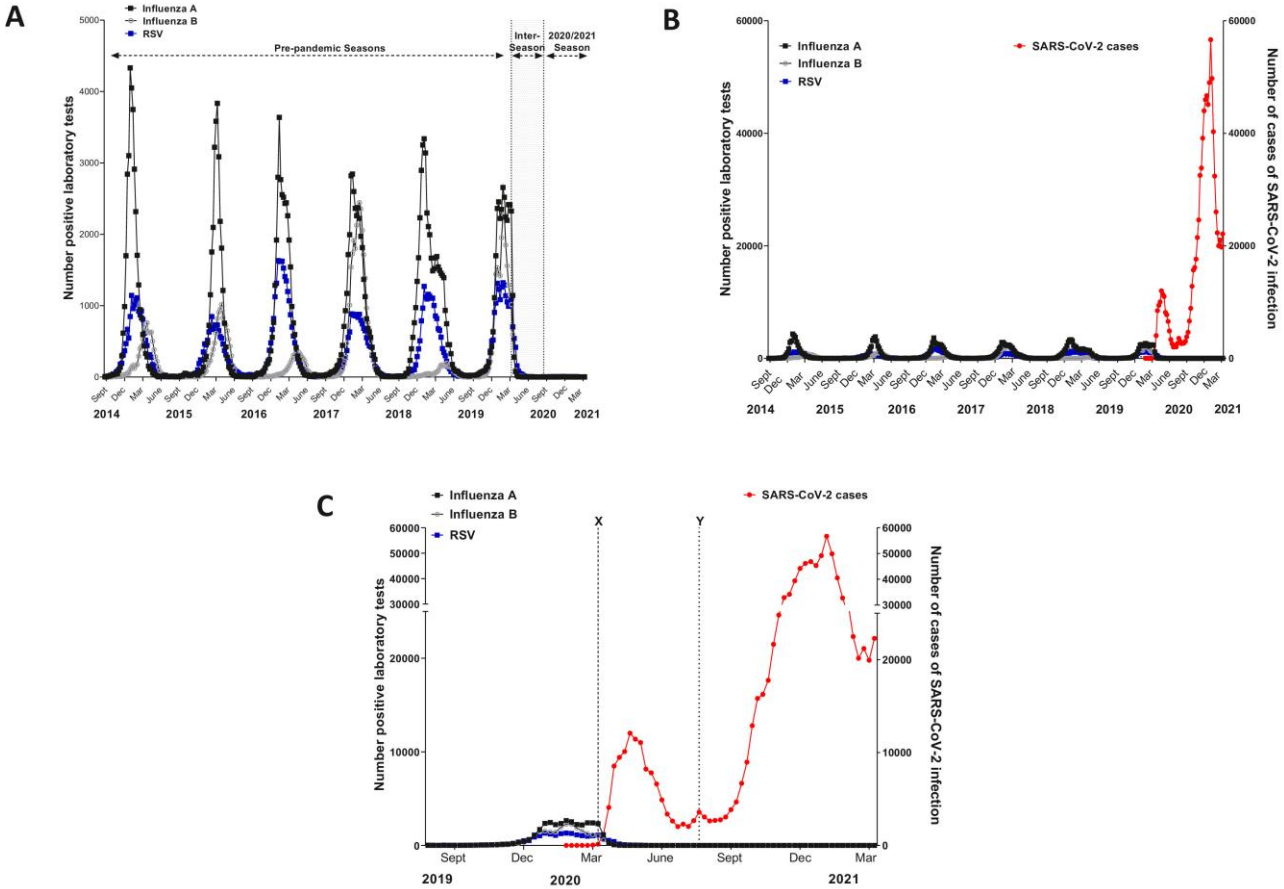
Cumulative respiratory viruses detections by year and viral species.

Ippolito G, La Vecchia A, Umbrello G, Di Pietro G, Bono P, Scalia S, Pinzani R, Tagliabue C, Bosis S, Agostoni C, Marchisio PG. Disappearance of Seasonal Respiratory Viruses in Children Under Two Years Old During COVID-19 Pandemic: A Monocentric Retrospective Study in Milan, Italy. Front Pediatr. 2021 Aug 5;9:721005. doi: 10.3389/fped.2021.721005. PMID: 34422733; PMCID: PMC8374241.



Plot of influenza patients from September 2019 to January 2020 in Okinawa, Japan. The horizontal bar represents the number of patients referred to one hospital per week per selected time points. Data from the 2015/16, 2016/17, 2017/18,2018/19, and 2019/20 summer seasons are shown. In September 2019, a peak is observed. After the SARS-CoV-2 pandemic, the summer influenza in the Okinawa prefecture disappeared

Sunagawa S, Iha Y, Kinjo T, Nakamura K, Fujita J. Disappearance of summer influenza in the Okinawa prefecture during the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. Respir Investig. 2021;59(1):149-152. doi:10.1016/j.resinv.2020.10.010

