Pandemics Past and Present: Social Impacts Connecting the Second Plague Pandemic to COVID-19

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Background

Yersinia pestis, the bacterium behind the bubonic plague, was passed from port to port as merchant ships traveled. Yet economic expansion from merchant activity did not reach the general population and left many families to struggle in poverty (Bridbury, 1977)

SARS-COV-2 is transmitted from person-to-person via respiratory droplets (CDC.gov). It spread quickly as well, leading to travel bans and lockdowns.

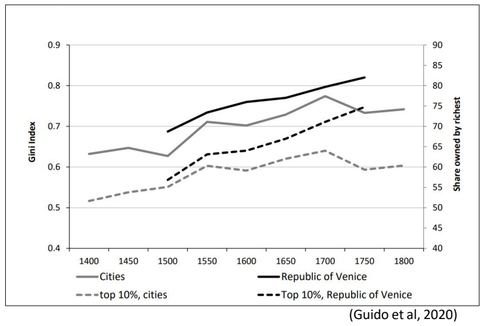
Relevant Statistics

According to the CDC, People of color had a rate ratio of death that was **7.6x** that of White, Non-Hispanic persons

Hate crimes against Asian Americans were **39.2%** more likely to be carried out by strangers (Zhang et al, 2021)

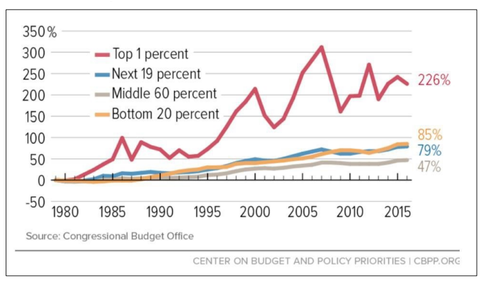
Wealth Distribution Timeline

Venice by Gini Index

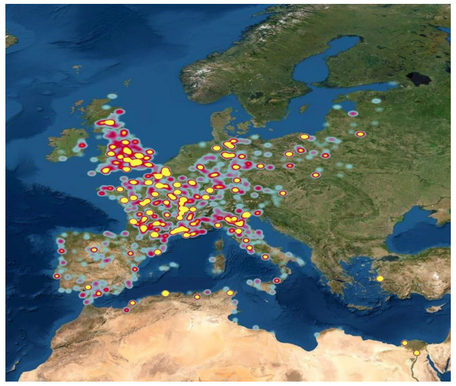


(Guido et al, 2020)

United States by Income Gains

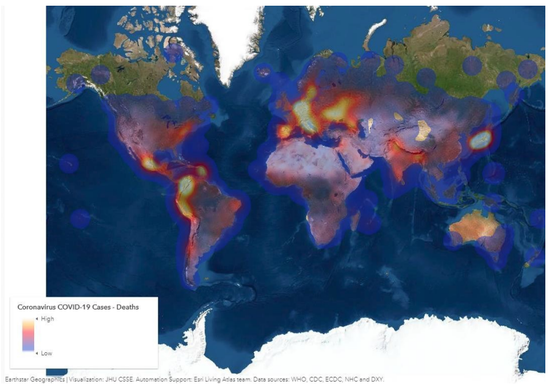


Methods and Materials



Bubonic Plague in Europe Cases/Deaths Heatmap (1347-1900)

A survey of recent literature and data revealed the that social inequality increases the number of deaths and the rate of transmission. To further investigate this phenomenon samples will be retrieved from burial sites on the island Lazzaretto Vecchio and analyzed though proteomics, stable isotopes, and genomics techniques.



COVID-19 Cases/Deaths Worldwide Heatmap (up to 3/16/21)

Results

Observed Inequalities: Second Plague

- Bioarchaeology studies performed on plague victims have produced evidence of malnutrition and poverty. Using skeletal remains from the East Smithfield cemetery collection in London along with two medieval Danish urban parish cemeteries for control, it was discovered that adult stature correlated to mortality risk (DeWitte & Hughes-Morey, 2012).
- Another study with samples from the same East Smithfield cemetery compared to other Danish cemeteries concentrated on the relationship between frailty and mortality.
- The results suggested that individuals without skeletal lesions (considered healthy) were less likely to die than those with them (DeWitte & Wood, 2008).
- *Yersinia pestis* can be identified through high-throughput real-time PCR (Thi-Nguyen et al, 2011). Thus, plague victims can be distinguished from those that passed of other ailments but were collected from the same burial site.
- While Jews did not have a higher risk of dying from plague, antisemitism did increase as did instances of violence against Jews in Europe (Cohn, 2007).
- The amounts of death across social classes led to the appearance of inequality decline but in the social upheaval that followed inequality grew as measured by Gini indexes (Alfani 2020).

Skeletal lesions present → Malnutrition identified → Increased risk of death from the plague

Observed Inequalities: COVID-19

- For some, direct contact with other persons was unavoidable whether it was due to their profession or living environment.
- Factors outside of one's control put people at a higher risk including education and income level (Hawkins et al, 2020).
- The disparity between those who could find work during the pandemic and those who could not was visible both in Europe and the United States (Adams-Prassl et al, 2020).
- Whether or not individuals could work remotely and reliance on public transportation factored into their risk of exposure outside of the home (Ananat & Gassman-Pines, 2020).
- Financial insecurity and food insecurity became even larger concerns during the pandemic as employees that were not laid off or furloughed suffered work hours cuts and thus a smaller paycheck (Ananat, & Gassman-Pines, 2020).

Rate ratios compared to White, Non-Hispanic persons	American Indian or Alaska Native, Non-Hispanic persons	Asian, Non-Hispanic persons	Black or African American, Non-Hispanic persons	Hispanic or Latino persons
Cases[1]	1.9x	0.7x	1.1x	1.3x
Hospitalization[2]	3.7x	1.1x	2.9x	3.2x
Death[3]	2.4x	1.0x	1.9x	2.3x

CDC.gov

Discussion

- The impact of race and socioeconomic status on one's probability of being exposed to COVID-19 is a reflection of current disparities in American society.
- During the bubonic plague there was not a concerted effort to provide equal treatment for the rich and the poor as demonstrated in Bologna where wealthy individuals could escape and quarantine while everyone else was stuck inside the walls of the city (Sabbatani et al, 2021).
- Wealth provided access to better plague hospitals and an opportunity to try a wider variety of treatments (Sabbatani et al, 2021).
- The economic consequences of pandemics tend to be asymmetric and whether the results came out of the plague or COVID-19 there was an impact on the affected countries' demographics (Alfani, 2021).

Conclusions

During epidemics, social inequalities are brought to the forefront.

- Social groups become more stratified by financial and health stressors, and existing prejudice can lead to violence.
- This data demonstrates why all benefit from helping those at a disadvantage instead of ignoring the disproportionate odds within communities of color and those from lower-income households.
- Current knowledge of infectious diseases and their impact on society still contains gaps and must continue to be expanded.
- The USF Venice project will uncover what factors contributed to the death of plague victims and how that knowledge can be applied to the modern-day.

Future Directions

Future research should continue to study past outbreaks of disease and compare their findings to modern society.

Distinct patterns emerge from history and must be acknowledged in order prepare more effectively for future epidemics.

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Acknowledgements

Data collection for the USF Venice Project has been halted due to the COVID-19 pandemic, but there are plans to continue the work with a multidisciplinary team.

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