

# **COVID-19 misinformation against Denmark early 2022: A focused review**

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## **Abstract**

This paper reviews the data underlying Denmark's decision to remove infection-control policies on February 1, 2022, during the SARS-CoV-2 omicron wave, and claims about this policy that led to the Danish Statens Serum Institute (SSI) directly engaging several high-profile Twitter accounts, which was unprecedented in Danish history. In the analyses, we categorize four main categories of misinformation used by SSI: 1) Misrepresentations of epidemiological data, 2) misleading claims of mass psychiatric disease, 3) misleading claims of pediatric adverse events, and 4) conspiracy theories in relation to eugenics and data manipulation.

We conclude that Denmark's decision to open was based on some of the most complete testing, sequencing and register data and transparent public discussion of essential features of the data, such as incidental omicron hospitalisations and deaths. SSI's claims of misinformation against Denmark, and we conclude that some of this was associated with organized groups using many of the same methods as the antivaccine movements (falsehoods, data misuse, conspiracy theories and distrust in authorities) to distort data used by authorities for decision-making.

We recommend that further analysis is carried out to understand better the motivations and impact of these groups on the public debate during the pandemic, also in other countries.

**Keywords: SARS-CoV-2; COVID-19; misinformation; pandemic; government response.**

## 1. Introduction

The pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)<sup>1-3</sup> led to policy efforts to control the epidemic applied across the world<sup>4,5</sup>. Social media played a major early role in communicating accurate information and making decisions transparent, facilitating information from official authorities such as the World Health Organization (WHO) and the European Center for Disease Control (ECDC), and from individual scientists giving their best attempts at representing the data available<sup>6-8</sup>. One of the most important of these social media was Twitter<sup>7,9</sup> but Facebook, LinkedIn, YouTube and other sites also played substantial roles<sup>8</sup>.

However, social media also played a major role in spreading misinformation with for example, anti-vaccination misinformation or claims that the virus did not exist fueled by misrepresentation of data<sup>10-13</sup>. On the opposite extreme were false claims vastly overstating the risk of disease and spreading unwarranted fear<sup>12,14</sup>. Research suggests that both types of misinformation led to polarized beliefs and anxieties, fear and panic<sup>15,16</sup>.

This paper reviews the unique situation of misinformation directed towards Denmark in relation to the removal of pandemic policies February 1, 2022, leading to a normalization of life after the pandemic. We first briefly analyze the pandemic in Denmark, the data and decisions leading to the policies of late 2021, and the data and analysis leading to the removal of pandemic policies on February 1, 2022. We then discuss the misinformation that started rolling in by the end of January 2022, specifically reviewing the claims made on the platform Twitter. We also discuss the efforts to engage with this by the Danish institution responsible for providing data and recommendations regarding the pandemic, Statens Serum Institut (SSI)<sup>17</sup>, and other experts<sup>18,19</sup>.

## 2. Background: Denmark during the SARS-CoV-2 pandemic

### 2.1. Denmark's epidemic situation and COVID-19 policies in 2020-2021

Denmark took a relatively stringent approach with a general lockdown in March 2020, as one of the first countries in the world. However, mitigations were relatively mild overall compared to many other countries: Denmark did not apply stay-at-home orders, movement restrictions, mitigation in private settings, or large fines for breaking COVID-19 rules. From April to August 2020, Denmark lessened restrictions in several steps, with an emphasis on first opening schools and educational institutions.

Several mitigations and a very substantial COVID-19 testing program using both PCR and lateral flow tests were introduced in September 2020<sup>20</sup>. Masks were introduced in public transport in the second half of 2020 and were gradually extended to crowded public indoor settings<sup>20</sup>, except for children below 12 years of age, or in primary school (grade 1-9). Mitigations were expanded as the Winter wave approached and resulted in a second lockdown in December 2020 that, in contrary to the first, included mask mandates in public indoor settings for all people 12 years and above. Concern over the Cluster 5 mink variant led to the culling of all minks and a selective lockdown in Northern Jutland in November 2020<sup>21</sup>.

These mitigations were maintained through the first months of 2021 when the alpha variant took over. During February 2021 Denmark began to gradually loosen restrictions in the midst of a much more intense political debate climate than during the first reopening in Spring 2020<sup>20</sup>, partly due to a changed political situation after the mink culling and partly due to criticism of the epidemiological alpha variant forecasts being too negative according to some experts, with the fear of a large wave and predicted hospitalizations even at status quo never materializing.

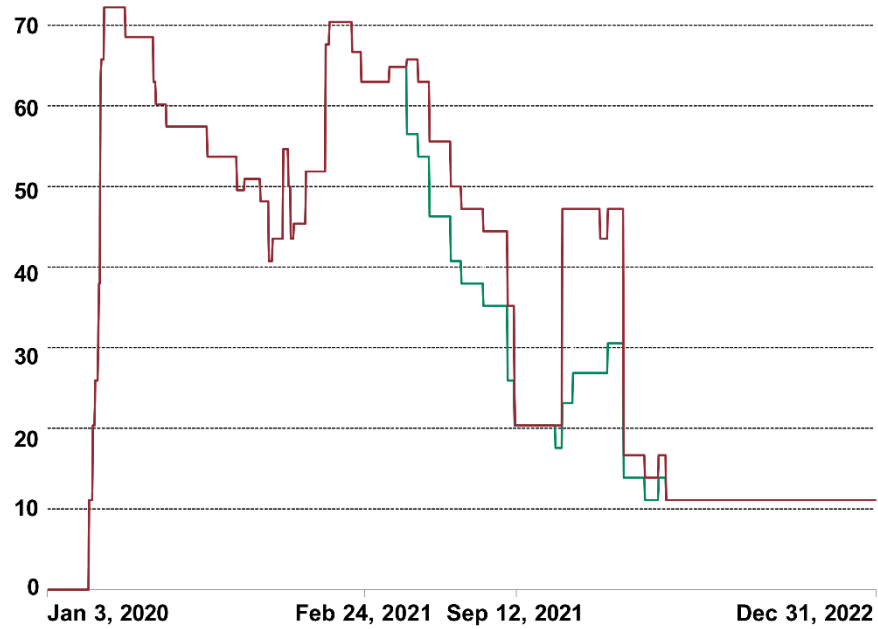
Vaccination campaigns took off in earnest with the Winter wave 2020/2021, starting with healthcare workers, old and vulnerable, and reaching the mid-age population by Summer 2021. Denmark had a fast vaccine rollout in 2021 and high vaccine uptake in the old and adult population, including very high rates in the oldest population most at risk<sup>22</sup>.

The emergence of the delta variant in Summer 2021 was associated with comparatively little infection and death in Denmark relative to some other European countries and did not substantially affect the removal of Non-Pharmaceutical Interventions (NPIs) that occurred during the Summer. The few restrictions that remained in September 2021 were removed on September 10. Although regarded by some as “*Freedom Day*”, this was misleading since NPIs had been gradually reduced over the previous six months since the school children up to grade 4 returned to class on February 8, 2021.

During Autumn 2021, with the Winter wave slowly taking off, policies were reintroduced, including recommendation to vaccinate children, which in the end of November 2021 was expanded to 5-11-year-olds, and extensive testing policies, and use of “corona passports” (requiring evidence of vaccination, previous infection, or recent testing before entry into public buildings and restaurants). Denmark’s high testing levels (which served purposes both of infection control and information to feed local and national policies) imply that more cases were identified, and thus the case numbers cannot be directly compared to other countries.

During December 2021, the delta variant was swiftly replaced by the omicron variant in a new Winter wave. The variants spreading in Denmark were BA.1 (the globally dominant variant at the time) and increasingly (and dominantly from 2022) BA.2<sup>23</sup>. In late December 2021, it was clear that omicron had reduced disease impact on Denmark’s highly vaccinated population, and emerging data also indicated that vaccination did not prevent the spread of omicron very well compared to the delta variant<sup>24</sup>, due to antigenic drift caused by many new spike protein mutations<sup>25,26</sup>. Based on seroprevalence estimates, omicron in Denmark was estimated to have an infection fatality rate of 6.2 per 100,000 (0.000062) for 17–72 years of age<sup>27</sup>, illustrating this new situation.

