

RESEARCH

Open Access



Epidemiological outcomes and policy implementation in the Nordic countries during the COVID-19 pandemic

Adam Hallberg¹, Mia Aakjaer², Katri Aaltonen³, Morten Andersen², Elisabeth Pedersen⁴,
Mohammadhossein Hajiebrahimi¹, Hedvig Nordeng⁴, Fredrik Nyberg⁵, Per-Jostein Samuelsen⁶ and
Björn Wettermark^{1,7*}

Abstract

Background During the initial phase of the COVID-19 pandemic, there was an intensive debate on which strategies would be most effective to minimize the negative societal impact of the pandemic. This study aimed to provide an overview of key epidemiological outcome measures of the disease in the Nordic countries and the subsequent policy implementation that were undertaken to curb the outbreak.

Methods Time trends in test-positive infections, hospitalizations, and intensive care unit (ICU) admissions due to COVID-19 as well as COVID-19 mortality and excess mortality were compared between Denmark, Finland, Iceland, Norway, and Sweden. The epidemiological patterns were presented in relation to 13 different policies implemented to a different degree in the countries, eight of which were related to containment and five to health systems policy. A stringency index summarized the intensity of the policies. Data were collected from Our World in Data, the Oxford COVID-19 Government Response Tracker and Eurostat. The investigated time period was 1 January 2020 to 30 April 2022.

Results Overall, Sweden had more infections, deaths, hospitalizations, and ICU admissions than the other Nordic countries during the first three waves of the pandemic. However, in the fourth wave, Denmark exceeded Sweden in all outcomes. The overall stringency among the Nordic countries varied broadly. The lowest average stringency index was observed in Iceland and the highest in Sweden. Excess mortality over the whole study period was lowest in Iceland while Norway had very few ICU admissions.

Conclusions The Nordic countries took vastly different approaches to contain the spread of the pandemic, but the long-term impact on excess mortality was similar. The variety in policy responses and epidemiological measures bring many opportunities for learning across the countries.

Keywords COVID-19, Policy, Mortality, Hospitalization, Nordic countries

*Correspondence:
Björn Wettermark
bjorn.wettermark@uu.se

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

Text box 1. Contributions to the literature

- The Nordic countries share many similarities in terms of population demography and health systems, but they took very different approaches during the Covid-19 pandemic.
- There are limited scientific papers available visualizing the interplay between policy measures and epidemiological outcomes during the Covid-19 pandemic.
- Even though the complexity and rapid changes in policies does not allow for any evaluation of the impact of single policies, visualization may provide opportunities for learning across the five countries to plan for future policy decisions.

Background

The first Corona virus disease 2019 (COVID-19) infections were detected in Wuhan, China, in December 2019 and the epidemic quickly spread around the world. In January, when the news about the novel coronavirus spread, the Nordic countries took various actions. Iceland directly enacted its preparedness act and in mid-February physical distancing and travel restrictions were implemented in Norway [1, 2]. Yet, the first case in the Nordic countries was detected in Finland on 29 January 2020 [3]. Sweden detected the first case the next day [4]. Norway and Denmark reported their first cases one month later, on 26 February, and the World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020 [2, 5]. On 28 February 2020 Iceland reported its first infection [1]. Denmark and Norway began imposing restrictions to limit the spread of COVID-19 and implemented lockdown measures on 12 March 2020, two weeks after detecting their first cases. In mid-March, Finland used its Emergency Powers act and Denmark used their National Preparedness act to enact restrictions, such as bans on international travel and reduced social interactions. Finland also had internal movement restrictions in place for approximately three weeks from 27 March 2020 to 15 April 2020 [6]. Sweden, on the other hand, initially relied mainly on recommendations to the general public [4]. As in the other Nordic countries, communication mainly took place through press briefings. There was no formal lockdown in Sweden, but strict hand hygiene and physical distancing was early recommended by authorities [4]. On 13 March 2020, as the first Nordic country, Iceland began screening individuals, and the initial study showed that COVID-19 to a large extent was asymptomatic [1].

Globally, the pandemic led to extraordinary policy responses, that have been broadly categorized into initial conversion towards cautionary actions through closure and containment policies, subsequent differentiating stringency across countries related to stay-at-home policies, and further increasing heterogeneity in approaches across countries and subnational regions [7]. In retrospect, restrictive policy measures have been associated with reduced transmission rates and fatalities, but they

have also been blamed for negative consequences on mental health, and economic disruptions; however, with a large heterogeneity in impact across studies [8–14].

The differences between countries must be considered when judging policies implemented to mitigate the pandemic regarding the outcome in terms of e.g. number of cases and deaths observed and the timing of such outcomes. The initial lack of large-scale coordinated containment/suppression measures such as school closings, limitation on gatherings, and physical distancing in Sweden made it an outlier compared to most other European countries in both pandemic response and initial impact on population health [6, 15]. While some previous articles have addressed the question of Sweden as a policy outlier, they focused on the first wave or early pandemic [5, 6, 15–18]. Other researchers have focused on the economic trade-offs of certain policy decisions [19] and health system resilience, comparing up to 30 countries [20]. There are also other policy evaluations comparing different policy perspectives between one or two Nordic countries and others [21–25]. Other research has compared excess mortality across countries but has not included any comparative data on policy measures [26]. To the best of our knowledge, there is no comprehensive overview of both epidemiological outcome measures and policies implemented in all the five Nordic countries. Such an analysis would provide a valuable platform for learning across countries, to plan for future policy decisions or more in-depth evaluations of the effectiveness of different strategies.

The aim of this study was to describe the evolution of the COVID-19 pandemic in Denmark, Finland, Iceland, Norway, and Sweden by comparing major policy implementations in each country to mitigate the spread of the disease, with key epidemiological outcome measures from each country on test-positive infections, hospitalizations, and ICU admissions due to COVID-19, COVID-19 mortality, and excess mortality.

Methods**Study design and setting**

This was an ecological study comparing time trends in epidemiological outcomes of the disease (infection rates, hospitalizations, ICU admissions, and deaths due to COVID-19) with policies implemented to manage COVID-19 in Denmark, Finland, Iceland, Norway, and Sweden. The study included data from all five Nordic countries, which together have a population of twenty-seven million people. A summary of key data regarding population demography, healthcare spending, and availability of healthcare professionals in the countries is presented in Supplementary Table S1.

The Nordic countries share many similarities in terms of population, demographic characteristics, and how

their health systems are structured. All countries have a tax-funded health care system with universal coverage for all residents [27]. Health care is decentralized and regulated at different levels, with the national level setting strategic policies, legislation and framework for the healthcare system [24]. However, the extent to which the governance has been decentralized to regions and municipalities varies substantially between the countries [6]. Additional information about the health systems in the Nordic countries can be found as Supplementary material and in the paper by Laugesen et al. 2021 [27].

