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COVIDWATCHEU-NPA PROJECT #411 FINAL REPORT 2 - March, 2021

2. COVID-19 Testing, Cases, Deaths Data

2.1   Introduction

Direct comparison of nationally reported figures of COVID-19 cases and deaths is not appropriate when attempting to compare countries' responses to this pandemic. This is due to the differences in testing availability among countries, testing criteria and differences in mortality case definitions and reporting as outlined in Report 1. In addition, some, if not all of these criteria have evolved in each country as the pandemic unfolded which introduces further complexity. If each country's response to the pandemic were uniform, we might expect less variance in the number of cases and mortality experienced among different countries.

Furthermore, certain factors, such as age, obesity, co-morbidity and ethnicity confer additional risks for those infected with SARS-CoV-2, and these will be more or less relevant in different countries due to their population characteristics at baseline. However, it is also true that by evaluating a countries performance over time (i.e. comparing its response at one point in time to another), we can learn important lessons by examining the temporal links between policies and COVID-19 trends during various stages of the pandemic thus far. All information presented in the following graphs accounts for population i.e. cases and deaths are displayed as "per 100,000 inhabitants".

Table 4 below outlines the main data points of interest, up until the end of February 2021. Information for tests conducted in Greenland was not available at time of writing.

Table 1- Key Test, Case, Death Data (per 100,000 inhabitants unless otherwise stated)

COUNTRY (ordered by Deaths per 100,000)	Number of Tests	Number of Tests per 1,000 persons	Positivity Rate (number of cases / number of tests)	Number of COVID-19 Cases	Number of COVID-19 Deaths	Cases per 100,000 citizens	Deaths per 100,000 citizens	Case Fatality Proportion (deaths per 100 positive cases)
[population]					(as of 28th Feb 2021)			
Greenland [57k]	-	-	-	30	0	52.6	0.0	0.0%
Faroe Islands [52k]	223,878	4,295	0.3%	658	1	1262.4	1.9	0.2%
Iceland [339k]	490,337	1,446	1.2%	6,049	29	1784.2	8.6	0.5%
Norway [5.5m]	4,290,920	778	1.7%	70,953	622	1286.3	11.3	0.9%
Finland [5.5m]	3,355,883	608	1.7%	58,359	742	1057.6	13.4	1.3%
Ireland [4.9m]	3,548,898	724	6.2%	219,592	4,319	4477.8	88.1	2.0%
Northern Ireland [1.8m]	1,650,954	906	6.8%	112,493	2,055	6174.1	112.8	1.8%
Sweden [10.2m]	6,293,112	615	10.8%	680,130	12,826	6648.4	125.4	1.9%
Scotland [5.4m]	4,562,237	836	4.4%	202,084	7,131	3705.2	130.7	3.5%

2.2   Analysis of Testing, Cases, Deaths Data

There are 4 parameters described in table 6 which can be useful to consider when examining countries responses to the pandemic. Each is now described in more detail, with a graph detailing the metric over time.

1. *COVID-19 Cases per 100,000 citizens:* once fit-for-purpose testing systems were established in countries, case numbers indicate how active the virus has been over time in countries. Case data has become more sophisticated as the pandemic has evolved, and now many countries are genomically sequencing SARS-CoV-2 in an effort to better understand the behaviour of the virus and the humans who spread it. However, this report focuses on basic numbers of COVID-19 cases, as these are reported openly by all countries. Figure 1 below describes new weekly cases of COVID-19 throughout the pandemic.
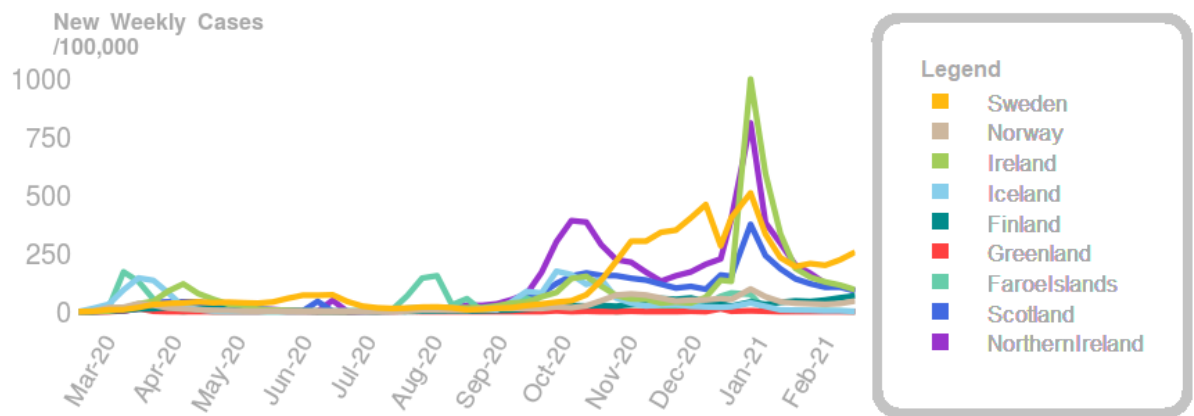
Figure 1- Weekly COVID-19 Case Data for all 9 Regions over time