In January 2022, a marked wave of omicron cases was apparent, with >50,000 cases/day (population: 5.8 mill) by end January, and it had been established that the variant had a milder disease impact. With a firm grip and surprising at the time, all mandated population-directed mass policies were abandoned at once on February 1, 2022<sup>28</sup>. The two first lockdowns and the gradual openings after them, the Winter 2021/2022 restrictions, and the removal of restrictions September 2021 and February 2022 are visible in the Oxford COVID-19 Government Response Stringency Index<sup>29</sup> for Denmark (**Figure 1**).



Source: Hale, T., Angrist, N., Goldszmidt, R. et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nat Hum Behav* 5, 529–538 (2021). <https://doi.org/10.1038/s41562-021-01079-8>

**Figure 1. Oxford COVID-19 Government Response Stringency Index for Denmark<sup>29</sup>.** Data as reported on <https://ourworldindata.org/>, depicting the gradual re-openings after the first two lockdowns and the re-openings Sep 2021 and Feb 2022. Red: Unvaccinated. Green: Vaccinated.

## 2.2. Denmark’s epidemic situation in 2022

With a definition of hospitalization or death as caused by COVID-19 for all cases with a positive COVID-19 test within a time frame of 14 and 30 days, respectively, before the event, it was clear in late 2021 that a high omicron prevalence combined with high testing levels would lead to many “incidental” hospitalizations and deaths that would distort the epidemic size<sup>28</sup>. SSI researchers developed a model to estimate incidental numbers and turned focus to intensive care unit occupancy, which implies more stringent criteria. Key epidemiological data were reported in weekly updates and the data was readily made available both as data dashboards and downloadable spreadsheets from SSI.dk.

Importantly for the context, SSI had very good epidemiological model estimates in 2022, as they had been gradually improved based on criticism and new data arriving during 2021. The SEIR (Susceptible, Exposed, Infected, and Recovered)-type models had been met with criticism for being too pessimistic in February 2021<sup>30</sup> in relation to the first opening of school grades 0-4<sup>31</sup>. The criticism related to poor description of heterogeneous transmission, seasonality for the reproduction number (estimated by some researchers to give 27% less transmission in the Summer in Denmark)<sup>32</sup>, too low population start immunity (3%), and uncertainty regarding transmission of children in schools<sup>30</sup>. This later led to inflated predictions of COVID-19 patients with a central estimate of 118 (36-376) admissions per day by April 15 2021<sup>33</sup>, corresponding to

870 hospitalized patients<sup>34</sup>; actually observed ~34 and ~240 at the top of the curve in April). There was substantial public and political debate in Denmark in relation to the continued use of pandemic restrictions versus reopening in the first half of 2021.

However, SSI then adjusted its models, resulting in much better performance. In particular, vaccine efficacy against transmission was initially overestimated in Summer 2021, but then adjusted as data arrived, resulting in good SSI model performance in the second half of 2021. This model and some of the most complete registry and SARS-CoV-2 testing and sequencing data in the world<sup>35,36</sup> were used by SSI to conclude that society could be opened as immunity-induced susceptibility depletion would quench the omicron wave during February. SSI's lead modeler made a public interview appearance to explain the data and basis for the decision<sup>37</sup>.

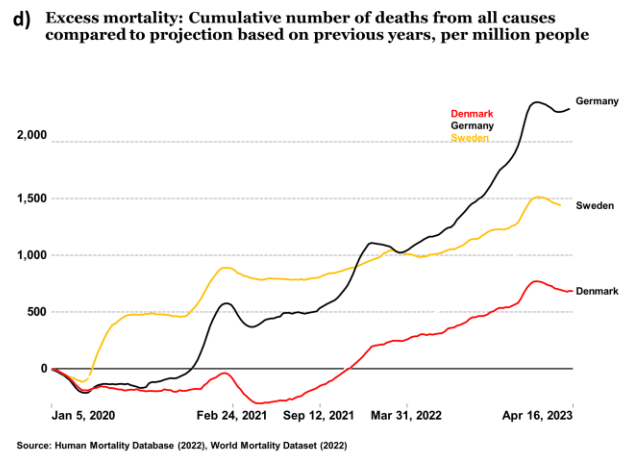
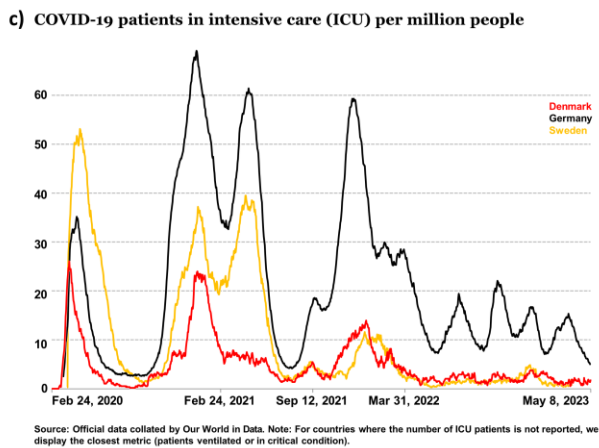
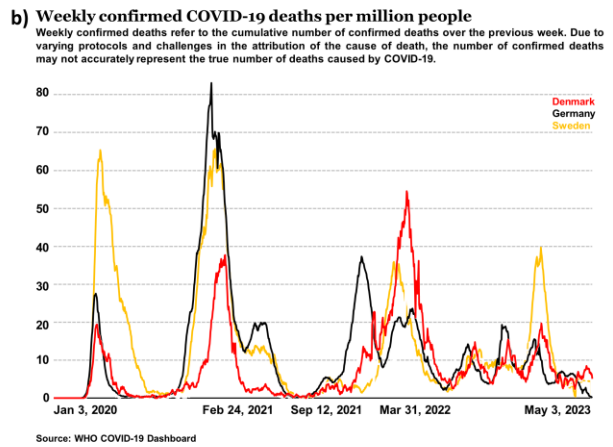
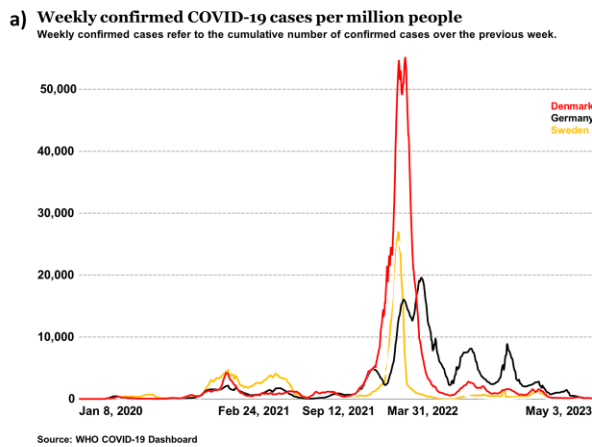
In summary, scientifically sound interpretation of the high-quality epidemic data from Denmark were openly communicated with the message that 1) direct reported case and hospitalization data needed correction due to high testing levels and COVID-19 hospitalization/death definitions and could not be used alone to assess the status of the epidemic, 2) methods were developed to estimate the epidemic more accurately; 3) and Denmark was close to the point where the curve would decline due to susceptibility depletion. In the official recommendation to open, the “decoupling” of omicron cases and disease was noted as a central feature<sup>38</sup>.

### **2.3. Data at the time of normalization and subsequently**

Denmark had high case counts during the pandemic and during the omicron wave, compared to neighboring countries, at least partly due to the very intense Danish testing strategy. When applying metrics not biased by test strategy, Denmark has been one of the best-performing countries in the world and in Europe, a feature shared with other Nordic countries<sup>39-41</sup>.

