

# Pandemics in Hawai'i: 1918 Influenza and COVID-19

**Title:** Pandemics in Hawai'i: 1918 Influenza and COVID-19

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## Presenter's resume:

**Prof. Monique Chyba**'s is a mathematician at the University of Hawaii, Manoa. Her main expertise is the development of geometric methods to solve optimal control problems. One of her central objectives is to understand the role of singular extremals in optimal strategies for nonlinear control systems. Her research is oriented towards applications such as the motion planning problem for multi-agents using spectral graph theory, and geometric approaches to navigation for autonomous underwater vehicles and quadcopters or morphogenesis. She also works on data-driven problem and modeling applied to microbiomes diversification, disease spread and more. Her PhD is from the University of Geneva in Switzerland in Mathematics.



# University of Hawai'i at Manoa Team

Faculty: **Monique Chyba & Yuriy Mileyko**

Grad Students: **Richard Carney & Christopher Gray &  
Oleksandr Markovichenko**

Undergrad Students: **Alan Tong & Elizabeth Swantek &  
Dikshika Shrestha**

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*University of Hawai'i at Manoa*

Faculty: **Thomas Lee**

*Office of Public Health Studies*

*University of Hawai'i at Manoa*

Faculty: **Alice E. Koniges**

*Hawai'i Data Science Institute*

*University of Hawai'i at Manoa*

Grad Student: **Victoria Kala**

*Department of Mathematics*

*University of California, Los Angeles*

Grad Student: **Katherine Guo**

*Monte Vista High School*

*Danville, California*



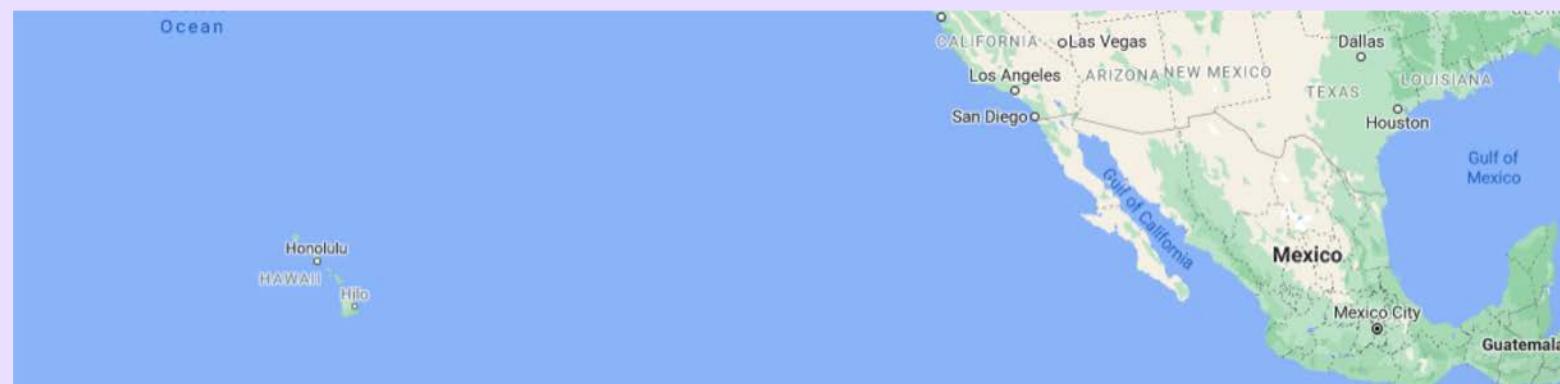
The team is growing with a large R\_0 number :-) and not everyone is on the picture



# History of Pandemics in Hawai'i

# Hawai'i Features

- Early viruses entering Hawai'i decimated the vulnerable, Native Hawaiian population.
  - Despite sailors attempting to prevent spread of disease, complications resulted in over-staying on the island.
- Hawai'i carries a large population of elderly, a more susceptible demographic of most diseases.
- The isolated environment of the archipelago allows for a situational closure of borders.

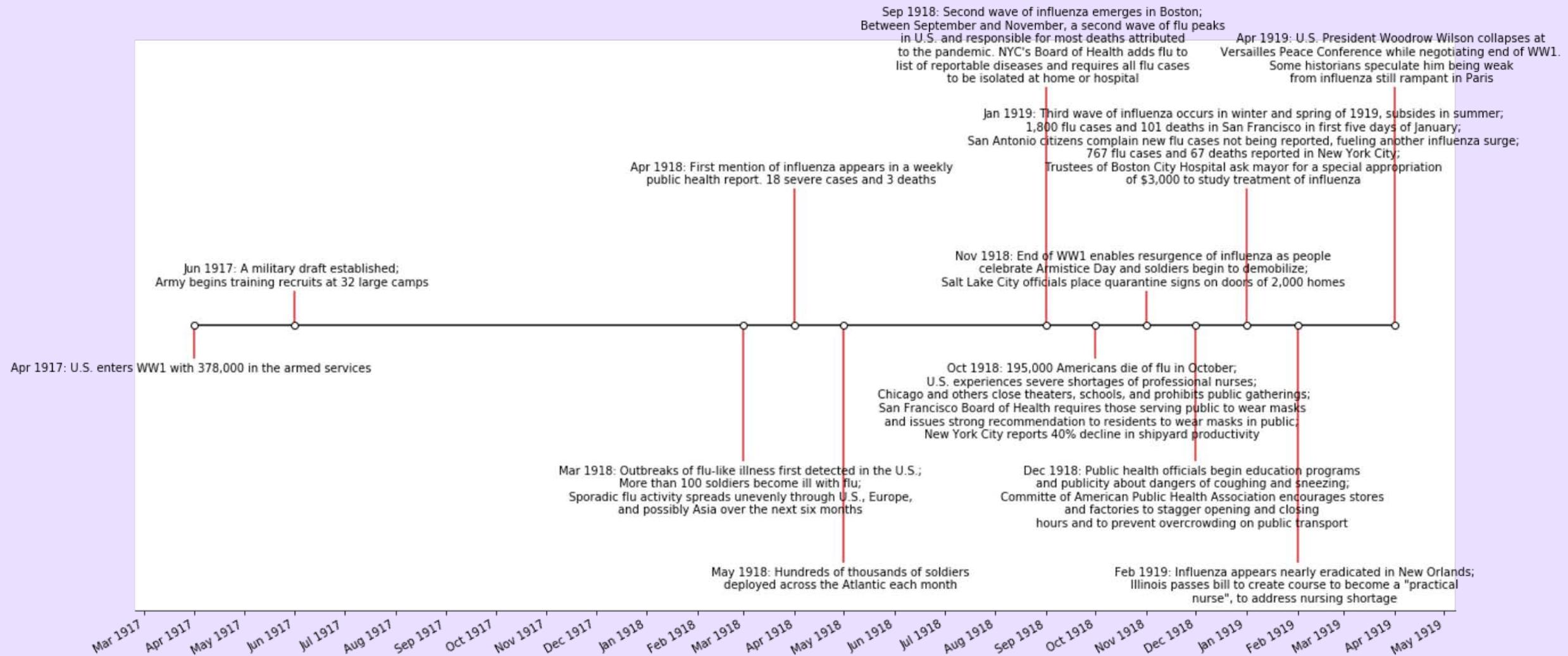


# 1918-1920 Influenza Pandemic

- Killed an estimated 21 million people globally
  - 675,000 Americans
  - 2,300 people in Hawai'i
- Swept through Hawai'i in two waves:
  - July 1918 – August 1918
  - December 1918 – January 1919
- Health facilities faced supply shortages, communities shut down, and officials argued closure would have little effect on death rates.