Data sources and outcome measures

Data was collected from Our World in Data (OWID) and the Oxford COVID-19 Government Response Tracker (OxCGRT). Both data sources are available under a CC BY 4.0 license [28]. OWID compile data collected from national public health agencies, WHO COVID-19 data, the European Centre for Disease Prevention and Control (ECDC), the World Bank, the Organisation for Economic Co-operation and Development, and JHU Center for Systems Science and Engineering (CSSE) among others on nine different markers. The full technical documentation has been explained elsewhere [29].

The OxCGRT collected its data from publicly available data such as news articles, government press releases, and briefings [30].

We assessed four epidemiological outcomes: Infections, hospitalization, ICU admissions, and deaths due to COVID-19. OWID, in turn, collected data on infections and deaths from the WHO. We defined a confirmed infection of COVID-19 in this study as a person confirmed with any laboratory test that is in accordance with WHO guidelines, regardless of symptoms [31]. Data for ICU and hospitalization according to OWID were collected from the local authorities in three countries: Statens Serum Institut in Denmark, National Board of Health and Welfare in Sweden, and The Finnish Institute for Health and Welfare, respectively. For Iceland and Norway, OWID collected their data from the European Centre for Disease Prevention and Control.

The OxCGRT data for policy was scored by OxCGRT and the degree of intensity in each type of policy were rated as “policy level” rated from zero to a maximum level of 2 to 5 depending on the type of policy (see further below). Their method and basis for the scoring has been described elsewhere [32]. Researchers at Oxford University at the Blavatnik School of Government manage the OxCGRT database. The definitions of the OxCGRT were harmonized for all countries but may be different from the formal definitions were used in national statistics in each country, for example, testing policy data for Finland does not agree with the Finnish definitions. Excess

mortality data was collected from Eurostat and a detailed technical outline has been described [33]. The Eurostat data were collected weekly from April 2020 with the specific aim to “support the policy and research efforts related to COVID-19.” [30] Excess death was defined as “the rate of additional deaths in a month compared to the average number of deaths in the same month over a baseline period”. The baseline period set by Eurostat was defined as 2016–2019 not adjusted for age but for coverage (incompleteness) [34] The granularity of the excess mortality data for Eurostat is monthly while the data provided by OWID and OxCGRT are daily data points.

We define a COVID-19 wave as an upward and/or downward period in infection occurrence that is substantially sustained over a period of time, which distinguishes a wave from an uptick, a downtick, reporting errors, or volatility in new cases [35]. The common dates selected to delimit COVID-19 waves for this study across the five countries are presented in Supplementary Table S2.

Investigated policies

Eight different containment policies and five health system policies were investigated in this study (Supplementary Table S3). Policies were scored from 0 to increasing stringency by integers. For example, school closings were scored 0–3 (where 3 indicated requiring closing at all levels), while restrictions on gatherings were scored 0–4 (where 4 indicated restrictions on gatherings of ≤ 10 people). For details, see Supplementary Table S3.

The “government response index” is an average over all indicators in the OxCGRT database and shows how the response has varied, becoming more or less strict in limiting people over the study period. We used the government response index to get an overall composite view even though it also contains economic policies as factors. For details on how the index is calculated, see the original reference [29].

Statistical analyses and visualization

For all policies investigated, a timeline was constructed using the OxCGRT data. Graphs were generated using Microsoft Excel and the countries were separated using a ± 0.05 spacing difference, meaning that $3.05 = 2.95 = 3$. For the epidemiological outcomes, we created timelines using data from OWID and since the fourth wave had more infections than previous waves, the infection timeline was separated into two panels.

Ethical considerations

The data was entirely based on published and publicly available aggregate data. Consequently, no ethical approval was needed for this study.

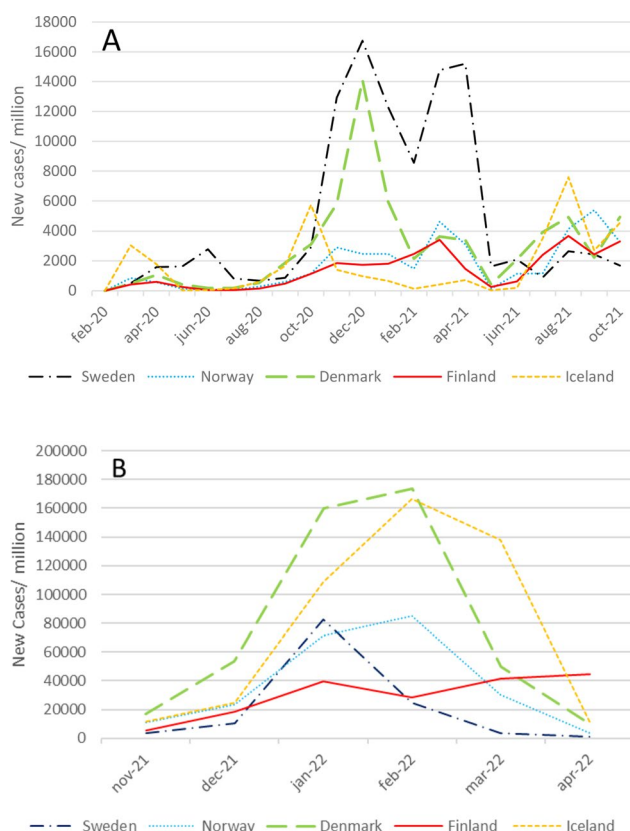


Fig. 1 Number of Corona virus disease 2019 positive infections per month in the first three waves (A) and during the fourth wave (B)

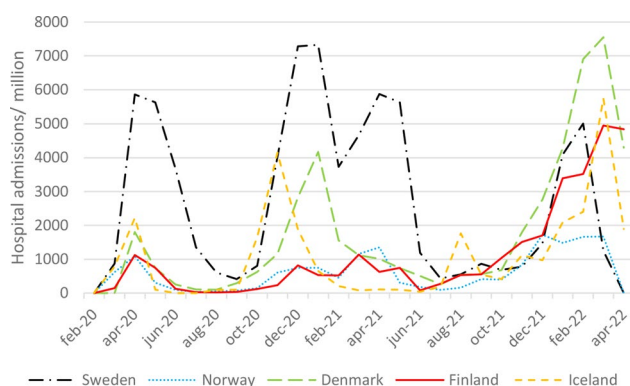


Fig. 2 Hospital admissions per million inhabitants and month during the COVID-19 pandemic

Results

The number of COVID-19 positive infections reported during the four waves are visualized in Fig. 1. Sweden reported more infections per million inhabitants than any other Nordic country in the first three waves. In the fourth wave, Denmark and Iceland reported more infections per million inhabitants than the other Nordic countries. The Nordic countries experienced waves of infections, hospitalizations, deaths, and ICU admissions

