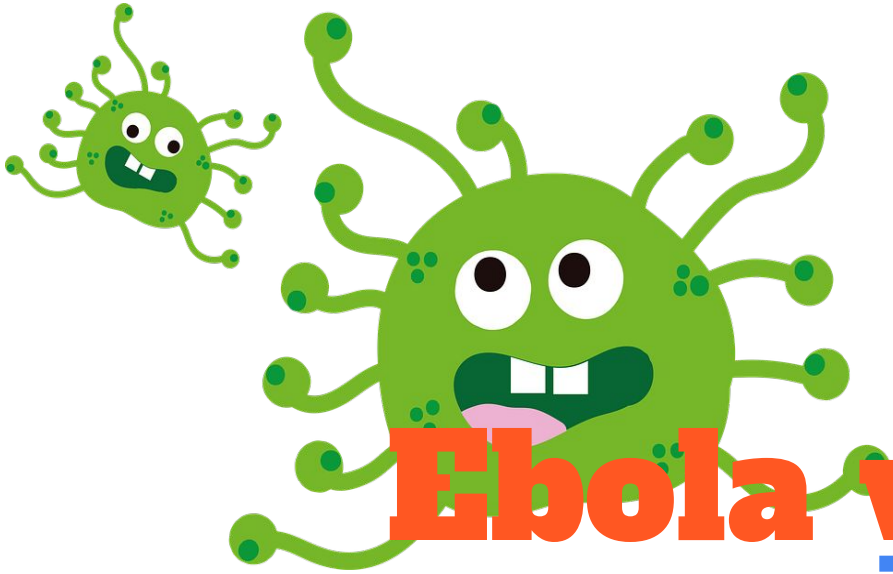

Ebola vs SARS

A Look at Infection and Mortality Rates

Jsons and the Pretty Pprintcesses

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Purpose

In the midst of the current pandemic, we wanted to evaluate past viral outbreaks to study the effects of population and spreadability on mortality rates. In this analysis we focused on two recent outbreaks, Ebola outbreak in West Africa from 2014-2016 and the SARS outbreak in 2003.

We asked ourselves:

What are the cumulative number of cases and deaths for both viruses? Which countries were the most affected?

Are there differences in mortality rate for each disease? Does healthcare systems have an impact on total cases and deaths?

How prevalent are these viruses in the countries they affect?

Description of Ebola and SARS

Ebola Virus

Viral illness primarily located in West Sub Saharan Africa. Mostly spread human to human but can also be spread from contact with an infected non human primate. Has an R nought value of 1.5 - 1.9

How Ebola is Spread

Aside from non human contact, Ebola is spread through contact with the blood or body fluids of an infected person. The virus can stay on surfaces for up to 7 days.

Symptoms

Influenza like symptoms including fever, headaches, cough, body aches and diarrhea. Extreme cases have seen ebola hemorrhagic fever and kidney and liver failure.

Description of Ebola and SARS

SARS (Severe Acute Respiratory Syndrome)

Viral respiratory illness caused by the coronavirus. It is uncertain how it was transferred to humans but it is believed to have originated from an animal virus. The first case was reported in China in 2003 and the outbreak was mainly spread throughout East Asia and North America. Has an R nought value of 0.19 - 1.08

How SARS is Spread

It is spread human to human, mainly airborne through respiratory droplets (coughs and sneezes). The virus can also be spread through contaminated objects handled by infected individuals.

Symptoms

Influenza like symptoms including fever, headaches, cough, body aches and diarrhea.

Project Description

During our research we found that both outbreaks spread to various countries around the world but they were mainly concentrated in a few countries. For example SARS was reported in 36 countries but only had 6 countries with over 100 cumulative cases. Similarly Ebola cases were reported in 10 countries but on 3 showed significant cases.

We hypothesize that Ebola will have more cumulative cases due to the virus having a higher r0 value. With the higher infection rate, deadlier symptoms, and less developed healthcare systems Ebola will see a higher death rate in affected countries.

Ebola: “A first-world virus on a third-world region”

What countries did Ebola affect the most?