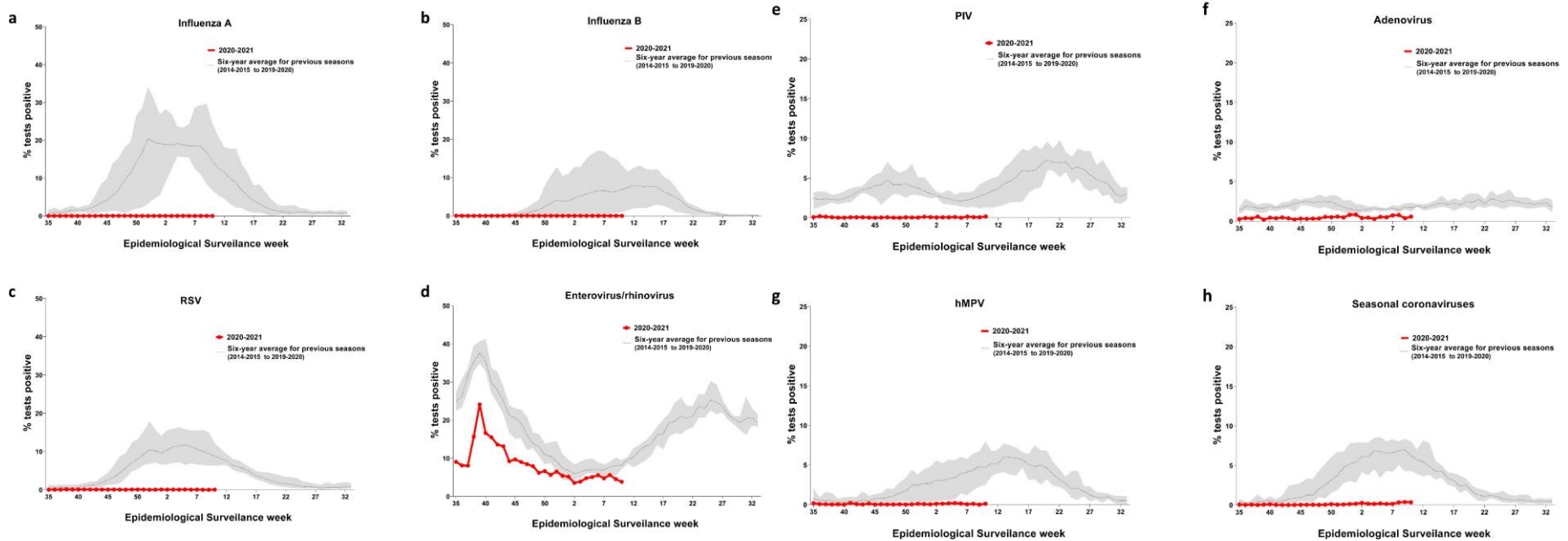


Seasonal variation in influenza and respiratory syncytial virus detection in pre-pandemic seasons and the 2020/2021 season

The impact of the COVID-19 pandemic on influenza, respiratory syncytial virus, and other seasonal respiratory virus circulation in Canada: A population-based study

Helen E. Groves, Pierre-Philippe Piché-Renaud, Adriana Peci, Daniel S. Farrar, Steven Buckrell, Christina Bancej, Claire Sevenhuysen, Aaron Campigotto, Jonathan B. Gubbay, Shaun K. Morris

The Lancet Regional Health – Americas Volume 1 (September 2021) DOI: 10.1016/j.lana.2021.100015



Temporal distribution of non-SARS-CoV-2 respiratory viruses by percentage test positivity in 2020/2021 season compared with pre-pandemic seasons. Data plotted by epidemiological surveillance week. For 2020/2021 season data plotted from week 35 (week ending 29th August 2020) to week 6 (week ending 13th February 2021) 2020).

The impact of the COVID-19 pandemic on influenza, respiratory syncytial virus, and other seasonal respiratory virus circulation in Canada: A population-based study

Helen E. Groves, Pierre-Philippe Piché-Renaud, Adriana Peci, Daniel S. Farrar, Steven Buckrell, Christina Bancej, Claire Sevenhuysen, Aaron Campigotto, Jonathan B. Gubbay, Shaun K. Morris

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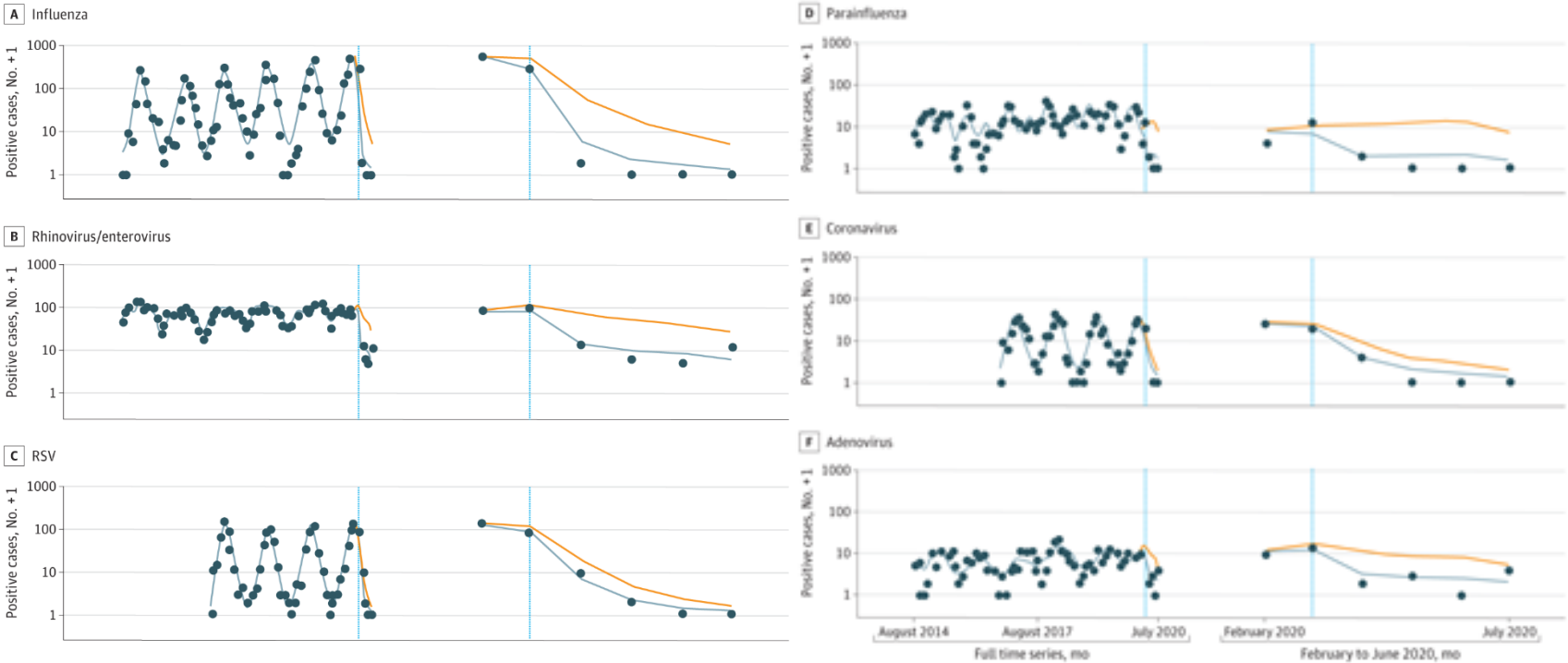
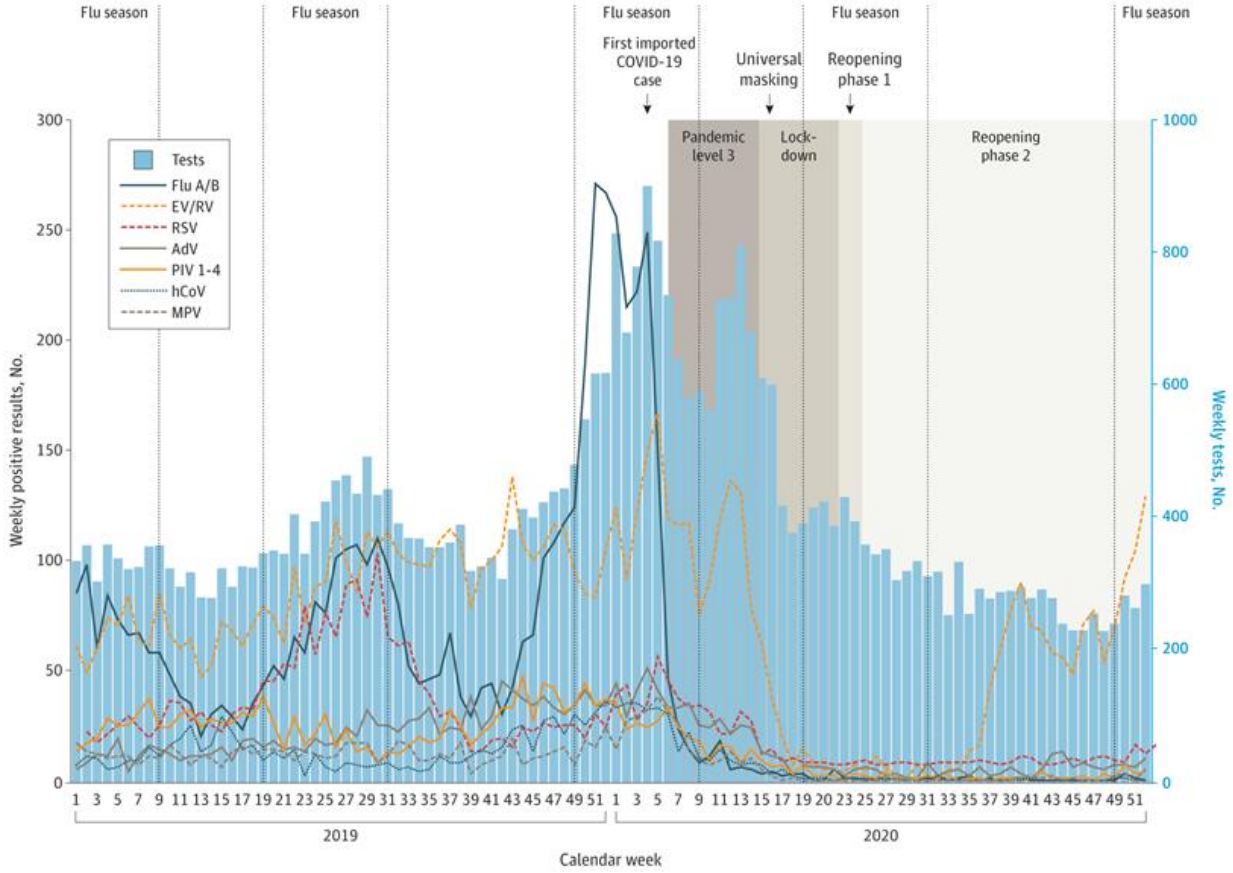