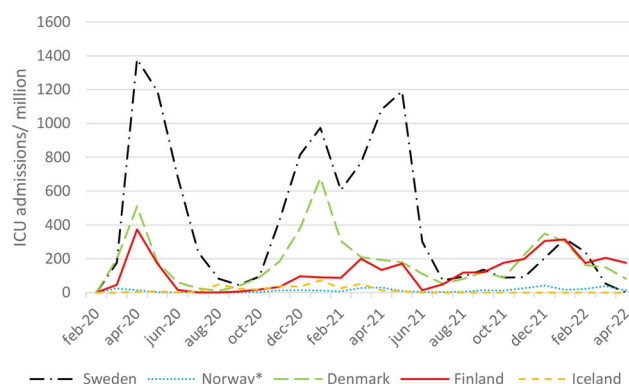


Fig. 3 Intensive care unit (ICU) admissions per million inhabitants and month during the COVID-19 pandemic. * Norwegian data was obtained from the Norwegian Institute of Public Health

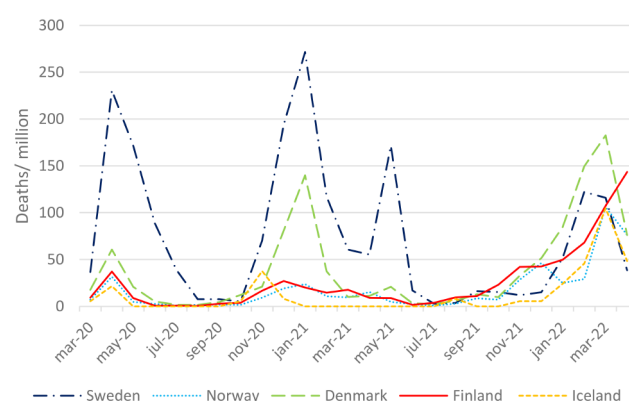


Fig. 4 Deaths per month with deaths attributed to COVID-19, per million inhabitants, during the COVID-19 pandemic

at slightly different times depending on when and how the virus arrived and spread within the country.

While there were more inpatient hospitalizations per million inhabitants in Sweden during the first three waves, Denmark became the top country in the fourth wave (Fig. 2). Both Finland and Norway had low levels of inpatient hospital admissions during the initial phases of the pandemic, but there was a rise in hospitalizations in Finland during the fourth wave. Iceland had peaks mainly in the second and fourth waves.

Compared to Denmark, Finland and Sweden; Norway and Iceland did not have as many ICU admissions. The greatest increase in ICU admissions was observed in Sweden followed by Denmark (Fig. 3).

Sweden had a higher number of deaths per million inhabitants compared to the other Nordic countries during the first three waves. During the fourth wave, Denmark had the highest number of deaths per million (Fig. 4). In Finland, mortality increased rapidly towards the end of the observation period.

Excess mortality relative to 2016–2019 average mortality as reported by Eurostat also varied substantially over time and between the Nordic countries (Fig. 5). Sweden

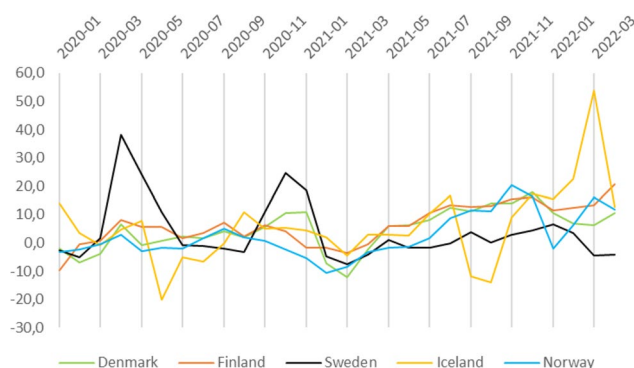


Fig. 5 Monthly excess mortality in the Nordic countries during the COVID-19 pandemic. Percentage of additional deaths in each month compared to 2016–2019 average mortality for the same month

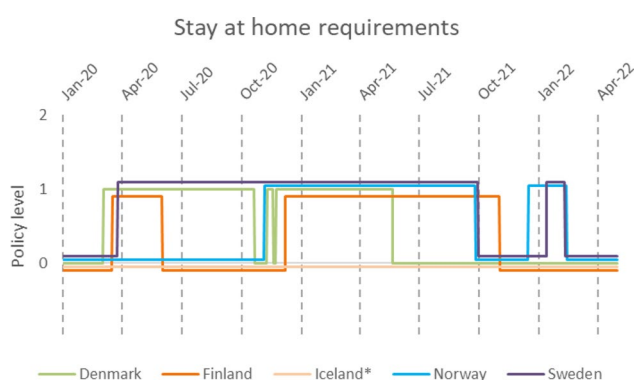


Fig. 6 Stay-at-home or shelter-in-place policy. 0- No measure, 1-Recommend not leaving home. 2-Require not leaving home with exceptions for daily exercise, grocery shopping and essential trips. 3- Require not leaving the house with minimal exceptions

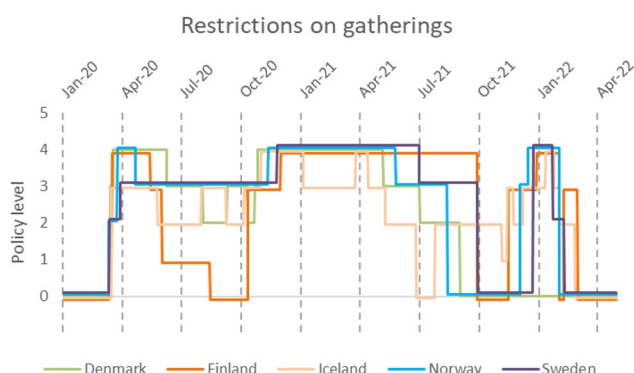


Fig. 7 Changes in restriction on gatherings policy. 0-No measure, 1-Restrictions on very large gatherings (> 1000 people) 2-Restrictions on gatherings between 101–1000 people, 3-Restrictions on gatherings between 11–100 people, 4-Restrictions on gatherings of ≤ 10

had the highest excess mortality at the beginning of the pandemic, while Iceland had the highest excess mortality towards the end of the study period. The different waves of the pandemic are discernible in the excess mortality data. We observed a negative excess mortality in all Nordic countries at some point during the study period.

