2019-nCoV | HBV Vaccination Correlation Report

The Penn State Asset Management Group

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Abstract:

During personal conversations with Dr. Howard Katz of Advanced Internal Medicine, Colts Neck, NJ about the topic, a few things were made clear about his thesis. The following transcript is used to aid the reader in understanding why the researchers sought out to research the topic in depth.

> "The prevailing theory around the world regarding 2019-nCoV infections has been that patients most negatively affected by the virus were elderly, deemed to have immunosuppression based on age alone. However the theory is also applied to influenza which affects the very old and the very young. Why then has the 2019-nCoV affected the elderly disproportionately to the very young? Looking at the data of 2019-nCoV infection, particularly in cases of death, there appeared to be a drop-off in patients younger than 30 years old. There also appeared to be a paucity of cases in medical professionals given their potential level of exposure. I considered the connection between those under 30 years of age and individuals that work in healthcare. The only connection was the HBV vaccine. The current day HBV vaccine was created in CY1990 and was included by the ACIP in CY1991 as part of the childhood vaccine regimen. Because the HBV vaccine was used routinely in childhood vaccines in CY1991, the population that would have received it would currently be 30 or younger or health care workers.
>
> This led me to look at the HBV vaccine more closely in the following ways; what countries did not include this vaccine in their childhood vaccine regimens? What vaccines were other countries using, particularly in Italy, which was disproportionally affected by the 2019-nCoV? What is the non-responder rate to the HBV vaccine and what risk factors were present in the non-responders to lead to a lack of Anti-HBs? Was there a commonality between the outer envelope of the 2019-nCoV and HBV? Given that the 2019-nCoV was affecting such a large group of people over the age of 30, was there any medical conditions to explain those patients affected the most? Were those medical conditions such as those found in Louisiana in some way related to the lack of production of Anti-HBs?
>
> After considering the information above, the HBV vaccine and the resulting Anti-HBs, or lack there of, may be one explanation for those who were affected by the 2019-nCoV. This hypothesis led to the following research and information regarding whether the HBV vaccine has any connection to the way in which 2019-nCoV has been affecting world populations."[16]

2019-nCoV, an infectious disease originally identified in Wuhan, China, has caused stress on global health and has sent the United States into a national state of emergency as of March 13, CY2020. Many of the countries cases, grouped by age, resembles a bell-shaped curve whereas mortality rates are shifted significantly right on the curve. Such difference between the two distributions makes CDC's statement about 2019-nCoV deaths being related to the strength of patient's immune systems fallacious as mortality rates of young children and older adults point to a sizeable disparity. After making the assumption that 2019-nCoV deaths cannot be simply explained by the strength of patient's immune systems, the researchers looked into possible vaccination and drug implementation that ages ~0-35 years old would have received, whereas the older generations would not have. HBV vaccinations, first introduced on a global scale during 1H1990's, demonstrates a correlation of reducing the mortality rate of 2019-nCoV. In accordance with the previous hypothesis, HBV vaccinations fit the following defining characteristics; there exists a high reception level of generations under ~35 v. extraordinarily lower reception levels as the population ages; mandatory vaccination protocol for all medical staff across the United States; varying degrees of HBV vaccination protocols on a global scale insinuating respective correlations to the mortality rate by country of 2019-nCoV.

According to the following research displaying the correlation between 2019-nCoV deaths and HBV vaccination rates across countries around the world, it can be assumed that correlation between the two may exist. While correlation does not equal causation, further research on the relation between 2019-nCoV death rates and anti-HBs rates could offer the chance of lower mortality rates thus a significant shift in the treatment and care of 2019-nCoV patients within the U.S.

Anti-HBs Prevalence as it Pertains to Obesity & Diabetes

According to a health study done in North Taiwan, where fasting plasma glucose, lipids, uric acid and HBV serology were measured for each subject, there was a significant correlation to subjects with seroprotective titers of Anti-HBs from HBV vaccinations and those without protective titers of Anti-HBs. According to the study, “those without protective titers of anti-HBs after vaccination or without hepatitis B infection (anti-HBs(−) and anti-HBc(−)) had 34.00% higher risk for metabolic syndrome, and those with natural infection of hepatitis B (anti-HBc(+)) had 58.00% higher risk for metabolic syndrome.” Note that a “positive anti-HBc (anti-HBc(+), titer ⩾1.00 Sample/Control (S/CO)) means that the subject has natural infection of HBV.”[14] Looking then at the prevalence of metabolic syndrome in the U.S. and Europe compared to that of Asia, researchers noticed an occurrence percentage of 20.00%-30.00% v. 10.00%-20.00% respectively. Making the jump to 2019-nCoV, the researchers compared the prevalence of metabolic syndrome in Figure 1.10 to the case statistics in Louisiana and China in Figure 1.20. Considering that Anti-HBs levels have been known to not manifesting with underlying conditions such as diabetes and obesity, it is important to note that within the Louisiana 2019-nCoV deaths 69.00% of the deaths were for patients with one or the other underlying conditions. Note also that as mentioned in the abstract, 2019-nCoV deaths is unlikely to “target” the immuno-compromised as only 4.00% of the deaths in Louisiana are in tandem with said underlying condition; as well as the lack of deaths around the world in ages 0-9 years old. Furthermore, the right-shifted curve of the 2019-nCoV deaths are further exhibited by Appendix D, where for CY2018, 67.39% of the population with diabetes falls in the age range of 44+.