The observed number of positive test results (blue dots), the fitted number of positive results to the seasonally adjusted model (solid blue line), and the fitted number of positive results for the counterfactual absence of a shelter-in-place order (orange line). Respiratory syncytial virus (RSV) and adenovirus data were not available for 2014 to 2016.

From: **Evaluation of Seasonal Respiratory Virus Activity Before and After the Statewide COVID-19 Shelter-in-Place Order in Northern California**
JAMA Netw Open. 2021;4(1):e2035281. doi:10.1001/jamanetworkopen.2020.35281



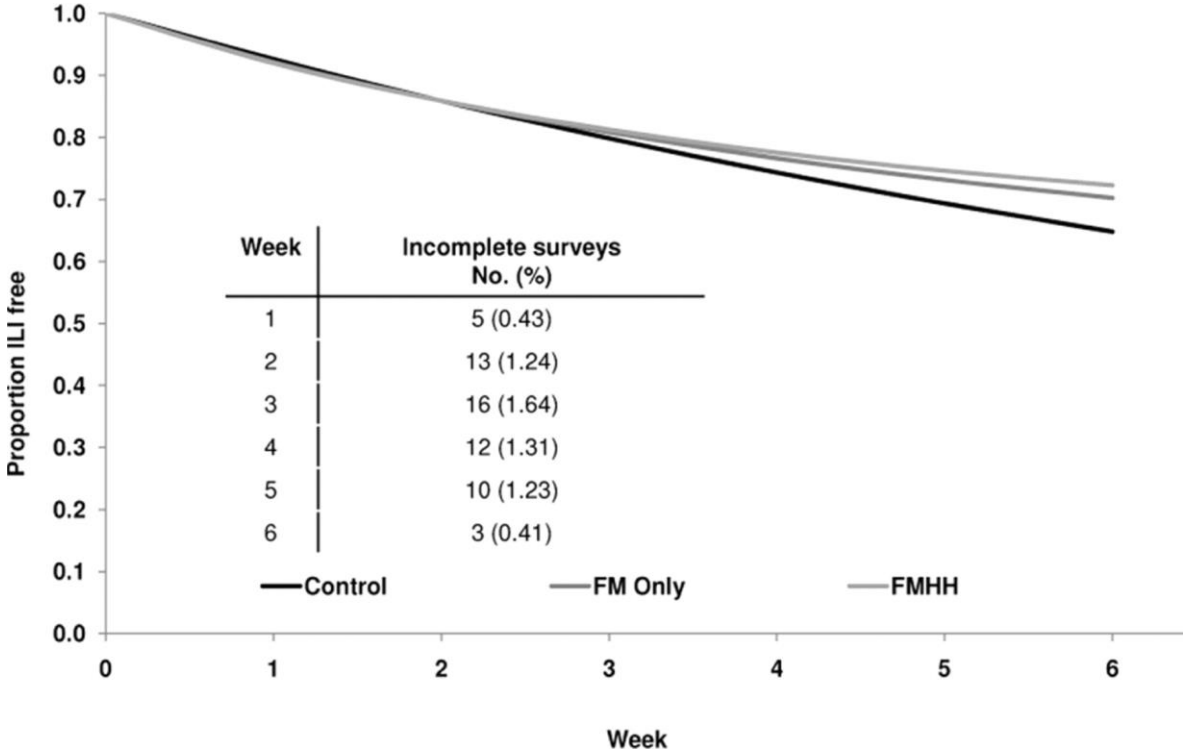
Numbers of Respiratory Virus Tests and Positive Tests for Different Viruses in 2019 and 2020
Blue bars indicate weekly numbers of multiplex tests performed, and colored lines indicate positive tests for different viruses per calendar week in 2019 and 2020.