At the time of normalization, omicron cases, COVID-19 associated hospitalizations and deaths were soaring. The weekly case counts passed 50,000 per million briefly, with a double top at Jan 30 and Feb 14, and a small valley in between (**Figure 2a**). Registered COVID-19 associated deaths (including incidental deaths) were the highest during the pandemic for Denmark, although the numbers were comparable to those seen in other waves in Germany and Sweden (**Figure 2b**). ICU patients per million topped on January 6, 2022 at about 14, and then declined to about 5–6 early February, then slightly increasing to about 8 in the end of February and declining again to 2-3 moving into Summer (**Figure 2c**). Cumulative all-cause excess mortality estimated by the WMD method<sup>42</sup> indicated a linear increase until early 2022, and then a linear increase with smaller inclination until Summer, with no clear impact of the February 1 opening (**Figure 2d**).

Altogether, data adjusted for incidental hospitalizations and deaths indicated a disease burden comparable to previous waves, consistent with what had been seen in the original omicron wave in South Africa<sup>43</sup>. The mortality was estimated to be reduced compared to previous waves despite the high case count<sup>28</sup>, and emphasis was directed towards excess deaths that, despite limitations when comparing countries<sup>40,41</sup>, reasonably can be used to assess changes in within-country mortality burden over shorter periods of time.

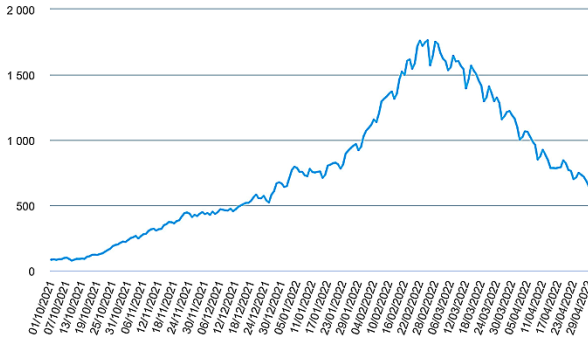


**Figure 2. Data from Our World In Data (<https://ourworldindata.org/>).** These were intensively used on social media, often without context or limitations (Denmark in red compared to Sweden in yellow and Germany in black). **a)** Weekly confirmed cases per million people. **b)** Reported COVID-19 associated deaths per million. **c)** Patients in ICU per million. **d)** All-cause excess deaths per million compared to Sweden and Germany, based on the World mortality dataset model<sup>42</sup>.

A zoom-in using *Statistics Denmark's* data is given in **Figure 3**, with patients hospitalized with COVID-19 shown in **Figure 3a**. COVID-19 associated deaths (blue), patients in ICU (green), and patients on ventilation (orange) are shown in **Figure 3b**. Weekly hospital admissions topped February 20 with no indication of a double top and no clear impact of the opening (**Figure 2c**).

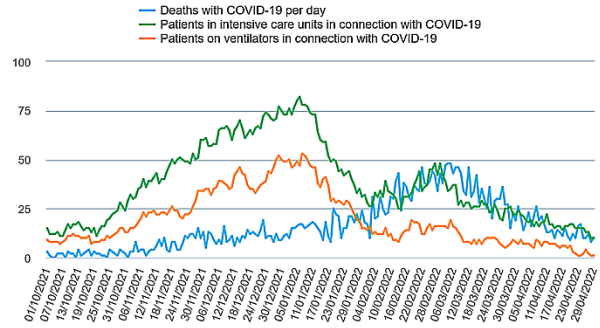
### a COVID-19 spread of infection per day (eksperimentel statistik)

Key figures: Persons hospitalised in connection with COVID-19:



### b COVID-19 spread of infection per day (eksperimentel statistik)

Key figures:



**Figure 3. Key COVID-19 indicators of the Winter wave 2021/2022 from Statistics Denmark. a)** Number of patients in hospital with a positive COVID-19 test. **b)** Deaths (blue), and patients in ICU (green) and on ventilation (orange).

## 3. Reactions to Denmark's policy and epidemiological data

### 3.1. Denmark's decision to open society

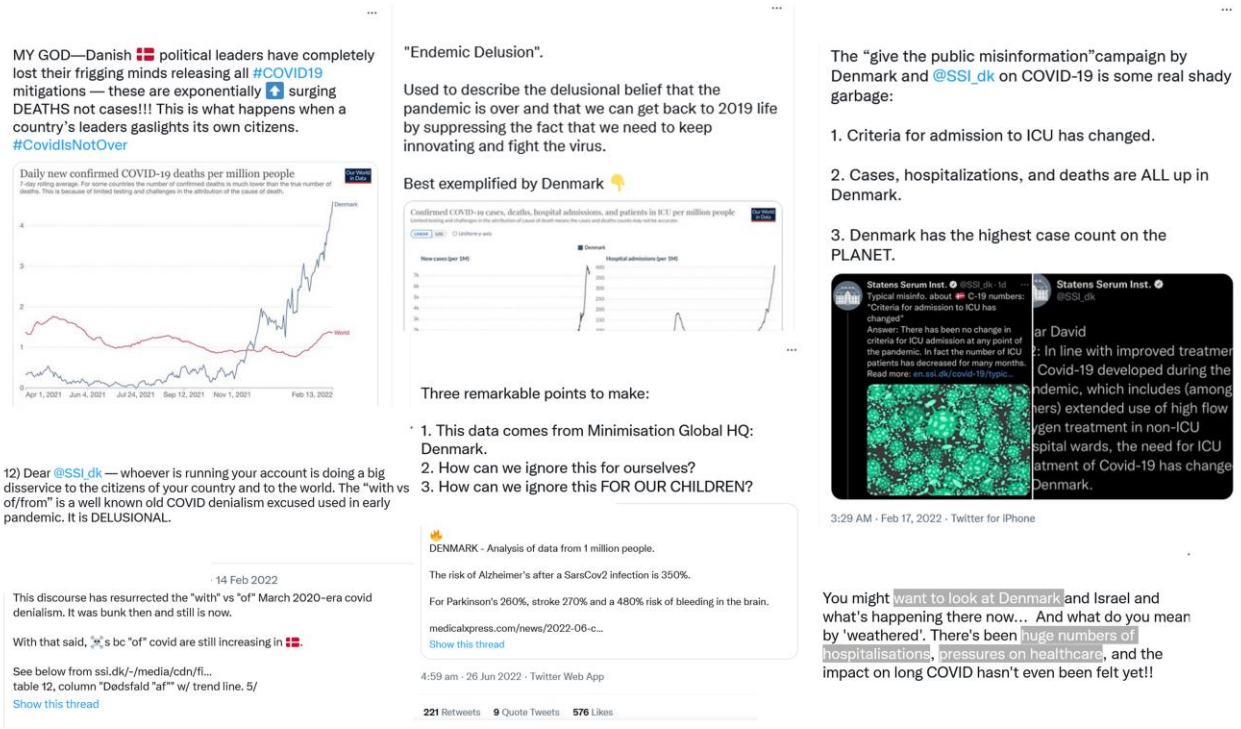
On January 26 2022, the government announced its intention, based on the recommendation by the epidemic commission<sup>44</sup>, to open society completely February 1 and remove almost all restrictions (except test and vaccination recommendations, and the authorities recommended hospitals and care homes to still require mask use to protect old and vulnerable)<sup>38</sup>. As part of the decision, COVID-19 would no longer be considered a society-critical disease, a categorization legally required for the enforcement of mandates and restrictions.

To CNN, Health Minister Magnus Heunicke said that “we promised the citizens of Denmark that we will only have restrictions if they are truly necessary and we’ll lift them as soon as we can.”<sup>45</sup> Heunicke and Søren Brostrøm, the director-general of Denmark's Health Authority (Sundhedsstyrelsen, <https://www.sst.dk/en/>, SST) also cited high vaccination coverage and associated population immunity as a cause of the decision, but spoke against the use of vaccination mandates<sup>45</sup>.

