



# **Interdisciplinary Centre on Population Dynamics - CPop -**

## **Evaluation Report 2018-2021**











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## Motivation and purpose

This report serves for the evaluation of the Interdisciplinary Centre on Population Dynamics (CPop) as an SDU strategic project. According to its founding document (Appendix 1) CPop should be evaluated at the end of the four-year period 2018-2021. CPop Steering Board and SDU office of the Vice-Chancellor requested the evaluation report and approved its structure presented in this document. In its first part, the evaluation report provides an overview of the major CPop achievements referring to the initial goals, review of its organizational and financial structure for the period 2018-2021. In the second part, it outlines the vision and goals for CPop's future, including the financial plan.







## Executive summary

Interdisciplinary Centre on Population Dynamics (CPop) is a virtual research institute spanning across four faculties of the University of Southern Denmark (SDU) founded in 2018. Its main focus is on innovative and excellent research linked to population ageing, a topic with high societal relevance and impact in Denmark and worldwide.

### ➤ **Research: Excellence and interdisciplinarity**

Nearly sixty CPop-affiliated scientists conduct theoretical, empirical, and applied research across social, natural, health sciences and humanities. Interdisciplinary research areas include:

- formal demography and mortality forecasting,
- biodemography and conservation demography,
- lifespan and health inequalities,
- relations of welfare state and ageing population,
- causes and consequences of longer and healthier lives and why some individuals are left behind,
- literary perceptions of ageing.

The future research projects are building on the current expertise bringing in broadening focus on fertility, fecundity, and generational demography.

Between 2018 and mid-2021 CPop researchers published nearly three hundred peer reviewed contributions, including more than 250 peer reviewed articles. Many of them in prestigious scientific outlets such as Science, PNAS, Demography, International Journal of Epidemiology, or PlosOne.

### ➤ **Funding: Growth based on SDU support and success in the external grant acquisition**

University support through funding has been essential to CPop. This allowed new ideas to grow and new talents to be hired. It helped CPop to establish itself into a true SDU Centre of Excellence as outlined in the founding document. SDU central budget fund (Frirumspulje) contributed a total amount of 40 million DKK most of which was spent in the period 2018 to 2021. Additional money were contributed to CPop units by respective faculties. Saved resources from this period will be spent on CPop activities in the years to come.

Over the past years, both the senior and early career researchers have been successful in securing external grants. They have been able to attract the most prestigious grants such as the ERC Advanced Grant. In 2021, external funding accounts for 44 % of CPop's income. The ability of CPop researchers to secure external funding allowed CPop to reach the total annual income of 31,5 Mio DKK in 2021, very close to the initial commitment laid out in the founding document (32 Mio DKK).

The future funding of CPop activities relies on an important contribution from external grants complemented by faculty contributions, and future new income from teaching (if accreditation of a new teaching programme is successful, income from teaching will flow to CPop budget from 2025).

### ➤ **Teaching: Focus on doctoral students and a brand-new interdisciplinary Master in Population Studies**

Educating and supervising PhD students has been a priority at CPop. Between 2018 and mid-2021, thirteen PhD students were working on their dissertation under main supervision of CPop Affiliates. All PhD students of CPop have been financed through external research grants.



Most CPop affiliates are engaged in graduate and undergraduate teaching. Additional interdisciplinary teaching initiatives were organized by CPop affiliates through the European Doctoral School of Demography and a Talent Programme 'Radical Rethink! The Future of Aging Societies'.

All Nordic countries and all influential European countries have a demography programme and/or a demography centre, except for Denmark. CPop wants to get demography back on the Danish knowledge map. Thus, we have started the process for accreditation and establishment of a new two-year Master's programme in Population Studies at SDU. The programme is planned to be launched in 2023, conditional upon receiving accreditation.

➤ **Outreach: Vibrant, diverse, relevant**

A diverse portfolio of outreach activities has been going on including applied research on forecasting population dynamics of longer and healthier lives, or on conservation of endangered species. CPop researchers are engaged in policy analysis of the social, economic and health consequences and policy implications of changing population dynamics or serving in various public expert committees and advisory boards. CPop research contributes to several UN Sustainable Development Goals by building knowledge, methods, and providing expertise. A recent study of CPop team looking at excess death due to COVID-19 attracted world-wide attention and became the most discussed scientific paper in the world during the week upon its publication<sup>1</sup>.

CPop is active on its website and through social media. Its Twitter has more than a thousand followers and is updated regularly with CPop news.

➤ **Governance: Reflecting university needs and dynamics**

CPop has a stable governance structure since March 2020. It has a Steering Board of three deans that oversees the strategic, formal, and financial matters, and an Academic Coordination Committee that coordinates the research, teaching, fundraising, and outreach initiatives of CPop. CPop reports to the Steering Board and to the Dean of Business and Social Sciences. CPop governance has undergone several changes since its foundation in 2018 leading to a structure without one general Director and without the initially planned Impact Unit for research outreach, fundraising and dissemination.