2. *COVID-19 Deaths per 100,000 citizens:* Evidently a "hard" measure, albeit dependent on how deaths are reported, deaths from COVID-19 tells us in rough terms how active COVID-19 is in countries. Indeed, in countries who have seen many COVID-19 deaths, deaths data indicates how active the virus is in older and vulnerable populations, given the very strong correlation between advancing age and severe illness. Figure 2 shows how COVID-19 deaths occurred in 2 distinct waves - early on and more recently. It should be noted that the deaths in the 1st wave are not reflected in any noticeable way in the case data shown in Figure 1, due to the fact testing systems were not adequate early on.
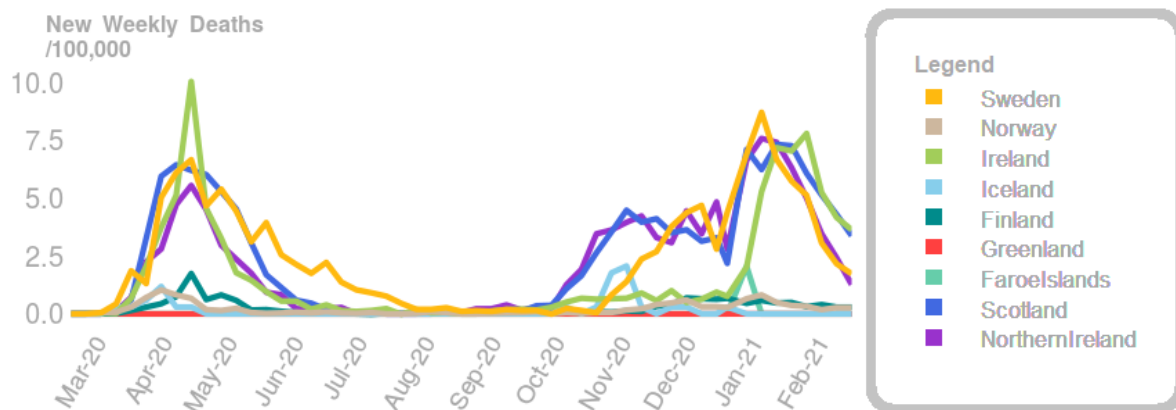

Figure 2- Weekly COVID-19 Mortality Data for all 9 Regions over time

3. *Positivity Rate:* This is calculated by dividing the number of positive cases found in a given time period by the total number of tests carried out in the same time period. It was flagged by the WHO as a useful measure to consider in May 2020 [14] as it tells us something about how well a country is staying on top of virus activity in its communities. The lower the positivity rate the more likely a country is to have virus transmission rates under control. If a country has a fit-for-purpose testing system (and contact tracing system) for COVID-19, symptomatic people and close contacts of

known cases will be identified quickly and can isolate and access testing quickly. Different countries took different lengths of time to get their testing systems fit-for-purpose with many initially only testing people requiring hospital care (i.e. people unwell with COVID-19 symptoms). This means that their positivity rate early on in the pandemic was high, as they were not testing those with mild illness or asymptomatic infections, which we now know accounts for 40-45% of all SARS-CoV-2 infections[15]. This meant that a majority of cases of SARS-CoV-2 infections were likely to be missed, thereby allowing further community transmission. The WHO have suggested countries could consider their virus activity levels to be somewhat controlled if the positivity rate was 5% or below. Figure 3 shows the summer was a period of relative control, before the deterioration seen in the later part of 2020. Note testing data for Greenland is not readily available and Northern Irish data begins at the end of April.

