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Will covid-19 be eradicated?

Matthew Kieke
mtk56@uakron.edu

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Honors research Project

Will Severe Acute Respiratory Syndrome Coronavirus 2 (COVID-19) Be Eradicated?

Matthew Kieke

The University of Akron

Spring 2022

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Abstract

While the only thing talked about since March 2020 has been the covid-19 pandemic, I wanted to explore the relationship between other pandemics and diseases. Throughout this paper, I want you to understand what it means to eradicate a disease, the history of disease eradication, and get an idea of whether that is likely to happen with covid-19.

Introduction

This covid-19 pandemic has changed the world as we know it. As a student at the University of Akron, I used to attend classes in person four days a week. But the pandemic forced classes to go online. Countless people have gotten sick, had their businesses closed, or had to follow new restrictions. To show how disruptive on the economy covid-19 has been, I have included a graph of US unemployment over time from the ST Louis Fed (20).



Figure 1. The spike in 2020 attributed to Covid-19. This is significant because it is the largest spike since recording and warrants more investigation.

But instead of burying myself in despair, I chose this project because I wanted to find out more about how covid-19 could be eradicated. I wanted to go back to the “normal” that I remember before covid-19. I didn’t know much about the question, but I heard words like “endemic”, “forever pandemic”, and “anti-vaxer”. But I believe that because polio was eradicated by vaccination, maybe covid-19 can be eradicated by vaccination. However, I only know the headlines about polio eradication. I did not know what that meant. I also did not know how similar polio was to covid-19. And since the last pandemic in the United States was the Spanish flu, I wanted to learn more about it. *Therefore, in this paper I want to define the meaning of “eradication”, explain the history of various diseases that have been eradicated, compare, and contrast them to covid-19, and finally, answer the question: “Will covid-19 be eradicated”?*

Distinctions

I want to start by distinguishing between eradication and elimination. They are often used interchangeably, but they have similar, yet separate meanings. *OurWorldInData (1)*, the co-leading covid-19 case/death monitor says about the difference: “Eradication of a disease refers to a deliberate effort that leads to the permanent reduction to zero of the worldwide incidences of infection caused by a specific agent.” This also means no cases are recorded worldwide, and we also do not believe cases will develop. In contrast: “Elimination of a disease refers to the deliberate effort that leads to the reduction to zero of the incidences of infection caused by a specific agent in a defined geographic area.” This means that elimination is when zero cases are observed in a specific geographical region. Whereas eradication means zero cases are observed worldwide. A disease can be eliminated and eradicated, it can also be eliminated but not yet eradicated. An example of this is polio and the United States. It has been eliminated in the US for 30 years, but not eradicated because cases exist worldwide (22).

Eradication is quite rarer than elimination. So far, the world has only eradicated two diseases, smallpox (1980) and rinderpest (2011). However, *the International Task Force for Disease Eradication (ITFDE)*, an organization inspired by the successful eradication of smallpox (19), has listed seven candidates for potential eradication. Among their list, Polio and Guinea Worm disease are the two diseases are considered “Most likely to be eradicated”. The other five candidates are lymphatic fibrosis, measles, mumps, rubella, and cysticercosis are considered “targeted to be eradicated”. The distinction between the “Most likely to be eradicated” and “Target for eradication” is a “Most likely to be eradicated” disease means that all parts of the ITFDE list are currently met. But a “Target for eradication” only means that the criteria on the ITFDE list are met or planning to be met. In the following paragraph, I will explain the characteristics of the ITFDE list.

Fitting the ITFDE Characteristics of Eradication

For a disease to be eradicated, it first must be infectious. Second, it must have a vaccine or treatment after infection available.

To further guide you must consider the following questions:

- How many pathogens cause the disease?
The more pathogens cause the disease the more difficult it will be to eradicate
- Does the disease-causing pathogen have one or more hosts?
Diseases with multiple hosts are difficult to target for eradication because it often means that the disease will have to be eradicated in all of them
- Are there any identifiable symptoms of the disease?
Some diseases are not easy to detect in the first place, making treatment more difficult to start, and outbreaks harder to contain
- Has regional disease elimination proven possible?
A disease must show that it can be eliminated first as a proof of concept to be replicated worldwide

- Is the perceived disease burden high and is financial and political support available?