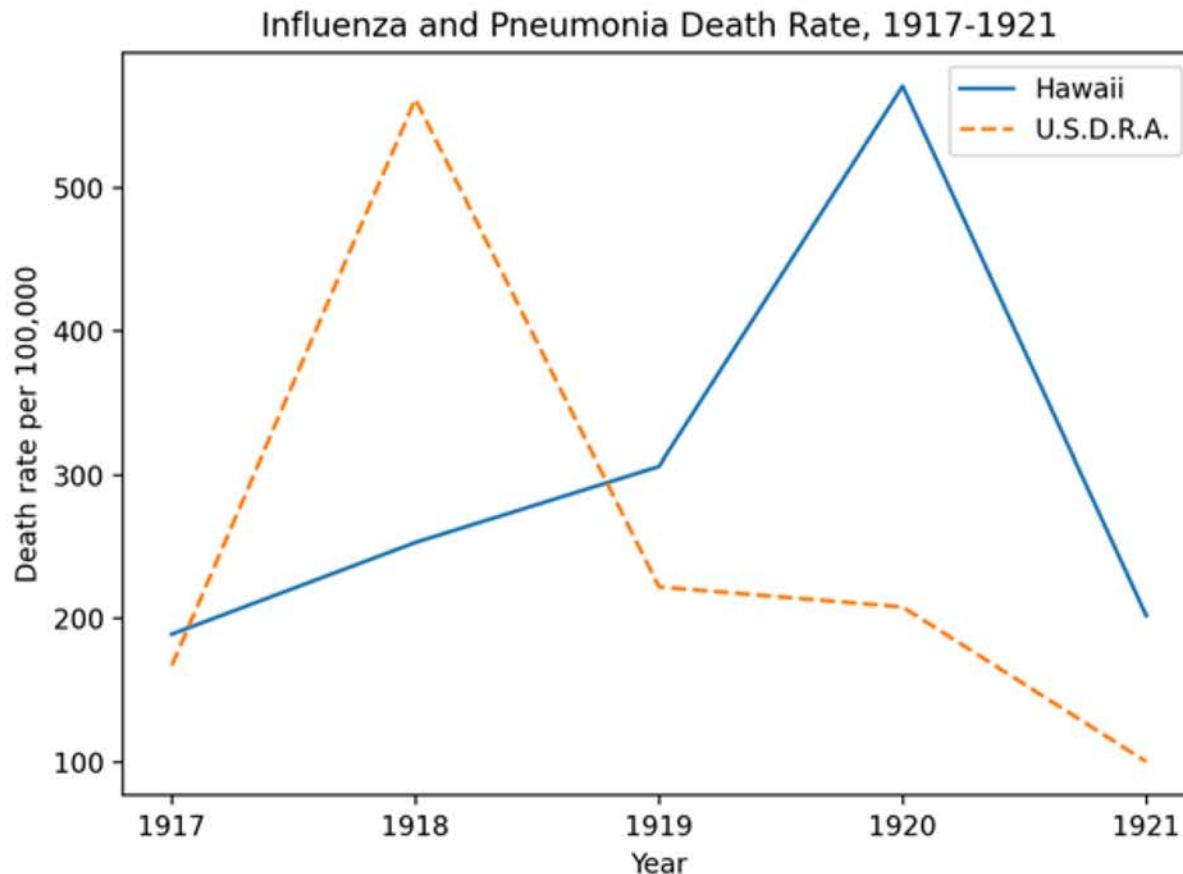
# Timeline of 1918-1920 Pandemic Major Events



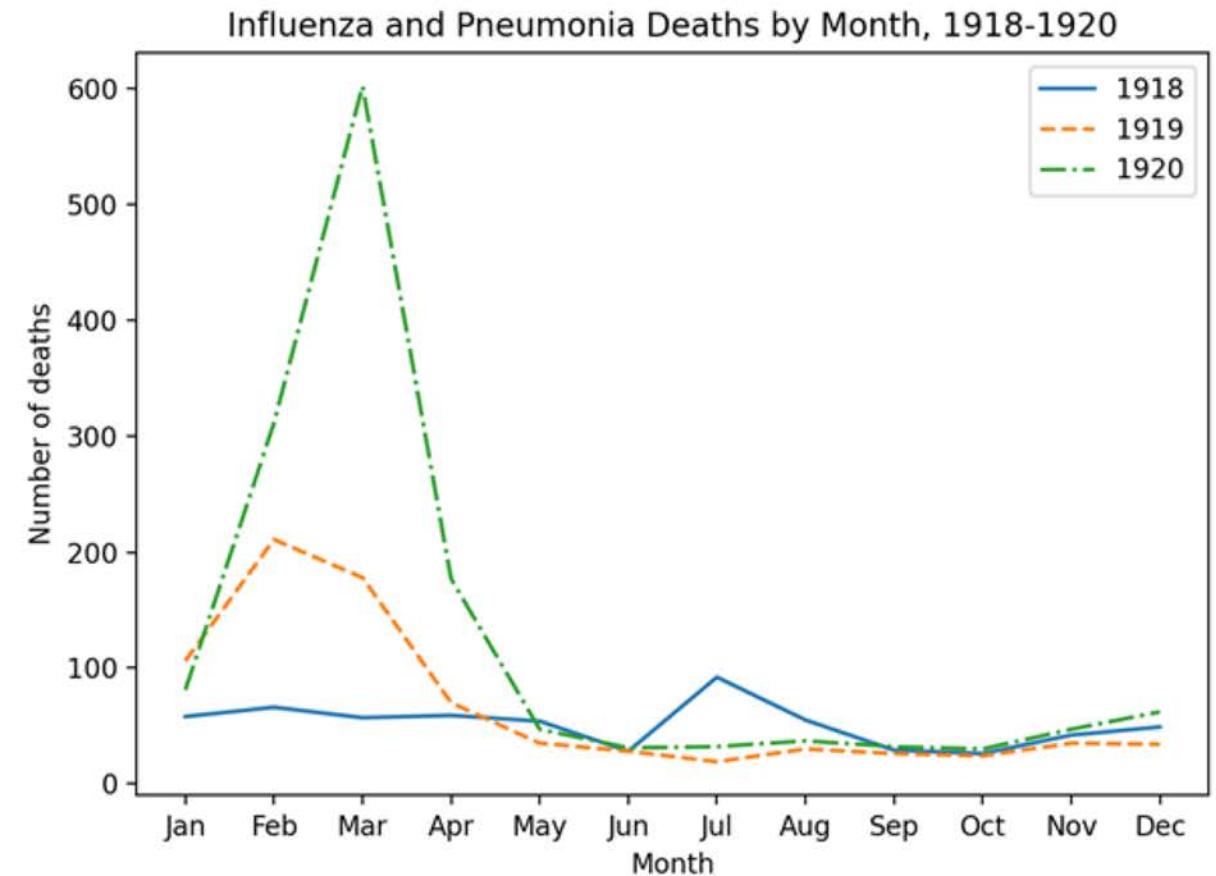
# Data on 1918-1920 Influenza Pandemic

- Morbidity for influenza was unavailable before October 21, 1918.
- Influenza morbidity is often under reported when compared to influenza mortality.
- Hawai'i, a territory and not yet a state, had data omitted from national totals until being added to the death registration area in 1917.
- Morbidity figures tended to omit pneumonia, an often outcome for influenza patients.