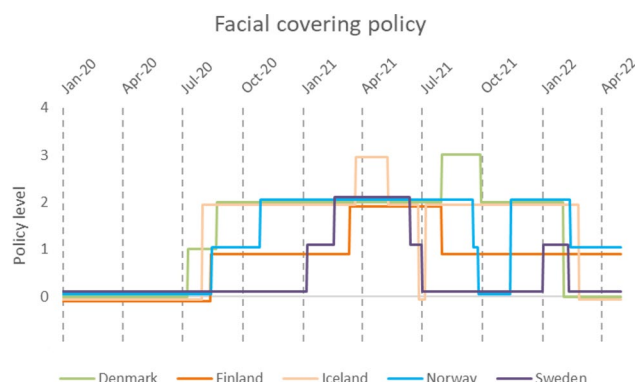


Fig. 8 Change in masking policy in the Nordic countries during the COVID-19 pandemic, according to time and policy level. 0-No policy, 1-Recommended, 2-Required in some specified public places when physical distancing is not possible. 3-Required in all public places when physical distancing is not possible. 4-Required outside the home at all times regardless of location or presence of people

Health system policy measures

All Nordic countries except for Iceland recommended people to stay at home but for different periods (Fig. 6). No country went beyond recommending staying at home and, consequently, no Nordic country applied enforcement for people to stay at home linked to any legal measure.

The restrictions on gatherings also varied between countries (Fig. 7). Yet, at some point in time all countries imposed the most restrictive policy, limiting gatherings of more than ten people.

No Nordic country ever implemented a masking policy at level four, requiring masks to be worn outside the home regardless of location or presence of people (Fig. 8). At the end of the fourth wave, only Finland and Norway still recommended masking. The first country to enact a policy on masking was Denmark, closely followed by the other Nordic countries, except Sweden, which recommended masking in January 2021.

Vaccination access was similar between the Nordic countries and by 7 August 2021, it was extended to all persons above 18 years of age (Fig. 9). Norway was the first Nordic country to make the vaccines available. On 27 December 2020, the first dose was administered in both Sweden and Norway. Denmark was more rapid to make the vaccine available for all essential workers, clinically vulnerable, and elderly persons. Other Nordic countries more gradually reached their targets for vaccination coverage. All Nordic countries provided the vaccine at no cost to the individual.

Public information campaigns (Fig. 10) were quickly introduced along with testing strategies (Fig. 11) and contact tracing (Fig. 12) in all countries. However, there were quite a lot of differences in testing and contact tracing policy implementations between countries and even within countries, e.g. Swedish regions.

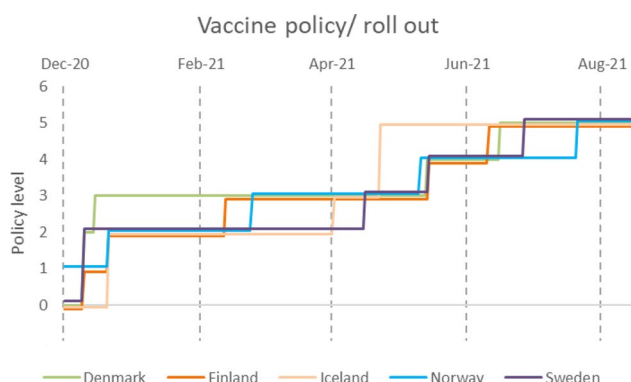


Fig. 9 Vaccination rollout in the Nordic countries according to time and policy level. 18 December 2020 to 1 September 2021, from there on out the vaccine is available at policy level 5 in all Nordic countries. 0-No vaccine available, 1-Available to one of the following groups: key workers / clinically vulnerable groups / elderly, 2-Available to two of the aforementioned groups, 3-Available to all aforementioned groups, 4-Available to all groups plus partially available to select broad groups and ages, 5-Universal availability

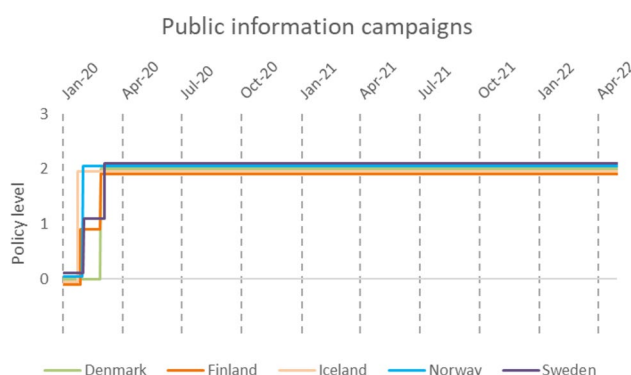


Fig. 10 Public information campaigns in the Nordic countries during the COVID-19 pandemic, according to time and policy level. 0-No campaign, 1-Public officials urging caution, 2-Coordinated public information campaigns

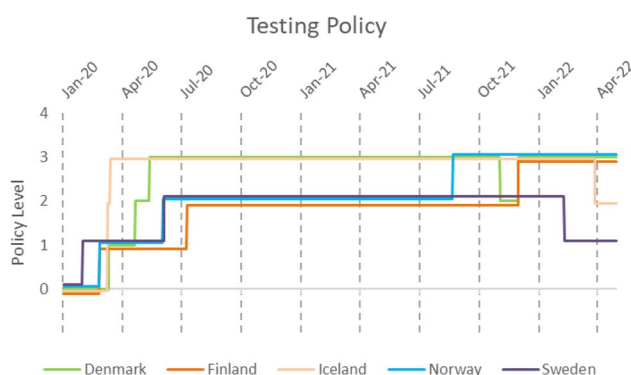


Fig. 11 Implementation of testing policy in the Nordic countries during the COVID-19 pandemic, according to time and policy level. 0-No testing policy, 1-Only those who have symptoms and meet specific criteria such as key workers, inpatients, part of contact tracing, 2-Testing of anyone with symptoms, 3-Open public testing

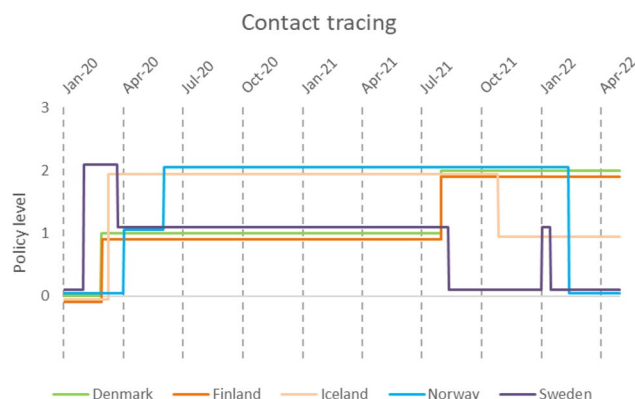


Fig. 12 Implementation of contact tracing policy in the Nordic countries during the COVID-19 pandemic, according to time and policy level. 0-No contact tracing, 1-Limited contact tracing not done for all infections, 2-Comprehensive contact tracing done for all identified infections

Iceland and Denmark were first to impose a level three testing policy, which meant that testing was available to anyone with or without symptoms (Fig. 11). Sweden did not have a testing policy where anyone who wanted could be tested; rather, only symptomatic people and individuals identified via contact tracing or in risk occupations such as health care were recommended to get tested. However, in practice, if you went to a testing point and claimed to have symptoms you were tested. According to the OWID data, Finland implemented universal testing during the fourth wave. However, based on qualitative description on policy responses, at least some restrictions (e.g., to symptomatic, exposed, specific occupations) remained throughout the observation period [28]. Sweden ended contact tracing after the third wave and Norway after their peak during the fourth wave (Fig. 12). Denmark, Finland, and Iceland all kept some level of contact tracing throughout all four waves. Finland reduced testing and tracing capacity to ease the burden on the healthcare system since September 2021.

