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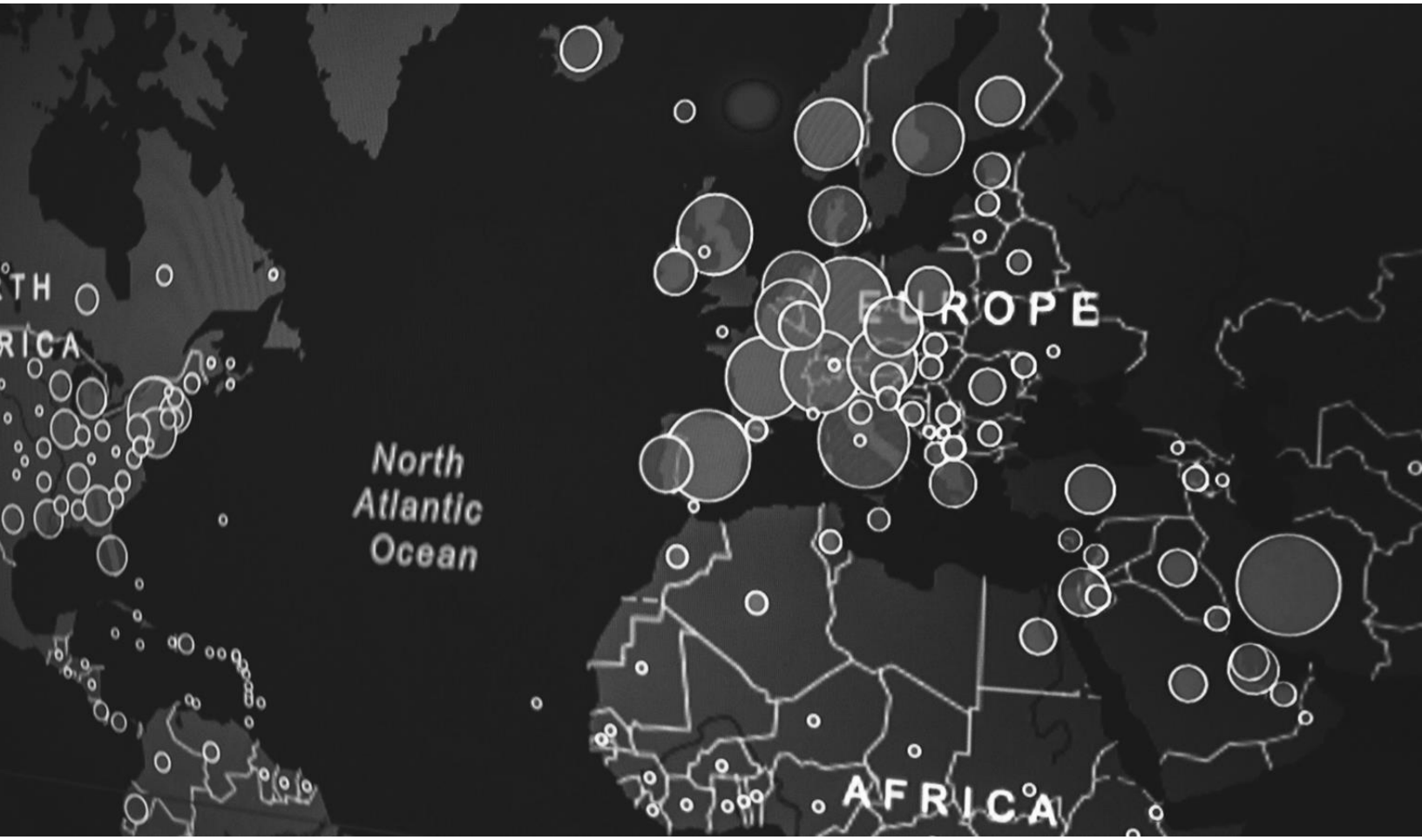
RAPID RESPONSE REPORT ON COVID-19 IN NEW BRUNSWICK MARCH 31, 2020



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Rapid response report on COVID-19 in New Brunswick: March 31, 2020

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INTRODUCTION

The purpose of this rapid response report is to provide information on what the current literature indicates about differences in COVID-19 impacts across countries and regions and what might explain those differences. Based on this information, the report presents some preliminary estimates of outcomes for New Brunswick (NB) based on scenarios in other countries deemed to be relatively similar to NB in key dimensions. Studying the experiences of other places can help inform how the disease could actually progress in NB.

Overview

We examined COVID-19 outcomes in regions with healthcare systems and control measures similar to those in New Brunswick. In Table 1, we present a range in which COVID-19 rates *could* fall when New Brunswick reaches the peak of the pandemic. A full projection based on outcomes of multiple other countries can be viewed in Appendix 2.

Table 1: Projected Range of Outcomes for NB based on Outcomes in South Korea, Spain, and Denmark

If NB follows*…	10-day projection (total cases, all ages)			Projection based on highest case rate* (all ages)			Days since first case
	Cases	**Hospitalized**	**ICU/ Critical**	**Cases**	**Hospitalized**	**ICU/ Critical**	
South Korea	120	16	4	147	19	4	72
Spain	550	72	17	1570	204	47	60
Demark	178	23	5	383	50	11	34
**as of March 31, 2020, when NB had 70 confirmed cases*							

The above table presents the possible trajectory of COVID-19 in New Brunswick if cases in the province follow those observed in other countries that confirmed their first cases earlier in the pandemic than NB. The estimated number of cases based on South Korea demonstrates the impact of excellent infection control measures. The range presented in the Spain row represents a scenario in which the spread of the virus was not initially effectively controlled. Finally, the estimates in the Denmark row represent a 'middle ground' for the province; however, Denmark only diagnosed its first case 33 days ago, and thus it may be too early to determine its trajectory of cases.

While the ranges based on outcomes in South Korea and Spain were chosen to present best-case and worst-case scenarios for New Brunswick, Denmark was selected due to similar demographics to NB. There are many differences between the two regions, including population density measures, but Denmark and New Brunswick have fairly similar median ages (46 and 42.3, respectively), and 20% of each population is above 60 years old – making Denmark a potentially more comparable country than the others. It should be emphasized that for countries that have not yet been able to control the spread of infection (e.g., Spain) the peak case rate will likely be much higher than the current highest case rate.