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<sup>1</sup> Aburto, Schöley, Kashnitsky, ..., Kashyap. 2021. 'Quantifying impacts of the COVID-19 pandemic through life-expectancy losses: a population-level study of 29 countries.' *International Journal of Epidemiology*.



## Part I. CPop Achievements 2018-2021







## 1. Mission and Goals

The purpose of SDU's Interdisciplinary Centre on Population Dynamics (CPop) is to advance interdisciplinary research that furthers understanding of the demographic, social, economic, health, and cultural consequences of population change, especially population aging in human and non-human populations and their policy implications. These implications are highly relevant for ageing societies, including Denmark but also internationally, and for conservation of non-human endangered species. About sixty of CPop core and affiliated researchers across four SDU faculties are building on their expertise spanning demography, mathematics, statistics, biology, epidemiology, economics and health economics, political science and humanities conducting insightful, cross-disciplinary research.

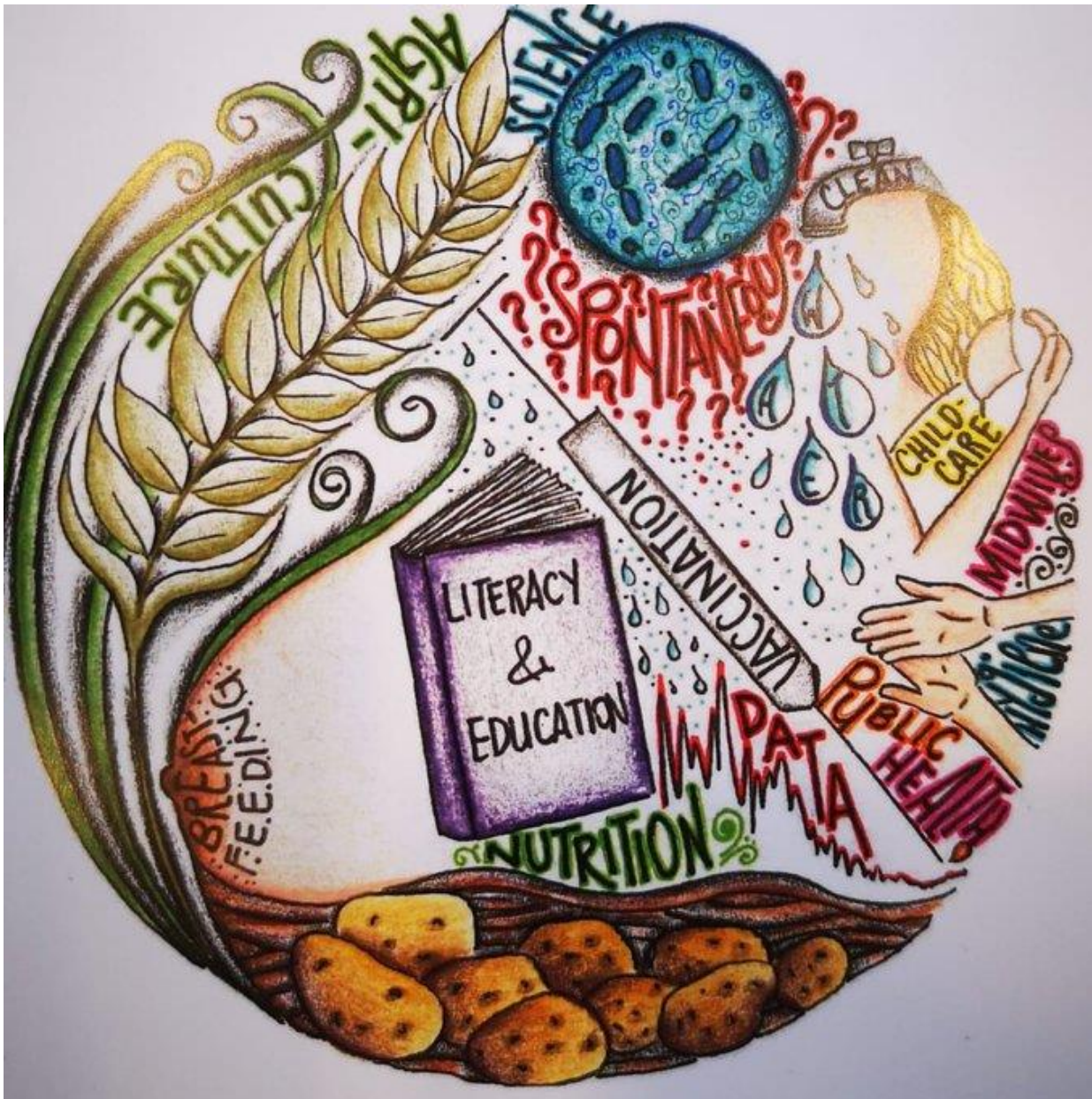
Specifically, the **goals** of CPOP are:

1. To publish **ground-breaking, interdisciplinary research** in widely read journals with extensive press coverage, leading to widespread citations, international awards and prestigious external grants.
2. To create unique interdisciplinary **educational activities** that will develop the talent of our students and educate them about the causes and consequences of longer, healthier lives.
3. To create direct **value for society** by becoming a paradigm of how university programs can reach out to the public with applied and relevant research on, e.g., forecasting population dynamics, thereby shaping the future of our society.
4. To look beyond our borders and strengthen SDU's **internationalization efforts**.