Wan WY, Thoon KC, Loo LH, et al. Trends in Respiratory Virus Infections During the COVID-19 Pandemic in Singapore, 2020. JAMA Network Open. 2021 Jun;4(6):e2115973. DOI: 10.1001/jamanetworkopen.2021.15973. PMID: 34181015; PMCID: PMC8239970.

Weekly rates with 95% confidence intervals of diagnosis of common pediatric infectious diseases in 2019 and 2020. Rates are expressed as diagnoses per 100 000 patients per day. The shaded area represents period of SD implementation in 2020.
A, AOM.
B, Bronchiolitis.
C, Common cold.
D, Croup.
E, Gastroenteritis.
F, Influenza.
G, Nonstreptococcal pharyngitis.
H, Pneumonia.
I, Sinusitis.
J, SSTI.
K, Streptococcal pharyngitis.
L, UTI.

Social Distancing for COVID-19 and Diagnoses of Other Infectious Diseases in Children Jonathan Hatoun, Emily Trudell Correa, Sara Mary Alice Donahue, Louis Vernacchio Pediatrics Oct 2020, 146 (4) e2020006460; DOI: 10.1542/peds.2020-006460

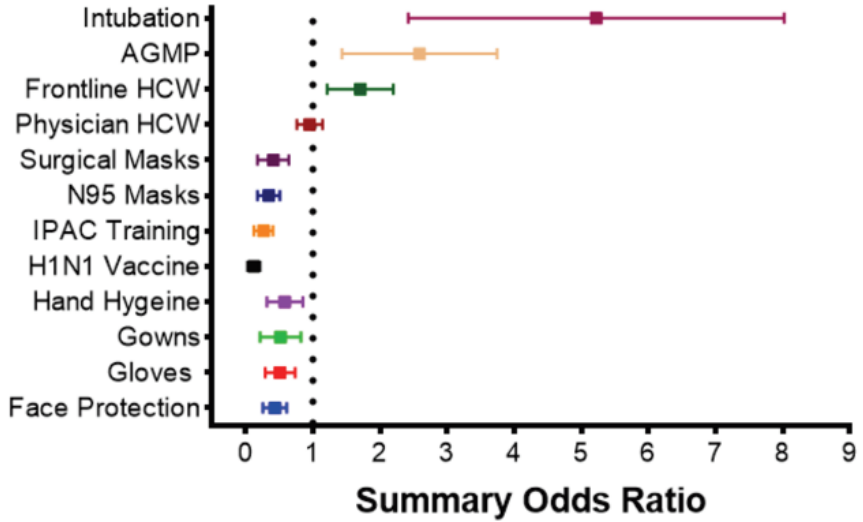
ADJUSTED KAPLAN-MEIER SURVIVAL CURVE.



The figure shows the proportion of participants that are ILI-free by intervention arm over the 6-week study period adjusted for age, sex, race/ethnicity, handwashing practices, sleep quality, stress, alcohol consumption, and influenza vaccination

J Infect Dis, Volume 201, Issue 4, 15 February 2010, Pages 491–498, https://doi.org/10.1086/650396

FOREST PLOT OF ALL THE SUMMARY ODDS RATIOS FOR META-ANALYSED RISK FACTORS

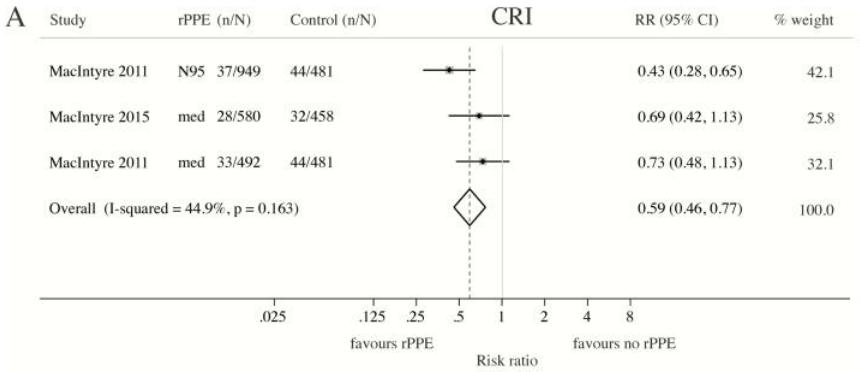


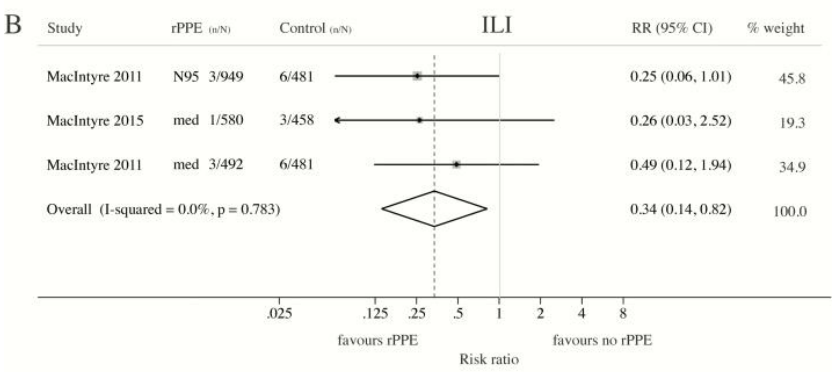
Represents the overall odds ratios for meta-analysed risk factors on healthcare worker infection during all included viral respiratory pandemics. Comparator groups:

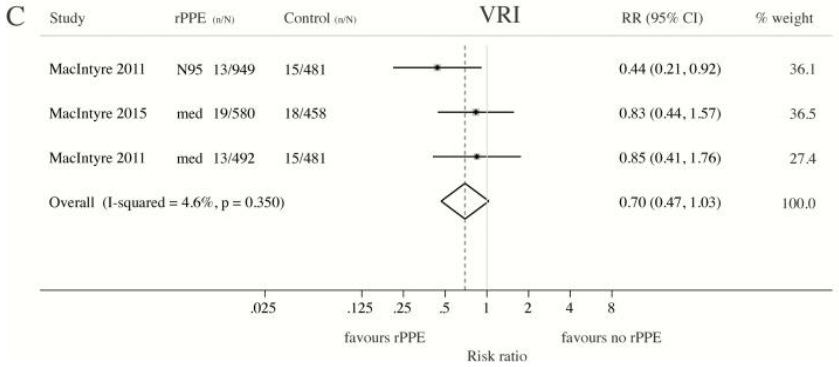
- Intubation vs no intubation
- AGMP vs no AGMP
- Frontline HCW vs non-frontline HCW
- Physician vs nurse
- Surgical mask vs no surgical mask
- N95 mask vs no N95 mask;
- IPAC training vs no IPAC training
- Hand hygiene vs no hand hygiene
- Gowns vs no gowns
- Gloves vs no gloves
- Face protection vs no face protection.