Prevalence of Metabolic Syndrome v. BMI Categories

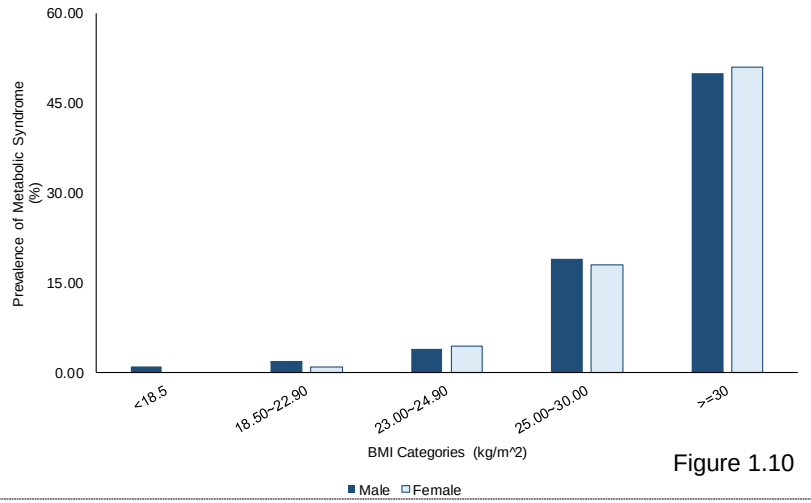


Figure 1.10

Underlying Condition v. Louisiana & China Cases

Underlying Condition	Louisiana Death %'s	China Death Rate %'s
Diabetes	41.00%	9.20%
Chronic Kidney Disease	31.00%	-
Obesity	28.00%	-
Cardiac	23.00%	13.20%
Pulmonary	18.00%	-
Neurological	5.00%	-
No Underlying Conditions	5.00%	0.90%
Immuno-Compromised	4.00%	-
Chronic Liver Disease	1.00%	-
Chronic Respiratory Disease	-	8.00%

Figure 1.20

Italy HBV vaccination v. 2019-nCoV

Italy has been the epicenter of 2019-nCoV pandemic with extraordinarily high fatality rate; the overall case-fatality rate in Italy (7.20%) is substantially higher than in China (2.30%) or the world's CFR (4.23%).[15] Italy started a universal, compulsory program that provide Hepatitis B to adolescents at 12 years of age and newborns in the second half of 1991. According to the National Surveillance System (SEIEVA), the incidence of acute hepatitis B per 105 inhabitants declined from 5.40 in CY1990 to 2.90 in CY1998. The reduction was even greater among 15–24-year-old individuals, where the incidence rate per 105 decreased from 17.30 to 4.20 in the same period. Furthermore, a generation of children and young people (at present cohorts from 0 to 40 years) is practically emerging with practically no markers of HBV infection. It is worth noting that population of Age 0-30 contributed 0.00% of Italy 2019-nCoV death cases as exhibited in Figure 1.40. After examining the case-fatality rate by age group in Figure 1.30, age cohort 0-40 demonstrates considerably low CFR (0.00-0.30%) and for age group older than 40, CFR averages 7.52% that is closed to the overall CFR in Italy. Italian population shows different demographic characteristics than other countries; in CY2019, approximately 23.00% of the Italian population was aged 65 years or older, the exact cohort that is not benefited and covered by its government's HBV vaccination policy. The large difference in CFR of age groups that are covered by HBV vaccine, namely age 0-40 with near 0.00% mortality rate, and the age groups that are not, age above 41 with averaged 7.59% mortality rate, strengthen the credibility of the hypothesis that a strong interrelationship exist between HBV vaccination and 2019-nCoV mortality rate.