On February 11 it was further announced that <18 years would not be offered a third vaccination dose and adults were not offered a fourth dose<sup>46</sup>. On March 10, 2022, it was then announced that only sick people would be tested for COVID-19 moving forward, the most important remaining pandemic guideline<sup>47</sup>.

### 3.2. Comments in relation to the epidemiological data

The announcement was met with both surprise, celebration, disbelief, and strong criticism. Accordingly, the different interpretations of this decision and its potential consequences offer an informative case-study of public health discussions for a country with excellent data.



**Figure 4.** Examples of Twitter statements made regarding Danish epidemiological data in 2022.

**Figure 4** provides some notable examples of Twitter accounts with >10,000 followers who commented on Denmark’s epidemiological data in relation to the decision to open. One account used OWID graphics to claim that deaths were exponentially surging, and that Denmark’s leaders were “gaslighting” its citizens:

*“MY GOD—Danish political leaders have completely lost their frigging minds releasing all #COVID19 mitigations — these are exponentially surging DEATHS not cases!!! This is what happens when a country’s leaders gaslights its own citizens. #CovidIsNotOver”*

The tweet did not include any nuance on the interpretation and limitations of the data or provide the normal scientific explanations relating to incidental deaths and the predictions made by SSI, but instead used the term “gaslights”, leaving the misleading impression that Denmark was not acting on a scientific basis as recommended by its epidemic commission. The same account also attacked SSI’s twitter account and claimed that incidental COVID-19 deaths, which are well understood epidemiologically<sup>28</sup>, were “well known old COVID denialism” (**Figure 4**).

Experts were also involved in the debate, one stating that Denmark was in a “*delusional belief that the pandemic is over*”, “*suppressing the fact that we to need keep innovating and fight the virus.*” (**Figure 4**), a take that played into conspiracy theories of hidden agendas and manipulated data further discussed below. Another claim was that Denmark and SSI were engaged in “public misinformation”. The same tweet ironically claimed that “criteria for admission to ICU has changed”, a widely circulated falsehood discussed below. Inaccurate statements about pressure on healthcare, also without context and SSI’s explanations, were also common (**Figure 4**).



The "psychiatric" wards are filling up!

(Purple line)

What the HELL ?

Seriously now, what is going on in Denmark ?

5/5

12:16 PM · Feb 3, 2022 · Twitter for iPhone

219 Retweets 62 Quote Tweets 819 Likes

The psychiatric hospitals in Denmark have significant COVID-19 outbreaks. Counting them separately because they're "only psych patients"

Significant underlying mental health conditions (even depression) can result in severe outcomes if infected with COVID-19 – seems overlooked

2:44 PM · Feb 3, 2022

8) Are hospitalizations in #Ba2 dominant Denmark surging? Yes— all time high - including a never before seen surge in psychiatric wards. Notice last year's surge never saw such a thing before.

6:48 PM · Feb 4, 2022

151 Retweets 26 Quotes 441 Likes 20 Bookmarks

Worrying thread about Denmark. Reinfections, child hospitalisation, and PSYCHIATRIC wards now filling up. We are as open as them (masks still required here) but our data is not available anymore. Is it being deliberately hidden??? [t.co/xDmxY9R9WN](https://t.co/xDmxY9R9WN)

Feb 3

Ok Denmark's new data is worrying now ⚠️

A thread with fresh data 📊

First, look at the reinfections.

Figure 5. Examples of claims about psychiatric effects of COVID-19 after Denmark's reopening.

### 3.3. Claims of mass psychiatric events

One of the more notorious claims on Twitter related to psychiatric disease in the wake of the omicron wave in Denmark (Figure 5). This happened despite the authorities explaining clearly that the routine testing of Danish psychiatric patients led to many COVID-19-positive incidental admissions of this type. In fact this instead illustrated well why taking incidental admissions into account is important. When large parts of the population had been infected by omicron, these incidental admissions would be reported also, but they were misrepresented as real COVID-19 associated psychiatric disease by several Twitter accounts as part of a catastrophe narrative.

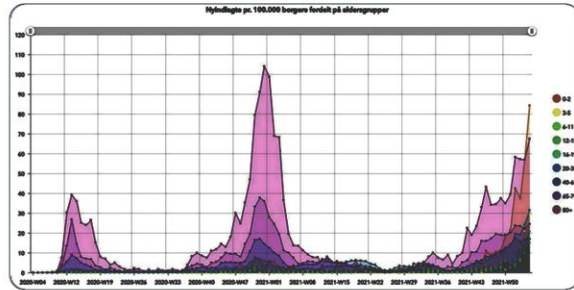
Some claimed that data were "deliberately hidden" (Figure 5), a fairly erroneous claim given Denmark's high transparency and data quality during the pandemic, a feature that ironically also makes a country more vulnerable to misinformation if the data are used selectively or incorrectly. Another equally false claim was that psychiatric wards filled up due to repurposing of psychiatric wards for COVID-19 patients associated, due to restrictions on ICUs ("probably using psychiatric wards because they cut ICU beds"). As the other false claims discussed in this paper, this claim and variations of it were debunked by SSI on their home page<sup>17</sup>.

Ok now this is worrying.

Denmark is witnessing an \*exponential\* rise of hospital admissions.

Kids are being hospitalized massively.

The world should be screaming.



Aleks Jakulin

236

2.3K

4.1K

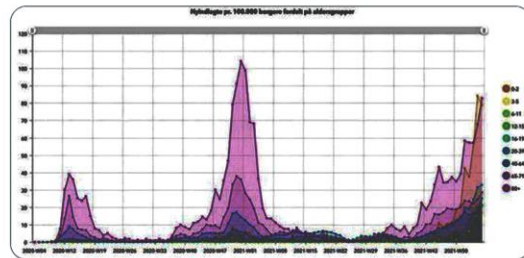
2:13 PM · Jan 26, 2022 · Twitter Web App

3,852 Retweets

1,004 Quote Tweets

8,665 Likes

9) **especially children** — hospitalizations in youngest 0-2 age children in Denmark **now** rivaling rates in the elderly! Again, this NEVER happened before last year.



25

282

605

11

1

Hospitalizations of children growing exponentially.

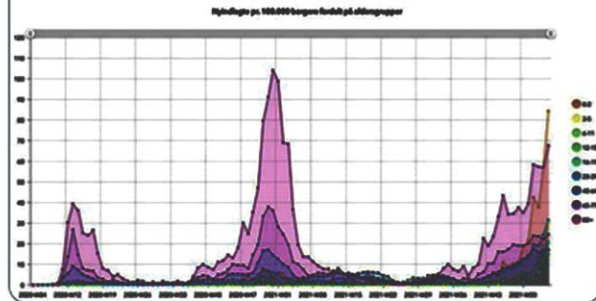
Ok now this is worrying.

Denmark is witnessing an \*exponential\* rise of hospital admissions.

Kids are being hospitalized massively.

The world should be screaming.

Show this thread



56

707

1.3K

they are probably all reinfections, too

6

11

118

**We are hearing about families reinfected within 1,5 or 2 months now. Madness here in Denmark now. Impossible to protect ourselves in schools or at work.**

12:59 am · 27 Jan 2022 · Twitter for iPhone

7 Retweets 41 Likes

Figure 6. Examples of claims about disease among Danish children.

### 3.4. Claims of pediatric disease

Another prominent type of claim was about pediatric disease following Denmark's opening, by misusing preliminary dashboard (rather than final registered) data (Figure 6), such as: "Kids are being hospitalized massively. The world should be screaming"; "Hospitalizations of children growing exponentially"; "they are probably all reinfections"; "Impossible to protect ourselves in school or at work". These notable claims on Twitter went viral with thousands of likes, SSI providing estimates of the pediatric hospitalization burden corrected for incidental admissions in its weekly reports, available to those interested in the epidemiological situation in Denmark.