CPop is an SDU Strategic Initiative with researchers affiliated to four of its five faculties, including Health (HEALTH), Humanities (HUM), Social Sciences (SAM) and Natural Sciences (NAT). A core unit of researchers in demography (Kernel) is nested at SAM. It succeeds the former Max Planck Odense Center on the Biodemography of Ageing (MaxO) that was [evaluated in 2017](#) as the world's top research program on the biological and biomedical demography of aging. Building on this foundation, CPop expands into a truly multidisciplinary virtual institute with substantive participation of four SDU faculties and a multi-faceted research agenda that addresses the consequences of the rapidly on-coming demographic changes.

CPop Mission and Vision are presented in a founding document from February 2018 and in its revised version from September 2019 (see Appendix 1). After a transition period that saw its formal establishment, CPop started to operate officially from September 2018.





Possible causes of mortality decline in the past, drawing by a former CPop affiliate Catalina Torres.



## 2. Infrastructure

### 2.1 Organisation

The Interdisciplinary Centre on Population Dynamics (CPop) builds on the collaboration and close interaction between researchers from five research units across four faculties of SDU. The five CPop units are:

**The CPop Demographic Centre** (CPop DEM, previously CPop Kernel) advances basic and applied research in demography of survival, longevity, population ageing and methods for mortality forecasting. CPop DEM has a special function of the institutional support of the CPop network. It was established to 1) support integrity and coherence of CPop, 2) offer demographic expertise on population dynamics essential for fulfillment of the mission of the center, 3) provide managerial support via the Chief Academic Officer to all parts of CPop, (in particular to the CPop Director), and 4) coordinate the research, applied research, teaching and outreach activities of the virtual four-faculty institute. As such, CPop DEM serves all four faculties but functions also as an independent unit that carries out excellent interdisciplinary research.

**The CPop Science unit** (CPop NAT) focuses on research of demography of animals and plants, conservation demography and advancement of mathematical and computational methods.

**The CPop Business and Social Sciences unit** (CPop SAM) focuses on research on consequences of ageing and longevity for public health and on the interplay between demographics, economics, politics and policies.

**The CPop Health Sciences unit** (CPop HEALTH) advances research in epidemiology, biostatistics and biodemography of ageing.

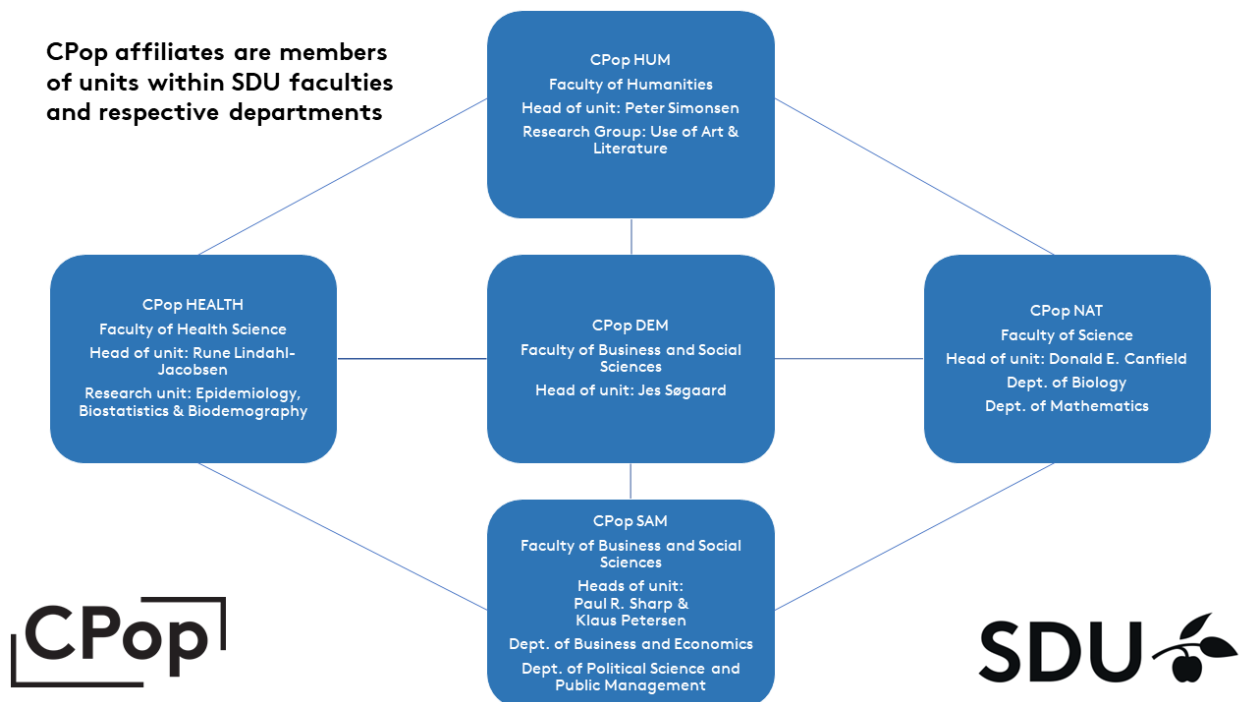
**The CPop Humanities unit** (CPop HUM) focuses on studying cultural implications of ageing.