Italy v. China Deaths & Fatality Rates

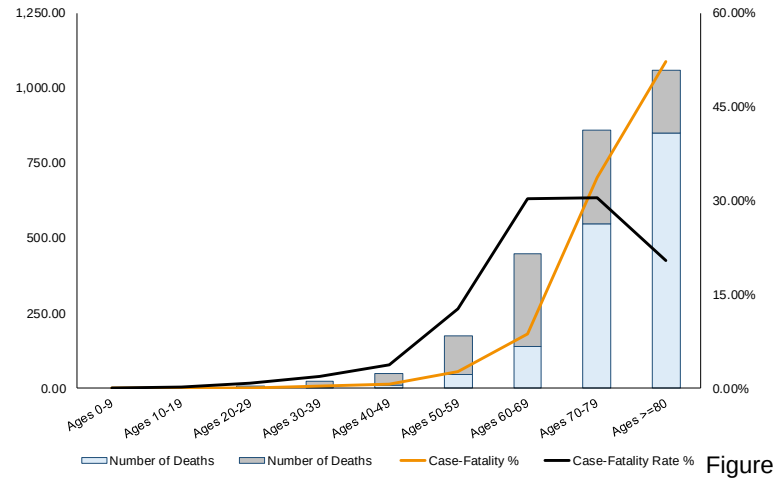


Figure 1.30

Italy Death by Age v. Median Death 2019-nCoV

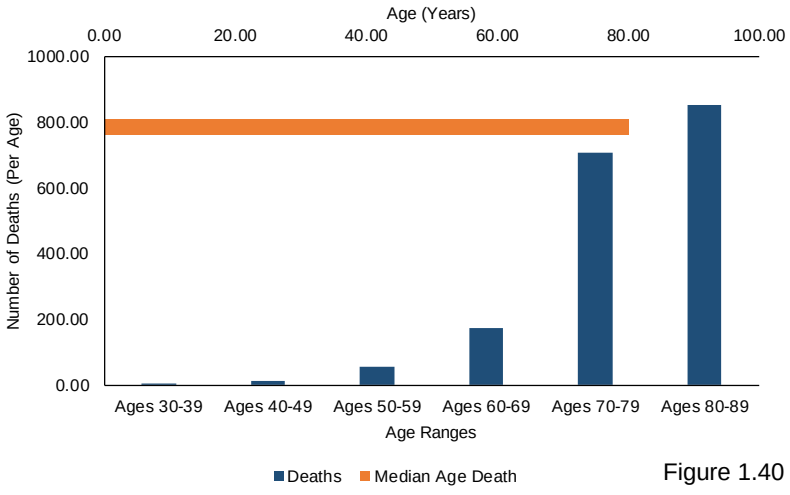


Figure 1.40

China Overview 2019-nCoV | HBV Vaccine

China's implementation of HBV vaccinations and 2019-nCoV death rates have indicated correlation. Hepatitis B (HBV) is a serious health problem in China. Since CY1992, the Chinese government prioritized implementing the HBV vaccination for newborns.[1] China began to see a larger reduction in HBV infections. From CY1992, HBsAg prevalence of people 1-14 years old average ~10.50% whereas in CY2014 the average fell to ~0.50%. Improvement is less significant as people age and the spread between CY1992-2014 HBsAg levels narrows; in CY1992, ages 20-29 have an average HBsAg prevalence of ~9.80% and in CY2014 the mean shifted down to ~5.00%. As shown in Figure 1.50, the Anti-HBs prevalence increased substantially since CY1992 by an average growth rate of 17.25% across ages 1-29. Using the growth rate of Anti-HBs across the curve, the researchers projected that the Anti-HBs prevalence of CY2020P would increase to an average level of 69.60% across the pool, which is 44.94%, 13.44%, and 10.44% higher than CY1992, CY2006, and CY2014 respectively.[2] Showcased in Figure 1.60 despite the fact 2019-nCoV confirmed cases are in a bell-shaped distribution with a skew to the left, the mortality rate starts its ascent into exponential growth at ages 30-39 years old, thus shifting the mortality rate significantly to the right despite a median confirmed case statistic of 30-39 years. It is then surmised that the two statistics are not a coincidence but rather the lack of HBV vaccination rates and lower Anti-HBs levels directly correlates to significantly higher mortality rates for older adults, population range age 40-49, to seniors, age 70+. The respective data indicates the increasing prevalence of Anti-HBs and of the falling prevalence of HBsAg in Chinese youth in relation to the exponential curve of Chinese 2019-nCoV patients' deaths, in tandem with information given later in the report, are correlated at the very least.