The scenarios presented above show projected potential outcomes for New Brunswick in terms of expected cases, hospitalizations, and ICU/critical care admissions if our case rate trajectory

follows those of the countries listed – South Korea, Spain, and Denmark. The estimates presented in Table 1 have been standardized to the NB population.

According to the Public Health Agency of Canada (PHAC), as of March 27, 13% of all COVID-19 cases are expected to be hospitalized, and 3% of all cases are expected to be admitted to the ICU/critical care. People over the age of 60 are expected to make up 56% of all hospitalizations and 52% of all ICU admissions. While Table 1 presents estimates for the population overall, Table 2 in Appendix 2 breaks down the above estimates into age groups over and under 60 years of age, as well as overall population.

Two projections are provided in Table 1:

1) What *might* happen in NB in 10 days (from March 31st) if we follow the trajectories of the different countries listed.

2) What *could* the outcomes for NB be if we have the same case-rate as the other countries' highest rates to date (again, based on March 31 rates).

In the best-case scenario – if New Brunswick follows a COVID-19 path similar to that of South Korea – the province would have 120 cases in 10 days and 147 at the "max."

In the worst-case scenario – if we follow the same trajectory as Spain – the province would have 550 cases in 10 days and 1,570 at the "max."

Based on these estimates, we are still within capacity of our health care system. However, it should be noted that the "max" rate refers to the highest observed rates *thus far*. Italy and Spain likely have not yet reached their peaks, so NB would expect to surpass capacity as time goes on if we follow the same paths. These estimates can be updated as newer data become available and maximum infection rates are estimated more accurately. Similarly, the hospitalization and ICU admissions presented above must be interpreted with caution, as the rates published by PHAC lag behind real-time data. This estimate will become more accurate as more data become available.

While this range of outcomes presents potential situations for which New Brunswick should prepare, the existing literature suggests that differences in COVID-19 outcomes depend on a number of factors – many of which could impact (either increase or decrease) the trajectory of COVID-19 in our province. These factors are detailed below.

KEY FINDINGS

COVID-19 has produced different outcomes in different countries, making it difficult to predict the trajectory it will follow in New Brunswick. For instance, countries such as Italy and Spain are experiencing high rates of infection and have mortality rates around 10% and 7%, respectively. Other countries, such as Germany, are showing moderately high infection rates but low mortality rates (0.7%). Even within the same countries, rates of infection, hospitalization, and mortality vary by region. This suggests that rates of COVID-19 in New Brunswick may not necessarily follow those of neighbouring provinces.

To determine why COVID-19 appears to follow different trajectories in different communities, we reviewed the existing literature and identified key factors that may be impacting the course of the disease in other countries – specifically, countries further ahead in local disease progression than Canada, and New Brunswick in particular. According to a wide variety of sources – including peer-reviewed articles, government publications, public media, and educated speculative analyses – the key factors accounting for the differences between COVID-19 trajectories include

- **Demographics**, such as population age structure and density,
- **Preventive measures**, including social controls and the timing of their implementation,
- **Screening**, as both a source of control and a measure of reporting cases,
- **Population health**, in particular the prevalence of pre-existing conditions, and
- **Health care system capacity**, including number of critical care beds and ventilators.

There are, however, some caveats to these factors. For instance, while the claim that COVID-19 is more lethal in older patients appears to explain the high fatality rate in Northern Italy – which has a relatively high population of individuals over the age of 65[iii] – Germany has an even larger proportion of seniors (22.4% vs. 21.7%) and a much lower COVID-19 mortality rate. Likewise, while many of the countries with high infection rates also have relatively high population density, some of the countries that have most successfully managed the virus to date have the highest population densities examined herein. (As presented in Appendix 1, South Korea, Taiwan, and Singapore have population densities of 523, 673, and 8,358 people/sq km, respectively.) This does not mean that population age structure and density are not important factors to consider; rather, behavioural differences in populations make it difficult to compare outcomes across different cultures.

Health care system capacity is also frequently identified as an important factor in the fight to improve COVID-19 outcomes, with hospitals and government leaders voicing the need for more critical care beds and more ventilators to effectively mitigate the impact of the virus. However, many at-risk and elderly individuals tend to experience poor outcomes even on ventilators; this suggests that preventing spread is likely to be more effective – though, it does not minimize the importance of improving health system capacity.

Other factors appear less contested. For instance, pre-existing health conditions, particularly respiratory and immunocompromised conditions, are consistently associated with higher individual mortality rates. Likewise, the countries that implemented strict screening procedures and other preventive measures earlier appear to have better outcomes to date than those places, such as Spain, that waited longer to put emergency measures in place. However, while the lower mortality rates in countries with wider testing criteria – such as South Korea and Germany – could reflect more successful mitigation of the virus, it is also likely that these countries have more accurately identified the number of infections and therefore have a larger base of individuals

against which to compute hospitalization and mortality rates among those infected. If a region only confirms a portion of the COVID-19 cases present, the COVID-19 mortality rates in that region are likely to appear larger than is actually the case. For a comparison of COVID-19 mortality rates for the total population and COVID-19 mortality rates for identified infections, see Appendix 1.

New Brunswick at a Glance

New Brunswick is still in the early stages of COVID-19, and this gives the province the valuable opportunity to analyze the earlier progression of the disease in other regions and make preparations based on this information. Because the factors mentioned above are likely to impact the course of the disease in NB, it is important to recognize the ways in which the province is similar to (or differs from) the countries it may be observing.

New Brunswick has a relatively large proportion of seniors, with individuals over the age of 65 making up 20% of the total population. Likewise, the median age in NB is 46 – much higher than the national median age of 41.[iii] The population health of New Brunswick is also comparably worse than in most other provinces. Chronic diseases are prevalent in over 60% of the NB population.[iv] Hypertension in particular is common, present in an estimated 27% of New Brunswickers;[v] this is significant to note, as hypertension was the most common comorbidity observed in Italian patients who have died from COVID-19 (present in ~74% of cases).[vi]

The first case of COVID-19 in New Brunswick was diagnosed on March 11, 2020 – and five days later, with 11 cases confirmed, the province declared a state of emergency, enacting social distancing restrictions and closing schools and many workplaces. To date, NB has tested 2,605 individuals for COVID-19 – expanding testing criteria on March 24 from only persons with connections to travel, to persons experiencing symptoms. Although NB's testing capacity is lower than that of other provinces and many other countries, its social control measures were implemented comparably early.