The perceived burden of a disease, the estimated cost of eradication, and the political stability of affected countries are factors in whether governments can successfully eradicate diseases

These criteria all must be met to be on the list of the ITFDE to be considered “Most likely for eradication”. If one of the above criteria is not met, they can still be planned to be met, to make the “Target for eradication” list. If neither of the above two conditions is met, then the disease will not be eliminated. As information changes about diseases and countries over time, additions to either list can be made. In the next paragraph, I will talk about smallpox.

Smallpox

While the origin of smallpox is not officially known, it was a disease that lasted over 2000 years. It is described as an acute contagious viral disease, that produces a fever and red pustules, and usually leave permanent scars. A timeline of the disease was created by Dr. Grant McFadden, Ph.D. He is a member of the WHO research oversight committee on Variola Viruses, which has been investigating how viruses evade the immune system for over 30 years (2, 3, 20).

>2000 BC	Smallpox appears in humans in Africa and the Far East
1157 BBC	Pharaoh Ramses V dies of smallpox
910 AD	Clinical disease first described (by Rhazes)
1096-1291	Crusaders accelerate smallpox importation to Europe
1507-1530	Aztec, Mayan, and Inca empires decimated by smallpox
1400-1800	European fatalities alone exceed 500 million/century
1763	First intentional use as a bioweapon (against Native Americans)
1798	Vaccination introduced by Jenner
1965	WHO initiates intensified worldwide eradication program
1977	Last natural case of smallpox (in Somalia)
1978	Last case of smallpox in humans (lab accident in the UK)
1980	WHO certifies worldwide eradication of smallpox
1983	All known variola stocks transferred to the two certified WHO collaborating centers (US and Russia)
1993	Variola DNA genome sequence published
1996	World Health Assembly (WHA) recommends variola destruction (in 1999)
1999	WHA recommends postponing destruction to permit further research with live variola virus
1999	First IOM report on research needs for live variola virus
1999	Biohazard published (K. Alibeck)
2001	US announces postponement of variola destruction
2009	Second IM Report on research needs for live variola virus
2011	WHA vote on destruction of the declared live variola virus stocks (expected)

Figure 2. What I believe to be the key to the eradication effort were two important factors: the vaccine development in 1798, and the WHO initiated the eradication program in 1965.

Vaccines reduce the incidence of cases and severe reactions to diseases. But a worldwide targeted eradication program involves providing vaccines to the poorer countries of the world, that do not have the money, or the political system to provide vaccines to their populations. I believe that vaccination leads to a more severe decrease in yearly deaths than a WHO-initiated eradication program, as evident by the graph below of the city of Boston data from Harvard (5).

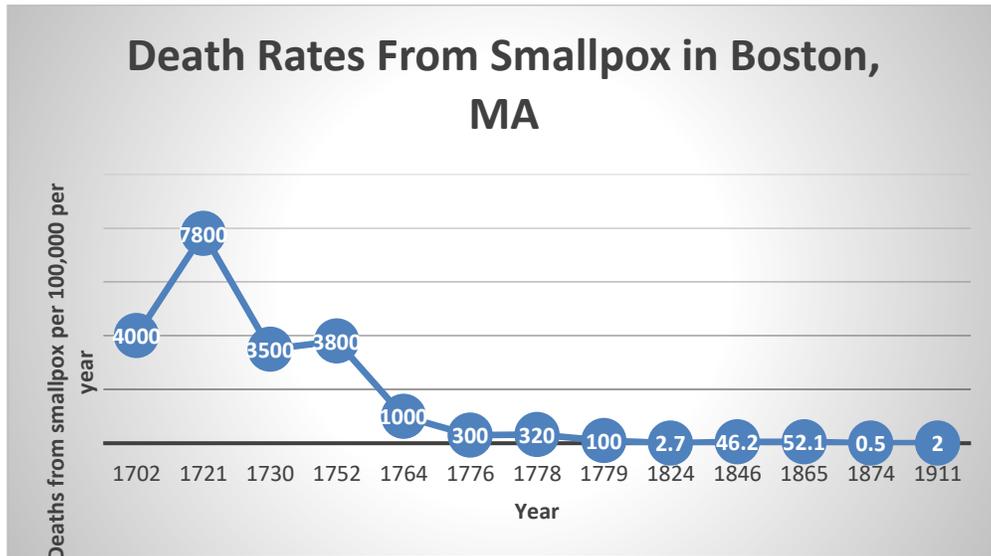


Figure 3. After Jenner’s vaccine was first used in 1800, the deaths of smallpox never returned to the levels of the 1700s.

