Nordic Pandemic Preparedness Modelling Workshop

18th-19th November, Lysebu Hotel

Implementation of The Winter Menace
Pandemic Preparedness Exercise

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Participants and Affiliations

Abbas K. Rizi	Technical Institute of Denmark
Anja Bråthen Kristoffersen	Norwegian Institute of Public Health
Anna Suomenrinne-Nordvik	Finnish Institute for Health and Welfare
Bastian Prasse	European Centre for Disease Prevention and Control (ECDC)
Birgitte Freiesleben de Blasio	Norwegian Institute of Public Health and University of Oslo
Eivind Almaas	Norwegian University of Science and Technology
Fanny Bergström	Stockholm University
Fredrik Liljeros	Stockholm University and Karolinska Institute
Geir Storvik	University of Oslo and Norwegian Computing Center
Gerard Farré	The Public Health Agency of Sweden
Gianpaolo Scalia Tomba	University Of Stockholm and University of Rome Tor Vergata
Gunnar Rø	Norwegian Institute of Public Health
Jenny Storvik	Norwegian Institute of Public Health
Joel Siurua	University of Helsinki
Jonas C. Lindstrøm	Norwegian Institute of Public Health
Jørgen Eriksson Midtbø	Norwegian Institute of Public Health
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Lisa Brouwers	The Public Health Agency of Sweden
Lone Simonsen	PandemiX, Roskilde University
Marissa Erin Leblanc	Norwegian Institute of Public Health
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Mikhail Shubin	University of Helsinki
Mikko Kivelä	Aalto University
Philip Gerlee	Chalmers University of Technology

Sasikiran Kandula	Norwegian Institute of Public Health
Snorre Nilsen Eikeland	Helse Stavanger HF
Solveig Engebretsen	Norwegian Computing Center
Tapio Ala-Nissilä	Aalto University, Espoo, Finland
Tom Britton	Stockholm University

Additional speakers:

Karin Maria Nygård	Norwegian Institute of Public Health
Olav Hungnes	Norwegian Institute of Public Health

Program

Monday November 18th

12:00 – 13:00	Lunch	
13:00 – 13:15	Welcome, and brief presentation	Birgitte Freiesleben de Blasio FHI
13:15 – 14:00	Introductory lecture Framing of scenario	Olav Hungnes FHI Gunnar Rø FHI
Coffee break		
14:15 – 16:15	Group exercise	
Coffee Break		
16:30 – 17:30	Plenum summary from the groups	Gunnar/Birgitte
18:00	Dinner and social mingling	

Tuesday November 19th

08:45 – 10:45	Group exercise	
Coffee break		
11:00 – 12:15	Plenum summary from the groups	Karin Nygård FHI, Birgitte
12:30 – 13:30	Lunch	
13:30 – 15:00	Evaluation and discussion ECDC observer feedback	Birgitte Bastian Prasse ECDC
Coffee break		
15:15	The Nordic Pandemic Modelling Network	Birgitte
15:45 – 16:00	Farewell!	

Aims

- The role of mathematical modelling in the response to an outbreak/pandemic scenario in the Nordic countries.
- How people from different institutions (academic, public health and others) can work together during crises. Highlight needs and potential barriers.
- How a Nordic modelling network can support national responses to infectious diseases challenges.
- What can be done to improve preparedness for modelling and use of the results in the next crises.

Location

The two-day workshop took place at the Lysebu Hotel in Holmenkollen, located on the outskirts of Oslo, with convenient metro-train connections to the city center. The venue featured the main meeting room and several lounge areas where participants could collaborate in small groups.

Day 1: November 18th

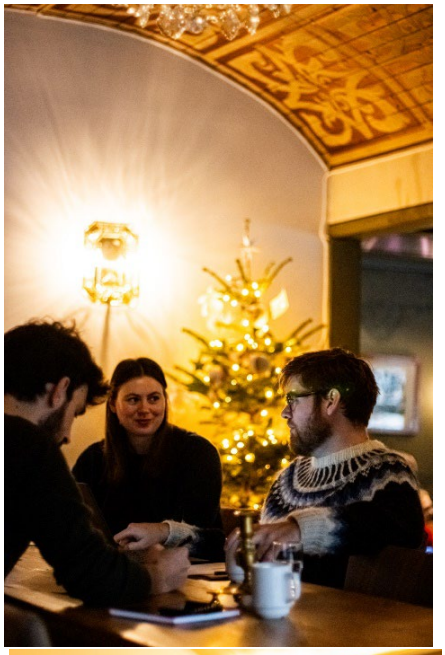
The workshop began with a midday communal lunch, allowing participants from across the Nordic region to arrive in Oslo on the same day. The event centered on a tabletop pandemic preparedness exercise, based on a *"Winter Menace"* scenario.