CPop affiliates are members of units within SDU faculties and their departments. The CPop DEM Centre is an independent Centre not belonging to any department. It is formally nested at the Faculty of Business and Social Sciences.

According to the founding document (see Appendix 1), CPop was envisioned to have a professional *Impact Unit* to support and coordinate the portfolio of outreach activities. This Unit's aim was to ensure a close and innovative dialogue with stakeholders and its three highly specialized administrators were supposed to be instrumental in securing funding from the private sector. The Impact Unit was supposed to be placed under CPop DEM led by one of CPop's Deputy Directors. This position was never filled, and the unit was not created since it was supposed to be done by the newly hired CPop Director. In practice, the role of such unit is partially substituted by the Research Support unit of the Faculty of Business and Social Sciences.



Figure 1: Organizational structure of CPop



## 2.2 Governance

Since 2020, CPop has a Steering Board of three deans that oversees the strategic, formal and financial matters, and an Academic Coordination Committee that coordinates the research, teaching, fundraising, and outreach initiatives of CPop. Currently, CPop reports to the Steering Board and to the Dean of Business and Social Sciences.

CPop governance has undergone several changes over the past years (see Table 1). Upon its foundation, CPop was reporting to the Vice Chancellor and the operation of CPop was steered by the Internal Scientific Committee chaired by CPop Director. During 2019, CPop Director position was to be filled through an international hiring process. In June 2019, the Vice Chancellor Henrik Dam decided that none of the shortlisted candidates would be selected for the position. He then appointed a Steering Board with five members representing each CPop unit to lead the Centre collectively with Rune Lindahl-Jacobsen as chair and Vice Chancellor as a governor. In September 2019, Vice Chancellor appointed the Dean of SAM Jens Ringsmose to take over the role of CPop governor. In March 2020, Jes Søgaard was appointed as CPop DEM Director who also acts as a Chair of the Academic Coordination Committee. Since March 2020, he is also an Executive Secretary of the Steering Board consisting of the Deans of NAT, HEALTH, and SAM faculties. Position of CPop Director was not filled and ceased to exist in the governance structure.



Table 1: CPop Governance Structure

| <u>Time Period</u>   | <u>September 2018 – June 2019</u>    | <u>July 2019 – February 2020</u>                                     | <u>Since March 2020</u>  |
|----------------------|--------------------------------------|--|--|
| CPop Governance      | Henrik Dam, SDU Vice Chancellor      | Jens Ringsmose, Dean of Faculty of Business and Social Sciences, SDU | Jens Ringsmose, Dean of Faculty of Business and Social Sciences, SDU |
|                      | -                                    | -  | Steering Board of three Deans (NAT, HEALTH, SAM)                     |
| CPop Director        | James Vaupel                         | -  | -  |
| Management group     | <u>Internal Scientific Committee</u> | <u>CPop Steering Board</u>   | <u>CPop Academic Coordination Committee:</u>                         |
| Chair                | James Vaupel                         | Rune Lindahl Jacobsen  | Jes Søgaaard   |
| CPop DEM             | Annette Baudisch                     | Annette Baudisch   | Annette Baudisch, Jes Søgaaard                                       |
| CPop Health          | Rune Lindahl Jacobsen                | Rune Lindahl Jacobsen  | Rune Lindahl Jacobsen  |
| CPop HUM             | Peter Simonsen                       | Peter Simonsen   | Peter Simonsen   |
| CPop NAT             | Donald Canfield                      | Donald Canfield and Fernando Colchero                                | Donald Canfield and Fernando Colchero                                |
| Co-Head of CPop SAM  | Christian Møller Dahl                | Christian Møller Dahl  | Peter Sandholt Jensen, replaced by Paul R. Sharp in May 2021         |
| Co-Head of CPop SAM  | -                                    | Klaus Petersen   | Klaus Petersen   |
| Early career members | -                                    | -  | Maria Baden, José Manuel Aburto                                      |
| Managing Secretary   | Jana Vobecká                         | Jana Vobecká   | Jana Vobecká   |

In May 2021, Academic Coordination Committee decided to broaden the Committee membership by two early career CPop affiliates (Assistant Professors and more junior research staff). Following a vote among early career CPop affiliates, José Manuel Aburto and Maria Baden were elected as additional Committee members.