Next, here is a graph of the number of countries that reported a smallpox case from 1950 to the eradication of the disease from Wallace (4).

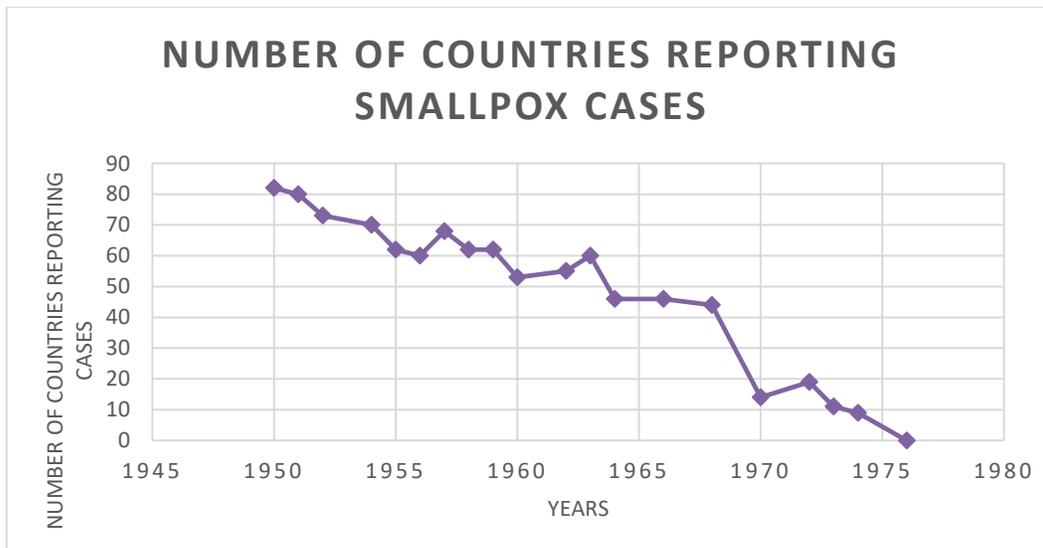


Figure 4. As you can see by the graph below after the WHO eradication program started in 1965, we saw a sharp drop in countries reporting cases, all the way to zero.

I believe that a worldwide vaccine distribution plan, like the one the WHO did as part of the eradication plan in 1965, leads to faster eradication of diseases, than a vaccine, based on the country case data.

Covid-19

Severe acute respiratory syndrome coronavirus 2, also known as covid-19, is a disease that caused the coronavirus pandemic. As of April 2022, covid-19 has killed 980,000 Americans, which is equivalent to .30% of the entire American population. Therefore, it has reason to be eradicated. Below we will discuss if covid-19 meets each of the ITFDE standards for the eradication of diseases.

- For a disease to be eradicated, it first must be infectious
Yes, it is infectious. Depending on the variant, covid-19 patients on average infect 2-10 other people (8).
- It must have a vaccine or treatment after infection available.
Yes, for both. According to the CDC website, 3 vaccines, and 15 treatments are available (9).
- How many pathogens cause the disease?
Multiple variants are separate pathogens, but they share enough characteristics to be considered similar.
- Does the disease-causing pathogen have one or more hosts?
While there have been documented positive cases in cats, dogs, and minks (10) the CDC admits: (11) “At this time, there is no evidence that animals play a significant role in spreading SARS-CoV-2”. Therefore, we can conclude that the only host is humans.
- Are there any identifiable symptoms of the disease?
According to a University of Florida study, 35% of all covid cases do not show symptoms. While the other 65% do show symptoms (12), a large plurality does not.
- Has regional disease elimination proven possible?
The graph below shows the daily recorded covid-19 cases in New Zealand, a country of 5 million people, from their department of health (13).