Anti-HBs Prevalence %

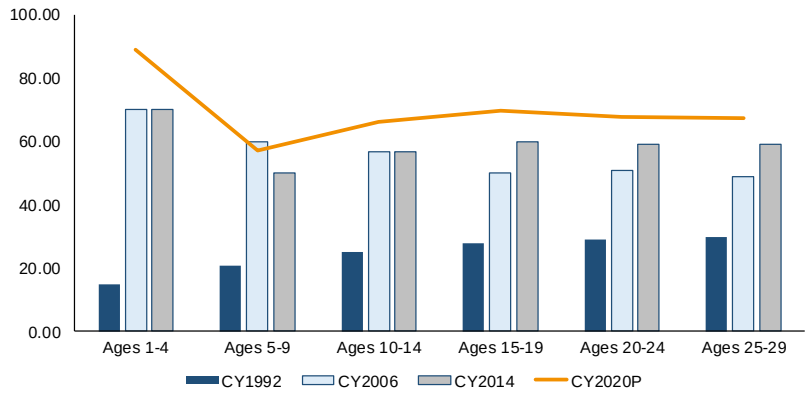


Figure 1.50

Confirmed Cases v. Total Deaths v Death Rate

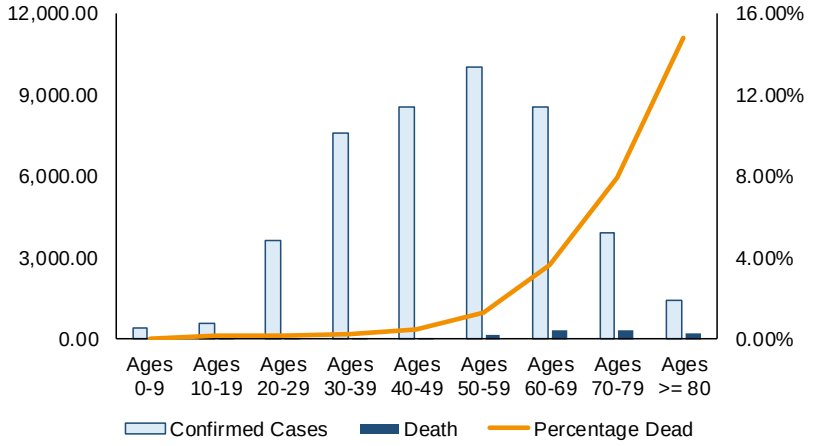


Figure 1.60

Case Study: Spain v. U.S.

According to Appendix A, Spain exhibits a 2.68x death rate per capita with that of the U.S. To further examine the correlation between 2019-nCoV mortality rate by age group and HBV vaccination, researchers investigate the efficacy of HBV vaccination protocols in U.S. and Spain, respectively. While unable to track HBsAg and Anti-HBs prevalence data in Spain in juxtaposition to the U.S., researchers use data pertaining to CY1997-CY2005 annual Hepatitis B cases and Hepatitis B cases YoY percentage within the same period to gauge the efficacy of HBV vaccination policies in each country. Showcased in Figure 1.70, after the introduction of HBV vaccines in 1H1990s, U.S. has decreased HBV cases on a YoY average of 8.17% from CY1997-CY2015.[4] Spain's HBV annual cases, on the other hand, bounce back and forth during CY1997-CY2005; decreased nearly 20.00% in CY2001 and increased over 17.00% the next year.[5] According to a study regarding vaccine-included immunity, in Madrid, population aged 16-80 years, the prevalence of HBV infection was 11.00%, and that of chronic infection was 0.70%. The prevalence of vaccine-induced immunity in the population aged 16-20 years was 73.00%.[6] While U.S. has a zero-mortality from population under the age of Washington State, one of the states that has been impacted by 2019-nCoV the most, exhibits 0 mortality rate for population under age 30. (Appendix C), Spain's less effective implementation of HBV vaccines and poor results corresponds to a non-zero mortality rate within the same age pool in Spain.