Tian, C., Lovrics, O., Vaisman, A., Chin, K., Tomlinson, G., Lee, Y., . . . Singh, M. (2021). Risk factors and protective measures for healthcare worker infection during highly infectious viral respiratory epidemics: A systematic review and meta-analysis. Infection Control & Hospital Epidemiology, 1-102. doi:10.1017/ice.2021.18

META-ANALYSIS OF RCTS ASSESSING THE PROTECTIVE EFFECT OF MEDICAL MASKS AND N95 RESPIRATORS AGAINST CLINICAL AND LABORATORY-CONFIRMED RESPIRATORY OUTCOMES







(A) Clinical respiratory illness (CRI)
(B) Influenza-like illness (ILI)
(C) Laboratory-confirmed viral respiratory infection (VRI)

Clin Infect Dis, Volume 65, Issue 11, 1 December 2017, Pages 1934–1942, https://doi.org/10.1093/cid/cix681

SUMMARY

We have seen a decrease in influenza, since 2020 COVID outbreak

Several International and national studies confirm the decrease

This likely is in part due to social distancing, mask wearing and symptom checks

Increased testing possibly played a part in early detection and isolation

There are studies showing impact of mask wearing in decrease in influenza rates in community and health care settings

Other factors remain unknown, unproven

OUR EXPERIENCE

The Outbreak Management

Clinical Infectious Diseases

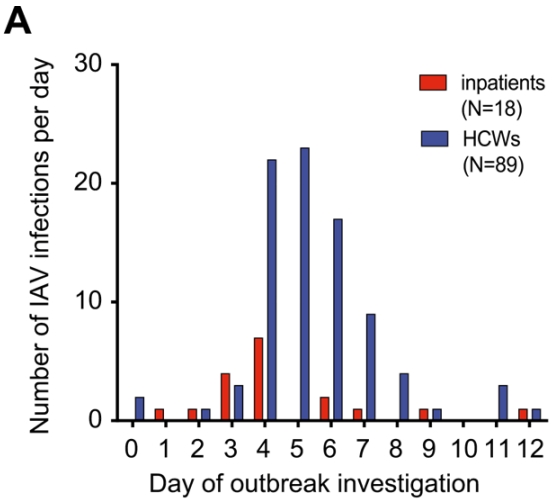
MAJOR ARTICLE

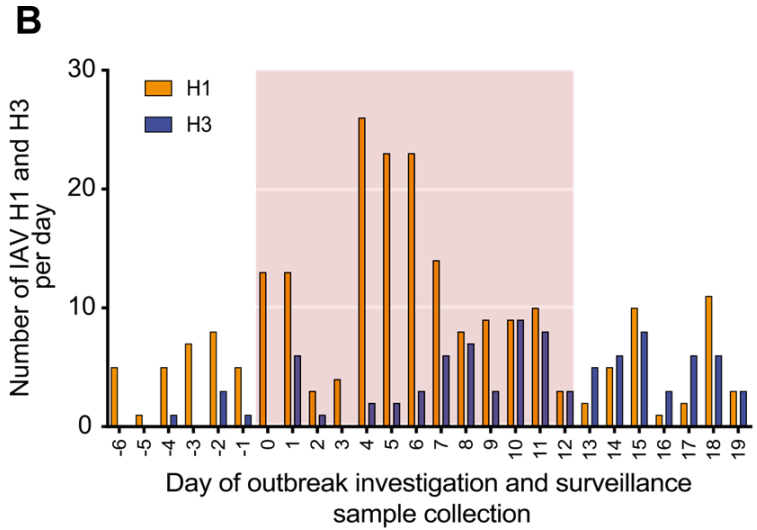
Real-Time Investigation of a Large Nosocomial Influenza A Outbreak Informed by Genomic Epidemiology

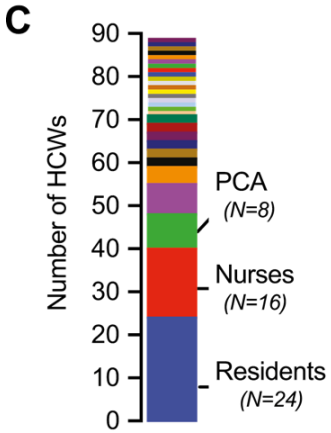
Waleed Javaid,[1,2,a] Jordan Ehni,[2,a] Ana S. Gonzalez-Reiche,[3,a] Juan Manuel Carreño,[4] Elena Hirsch,[4] Jessica Tan,[4,5] Zenab Khan,[3] Divya Kriti,[3] Thanh Ly,[6] Bethany Kranitzky,[7] Barbara Barnett,[7,8] Freddy Cera,[9] Lenny Prespa,[9] Marie Moss,[1] Randy A. Albrecht,[4,10] Ala Mustafa,[3] Ilka Herbison,[1] Matthew M. Hernandez,[4,5] Theodore R. Pak,[3] Hala A. Alshammary,[4] Robert Sebra,[3,11,12] Melissa L. Smith,[3,b] Florian Krammer,[4] Melissa R. Gitman,[6] Emilia Mia Sordillo,[6] Viviana Simon,[1,4,10] and Harm van Bakel[3,11]