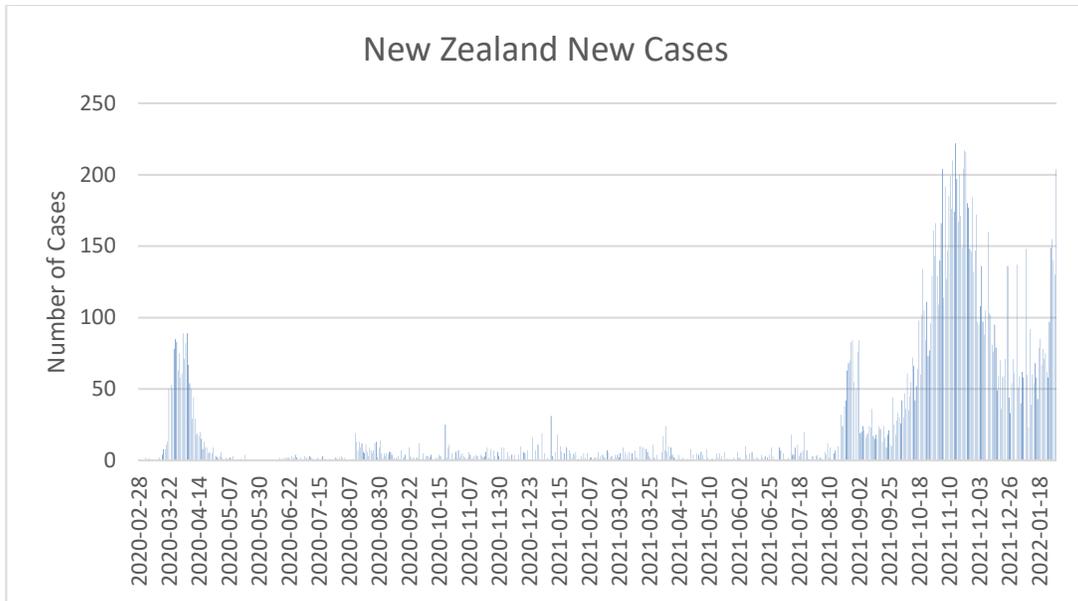


Figure 5. They had a few peaks, but they were all caused by variants originating outside of their borders. So yes, it can be eliminated at a regional level, if you ignore outbreaks caused beyond geographic boundaries.

- Is the perceived disease burden high and is financial and political support available?

The total federal spending to combat the pandemic over the last year is about \$6 trillion (14). The U.S. has spent about \$7.9 trillion on warfare since World War I, in inflation-adjusted dollars. This shows that financial support is available. But on the political support issue, is a different story. First, 28% of Americans are either unwilling or uncertain about getting vaccinated (15). Second, rich countries are blocking a patent waiver at the WTO, which would enable poorer countries to produce vaccines themselves (16). So, I don't believe the political support exists currently to eradicate covid-19.

In the next paragraph, I will compare Covid-19 to the Spanish flu.

The Spanish Flu

The 1918 Spanish influenza was caused by an H1N1 influenza A virus postulated to be of avian origin. The 1918 Spanish influenza lasted from 1918 to 1920. It infected many people worldwide. Below is a table summarizing the effects, from *Worldometer* (6), *Census.gov* (7) & *Demographia* (30).

	Spanish Flu	Covid-19
Worldwide Cases	500 mil	491 mil
% Worldwide Pop	33.30%	6%
US Cases	22 mil	80.1 mil
% US Pop	20.75%	25%
World Deaths	17-100 Mil	6.15 mil
% World Pop	1-6%	0.80%
US Deaths	.675 mil	.98 mil
% US Pop	0.60%	0.30%

Figure 6. From a proportional level, the Spanish flu was more infectious, and more deadly worldwide, than covid-19. Note: the covid-19 pandemic is ongoing and could surprise those numbers by the time it is over. As far as the US vs the world on a proportional level, the Spanish flu infected more of the worldwide population than the US population. Also, the Spanish flu was more deadly worldwide than in the US.

Second, the patient population differed. While the 1918 influenza killed a disproportionate number of 25–40-year-old, COVID-19 mostly affects those over the age of 65, especially those also with comorbidities. Third, while treatments and vaccines exist today for covid-19, neither an influenza vaccine nor antibiotics to treat associated secondary bacterial infections were available for the Spanish Flu. Therefore, the worldwide containment efforts relied heavily on isolation and quarantine, like the pre-vaccine/current efforts against COVID-19. Next, I will include graphs to explain the difference between the two pandemics.