Country	Latitude	Longitude
Guinea	9.945587	-9.696645
Liberia	6.428055	-9.429499
Sierra Leone	8.460555	-11.779889

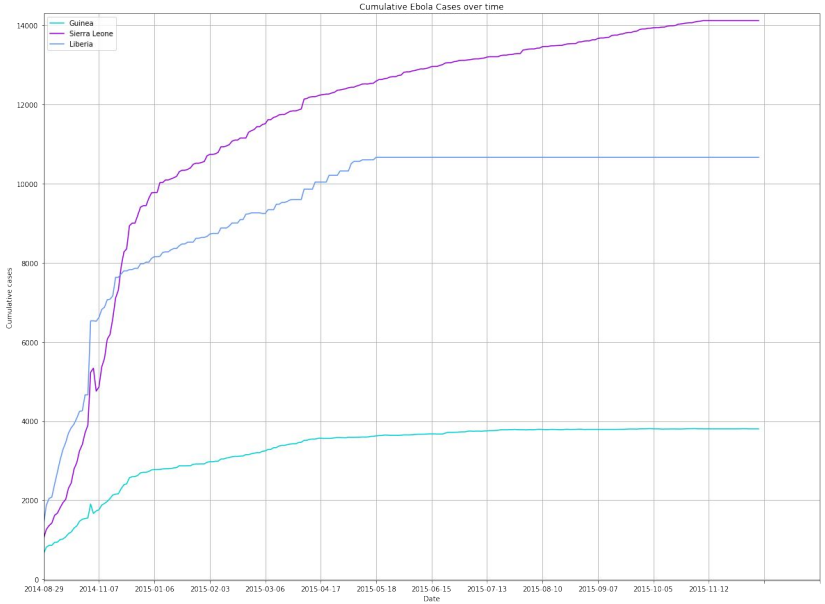
Were these countries prepared for the disease?

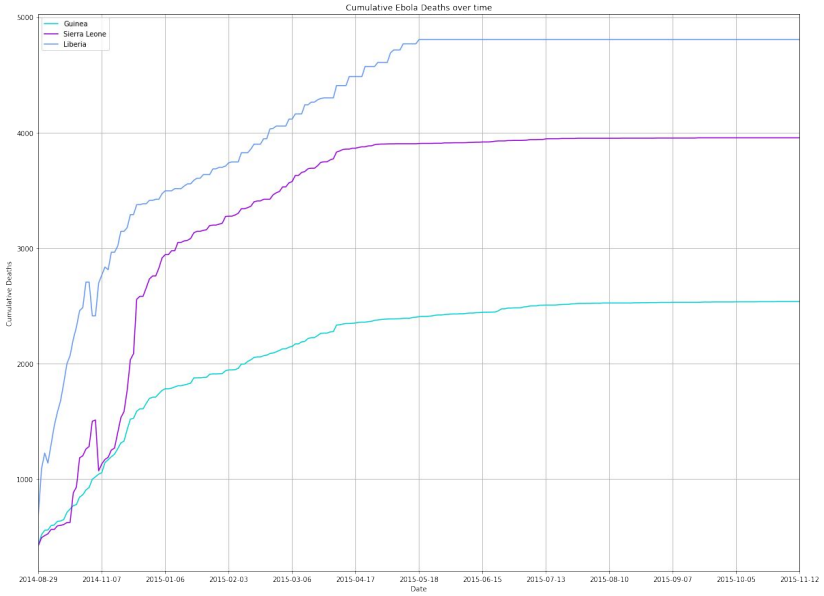
	Country	Cases	Deaths	Population	GDP per capita (USD)	Hospital beds per 1000 people	Cases per 10,000 population	Deaths per 10,000 population
0	Guinea	3810	2536	11150977	1064	0.3	3.42	2.27
1	Liberia	10666	4806	4359505	621	0.8	24.47	11.02
2	Sierra Leone	14122	3955	7017144	504	0.4	20.12	5.64

	Country	Type	Population	GDP per capita (USD)	healthcare expenditure (% GDP)	Pandemic Prepardness Score	Hospital beds per 1000 people
0	Guinea	Ebola	11150977	1064	4.12	32.7	0.3
1	Liberia	Ebola	4359505	621	8.16	35.1	0.8
2	Sierra Leone	Ebola	7017144	504	13.42	38.2	0.4