Figure 3- Positivity Rate (rate of positive results per 100 tests) over time

4. *Case fatality proportion (CFP):* CFP is important when we are trying to assess how dangerous current variants of SARS-CoV-2 are. CFP is calculated by dividing the number of deaths by the numbers of cases in a country. Early on in the pandemic, community testing was less frequent than hospital-based testing and thus early CFP values were a lot higher than more recent estimates[16]. As countries test more people in the community setting (many of whom are younger and do not experience severe illness or are asymptomatic), CFP will continue to fall to better reflect the true population-wide effect of COVID-19. Countries with high cumulative CFPs (displayed in Table 4) either did not test very widely for the virus (i.e. missed mild and asymptomatic cases) or had many older and vulnerable patients infected, or possibly both. Figure 4 shows how the proportion of patients dying from COVID-19 after they contract the disease has fallen as the testing systems expanded to capture infections in younger and less vulnerable groups.
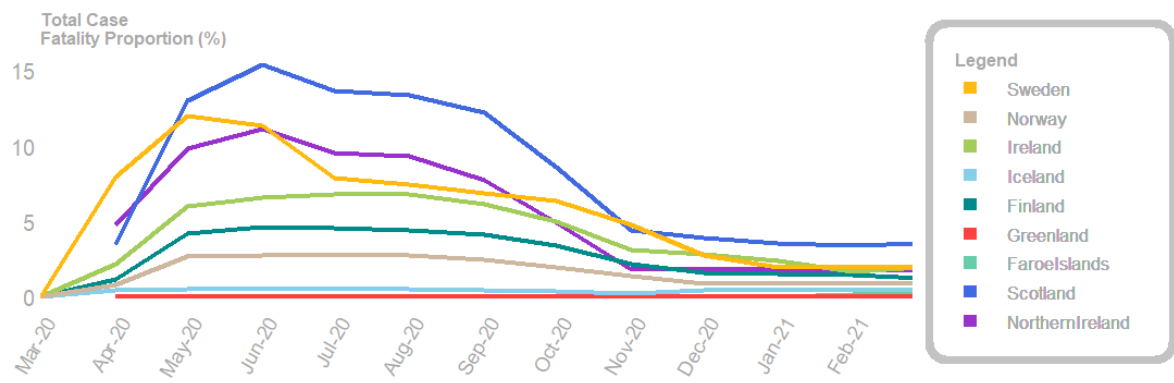
Figure 4- Overall Case Fatality Proportion (number of deaths per 100 cases) in each country over time

2.3   Regional Breakdowns

As SARS-CoV-2 is spread by human travel and social interaction, examining countries in terms of their geographic location and cultural and economic relationships is sensible.