# Lag and Wave Behavior



Deaths for Hawaii and the US Death Registration Area.



On the right is the deaths from Influenza and pneumonia across the 1918-1920 pandemic.

INFLUENZA AND PNEUMONIA DEATHS BY AGE, SEX, AND RACE IN HAWAII, 1917-1921<sup>a</sup>

Subject	1917	1918	1919	1920	1921
Total	447	615	796	1,489	550
Age					
Under 5 years	294	360	274	482	364
5 to 19 years	24	34	86	146	27
20 to 39 years	38	96	86	146	27
40 to 59 years	44	74	112	247	57
60 years and over	47	50	54	85	36
Age	—	—	—	2	1
Sex <sup>b</sup>					
Male	273	346	440	940	—
Female	174	269	356	649	—
Race <sup>c</sup>					
Hawaiian	127	187	155	369	122
Part-Hawaiian	—	47	36	84	48
Caucasian	51	77	107	197	74
Chinese	149	185	311	553	178
Filipino	—	74	126	157	79
Others	91	11	17	21	14

<sup>a</sup> Data available from [4].

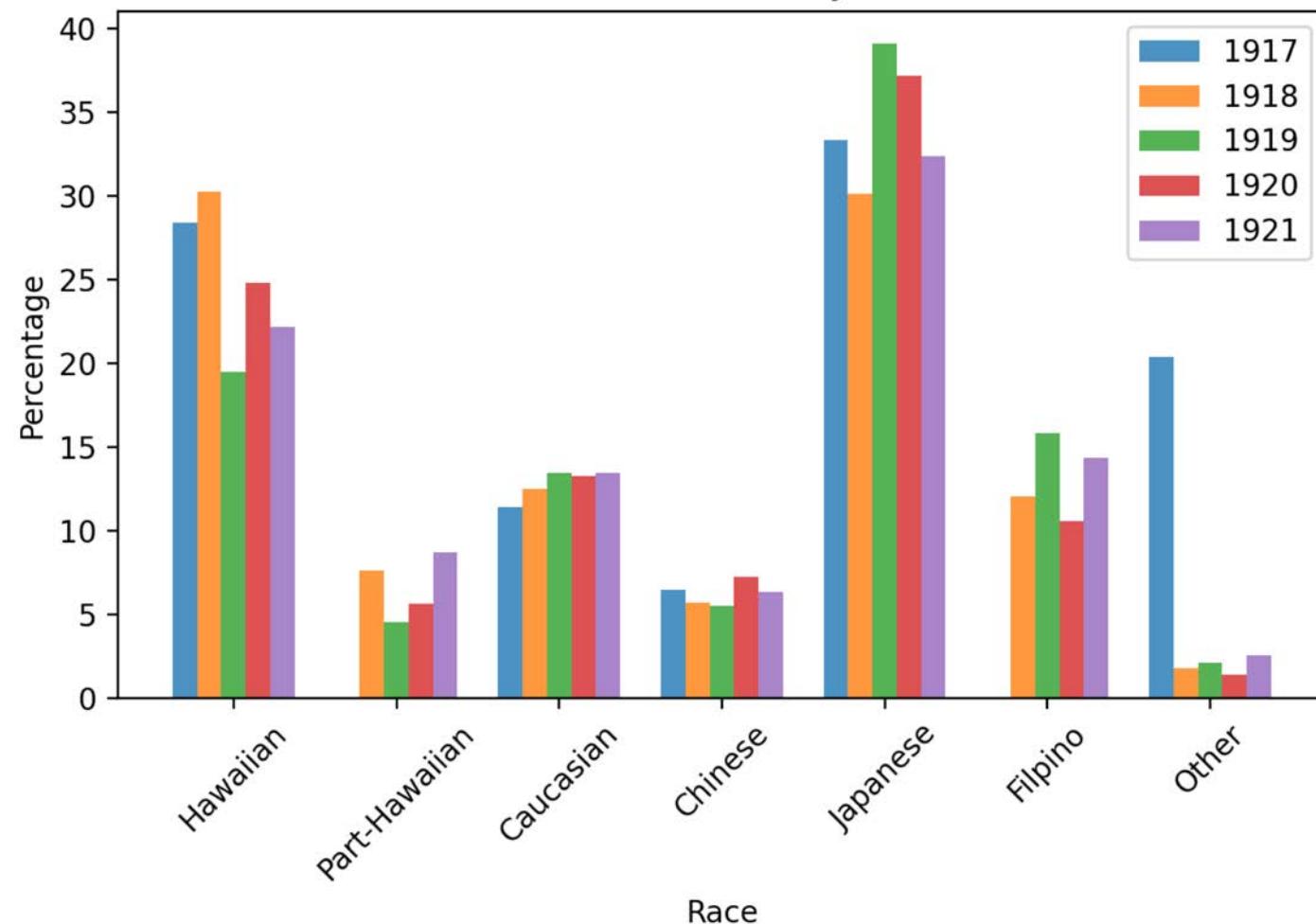
<sup>b</sup> Sex was not recorded for 1921.

<sup>c</sup> Part-Hawaiians and Filipinos combined with "Other" in 1917.

Death rates were highest for children under 5 and lowest for children between 5 and 19.

Sex death ratios remained the same.