*Civil unrest is common in this region, which might be an additional cause of the disease's rapid spread/evolution

Ebola: Cases & Deaths



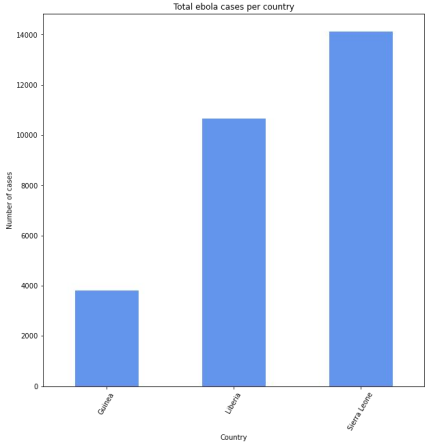


Ebola Death Rate

Country	Death Rate
Guinea	66.6%
Liberia	45.1%
Sierra Leone	28%

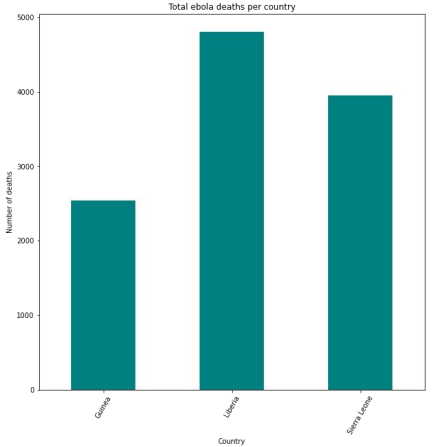
Country	Cases
Guinea	3810.0
Liberia	10666.0
Sierra Leone	14122.0

Cases



Country	Deaths
Guinea	2536.0
Liberia	4806.0
Sierra Leone	3955.0

Deaths



Sars: “Deadly but not so deadly”

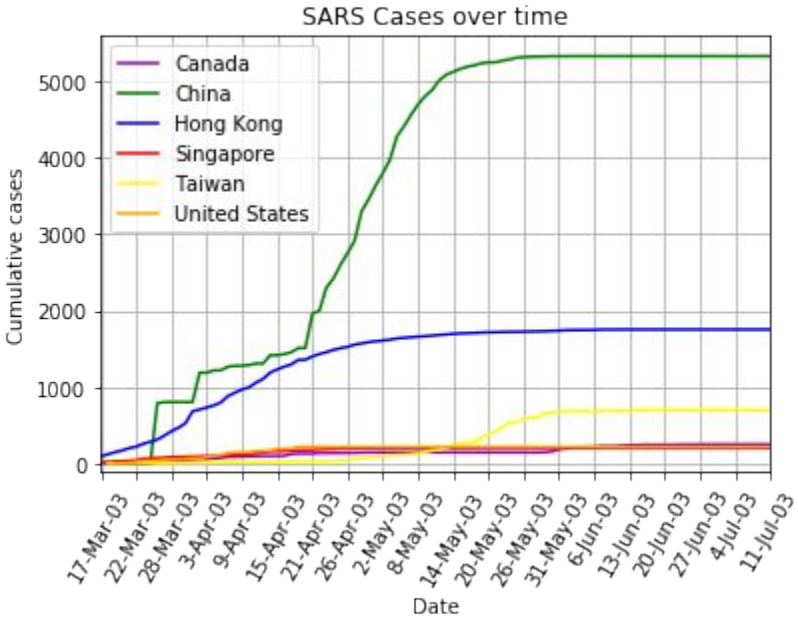
What countries did Sars affect the most?