2.3.1   Ireland – Northern Ireland – Scotland

Ireland, Northern Ireland and Scotland have each experienced 3 waves of COVID-19. The 2nd and 3rd waves have not been as distinctly separate as the 1st wave was. Clearly all 3 countries have been severely affected by COVID-19, with their health services overburdened at 2 points over the past 12 months due to the direct effects of this illness. The dire situation intensive care units faced in early 2021 was in a large part responsible for the reintroduction of severe restrictions in all 3 countries, which are ongoing at the time of writing.
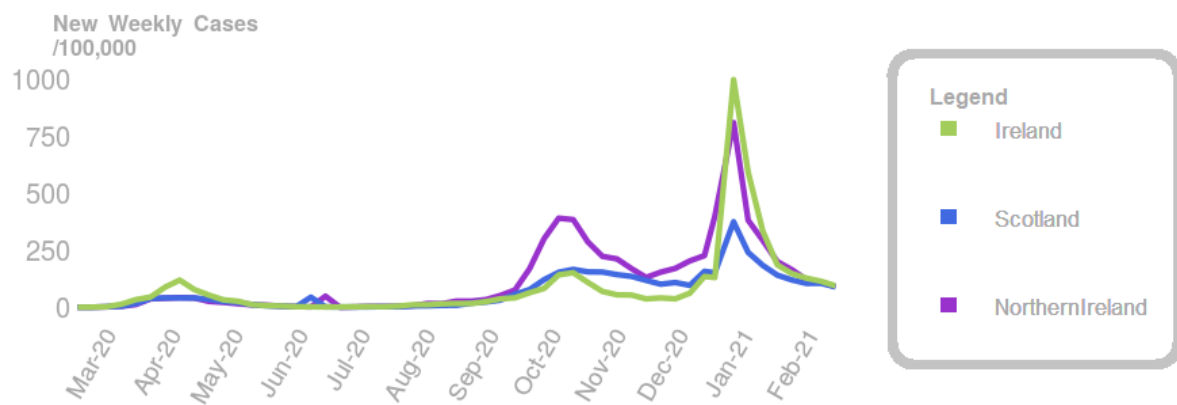

Figure 5- Weekly COVID-19 Cases Data from Ireland, Scotland, Northern Ireland
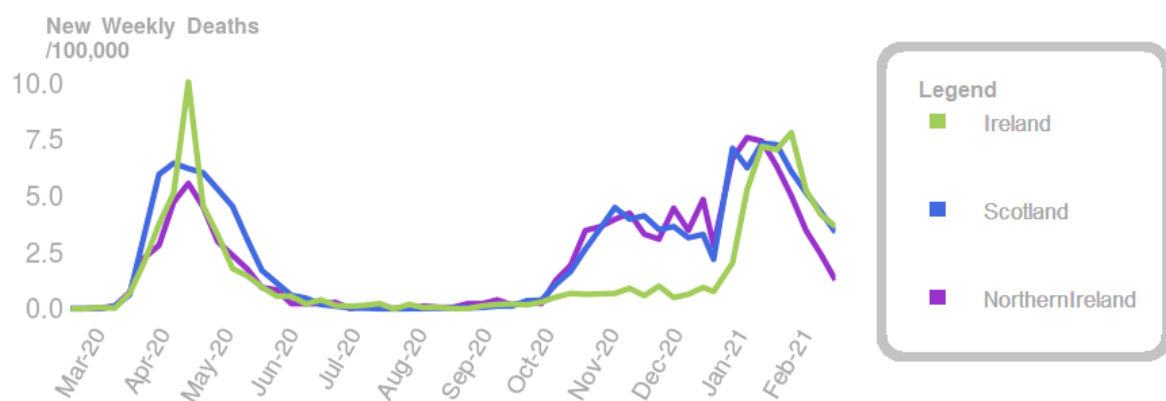

Figure 6- Weekly COVID-19 Deaths Data from Ireland, Scotland, Northern Ireland

Again, in comparison to the second and subsequent waves of COVID-19, it is clear when we consider the large spike of deaths seen in April to June 2020 that testing systems were inadequate and huge numbers of citizens developed COVID-19 infections that went undetected. However, it is the third wave that has seen the greatest number of cases and

deaths from COVID-19 in all 3 countries with the arrival of the third wave in Ireland noticeably later than its neighbours.