Geographical Comparisons

Successful Cases in Asia[vii]

Even though Taiwan, Singapore, and Hong Kong have strong economic, cultural, and linguistic ties with China, these countries managed to keep deaths resulting from COVID-19 to the single digits (5 in Taiwan, 3 in Singapore, and 4 in Hong Kong), while deaths in China reached over 3,000.[viii] The common theme in the three jurisdictions was a range of aggressive early measures that involved vigorous testing and tracing of infected persons. For instance, on February 6, 2020, Taiwan's measures included barring arrivals from China. In Singapore, police were deployed to track down contacts of infected residents and using government-issued cellphones to keep track of those in quarantine. Hong Kong took a similar approach.

When the first cases of COVID-19 were confirmed in South Korea, the country conducted thorough tests, screening symptomatic and asymptomatic persons. They successfully managed to mitigate an increase in the number of cases even after communal spread in a few clusters, particularly in the cities of Daegu and Cheongdo. Public health authorities and local governments further collaborated to document the movements of infected people – down to the minute. Authorities sought personal testimonies, watched closed-circuit television, investigated smartphone GPS data, and more, publicizing the 'moving histories' of COVID-19 patients. With the help of mobile apps, South Koreans were able to learn if they might have been exposed to the virus, enabling them to quickly visit a doctor and/or self-quarantine.

However, it is important to note that while New Brunswick began implementing social control measures shortly after its first case of COVID-19 – not unlike the countries above – its measures were not as strict. Moreover, the province does not have access to the same testing and tracking resources. It is therefore unlikely that the path of COVID-19 in NB will be the same as that in Singapore, Taiwan, Hong Kong, and South Korea. Nonetheless, the success of these countries in mitigating the impact of COVID-19 suggests the importance of testing New Brunswickers and enforcing measures such as self-isolation and stricter border controls as strategies to decrease the spread and mortality rates of COVID-19.

Various Responses in Europe[ix]

In contrast to the governments in Taiwan, Singapore, Hong Kong, and South Korea, European policymakers have not been able to rapidly deal with the COVID-19 pandemic and are now struggling to keep up with the spread of the virus. It is possible that the aforementioned Asian countries were able to quickly apply lessons learned from previous outbreaks, such as SARS and MERS, whereas their European counterparts failed to recognize the magnitude of the threat and – consequently – failed to organize a systematic response to it. Many of the restrictions imposed in Europe were implemented only gradually, which was inconsistent with the rapid exponential growth of the virus. Moreover, even when emergency declarations were made, many were initially met with skepticism by politicians and the public alike. This was the case in Spain and Italy, both of whom have exhibited extremely high rates of COVID-19 infection and mortality. The resultant overload of cases precipitated an overload of the health care system, requiring difficult treatment decisions to be made by health care staff.

Although as of the time of this report Germany currently has the fifth-highest number of coronavirus cases in the world, it differs from its European counterparts (specifically, Spain, France, and Italy) in that it has only a fraction of the death toll seen in other countries. Germany is at a slightly later stage of the outbreak (e.g., 67 days since first infection vs. 63 days in Spain and 64 days in Italy), but it also has a well-developed healthcare system, with both public and private options, and it implemented strict preventive measures – such as the closure of borders – much earlier in the pandemic than some of its neighbouring areas.

While the various COVID-19 outcomes in Europe present a range of possibilities for New Brunswick, the worst-case scenarios embodied by the outcomes in countries such as Spain and Italy suggest that Canada, and specifically New Brunswick, should continue to maintain preventive measures.

What Does This Mean for New Brunswick?

Even though COVID-19 is shown to result in higher hospitalization and mortality rates among the elderly, and New Brunswick has a proportionally large senior population, this does not mean NB will therefore experience poor outcomes similar to those in Italy. Other countries with older populations – such as Germany and Finland – have seen more moderate rates of critical hospitalization and mortality, possibly due to control and screening measures implemented early.

While New Brunswick does not possess the same testing capacity as other countries – and even other provinces – it is possible the early emergency measures put in place were an effective first step. The early measures may have pushed the peak of infection further and provided the provincial healthcare system with more time to prepare. It is likely that clusters of cases could appear at times, especially from imported cases; therefore, continuous testing could be necessary to control community spread. Another element potentially working in New Brunswick's favor is its population density (11 people per kilometer squared), which is low compared to many European countries. Although population density does not appear to be as strong of a determinant as actual population behaviours, it is possible that – combined with the early adoption and ongoing enforcement of social isolation measures – this factor could help mitigate spread.

If age is not necessarily a determining factor for the trajectory of the virus, population demographics could still play a key role, as a large proportion of New Brunswickers have underlying health conditions – the majority of them chronic and some associated with mortality rates in other countries. Further, on the topic of health, the capacity of the health care system in New Brunswick could be an important factor in managing disease outcomes, including the province's ability to test for infection in health care workers.

To more comprehensively understand how COVID-19 could progress within New Brunswick, further analysis is important, including the impact of the virus on other health care systems worldwide, what explains observed differences, and the links between health system capacity and policy responses in slowing the disease's trajectory in NB.

Modelling COVID-19 – Recent Literature

Simulation modelling studies from Canada,[x] the US,[xi] UK,[xii] and Australia[xiii] – while not directly generalizable to NB – further provide a sense of what we might expect. These studies have not yet been peer-reviewed, as they – like COVID-19 – are extremely new. Nonetheless, their findings provide valuable guidance regarding social controls in New Brunswick:

The Ontario study examines potential timeframes required for social distancing up to 18 months; the US and UK studies examine social distancing for 5 months at a time and provide decision rules for triggers; and the Australian study examines impacts of interventions in place from 0 to 10 weeks.

Case 1 – No Restrictions – In every model, no restrictions/measures result in an overload of the health system. Based on an Ontario modelling study, at the peak of the outbreak (expected between 100-150 days), the daily number of new COVID-19 infections is estimated to be 10 per 1,000. Projected onto the NB population, that would be ~**7,500 new infections on the day of peak infection**. If 3% of infected individuals require critical care/ICU, this represents 225 additional individuals daily requiring ICU admission at peak infection, in addition to those already in critical care. The Canadian Institute for Health Information (CIHI) data indicates **NB has an estimated maximum ICU capacity of 150 beds per 750,000 population**.

