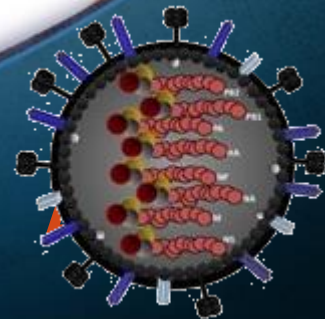


# Influenza & COVID

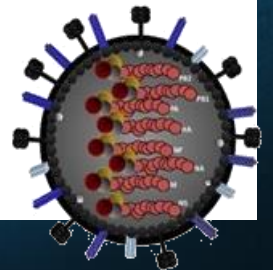
**Dr. Zeinab Siami**





# Influenza epidemic

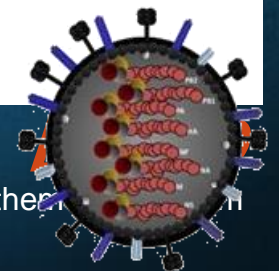
- The annual influenza epidemic substantially affects health care systems worldwide.
- ❖ The extent of the morbidity and mortality in any given year reflects the degree of **genetic drift or shift** in the dominant strain of the influenza virus and the **efficacy and coverage of vaccination**.



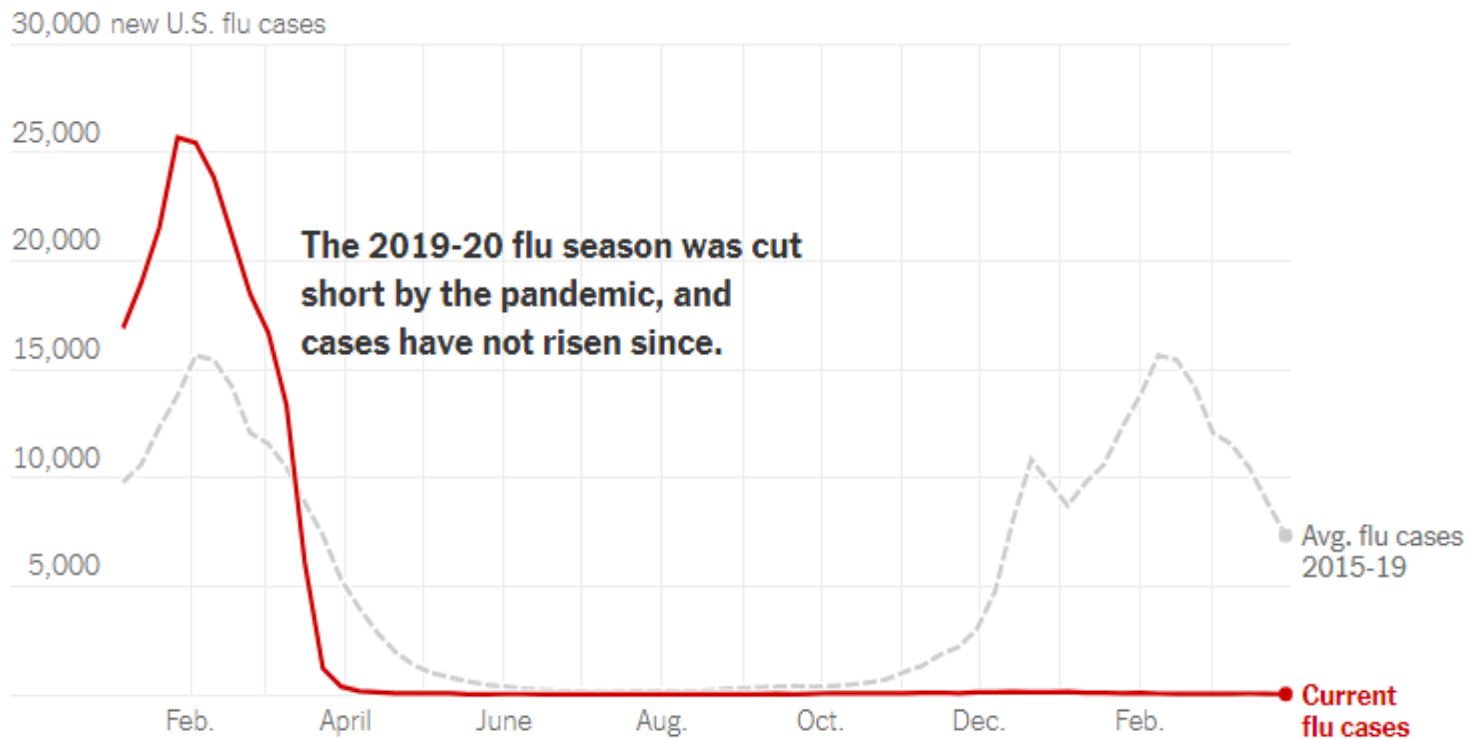


# A quiet year for the flu in 2020

- Although experts were concerned about a possible twindemic last year, **the 2020–2021 flu season was unusually quiet**, with the number of cases lower than expected.
- The CDC report that in the United States, **there were fewer confirmed cases of hospitalization** due to flu than in any other year since the collection of such data began in 2005.

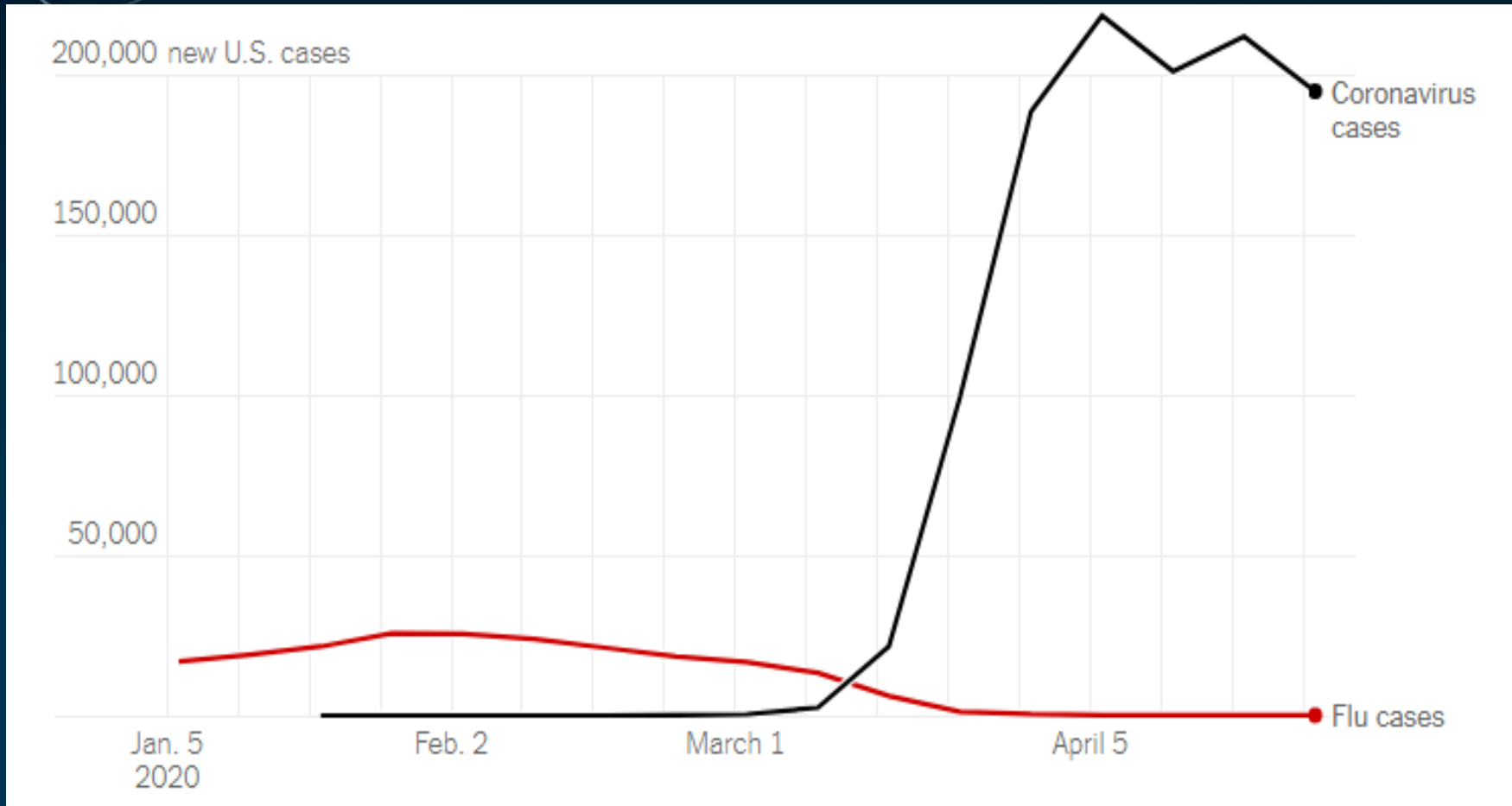


- There have been **fewer influenza cases** in the United States this flu season than in any on record. About 2,000 cases have been recorded since late September, according to data from the Centers for Disease Control and Prevention. In recent years, the average number of cases over the same period was about 206,000



Note: Figures reflect weekly totals of positive flu tests, from public and clinical laboratories. - Source: Centers for Disease Control and Prevention

# Influenza vs. coronavirus



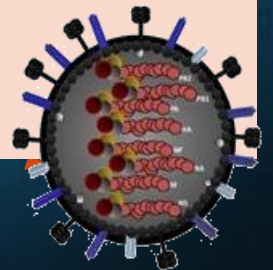
- ✓ Flu cases dropped even as the coronavirus spread.





# Effect of COVID-19 on influenza

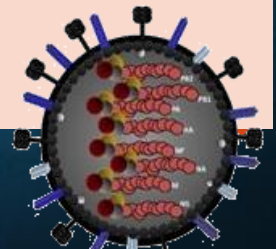
- The mere presence of the coronavirus may have played **a role in suppressing flu cases**, because there is often just one dominant respiratory virus in a population at a given time. “One tends to keep the other out,”
- And influenza was not the only virus that disappeared over the last year; there were also substantial drops in other respiratory illnesses, including the R.S.V., which is the most common cause of pneumonia in infants.