Containment and restrictive policy

We investigated eight policies related to disease containment and limiting people-to-people transmission. All eight policies were used to varying extents and varying strictness in the Nordic countries. Two policies that have received much attention in the public debate were school closings and restrictions on gatherings (Figs. 7 and 13). In the case of restrictions on gatherings, we observed fluctuating policy implementation with great variability both within and between countries (Fig. 7). In the case of school closings, observations indicated a similar non-consensus, with large variability in response, albeit less so than for restrictions on gatherings (Fig. 13). An interesting comparison between school and workplace closings can be observed with similar restriction levels during the first wave of March through April 2020 (Fig. 13 and S1).

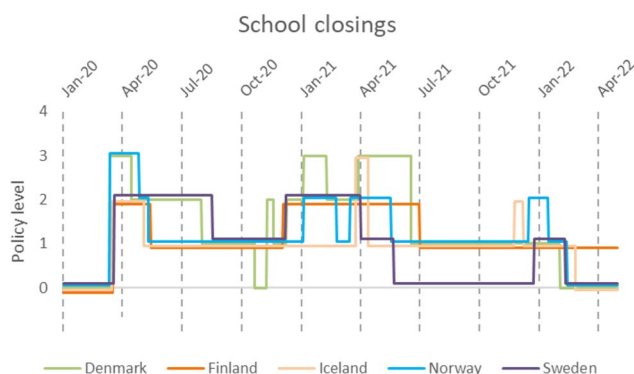


Fig. 13 Changes in school closing policy. 0-No measure, 1-Recommended closing, 2-Required closing at some level, 3-Required closing all levels

followed by a second restricting of both policies corresponding to the third wave. The closing of public transportation fluctuated much less and reached an overall lower score compared to restrictions on gatherings. Iceland for instance had a very brief period with public transport restrictions, only reaching a level 1 for less than 90 days while Sweden kept level 1 for more than 450 days (Figure S5).

Supplementary Figures S6-S15 show epidemiological outcomes together with a stringency index which ranges from 0 to 100. Norway (75.9), Denmark (72.2), and Finland (67.3) all ranked higher than Sweden (32.4) in terms of stringency index in March 2020.

Discussion

In this study, we found that the Nordic countries used a large range of approaches to mitigate the COVID-19 pandemic with subsequent differences in epidemiological outcomes. All Nordic countries imposed physical distancing, limited the number of people at public gatherings and restricted international travel. However, the level, timing and duration of each policy varied heavily in each Nordic country. Our study showed that Sweden may have lost some time and control initially, partly due to a different legal framework and healthcare/care structure, but had equal or even better results on disease-spreading and excess mortality in the long term.

Our study confirms previous findings [17] that Sweden initially had more COVID-19 infections and deaths compared to other Nordic countries, which may be related to less strict policies initially during the pandemic. Sweden's approach was questioned by some observers during the early pandemic for relying too much on recommendations instead of strict policy rules, but our study shows that the country does not seem to have fared appreciably worse in the long run with respect to excess mortality. However, different assessments of excess mortality come to somewhat different conclusions in this regard [37, 38]. Sweden and Iceland both had quite high excess mortality

during certain time periods, Sweden had up to 40% in March 2020 and Iceland had over 50% in March 2022. For Iceland, this can be explained by the small population size, resulting in larger random variation. The large number of hospitalizations and high mortality in Denmark during the fourth wave (late 2021 to early 2022) reflects that a very large part of the adult population (59%) were infected with the omicron variant [39]. Omicron was not associated with more severe disease, but in the mortality surveillance numbers are “death with COVID-19”, i.e., counting all deaths during 30 days after COVID-19 (ref) [40]. It shows that the evaluation based on death certificates (deaths caused by COVID-19) gives much lower numbers, emphasizing the importance of exact definitions when you analyze data over time and between countries. In Finland, mortality increased rapidly since the end of 2021, and in 2022, it contributed to decreasing life expectancy. This seems partly attributed to the COVID-19; however, other reasons such as changes in the population age structure may have also played a role [41]. A longer comparison of Denmark, Finland, Norway, and Sweden showed relatively low excess mortality in all countries, but substantial variation in the timing [42]. Overall, analyses of excess mortality have many methodological challenges and assessments of, e.g., seasonal variations [43] and regional differences within a country [44] have added some insights. It will also depend on the selected baseline, and it has been suggested that in 2020, Sweden's excess mortality reversed health gains to levels seen during 2017-2018 [45].

We also found large variations between the Nordic countries in policy and decision-making. There are many reasons for the different approaches including differences in sociodemography, legislation and healthcare systems. Early during the pandemic, it became clear that controlling contact rates was a key to outbreak control, and strategies should be adapted to population densities [45]. Later studies have confirmed that population density and human mobility had a significant impact on infections rates and deaths, but there has so far been more significant associations between geography and COVID-19 within than between countries [46]. Overall, the Nordic countries have sparse population densities compared to other countries, with Iceland having the added benefit that it is geographically isolated as an island.

Some differences between the Nordic countries in policies implemented should also be viewed in relation to contextual factors around the health system and the role of different stakeholders. The Swedish legal framework did at the time not allow a “state of emergency”, except for in case of war [47, 48]. Other Nordic countries on the other hand had this option and both Finland and Norway declared it early on. So even though similar responses were enacted the extent to

which the different governments could enforce them varied significantly. Earlier studies have shown that Finland and Denmark had strong political influence in their decision-making, while Norway, Iceland, and Sweden relied more heavily on expert advice that was freer from political interference thus leading to more network-based governance [22].

It would have been valuable to assess which of all the different policies implemented in the Nordic countries at different time points that had an impact on the disease spreading. This is, however, not feasible to do given the multiple policies implemented concomitantly and the rapid changes in the nature of them, partly done as responses of a rapid spreading of the infection and partly in anticipation of preventing such spread. However, laying out the policies and outcomes side by side as done here provides some basis for an informed discussion. There is also some evidence from the literature on the effect of some policies. A review of 18 studies from different countries in Asia, Europe and North America, conducted early during the pandemic, suggested that travel restrictions, quarantine of travelers, city lockdown, restrictions of mass gathering, physical distancing measures, compulsory mask wearing, contact tracing and testing, school closures and personal protection among health workers were effective in mitigating the spread of COVID-19 [49]. The quality of some studies were, however, rated as rather low, partly due to the problems raised above.