Case 2 – Implementing combined restrictions and measures – This scenario has the greatest impact. Studies on the US and UK suggest that suppression measures (e.g., case isolation, home

quarantine, school and university closures, and community-wide social distancing), as have been implemented in NB, can 'flatten' or delay the curve (to buy time for a vaccine to become available), maintaining the need for ICU admissions below the current capacity in NB. Mitigation strategies that implement social distancing for vulnerable populations only (e.g., older than 70 years) delay the curve but do not flatten it below the current NB ICU capacity. The Ontario study does not assess mitigation but demonstrates similar results for suppression measures.

Case 3 – Time for restrictions and measures – To be effective, restrictions/measures need to be in place for several months at a time. The longer measures are in place, the greater the impact. **In fact, removing restrictions/measures prematurely results in the rebounding of the curve and a reversal of the impacts restrictions/measures had made while in place.** These studies suggest that intermittent social distancing may be possible using decision rules that trigger the relaxing or tightening of social distancing and school closure restrictions/measures over time based on real-time ICU occupancy rates. Although case isolation and contact tracing should remain in place continuously, **intermittent social distancing strategies** could help to reduce the amount of disruption to society while helping to not overload the capacity of our health care system.

APPENDIX 1 – selected tables and figures

Statistics on age and population density

Figure 1: Percentage of Populationover Age 65

Singapore	10%
China	11.3%
Taiwan	14.4%
South Korea	14.5%
Iceland	14.8%
US	16%
Australia	16.4%
Canada	17%
Norway	17%
UK	18.2%
Spain	18.2%
Switzerland	18.3%
Denmark	19.5%
France	19.8%
NB	20%
NS	20%
Finland	21%
Italy	21.7%
Germany	22.4%

Figure 2: Median Age

Iceland	37.5
Australia	37.9
US	38.3
China	38.4
Norway	39.8
UK	40.5
Canada	41.2
Denmark	42.3
Singapore	42.2
France	42.3
Taiwan	42.5
Finland	43.1
Switzerland	43.1
South Korea	43.7
Spain	44.9
NS	45.5
Germany	45.7
NB	46
Italy	47.3

Figure 3: Population Density per Kilometre^2

Australia	3
Iceland	3
Canada	3.9
NB	11
Norway	15
NS	17.4
Finland	18
US	36
Spain	94
France	119
Denmark	137
China	153
Italy	206
Switzerland	219
Germany	240
UK	281
South Korea	527
Taiwan	673
Singapore	8,358

COVID-19 infections, tests, critical care, and mortality rates

Figure 4: Total COVID-19 Infections per 1,000 *(total population)

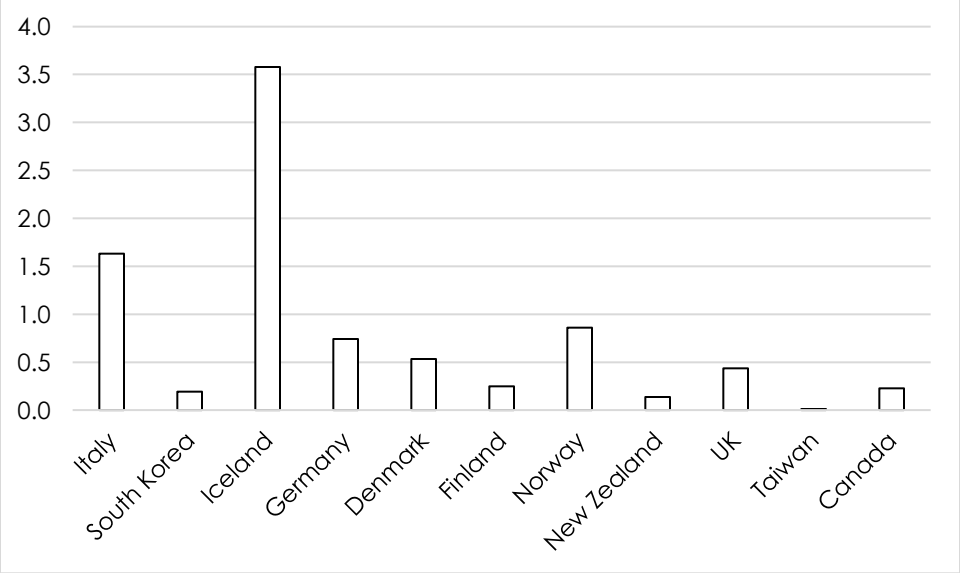


Figure 5: Tests per 1,000 (total population)

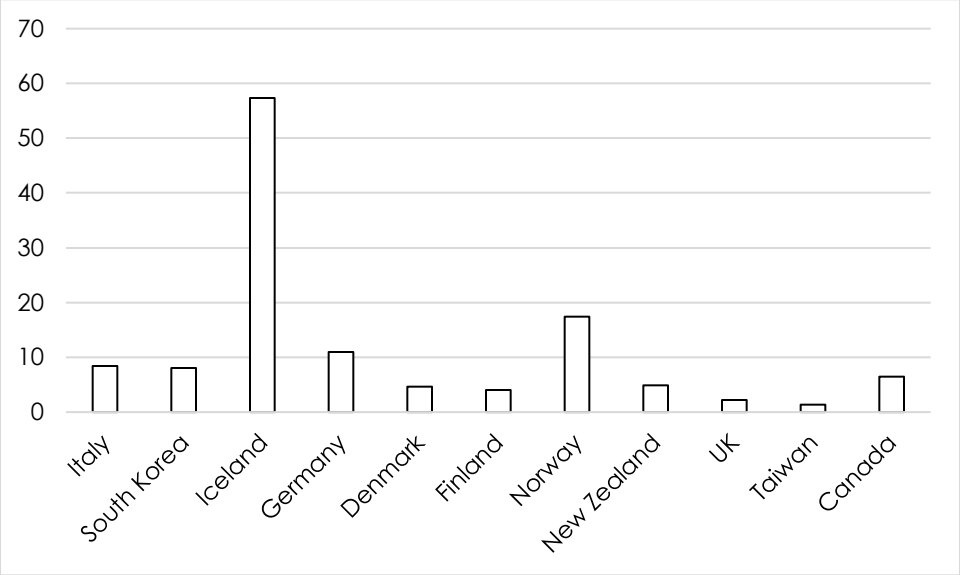


Figure 6: Critical Care per 1,000 (active infections)

