

SECTION A: RESEARCHER / RESEARCH TEAM INFORMATION	
Lead Applicant Details	
Title	Dr.
First name (given name)	Yihan
Surname (family name)	Cao
Gender	Female
Position at employing organisation/ institution	Researcher
ORCID ID (https://orcid.org) or URL to academic profile	https://orcid.org/0000-0002-3353-9825 <i>(if no ORCID or URL, please attach a short academic CV)</i>
Email	yihan.cao@ibv.uio.no
Employing Organisation/Institution <i>Institution with a remit including health, research or academic pursuit, and with legal status which includes the scope to sign the Data Transfer Agreement.</i>	
Institution name	University of Oslo
City, Country	Oslo, Norway
Does your institution agree to execute the Data Transfer Agreement? (if your application is approved)	YES (delete as appropriate)
Co-applicants <i>ALL individuals accessing the data must be listed. Any additions must be notified to the COVID-19 Data Access Committee. Add rows as necessary.</i>	
1. Name	Ruiyun Li
1. Position / Role in analysis	Co-author
1. Organisation/Institution	University of Oslo, Norway
2. Name	Andreas Thomas Eilersen
2. Position / Role in analysis	First author
2. Organisation/Institution	University of Copenhagen, Denmark
3. Name	Nils Chr. Stenseth
3. Position / Role in analysis	Project leader, co-author
3. Organisation/Institution	University of Oslo, Norway
Conflicts of Interest <i>List details of any existing or perceived conflicts of interest (financial or non-financial) that exist relating to the use of the requested data by the data requestor and/or co-applicants (see ICMJE.org for the definition of conflicts of interest)</i>	

We have no conflict of interest to declare relating to the use of the requested data by the data requestor.

COVID-19 Data Platform - Data Access Application Form

Please review the [Data Access Guidelines](#) and the [Data Transfer Agreement](#) before completing this form. A complete application should address all of the Review Considerations outlined in the Data Access Guidelines. Note that the details of all approved applications will be made publicly available on the COVID-19 Data Platform website. Complete all sections of this form fully and return to covid19@iddo.org.

SECTION B: RESEARCH PLAN**Title of Proposed Research**

Pathogen evolution towards Evolutionarily Stable Strategies (ESS) in a socially age-structured epidemic

Is this a re-submission of a previous application to the COVID-19 DAC? If yes, provide the submission date of the previous application.

No

Summary of Research in Lay Language *(suggested ~ 100 words)*

In this research, we explore the evolution of a pathogen (e.g. SARS-CoV-19) circulating in a socially structured population from the initial non-stable state during the pandemic towards the expected stable state in its endemism .

Summary of Research Objectives and Scientific Value *(suggested maximum 400 words)*

The aim of this research is to understand the evolutionary dynamics (both in the initial phase of transmission and long-term state) of human pathogens in socially age-structured framework. By tracing trajectories towards the Evolutionarily Stable Strategy, we found the long-term dynamics is highly dependent upon demography of the host population. The conclusion is made from numerical analysis with a mechanistic model. To back up the statements and findings, we need real-life clinical data and infections data related to COVID-19 from various populations to support the theoretical results from our mechanistic model. To be specific, we want to confirm using the clinical data from various countries that virus variants in older populations are more virulent among older people but last longer among younger people. The finds in this research would contribute to understanding the evolution of novel pathogens such as SARS-CoV-2 that are in the initial phase of transmission but with possible long-term dynamics.

Primary and Secondary Outcome Measures *(suggested maximum 200 words)*

In this research, we have shown with a theoretical mechanistic epidemiology model that disease severity of SARS-COV-19 is more variable in older populations than in younger populations. To support the theoretical findings with real-life data, the next step is to gather clinical data and to show the difference of virus virulence among old people between old populations and young populations.

Proposed Methodology and Statistical Analysis Plan *(suggested maximum 400 words)*

We use an ecological epidemiology model and explore the expected stable state with numerical analysis, this part of work has been done. To back up the finds from the mechanistic model, we need to make a statistical analysis as supplements. With the clinical data provided by you, we would conduct statistical tests to show that the differences of the virus virulence (maybe measured by length of hospitalization) among old people between old populations (e.g. Japan, UK) and young populations (e.g. South Africa and Brazil) are statistically significant.