Spanish Flu Vs Covid-19 Deaths Visualized

The first thing we need to be aware of when comparing data between these two pandemics is the difference in the US population over the last 100 years. In 1918, the US was about 80 million people in the registration states*(30), in contrast to 330 million by 2020 for the whole US (7). Second, we do not know exactly how many people died of the Spanish flu. Countrywide testing was not available as it is for covid-19. So, the common way to look at deaths is by looking at influenza and pneumonia deaths, according to HealthAffairs and the CDC (22-25).

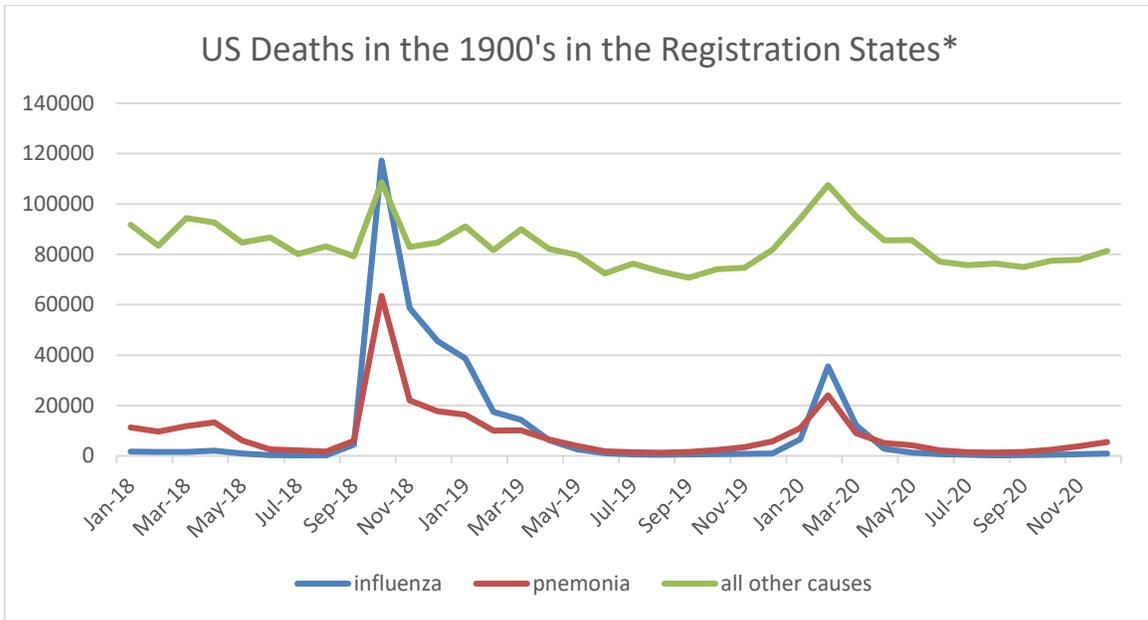


Figure 7. It appears to show two distinct rises in cases (Sept 18-Mar 19) & (Jan 20–May 20). *See Disclaimer to Registration States Paragraph

But to further evaluate the relationship between variables, I calculated some Pearson correlations from our data in the graph above.

Corr btwn Influenza & Pnemonia (Spanish-flu)	0.942124839
Corr btwn influenza and other deaths (Spanish Flu)	0.593773142
Corr Btwn pnemonia and other deaths (Spanish Flu)	0.756340694

Figure 8. The first indicates a very strong positive relationship. The second indicates a semi-strong positive relationship. The third indicates a strong positive relationship

Overall, I think that influenza and pneumonia move closely together, we can continue to use them for our analysis of the Spanish flu. And because “other deaths” move in the same direction with semi to strong strength, we can also keep using it for analysis.