Influenza Deaths by Race



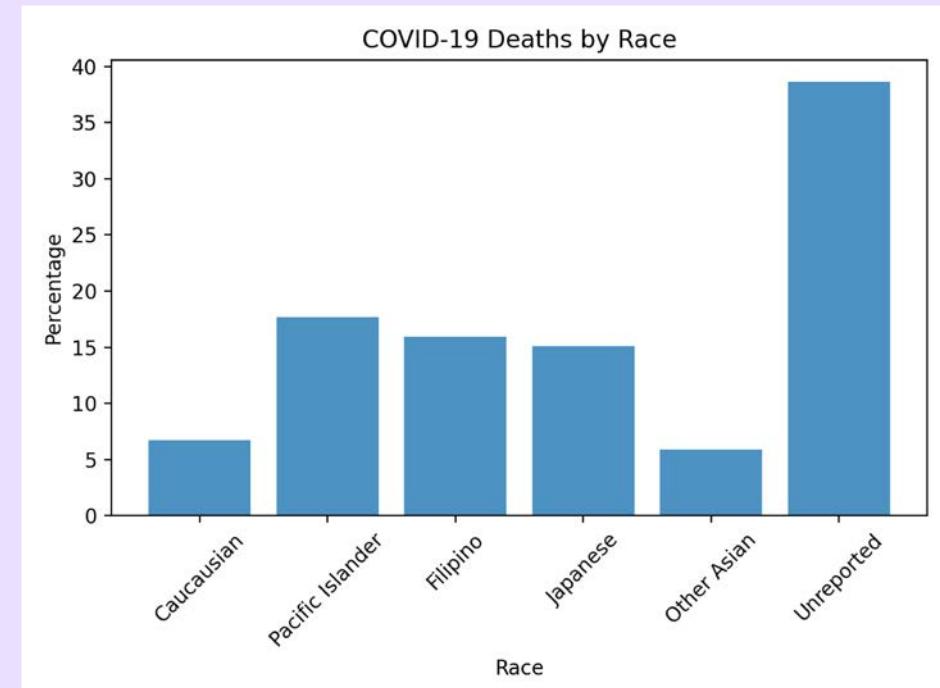
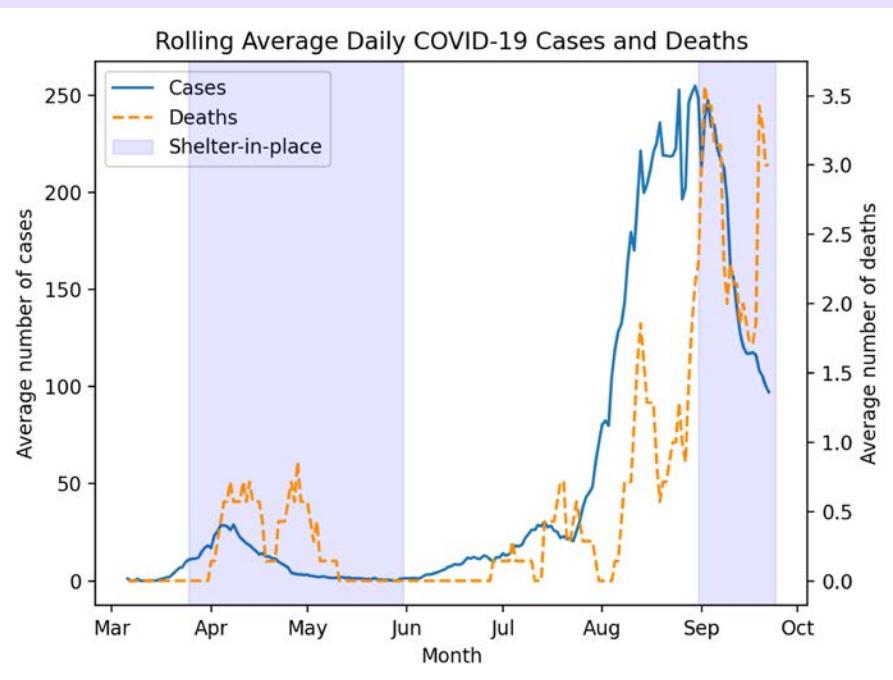
Flu deaths more strongly affected Japanese and pure Hawaiian ethnicities.

A photograph of four women performing a hula dance outdoors. They are wearing traditional hula skirts and face masks. The woman on the far left wears a grey t-shirt and a red hula skirt, and has her hands raised in a 'shaka' sign. The woman next to her wears a light green dress and a straw hat, also with hands raised. The woman in the center wears a white dress and a blue patterned mask, with her hands raised. The woman on the far right wears a blue patterned dress and a blue patterned mask, also with hands raised. They are standing in front of palm trees and mountains. The text 'COVID-19 in Hawai'i' is overlaid in large white letters.

# COVID-19 in Hawai'i

# Hawai'i Numbers (as of Sept. 22nd)

- 11,522 cases
  - 749 hospitalizations
  - 120 deaths
  - Death rate of approximately 1.04% of infected individuals.



Pacific Islanders are disproportionately affected by COVID-19 even though they make up only about 4% of Hawaii's population.

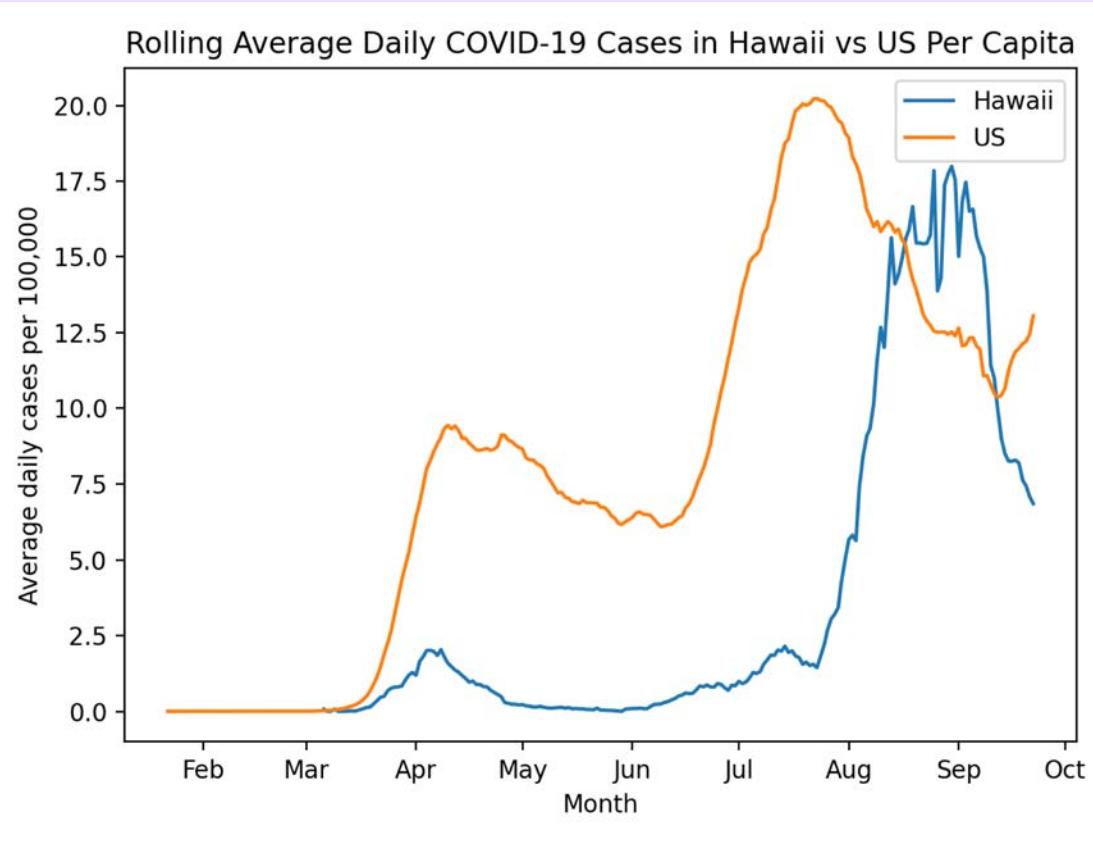
# By Age, Sex, and Race

Age	Deaths	Sex	Deaths	Race	Deaths	State Population
30-39 years	1	Male	79	Caucasian	8	25%
40-49 years	5	Female	40	Native Hawaiian	<5	21%
50-59 years	12	Total	119	Pacific Islander	21	4%
60-69 years	19			Filipino	19	16%
70-79 years	37			Japanese	18	15%
80+ years	45			Chinese	<5	4%
Total	119			Other Asian	7	4%
				Black	<5	2%
				Other	<5	8%
				Unreported	46	
				Total	119	