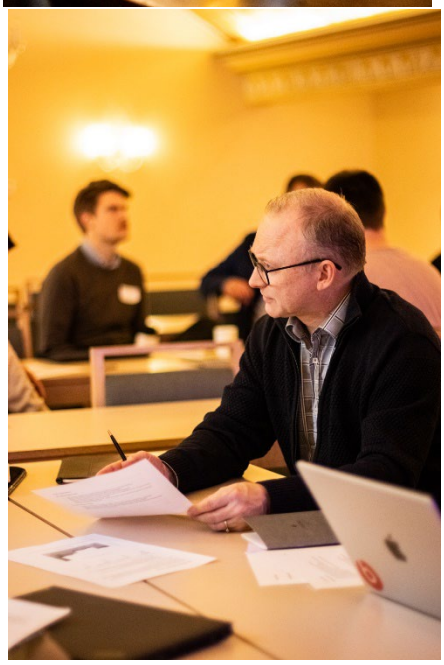
This fictitious case introduced a novel hybrid *mpox-parainfluenza* pathogen with an uncertain mode of transmission, initially discovered among attendees of the Arctic Pride festival in Tromsø and spreading across Nordic countries. The scenario unfolded amid a large NATO military exercise in Northern Norway, Sweden, and Finland. The exercise was organized over two days with about two hours each day to work in smaller groups. On the second day, additional detail about the scenario and a video were provided.

The workshop commenced with a welcome address by Birgitte, followed by participant introductions. Olav Hungnes from the Department of Virology at NIPH delivered a fictional confidential presentation about the novel virus, providing a status on what is known about the novel pathogen, laying the foundation for the group exercise. He also addressed initial questions from the modellers about the scenario. Gunnar then introduced the formal framework of the exercise, explaining the concept of a tabletop exercise and the aim of the exercise. Participants were divided into six groups of 6–7 people, ensuring a mix of modellers from public health agencies and universities, representing different countries and varying levels of experience.

After a short break, the first group exercise session began. The themes for Day 1 were (i) Modelling approach; (ii) Modellers' role in operational work; (iii) Nordic collaboration during crises. Each group received a handout detailing the case, the objectives of the exercise, and questions for discussion (Appendix A). The day concluded with a plenary session where groups presented their findings and a communal dinner that fostered networking and social interaction.





Key Points from the Plenum Discussion

<u>Modelling Approach</u>

- Identification of the role of sexual vs droplet transmission was important for realistic simulations, avoiding prematurely classifying the disease as an STD based solely on affected demographics.
- It was suggested to start with a simple model and short-term horizon and add parameters as new information emerges. Gender-based stratification is important due to the higher prevalence among men.

- Other groups suggested postponing running models until sufficient data (infectivity, mortality, incubation period) is available. Instead, consult mpox and influenza modeling experts for better understanding.
- The discussion emphasized the importance of gathering critical data. Extensive contact tracing, interviews, household testing, alongside hospitalization and mortality rates, and collaboration with healthcare facilities are essential to understanding transmission. Challenges include underreported cases, sensitive data exchange, and aggregating data across Nordic countries. ECDC, WHO protocols, and TESSy can serve as resources. It was also argued that building a model is a good way to understand what data would be needed to make reasonable scenarios.
- Focus should be made on a population of 10,000 soldiers in Tromsø, with isolation as a control measure. Isolation could last 6–7 days based on current information. It would be feasible to sequence data for all positive cases due to the small affected population. Limited information sharing by NATO with academia or authorities might affect outbreak portrayal.



Modellers' Role in Operational Modelling

- Public health agencies need to establish clear protocols for collaboration and outreach to universities to facilitate effective knowledge sharing. Pre-established templates and networks are essential to prevent delays in identifying collaborators during a crisis, while extra personnel may be required to manage additional modeling efforts. Funding should be allocated for PhD students to actively engage in pandemic response work.
- External funding is vital for supporting collaborations and enabling academic participation in pandemic preparedness. Universities should adopt a proactive approach to contribute their expertise, rather than waiting for public health authorities to initiate contact. Improved coordination is needed, as institutions often utilize funding internally without involving public health authorities, which undermines collective response efforts.
- Academic institutions often face challenges in rapidly deploying models due to the tendency to prioritize thorough understanding before launching projects. By publishing their findings, academics can promote transparency and foster mutual understanding with health authorities.
- Diverse expertise, as seen in US crisis management approaches that involve economists, should be incorporated to provide comprehensive solutions.
- Crisis management teams should be appropriately sized, with well-distributed tasks and clear roles for both immediate and future scenarios. Sharing of operational tasks between public health agencies and university groups would be beneficial.
- Local knowledge must not be overlooked, as it provides unique insights that can enhance decision-making.
- Shared data platforms can help ensure that such information is effectively integrated. There are currently many legal complexities related to data sharing and collaboration, particularly for university-affiliated individuals.
- Academics can also provide an important role of peer-reviewing both international studies and models provided by public health institutes.