CPop has an *External Scientific Committee* that plays an active role in CPop's evaluation. Members to the Committee were nominated in December 2018 and approved by the Vice-Chancellor. Its members are:

- Axel Börsch-Supan - Director of the Max Planck Institute for Social Law and Social Policy in Munich
- Arne Traulsen - Director of the Max Planck Institute for Evolutionary Biology in Plön



- Kenneth Wachter, University of California Berkeley - member of the U.S. National Academy of Sciences and former Chair of the External Scientific Committee of the Max Planck Institute of Demographic Research.
- Jane Falkingham - University of Southampton, Dean of the Faculty of Social, Human and Mathematical Sciences, Director of the U.K. Centre on Population Change, President of the European Association for Population Studies,
- Deborah Roach - Professor of Biology at the University of Virginia Charlottesville, past President of the Evolutionary Demography Society, co-author of a book in press about Biodemography.
- Søren Fiig Jarner, Vice President - Quantitative Research at ATP Denmark.
- Torben M. Andersen - Professor at the Department of Economics and Business Economics, Aarhus University.

### 2.3 People

CPop is a dynamic team of 59 affiliates (by mid-2021) representing both junior and senior academic levels and an admin team of CPop DEM Director, CPop Chief Academic Administrator, CPop DEM Secretary and a Data Manager. CPop affiliation of our staff is based on shared research interest and cross-disciplinary collaboration. Thus, affiliates are coming from four faculties of SDU and are financed not only by CPop resources but also by other SDU resources and external research funding.

The number and structure of CPop affiliates changed considerably since 2018. The number of affiliates grew from 40 in 2018 to 57 in 2019 and since then stayed quite stable. The 2019 growth reflects an increase of CPop affiliates from the Faculty of Business and Social Science. By mid-2021, the team had 27 senior and 25 junior affiliates, including 6 PhD fellows. List of CPop affiliates by mid-2021 is in Table 3 and their development over time in Table 2.





Table 2: CPop and CPop DEM staff by position, dominant source of funding, 2018 - 2021

| <b>CPop Researchers (as of December each year)</b>          | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021*</b> |
|---|-------------|-------------|-------------|--------------|
| <b>Research staff – Total</b>                               | 38          | 54          | 54,1        | 54,1         |
| – Funded by CPop budget (predominantly or fully, UK10)      | 18          | 19          | 15,1        | 14,1         |
| – Funded by other SDU resources (UK 10)                     | 6           | 26          | 18          | 20           |
| – Funded by external grants (predominantly or fully, UK 95) | 17          | 12          | 22          | 21           |
| Professors  | 5           | 11          | 12,1        | 12,1         |
| Associate Professors  | 6           | 14          | 12          | 14           |
| Assistant Professors and Post-Docs                          | 12          | 13          | 18          | 16           |
| PhD Fellows   | 12          | 9           | 6           | 6            |
| Research Assistants   | 2           | 7           | 6           | 5            |
| <b>Administrative and management staff</b>                  | 2           | 3           | 3,9         | 3,9          |

\* Situation as of May 2021

| <b>CPop DEM Researchers (as of December each year)</b>      | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021*</b> |
|---|-------------|-------------|-------------|--------------|
| <b>Research staff – Total</b>                               | 15          | 12          | 16,1        | 17,1         |
| – Funded by CPop budget (predominantly or fully, UK10)      | 5           | 7           | 4,1         | 4,1          |
| – Funded by other SDU resources (UK 10)                     | 1           | 0           | 1           | 1            |
| – Funded by external grants (predominantly or fully, UK 95) | 9           | 5           | 11          | 12           |
| Professors  | 2           | 2           | 2,1         | 2,1          |
| Associate Professors  | 1           | 2           | 2           | 3            |
| Assistant Professors and Post-Docs                          | 4           | 1           | 5           | 5            |
| PhD Fellows   | 7           | 2           | 2           | 2            |
| Research Assistants   | 1           | 5           | 5           | 5            |
| <b>Administrative and management staff</b>                  | 3           | 3           | 3,9         | 3,9          |

\* Situation as of May 2021

Note 1: CPop DEM director is employed as 90% of FTE as Administrative staff and 10% FTE as Professor MSO.