## 4. Discussion

A main reason for Denmark's decision to reopen was the high vaccine-induced immunity, and in the wake of the omicron wave, hybrid immunity when most of the population was infected. In the US, vaccine uptake was substantially lower, and thus it was important to stress that the Danish epidemic situation could not be transferred directly to North America. However, such reasonable concerns were mixed with and confused by the large body of falsehoods and attacks on Danish authorities and doctors (eugenics, manipulation of data, etc.).

As summarized in Supporting Information, SSI intervened when the misinformation reached a very high level. SSI intervened both via its web page (**Figures S2-S10**) and engaging directly with some high-profile twitter accounts (**Figure S11**) when data were presented out of context. The intervention of SSI correcting Twitter-accounts was unprecedented in Denmark and probably one of the first times a major health authority engaged so directly on a major social media site, which makes the event of interest from this perspective also.

The reasons for this intervention are not clear but it is possible that the misinformation could be perceived as damaging Denmark's reputation, causing hate towards authorities or doctors for engaging in "eugenics" (some tweets e.g., mentioned wanting to do "violence" in relation to Denmark's "eugenics" (**Figure 7**). Other professors and SST personnel also engaged in debunking false claims such as that ICU data had been manipulated (**Figure S12**).

It was unclear whether the claims came from specific politically or financially motivated groups. However, some accounts were associated with organizations such as "ZeroCovid Danmark"<sup>48</sup> who endorses an elimination strategy commonly referred to as "zero-covid". These groups seemed to have started already in early 2020, appeared highly organized, well-funded and associated with many similar groups in other countries.

At least three accounts with more than 100,000 followers were associated with the *World Health Network*<sup>49</sup>, which was again associated with many European zero-covid organizations according to its home page<sup>50</sup>. This organization was also noted for declaring the monkeypox outbreak a "pandemic" during Summer 2022<sup>51-53</sup>. One of these accounts, promoted on Twitter as an expert on the pandemic, accused Denmark's SSI of "gaslighting of its citizens" and compared this to the war in Ukraine (**Figure 8**).

With the new threat from SARS-CoV-2, some views polarized into extreme positions, on one side claiming e.g., that the virus did not exist or that remedy (e.g., vaccines) should not be used, on the other side exaggerating risks, emphasizing prolonged and costly policies, and not weighing cost-benefit balance. The misinformation highlighted by the SSI and reviewed here suggests that agents on both sides distorted data to promote their agendas, and thus, they should both be studied in a complete assessment of misinformation during the SARS-CoV-2 pandemic.



**Figure 8.** Examples of views on Denmark. From left to right: “Huge excess mortality”, comparing “SSI gaslighting” to war in Ukraine, claiming Denmark relies on long-term care facilities instead of ICUs (false), referring to SSI’s social media responses as “shameful”, and child hospitalisation rates “rivaling those in elderly” (based on a plot of preliminary SSI dashboard data).

## 5. Conclusions

As highlighted by SSI and reviewed in detail here, misinformation and smearing against Denmark occurred in early 2022. This misinformation covered a range of topics and at least partly related to specific groups and social media subcultures using many of the same methods as the antivaccine subculture (falsehoods, data misuse, conspiracy theories and distrust in authorities) but instead with an effect to cause fear and distrust in the public health authorities by distorting the data. We recommend that further analysis is carried out to understand better the methods, motivations, and impact of these groups on the public debate during the pandemic.

**Conflicts of interest.** The authors declare that they have no conflicts of interest, financial or otherwise, associated with this work.

## References

1. Machhi J, Herskovitz J, Senan AM, et al. The natural history, pathobiology, and clinical manifestations of SARS-CoV-2 infections. *J Neuroimmune Pharmacol*. 2020;15:359-386.
2. van Dorp L, Houldcroft CJ, Richard D, Balloux F. COVID-19, the first pandemic in the post-genomic era. *Curr Opin Virol*. 2021;50:40-48.
3. Wu D, Wu T, Liu Q, Yang Z. The SARS-CoV-2 outbreak: what we know. *Int J Infect Dis*. 2020.
4. Haug N, Geyrhofer L, Londei A, et al. Ranking the effectiveness of worldwide COVID-19 government interventions. *Nat Hum Behav*. 2020:1-10.
5. Hsiang S, Allen D, Annan-Phan S, et al. The effect of large-scale anti-contagion policies on the COVID-19 pandemic. *Nature*. 2020;584(7820):262-267.
6. Saud M, Mashud M, Ida R. Usage of social media during the pandemic: Seeking support and awareness about COVID-19 through social media platforms. *J Public Aff*. 2020;20(4):e2417.
7. Chen E, Lerman K, Ferrara E. Tracking social media discourse about the covid-19 pandemic: Development of a public coronavirus twitter data set. *JMIR public Heal Surveill*. 2020;6(2):e19273.
8. Wong A, Ho S, Olusanya O, Antonini MV, Lyness D. The use of social media and online communications in times of pandemic COVID-19. *J Intensive Care Soc*. 2021;22(3):255-260.
9. Xue J, Chen J, Chen C, Zheng C, Li S, Zhu T. Public discourse and sentiment during the COVID 19 pandemic: Using Latent Dirichlet Allocation for topic modeling on Twitter. *PLoS One*. 2020;15(9):e0239441.
10. van der Linden S. Misinformation: susceptibility, spread, and interventions to immunize the public. *Nat Med*. 2022;28(3):460-467. doi:10.1038/s41591-022-01713-6
11. Musi E, Aloumpi M, Carmi E, Yates S, O'Halloran K. Developing fake news immunity: fallacies as misinformation triggers during the pandemic. *Online J Commun Media Technol*. 2022.
12. Rosenberg H, Syed S, Rezaie S. The Twitter pandemic: The critical role of Twitter in the dissemination of medical information and misinformation during the COVID-19 pandemic. *Can J Emerg Med*. 2020;22(4):418-421.
13. Cinelli M, Quattrocioni W, Galeazzi A, et al. The COVID-19 social media infodemic. *Sci Rep*. 2020;10(1):1-10.
14. Lăzăroiu G, Horak J, Valaskova K. Scaring ourselves to death in the time of COVID-19: pandemic awareness, virus anxiety, and contagious fear. *Linguist Philos Investig*. 2020;19:114-120.
15. Taylor S, Landry CA, Paluszec MM, Rachor GS, Asmundson GJG. Worry, avoidance, and coping during the COVID-19 pandemic: A comprehensive network analysis. *J Anxiety Disord*. 2020;76:102327.

16. Gabarron E, Oyeyemi SO, Wynn R. COVID-19-related misinformation on social media: a systematic review. *Bull World Health Organ.* 2021;99(6):455-463A. doi:10.2471/BLT.20.276782
17. SSI. Typical misinformation regarding Danish COVID-numbers. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>. Published 2022. Accessed April 20, 2023.
18. Editorial. SSI tager kampen op: Her er den typiske misinformation om danske covid-tal. *Sundhedspolitisk Tidsskrift.* <https://sundhedspolitisktidsskrift.dk/nyheder/5877-ssi-tager-kampen-op-her-er-den-typiske-misinformation-om-danske-covid-tal.html>. Published 2022.
19. Delmelle A. SSI counters overseas misinformation concerning Denmark's COVID-19 numbers. *CPH Post.* <https://cphpost.dk/2022-02-16/news/many-specialist-abroad-question-whether-lifting-restrictions-was-a-good-idea/>. Published 2022.
20. Christensen T, Jensen MD, Kluth M, 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.
21. Dall Schmidt T, Mitze T. SARS-CoV-2 outbreaks on Danish mink farms and mitigating public health interventions. *Eur J Public Health.* 2022;32(1):151-157.
22. Islind AS, Óskarsdóttir 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(1):16891.
23. SSI. *Risk Assessment of Omicron BA.2.*; 2022. <https://en.ssi.dk/-/media/arkiv/subsites/covid19/risikovurderinger/2022/risk-assesment-of-omicron-ba2.pdf>.
24. Gram MA, Emborg H-D, Schelde AB, et al. Vaccine effectiveness against SARS-CoV-2 infection or COVID-19 hospitalization with the Alpha, Delta, or Omicron SARS-CoV-2 variant: A nationwide Danish cohort study. *PLoS Med.* 2022;19(9):e1003992.
25. Cao Y, Wang J, Jian F, et al. Omicron escapes majority of existing SARS-CoV-2 neutralizing antibodies. *Nature.* 2022;602(7898):657-663. doi:10.1038/s41586-021-04385-3
26. Mannar D, Saville JW, Zhu X, et al. SARS-CoV-2 Omicron variant: Antibody evasion and cryo-EM structure of spike protein ACE2 complex. *Science (80- ).* 2022;375(6582):760-764. doi:10.1126/science.abn7760
27. Erikstrup C, Laksafoss AD, Gladov J, et al. Seroprevalence and infection fatality rate of the SARS-CoV-2 Omicron variant in Denmark: A nationwide serosurveillance study. *Lancet Reg Heal.* 2022;21:100479.
28. Friis NU, Martin-Bertelsen T, Pedersen RK, et al. COVID-19 mortality attenuated during widespread Omicron transmission, Denmark, 2020 to 2022. *Eurosurveillance.* 2023;28(3):2200547.
29. Hale T, Angrist N, Goldszmidt R, et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nat Hum Behav.* 2021;5(4):529-538.