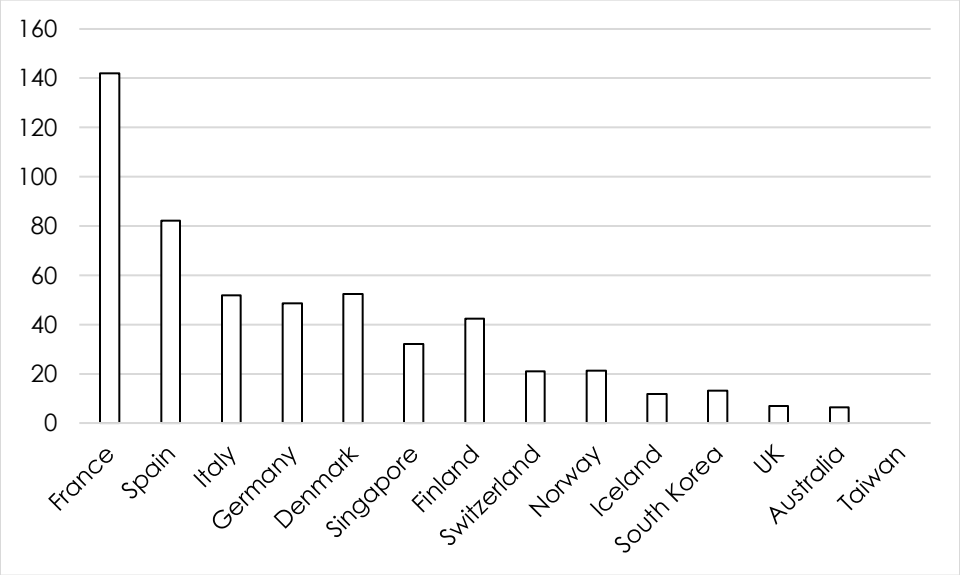


Figure 7: Mortality rate per 1,000 (total population)

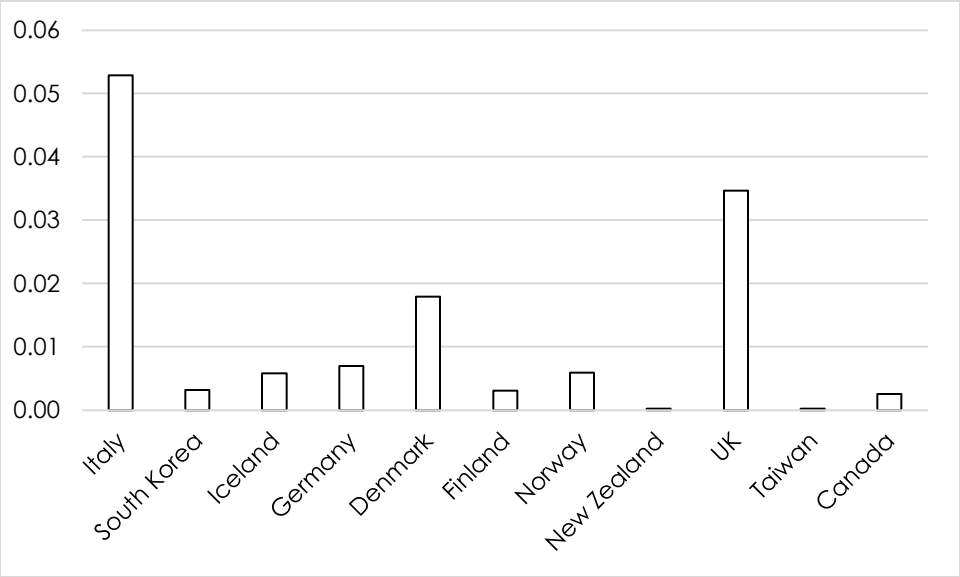
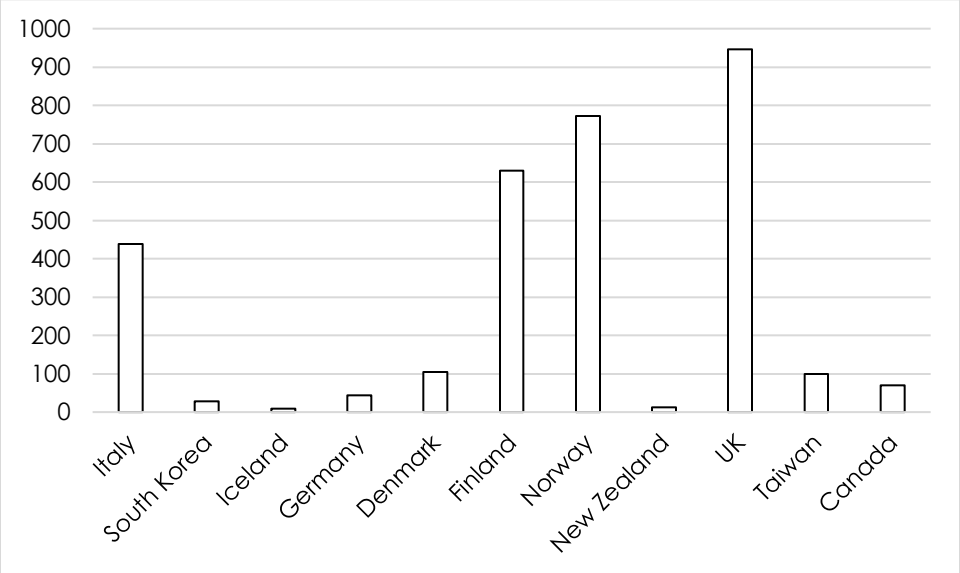


Figure 8: Mortality rate(CFR)[1] per 1,000 (infected people)



[1] Calculating mortality rates while an epidemic is ongoing is complicated, as the outcomes of current cases are not yet determined (i.e., individuals currently battling COVID-19 have neither died nor recovered). Therefore, the mortality rates presented above (Crude Fatality Ratio = Deaths/(Death + Recovered) reflect the outcomes of cases from a previous point in time – not the outcomes at present. The number of recoveries in various countries (e.g., Finland, Norway) could be lagging in the data, whereas the number of cases and deaths is more readily available. For more information on calculating mortality rates, see https://www.worldometers.info/coronavirus/coronavirus-death-rate/#correct.