Finally, vaccination uptake is important to quell a pandemic and a recent study showed that European countries rapidly providing vaccination and booster administration had lower excess mortality than European countries that were slower to immunize their citizens [50]. Sweden achieved a slightly lower vaccination uptake rate (73%) by beginning of 2022 than the other Nordic countries (81–84%) [51]. Another study showed interesting differences between the Nordic countries in vaccine coverage over time and in special population groups [52]. However, compared to other countries, all the Nordic countries performed rather well in terms of vaccinations [53], which may be attributable to a history of trust toward institutions and a high education level enabling informed decisions. Further analyses of the impact of country variation in vaccination rates in different population strata on the epidemiological outcomes would be interesting, but is not feasible within this ecological study design using only aggregated data. Such studies would require more analytical epidemiological methods using individual level healthcare data on vaccinations, risk factors and outcomes, which might be feasible using the rich Nordic population-based registers [27, 54].

Strength and limitations

We believe our study adds insights to previously published studies since it particularly highlights the interplay between policy and subsequent epidemiological outcomes. While we have not done a specific evaluation of the effect of certain policies, we have provided a comprehensive overview of epidemiological measures and the large range of different policies over essentially the entire pandemic period. We used open-access aggregated standardized datasets collected from government agencies about the spread of the virus and the evolution of the public health measures [55]. A similar methodology (e.g., stringency index, policy levels) enabled comparisons.

However, we also acknowledge some limitations. Iceland and Norway have fewer people aged over 70 years (9.9% and 12.6%, respectively) compared to the other Nordic countries [18]. This has not been accounted for in the analysis of excess mortality used here. Furthermore, the observed difference in excess mortality might vary depending on which baseline periods that are used, something that is also mentioned by Kepp et al. [37]. Apart from vaccines, the policies we investigated did not include specific information on interventions aiming at protecting high-risk groups, that may have influenced the outcomes and mortality in vulnerable persons such as the older population.

There was quite limited testing availability at the start of the pandemic, something which may have contributed to an under-reporting of infections [56–58]. Data on reported infections during the final wave are also not comparable to previous waves, because of milder symptoms and increasing use of home testing, and changes in the testing and contact tracing strategy in the beginning of 2022.

While the epidemiological outcome measures to large extent are standardized and have been validated and used in large numbers of scientific papers, the policy ratings are more subjective. There may also be large variations within the Nordic countries not captured in national assessments as implemented by OxCGRT. Many policies (school closures and internal movement restrictions for example) were implemented differently across regions, depending on the number of infections. Thus, a better understanding of the covariation between policies and epidemiological outcomes would require more detailed within-country regional comparisons.

The reliability of the OxCGRT policy data is particularly questionable for Finland, where the dates and levels do not always seem in line with other evidence. This may be due to limitations of the data collection method in capturing within-country heterogeneity. In the Finnish case, the decentralized model of management and distribution of tasks and responsibilities across different agencies and bodies is likely to have complicated summarizing

evidence [3, 59]. Nevertheless, we used data as published by the OxCGRT, because changes would have undermined the main strength of the data: having been systematically collected from all countries they cover using the same methodology. Finally, although our study covered a long period, it is important to acknowledge that assessing the spreading of the infection and subsequent changes in mortality related is only one impact of a pandemic, and the total societal impact in terms of, e.g., increased burden of non communicable diseases, mental health problems, economical recession and increasing inequities remains to be systematically evaluated [60].

Conclusion

This paper provides an overview of the COVID-19 pandemic and measures taken to mitigate the spreading of the infection in the five Nordic countries. Policymakers took vastly different approaches to contain the spread of the pandemic but the long-term epidemiological impact seems similar. The complexity and rapid changes in different policies does not allow for firm conclusions of the impact of single policies on the epidemiological outcomes, but the overview provide opportunities for learning across the five countries, to plan for future policy decisions or more in-depth evaluations of the effectiveness of different strategies.

Abbreviations

COVID-19	Coronavirus disease 2019
GP	General practitioner
OWID	Our world in data
OxCGRT	Oxford COVID-19 government response tracker
ICU	Intensive care unit
WHO	World health organization

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s13690-025-01531-5>.

Supplementary Material 1

Acknowledgements

We would like to thank Professor Thor Aspelund from the University of Iceland for his valuable comments on the Icelandic data.

Author contributions

MA conceived the study. AH led data collection, analysis and drafted the manuscript. All coauthors contributed to the interpretation of data, critically reviewed and revised the manuscript. BW acted as senior lead for the scientific content of the work. PJS aided with illustration ideas and helped with the conception of diagrams. All authors read and approved the final manuscript.

Funding

Open access funding provided by Uppsala University.

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was done as part of the Nordic COHERENCE project, project no. 105670 funded by NordForsk under the Nordic Council of Ministers; the EU-COVID-19 project, project no. 312707 funded by the Norwegian Research Council's COVID-19 Emergency Call; Academy of Finland Flagship Program (decision number: 320162); Academy of Finland (decision numbers: 332624); Regional Health

Authority of Northern Norway (Helse Nord; HNF-1648-22); and by a grant from the Novo Nordisk Foundation to the University of Copenhagen (NNF15SA0018404). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable. The study was conducted with aggregate, publicly available data.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Pharmacy, Uppsala University, Box 580, Uppsala 751 23, Sweden

²Pharmacovigilance Research Center, Department of Drug Design and Pharmacology, University of Copenhagen, Copenhagen, Denmark

³INVEST Research Flagship Center, University of Turku, Turku, Finland

⁴Pharmacoepidemiology and Drug Safety Research Group, Department of Pharmacy, Faculty of Mathematics and Natural Sciences, University of Oslo, Oslo, Norway

⁵School of Public Health and Community Medicine, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

⁶Regional Pharmacovigilance and Medicines Information Centre (RELIS), University Hospital of North Norway, Tromsø, Norway

⁷Pharmacy and Pharmacology Centre, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

