

# Artificial intelligence-based knowledge curation to direct COVID-19 research and public health efforts

**Principal Investigators:** Sonja Aits (Lund University)

**Program research area:** Data-driven research – models and AI.

**Collaborators:** Pierre Nugues, Marcus Klang, Johan Frid (Lund University)

May 2020

## Aim & Impact

The information that can guide researchers, clinicians and public health authorities in their efforts to tackle COVID19 is scattered across thousands of articles, bioinformatics databases, social media posts and electronic health records from COVID19 patients. Our aim is to enable the extraction and combination of this information using artificial intelligence and to deliver actionable insights that can direct COVID19 research, clinical care and public health efforts.

## COVID19 knowledge sources

Scientific literature  
Electronic health records  
Social media posts  
News reports  
Bioinformatics databases



## Knowledge extraction and connection



Symptoms  
Risk factors  
Co-morbidity  
Virus-host interaction  
Drug candidates  
Animal/cell models

Adverse effects  
Patient classification  
Disease progression  
Virus transmission  
Societal effects  
etc, etc

## Actionable COVID19 insights for

Therapy development  
Research tool identification  
Clinical decision-support  
Pandemic surveillance  
Public health measures  
etc, etc



# A multi-level digital twin framework for Covid-19

**Principal Investigators:** Gunnar Cedersund (Linköping University)

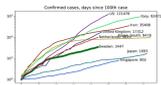
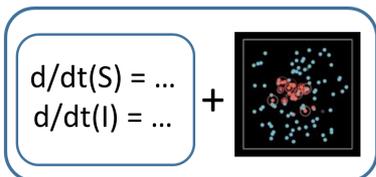
**Program research area:** Biobanks for COVID-19 research/etc.

**Collaborators:** John Kelleher, Dublin

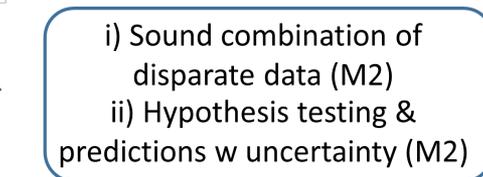
May 2020

Epidemiological models

Existing SEIQR and agent-based models



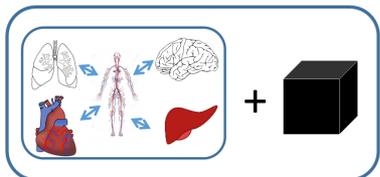
AIM 2



M = month of delivery

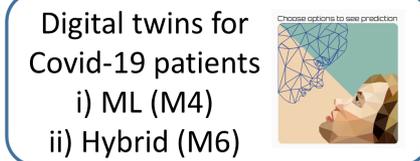
Method transfer

Patient models



Existing digital twin technology  
Combining physiology and ML

AIM 1



AIM 3



## Societal actions

- Monitoring of spread (M2)
- Predictions of social/legal interventions (M6)

## Clinical actions

- Identify high-risk patients (M4)
- Tailored treatments (M6)
- Etiology & targets (M8)



# Characterization of ICU treated COVID patients in Sweden SciLifeLab

**Principal Investigators:** Jonathan Grip (Karolinska Institutet)

**Program research area:** Covid 19 AI and modeling

**Collaborators:** Emma Larsson, Johan Mårtensson, Olav Rooyackers

May 2020

## Aims:

- 1) Characterization of ICU treated COVID-19 patients in Sweden 2020
- 2) Description of the clinical course of ICU treated COVID-19 patients in Karolinska University Hospital

## Preliminary results:

- 1) Between March 6<sup>th</sup> and April 5<sup>th</sup> a total of 604 patients with COVID were admitted to Swedish ICU:s. Median age was 61 (IQR 52-70), 76% were males and overall 30 day mortality was 32.1%, with a strong correlation to older age
- 2) Between March 9<sup>th</sup> and April 20<sup>th</sup> 260 patients with COVID were admitted to ICU at Karolinska University Hospital. Median age was 59 (IQR 51-65), median ICU length of stay was 12 days (IQR 6-18), 80% were males and overall 30.3% had died by April 30<sup>th</sup>

## Methods

- 1) All Swedish ICU departments report demographic data and ICU related interventions to the Swedish Intensive Care Registry (SIR). Data can be extracted for research pending ethical application. Demographical and outcome data will be analysed.
- 2) Detailed clinical data from all ICU treated patients in Karolinska University Hospital are collected in a database which will be used to describe the clinical course of COVID-19, as well as assess potentially successful strategies.

**Principal Investigators:** Emma Larsson (Karolinska Institutet)

May 2020

**Program research area:** Data-driven research: models and AI. Title: COVID-19 – a population-based project of ICU patients

**Collaborators:** Jonathan Grip

Aim of project and impact on society  
(Goals/Objectives, project plan)

The overall aim of this epidemiological project is to do a comprehensive description of patients treated in Swedish ICUs during the COVID-19 pandemic. The analyses include description of the patient population, mortality and various aspects of long-term follow-up.

Knowledge of risk factors for being treated at an ICU provides important knowledge for future pandemic preparedness. Knowledge of various aspects of long-term follow-up enables survivors to be offered the best possible recovery and quality of life, as well as opportunities for optimal follow-up

Results and conclusions if any already  
(preferably as figures, charts, tables....)

The first study is a population-based cohort study presenting 30-day mortality of 604 patients with COVID-19 admitted to Swedish ICUs. This study has recently been submitted.

Short about method if applicable  
(preferably as a figure)

In this population-based cohort study we included all consecutive patients with COVID-19 admitted to Swedish ICUs from March 6 to April 5, 2020. Data was extracted from the Swedish Intensive Care Register. The primary outcome was 30-day mortality after ICU admission. Demographics, comorbidities and clinical characteristics was also retrieved.

**Principal Investigators:** Emma Lundberg (KTH Royal Institute of Technology)

May 2020

**Program research area:** AI and models

**Collaborators:** Wei Ouyang, Kevin Smith, Jordi Carreras-Puigvert, Christophe Zimmer, Charlotte Stadler.

- This project aims to build a platform for sharing available AI models and datasets related to COVID-19. Web applications will be built to enable easy deployment and prototyping of the models.
- Project plan:
  - Build an online COVID-19 platform for hosting AI models, dataset and web applications from the community.
  - Build web applications to allow simple deployment of the models in the platform.
  - Build and deploy AI-based X-ray/CT image reading software for assisting image based COVID-19 pneumonia diagnostic AI models for COVID-19 research and clinical diagnostics.
  - Develop AI-based software to automatize and speedup the data analysis in drug screening, molecular diagnostics and other key SciLifeLab COVID-19 projects
  - Dissemination of the platform and tools