30. Astrup P. Professor kritiserer SSI: Udregninger er for pessimistiske. *BT*. <https://www.bt.dk/politik/professor-kritiserer-ssi-udregninger-er-for-pessimistiske>. Published 2021.
31. SSI. *Notat Om Prognoser for Smittetal Og Indlæggelser Ved Scenarier for Genåbning Af 0.-4. Klasse i Grundskolen.*; 2021. [https://covid19.ssi.dk/-/media/cdn/files/notat-om-prognoser-for-smittetal-og-indlggelser\\_01022021.pdf](https://covid19.ssi.dk/-/media/cdn/files/notat-om-prognoser-for-smittetal-og-indlggelser_01022021.pdf).
32. Johnsen MG, Christiansen LE, Græsbøll K. Seasonal variation in the transmission rate of covid-19 in a temperate climate can be implemented in epidemic population models by using daily average temperature as a proxy for seasonal changes in transmission rate. *Microb Risk Anal*. 2022;22:100235.
33. SSI. *Tillægsnotat Af d. 2. Marts 2021 Til "Ekspertrapport Af Den 21. Februar 2021 - Prognoser for Smittetal Og Indlæggelser Ved Genåbningsscenarier d. 1. Marts"*; 2021. <https://www.ssi.dk/-/media/cdn/files/tillaegsnotat-af-2-marts-2021-vedr-genaabning-af-efterskoler-og-hoejskoler.pdf?la=da>.
34. SUM. Fagligt grundlag for genåbning. <https://sum.dk/nyheder/2021/februar/fagligt-grundlag-for-genaabning>. Published 2021.
35. Rosén M. National Health Data Registers: a Nordic heritage to public health. *Scand J Public Health*. 2002;30(2):81-85.
36. Laugesen K, Ludvigsson JF, Schmidt M, et al. Nordic health registry-based research: a review of health care systems and key registries. *Clin Epidemiol*. 2021;13:533-554.
37. UnHerd. Denmark's state modeller: Why we've ended ALL Covid laws. 2022. <https://unherd.com/thepost/denmarks-state-modeller-why-weve-ended-all-covid-laws/>.
38. SUM. Alle restriktioner udløber 31. januar. <https://sum.dk/nyheder/2022/januar/alle-restriktioner-udloeber-31-januar>. Published 2022.
39. Schöley J, Aburto JM, Kashnitsky I, et al. Life expectancy changes since COVID-19. *Nat Hum Behav*. 2022;6:1649–1659. doi:10.1038/s41562-022-01450-3
40. Kepp KP, Bjork J, Kontis V, et al. Estimates of excess mortality for the five Nordic countries during the Covid-19 pandemic 2020-2021. *Int J Epidemiol*. 2022;51(6):1722–1732. doi:10.1093/ije/dyac204
41. 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-Population Heal*. 2023;22:101377.
42. Karlinsky A, Kobak D. Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality Dataset. *Elife*. 2021;10:e69336. doi:10.7554/eLife.69336
43. Jassat W, Karim SSA, Mudara C, et al. Clinical severity of COVID-19 in patients admitted to hospital during the omicron wave in South Africa: a retrospective observational study. *Lancet Glob Heal*. 2022;10(7):e961-e969.



44. Epidemikommisionen. *Indstilling Om Kategorisering Af COVID-19 Som Samfundskritisk Sygdom Samt Ophævelse Af Restriktioner.*; 2022.  
[https://sum.dk/Media/637787213721750094/Indstilling fra Epidemikommisionen om kategorisering af COVID-19 som samfundskritisk sygdom.pdf](https://sum.dk/Media/637787213721750094/Indstilling%20fra%20Epidemikommisionen%20om%20kategorisering%20af%20COVID-19%20som%20samfundskritisk%20sygdom.pdf).
45. CNN. Denmark becomes first EU country to lift all Covid-19 restrictions.<https://edition.cnn.com/2022/02/01/europe/denmark-lifts-covid-restrictions-intl/index.html>. Published 2022.
46. SST. Ingen nye udvidelser af covid-19 vaccinationsprogrammet.  
<https://sst.dk/da/Nyheder/2022/Ingen-nye-udvidelser-af-covid-19-vaccinationsprogrammet>. Published 2022.
47. SST. Fremover skal kun syge testes for covid-19.  
<https://www.sst.dk/da/Nyheder/2022/Fremover-skal-kun-syge-testes-for-covid-19>. Published 2022.
48. Grau-Herzog N, Brøndsholm Andersen C, Hagen C. Zero Covid: Strategiskifte skal få os ud af pandemien. *POV International*. <https://pov.international/zero-covid-strategiskifte-pandemien/>. Published 2021.
49. Bar-Yam Y, Gurdasani D, Baker MG, et al. The World Health Network: a global citizens' initiative. *Lancet*. 2021;398(10311):1567-1568.
50. WHN. World Health Network - Partners and member organizations. 2022.  
<https://whn.global/partners-and-member-organizations/>. Accessed May 9, 2023.
51. Srivastava G, Srivastava G. Human monkeypox disease. *Clin Dermatol*. 2022;40(5):604-612.
52. Farahat RA, Head MG, Tharwat S, et al. Infodemic and the fear of monkeypox: call for action. *Trop Med Health*. 2022;50(1):1-3.
53. Abdelaal A, Serhan HA, Mahmoud MA, Rodriguez-Morales AJ, Sah R. Ophthalmic manifestations of monkeypox virus. *Eye*. 2023;37(3):383-385.

# SUPPORTING INFORMATION

2) Let's check in on Denmark which was the earliest #BA2 surging country... and where #BA2 is completely dominant. It has caused HUGE excess mortality... for 6 weeks in a row; despite high boosters— because denmark has released all other mitigations. They are now "come what may" 🙄

Mar 15  
Denmark has had excess death since they declared Freedom Day | ssi.dk/sygdomme-bered...  
All 6. Weeks.  
Total Mortality in Denmark from Danish Freedom Day (Week 5) to Week 10, 2022

3:18 pm · 24 Feb 2022 · Twitter Web App

Dear all,  
Whatever is driving mortality in Denmark should be raising eyebrows.