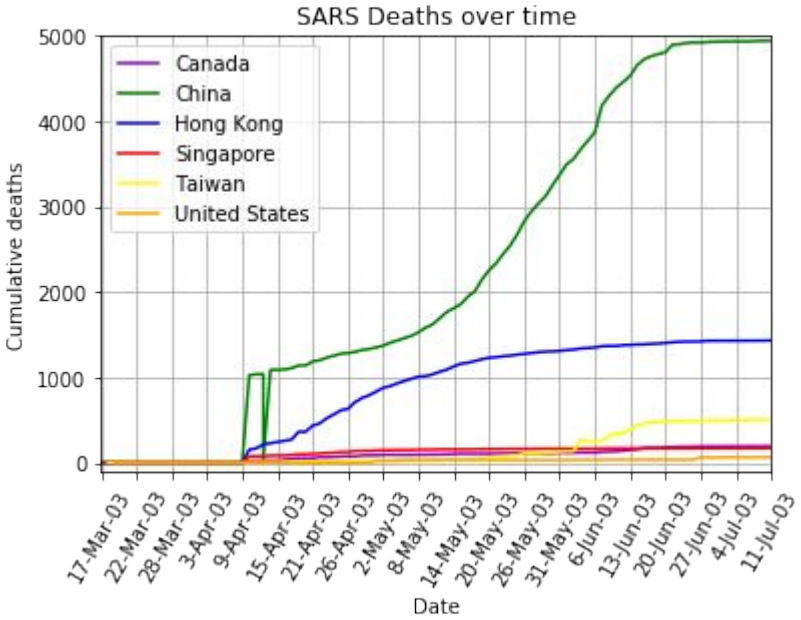
Country	Latitude	Longitude
Canada	56.13036	-196.34677
China	35.86166	104.19539
Hong Kong	22.31930	114.16936
Singapore	1.35208	103.81983
Taiwan	23.69781	120.96051
United States	37.09024	-95.71289

How did Sars evolve over time?

	Country	Cumulative number of case(s)	Populations 2003	Number of deaths	Number recovered
0	Canada	252	32,207,113	38	194
1	China	5329	1,286,975,468	348	4941
2	Hong Kong SAR, China	1755	7,394,170	298	1433
3	Singapore	206	4,608,595	32	172
4	Taiwan, China	698	22,603,001	84	507
5	United States	220	290,342,554	0	67

