Climate change effects on the epidemiology of infectious diseases and the impacts on Northern societies

Nordic Centre of Excellence (NCoE)
Approximately 63 MNOK from 2016 to 2021
Equally coordinated by Birgitta Evengård, Umeå University, and Tomas Thierfelder, Swedish University of Agricultural Sciences
Administrative director: Svenja Stöven, Umeå University
By initiative of Birgitta Evengård, Tomas Thierfelder, Shaun Quegan, and Ann Albihn
In collaboration with three fellow NCoE's

A OneHealth perspective to the objectives of:
• Clarifying the climate-change effects on the geographic spread of urgent human and animal diseases in the North
• Clarifying the associated societal effects in a perspective of gender, age, and traditions
• Suggesting infrastructures for strengthening international resilience concerning the associated threats

Photos: Carl-Johan Utsi
The CLINF Nordic Centre of Excellence
Climate-change Effects on the Epidemiology of Infectious Diseases and the Impacts on Northern Societies

*NCoE within the NordForsk programme “Responsible Development in the Arctic: Opportunities and Challenges – Pathways to Action”*

Approximately 63 MSEK for the period 2016 – 2021, whereof 35 from NordForsk

**Participating nations:** Russia, Finland, Norway, Sápmi, Sweden, Denmark, UK, Iceland, and Greenland. *CLINF operates from Nuuk to Yakutsk!*

**Participating organisations:** Novosibirsk Institute of Internal and Preventive Medicine; Yakut Scientific Research Institute of Agriculture; Tomsk State University; Northern Arctic Federal University of Archangelsk; St. Petersburg Pasteur Institute; Finnish Bureau of Meteorology; Finnish Natural Resources Institute; Northern Research Institute of Norway; Nordland University, Norway; Sámediggi; Ájtte; Umeå University; Swedish National Veterinary Institute; Swedish University of Agricultural Sciences; Stockholm University; Statens Seruminstitut, Denmark; Sheffield University, UK; Icelandic Food and Veterinary Authority; Veterinary and Food Authority of Greenland; University of the Arctic; INTERACT; and many others.
The CLINF Nordic Centre of Excellence
Climate-change Effects on the Epidemiology of Infectious Diseases and the Impacts on Northern Societies

*NCoE within the NordForsk programme “Responsible Development in the Arctic: Opportunities and Challenges – Pathways to Action”*

**Reference organisations:** Russian Association of Indigenous Peoples of the North; Norwegian Reindeer Herders Association; The Organisation for all Norwegian Sámi; Nordic Organisation for Reindeer Research; The Sámi Council; The Reindeer Herders' Association; Greenland Centre for Health Research; Ilisimatusarfik; Board for Health Research in Greenland; County Administrative Board of Västerbotten; Municipality of Kiruna; Municipal and County officials of Nordland, Troms, and Finnmark; Norwegian Farmers and Smallholders Union; Swedish Animal Health Service; ProAgria; and others.

**Initiative and collaborative coordination:** Umeå University (*Birgitta Evengård*), SLU ET (*Tomas Thierfelder*), University of Sheffield (*Shaun Quegan*) and the Swedish National Veterinary Institute (*Ann Albihn*). CLINF NCoE administration is lead by Dr. *Svenja Stöven* at Umeå University.
Basic hypothesis of the CLINF NCoE

The habitats of CSI vector organisms are expanding towards the North, when Northern landscapes transform with climate change!

- Bluetongue
- West Nile fever
- Tularaemia
- TBE
- etc.

Geographic CSI extension (hypothetic)

CSI: “Climate Sensitive Infections”
Basic hypothesis of the CLINF NCoE

The habitats of CSI vector organisms are **expanding** towards the North, when Northern landscapes **transform** with climate change!

The hypothesised Northward CSI expansion introduces **changed societal CSI exposure** in societies that depend on the welfare of **husbandry animals** by means of:

- Economy
- Wealth
- Status
- Belief
- Etc.

The resulting dynamic societal effects depend on factors such as **Gender and Age**, and **add to** the effects of changed human CSI exposure.

CLINF addresses the resulting holistic scenario with a multidisciplinary **OneHealth** approach.
Integration of the CLINF NCoE

Parallel themes
- WP1. Birgitta Evengård (UmU): Human and animal diseases in the Nordic region: Retrospective data processing and modelling of future scenarios for locally applicable alert systems for CSI (Climate Sensitive Infections).

Crosscutting issues
- WP5. Jan Åge Riseth (NORUT): Traditional knowledge, gender, and local agency.
- WP6. Tomas Thierfelder (SLU ET): The CLINF geographic information system.
Example of current CLINF work
Integrative across CLINF WP’s 1, 2, and 3, utilising WP6 infrastructures

*The Geography of Northern Infectious Diseases, with particular attention to gender and age*

**Diseases reference data:**

CLINF has inventoried and acquired human and animal diseases data covering the thirty-year climate reference period through all Arctic nations from western Greenland to the Russian pacific.

<table>
<thead>
<tr>
<th>Nation</th>
<th>BOR</th>
<th>BRU</th>
<th>CRY</th>
<th>LEP</th>
<th>PUU</th>
<th>QFE</th>
<th>TBE</th>
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<tbody>
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<td>n/a</td>
<td>n/a</td>
<td>2007 - 2007*</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Iceland</td>
<td>n/a</td>
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</tbody>
</table>

Temporal coverage of CLINF human CSI data per nation and disease. Where not applicable (n/a), the diseases have not been reported. * = A single case of QFE reported in Greenland 2007.