2.3.2 Finland – Sweden – Norway

Examination of Finland, Sweden and Norway reveals Sweden has had a vastly different experience of the pandemic as compared to its close neighbours (see Figures 7 & 8). Again, many thousands of deaths were recorded in Sweden early in the pandemic that were not associated with a relative increase in case numbers due to an inadequate testing system. Like the 3 countries in Section 2.3.1, Sweden has seen a large peak of viral activity around Christmas time, and subsequent deaths in early 2021. Norwegian and Finnish citizens have not experienced large numbers of COVID-19 cases or deaths in comparison.
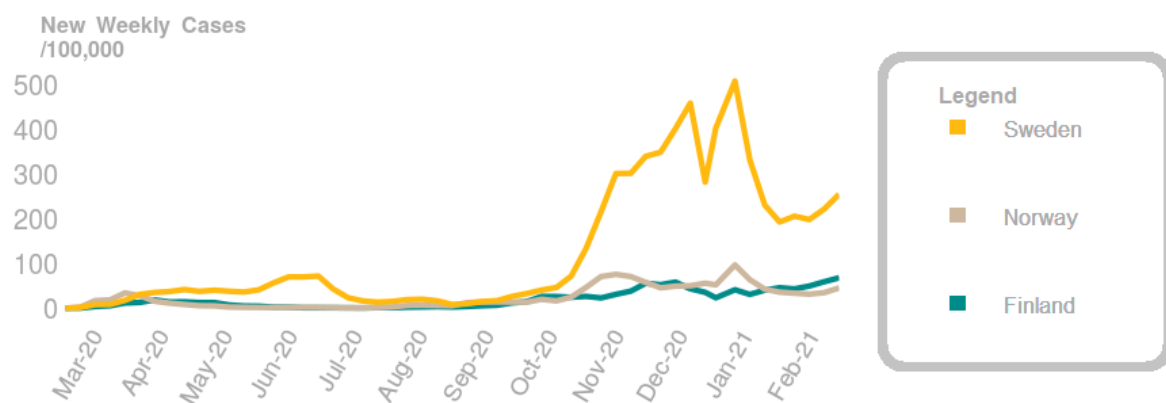

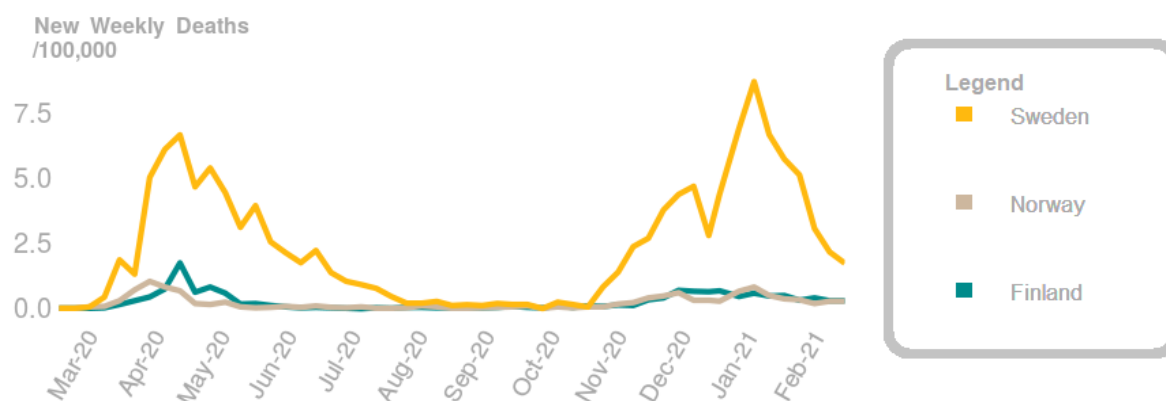*Figure 7- Weekly COVID-19 Cases Data from Sweden, Norway, Finland*