Spain 2019-nCoV Mortality Rate by Age

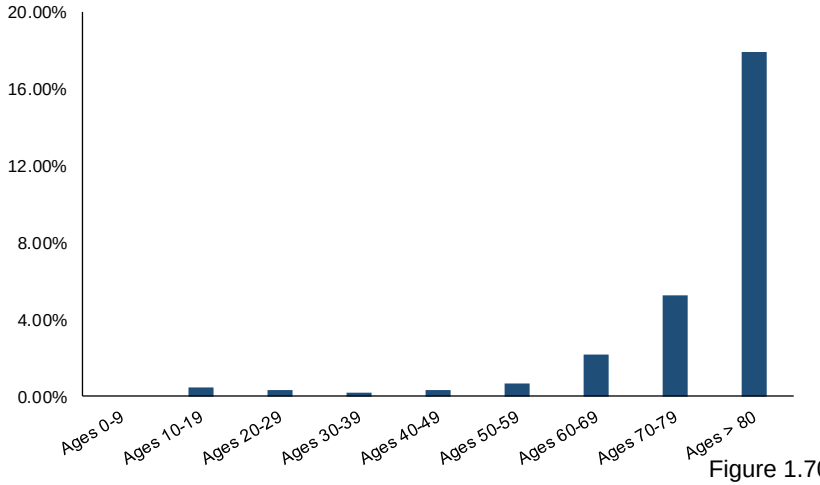


Figure 1.70

U.S. v. Spain HBV Cases & Improvement

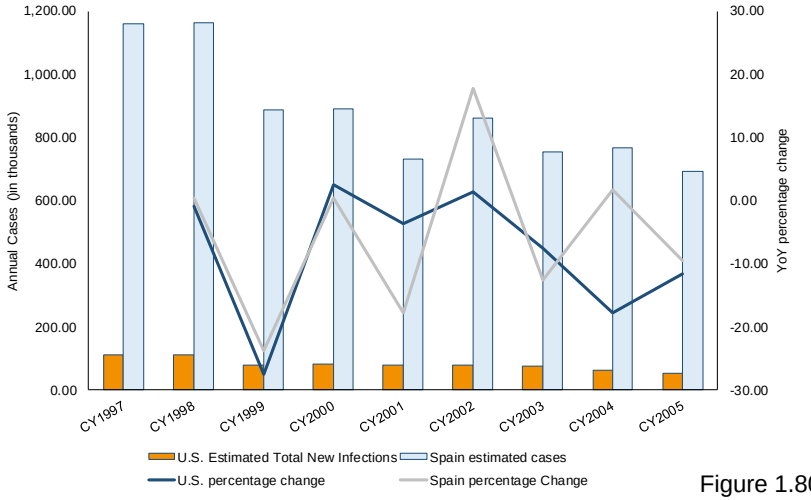


Figure 1.80

U.S. v. Other Countries Death 2019-nCoV | HBV

The United States has been used as a benchmark throughout the report to aid the comparability of the different nations. Noted in Appendix A, both Sweden and the Netherlands showcased 2019-nCoV death rate multiples per capita of 5.19x and 6.94x that of the U.S. The countries have not introduced HBV vaccinations into NIPs thus aligning the death rate multiple's larger value.[7] China, Italy, Spain, and South Korea implemented a universal HBV vaccination program ~1H1990's. Figures 1.90 and 2.00 therefore are indicating an inverse relationship between HBV vaccination rates and 2019-nCoV death rates both in the U.S. and around the world. Figure 1.90 is forecasted out for ages 50-80+ utilizing the simple moving average growth rate from the preceding statistics. Total reduction of HBV vaccination rates reported was 59.49% from ages 30 and up. However, there are still deaths for ages 0-29 despite upwards of ~66.20% HBV vaccination rates, and the reason relies less on vaccination statistics but more so due to the Anti-HBs error margin. The HBV vaccine is 80.00% to 100.00% effective in preventing infection or clinical hepatitis for patients who receive the full vaccination dosage and treatment. A simple average concludes that ~10.00% of HBV vaccinations will not guarantee the proper amount of Anti-HBs prevalence.[8] The point is further emphasized by Appendix C; utilizing U.S. Census data and Immunization Records from the CDC in tandem, researchers came to the projection estimate that only 24.30% of people over 30 are vaccinated for HBV by finding out the current levels of HBV immunization rates for the U.S., then the researchers filtered and cleaned U.S. census date regarding population size broken down by age, then identified and compared the age group size to the immunization records of that of the CDC. After making assumptions based off the curve in Figure 1.90, the researchers were then able to project out the estimate for U.S. citizens >30 immunization rates.[9] Appendix C also demonstrates the death rate multiple for 2019-nCoV patients in NYC, which represents 45.45% of the 2019-nCoV cases within the U.S. The multiples indicate that patients are 10.50x (45-64), 33.00x (65-74), and 102.00x (75+) more likely to die than people under 44 years old. The clear correlation of the two metrics, death rate multiples of 2019-nCoV and HBV vaccination rates, indicate possible causation of the HBV vaccine and reduced mortality rates of 2019-nCoV.

Adults: 18-49 Reported Receiving HBV Vaccine (%)