# What will happen when the flu returns?

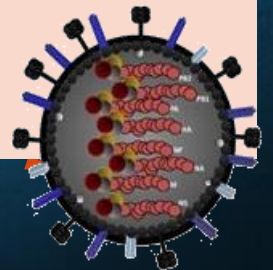
- If immunity to the flu declined during the pandemic because of the lack of exposure to the latest flu strains, **more people than usual may be susceptible to the virus.**
- Every year, anywhere between **20 to 30 percent** of the population gets its immunity sort of boosted and stimulated by being exposed to the flu virus, **We are not going to have that this year.**
- **Decreases in natural immunity are a concern**, and lower immunity could lead to more infections and more severe disease.



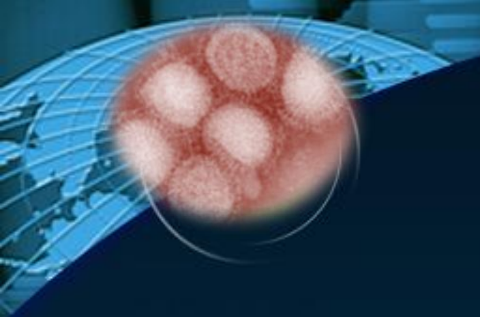


# Concerns about the concurrence of the two diseases

- Co-circulation of COVID-19 and influenza can worsen the impact on health systems that are already overwhelmed







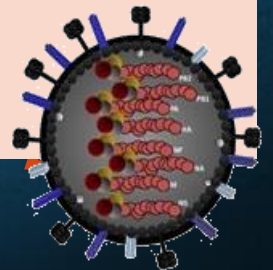
# How are COVID-19 and influenza viruses similar?

❖ **Similar respiratory symptoms** →

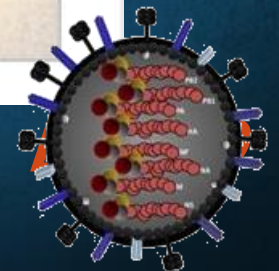
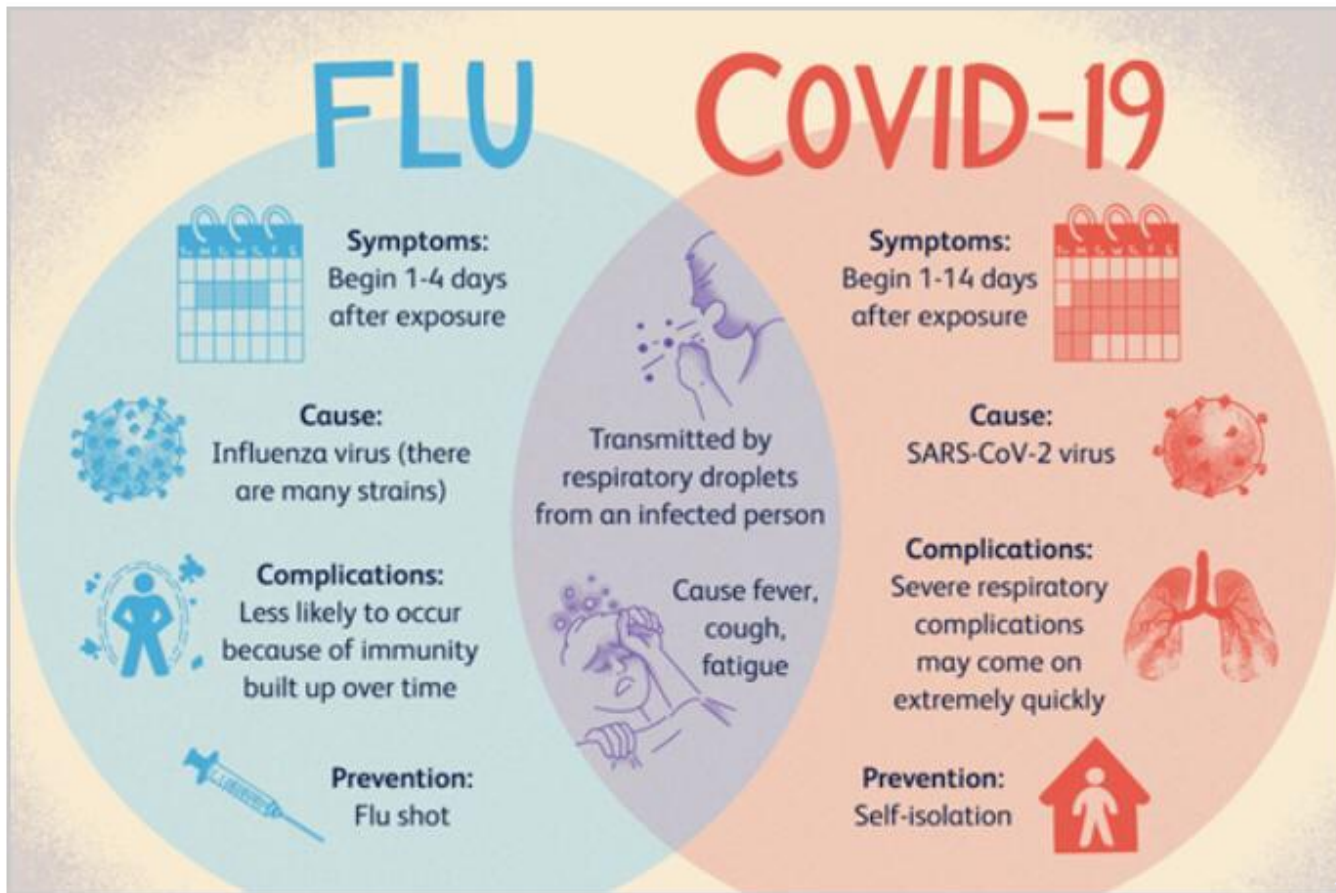
So it makes it difficult to differentiate between two diseases

❖ **Similar transmission routes** →

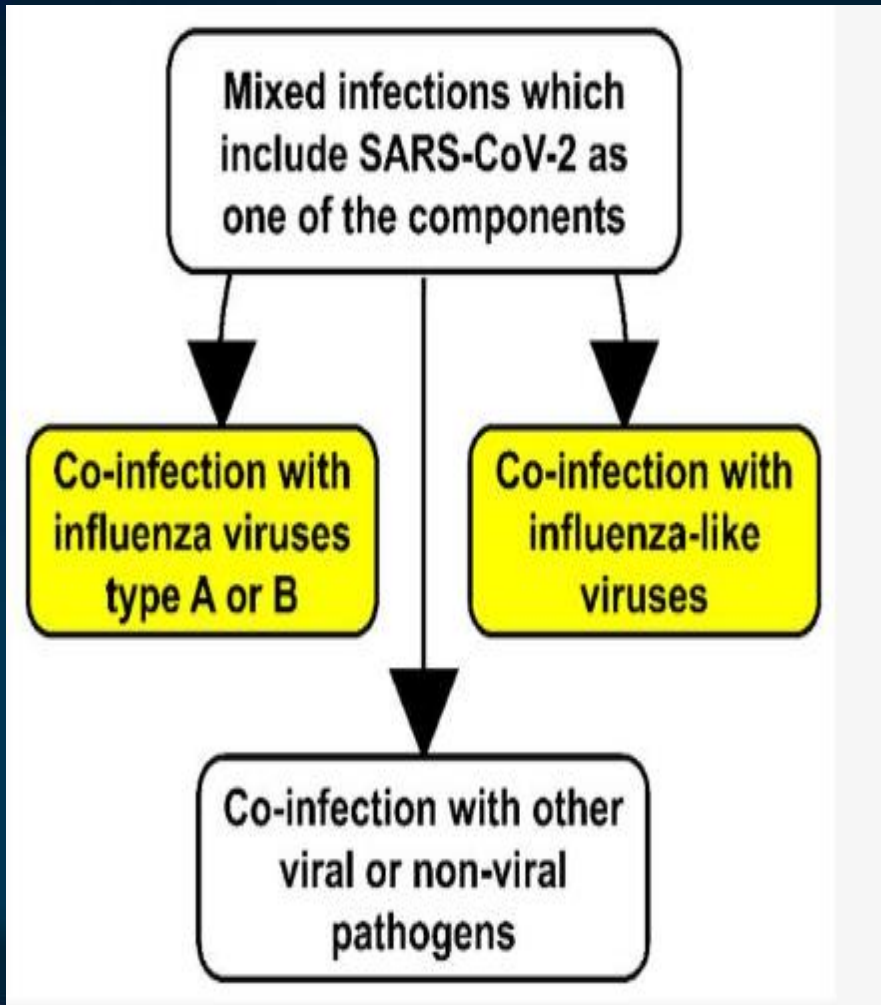
- So the same public health measures are important to prevent both infections.



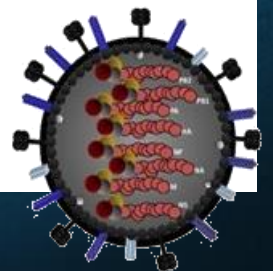
# Comparison Between Seasonal Flu and COVID-19



# Considering Co-infection



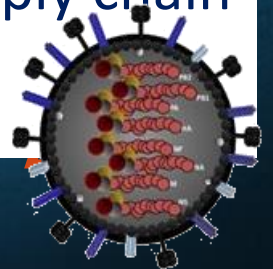
- ❖ Physicians in several countries have reported patients who **tested positive for both COVID-19 and seasonal influenza.**
- ❖ **Quicker and more widely available testing** is needed to distinguish between COVID-19 and influenza, which have similar symptoms, at least at first, but require different treatments.