Nordic Collaborations

- Collaboration among Nordic modellers during a crisis could include peer reviews, joint projects, and task distribution across individuals or institutions. Establishing a coordinated network with regular meetings (monthly or bi-monthly) would help track progress, share updates, and assign tasks effectively.
- The collaboration structure should feature a coordinating role to manage efforts, supported by government funding. The network's openness needs consideration, such as whether any academic could join. Dedicated researchers could monitor and summarize new studies, ensuring modellers work with the latest information. Each country could designate a representative for this task.
- A "Nordic umbrella" could facilitate access to shared mobile data for cross-border analysis. While formal institutional contact may be restricted during NATO-related situations, informal connections can be critical.
- Additionally, funding could support a collaborative website, akin to a Wikipedia, summarizing members and their work, promoting transparency and knowledge sharing.

Day 2: November 19th

On Day 2, participants resumed working in their assigned groups, building on new information about the case (Appendix B). The thematic focus of the questions were related to updated modelling approaches, given the new information and Nordic collaboration. One hour into the group work, all participants received an email with a video suggesting the outbreak was linked to an anti-Western organization, threatening further viral releases in Nordic capitals. The email included a request for the groups to meet with Nordic health ministers within an hour to provide feedback on the situation and propose potential interventions (Appendix C).

Following the group work, Karin Nygård from NIPH, acting as the health minister with assistance from Birgitte, engaged the groups in discussions about their interpretations of the scenario and their recommendations for managing the unfolding crisis.



Key Findings from the Plenum Discussion

<u>Situational Awareness and Modelling Approaches</u>

- Overall, there was consensus that the ongoing outbreak poses significant concerns of a potential epidemic due to its short generation time and the two-month duration since the first reported case.
- Priorities should be on investigating differences in the spread and impact of the virus across the Nordic countries.
- Despite new data available, modelling efforts face challenges due to limited data, though analyzing trends remains feasible.
- The possibility of terrorism complicates outbreak management with law enforcement and military agencies potentially withholding critical information.
- Bioterrorism introduces further uncertainties that require careful consideration in the modelling efforts.
- Understanding where the virus spreads is crucial for targeting public health interventions; however, biases in testing present challenges. Tailored testing strategies for the new virus is important.
- If the outbreak coincides with the flu season, distinguishing between flu and the novel virus could prove difficult to symptom similarities. and mass flu vaccination could be considered.

- Recent increases in case numbers may be linked to mass gatherings and present opportunities for virus sequencing. Contact tracing and demographic-specific spread analysis, including among children, would provide critical information to enhance the models. Specific factors from events like Arctic Pride, such as settings that facilitated disease spread, also warrant analysis to understand potential infection scales and inform future interventions.

Plans for Coordination and Collaboration Across the Nordic Countries

- Effective pandemic response depends on understanding and coordinating available data across Nordic countries, treating the disease spread as a shared threat.
- Data collection, sharing, and analysis protocols should be established during peacetime to enable seamless collaboration in crises.
- Confidentiality concerns during threats may limit data sharing, and varying transparency levels between countries could impede decision-making. Shared model parameters are crucial for consistency.
- Secured servers can expedite estimate releases while protecting sensitive information, and rapid publication of results ensures timely public health responses.
- Regional-level data, while typically non-sensitive, can provide valuable insights into localized disease trends.

After a shared lunch, the workshop concluded with an evaluation session.

Bastian Basse from the ECDC modelling team, who observed the exercise, provided feedback. He praised the strength of Nordic modelling teams compared to other European regions and emphasized challenges related to data availability and model development.

Birgitte and Gunnar then facilitated feedback from participants, gathering insights to improve future exercises. The workshop ended with Birgitte presenting updates on funding opportunities and new applications aimed at sustaining the Nordic Pandemic Preparedness Modelling Network.