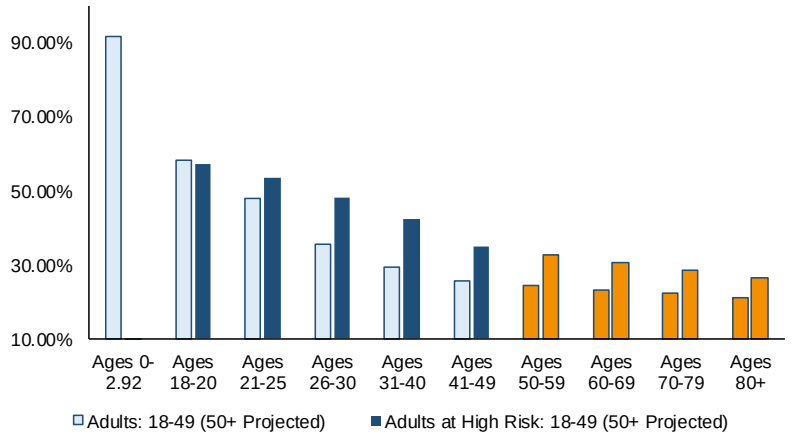


Figure 1.90

March 22, CY2019 Death Rates

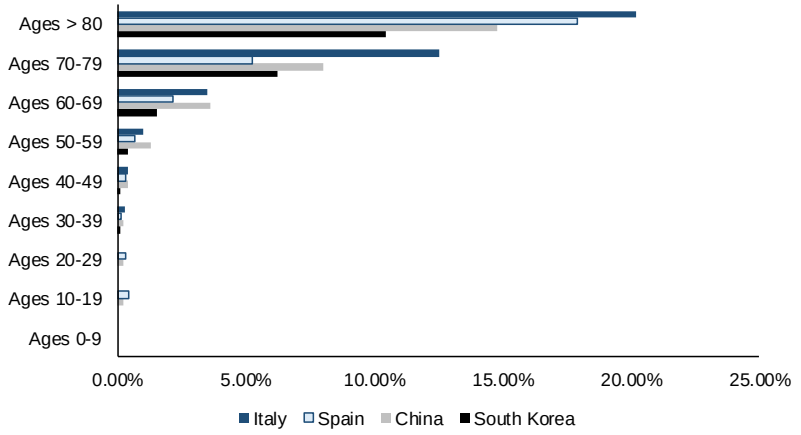


Figure 2.00

U.S. 2019-nCoV Cases v. Deaths Explained Cont.

To further ascertain the interrelationship between 2019-nCoV death rates and HBV vaccinations, patients' level of sickness becomes a critical metric to examine. In Figure 2.10, U.S. hospitalization rates and ICU admission rate respectively average out to 28.39% and 9.86% across the curve. This implicates that on average, patients aged 55-74 are the most likely age group to be hospitalized and admitted to the ICU on a per-case basis for 2019-nCoV. Returning to Figure 1.90, patients who are generally more sick and need further assistance are grouped into the same age bracket that HBV vaccinations are below 25.00% on average. In Figure 2.20 the Washington Department of Health enabled researchers to perceive the bell-shaped distribution of confirmed cases but a distinct rightward shift of deaths to the older generation of 2019-nCoV in accordance with previous statements. A problem also arises in the case of declining Anti-HBs levels in patients after 9-15 years of receiving the HBV vaccination. While Anti-HBs prevalence may decline as people age the protection the vaccine has produced should not, and it becomes harder then to monitor the ones have received HBV vaccinations in older age group has received the HBV vaccination.[10] Not only are Anti-HBs levels declining as time progresses but also the age requirements by the U.S. government for HBV vaccinations reception, and the timeline itself paints a picture of who in the U.S. is receiving vaccinations. In CY1999 the U.S. made 19 years old the cutoff when they don't "advise" to be vaccinated.[11] During CY1995, ACIP recommended the routine vaccination of 11-12 year old's who had not been previously vaccinated.[12] Throughout CY1993-2000, 90.00% of U.S. children aged two receive three doses of hepatitis B vaccine, a coverage rate that meets national health goals while 13-15 year old's had a 67.00% vaccination rate. During CY1986--2000, the rate of acute hepatitis B among children aged 1-9 years declined >80.00% Finally, in CY2017 children aged 19-35 months had 91.40% vaccination rate.[13]

U.S. 2019-nCoV Hospitalizations v. ICU Admission v. Fatality

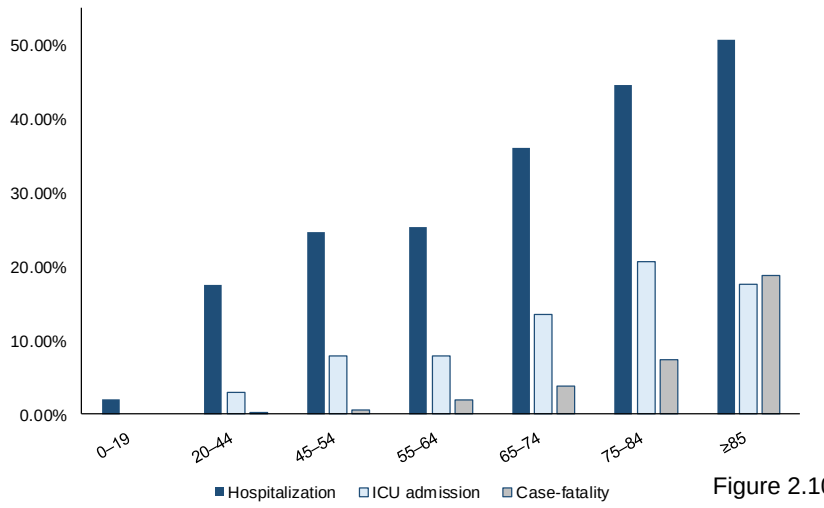


Figure 2.10

% of Cases v. % of Death (Washington DOH)