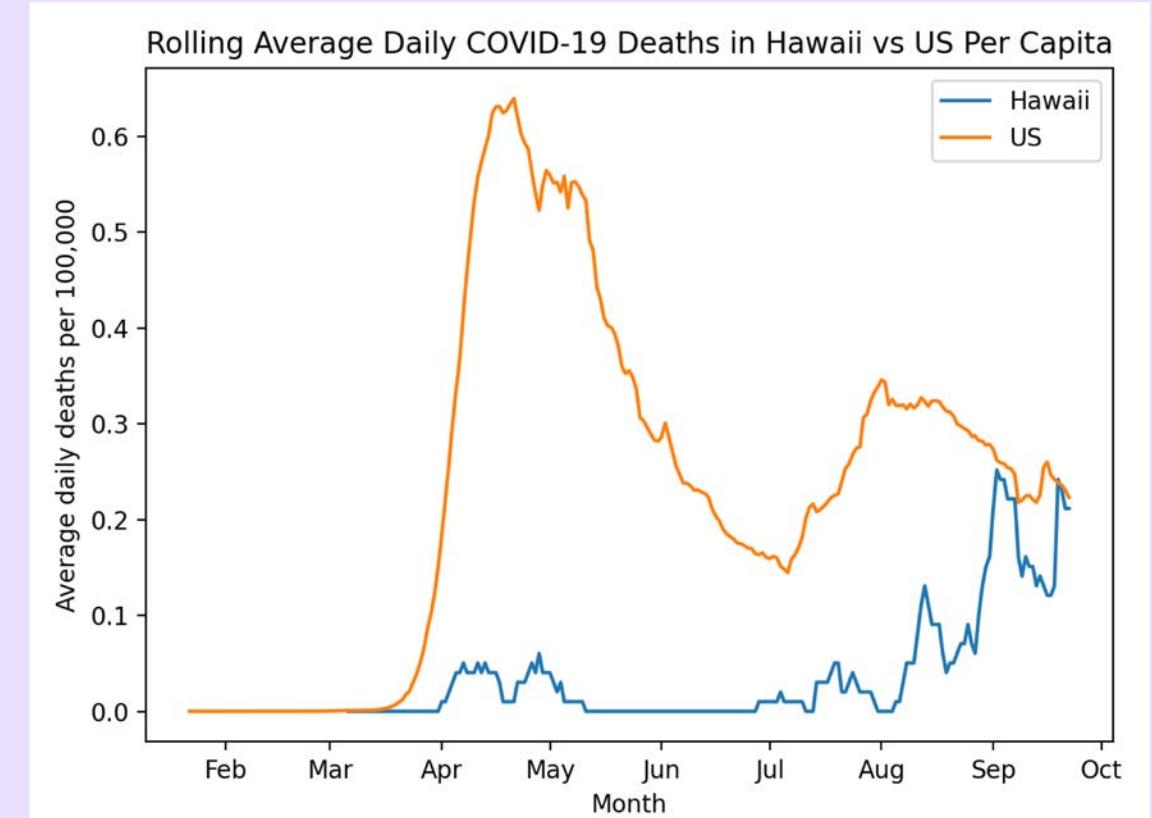
<sup>a</sup> Data available from the Hawai'i DOH up until September 18, 2020.

Further dashboards are available from the DOH and other various public sources

# Hawai'i and the United States (as of Sept. 22)

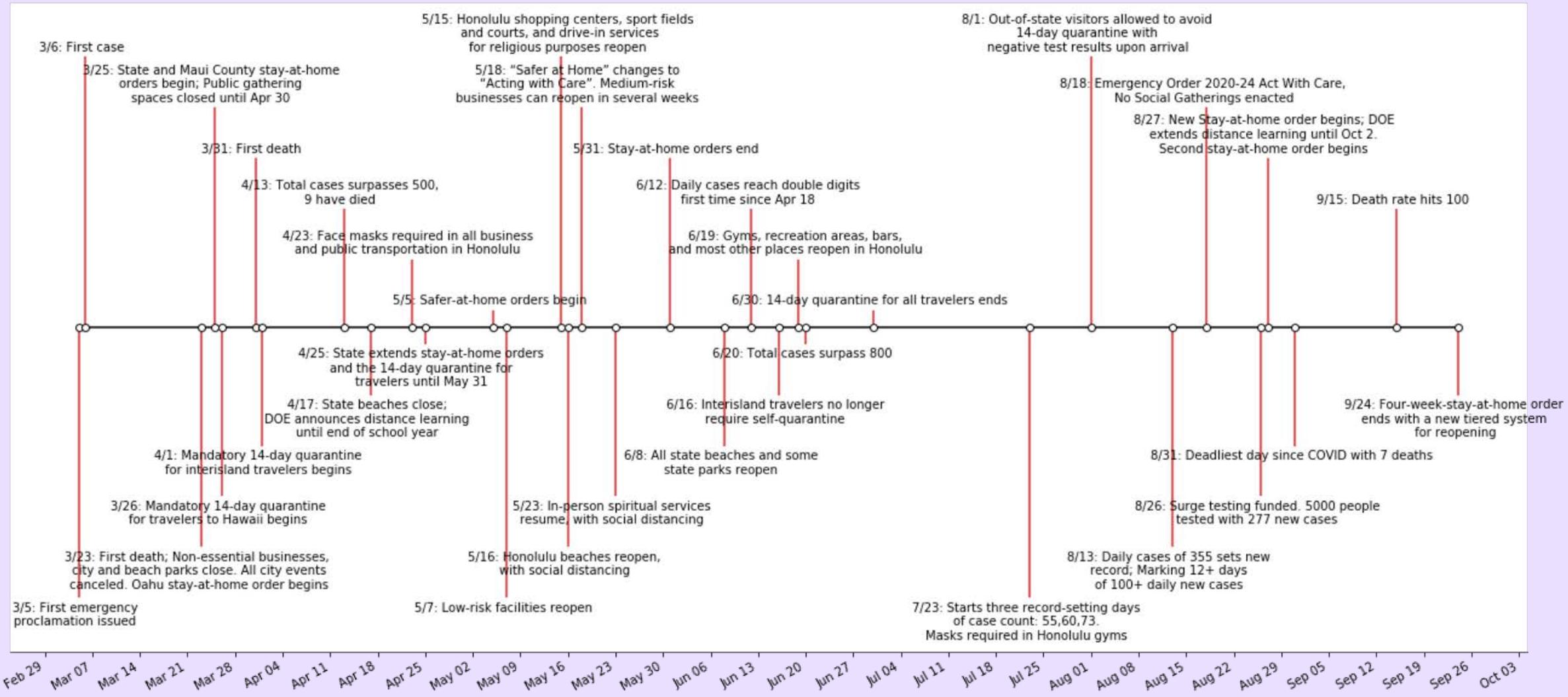


Hawai'i exhibits the same “waves” behavior that the rest of the nation does.



The death rate in Hawai'i is approximately 1.04%, which is lower than the current national average of approximately 2.92%.