Received: 22 August 2024 / Accepted: 7 February 2025

Published online: 20 February 2025

References

1. Scudellari M. How Iceland hammered COVID with science. *Nature*. 2020;587(7835):536–9.
2. Ursin G, Skjesol I, Titter J. The COVID-19 pandemic in Norway: the dominance of social implications in framing the policy response. *Health Policy Technol*. 2020;9(4):663–72.
3. Tiirinki H, Tynkkynen LK, Sovala M, Atkins S, Koivusalo M, Rautiainen P, et al. COVID-19 pandemic in Finland-Preliminary analysis on health system response and economic consequences. *Health Policy Technol*. 2020;9(4):649–62.
4. Ludvigsson JF. The first eight months of Sweden's COVID-19 strategy and the key actions and actors that were involved. *Acta Paediatr*. 2020;109(12):2459–71.
5. Mens H, Koch A, Chaine M, Bengaard Andersen A. The Hammer vs Mitigation-A comparative retrospective register study of the Swedish and Danish national responses to the COVID-19 pandemic in 2020. *APMIS*. 2021;129(7):384–92.
6. Saunes IS, Vrangbæk K, Byrkjeflot H, Jervelund SS, Birk HO, Tynkkynen LK, et al. Nordic responses to Covid-19: governance and policy measures in the early phases of the pandemic. *Health Policy*. 2022;126(5):418–26.
7. Phillips T, Zhang Y, Petherick A. A year of living distantly: global trends in the use of stay-at-home orders over the first 12 months of the COVID-19 pandemic. *Interface Focus*. 2021;11:20210041.
8. Stokes J, Turner AJ, Anselmi L, Morciano M, Hone T. The relative effects of non-pharmaceutical interventions on wave one Covid-19 mortality: natural experiment in 130 countries. *BMC Public Health*. 2022;22(1):1113.
9. Herby J, Jonung L, Hanke S. A literature review and meta-analysis of the effects of lockdowns on covid-19 mortality-II. *medRxiv*. 2023; 2023–08.

10. Faramarzi A, Norouzi S, Dehdarad H, Aghlmand S, Yusefzadeh H, Javan-Noughabi J. The global economic burden of COVID-19 disease: a comprehensive systematic review and meta-analysis. *Syst Rev*. 2024;13(1):68.
11. Janzen B, Radulescu D. Effects of COVID-19 related government response stringency and support policies: evidence from European firms. *Econ Anal Policy*. 2022;76:129–45.
12. Dettmann LM, Adams S, Taylor G. Investigating the prevalence of anxiety and depression during the first COVID-19 lockdown in the United Kingdom: systematic review and meta-analyses. *Br J Clin Psychol*. 2022;61(3):757–80.
13. Panchal U, Salazar de Pablo G, Franco M, Moreno C, Parellada M, Arango C, Fusar-Poli P. The impact of COVID-19 lockdown on child and adolescent mental health: systematic review. *Eur Child Adolesc Psychiatry*. 2023;32(7):1151–77.
14. Bonati M, Campi R, Segre G. Psychological impact of the quarantine during the COVID-19 pandemic on the general European adult population: a systematic review of the evidence. *Epidemiol Psychiatr Sci*. 2022;31:e27.
15. Kuhlmann S, Hellstrom M, Ramberg U, Reiter R. Tracing divergence in crisis governance: responses to the COVID-19 pandemic in France, Germany and Sweden compared. *Int Rev Admin Sci*. 2021;87:556–75.
16. Askim J, Bergstrom T. Between lockdown and calm down. Comparing the COVID-19 responses of Norway and Sweden Local Govern Stud; 2021.p.1–21.
17. Yarmol-Matusiak EA, Cipriano LE, Stranges S. A comparison of COVID-19 epidemiological indicators in Sweden, Norway, Denmark, and Finland. *Scand J Public Health*. 2021;49:69–78.
18. Lindstrom M. The COVID-19 pandemic and the timing of government response: a comparison of four nordic countries March-June 2020. *Scand J Public Health*. 2023;51(5):754–8.
19. Irfan FB, Minetti R, Telford B, Ahmed FS, Syed AY, Hollon N, et al. Coronavirus pandemic in the nordic countries: Health policy and economy trade-off. *J Glob Health*. 2022;12:05017.
20. Haldane V, De Foo C, Abdalla SM, Jung AS, Tan M, Wu S, Chua A, et al. Health systems resilience in managing the COVID-19 pandemic: lessons from 28 countries. *Nat Med*. 2021;27(6):964–80.
21. Gordon DV, Grafton RQ, Steinshamn SI. Cross-country effects and policy responses to COVID-19 in 2020: the nordic countries. *Econ Anal Policy*. 2021;71:198–210.
22. Christensen T, Jensen MD, Kluth M, Kristinsson GH, Lynggaard K, Lægrend P, et al. The nordic governments' responses to the Covid-19 pandemic: a comparative study of variation in governance arrangements and regulatory instruments. *Regul Gov*. 2022. <https://doi.org/10.1111/rego.12497>.
23. Fouda A, Mahmoudi N, Moy N, Paolucci F. The COVID-19 pandemic in Greece, Iceland, New Zealand, and Singapore: Health policies and lessons learned. *Health Policy Technol*. 2020;9(4):510–24.
24. Mishra S, Scott JA, Laydon DJ, Flaxman S, Gandy A, Mellan TA, et al. Comparing the responses of the UK, Sweden and Denmark to COVID-19 using counterfactual modelling. *Sci Rep*. 2021;11(1):16342.
25. Hanson C, Luedtke S, Spicer N, Stilloff Sørensen J, Mayhew S, Mounier-Jack S. National health governance, science and the media: drivers of COVID-19 responses in Germany, Sweden and the UK in 2020. *BMJ Glob Health*. 2021;6(12):e006691.
26. Kepp KP, Björk J, Kontis V, Parks RM, Bæk KT, Emilsson L, Lallukka T. Estimates of excess mortality for the five nordic countries during the COVID-19 pandemic 2020–2021. *Int J Epidemiol*. 2022;51:1722.
27. Laugesen K, Ludvigsson JF, Schmidt M, Gissler M, Valdimarsdottir UA, Lunde A, Sørensen HT. Nordic Health Registry-Based Research: a review of Health Care systems and Key registries. *Clin Epidemiol*. 2021;13:533–54.
28. Creative C. — Attribution 4.0 international — CC BY 4.0. <https://creativecommons.org/licenses/by/4.0/>
29. GitHub. [owid/covid-19-data](https://github.com/owid/covid-19-data). Data on COVID-19 (coronavirus) by Our World in Data. Updated daily by Our World in Data. [Accessed: 14 March 2024]. Available from: <https://github.com/owid/covid-19-data/tree/master/public/data>
30. Hale T, Angrist N, Goldszmidt R, Kira B, Petherick A, Phillips T, et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nat Hum Behav*. 2021;5(4):529–38.
31. Mathieu E, Ritchie H, Rod  s-Guirao L, Appel C, Giattino C, Hasell J et al. Coronavirus pandemic (COVID-19). published online at OurWorldInData.org. [Accessed: 14 March 2024]. Available from: <https://ourworldindata.org/coronavirus>
32. Phillips T, Tatlow H. Method for scoring policy indicators. Methodology for calculating indices Available from: https://github.com/OxCGRT/covid-policy-tracker/blob/master/documentation/index_methodology.md
33. Eurostat. Excess mortality by month (demo_mexrt). Reference Metadata in Euro SDMX Metadata Structure (ESMS). Available from: https://ec.europa.eu/eurostat/cache/metadata/en/demo_mexrt_esms.htm#meta_update164426224869. [Accessed: 14 March 2024].
34. Excess mortality - statistics. Excess mortality in the EU between January 2020 and November 2022. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Excess_mortality_-_statistics [Accessed: 14 March 2024].
35. Zhang SX, Arroyo Marioli F, Gao R, Wang S. A second Wave? What do People Mean by COVID waves?– A working definition of epidemic waves. *Risk Manag Healthc Policy*. 2021;14:3775–82.
36. World Health Organization. Health system response monitor. Available from: www.covid19healthsystem.org/mainpage.aspx [Accessed: 14 March 2024].
37. Kepp KP, Björk J, Emilsson L, Lallukka T. The contribution of population age-sex structure to the excess mortality estimates of 2020–2021 in Denmark, Finland, Iceland, Norway, and Sweden. *SSM Popul Health*. 2023;22:101377.
38. Zahl PH, Hemstr  m O, Johansen R, Mamelund SE. Mortality in Norway and Sweden during the COVID-19 pandemic 2020–22: a comparative study. *J Infect Public Health*. 2023;S1876-0341(23)00371-4.
39. Statens Serum Institut (SSI). Report on the epidemiology of COVID-19 in Denmark March 4th 2022. (In Danish) Available from: <https://www.ssi.dk/aktuelt/nyheder/2022/ssi-konner-at-59-af-de-voksne-danskere-har-varet-smitte-t-med-covid-19-siden-november> [Accessed: 07 June 2024].
40. Statens Serum Institut (SSI). Report on the epidemiology of COVID-19 in Denmark February 18th 2022. (In Danish) Available from: <https://www.ssi.dk/aktuelt/nyheder/2022/doedeligheden-pga-covid-19-stiger-ikke-svarende-til-smittetal> [Accessed: 07 June 2024].
41. Karlinsky A, Kobak D. Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality dataset. *Elife*. 2021;10:e69336.
42. Forthun I, Madsen C, Emilsson L, Nilsson A, Kepp KP, Bj  rk J, Vollet SE, Lallukka T, Skrido Knudsen AK. Excess mortality in Denmark, Finland, Norway and Sweden during the COVID-19 pandemic 2020–2022. *Eur J Public Health*. 2024. <https://doi.org/10.1093/eurpub/ckae091>. Epub ahead of print. ckae091.
43. Modig K, Ahlbom A, Ebeling M. Excess mortality from COVID-19: weekly excess death rates by age and sex for Sweden and its most affected region. *Eur J Public Health*. 2021;31:17–22.
44. Kolk M, Drefahl S, Wallace M, Andersson G. Excess mortality and COVID-19 in Sweden in 2020: a demographic account. *Vienna Yearb Popul Res*. 2022. <https://doi.org/10.1553/populationyearbook2022.res2.2>.
45. Rockl  v J, S  jd  n H. High population densities catalyse the spread of COVID-19. *J Travel Med*. 2020;27(3):taaa038.
46. Vandelli V, Palandri L, Coratza P, Rizzi C, Ghinai A, Righi E, Soldati M. Conditioning factors in the spreading of Covid-19 - does geography matter? *Heliyon*. 2024;10(3):e25810.
47. Jonung L. Sweden's constitution decides its exceptional Covid-19 policy. *VoxEU.Org* (blog); 18 June 2020. Available at <https://voxeu.org/article/sweden-s-constitution-decides-its-exceptional-covid-19-policy>. [Accessed: 14 March 2024].
48. Winblad U, Swenning AK, Spangler D. Soft law and individual responsibility: review of the Swedish policy response to COVID-19. *Health Econ Policy Law*. 2022;17(1):48–61.
49. Ayouni I, Maatoug J, Dhoubi W, Zammit N, Fredj SB, Ghammam R, Ghanem H. Effective public health measures to mitigate the spread of COVID-19: a systematic review. *BMC Public Health*. 2021;21(1):1015.
50. Matveeva O, Shabalina SA. Comparison of vaccination and booster rates and their impact on excess mortality during the COVID-19 pandemic in European countries. *Front Immunol*. 2023;14:1151311.
51. Tiirinki H, Viita-Aho M, Tynkynen LK, Sovala M, Jormanainen V, Keskim  ki I. COVID-19 in Finland: vaccination strategy as part of the wider governing of the pandemic. *Health Policy Technol*. 2022;11(2):100631.
52. Islind AS,   skarsd  ttir M, Cot C, Cacciapaglia G, Sannino F. The quantification of vaccine uptake in the nordic countries and impact on key indicators of COVID-19 severity and healthcare stress level via age range comparative analysis. *Sci Rep*. 2022;12:16891.
53. Alrasheedi AA. The prevalence of COVID-19 in Europe by the end of November 2022: a cross-sectional study. *Cureus*. 2023;15(1):e33546. <https://doi.org/10.7759/cureus.33546>. PMID: 36779135; PMCID: PMC9907732.
54. Xu Y, Li H, Kirui B, Santos A, Gisslen M, Castenbladh Leach S, Wettermark B, Vanfleteren L, Nyberg F. Effectiveness of COVID-19 vaccines over 13 months covering the period of the emergence of the Omicron variant in the Swedish population. *Vaccines* (Basel). 2022;10:2074.