# Co-infection

- ❖ Co-infection with influenza and SARS-CoV 2 has been observed, so a positive result for one virus does not exclude infection with the other.
- ❖ It is not yet clear whether initial testing should include both viruses or whether influenza testing can be added after SARS-CoV-2 results return.
- ❖ The preferred diagnostic algorithm will depend on which diagnostic tests are locally available with careful consideration of test characteristics, cost, turnaround time, and supply chain issues.

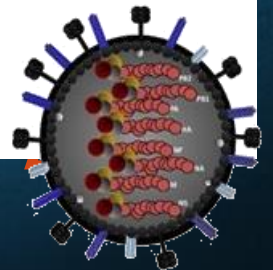




# Co-infection

- ❖ Co-infection was a significant risk factor for **prolonged hospital stay**.
- ❖ In addition, COVID-19 patients who were co-infected with influenza **shed SARS-CoV-2 longer than other COVID-19 patients** (17 days vs. 12 days on average).

**“We don’t know the reason**

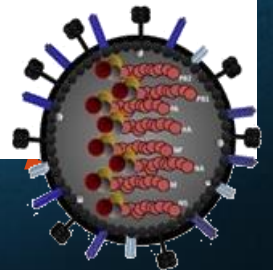






# Co-infection

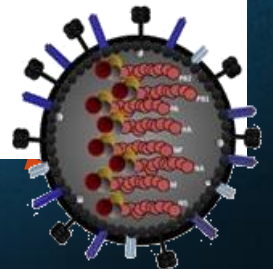
- Experts know little about treating people who have **COVID-19 and the flu at the same time**, but there is reason to think that **it might lead to more severe outcomes.**
- **Steroids** are a mainstay of COVID-19 treatment in patients who need supplemental oxygen, but prior research indicates that steroids can actually increase mortality in influenza infection. **It would be a challenge to figure out how best to manage** [people with both infections]

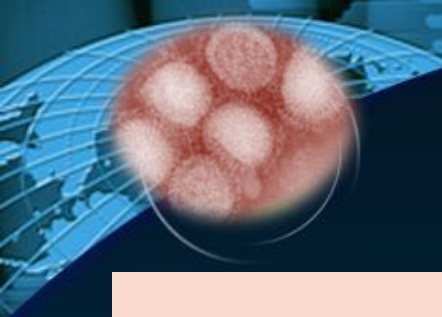


# Influenza VS COVID-19

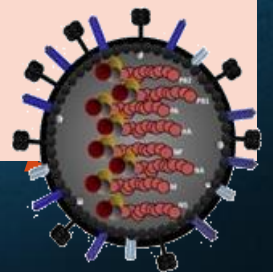


- ❖ The unexpected but welcome plummeting of influenza cases during the COVID-19 pandemic “certainly showed that **many of the social-distancing things we were doing were very effective.**
- Despite these mitigation measures, COVID-19 continued to spread, demonstrating that **SARS-CoV-2 is much more contagious than the influenza virus**





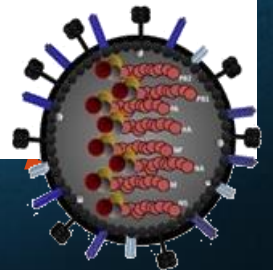
- Wearing masks, practicing physical distancing, washing the hands regularly, disinfecting surfaces, reducing travel, and closing schools all served to **limit the flu's ability to infect people.**
- **However, the relaxation of such mitigation measures in many places means that the environment is now becoming more inviting to non-COVID-19 respiratory diseases.**





# Effect of influenza on COVID-19

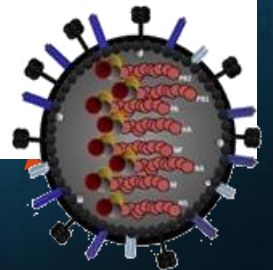
- ✓ **Coronavirus transmission can be decreased** dramatically while preventing influenza virus and following the application of influenza control measures.
- ✓ **It is recommended to Take immediate measures** that involve investigating thoroughly, testing, isolating and quarantining contacts.





# Effect of influenza vaccine on COVID

- ❑ Flu vaccine does not protect against COVID-19 But does reduce the risk of seasonal influenza that has the same symptom and the same way of transmission.
- ❑ So, due to the likelihood of co-epidemics of COVID-19 and influenza, the most effective strategy, **is to increase vaccination coverage** among people specially Persons who are at high risk of complications from influenza.







# Persons who are at high risk of complications from influenza

## Persons at High Risk of Complications

Children aged <5 years, and especially aged <2 years

Adults aged  $\geq 65$  years

Persons with chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematologic (including sickle cell disease), or metabolic disorders (including diabetes mellitus) or neurologic and neurodevelopment conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury)

Persons with immunosuppression, including that caused by medications or by HIV infection<sup>a</sup>

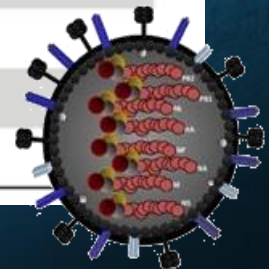
Women who are pregnant or postpartum (within 2 weeks after delivery)

Children and adolescents through 18 years who are receiving aspirin- or salicylate-containing medications and who might be at risk for experiencing Reye syndrome after influenza virus infection

American Indian/Alaska Native people<sup>b</sup>

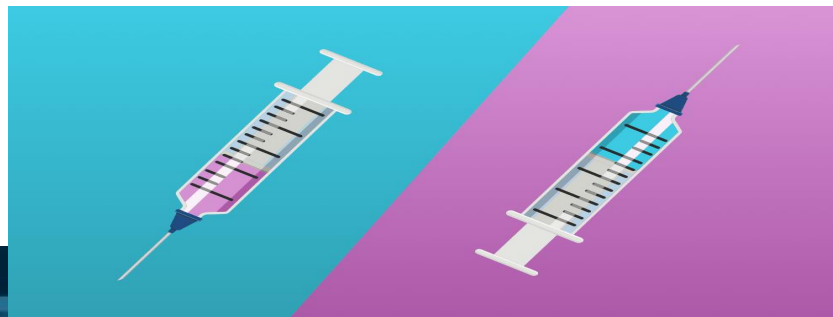
Persons with extreme obesity (ie, body mass index  $\geq 40$  kg/m<sup>2</sup>)

Residents of nursing homes and other chronic care facilities



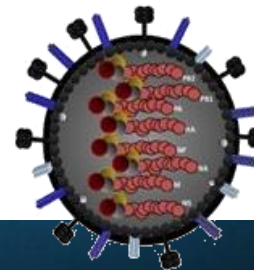
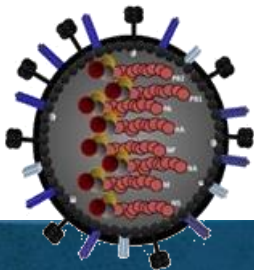
# Importance of flu vaccine

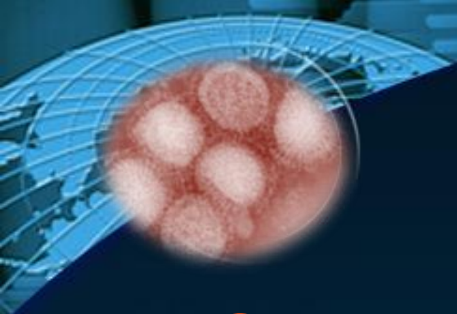
- “With all the focus on COVID vaccine, we want people to keep in mind this year **the importance of flu vaccine,**”
- Out of caution this past flu season, the CDC’s Advisory Committee on Immunization Practices advised intervals of at least 2 weeks between receiving a COVID-19 vaccine and any other vaccine. But the CDC now deems that practice unnecessary, so **people can be immunized against both COVID-19 and influenza at the same visit.**



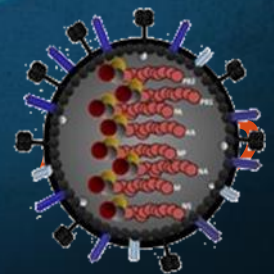
# Conclusion

- We saw an extremely low level of influenza last year, which is fantastic.
- However, that means that there are fewer people in the population that are relatively protected due to natural infection, and the virus may have an easier time spreading among the unvaccinated.
- On a population level, both vaccinated people and people who have immunity after having recovered from previous infections help to limit the spread of the virus.

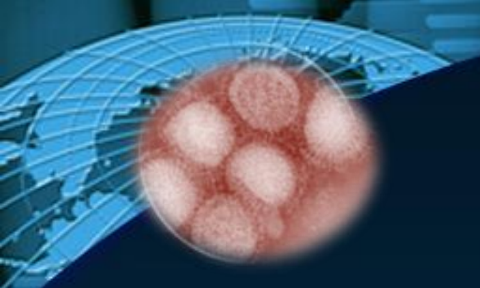




- Coronavirus disease 2019 (COVID-19) pandemic caused infection in a season when influenza is still prevalent.
- Influenza virus has similar transmission characteristics with COVID-19, including direct contact (human-to-human transmission) and transmission via airborne droplets

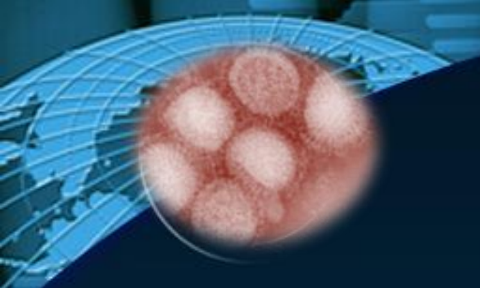


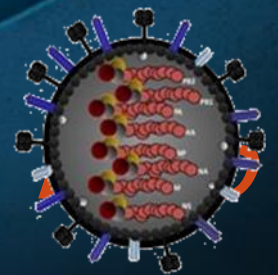


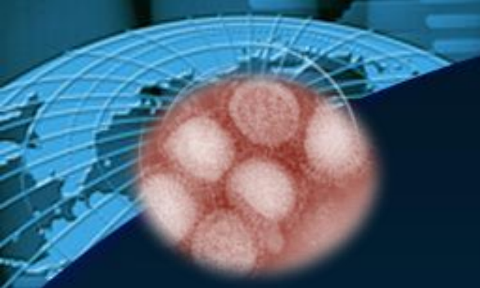
- 
- Both diseases present with **common clinical manifestations** including fever cough, rhinitis, sore throat, headache, dyspnea, and myalgia
  - On the other hand, there are epidemiologic and clinical differences: patients with influenza can be asymptomatic due to herd immunity and if develops, the disease is mild to moderate in severity in the majority of the patients with influenza, while most of the patients with COVID-19 develop symptoms within 5 to 7 days of infection and severe infection can be seen