Spatial resolution = diseases report district. Diseases are typically reported case-by-case, which may be recalculated into annual incidences. Tens of thousands cases. A total of approximately 30 human and animal diseases.
Example of current CLINF work
Integrative across CLINF WP’s 1, 2, and 3, utilising WP6 infrastructures

The Geography of Northern Infectious Diseases, with particular attention to gender and age

Diseases reference data:
When- and wherever possible, CLINF human diseases data are complemented with information regarding gender and age.

<table>
<thead>
<tr>
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</tbody>
</table>

Coverage of supplementary information concerning gender and age per nation and disease. Where not applicable (n/a), the diseases have not been reported. A bar (-) annotates the lack of supplementary information despite reported diseases. * = A single case of QFE reported in Greenland 2007.
Example of current CLINF work
Integrative across CLINF WP’s 1, 2, and 3, utilising WP6 infrastructures

The Geography of Northern Infectious Diseases, with particular attention to gender and age

Inferring diseases reference data:

• Defining a Northern “diseases climate”
• Spatiotemporal variation of diseases per se
• Spatiotemporal variation of proportions across categories of gender and age
• Time-delayed cross-correlations across animal- and human outbreaks
• Multivariata assessments regarding functional groups of diseases
  • Perhaps sharing “vector processes”
• Manuscript prepared for Philosophical Transactions of the Royal Society B

Particular focus on Russia

Considerable complementary funding has been received for supplementing CLINF databases with data concerning Russian/Siberian diseases.

CLINF-R/RII is currently expanding into Russia with special attention at “the Siberian thaw”
Example of current CLINF work
Integrative across CLINF WP’s 1, 2, and 3, utilising WP6 infrastructures

*The Geography of Northern Infectious Diseases,* with particular attention to gender and age

**Weather and landscape reference data:**

In parallel with having inventoried and acquired human and animal diseases data, the thirty-year climate reference period has also been covered with weather and landscape data through all nations from western Greenland to the Russian pacific.

3.5 Tb of satellite data covering variables such as:

- Greening, chlorophyll, biomass, evaporation, and phenology
- Temperatures, radiation, precipitation, humidity, soil moisture, and surface water
- Snow cover, land cover, topography, soils, and plant functional types
- Length of vegetation period, duration of soil freeze, and duration of snow cover
- Extremes of temperatures and precipitation, etc., etc.

A total of approximately 30 variables

Varying spatial and temporal resolutions, down to arc-seconds and days

Will be transformed into descriptives per diseases report district
Example of current CLINF work
Integrative across CLINF WP’s 1, 2, and 3, utilising WP6 infrastructures

*Climate-change effects on the Geography of Northern Infectious Diseases, with particular attention to gender and age*

**Inferring combined diseases and weather/landscape reference data:**

- Statistically explaining observed spatiotemporal variation of diseases with weather and landscape regressors
  - Best subset regression technique
  - In collaboration with CLINF ecological/biological expertise
  - Establishing the best possible statistical reference models per CSI
    - And/or per functional group of diseases
  - Also concerning the observed variation of proportions across categories of gender and age
- Time-delayed cross-correlations across animal- and human outbreaks
  - In the presence of weather and landscape covariates
    - With particular focus on extremes
- Manuscript prepared for Nature
Example of current CLINF work
Integrative across CLINF WP’s 1, 2, and 3, utilising WP6 infrastructures

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**Forecasting future CSI scenarios:**
- CLINF climate modellers are forecasting the best CSI reference regressors
  - Onto 30- and 60-year horizons
  - In accordance with the standard IPCC scenarios
- When forecasted regressors are re-inserted into the respective reference CSI models
  - The future geography of Northern infectious diseases may be predicted
    - Including an estimate of prediction errors
  - As well as future societal exposure
    - Which is an important input to CLINF societal scientists
CLINF OPEN data
CLINF operates in accordance with the OPEN initiative

CLINF NEWS
2019-01-09
Last minute travel grants available!
2019-01-09
Call for proposals: Ryder 2019 expedition
2019-01-09
Summer fellowships in Austria available: IIASA YSSP

CLINF
Stakeholder portal
Stakeholder organisations

What are we doing?
Read about the project

Login for CLINF partners
Link to CAMBRO

CLINF operates in accordance with the OPEN initiative and will gladly share its data:
• First with stakeholders and stakeholder organisations which have been inventoried and assessed as part of CLINF
• Thereafter publicly via its website at www.clinf.org where you will be linked to the CLINF GIS platform.
CLINF OPEN data
CLINF operates in accordance with the OPEN initiative

CLINF human CSI data have been added to the CLINF data repository. Welcome to have a look!

Tomas Thierfelder
den 24 januari
1 visning

Data repository

- Human CSI
  - Metadata human CSI.pdf
  - Tomas Thierfelder
  - Tillagt i förgräns

- TUL
  - TUL_incl_list_all.xlsx
  - Tomas Thierfelder
  - Redigerade för 12 dagar sedan

- TBE
  - TBE_incl_list_all.xlsx
  - Tomas Thierfelder
  - Redigerade för 12 dagar sedan

Snabblänkar

- Lär dig mer om en teamwebbplats
- Lär dig hur du lägger till en sida
Thank you!