16 Mar  
The evolution of excess mortality talking points in Denmark:  
Feb 12: Excess mortality is going towards zero  
Feb 17: Excess mortality is only rising in 85+  
March 15: People die every winter

Hi Philip, You follow me, so you should know better, in fact, excess mortality is going towards zero. Plenty to discuss, of course, but please start with the facts. [twitter.com/ssi](https://twitter.com/ssi)

PSA to anyone interested in informing public discourse about the severity of the epidemic situation in Denmark (and maybe elsewhere): Show extreme care when sharing screenshots... [Show this thread](#)

graphs-and-map...). The 2018-flu was bad, And the delta wave was getting very bad too, until overtaken by omicron and boosters. There is still excess mortality. But, as seen, this is often the case in winters. (5/17)

11:22 pm · 1 Mar 2022 · Twitter Web App

1,510 Retweets 173 Quote Tweets 5,794 Likes

EXCESS DEATHS CONTINUE—Remember when epidemiologists were really worried about Denmark? Well, EXCESS MORTALITY is now on 10-consecutive weeks and deaths are still not falling! 🚩 lifted all #COVID mitigations weeks ago, and this is the wholly predictable result. #CovidIsNotOver

- 20 Apr  
In the 10 weeks since Freedom Day | ssi.dk/sygdomme-bered... in Denmark, there has been 10 straight weeks of excess death.

Would masks or staying home when sick saved these people? Why are more people dying than expected?  
ssi.dk/sygdomme-bered...

Total Mortality in Denmark from Freedom Day (Week 5) to Week 14, 2022

5:10 pm · 20 Apr 2022 · Twitter for iPhone

448 Retweets 39 Quote Tweets 1,080 Likes

**Figure S1. Tweets on excess deaths in relation to Denmark’s opening.** Denmark had some of the lowest pandemic excess deaths of Europe, and the COVID-19 specific mortality of the omicron wave was estimated to be lower than for other SARS-CoV-2 waves in the country<sup>28</sup>.

## Typical misinformation regarding Danish COVID-numbers

Much misinformation and misunderstandings exist regarding Danish COVID-19 numbers. On this page, we answer some of the most typical ones.

Updated 22 March 2022

The COVID-19 pandemic has since its beginning been unpredictable in many ways. The SARS-CoV-2 virus mutates, and health authorities worldwide have continuously had to change their strategies e.g. regarding surveillance and treatment of the disease.

This also means that our data and our knowledge about the disease changes. Unfortunately, this leads to misunderstandings and misinterpretations regarding Danish COVID-19 numbers, which are shared through the media in general and social media in particular.

Below, we have collected and answered some of the more typical pieces of misinformation and misunderstandings. However, since the pandemic, and our data and knowledge change, so will this page. The information on this page is in other words snapshots of the Danish numbers and of COVID-19 in Denmark.

Please note: The information and numbers on this page were updated on 22 March 2022.

Misinformation: Extremely many people are hospitalised because of COVID-19 in Denmark. ▾

Misinformation: Extremely many people die because of COVID-19 in Denmark. ▾

Misinformation: The mortality rate is rising in Denmark. ▾

Misinformation: The admission rates for infants and children are extremely high because of COVID-19. ▾

Misinformation: All children become very sick because of COVID-19. ▾

Misinformation: The psychiatric wards are filling up with COVID-19-patients, e.g. because Denmark has reduced the number of ICU beds. ▾

Misinformation: The criteria for admission to ICU has changed in late December 2021. ▾

Misinformation: That ICU numbers are dropping in Denmark is misleading – because instead of hospital ICUs, Denmark is relying on long-term care nursing home facilities. And the numbers there are going up. ▾

Misinformation: Denmark has decided that COVID-19 does not exist anymore. ▾

Misinformation: COVID-19 is not considered a threat to society because Denmark has decided that people who fall seriously ill are not an important part of society. ▾

Figure S2. Statens Serum Institut web page debunking some of the claims circulating on social media in early 2022. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

## Misinformation: Extremely many people are hospitalised because of COVID-19 in Denmark. ^

Updated 22 March

Answer: This is incorrect.

As of Week 10, 2022 a total of 1,748 COVID-19-positive persons had been hospitalised compared with 80,651 PCR confirmed COVID-19 cases. This is a decrease in both figures since Week 5. The proportion of COVID-19-positive persons hospitalised because of COVID-19 has decreased since July 2021 relative to the number of persons hospitalised with COVID-19. The share of persons hospitalised because of COVID-19 according to last available data (from Week 8) is now 48% of COVID-19 admitted positive persons.

Note: Hospitalised because of COVID-19 means that a person is admitted to hospital because of COVID-19. Hospitalised with COVID-19 means that a person is hospitalised and has a positive PCR-test. It does not mean that the person is admitted to hospital because of COVID-19.

**Figure S3.** SSI comment on hospitalization numbers, explaining the fraction of incidental hospitalizations and hospitalizations due to COVID-19. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

## Misinformation: Extremely many people die because of COVID-19 in Denmark. ^

Updated 22 March

Answer: This is incorrect.

In Denmark, the number of deaths from COVID-19 was, from the beginning of the epidemic, counted as the number of people dying within 30 days of a positive SARS-CoV-2 test. Although this test statistic is imprecise, for a long time it was not far from the true number of persons dying from COVID-19 (~90%).

However, with the common spread of the Omicron variant that causes less mortality than previous variants in a well-vaccinated population, there is an increasing number of SARS-CoV-2-infected persons who die from other causes relative to those who die from COVID-19. In fact, it is now more like 30-40% of COVID-19 positive deaths that are caused by other factors than COVID-19. And excess mortality is decreasing.

For more information about the mortality rate, please visit [this Danish article](#).

**Figure S4.** SSI web page explaining incidental deaths and deaths due to COVID-19. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

### Misinformation: The mortality rate is rising in Denmark. ^

**Updated 22 March**

Answer: This is incorrect.

During the last months of 2021, Denmark saw a higher number of deaths than expected in persons older than 75 years of age, which is anticipated to be caused by the Delta variant.

However, as from Week 1, 2022, the observed mortality relative to the expected mortality has decreased in Denmark, although it has fluctuated a bit from week to week.

For more information about the mortality rate, please visit [this Danish page about mortality](#).

About [surveillance of mortality related to COVID-19](#) in Denmark.

**Figure S5.** SSI web page debunking claims about high all-cause mortality in Denmark. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

### Misinformation: The admission rates for infants and children are extremely high because of COVID-19. ^

**Updated 22 March**

Answer: The admission rates for infants and young children <2 years of age are higher than those of older children and adolescents (3-19 years of age), but is still very low – by Week 12 a total of 1,952 hospitalisations were recorded among 53,240 COVID-19-positive children aged 0-2 years (4%).

Most of these children are registered as having been attended in an emergency department due to respiratory symptoms, but were sent home shortly after being seen, mostly within 12 hours after their arrival, as the children were not considered ill enough by the paediatricians that they required to be hospitalised for their COVID-19.

**Figure S6.** SSI web page commenting on misinformation regarding pediatric disease in Denmark. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

**Misinformation: The psychiatric wards are filling up with COVID-19-patients, e.g. because Denmark has reduced the number of ICU beds.**



**Updated 22 March**

Answer: This is incorrect.

Any patient in Denmark who is in need of intensive care treatment is referred to an intensive care unit (ICU). Because of the flexibility of the Danish hospital system, Denmark has – at any given time during the pandemic – had enough ICU beds, because other wards were converted into temporary ICUs.

The increasing number of COVID-19 positive persons in psychiatric wards reflects the increasing number of persons in Denmark, who have been infected with the Omicron variant which results in milder disease compared with previous variants.

Additionally, a very high share of the Danish population has been vaccinated against COVID-19 which largely protects against severe disease. For the same reasons, psychiatric patients – like the rest of the Danish population – presently experience higher rates of COVID-19. But COVID-19-positive psychiatric patients only remain in psychiatric wards if they do not have symptoms of COVID-19 that need to be treated with admission to a somatic hospital ward or an ICU. In conclusion: The psychiatric wards see an increasing number of COVID-19 patients due to the general increase in the number of COVID-19-infected persons in Denmark but these patients do not need admission to a somatic ward.