Note 2: Professor category includes full professors, professors MSO, visiting professors, professors emeriti



Table 3: CPop affiliates as of May 2021

| CPop DEM                       |                               | CPop NAT               |                     |
|--------------------------------|-------------------------------|------------------------|---------------------|
| <i>Aleksandrs Aleksandrovs</i> | <i>Data manager</i>           | Dalia Amor Conde       | Associate Professor |
| Angela Chang                   | DIAS Assistant Professor      | Ditte Wiig Tholstrup   | PhD Student         |
| Annette Baudisch               | Professor                     | Donald Eugene Canfield | Professor           |
| Cosmo Strozza                  | Research Assistant            | Fernando Colchero      | Associate Professor |
| Florian Ege                    | PhD Student                   | Johan Dahlgren         | Associate Professor |
| Ilya Kashnitsky                | Postdoc                       | Johanna Stärk          | Postdoc             |
| James W. Vaupel                | Professor                     | Maria Baden            | Postdoc             |
| <i>Jana Vobecká</i>            | <i>Chief Academic Officer</i> | Morgane Tidière        | Postdoc             |
| <i>Jes Søgaard</i>             | <i>Director, Professor</i>    | Owen Jones             | Associate Professor |
| Jesús-Adrian Álvarez           | PhD Student                   | CPop SAM               |                     |
| Jim Oeppen                     | Associate Professor           | Anthony Wray           | Assistant Professor |
| Jonas Schöley                  | Postdoc                       | Astrid Roll Vitved     | Research Assistant  |
| José Manuel Aburto             | Assistant Professor           | Christian Møller Dahl  | Professor           |
| Julia Callaway                 | Research Assistant            | Emil Nørmark Sørensen  | PhD Student         |
| <i>Lars Henrik Pedersen</i>    | <i>Secretary</i>              | Giovanni Mellace       | Associate Professor |
| Marie-Pier Bergeron Boucher    | Assistant Professor           | Isabella Trifan        | Postdoc             |
| Rita da Silva                  | Assistant Professor           | Jørgen T. Lauridsen    | Professor           |
| Serena Vigezzi                 | PhD student                   | Keith Andrew Meyers    | Assistant Professor |
| Silvia Rizzi                   | Assistant Professor           | Klaus Petersen         | Professor           |
| Trifon I. Missov               | Associate Professor           | Melike Wulfgramm       | Associate Professor |
| Virginia Zarulli               | Associate Professor           | Mircea Trandafir       | Associate Professor |
| CPop HUM                       |                               | Paul Richard Sharp     | Professor           |
| Anita Wohlmann                 | Associate Professor           | Peter Sandholt Jensen  | Professor           |
| Ella Fegitz                    | Postdoc                       | Pieter Vanhuyse        | Professor           |
| Nicklas Freisleben Lund        | Postdoc                       | Robert Gal             | Visiting Professor  |
| Peter Simonsen                 | Professor                     | Romana Careja          | Associate Professor |
| CPop SUND                      |                               | Seetha Menon           | Assistant Professor |
| Camilla Riis Nielsen           | PhD Student                   | Stine Grønæk Jensen    | Postdoc             |
| Linda Ahrenfeldt               | Associate Professor           | Terkel Christiansen    | Professor Emeritus  |
| Maarten Wensink                | Associate Professor           | Volha Lazuka           | Assistant Professor |
| Rune Lindahl-Jacobsen          | Professor MSO                 |                        |                     |

Note: Administrative staff is indicated in *Italics*.







## 2.4 Budget

Activities of CPop have been gradually built. This is also reflected in the overall budget and its gradual increase. Increased **external funding has reached nearly 14 Mio DKK in 2021 (1,9 Mio EUR), representing 44 % of the total CPop income.** In CPop DEM, the income generated by external grants in 2021 represents 50 % of its total budget. This demonstrates the ability of CPop researchers to secure external funding and allowed CPop to reach the total income of 31,5 Mio DKK, very close to the initial commitment laid out in the founding document (32 Mio DKK).

University support through funding has been essential, allowing new ideas to grow and new talents to be hired. SDU central budget fund (Frirumspulje) contributed a total amount of 40 million DKK in the period 2018 to 2021. 8 million have been allocated to the faculty units (0,5 Mio per year to NAT, HEALTH, SAM, and HUM) and 32 million to CPop DEM (8 Mio per year). Central fund budget is also allocated for the co-financing of the AXA Chair in Longevity Research (1,05 Mio DKK annually). Additionally, individual faculties co-funded their respective faculty units. NAT, HEALTH, and HUM faculties contributed 'in kind' through salaries of existing staff. SAM faculty contributed 'new' funds for research initiatives and new hirings at the Political Science and Business and Economics departments. Overview of the revenues and expenditures is in Table 4.

The Frirumspulje was used to pay personal costs (between 18 to 14 research staff and 3 admin staff per year) and operational costs. Some units generated savings over from this fund and the unspent resources will be spent on activities in year 2022 and eventually 2023.

The number of staff paid by external funding has increased over the years to 22 affiliates (researchers and a data manager) in mid-2021, 13 of which are from CPop DEM (see Table 2). The main source of external funding comes from various of public and private funders.