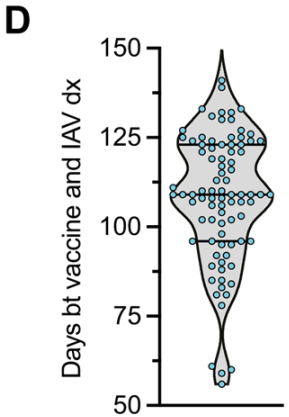
[1]Division of Infectious Diseases, Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [2]Department of Infection Prevention, Mount Sinai Beth Israel, New York, New York, USA, [3]Department of Genetics and Genomic Sciences, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [4]Department of Microbiology, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [5]The Graduate School of Biomedical Sciences, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [6]Clinical Microbiology Laboratory, Department of Pathology, Molecular, and Cell-Based Medicine, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [7]Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [8]Department of Emergency Medicine, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [9]Clinical Laboratory, Mount Sinai Beth Israel, New York, New York, USA, [10]The Global Health and Emerging Pathogens Institute, Icahn School of Medicine at Mount Sinai, New York, New York, USA, [11]Icahn Institute for Data Science and Genomic Technology, Icahn School of Medicine at Mount Sinai, New York, New York, USA, and [12]Black Family Stem Cell Institute, Icahn School of Medicine at Mount Sinai, New York, New York, USA

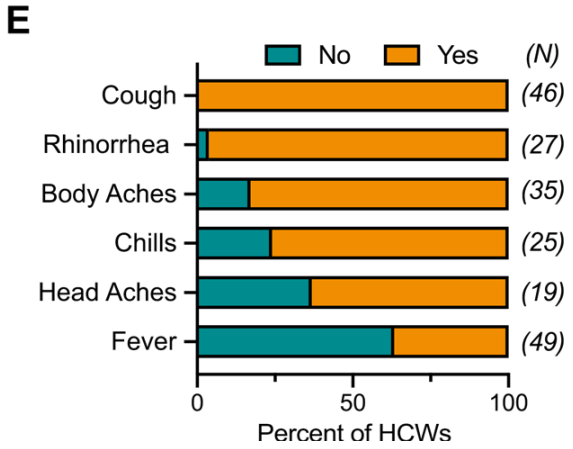
Waleed Javaid, Jordan Ehni, Ana S Gonzalez-Reiche, Juan Manuel Carreño, Elena Hirsch, Jessica Tan, Zenab Khan, Divya Kriti, Thanh Ly, Bethany Kranitzky, Barbara Barnett, Freddy Cera, Lenny Prespa, Marie Moss, Randy A Albrecht, Ala Mustafa, Ilka Herbison, Matthew M Hernandez, Theodore R Pak, Hala A Alshammary, Robert Sebra, Melissa L Smith, Florian Krammer, Melissa R Gitman, Emilia Mia Sordillo, Viviana Simon, Harm van Bakel, Real-Time Investigation of a Large Nosocomial Influenza A Outbreak Informed by Genomic Epidemiology, Clinical Infectious Diseases, 2020;, ciaa1781, https://doi-org.eresources.mssm.edu/10.1093/cid/ciaa1781



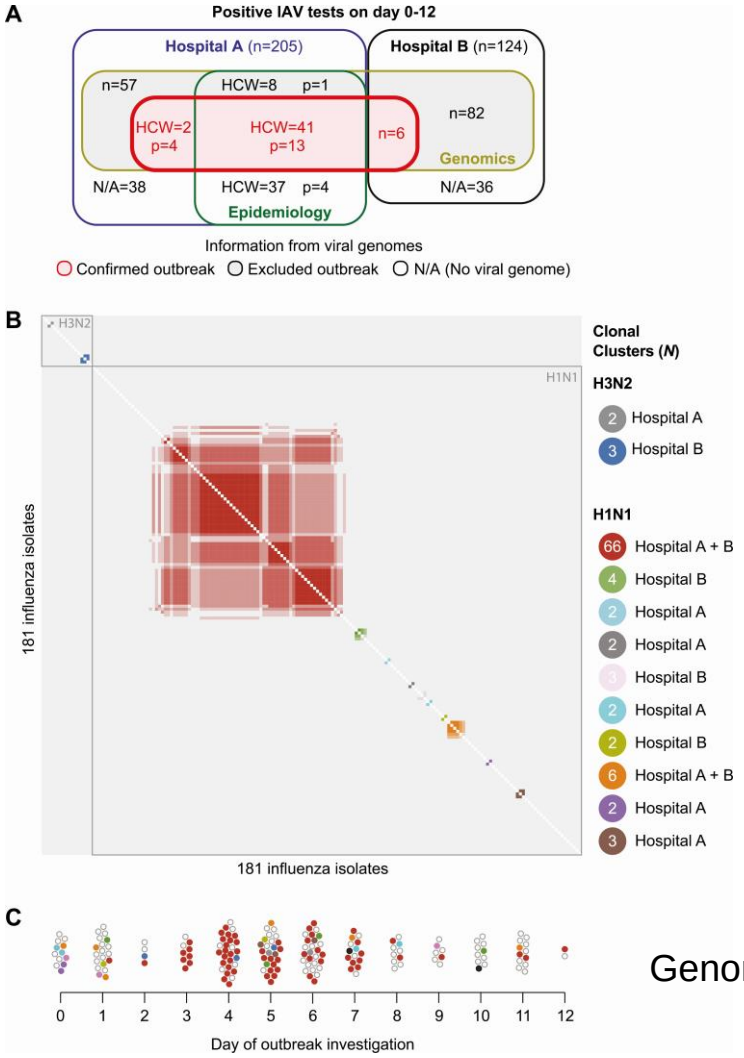








A. Timeline of the nosocomial IAV outbreak at a metropolitan hospital
B. Distribution of IAV subtypes detected in individuals identified in the outbreak investigation
C. The distribution of professions
D. The distribution of days between receiving seasonal influenza virus vaccination and testing positive for IAV among HCWs
E. Clinical signs and symptoms reported by HCWs who tested positive for IAV