Figure 8- Weekly COVID-19 Deaths Data from Sweden, Norway, Finland

2.3.3 Faroe Islands – Iceland – Greenland

The first point to note from these Figures 9 & 10 is their Y-axis scales, which are a fraction of those for the other country groupings. Relatively speaking, the Faroes, Iceland and Greenland have seen much less COVID-19 activity. Due to the ability to create comprehensive SARS-CoV-2 testing systems very quickly, the cases graphs (Figure 9) and positivity rate graph above (Fig 3) demonstrate that very early on, these countries had the ability to detect the majority of their SARS-CoV-2 infections. While this was arguably a more manageable task for smaller societies, these countries clearly shut down community transmission quickly and in the process prevented much COVID-19 morbidity and mortality. While the numbers have been small, the most deaths in Faroes, Iceland and Greenland were not seen early in the pandemic. The cases graph below shows how each country still needed to remain vigilant during the relatively quiet summer months to prevent importation and onward spread of the virus. While their remote island nature is clearly an advantage for these countries, none of them have escaped importation of SARS-CoV-2, although Greenland has seen very few cases. Small outbreaks in the Faroes and Iceland have been effectively quashed as soon as they arose with a noticeable rapid "up and down" trajectory in most outbreaks in these island communities. However, as has happened worldwide, when this virus gets an opportunity to spread, deaths occur.
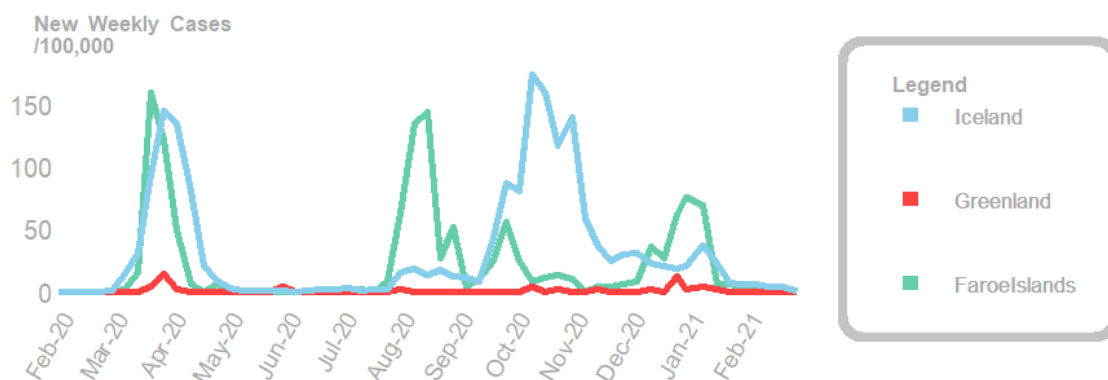

Figure 9- Weekly COVID-19 Cases Data from Iceland, Greenland, The Faroe Islands
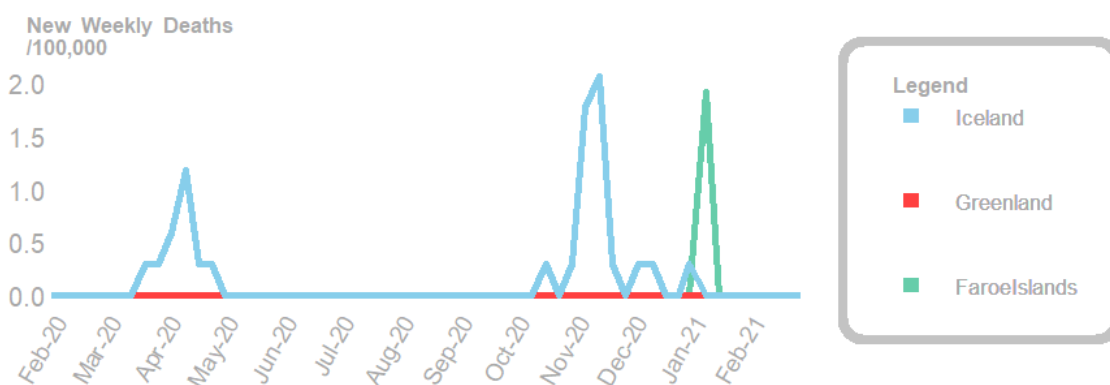

Figure 10- Weekly COVID-19 Deaths Data from Iceland, Greenland, The Faroe Islands