The largest external funders by mid-2021 were:

- In CPop DEM: EU Horizon 2020 (ERC Advanced Grant), ROCKWOOL Fonden, AXA Foundation (insurance company foundation), SCOR Foundation (insurance company foundation), Villum Fonden
- In CPop NAT: SPECIES 360 (NGO), US National Institute of Health
- In CPop SAM: DFF, Carlsbergfondet, VELUX Fonden, Helsefonden, Horizon 2020 (Marie Curie-Sklodowska initiative)
- In CPop HEALTH: US National Institute of Health
- in CPop HUM: Velux Foundation, Volkswagen Foundation



Table 4: Overview of the revenues and expenditures for the entire CPop and its units, in thousands DKK

**CPop Total**

| Income to finance CPop activities | 2018          | 2019          | 2020          | 2021*         |
|-----------------------------------|---------------|---------------|---------------|---------------|
| SDU Frirumspulje                  | 10.166        | 10.794        | 11.050        | 11.050        |
| SDU Faculty                       | 7.212         | 6.226         | 6.270         | 6.270         |
| SDU Other                         | 45            | 782           | 833           | 482           |
| External funding                  | 4.224         | 5.673         | 9.747         | 13.731        |
| <b>Total income</b>               | <b>21.647</b> | <b>23.475</b> | <b>27.901</b> | <b>31.533</b> |

| Expenditure by type of spending  | 2018          | 2019          | 2020          | 2021*         |
|----------------------------------|---------------|---------------|---------------|---------------|
| Salary - Research                | 9.908         | 14.591        | 15.612        | 22.659        |
| Salary - Admin. and student help | 746           | 1.971         | 2.592         | 3.608         |
| Operations cost                  | 2.233         | 2.633         | 1.784         | 5.478         |
| Kernel compensation NAT & SUND   | 1.300         | -             | -             | -             |
| Aministration Payment to SAM     | -             | 782           | 202           | 789           |
| <b>Total</b>                     | <b>14.186</b> | <b>19.977</b> | <b>20.191</b> | <b>32.535</b> |

**CPop DEM**

| Income to finance CPop activities | 2018          | 2019          | 2020          | 2021*         |
|-----------------------------------|---------------|---------------|---------------|---------------|
| SDU Frirumspulje                  | 9.050         | 9.050         | 9.050         | 9.050         |
| SDU Faculty                       | -             | -             | -             | -             |
| SDU Other                         | 45            | 782           | 833           | 482           |
| External funding                  | 1.560         | 1.449         | 4.146         | 9.390         |
| <b>Total income</b>               | <b>10.655</b> | <b>11.281</b> | <b>14.029</b> | <b>18.922</b> |

| Expenditure by type of spending  | 2018         | 2019         | 2020          | 2021*         |
|----------------------------------|--------------|--------------|---------------|---------------|
| Salary - Research                | 2.023        | 5.172        | 6.953         | 11.641        |
| Salary - Admin. and student help | 448          | 1.617        | 2.298         | 2.861         |
| Operations cost                  | 1.690        | 2.282        | 1.659         | 3.788         |
| Kernel compensation NAT & SUND   | 1.300        | -            | -             | -             |
| Aministration Payment to SAM     | -            | 782          | 202           | 789           |
| <b>Total</b>                     | <b>5.461</b> | <b>9.853</b> | <b>11.112</b> | <b>19.079</b> |



## CPOP HEALTH

| Income to finance CPop activities | 2018         | 2019         | 2020         | 2021*        |
|-----------------------------------|--------------|--------------|--------------|--------------|
| SDU Frirumspulje                  | 375          | 500          | 500          | 500          |
| SDU Faculty                       | 953          | 1.270        | 1.270        | 1.270        |
| SDU Other                         | -            | -            | -            | -            |
| External funding                  | -            | -            | 335          | -            |
| <b>Total income</b>               | <b>1.328</b> | <b>1.770</b> | <b>2.105</b> | <b>1.770</b> |

| Expenditure by type of spending  | 2018         | 2019         | 2020         | 2021*        |
|----------------------------------|--------------|--------------|--------------|--------------|
| Salary - Research                | 1.681        | 2.287        | 1.631        | 2.043        |
| Salary - Admin. and student help | 131          | 131          | 131          | 131          |
| Operations cost                  | 40           | 40           | 40           | 40           |
| Kernel compensation NAT & SUND   | -            | -            | -            | -            |
| Aministration Payment to SAM     | -            | -            | -            | -            |
| <b>Total</b>                     | <b>1.852</b> | <b>2.458</b> | <b>1.802</b> | <b>2.214</b> |