Now, I’ll show a graph of the US monthly deaths during the covid-19 pandemic, with covid-19, influenza, pneumonia, and all other caused deaths from the CDC (26 & 27)

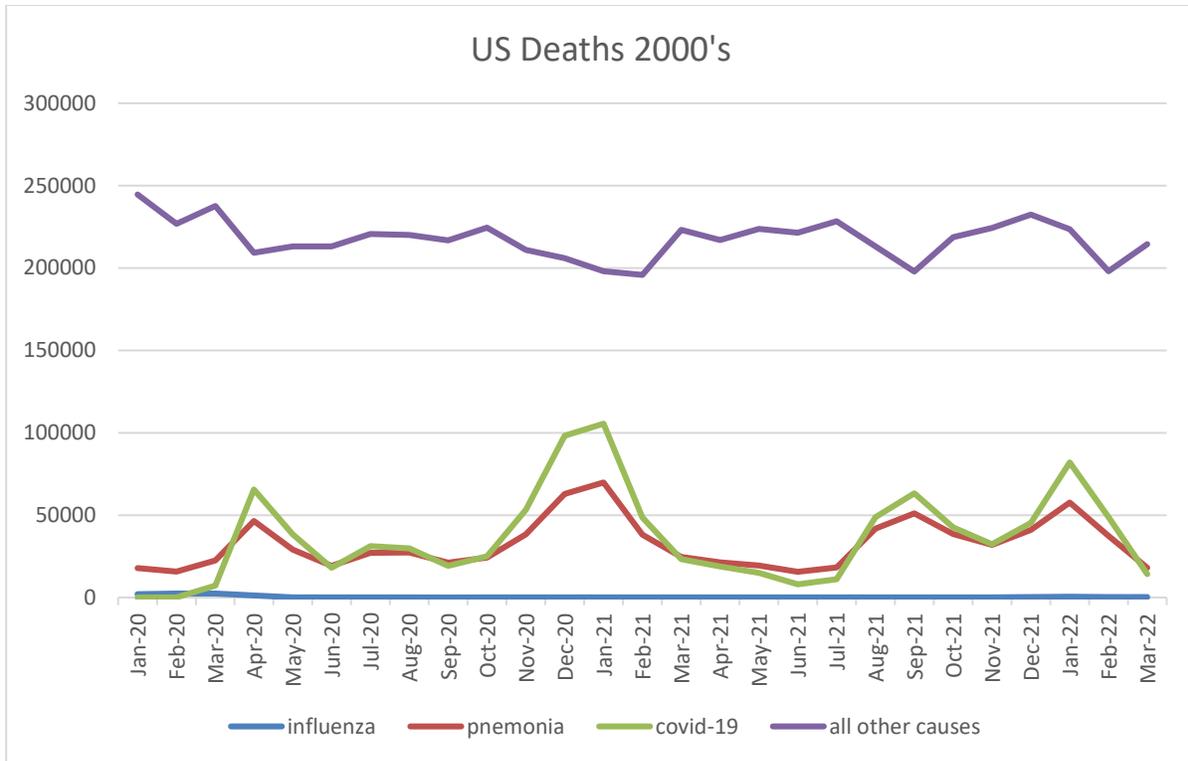


Figure 9. The first thing visually we can observe is a lack of clarity in direction over time. It appears only covid-19 and pneumonia deaths are moving in the same direction.

Therefore, we calculate a few more Pearson correlations from our data above.

Corr btwn covid-19 and Pneumonia	
	0.982829557
Corr btwn covid-19 and all other deaths (Covid-19)	
	-0.638831452

Figure 10. The first indicates a very strong positive relationship. The second indicates a semi-strong negative relationship.

We can rule out the influenza deaths as part of the covid-19 pandemic. They appear to be much lower than pneumonia and covid-19 deaths, which are highly correlated. We also should rule out “all other causes” deaths because while they may indicate a relationship of some sort, they don’t move in the same direction as covid-19 deaths.

Comparison

To compare the magnitude of the two diseases, I need to standardize the variables. The only way to standardize deaths is to make some assumptions about the US population,

specifically as in the registration states. First, our only available accurate sources on population is the 1910 and 1920 census data. While it's understood that the Spanish flu did start in 1918, which would undercount the true 1918 population since many people alive in 1918 did not make it to 1920. However, this is less growth in my opinion than 8 years of pre-birth control era births from 1910 to 1918. Therefore, I will use the 1920 population data to estimate the true 1918 population of the registration states. This number is about 80 million (30). Since 2020 US population is about 330 million (7), I will multiply the Spanish flu deaths by 4 and get adjusted deaths.