**Figure S7.** SSI web page debunking misinformation about psychiatric effects of COVID-19. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

**Misinformation: The psychiatric wards are filling up with COVID-19-patients, e.g. because Denmark has reduced the number of ICU beds.**



**Updated 22 March**

Answer: This is incorrect.

Any patient in Denmark who is in need of intensive care treatment is referred to an intensive care unit (ICU). Because of the flexibility of the Danish hospital system, Denmark has – at any given time during the pandemic – had enough ICU beds, because other wards were converted into temporary ICUs.

The increasing number of COVID-19 positive persons in psychiatric wards reflects the increasing number of persons in Denmark, who have been infected with the Omicron variant which results in milder disease compared with previous variants.

Additionally, a very high share of the Danish population has been vaccinated against COVID-19 which largely protects against severe disease. For the same reasons, psychiatric patients – like the rest of the Danish population – presently experience higher rates of COVID-19. But COVID-19-positive psychiatric patients only remain in psychiatric wards if they do not have symptoms of COVID-19 that need to be treated with admission to a somatic hospital ward or an ICU. In conclusion: The psychiatric wards see an increasing number of COVID-19 patients due to the general increase in the number of COVID-19-infected persons in Denmark but these patients do not need admission to a somatic ward.

**Figure S8.** SSI web page debunking misinformation that ICU criteria changed to make data look better. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

**Misinformation: That ICU numbers are dropping in Denmark is misleading – because instead of hospital ICUs, Denmark is relying on long-term care nursing home facilities. And the numbers there are going up.** ^

**Updated 22 March**

Answer: This is incorrect.

Anyone who is in need of an ICU is referred to one. Long-term care nursing facilities are not in any way and have not been used as replacements for ICUs.

The decreasing number of COVID-19-positive patients in Danish ICUs reflects that the dominant variant in Denmark, the Omicron variant, results in milder disease than previous variants and that a very high share of the Danish population has been vaccinated against COVID-19 which largely protects against severe disease.

**Figure S9.** SSI web page debunking misinformation that nursing home facilities were required to manage the epidemic surge. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

**Misinformation: COVID-19 is not considered a threat to society because Denmark has decided that people who fall seriously ill are not an important part of society.** ^

**Updated 22 March**

Answer: This is incorrect.

Every person is important in Denmark. Anyone falling seriously ill has been treated by the best of international standards throughout the pandemic and still are. COVID-19 is not considered as the same threat to society as it was previously because the Omicron variant generally results in milder disease than previous variants did and a very high share of the Danish population has been vaccinated against COVID-19, which largely protects against severe disease.

**Figure S10.** SSI web page debunking claims of changed health priorities allowing old, fragile people to die. <https://en.ssi.dk/covid-19/typical-misinformation-regarding-danish-covid-numbers>

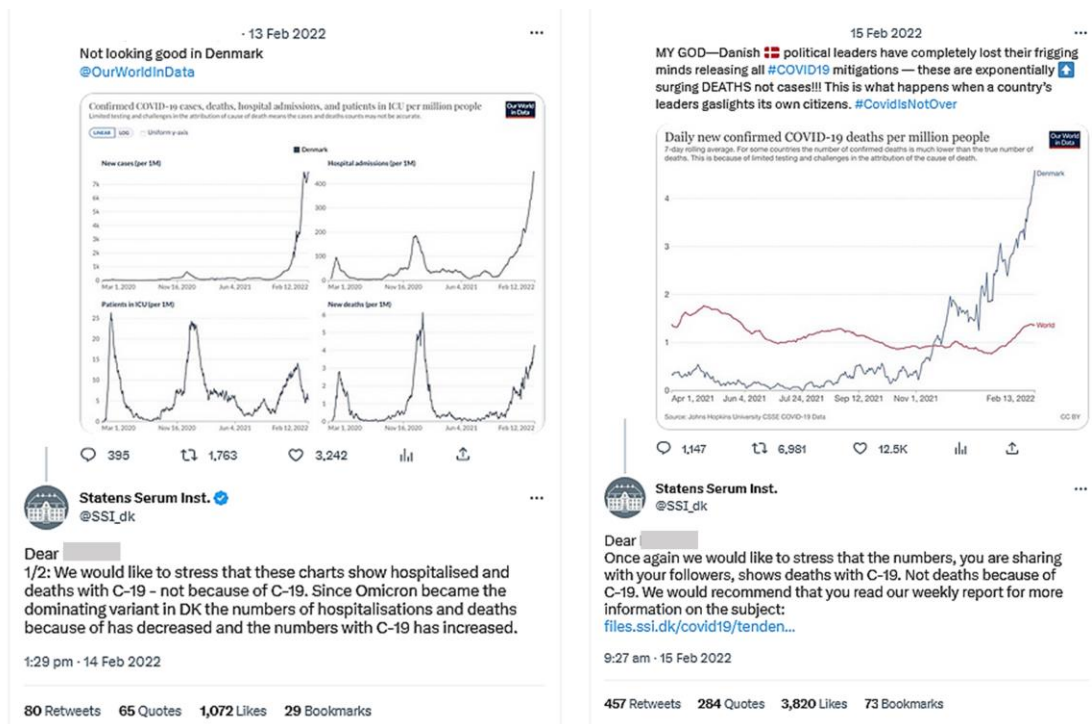


Figure S11. Examples of SSI directly engaging in responding on Twitter early 2022.

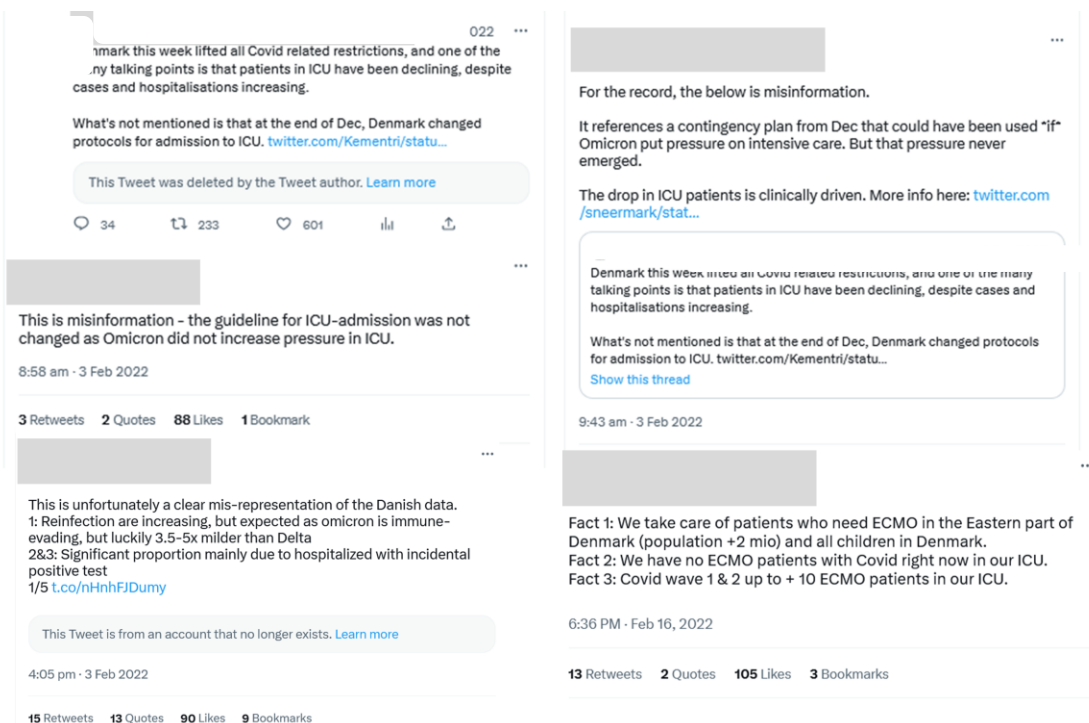


Figure S12. Examples of responses by Danish academics and government public-health experts attempting to debunk claims about changed ICU criteria in February 2022 (names removed for GDPR reasons).