Timing – When Emergency Measures were First Implemented

Figure 9: New cases in New Brunswick

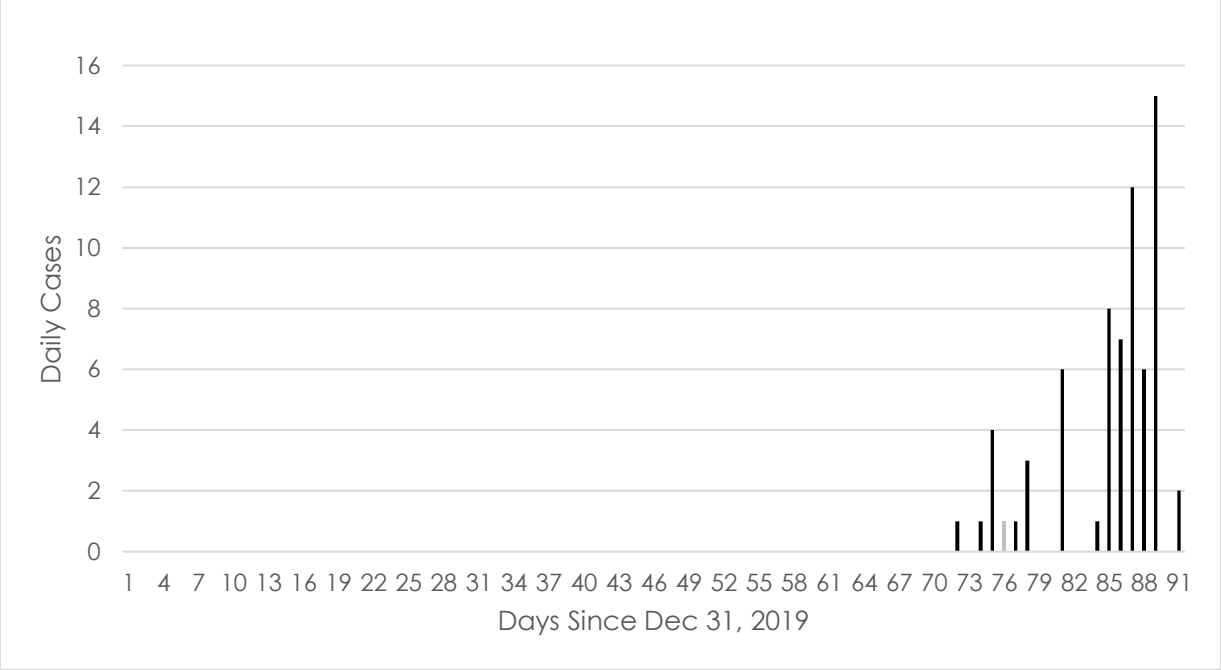


Figure 10: New cases in Canada

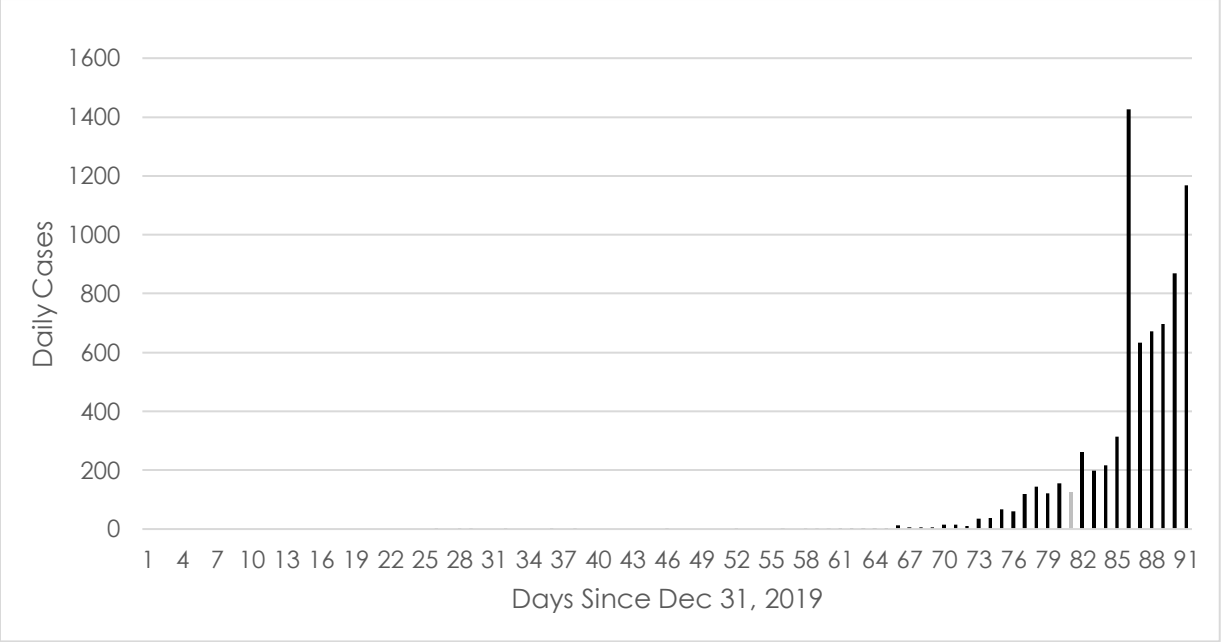


Figure 11: New cases in South Korea

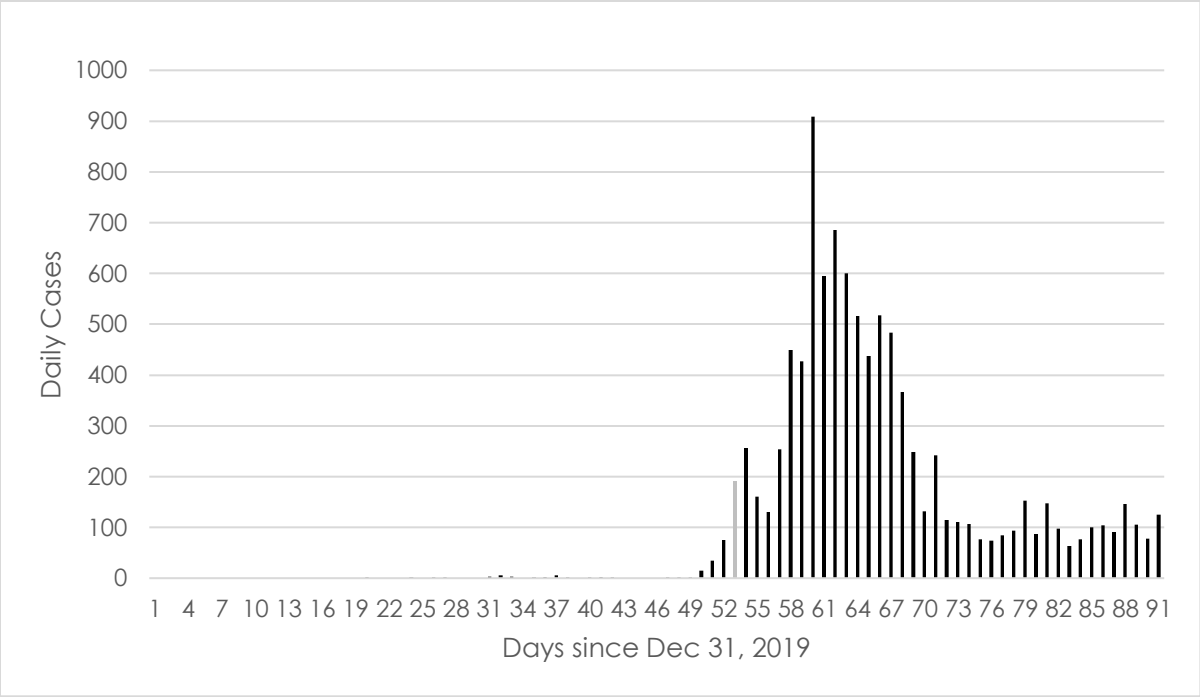


Figure 12: New cases in France

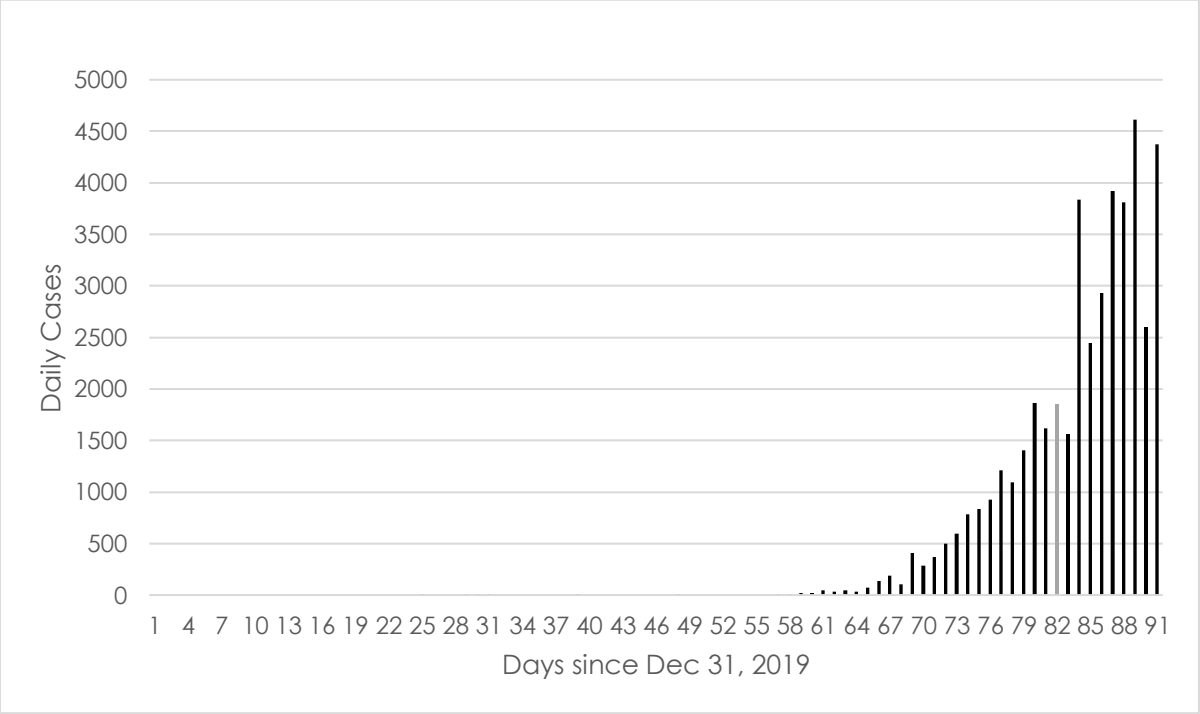


Figure 13: New cases in Italy

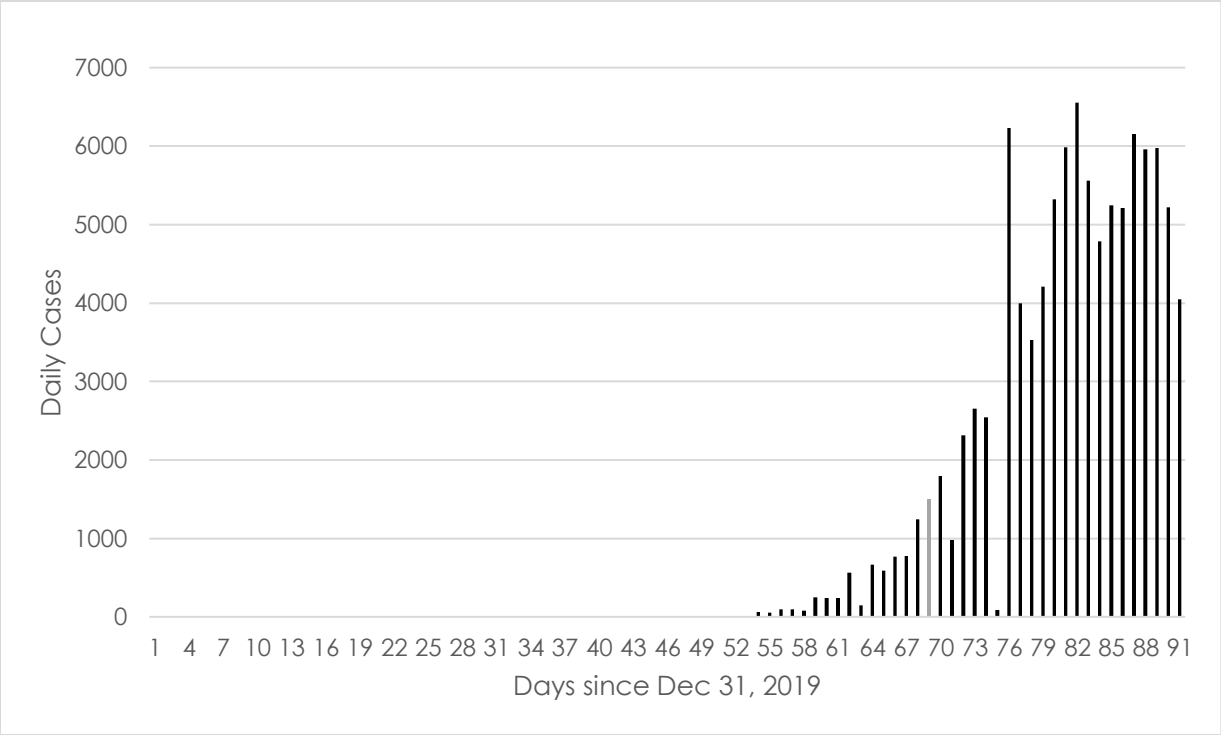
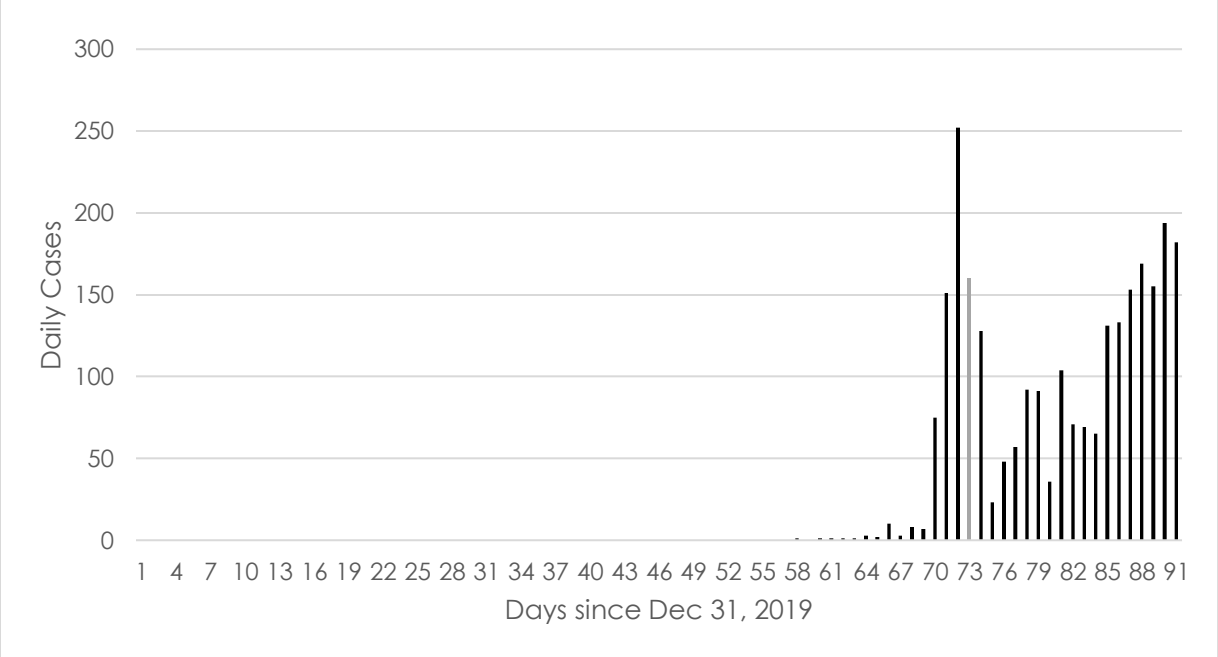


Figure 14: New cases in Denmark



APPENDIX 2 – projected outcomes

Table 2: Projected Range of Outcomes for NB based on Outcomes in Other Countries

		10-day projections			Projections based on highest case rate*			Days since first case
Country	**Age**	**Cases**	**Hospitalized**	**ICU/ Critical**	**Cases**	**Hospitalized**	**ICU/ Critical**	
South Korea	<60	94	7	2	113	8	2	
South Korea	60+	26	9	2	34	11	2	
South Korea	All ages	120	16	4	147	19	4	72
Italy	<60	312	23	6	1047	78	20	
Italy	60+	93	29	6	313	99	21	