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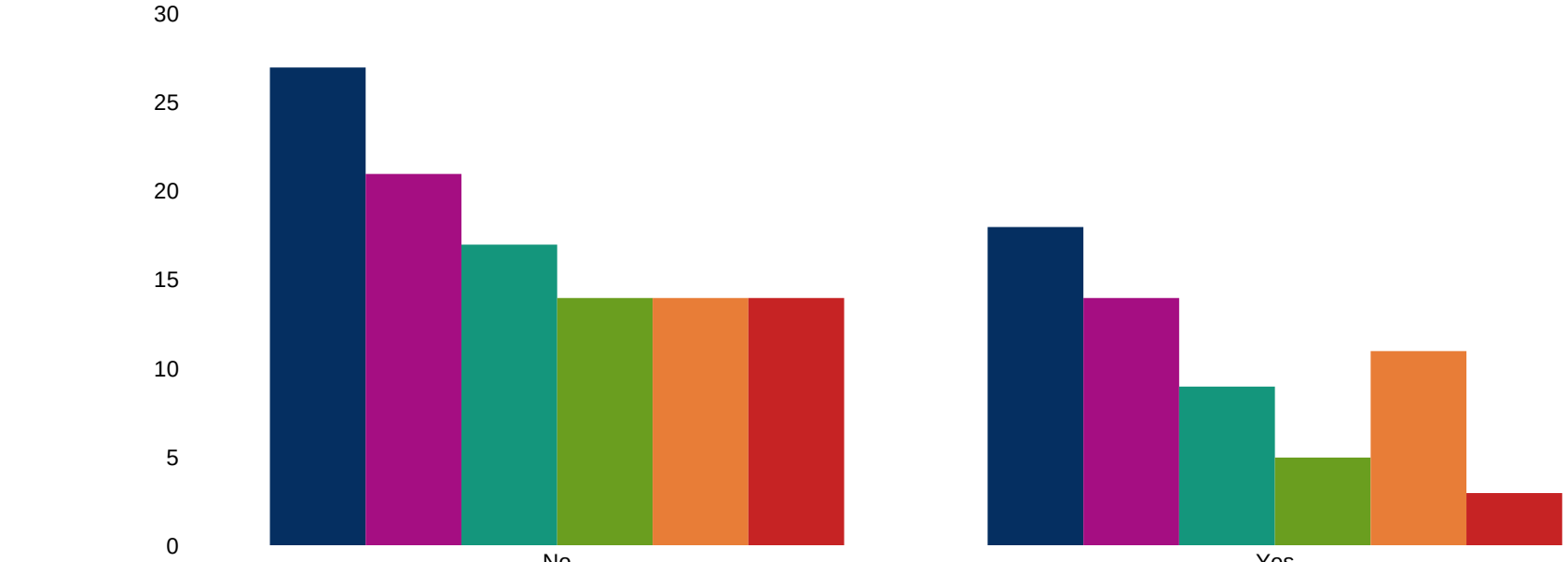
A) Venn diagram illustrating the number of sequenced outbreak-confirmed H1N1 strains (N = 66) and outbreak-excluded IAV, including unrelated H1N1 strains (N = 113) and H3N2 strains (N = 36), identified in Hospital A (investigation and surveillance) and Hospital B (surveillance). Epidemiology describes the cases identified by infection prevention.

B) Pairwise comparison of the complete viral genomes. Note the tight cluster of the outbreak H1N1 strains (N = 66, red cluster) at the center and the 2 small H3N2 clusters at the top left of the pairwise comparison.

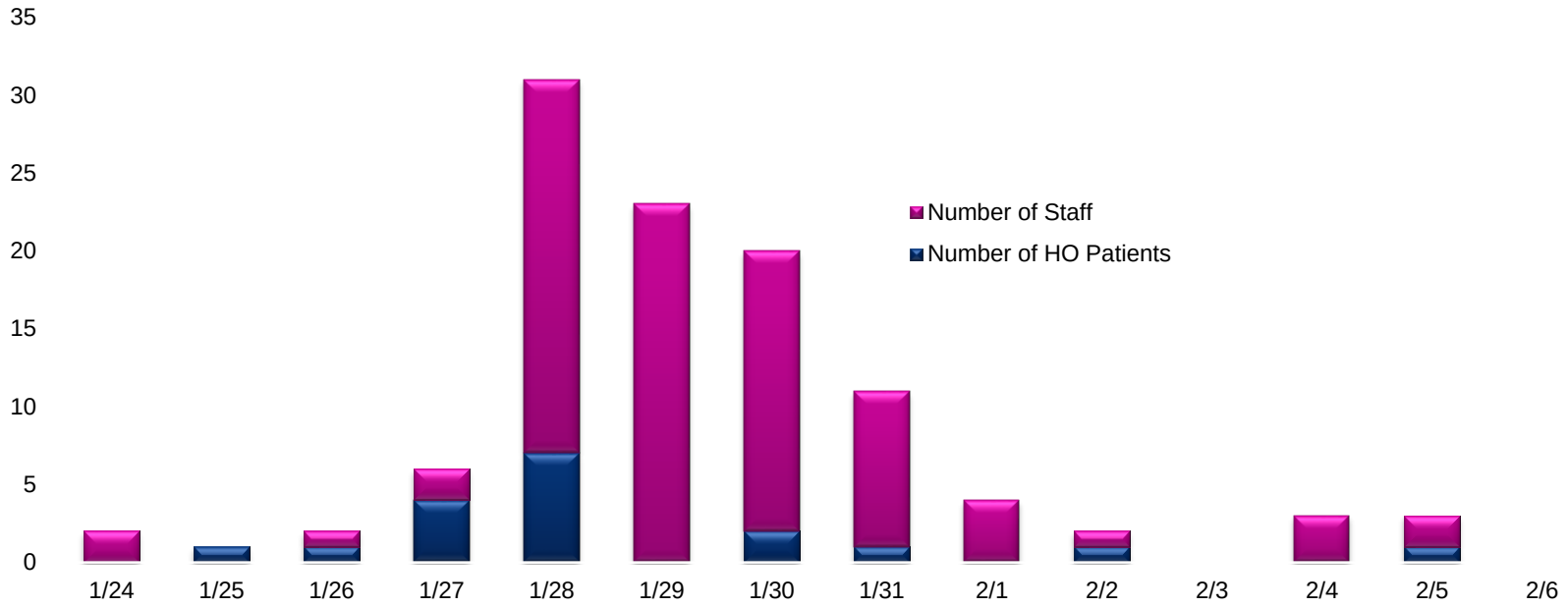
C) C, Dynamics of the case numbers and IAV strains during the investigation period. All color coding used in this panel are the same as those used in the panel B. The outbreak H1N1 strain (shown in red) was first detected on the day after the initiation of the investigation (day 1) in a hospitalized patient. The first 2 employees who tested positive for IAV on the day of the initiation of the investigation (day 0) harbored unrelated H1N1 strains. Abbreviations: HCW, healthcare worker; IAV, influenza A virus; N/A, no viral genome available; p, patient.