Second, covid-19 has 27 months of data. To keep dates normalized, I will use 27 months of Spanish flu data. To capture waves of the deaths, the best time to use would be May 1918 to July 1920. I number these months to further standardize. Last, I removed "All other causes" from the Spanish flu data to further declutter the line plot from the CDC and HealthAffairs data (22-26).

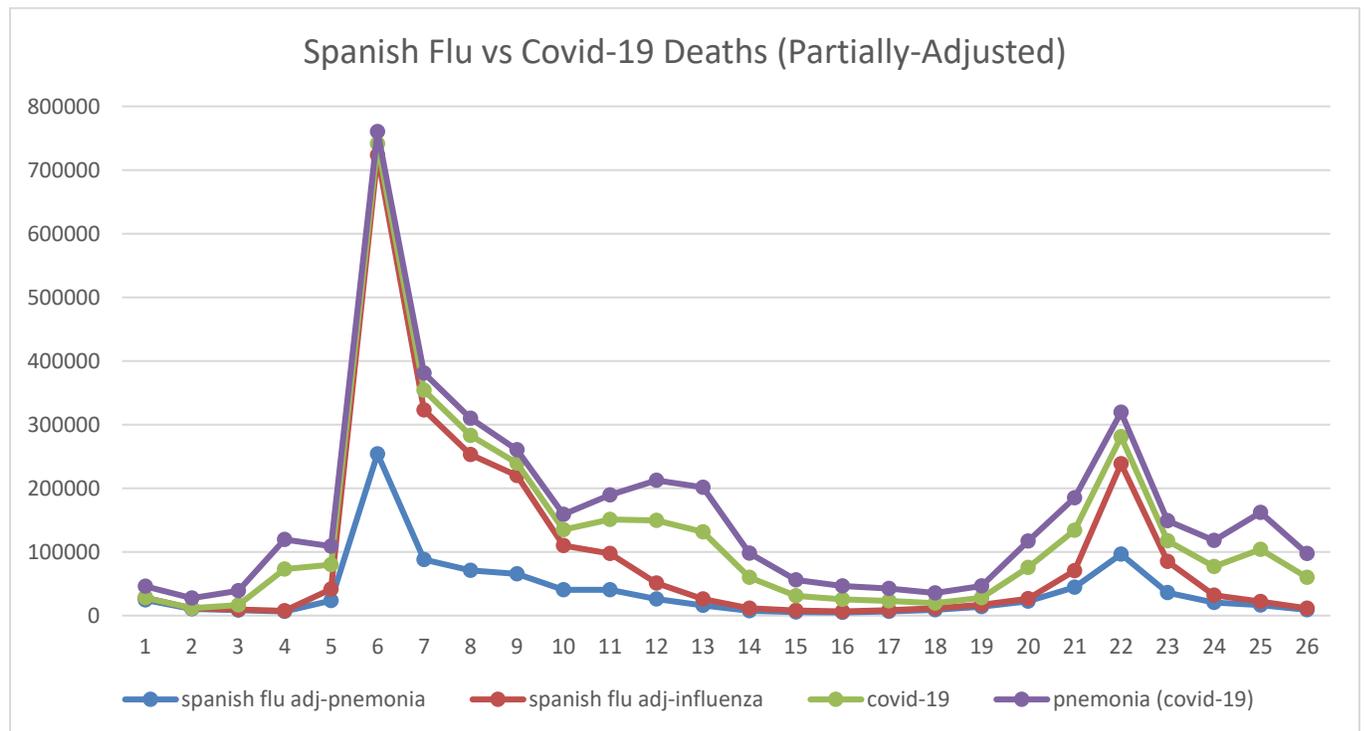


Figure 11. This line plot shows an astonishingly development of the two pandemics, with a few differences. They both peaked at around month 6 (Nov 1918 & June 2020), while gradually declining. After about 4 more months (Mar 1918 & Oct 2020), they diverged. Covid deaths stopped declining and started slowly increasing for 3 months (Jan 2021), only to continue to decline for 6 months. The last similarity was the increase around month 21 (Jan 1920 & Sept 2021) for only 3 months.

health scholar at the University of Maryland had to say on the issue: “*Not many hospitals accepted Black Americans, and those that did sent them to the basement for care*” (29). This can be interpreted to mean that Black Americans received substandard care in segregated hospitals—if they could even be admitted. These factors most likely offset each other; however, health data is scarce from this era, so it is inconclusive whether the registrations truly represented the true US Spanish flu population.