2.4   High versus Low COVID-19 Deaths

An additional grouping of countries into those with higher and lower COVID-19 mortality during the pandemic allows us to glean further information about the responses of the countries being considered in this report.
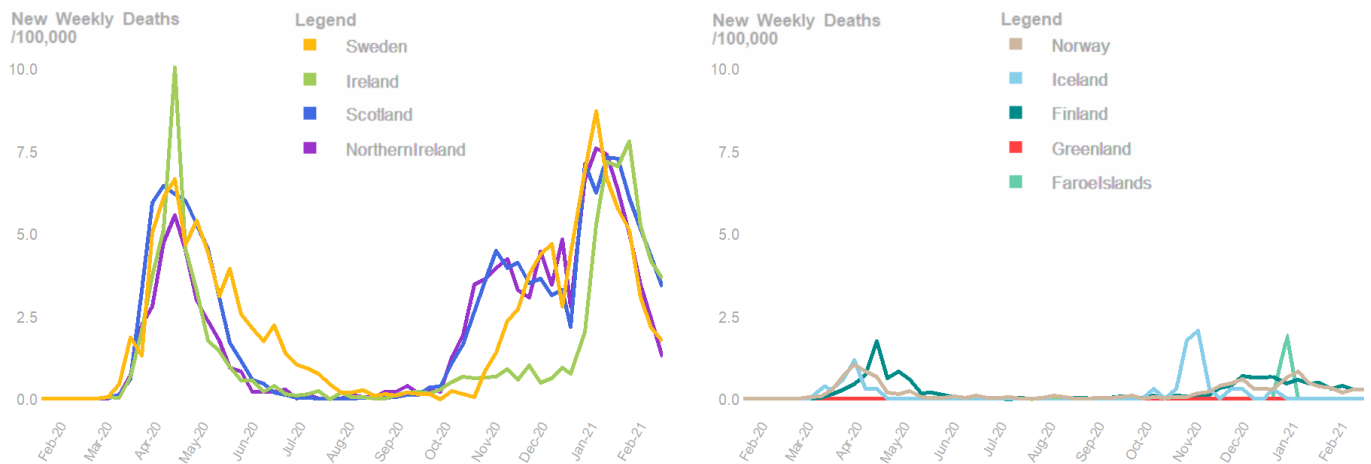

Figure 11- Grouping of countries with higher (left) and lower (right) COVID-19 deaths

Figure 11 groups the countries into those who have surpassed weekly death totals of 5 deaths per 100,000 (left) and those with less than 5 deaths per 100,000 (right). Graphing with the same Y-axis scale shows just how different the death toll from COVID-19 has been across these groups of countries.

While only a proxy for viral spread, and occurring 2 or more weeks after high COVID-19 activity in communities, peaks of COVID-19 deaths on the right-hand graph were very quickly crushed. On the other hand, for the countries on the left, numbers infected were clearly far larger as deaths peaks are far higher. Consequently, these peaks are then drawn out over a long period as large outbreaks take a long time to control.

Examination of the June to September period in each graph shows that the countries on the right achieved near-elimination of viral spread during outbreaks, while the countries on the left merely achieved a gradual suppression that never quite stopped cases (and subsequent deaths) occurring. While ongoing viral spread creates an ongoing death count from COVID-19, it also establishes the conditions to "seed" further waves of COVID-19.

2.5   Excess Mortality during COVID-19 pandemic

Excess mortality provides an estimate of the difference between observed numbers of deaths in a specific time period and the number of deaths that would be expected based on historical mortality data. Calculation of excess mortality during the pandemic will aid understanding of the overall effects of COVID-19, as this measure will not be subject to the effects of differences in testing and deaths registration outlined above. The baseline period for Table 5 was the average monthly mortality for the period 2015-2019.

Eurostat data on excess mortality is available for most countries examined in this report, with the notable exception of Ireland[17]. A slow death registrations process that is reliant on paper-based certification, means official deaths reporting in Ireland lags behind other countries. A third-party funeral registration website in Ireland has been used to estimate the excess mortality during the pandemic[18]. Greenland and the Faroe Islands, due to very few deaths, are excluded from this analysis.