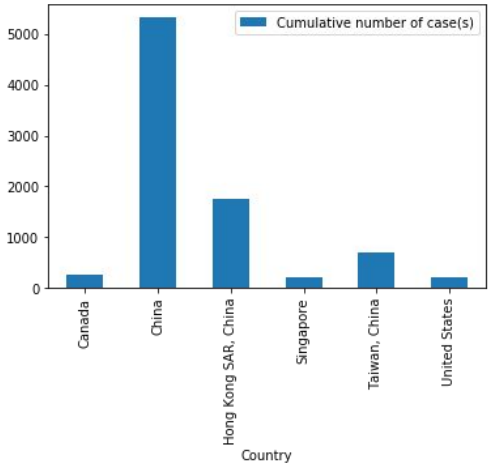
Sars: Cases & Deaths

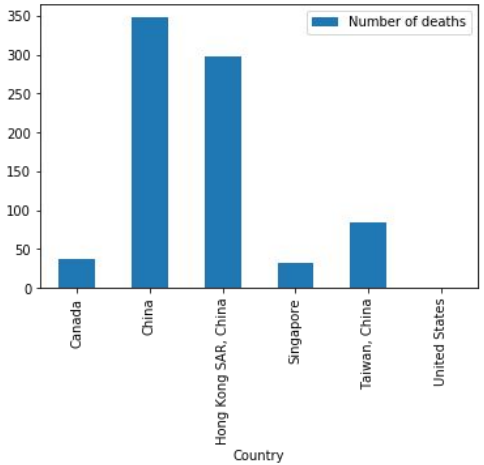


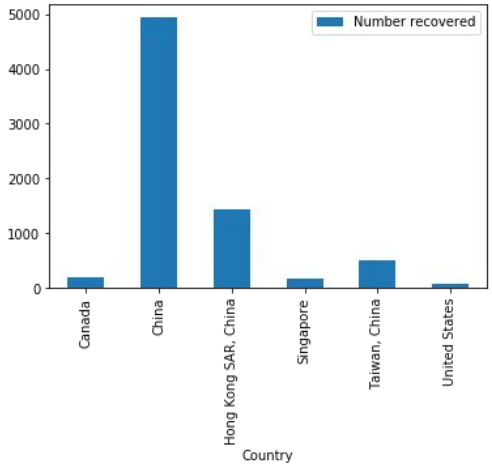


Sars: Cases, Deaths & Recoveries per 10,000 people

	Country	Cases	Deaths	Recoveries	Population	Cases per 10,000 population	Deaths per 10,000 population	Recoveries per 10,000 population
0	Canada	252	38	194	32207113	0.078244	0.011799	0.060235
1	China	5329	348	4941	1286975468	0.041407	0.002704	0.038392
2	Hong Kong SAR, China	1755	298	1433	7394170	2.373492	0.403020	1.938013
3	Singapore	206	32	172	4608595	0.446991	0.069435	0.373216
4	Taiwan, China	698	84	507	22603001	0.308809	0.037163	0.224306
5	United States	220	0	67	290342554	0.007577	0.000000	0.002308







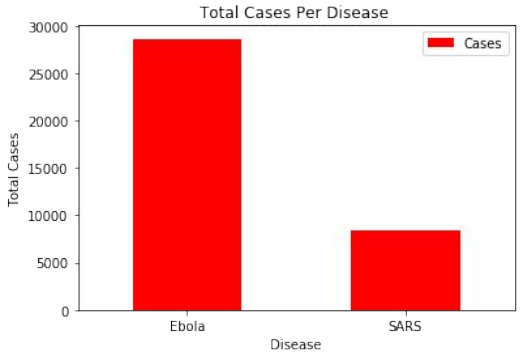
Were these countries prepared for the disease?

	Country	Cases	Deaths	Population	GDP per capita (USD)	Hospital bed per 1000 people	healthcare expenditure (%GDP)	Pandemic Preparedness Score	Cases per 10,000 population	Deaths per 10,000 population
0	Canada	252	38	32207113	46194.7	2.7	10.57	50.0	0.08	0.01
1	China	5329	348	1286975468	10261.7	4.2	5.15	25.0	0.04	0.00
2	Hong Kong SAR, China	1755	298	7394170	48755.8	4.9	5.15	25.0	2.37	0.40
3	Singapore	206	32	4608595	65233.3	2.4	4.44	37.5	0.45	0.07
4	Taiwan, China	698	84	22603001	10261.7	4.2	5.15	25.0	0.31	0.04
5	United States	220	0	290342554	65280.7	2.9	17.06	100.0	0.01	0.00