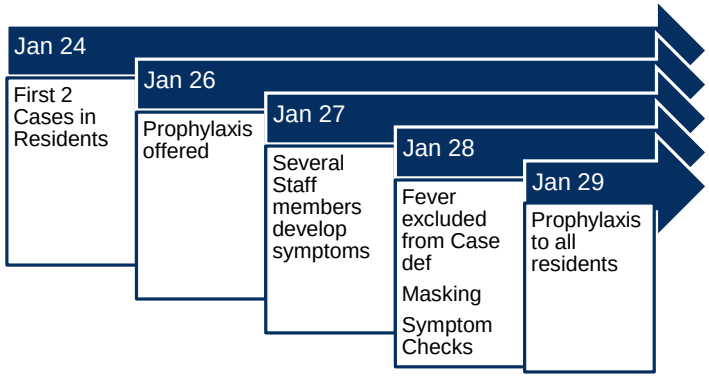
Genomics of the nosocomial outbreak

Fever?

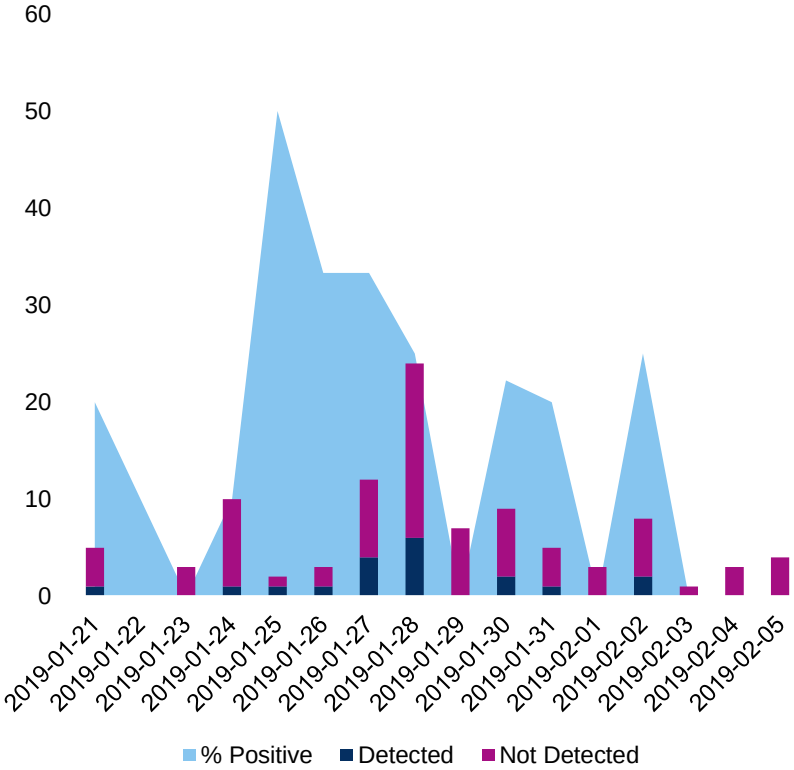


	No	Yes
Cough	27	18
Body Aches	21	14
Rhinorrhea	17	9
Headaches	14	5
Chills	14	11
Other Symptoms	14	3

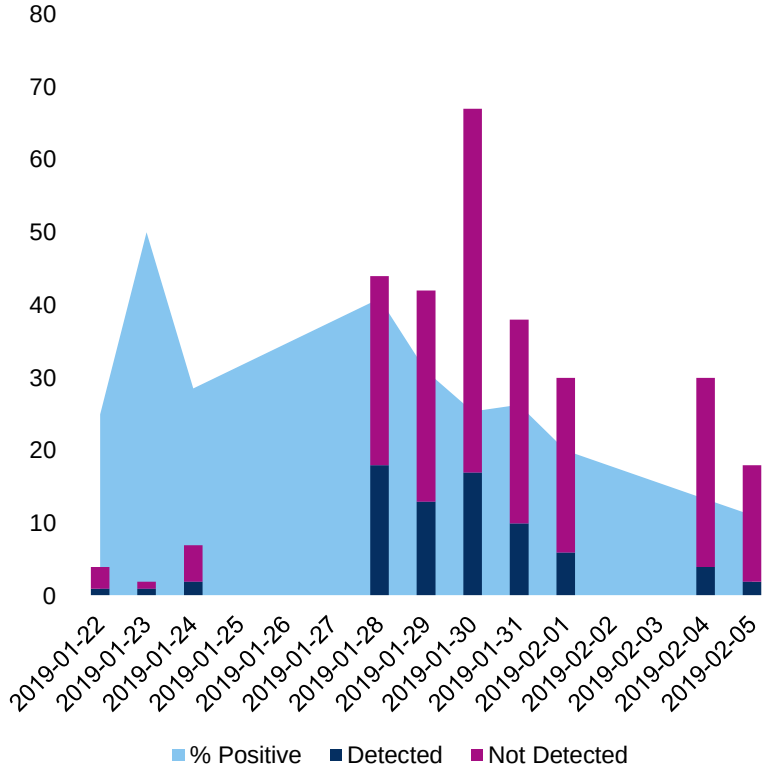

35
30
25
20
15
10
5
0
1/24
1/25
1/26
1/27
1/28
1/29
1/30
1/31
2/1
2/2
2/3
2/4
2/5
2/6
Number of Staff
Number of HO Patients


Jan 24
First 2 Cases in Residents
Jan 26
Prophylaxis offered
Jan 27
Several Staff members develop symptoms
Jan 28
Fever excluded from Case def
Masking
Symptom Checks
Jan 29
Prophylaxis to all residents

Patients



Staff



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SUMMARY

One year before COVID 19 pandemic, we experienced one of the largest outbreaks of influenza in our hospital

We were able to genetically link 41(out 89) HCW and 13 (out 18) patients with the outbreak strain

The outbreak was controlled within 72 hours of implementation of mandatory masking, symptom check, increased testing resulting in early detection and isolation

LESSONS LEARNED

WHAT WE KNOW NOW

Initial concerns of ‘twindemic’ were not realized

CDC and WHO data shows a significant decrease in incidence of influenza since March 2020 in both hemispheres

Studies from across the world indicate decrease in influenza and other respiratory viral infections

Studies in the past have shown masking and other measures help decrease influenza and other respiratory viral infections.

Our experience has shown that symptom checks, masking, and increased testing were instrumental in controlling institutional outbreak

WHAT WE DO NOT KNOW

When will influenza season return?

Would the next influenza outbreak be clinical more severe?

Is masking better then vaccination alone?

What is the value of symptom checks?

IMPACT ON OUTBREAKS

FOR THE NEXT INFLUENZA OUTBREAK.....

- Frequent Symptom Checks
- Modification of case definition based on clinical presentation
- Testing who are at risk of acquiring infection
- Surgical Masking, universal
- Clear and frequent communication
- Genomic sequencing as needed