# Timeline of COVID-19 Major Events in Hawaii

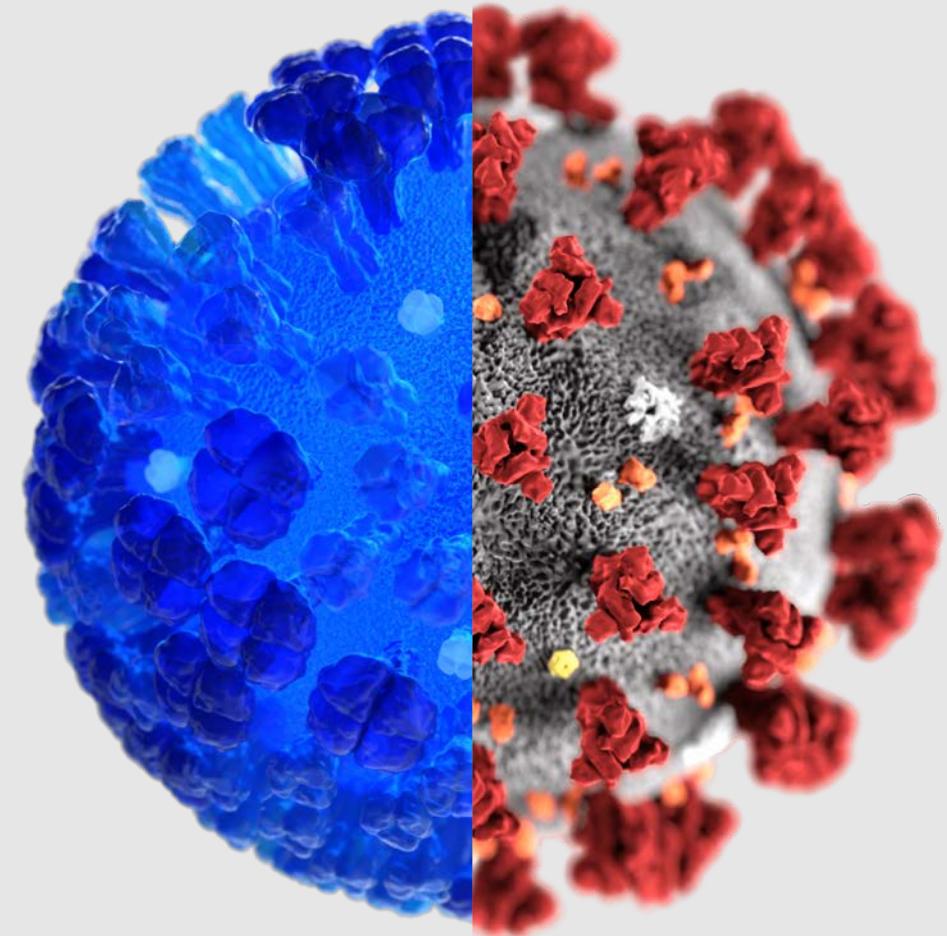


# 1918-1920

# Influenza versus

# COVID-19 in

# Hawai'i



CDC,  
<https://www.cdc.gov/flu/pandemic-resources/h1n1-summary.htm>  
<https://phil.cdc.gov/Details.aspx?pid=23312>

# Nuances of Comparison

- It may be too early to already compare the 1918-1920 Influenza pandemic to the COVID-19 Pandemic.
- Data for the 1918-1920 Influenza pandemic is limited to deaths, whereas the COVID-19 pandemic provides much more complete data.



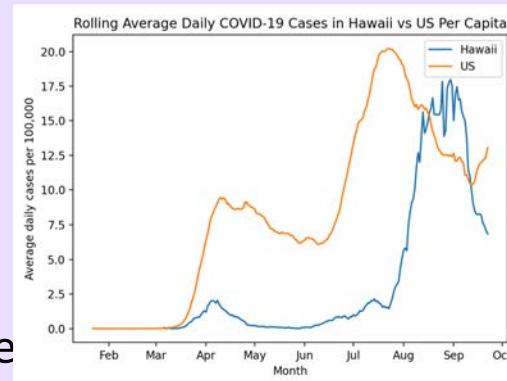
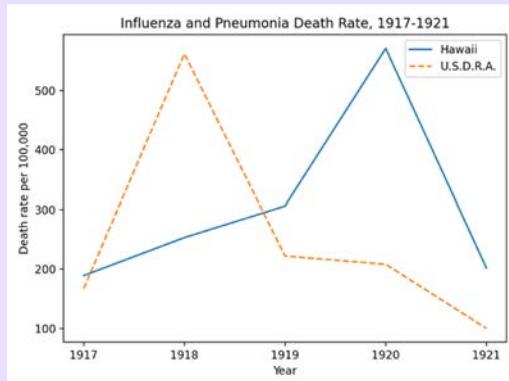
MOHAI

<https://www.historylink.org/file/20300>

# Comparisons and Contrasts - Deaths

## Comparisons:

- There is a delay of waves between the US and Hawai'i.



## Contrasts:

- Minority races at the time of the pandemic were disproportionately affected.

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- 5, while COVID-19 targets individuals older than 60.

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Subject	1917	1918	1919	1920	1921
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COVID-19 DEATHS BY AGE, SEX, AND RACE <sup>a</sup>					
Sex	Deaths				
Male	79				
Female	40				
Total	119				

<sup>a</sup> Data available from the Hawai'i DOH up until September 18, 2020.

INFLUENZA AND PNEUMONIA DEATHS BY AGE, SEX, AND RACE IN HAWAII, 1917-1921 <sup>a</sup>					
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Age	—	—	—	2	1

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80+ years	45
Total	119

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# Control Influenza, 2018-2020 Season

In initial stages of the pandemic, the public doubted the risk of the virus, comparing it to another type of annual flu.

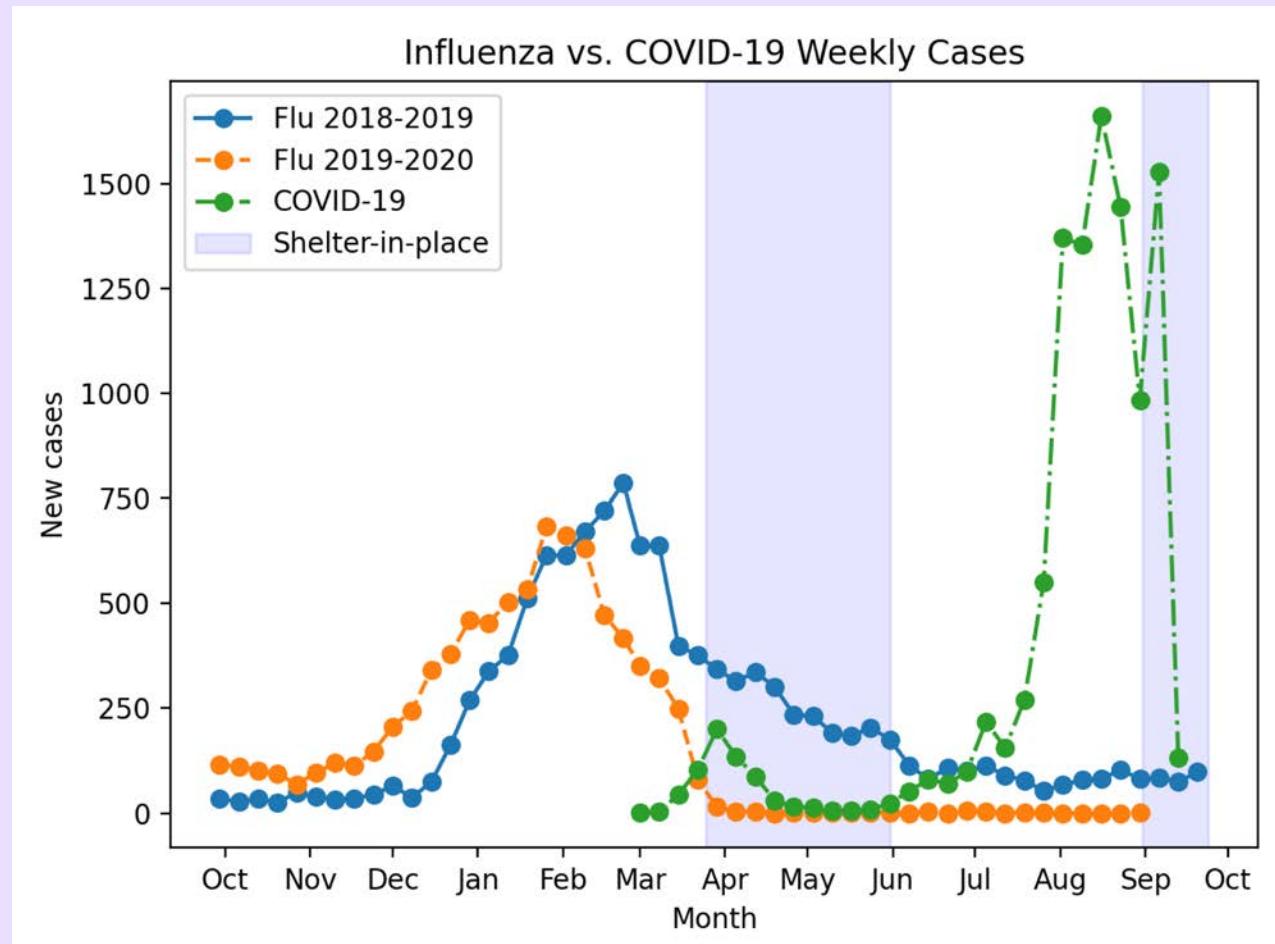
Now we will:

- Compare and contrast COVID-19 with the influenza through the *normal* seasons (2018-2019).
- Understand the effect of the COVID-19 pandemic on the new influenza season (2019-2020).



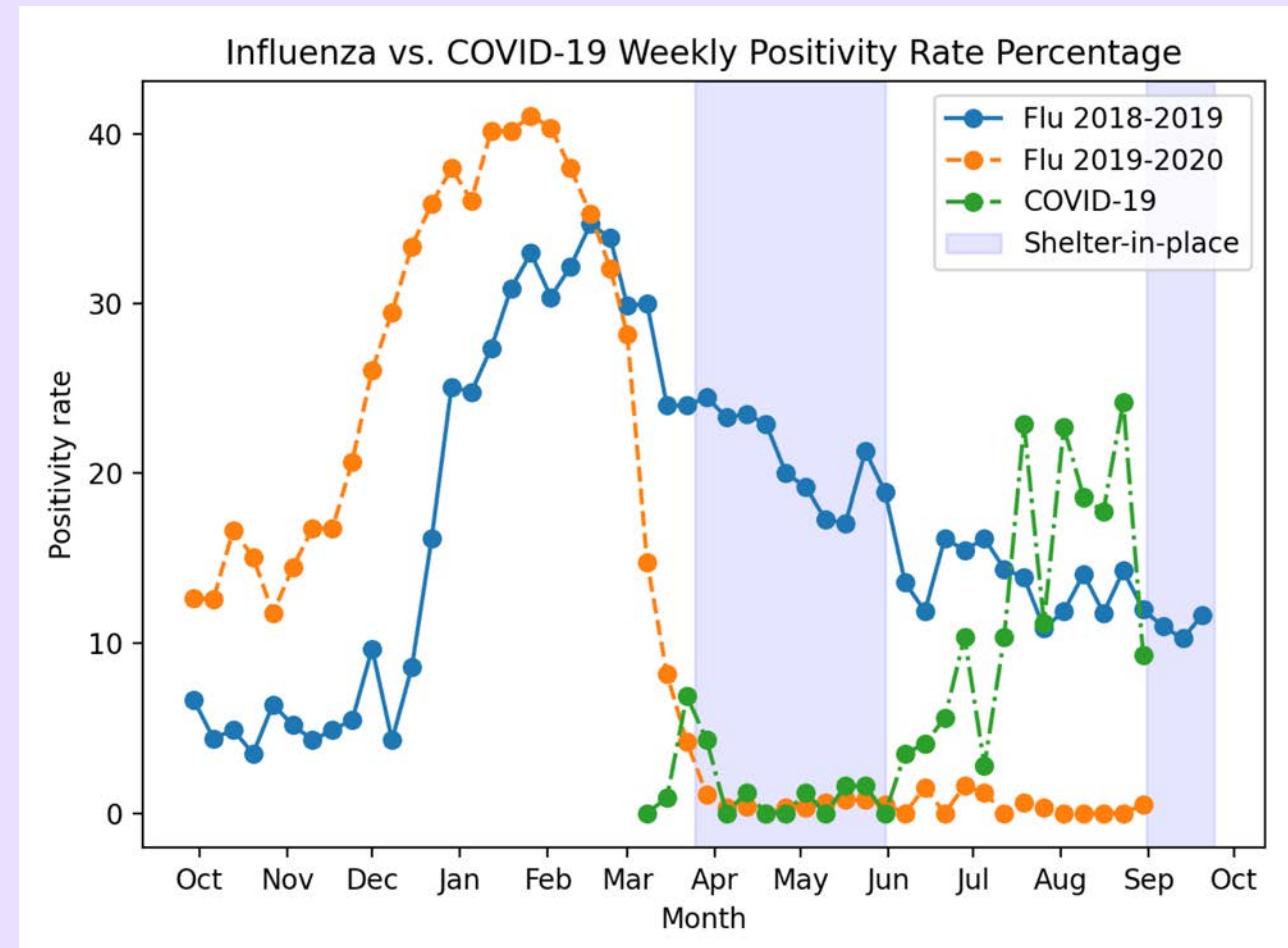
# Weekly Cases

- Influenza 2019-2020 was really similar to Influenza 2018-2019 leading up to the COVID-19 pandemic, but plummeted once the COVID-19 pandemic began.
  - A strong by-product of the stay-at-home order.
- The peak of cases for COVID-19 is more than double the peak of either flu.
  - Confirmation bias via. increased testing.
  - Higher reported infectious period of COVID-19.