55. Blauer B, Brownstein JS, Gardner L, Kraemer MU, Leiva Rioja ZB, Mathieu E, et al. Innovative platforms for data aggregation, linkage and analysis in the context of pandemic and epidemic intelligence. *Euro Surveill.* 2023;28(24):2200860.
56. Fredriksson M, Hallberg A. COVID-19 testing in Sweden during 2020- Split responsibilities and Multi-level challenges. *Front Public Health.* 2021;9:754861.
57. Rasmussen S, Petersen MS, Højby N. SARS-CoV-2 infection dynamics in Denmark, February through October 2020: nature of the past epidemic and how it may develop in the future. *PLoS ONE.* 2021;16(4):e0249733.
58. Nieminen TA, Auranen K, Kulathinal S, Härkänen T, Melin M, Palmu AA, Jokinen J. Underreporting of SARS-CoV-2 infections during the first wave of the 2020 COVID-19 epidemic in Finland-bayesian inference based on a series of serological surveys. *PLoS ONE.* 2023;18(6):e0282094.
59. Tiirinki H, Sovala M, Jormanainen V, Goebeler S, Parhiala K, Tynkkynen L-K et al. COVID-19 endemic phase in Finland: an analysis of health policies and vaccination strategy. *Health Policy Technol* 2023:100800.
60. Abrams D. The COVID decade: understanding the long-term societal impacts of COVID-19. British Academy of Sciences: Technical report; 2021.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.