Italy	All ages	405	53	12	1360	177	41	61
France	<60	260	19	5	465	35	9	
France	60+	78	25	5	139	44	9	
France	All ages	338	44	10	604	79	18	67
Spain	<60	424	31	8	1209	90	23	
Spain	60+	127	40	9	361	114	24	
Spain	All ages	550	72	17	1570	204	47	60
Denmark	<60	137	10	3	295	22	6	
Denmark	60+	41	13	3	88	28	6	
Demark	All ages	178	23	5	383	50	11	34
Norway	<60	217	16	4	501	37	9	
Norway	60+	65	21	4	150	47	10	
Norway	All ages	282	37	8	650	85	20	34
Finland	<60	156	12	3	156	12	3	
Finland	60+	46	15	3	46	15	3	
Finland	All ages	202	26	6	202	26	6	35

**As of March 31, 2020*

[i] https://jamanetwork.com/journals/jama/fullarticle/2763667
[ii] https://www.epicentro.iss.it/coronavirus/bollettino/Report-COVID-2019_20_marzo_eng.pdf
[iii] https://www.statista.com/statistics/444816/canada-median-age-of-resident-population-by-province/
[iv] https://nbhc.ca/sites/default/files/publications-attachments/June%202016_The%20Cost%20of%20Chronic%20Health%20Conditions%20to%20NB%20-%20FINAL.pdf
[v] https://nbhc.ca/sites/default/files/publications-attachments/June%202016_The%20Cost%20of%20Chronic%20Health%20Conditions%20to%20NB%20-%20FINAL.pdf

[vi] https://www.epicentro.iss.it/coronavirus/bollettino/Report-COVID-2019_20_marzo_eng.pdf
[vii] http://www.thesuburban.com/news/covid_19/taiwan-hong-kong-and-singapore-lessons-for-canada-in-fighting/article_0a120b41-8306-56be-a597-d6dd52430af9.html
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https://www.ijidonline.com/article/S1201-9712(20)30150-8/fulltext
[viii] https://www.worldometers.info/coronavirus/#countries
[ix] https://hbr.org/2020/03/lessons-from-italys-response-to-coronavirus
https://www.businessinsider.com/germany-why-coronavirus-death-rate-lower-italy-spain-test-healthcare-2020-3
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https://www.npr.org/2020/03/25/820595489/why-germanys-coronavirus-death-rate-is-far-lower-than-in-other-countries
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