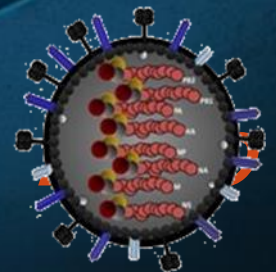


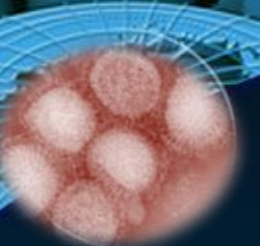


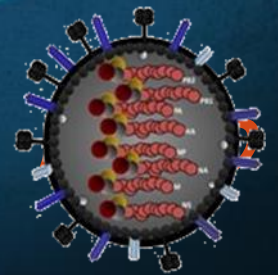
- 
- The signs and symptoms of uncomplicated, clinically mild influenza overlap with those of mild COVID-19.
  - **Ageusia and anosmia** can occur with both diseases, but these symptoms are more common with COVID-19 than with influenza.

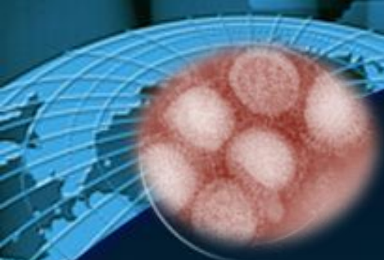


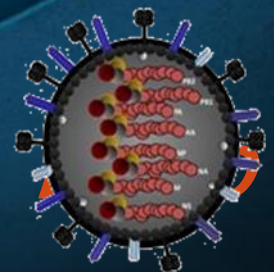
- 
- Fever is not always present in patients with either disease, particularly in patients who are immunosuppressed or elderly. Complications of influenza and COVID-19 can be similar,
  - But the onset of influenza complications and severe disease typically occurs within **a week of illness onset** whereas the onset of severe COVID-19 usually occurs **in the second week of illness**

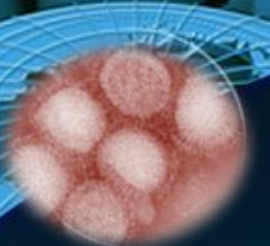


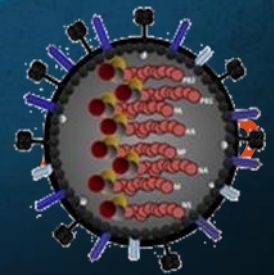
- 
- Acute respiratory distress (ARDS) is less common in influenza and mortality is  $<1\%$ , while ARDS is more common and mortality is 3% to 4%.
  - Viral shedding usually takes place 5 to 10 days in influenza, whereas it does 2 to 5 weeks in COVID-19



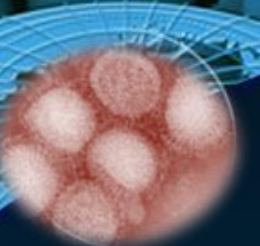
- 
- Because of the overlap in signs and symptoms, when SARS-CoV-2 and influenza viruses are circulating, diagnostic testing for both viruses in people with an acute respiratory illness is needed to distinguish between SARS-CoV-2 and influenza virus, and to identify SARS-CoV-2 and influenza virus coinfection.

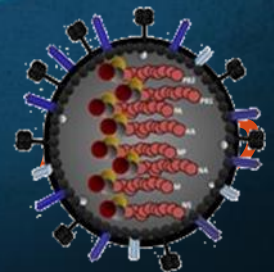


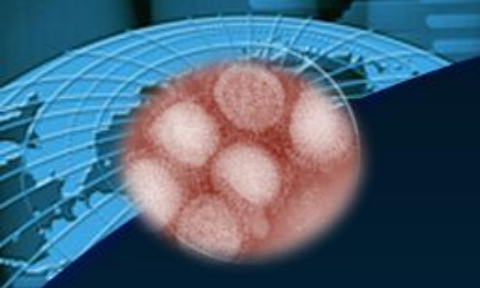
- 
- When influenza viruses and SARS-CoV-2 are cocirculating in the community, SARS-CoV-2 testing and influenza testing should be performed in all patients **hospitalized** with suspected COVID-19 or influenza
  - When influenza viruses and SARS-CoV-2 are cocirculating in the community, SARS-CoV-2 testing should be performed in outpatients with suspected COVID-19, and influenza testing can be considered in **outpatients** with suspected influenza if the results will change clinical management of the illness

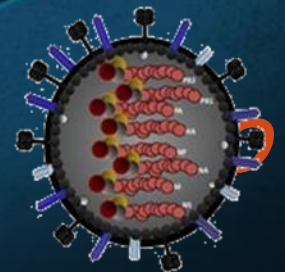





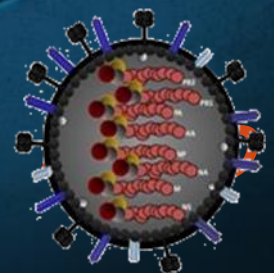
- 
- When SARS-CoV-2 and influenza viruses are cocirculating in the community, patients who require hospitalization and are suspected of having either or both viral infections **should receive influenza antiviral treatment with oseltamivir as soon as possible without waiting for influenza testing results**

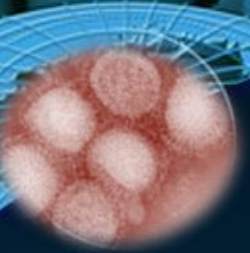


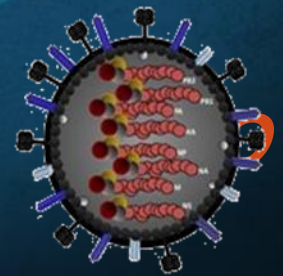
- 
- If a diagnosis of COVID-19 or another etiology is confirmed and if the result of an influenza nucleic acid detection assay from an upper respiratory tract specimen is **negative**:

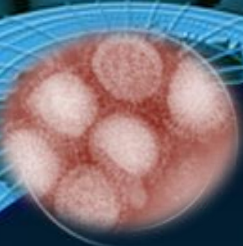


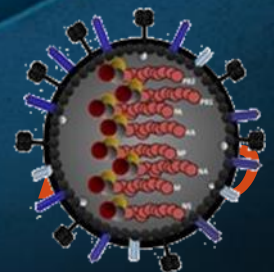
- 
- *In a Patient Who is Not Intubated:* Antiviral treatment for influenza can be stopped.
  - • *In a Patient Who is Intubated:* Antiviral treatment for influenza should be continued and if a lower respiratory tract specimen (e.g., endotracheal aspirate) can be safely obtained, it should be tested by influenza nucleic acid detection. If the lower respiratory tract specimen is also negative, influenza antiviral treatment can be stopped



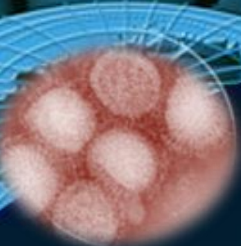
- 
- Corticosteroids, which may be used for the treatment of COVID-19, may prolong influenza viral replication and viral RNA detection and may be associated with poor outcomes
  - Oseltamivir has no activity against SARS-CoV-2.
  - Oseltamivir does not have any known interactions with remdesivir

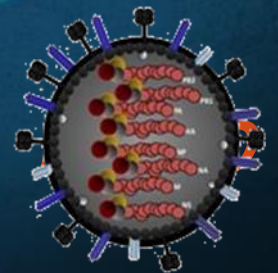


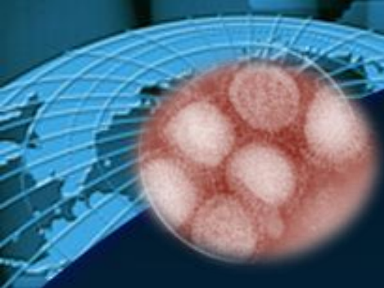
- 
- Standard-dose oseltamivir is well absorbed even in critically ill patients.
  - For patients who cannot tolerate oral or enterically administered oseltamivir (e.g., because of gastric stasis, malabsorption, or gastrointestinal bleeding), intravenous peramivir is an option
  - CDC does not recommend inhaled zanamivir and oral baloxavir for the treatment of influenza in hospitalized patients because of insufficient safety and efficacy data

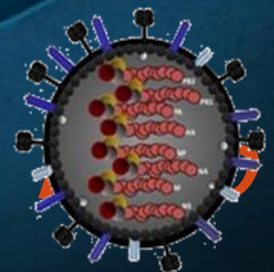


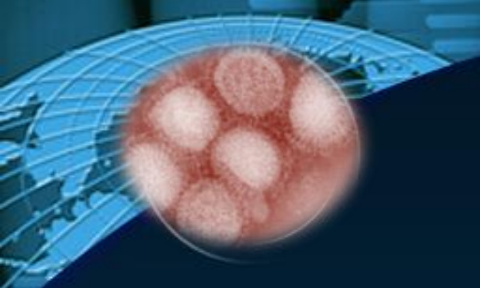


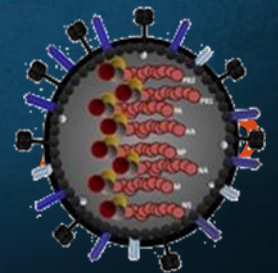
- 
- There are concerns about the risk of increased severity of coinfections.
  - Viral respiratory coinfection or pneumonia generally has been a severe disease of immunosuppressive patients.
  - Coinfections with respiratory syncytial virus (RSV) and human metapneumovirus (hMPV) caused more severe infection than either virus alone with longer hospitalization and oxygen requirement in children younger than 3 years of age