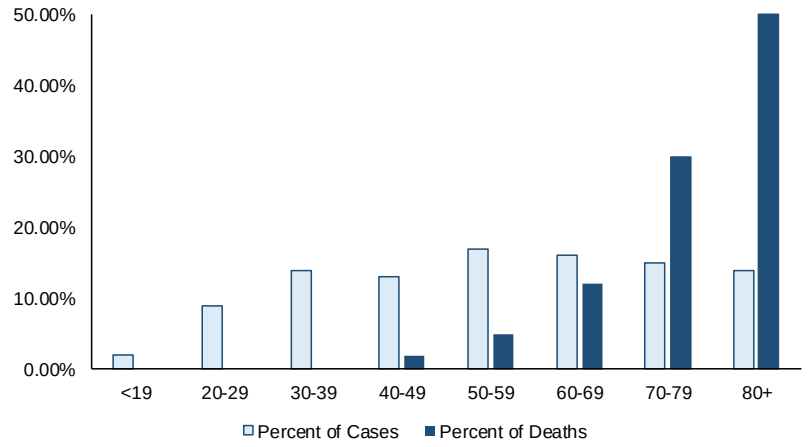
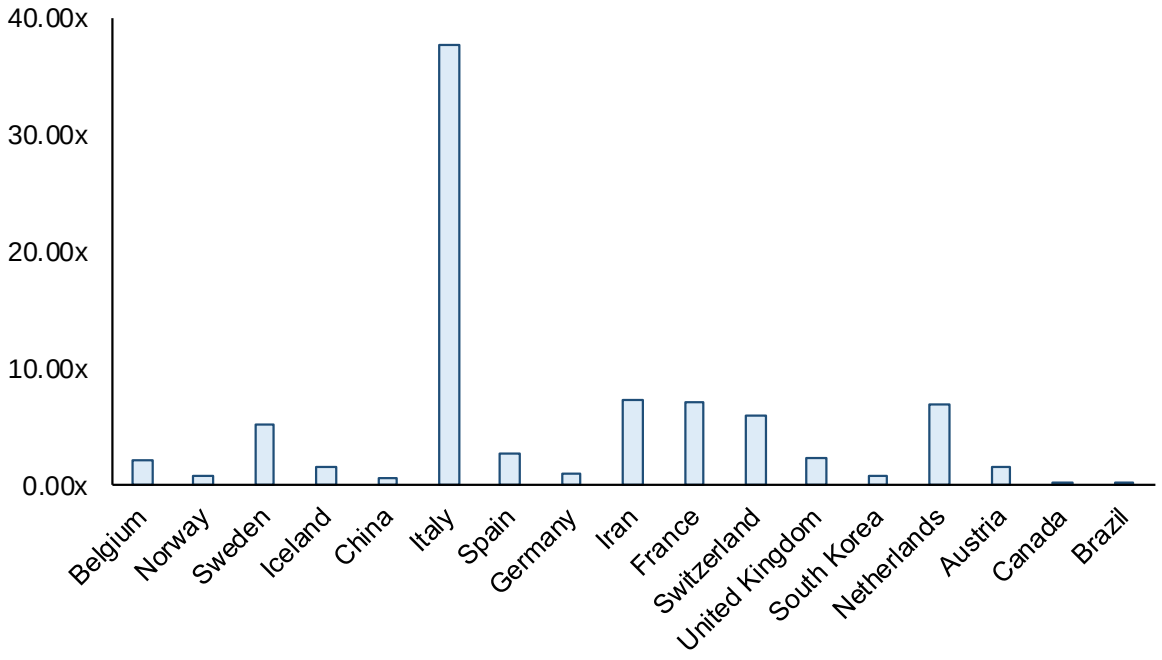


Figure 2.20

Appendix A: Death Rate Multiple Per Capita v U.S. Death Rates Per Capita

	Death Rate Multiple
Belgium	2.08x
Norway	0.70x
Sweden	5.19x
Iceland	1.62x
China	0.64x
Italy	37.65x
Spain	2.68x
Germany	0.90x
Iran	7.32x
France	7.09x
Switzerland	5.99x
United Kingdom	2.38x
South Korea	0.70x
Netherlands	6.94x
Austria	1.55x
Canada	0.29x
Brazil	0.10x



Note

The Death Rate Multiple Per Capita v U.S. Death Rates Per Capita was intended to be used as a means for the researchers to quantify a comparable death metric to that of the U.S. given varying population sizes and 2019-nCoV infection totals around the world. It was calculated by taking the total deaths divided by the total population of the country. Then using the U.S. death rate per capita percentage as a benchmark, the researchers took the death percentages per capita of Belgium, Norway, Sweden, Iceland, etc. and divided it into the U.S. death rate per capita percentage. This enabled the researchers the ability to compare the varying degrees of 2019-nCoV death rate multiples between countries. The colors ranges from navy blue to orange indicating varying levels of death multiples to that of the U.S.

Appendix B

By computing the resolved cases, which includes both death and recovered, divided by the total case in certain country, each country is assigned a progress score (percentage of completion multiplied by 100.00). Modified death rate represents the death rate calculated by death over total resolved cases. Researchers then regress the death rate modified with progress score in hope to normalize the varying phase different countries stand in combatting 2019-nCoV. Summary output states important statistical value pertaining to this linear regression.