Table 2- Excess deaths in NPA countries during 2020 compared to average monthly mortality for the period 2015-2019

COUNTRY (sorted by excess mortality)	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
Faroe Islands	-	-	-	-	-	-	-	-	-	-	-	-
Greenland	-	-	-	-	-	-	-	-	-	-	-	-
Norway[1]	-3.5%	-2.2%	-0.5%	2.9%	-3.0%	-1.6%	-2.0%	1.7%	4.8%	1.8%	0.3%	-3.4%
Iceland[1]	13.8%	3.6%	-2.0%	4.2%	7.5%	-20.6%	-5.4%	-6.7%	0.9%	10.0%	5.8%	8.6%
Finland[1]	-9.8%	-0.4%	0.5%	8.1%	5.6%	5.7%	1.8%	3.5%	7.0%	2.2%	5.5%	6.5%
Ireland[2]	-6.0%	-2.0%	2.4%	40.5%	9.1%	-1.8%	-1.2%	3.4%	2.9%	-	-	-
Sweden[1]	-3.4%	-4.9%	1.5%	38.3%	23.9%	10.6%	-1.2%	-1.3%	-2.1%	-3.4%	10.4%	-
Northern Ireland[3]	-4.8%	-4.8%	0.9%	47.7%	20.7%	4.4%	2.7%	6.8%	12.1%	18.9%	24.5%	10.8%
Scotland[4]	-4.2%	-6.5%	10.8%	70.2%	23.4%	1.3%	-0.1%	1.8%	2.5%	10.0%	17.7%	5.4%

1- https://ec.europa.eu/eurostat/databrowser/view/demo_mexrt/default/table?lang=en
2- https://www.cso.ie/en/releasesandpublications/fb/b-mpds/measuringmortalityusingpublicdatasources2019-2020/
3- https://www.nisra.gov.uk/publications/monthly-deaths
4- https://www.nrscotland.gov.uk/covid19stats + https://data.gov.scot/coronavirus-covid-19/detail.html

Predictably, Table 5 demonstrates countries that had a large number of COVID-19 cases and deaths such as Scotland, Ireland, Northern Ireland and Sweden also had the highest excess mortality. This is true of the "first wave" in April to May, and also in countries who experienced significant disease activity in late 2020.

2.6 Lessons from the UK

From Table 5, last year Scotland had 70% more deaths than would be expected in an average April. Overall last year Scotland saw 12% more deaths than would be expected. Further analysis of these additional deaths from death certificate data by the National Records of Scotland agency has revealed that 95% were due to COVID-19 [19,20]. From the Northern Ireland Statistics and Research Agency[21], analysis of excess deaths from March to December 2020 has revealed there were 15% more deaths than would be expected over this time period last year, and 97% of these excess deaths were COVID-19 related.

Interestingly, these in-depth analyses by the respective statistical agencies tend to use data gleaned from death certificates and not from respective Departments of Health data. Departments of Health data is based on the stricter definition of a COVID-19 death being one where there was a first positive swab result obtained in the previous 28-day period. Therefore, the excess death data reported above reveals a more complete picture about the direct effects of COVID-19 in both countries.

The National Records of Scotland estimates there were 6,701 COVID deaths in 2020, as compared to the official Department of Health figure of 4,885 deaths during the same period (a 37% discrepancy)[22]. Similarly, the Northern Ireland Statistics and Research Agency reports that there were 1,903 COVID-19 deaths in 2020[23], as compared to the official figure of 1,341 COVID-19 deaths at end December 2020[24] (a 42% discrepancy). While accurately assessing a novel disease like COVID-19 and the damage it is causing in real time is challenging, the obvious data discrepancies highlighted in this section are unlikely to help inspire public confidence in official reporting of progress during the pandemic.

2.6 Excess mortality conclusions

Examining excess mortality helps us to consider the broader healthcare system effects of COVID-19. This section shows that the vast majority of excess deaths seen in Scotland and Northern Ireland last year were indeed due to COVID-19, which correlates well with the fact that periods of high excess deaths mirror those of high COVID-19 activity, which has mirrored the experience of other countries[25]. However, the longer term effects on mortality and morbidity due to late presentations and consequent delayed diagnoses of other time-sensitive non-COVID conditions such as Cancer are as of yet unknown but are no doubt considerable.

Ongoing analysis of excess mortality, through efforts such as the EuroMOMO project[26], which includes data from Ireland, will continue to provide valuable insights and estimates of morbidity and mortality due to direct and indirect effects of COVID-19. Unfortunately, raw data underlying EuroMOMO graphs is not openly available and hence was not included in our analyses here.

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