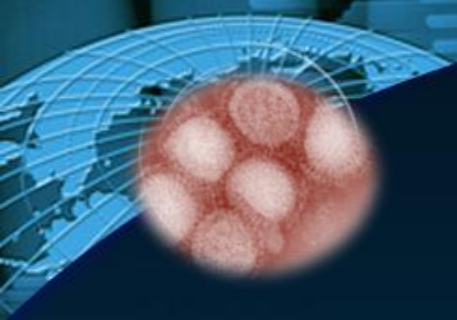


- 
- The rate of patients with dual respiratory viral infections who are hospitalized was found greater than that of patients with single viral respiratory, suggesting possible increased morbidity associated with coinfection.
  - In a study including 284 patients with viral pneumonia, 84 patients (29.6%) were found to have a respiratory coinfection

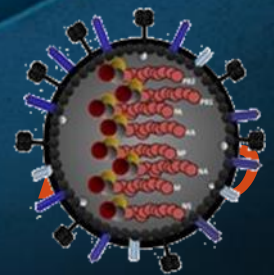


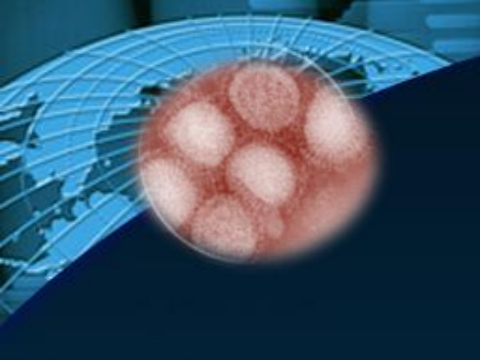
- 
- Patients with COVID-19 coinfecting with other respiratory pathogens are increasingly reported: with mycoplasma, legionella, CMV, parainfluenza, RSV, Epstein-Barr virus (EBV), hMPV, rhinovirus, and other coronaviruses



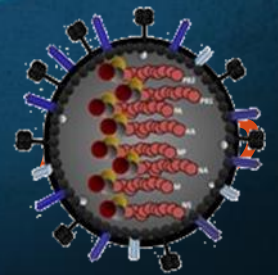


- Tis is higher than what was previously seen during the influenza pandemic in 2009 when 25% of patients with influenza infection had secondary bacterial co-infection

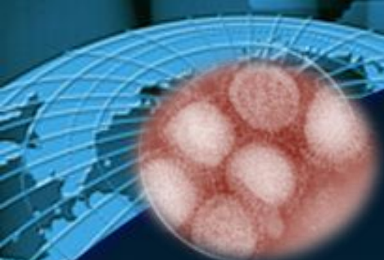




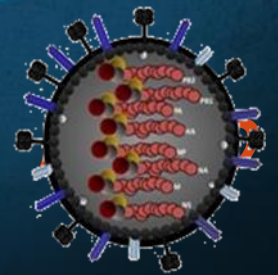
# **INFLUENZA VACCINATION AND COVID19**





- 
- The annual influenza epidemic substantially affects health care systems worldwide and has resulted in an estimated 12000 to 61000 deaths annually since 2010 just in the US.
  - This disease annually causes three to five million cases of severe illness and 290,000–650,000 deaths.

World Health Organization, Influenza (seasonal), November [https://www.who.int/news-room/fact-sheets/detail/influenza-\(seasonal\)](https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal)), (2018) , Accessed date: 9 May 2020.

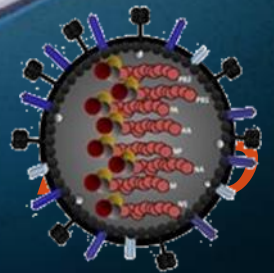


# Influence of High-Risk Medical Conditions on the Effectiveness of Influenza Vaccination among Elderly Members of 3 Large Managed-Care Organizations

**Eelko Hak,<sup>1,6</sup> James Nordin,<sup>1</sup> Feifei Wei,<sup>1</sup> John Mullooly,<sup>3</sup> Sung Poblete,<sup>4</sup> Raymond Strikas,<sup>5</sup> and Kristin L. Nichol<sup>1,2</sup>**

<sup>1</sup>HealthPartners Research Foundation, Bloomington, and <sup>2</sup>Veterans Affairs Medical Center and University of Minnesota, Minneapolis; <sup>3</sup>Kaiser Permanente Northwest, Portland, Oregon; <sup>4</sup>Oxford Health Plans, New York, New York; <sup>5</sup>Centers for Disease Control and Prevention, Atlanta, Georgia; and <sup>6</sup>Julius Center for General Practice and Patient Oriented Research, University Medical Center, Utrecht, The Netherlands

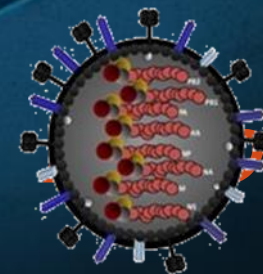
**Clinical Infectious Diseases**  
**2002; 35:370–7**



**Table 4. Absolute risk reductions for pneumonia/influenza hospitalizations or death due to all causes associated with vaccination and corresponding numbers of persons needed to vaccinate to prevent 1 outcome.**

Risk group	1996–1997			1997–1998		
	Event rate/1000 unvaccinated persons	Absolute risk reduction/1000 persons vaccinated <sup>a</sup>	No. needed to vaccinate to prevent 1 outcome <sup>b</sup>	Event rate/1000 unvaccinated persons	Absolute risk reduction/1000 persons vaccinated <sup>a</sup>	No. needed to vaccinate to prevent 1 outcome <sup>b</sup>
All	20.5	9.8	102	19.0	5.9	170
Healthy patients	8.2	3.8	264	8.2	3.5	290
High risk <sup>c</sup>	38.4	19.0	55	23.3	9.5	118
Heart and lung disease	82.6	38.8	26	56.4	15.8	63
Lung disease	57.6	27.6	35	37.4	10.1	99
Heart disease	43.5	21.3	47	36.0	10.8	93
Diabetes	35.7	17.8	56	31.8	6.7	150
Immunosuppression <sup>d</sup>	85.7	36.9	27	51.4	20.0	50
Other comorbid conditions <sup>e</sup>	69.6	39.0	26	44.9	17.5	57

**Clinical Infectious Diseases  
2002; 35:370–7**



# Effectiveness of influenza vaccination in reducing the risk of hospitalization for pneumonia and influenza or death from all causes

Risk group	1996-1997		1997-1998	
	Vaccine effectiveness, % (95% CI)	<i>P</i>	Vaccine effectiveness, % (95% CI)	<i>P</i>
All	48 (42-52)	<.001	31 (26-37)	<.001
Healthy patients	46 (34-56)	<.001	42 (28-52)	<.001
High risk <sup>a</sup>	47 (40-53)	<.001	29 (22-35)	<.001
Heart and lung disease	47 (35-57)	<.001	28 (17-38)	<.001
Lung disease	48 (38-56)	<.001	27 (18-36)	<.001
Heart disease	49 (42-56)	<.001	30 (21-37)	<.001
Diabetes	50 (37-60)	<.001	21 (6-34)	.009
Immunosuppression <sup>b</sup>	43 (30-53)	<.001	39 (30-47)	<.001
Other comorbid conditions <sup>c</sup>	56 (44-66)	<.001	39 (24-51)	<.001

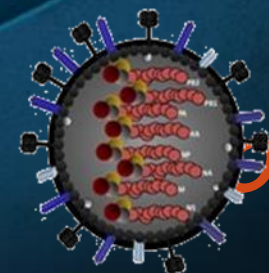
<sup>a</sup> At least 1 of the listed comorbid conditions (see Materials and Methods) diagnosed in outpatients or inpatients during the 12-month baseline period.

<sup>b</sup> Renal disease, hematologic or nonhematologic cancer, or receipt of a solid-organ transplant.

<sup>c</sup> Dementia/stroke, vasculitis, or rheumatologic disease.

5:370-7

Clinical Infectious Diseases  
2002; 35:370-7

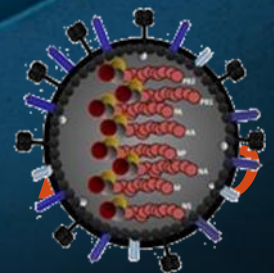






# GOLD 2021

- Influenza vaccination can reduce serious illness such as LRTI requiring hospitalization and death in COPD patients.
- Reduce exacerbation
- Decreased risk of IHD
- More effective in elderly pts with COPD
- Influenza vaccination is recommended for all patients with COPD.

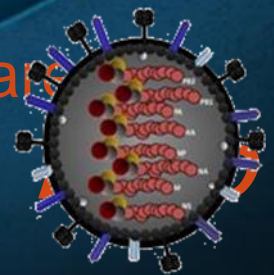






# GINA 2021





- Advise patients with moderate to severe asthma to receive an influenza vaccination every year.
- Influenza causes significant morbidity and mortality in the general population and contribute to some acute asthma exacerbation.
- A recent systematic review and meta-analysis that included observational studies with a wide range of study designs suggested that influenza vaccination reduce the risk of acute exacerbations, although for most of the studies, bias could not be excluded.
- There is no evidence for an increase in asthma exacerbations after influenza vaccination compared placebo.