Comparison Overview

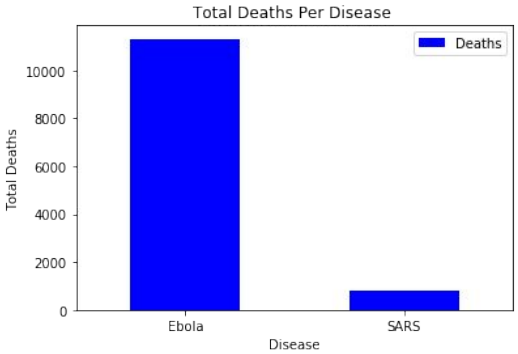
Total Cases*

Disease	Cases
Ebola	28638
Sars	8460



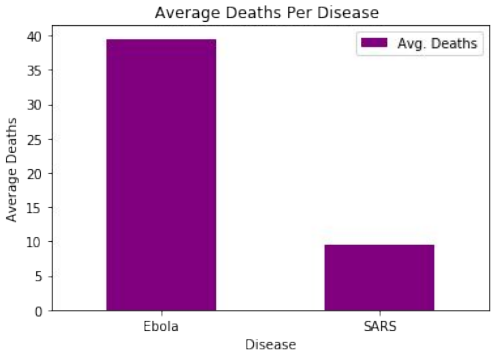
Total Deaths*

Disease	Deaths
Ebola	11312
Sars	800



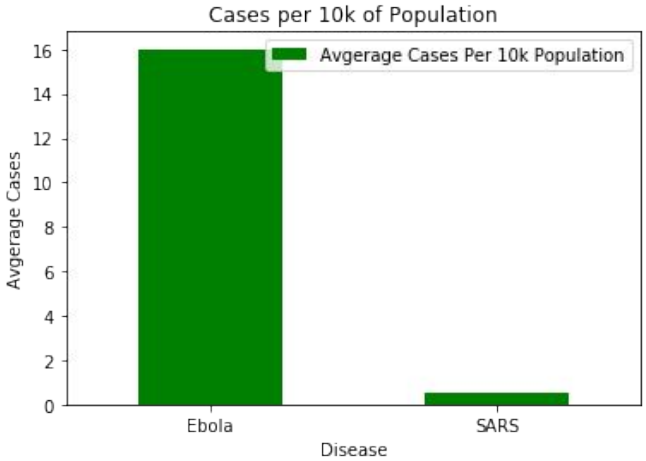
Death Rate*

Disease	Rate
Ebola	39.5%
Sars	9.5%



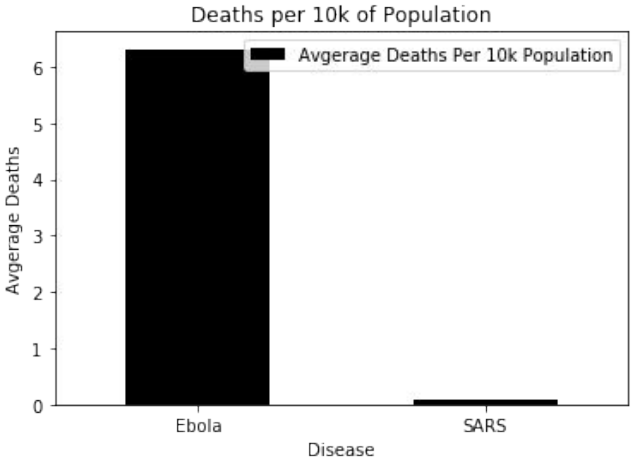
Cases per 10k People

Disease	Cases
Ebola	16
Sars	0.55



Deaths per 10k People

Disease	Deaths
Ebola	6
Sars	0.09



Conclusions

Based on our research our hypothesis is correct. Ebola has 3 times more cases than SARS and 14 times more deaths.

Is Ebola more deadly or poorly managed?

- Longer outbreak period
- More cases but less infected countries
- Poorer healthcare infrastructure and lower pandemic preparedness score in Ebola affected countries

Conclusions

What about within the countries affected by SARS?

- Poorer healthcare infrastructure and lower pandemic preparedness score in SARS affected Eastern Asian countries much more
- Death rate was much lower in China than in Hong Kong, although metrics are roughly the same except for large difference in population size

R naught (R0): If one person has a disease, the r0 value refers to how many people they will spread it to on average. Equation derived from factors such as population size, density, and transmission rates per certain time periods

Conclusions

For a pandemic to be over, R0 < 1.

If the R0 > 1, spreading will continue.

	Country	Disease	Cases per 10,000 population	Deaths per 10,000 population	R naught	Health Index
0	Canada	SARS	0.08	0.01	0.86	75.3
1	Hong Kong SAR, China	SARS	2.37	0.40	1.70	48.2
2	Singapore	SARS	0.45	0.07	1.83	58.7
3	Guinea	Ebola	3.42	2.27	1.51	32.7
4	Sierra Leone	Ebola	24.47	11.02	2.53	38.2
5	Liberia	Ebola	20.12	5.64	1.59	35.1

Data Sources

Possible data sources
SARS sources
https://www.kaggle.com/imdevskp/sars-outbreak-2003-complete-dataset

Ebola Sources
https://www.kaggle.com/imdevskp/ebola-outbreak-20142016-complete-dataset?select=ebola_2014_2016_clean.csv

https://www.worldpop.org/geodata/listing?id=74

SARS Rnaught

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3323341/

EBOLA Rnaught

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4169395/

Data Sources

World Bank Resources

https://www.worldpop.org/geodata/listing?id=74

https://data.worldbank.org/indicator/SH.MED.BEDS.ZS

https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS

https://www.ghsindex.org/