Debrief on the Tabletop Exercise Case

- It's beneficial that the focus was not on COVID-19
- More detailed demographic information would typically be available at the early stages of an outbreak.
- More information is needed on isolated cases to determine potential patterns of spread. Different views on the need for more information to increase modelling relevance vs. facilitating a broader discussion.
- Suggestion to increase the dynamics of the discussion by providing also new information during Day 1, not only Day 2 (Breaking news).
- Suggestion to reshuffle groups on Day 2 in order to broaden the knowledge and interactions during the workshop.
- A modelling exercise could be facilitated by handing out a case in advance of the workshop, so that the groups come prepared. Necessary for a modelling exercise. Also suggestion to be assigned different models in advance?
- Inviting external experts to participate in the modelling exercise could increase the credibility.

Future Suggestions for the Network

- Difficult, but critical to get an overview of the possibility of sharing data across countries in the event of an emergency. Suggestions to initiate collaborative projects using data from different countries to get practical experience in understanding data sharing limitations, building repositories to facilitate sharing of available data.
- The modelling network should build a system or processes to facilitate coordination of modelling between countries, perhaps with dedicated persons from each country with clear roles and responsibilities.
- An exchange program for PhD students could be beneficial for sharing knowledge and expertise across the network.

Appendix

Appendix A: Objectives of the Exercise and Questions for Discussion

Background

During the autumn, the Nordic countries have faced growing regional tensions near the Russian border. A major NATO military exercise involving over 10,000 soldiers is scheduled for February-March in Northern Norway, Sweden, and Finland. In December, Norway's national threat level increased following the announcement of the year's Nobel Peace Prize winner, which is viewed as controversial in some parts of the world.

Day 1

In early January (13-15), hospitals in Tromsø, Helsinki, Gothenburg, and Copenhagen report concurrent cases of patients with severe respiratory symptoms, rashes, and severe headaches. All investigations for known pathogens turn out negative, and after a few days virologists at Statens Serum Institute manage to identify a previously unknown virus. Initial cases predominantly involve MSM (men who have sex with men) who had recently attended the "Arctic Pride" festival in Tromsø.

By January 21, the virus is classified as a novel RNA-DNA-hybrid virus of parainfluenza and mpox, named "*mpox-paraflu*". Scientists are surprised by its highly unusual nature, raising questions about viral evolution, cross-species transmission, and potential medical impacts. The discovery prompts the rapid development of a PCR test. By January 25, the number of cases had risen to 105, with 21 hospitalized patients and 9 reported deaths, including a hospital staff member. Epidemiologists initially believe the virus spreads mainly through close skin-to-skin contact, lesions, and bodily fluids, similar to mpox, though some cases suggest respiratory transmission. The estimated generation time remains uncertain, ranging from 2 to 14 days.

In early February, NATO's Chief Commander in Europe informs the Nordic governments of a potential mpox-paraflu outbreak among soldiers at Setermoen, a major camp two hours drive from Tromsø.

The Nordic governments ask the public health agencies for a rapid risk assessment, including potential development and advice for risk management, and request the public health agencies to initiate modelling efforts and prepare to advise the governments concerning the epidemiological situation and possible scenarios.

Day 1 Questions

Modelling Approach

- What models or statistical methods would you use to simulate the spread of the new mpox-paraflu?
- How would you address the uncertainty in the transmission routes (sexual/close contact vs. droplet transmission)?
- What assumptions, stratifications, and limitations should be considered in your model?
- What data is required to build and run your model?
- What initial risk assessment can you make, and what potential scenarios and timelines should be explored?
- Is a specialized model needed to address the outbreak in the NATO camp?

Participation in Operative Work

- Reflect within the group on each member's ability to contribute to operational modelling during a crisis and their expertise.
- What resources (e.g., technology, funding) are essential for your participation?
- What organizational structures or pre-planning are necessary for effective involvement?
- How would you interact with and advice health authorities in a crisis situation?

Nordic Collaboration

- What forms of collaboration between Nordic modellers would be beneficial during the crisis?
- How should this collaboration be structured, and what processes or communication channels are needed?

Day 2

Day 2 Questions

Modelling Approach

- How do you adjust your model choices based on this new information?
- What assumptions and limitations should be considered?
- What critical information is needed, and how can it be obtained?
- What uncertainties in the current scenario need to be highlighted to the government, and how should they be communicated?
- What types of collaboration (e.g., sharing models, data, expertise) within the Nordic context would be beneficial?

Nordic Collaboration

- How can we best coordinate efforts across the Nordic countries to optimize resources and ensure alignment and complementarity in the models?
- What potential barriers to cross-border collaboration and information sharing exist, and how can these be overcome?