Article

# Influenza Vaccination and COVID-19 Mortality in the USA: An Ecological Study

Claudio Zanettini <sup>1,†</sup>, Mohamed Omar <sup>1,†</sup>, Wikum Dinalankara <sup>1</sup>, Eddie Luidy Imada <sup>1</sup>, Elizabeth Colantuoni <sup>2</sup>, Giovanni Parmigiani <sup>3,4</sup> and Luigi Marchionni <sup>1,\*</sup>

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<sup>2</sup> Department of Biostatistics, Johns Hopkins University, Baltimore, MD 21205, USA; ejohnso2@jhmi.edu

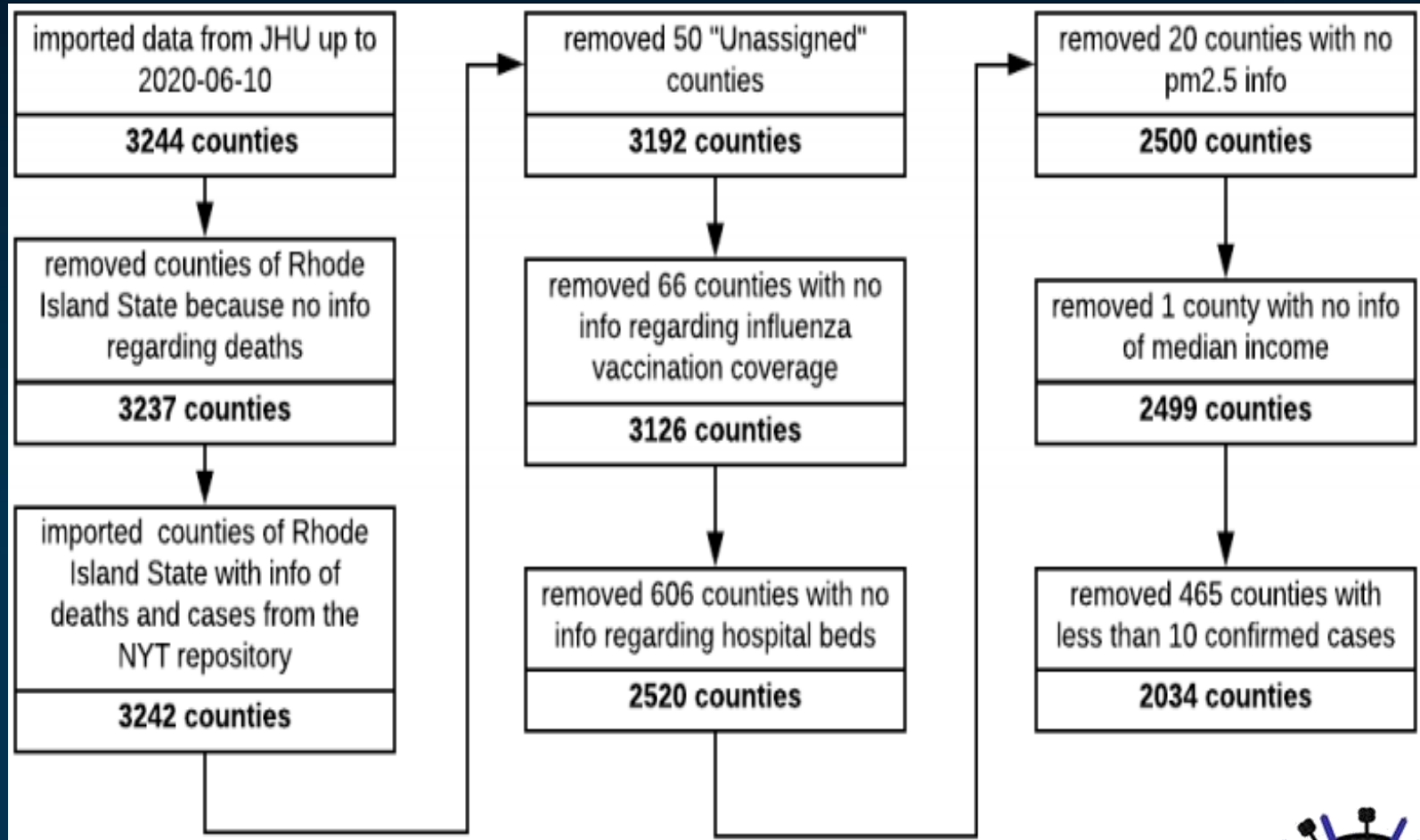
<sup>3</sup> Department of Data Sciences, Dana-Farber Cancer Institute, Boston, MA 02215, USA; gp@jimmy.harvard.edu

<sup>4</sup> Department of Biostatistics, Harvard TH Chan School of Public Health, Boston, MA 02115, USA

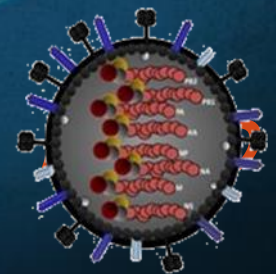
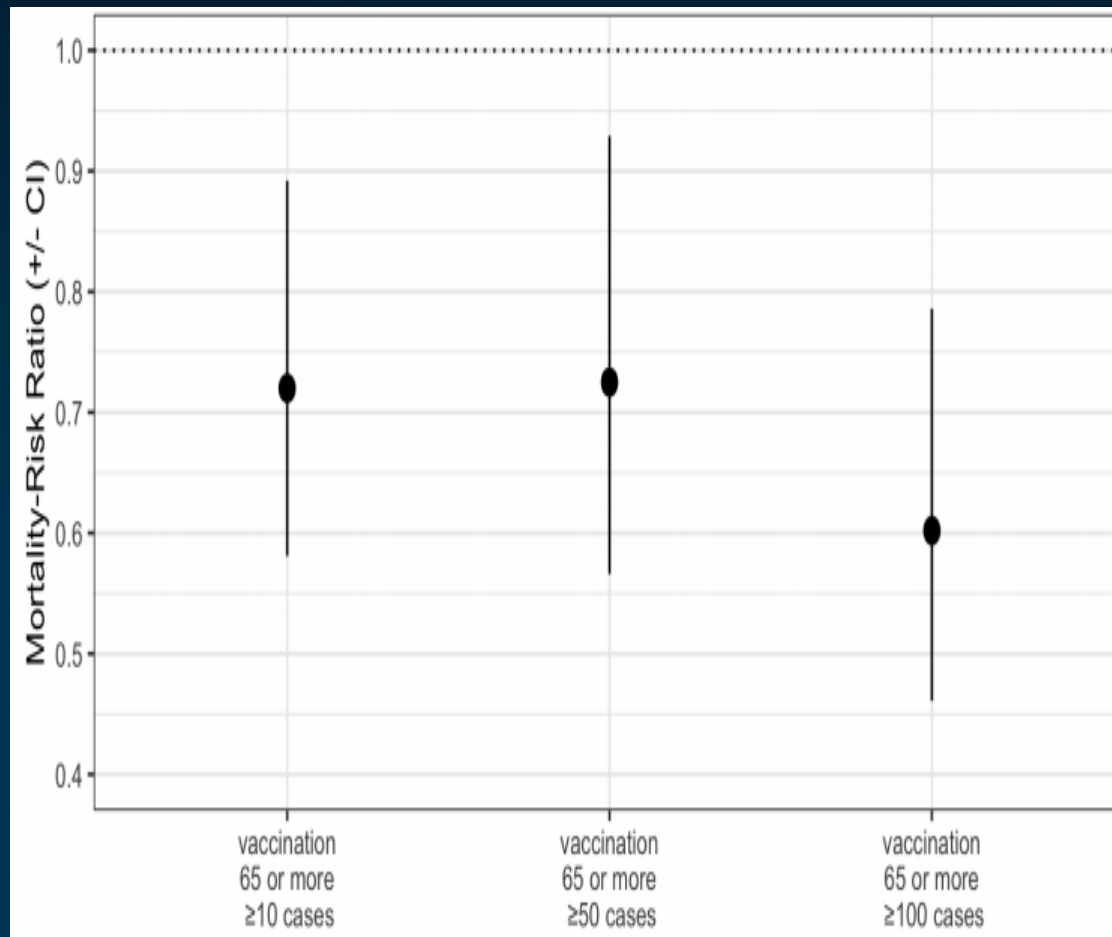
\* Correspondence: lum4003@med.cornell.edu; Tel.: +001-646-962-8767


† Equally contributing authors.

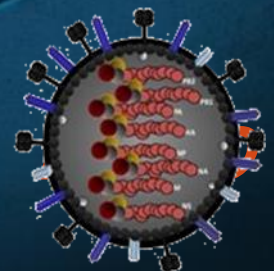
# Flowchart illustrating the steps of data collection and filtering



# Mortality rate ratio (MRR)



- 
- Unvaccinated individuals are at risk of persistent viral infections, leading to a decline in T-cell diversity
  - Influenza vaccination, on the other hand, does not induce a strong, virus-specific CD8 T-cell immune response, as seen with natural infection
  - influenza virus has been shown to induce apoptosis
  - influenza virus impair the cytotoxic effect of natural killer (NK) cells
  - unvaccinated individuals are more likely to have a higher proportion of influenza-specific resident memory T-cells (TRM) in their lungs
  - the Influenza A virus has been recently shown to up-regulate ACE2 receptors in the lung alveolar cells
  - Similar to COVID-19 disease, lymphopaenia is also observed in individuals with severe influenza and is associated with a higher mortality.