Ethics (suggested maximum 300 words)

Provide details of any approvals required by your institution to undertake this work, list reference numbers of any approvals, or provide clear evidence as to why no approvals are required (e.g. an extract of relevant the policy from your institutional ethics review board).

In addition, please give examples of which ethics guidelines you will be following with respect to delivering this project (e.g. you may wish to refer to general guidance such as the CIOMS/WHO [International Ethical Guidelines for Health-related Research Involving Humans](#), domain-specific guidance such as the FATML [Principles for Accountable Algorithms](#), or guidance specific to public health emergencies such as the Nuffield Council on Bioethics [Research in Global Health Emergencies: Ethical Issues](#) (as applicable).

The research work has been carried out in accordance with the ethics guidelines from University of Oslo, the details terms are listed on:

<https://www.uio.no/english/about/regulations/ethical-guidelines/#toc5>

The research work is ongoing in collaboration with and supervision from the project leader. The application for the data is also approved and encouraged by the project leader. The PI makes sure that the research activities abide by the ethics guidelines of the university. The signature of the PI can be found at the end of this form.

Publication and Dissemination Plan (suggested maximum 300 words)

Provide details of plans for authorship/acknowledgement of data contributors.

Provide details of timelines for publication and dissemination of research findings.

We would express our great appreciation to IDDO team for the valuable data and support for this research work in acknowledgement.

The almost finished manuscript will be submitted to an open access, peer reviewed journal within two months, as the main channel of dissemination of research findings.

Research Priorities Addressed (suggested maximum 300 words)

Provide details of how this research aligns with nationally or internationally set research priorities.

The research output would help us understand the evolutionary trajectories of pathogens include SARS-CoV-19, which currently is a national as well international threat to the public health. The priority to implementation research reflects its significant urgency to understand the direction in which the pathogen will evolve shortly after the outbreak and the eventual fate of this pandemic disease. This research is instrumental in informing health policy makers of health systems strengthening and the political dynamics.

Collaboration and Knowledge Sharing (suggested maximum 300 words)

Provide details of how this research will collaborate, support and/or share knowledge with appropriate partners. The platform is particularly interested in research that builds capacity in low-resource settings.

This research is in collaboration with researchers from University of Copenhagen, Pennsylvania State University, Emory University, University of California. The produced knowledge will be shared with them and our institution.

Funding (suggested maximum 100 words)

Provide details of how this research will be funded/resourced. Please name the source of funding.

This project is funded by the Research Council of Norway.

Scientific Review (suggested maximum 200 words)

If the project has been scientifically reviewed, please provide details. This could be by your institution, a funder/donor or review committee.

The research work is a part of a COVID-19 project (COVID-19 Seasonality):

<https://www.mn.uio.no/cees/english/research/projects/145021/>.

The general research proposal of this project was scientifically reviewed by Research Council of Norway to gain funding.

SECTION C: DATA

Data Variables

*Provide a list of the **data variables** required to achieve the research objectives.*

Note: Please go to www.iddo.cognitive.city to explore the interactive COVID-19 data inventory and to identify the variables, populations and data volumes required for your analysis. You can select the data variables from this inventory and copy it to this section.

Demographics: country, sex, age, AdmissionDate

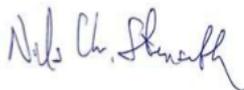
Clinical and Adverse Event: Signs and Symptoms

Disposition: discharged (discharge date*) , death

Healthcare Encounters: intense care unit, hospital

Microbiology Specimen Test Result: SARS CoV2 test result

Population: US, UK, South Africa, Brazil, Japan, China, Italy, France, Germany are the most important, but the more the better for our research.



Nils Chr. Stenseth (Project-leader)

Research Professor of Ecology and Evolution at University of Oslo

(www.mn.uio.no/cees/stenseth)