After comparing the normalized value with respect to the regression to the actual modified death rate, we can see from the heat map of the countries that have extraordinarily high mortality rate comparing to the relatively early stage they stand in combatting 2019-nCoV

World Death Modified 2019-nCoV

Country	Progress*	Death Rate Modified*	Normalized value	Difference
World Wide	28.73	15.72%	17.74254794	-2.02%
China	94.36	4.26%	58.28586091	-54.02%
Italy	22.67	44.49%	13.99792793	30.49%
US	2.37	63.49%	1.454139317	62.03%
Spain	18.20	40.46%	11.23778746	29.22%
Germany	10.06	5.49%	6.203259464	-0.71%
Iran	43.31	17.75%	26.75005651	-9.00%
France	20.47	25.44%	12.63658893	12.80%
Switzerland	2.61	53.87%	1.601119064	52.27%
UK	6.29	76.90%	3.874675675	73.02%
South Korea	42.20	3.27%	26.06341282	-22.80%
Netherland	5.64	98.35%	3.473315053	94.87%
Austria	0.70	76.92%	0.4221727	76.50%
Belgium	14.69	24.55%	9.063407573	15.49%
Canada	6.41	16.06%	3.952183412	12.10%
Norway	0.65	70.00%	0.391643685	69.61%
Portugal	2.17	66.15%	1.331796513	64.82%
Brazil	2.39	96.72%	1.466555083	95.25%
Sweden	3.09	79.49%	1.898691139	77.59%

***** Note that Sweden, Belgium, and Norway was not required by the WHO to implement infant Hepatitis B vaccination as most countries were in 1H1990s. Two of the three countries have a tremendously large modified death rate comparing to their normalized death rate.

Summary Output

Regression Statistics	
Multiple R	0.646009811
R Square	0.417328675
Adjusted R Squar	0.383053892
Standard Error	0.251333818
Observations	19

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.769139935	0.769139935	12.17596814	0.002807784
Residual	17	1.0738677	0.063168688		
Total	18	1.843007635			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.617803701	0.072781895	8.488425622	1.61386E-07	0.464247326	0.771360077	0.464247326	0.771360077
X Variable 1	-0.009004823	0.002580616	-3.489407992	0.002807784	-0.014449448	-0.003560199	-0.014449448	-0.003560199

Appendix C

Number of Vaccines CY1986-CY2018 Projected	170,253,615.30
< 30 Vaccinated	
Percentage	66.02%
Nominal	112,395,761.70
Error Adj. 9%	102,280,143.15
Percentage of Population	79.58%
> 30 Vaccinated	
Percentage	24.30%
Nominal	41,367,407.43
Error Adj. 9%	37,644,340.76
Percentage of Population	18.65%

% of Cases v. % of Deaths; Washington DOH

Age Group	Percent of Cases	Percent of Deaths
<19	2.00%	0.00%
20-29	9.00%	0.00%
30-39	14.00%	0.00%
40-49	13.00%	2.00%
50-59	17.00%	5.00%
60-69	16.00%	12.00%
70-79	15.00%	30.00%
80+	14.00%	50.00%

Case Breakdown NYC: 2019-nCoV

Population	Total Cases	Cases Per 10 k People in Age Group	Hospitalized	Hospitalized Rates	Deaths	Death Rate	Death Rate Multiple (Over 44)
Ages 0-17	446.00	2.60	28.00	6.28%	0.00	0.00%	-
Ages 18-44	8,880.00	26.40	629.00	7.08%	5.00	0.06%	-
Ages 45-64	6,786.00	33.00	1,061.00	15.64%	43.00	0.63%	10.50x
Ages 65-74	2,226.00	31.80	550.00	24.71%	44.00	1.98%	33.00x
Ages 75+	1,633.00	29.90	615.00	37.66%	100.00	6.12%	102.00x

Appendix D

Estimated #, %, and Awareness of Prediabetes Among Adults Aged >= 18 Years | United States, (CY2013–2016, & CY2018)

Characteristic	Prediabetes, CY2018 Estimates Number in Millions	Prediabetes CY2013-2016 Estimates Percentages	Prediabetes Awareness, CY2013-2016 Estimates Percentages
Total	88.00	34.50%	15.30%
Age			
Ages 18-44	28.70	24.30%	8.80%
Ages 45-64	35.10	41.70%	16.00%
Ages >65	24.20	46.60%	22.60%
Sex			
Men	40.90	38.00%	11.40%
Women	47.10	31.20%	19.80%
Race / Ethnicity			
White, non-Hispanic	54.80	33.90%	15.80%
Black, non-Hispanic	11.40	36.90%	16.80%
Asian, non-Hispanic	5.00	32.80%	9.80%
Hispanic	14.60	35.40%	10.80%

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(1) Liao, Xueyan, and Zhenglun Liang. “Strategy Vaccination against Hepatitis B in China.” Human Vaccines & Immunotherapeutics, Taylor & Francis, 2015, www.ncbi.nlm.nih.gov/pmc/articles/PMC4514356/.

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