Internal and Emergency Medicine

<https://doi.org/10.1007/s11739-021-02702-2>

IM - ORIGINAL

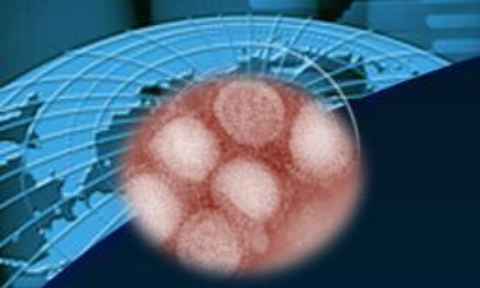


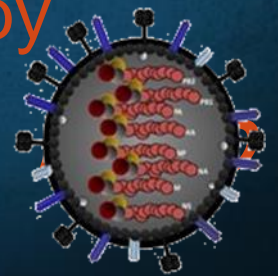
# Effect of influenza vaccine on COVID-19 mortality: a retrospective study

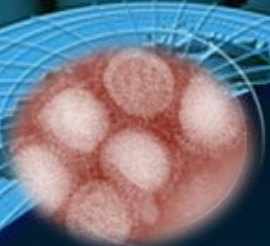
Marcello Candelli<sup>1</sup>  · Giulia Pignataro<sup>1</sup> · Enrico Torelli<sup>1</sup> · Antonio Gulli<sup>2</sup> · Enrico Celestino Nista<sup>1</sup> · Martina Petrucci<sup>1</sup> · Angela Saviano<sup>1</sup> · Debora Marchesini<sup>1</sup> · Marcello Covino<sup>1</sup> · Veronica Ojetti<sup>1</sup> · Massimo Antonelli<sup>2</sup> · Antonio Gasbarrini<sup>3</sup> · Francesco Franceschi<sup>1</sup>

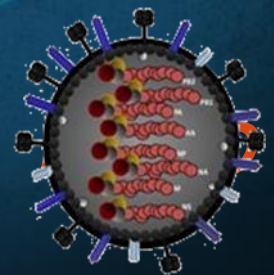
Received: 27 November 2020 / Accepted: 8 March 2021

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- 
- We retrospectively enrolled 635 patients who accessed our Emergency Department from March 1st to June 30th, 2020, and were diagnosed with COVID-19 infection confirmed by an RT-PCR on an oropharyngeal swab.
  - Clinical data, outcomes, and influenza vaccination status were collected from the electronic medical records of our Hospital.
  - We then compared clinical outcomes between vaccinated and non-vaccinated patients, by univariate and multivariate analysis.



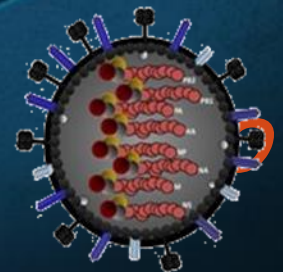
- 
- The prevalence of influenza vaccination was 24.9% (150/602) in COVID-19 patients.
  - The mean age of vaccinated patients resulted significantly higher when compared to unvaccinated patients ( $70.4 \pm 16$  vs  $57.3 \pm 15$  years;  $p < 0.0001$ ).
  - Vaccinated patients showed a higher prevalence of at least one chronic disease (110/150, 73.3%) than controls (230/452, 50.9%;  $P < 0.0001$ ; OR 2.65; IC 95% 1.768–3.984)





*No difference was found between the groups in :*

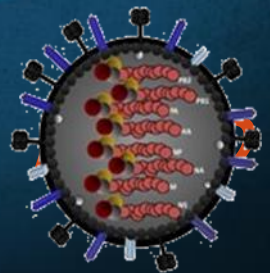
- Length of hospitalization
- admission in ICU
- PaO<sub>2</sub>/FiO<sub>2</sub> ratio
- high oxygen flux, non-invasive ventilation (NIV), or ETI
- days spent in ICU
- deceased at 60 days



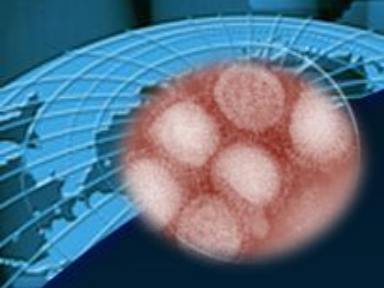
# Maximal need for oxygen supplementation, not invasive, and invasive ventilation in vaccinated and not vaccinated COVID-19 patients

Maximal need for oxygen	Vaccinated <i>N</i> (%)	Unvaccinated <i>N</i> (%)	<i>p</i>
No oxygen	53 (35)	193 (43)	0.11
Nasal high flux oxygen or venture mask	73 (49)	183 (40)	0.08
NIV	12 (8)	38 (8.4)	0.89
ETI	12 (8)	38 (8.4)	0.89

*NIV* non-invasive ventilation (Helmet or facial mask), *ETI* endotracheal intubation





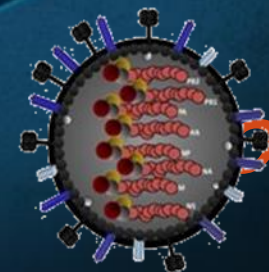


# Need for ETI in vaccinated vs unvaccinated patients at multivariate analysis with correction for gender, age, and comorbidities

	Need for ETI (50)	No need for ETI (552)	<i>p</i>	OR	95% IC limits
Vaccination <i>N</i> (%)	12 (24)	138 (25)	0.42	0.73	0.346-1.559
	Patients dead at 60 days (44)	Patients alive at 60 days (558)	<i>p</i>	OR	95% IC limits
Vaccination <i>N</i> (%)	8 (18.2)	142 (25.4)	0.001	0.20	0.082-0.510

*ETI* endotracheal intubation. Comorbidities evaluated for analysis: congestive chronic heart failure, Chronic obstructive pulmonary disease, Cardiac heart disease, Diabetes, hypertension, and neoplasms

After correction for gender, age, and comorbidities, we found a lower risk of death at 60 days in patients with flu vaccination than in not vaccinated patients ( $p=0.001$ ). Our study shows that flu vaccination could reduce the mortality of COVID-19.





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# American Journal of Infection Control

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AJIC  
American Journal of  
Infection Control

## Major Article

# Impact of the influenza vaccine on COVID-19 infection rates and severity

Anna Conlon PhD<sup>a,1</sup>, Carmel Ashur MD, MS<sup>b,\*</sup>, Laraine Washer MD<sup>c,d</sup>, Kim A. Eagle MD<sup>e</sup>,  
Marion A. Hofmann Bowman MD<sup>e</sup>

<sup>a</sup> University of Michigan School of Medicine, Ann Arbor, MI

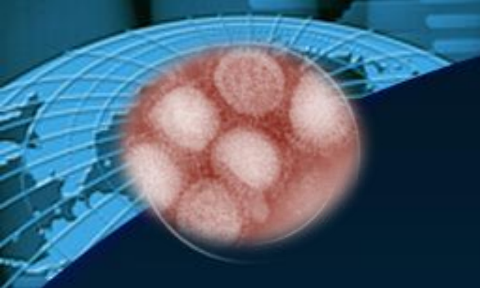
<sup>b</sup> Department of Internal Medicine, University of Michigan, Michigan Medicine, Ann Arbor, MI

<sup>c</sup> Division of Infectious Diseases, Department of Internal Medicine, University of Michigan Medical School, Ann Arbor, MI

<sup>d</sup> Department of Infection Prevention and Epidemiology, Michigan Medicine, Ann Arbor, MI

<sup>e</sup> Division of Cardiology, Department of Internal Medicine, University of Michigan, Michigan Medicine, Ann Arbor, MI



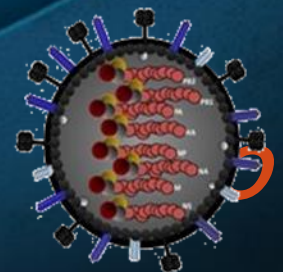
- 
- A total of 27,201 patients received laboratory testing for COVID-19.

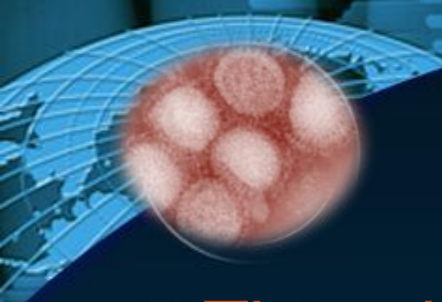
- ***primary outcome:***

comparison of positive COVID-19 testing in those who received the influenza vaccine versus those who did not.

- ***Secondary end points:***

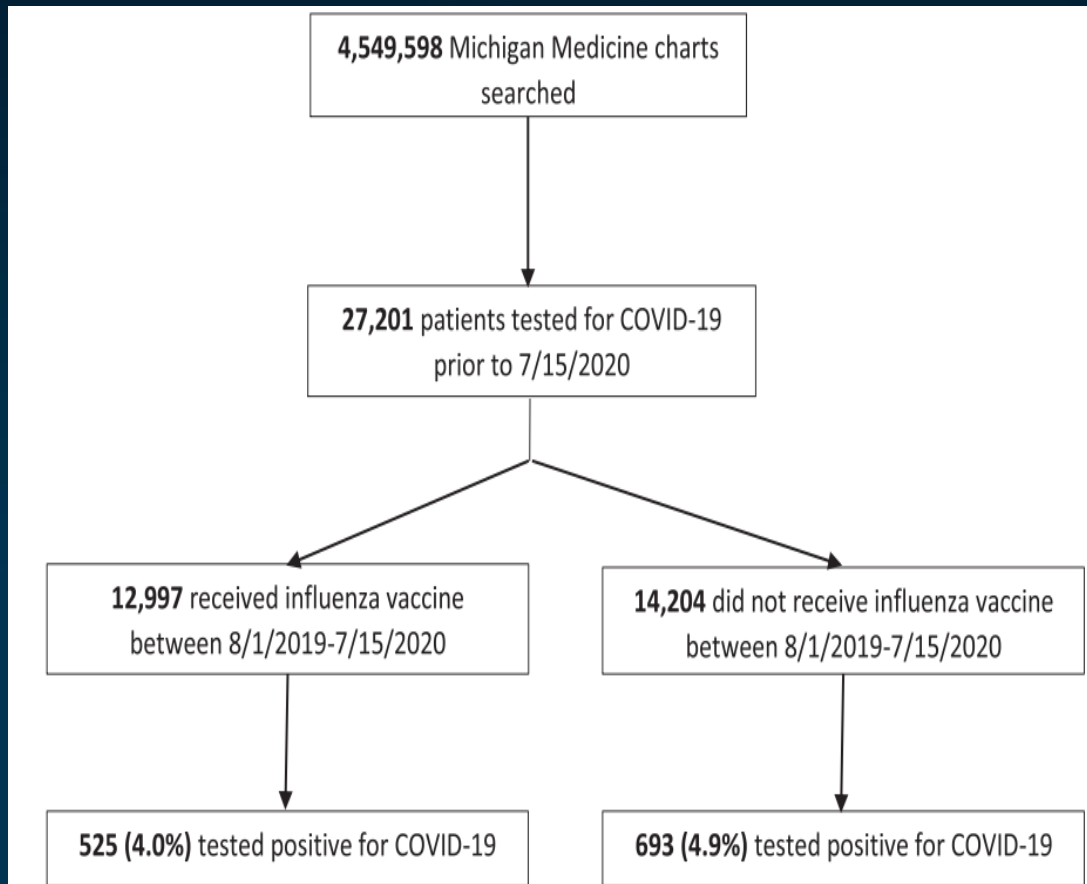
in patients testing positive for COVID-19 included mortality, need for hospitalization, length of stay, need for intensive care, and mechanical ventilation.