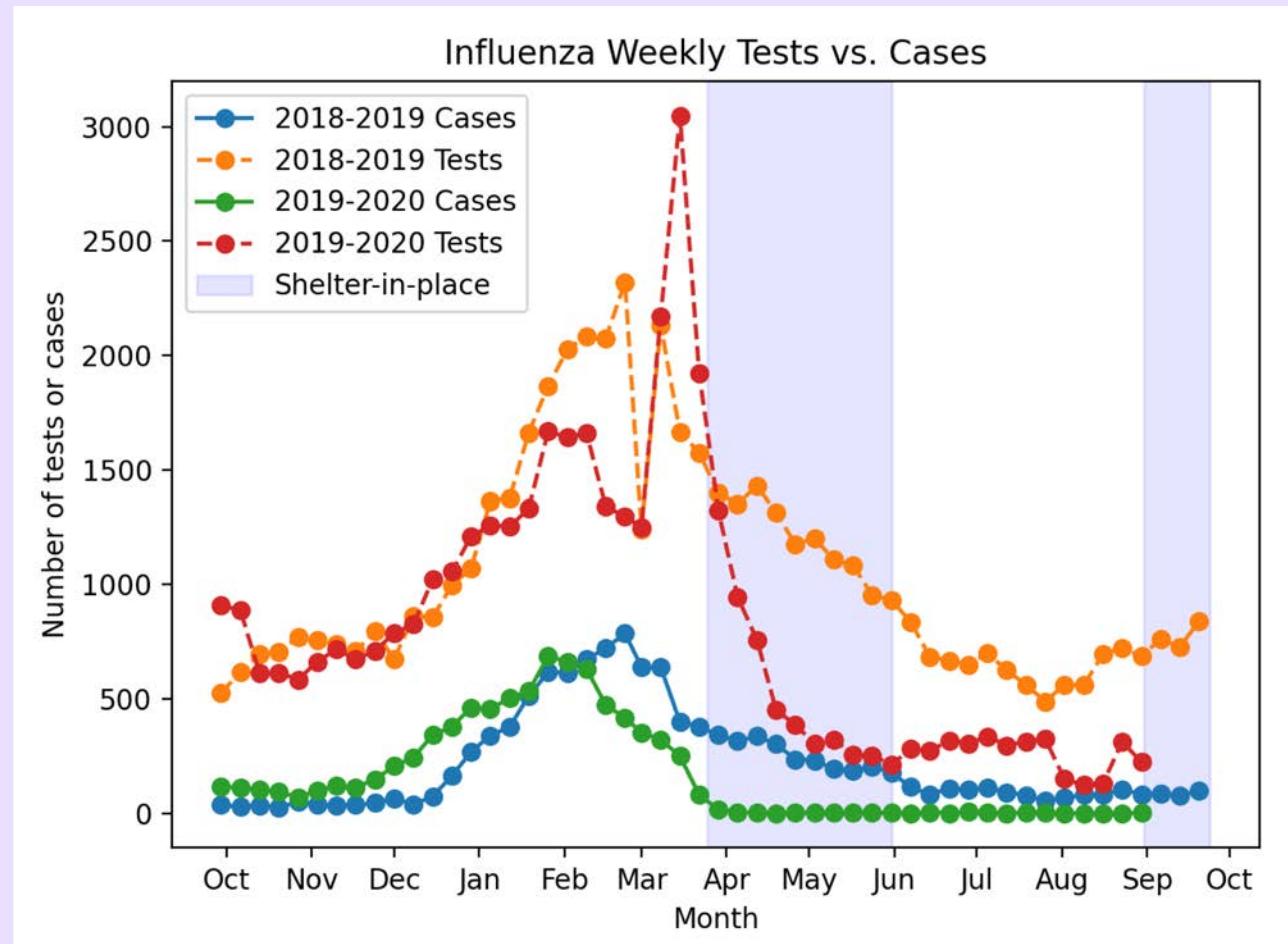
# Positivity Rate

- Influenza 2018-2019 has an average positivity rate of 17%, Influenza 2019-2020 has an average positivity rate of 13.7%, and COVID-19 has an average positivity rate of 2.2%.
  - Increased testing for COVID-19 likely affected Influenza 2019-2020, giving more negatives.



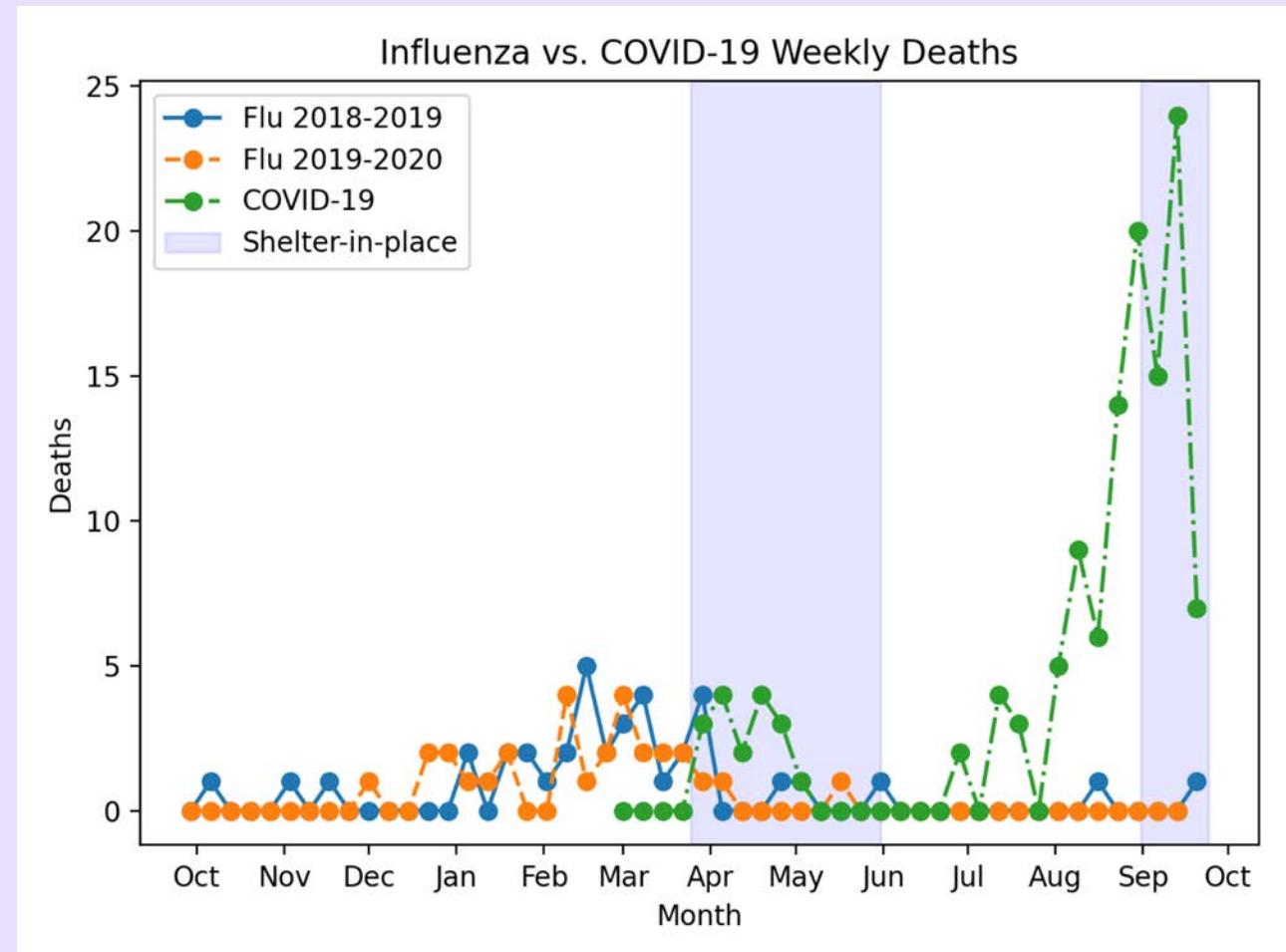
# Weekly Tests

- Before the stay-at-home order, the testing for influenza 2019-2020 significantly rose; however, once the stay-at-home order ended, testing for influenza 2019-2020 dropped.
  - The reason for this disparity is unknown, but we speculate that individuals with flu symptoms likely feared having COVID-19, and did not go to get tested.



# Weekly Deaths

- Influenza 2019-2020 did not stray far from Influenza 2018-2019 in this statistic, as they both decreased around the stay-at-home order.
- COVID-19 gives much more deaths than influenza, dismissing the idea of a “less dangerous flu”.



# How Will COVID-19 and Influenza Behave Together

Although it may be too early to draw definitive conclusions, the data shows similarities and differences between the two viruses.

With the new Influenza 2020-2021 season beginning, we will likely see less attention towards influenza and more towards COVID-19, leading to a tradeoff in damages.

# THANK YOU