Appendix B: New Information About the Case on Day 2

By late February, a PCR test is available, though still limited in supply. The outbreak in the NATO camp was identified as common influenza. By the 3rd of March there are 286 confirmed cases of mpox-paraflu and 20 reported deaths across the Nordic region. A single case has also been identified in the Netherlands. Further analysis suggests that the virus is man-made and originated in a laboratory.

Epidemiological Characteristics

- Higher morbidity and mortality are observed in children and the elderly.
- Primary transmission appears to be respiratory.
- Generation time is now estimated at 2-5 days, similar to parainfluenza.
- Systematic screening indicates that 25% of cases are asymptomatic, with a lower proportion among children.

Table1: Cases, hospitalizations and deaths per age group as of March 3rd

Age Group	Confirmed Cases	Hospitalizations	Deaths
<15	86	26	6
15-60	143	20	6
>60	58	20	8

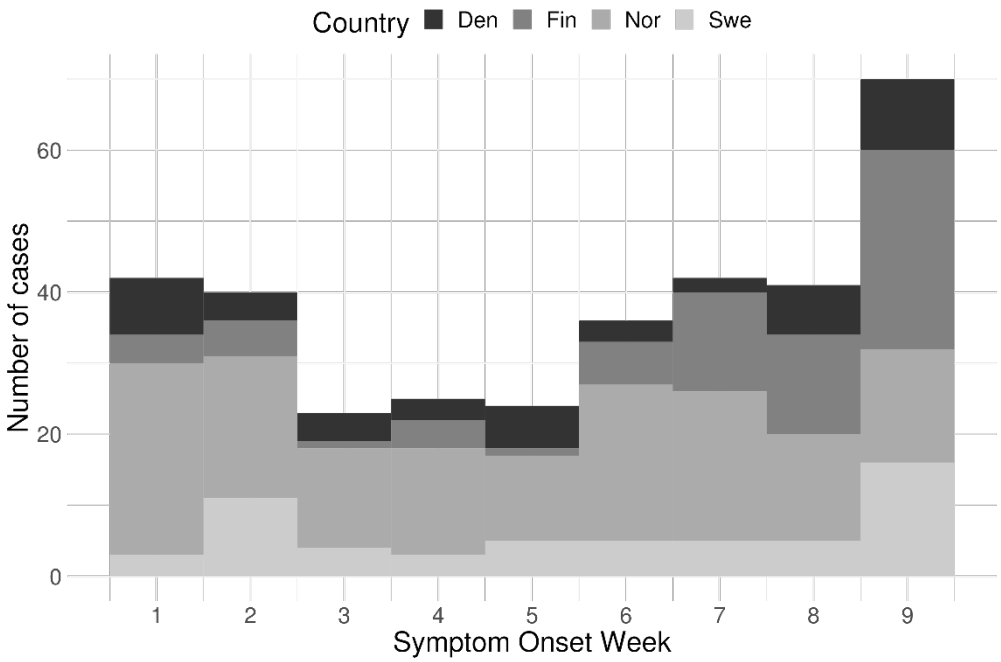


Figure 1: Number of PCR confirmed cases by symptom onset week and country.

Appendix C: Breaking News Email

BREAKING NEWS

BBC news report on possible bioterrorism:
https://drive.google.com/file/d/1FThbo06WDSIhfdS9MdPgDvB3qkQVwp8-/view?usp=sharing

Due to the developing situation, the Nordic Health ministries, represented by health director Karin Nygård, are hereby requesting advice from the modelling expert committees at 11 today (in 1 hour). The expert groups are asked to prepare a briefing on the following:

1. An assessment of the present situation (ignoring possible additional releases of the virus).
2. What additional modelling scenarios on short- and long term are appropriate/useful in the event of potential coordinated virus release into high-density locations. What are the major uncertainties to consider?
3. In light of the recent information and concrete threats, the Nordic governments are reconsidering their strategy for management of the situation. How strict measures would be needed to get control of the transmission (suppression)?
4. How can the models account for potential spontaneous behavioural changes in the population given the concrete threat of bioterrorism?
5. The Ministries are considering a ban on large gatherings to mitigate a potential targeted releases and mass-spreading events. What can the models say about the impact such a measure would have, viewed against the potential negative social and socioeconomic consequences? When can the ministries expect initial modelling results that would support in the decision-making process?
6. What are the plans for coordination, collaboration, and support among modelling groups across the Nordic countries? What data sources are critical to share among the Nordic countries?

Please also find attached epi-curves for hospitalisations and deaths for the current outbreak.

Best wishes,
Karin Nygård, Health Director