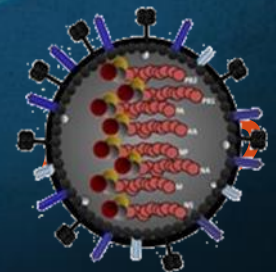


- The odds of testing positive for COVID-19 was reduced in patients who received an influenza vaccine compared to those who did not (odds ratio 0.76, 95% CI 0.68-0.86;  $P < .001$ ),  
mechanical ventilation (odds ratio, 0.45, 95% CI 0.27-0.78;  $P = .004$ )  
shorter hospital LOS (risk ratio, 0.76, 95% CI 0.65- 0.89;  $P < .001$ ).
- Influenza vaccination is associated with decreased positive COVID-19 testing and ***LOGO*** improved clinical outcomes.

# Study Flow Diagram of Search Results for Included Patients

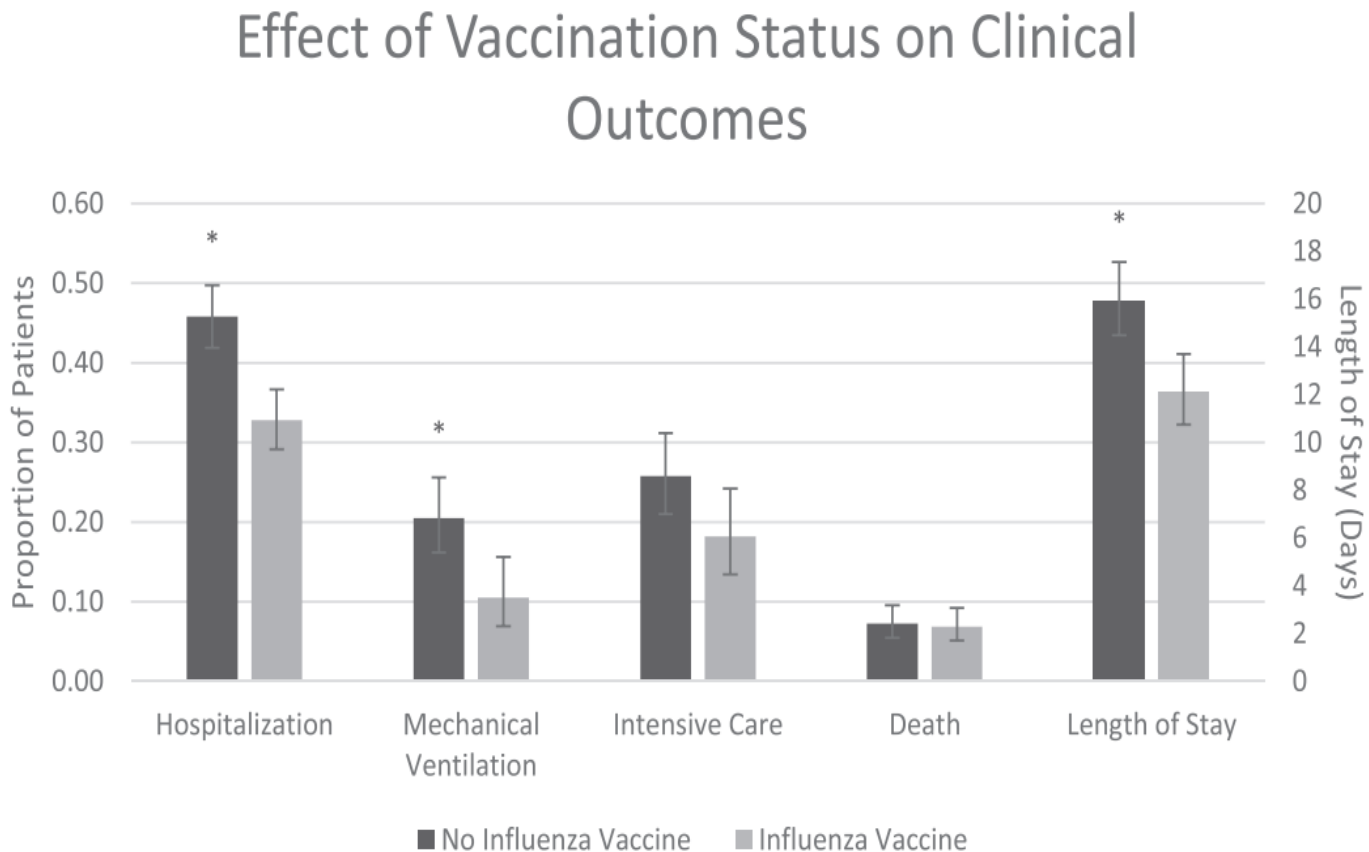


In patient who received the influenza vaccine, there was a significant reduction in the odds of testing positive for COVID19 compared to those who did not receive the vaccine (odds ratio 0.82, 95% CI 0.73-0.92;  $P < 0.001$ )





# Effect of Influenza Vaccination Status on COVID-19 Clinical Outcomes

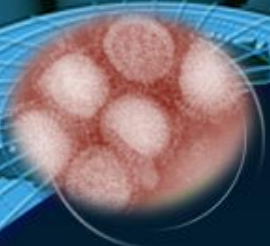




# Calculations

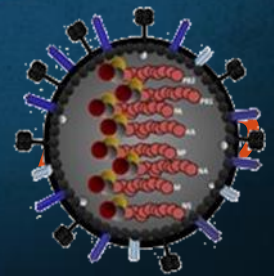
- Influenza has a variable Basic Reproduction Number ( $R^0$ ) but seasonal influenza is estimated as having an  $R^0$  of 0.9–2.1. Herd immunity is reached at  $1-1/R^0$ . For the upper  $R^0$  value of 2.1, this implies that herd immunity would be reached if 52.3% of the population were to be immune. If the influenza vaccine were to be effective in 50% of cases given, if all of the population were to take it, herd immunity would almost be reached.
- Hypothetically, the midpoint  $R^0$  for 0.9–2.1 is 1.5. If 33.3% of the population were to be immune for strains with  $R^0$  of 1.5, herd immunity would be achieved. If the population were to be 70% vaccinated, even a vaccine that is only 50% effective would still provide herd immunity.

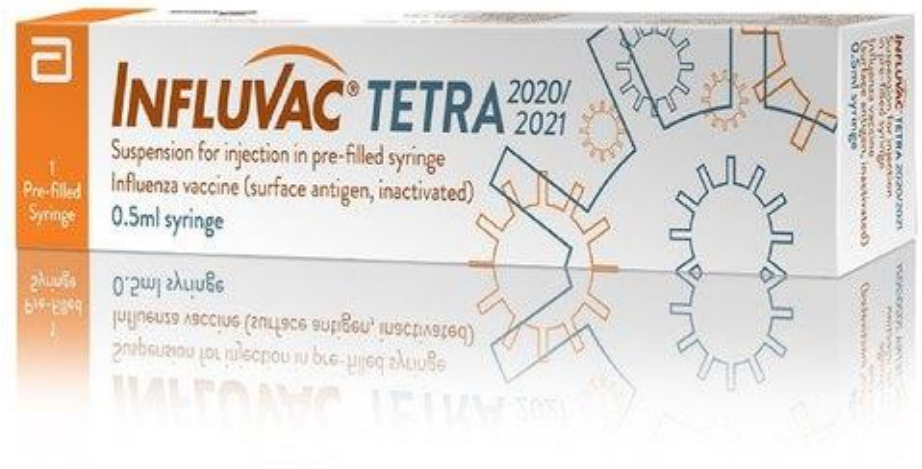
*LOGO*

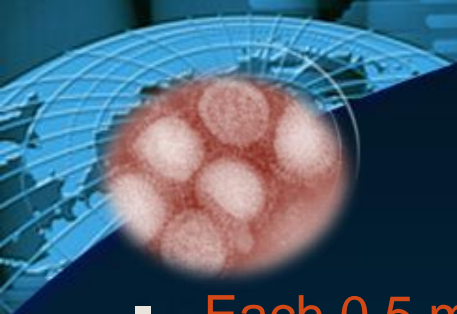


# In the long run, what is a logical plan?

- Reduced circulation of influenza viruses during the past year might affect the severity of the upcoming influenza season given the prolonged absence of ongoing natural exposure to influenza viruses.
- Pre-existing co-morbidity confer higher susceptibility to infection by COVID-19 and greater risk of mortality with infection.
- Influenza vaccination may have the potential to offer an additional means of mitigating serious adverse complications of COVID-19.
- Rapid expansion of the influenza vaccination programme is urgently needed as an integral component of the ongoing response to the COVID-19 pandemic







- Each 0.5 mL dose of INFLUVAC TETRA contains 15 micrograms of each of the four types of influenza virus fragments:
- A/Victoria/2570/2019 (H1N1)pdm09-like strain
- A/Hong Kong/2671/2019 (H3N2)-like strain
- B/Washington/02/2019-like (B/Victoria lineage) virus
- B/Phuket/3073/2013-like (B/Yamagata lineage) virus
- Other ingredients
- (inactive ingredients)
- Potassium chloride
- Monobasic potassium phosphate
- Dibasic sodium phosphate dihydrate
- Sodium chloride
- Calcium chloride dihydrate
- Magnesium chloride hexahydrate
- Water for injections

**LOGO**

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**Thanks For Your  
Attention**