Conclusion

In closing, I do not believe the evidence supports the belief that covid-19 will be eradicated. While some may argue it meets multiple IDFTTE criteria, including infection, treatments, similar pathogens, identifiable symptoms in combination with testing, regional elimination, and financial support. However, it presently does not have the political support in the US, or the world, to be eradicated. If citizens of the US do not plan to be vaccinated, proven historically important in the reduction of cases, or lead plans to vaccinate the world, covid-19 will not be eradicated.

Sources

1. <https://ourworldindata.org/eradication-of-diseases#:~:text=Eradication%20means%20that%20intervention%20measures,in%20a%20defin ed%20geographic%20area.>
2. <https://www.cdc.gov/smallpox/history/history.html>
3. https://www.researchgate.net/figure/History-of-Smallpox-Timeline-of-a-Serial-Killer_fig2_41401449
4. http://www.whale.to/vaccine/smallpox_graphs_h.html
5. <https://sitn.hms.harvard.edu/flash/special-edition-on-infectious-disease/2014/the-fight-over-inoculation-during-the-1721-boston-smallpox-epidemic/>
6. <https://www.worldometers.info/coronavirus/>
7. <https://www.census.gov/popclock/>
8. <https://www.npr.org/sections/goatsandsoda/2021/08/11/1026190062/covid-delta-variant-transmission-cdc-chickenpox>
9. <https://www.fda.gov/drugs/coronavirus-covid-19-drugs/coronavirus-treatment-acceleration-program-ctap>
10. <https://www.vetmed.ucdavis.edu/news/information-animals-covid-19>
11. <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html>
12. <https://epi.ufl.edu/articles/35-percent-of-all-covid-19-infections-never-show-symptoms.html>
13. <https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-data-and-statistics/covid-19-current-cases>
14. <https://www.chicagotribune.com/opinion/commentary/ct-opinion-covid-relief-package-cost-obrien-20210312-3bi5g7uxgfe6ngbfutj7luudey-story.html>
15. <https://morningconsult.com/covid19-vaccine-dashboard/>
16. <https://www.reuters.com/business/healthcare-pharmaceuticals/exclusive-wto-chief-says-vaccine-answer-close-facing-effort-block-it-2021-12-16/>
17. <https://pmj.bmj.com/content/97/1147/273>
18. <https://www.cartercenter.org/health/itfde/index.html>
19. http://ufrfprofessors.feed.research.ufl.edu/ufrf_professors/mcfadden-d-grant/
20. <https://fred.stlouisfed.org/series/UNRATE>
21. <https://www.cdc.gov/polio/what-is-polio/polio-us.html#:~:text=Thanks%20to%20the%20polio%20vaccine,poliovirus%20in%20the%20United%20States.>
22. https://www.cdc.gov/nchs/data/vsushistorical/mortstatsh_1918.pdf
23. https://www.cdc.gov/nchs/data/vsushistorical/mortstatsh_1919.pdf
24. https://www.cdc.gov/nchs/data/vsushistorical/mortstatsh_1920.pdf
25. <https://www.healthaffairs.org/doi/10.1377/forefront.20210329.51293/full/>
26. <https://www.cdc.gov/nchs/nvss/vsrr/covid19/index.htm>
27. <https://wonder.cdc.gov/controller/datarequest/D76>
- 28.

[https://www.academia.edu/43348347/Historical Insights on Coronavirus Disease 2019 COVID 19 the 1918 Influenza Pandemic and Racial Disparities Illuminating a Path Forward.](https://www.academia.edu/43348347/Historical_Insights_on_Coronavirus_Disease_2019_COVID_19_the_1918_Influenza_Pandemic_and_Racial_Disparities_Illuminating_a_Path_Forward)

29. [https://www.history.com/news/1918-flu-pandemic-african-americans-healthcare-black-nurses.](https://www.history.com/news/1918-flu-pandemic-african-americans-healthcare-black-nurses)

30. [http://www.demographia.com/db-state1900.htm.](http://www.demographia.com/db-state1900.htm)