## CPOP HUM

| Income to finance CPop activities | 2018        | 2019        | 2020        | 2021*       |
|-----------------------------------|-------------|-------------|-------------|-------------|
| SDU Frirumspulje                  | -           | 500         | 500         | 500         |
| SDU Faculty                       | 1.000       | 1.000       | 1.000       | 1.000       |
| SDU Other                         | -           | -           | -           | -           |
| External funding                  | -           | -           | -           | -           |
| <b>Total income</b>               | <b>1000</b> | <b>1500</b> | <b>1500</b> | <b>1500</b> |

| Expenditure by type of spending  | 2018         | 2019         | 2020         | 2021*        |
|----------------------------------|--------------|--------------|--------------|--------------|
| Salary - Research                | 1.000        | 1.158        | 1.524        | 1.583        |
| Salary - Admin. and student help | -            | -            | -            | -            |
| Operations cost                  | -            | -            | 1            | -            |
| Kernel compensation NAT & SUND   | -            | -            | -            | -            |
| Aministration Payment to SAM     | -            | -            | -            | -            |
| <b>Total</b>                     | <b>1.000</b> | <b>1.158</b> | <b>1.525</b> | <b>1.583</b> |



## CPOP NAT

| Income to finance CPop activities | 2018         | 2019         | 2020         | 2021*        |
|-----------------------------------|--------------|--------------|--------------|--------------|
| SDU Frirumspulje                  | 241          | 244          | 500          | 500          |
| SDU Faculty                       | 3.759        | 2.456        | 2.500        | 2.500        |
| SDU Other                         | -            | -            | -            | -            |
| External funding                  | 2.664        | 4.224        | 5.000        | 3.439        |
| <b>Total income</b>               | <b>6.664</b> | <b>6.924</b> | <b>8.000</b> | <b>6.439</b> |

| Expenditure by type of spending  | 2018         | 2019         | 2020         | 2021*        |
|----------------------------------|--------------|--------------|--------------|--------------|
| Salary - Research                | 6.033        | 6.457        | 4.968        | 4.453        |
| Salary - Admin. and student help | 166          | 223          | 92           | 291          |
| Operations cost                  | 465          | 244          | 0            | 1.200        |
| Kernel compensation NAT & SUND   | -            | -            | -            | -            |
| Administration Payment to SAM    | -            | -            | -            | -            |
| <b>Total</b>                     | <b>6.664</b> | <b>6.924</b> | <b>5.060</b> | <b>5.944</b> |

## CPOP SAM

| Income to finance CPop activities | 2018         | 2019         | 2020         | 2021*        |
|-----------------------------------|--------------|--------------|--------------|--------------|
| SDU Frirumspulje                  | 500          | 500          | 500          | 500          |
| SDU Faculty                       | 2.500        | 2.500        | 2.500        | 2.500        |
| SDU Other                         | -            | -            | -            | -            |
| External funding                  | -            | -            | 267          | 902          |
| <b>Total income</b>               | <b>3.000</b> | <b>3.000</b> | <b>3.267</b> | <b>3.902</b> |

| Expenditure by type of spending  | 2018       | 2019       | 2020         | 2021*        |
|----------------------------------|------------|------------|--------------|--------------|
| Salary - Research                | 171        | 517        | 1.536        | 3.939        |
| Salary - Admin. and student help | -          | -          | 71           | 325          |
| Operations cost                  | 39         | 67         | 85           | 450          |
| Kernel compensation NAT & SUND   | -          | -          | -            | -            |
| Administration Payment to SAM    | -          | -          | -            | -            |
| <b>Total</b>                     | <b>209</b> | <b>584</b> | <b>1.692</b> | <b>4.714</b> |

Note: 'Administration payment to SAM' is an amount that CPOP DEM pays from its income to the Faculty of Business and Social Sciences (Admin Bidrag).

\* Budget for 2021 is a mid-year estimate based on expected income and and planned spending in the entire calendar year.

It has been agreed that for a five-year period beyond 2021 CPOP DEM will receive institutional co-funding jointly by three faculties (SAM, NAT, and HEALTH). Each faculty will contribute 8,5 million DKK over five years (25,5 million in total).







### 3. CPop Activities and Output

This chapter is central to the evaluation and proves that CPop has been able to deliver on its commitments. It includes an overall review and highlights of CPop research, publication outputs, external grants, teaching, outreach activities and success, prizes, and international collaborations. Detailed review of output is in the Appendices.

#### 3.1 Research focus

CPop scientists conduct innovative theoretical, empirical, and applied research spanning a broad range of topics linked to population ageing. Interdisciplinary areas include formal demography and mortality forecasting, biodemography and conservation demography, lifespan and health inequalities, relations of welfare state and ageing population, causes and consequences of longer and healthier lives and why some individuals are left behind, as well as literary perceptions of ageing.

CPop develops several interdisciplinary research initiatives. Five major ones are described below. These all involve at least two faculties and research collaboration with international partners.

Initiative 1: Further develops the highly successful MaxO research on the **evolutionary demography of aging**, with a focus on the distribution of lifespans for humans and across other species and with increased emphasis on conservation demography of endangered species. This initiative is led by researchers from NAT working with researchers from HEALTH and CPop DEM and in close collaboration with international partners such as the Primate Life Histories Working Group (multiple universities), with the Department of Zoology at the University of Oxford, Royal Botanic Garden Edinburgh, with the Laboratoire de Biometrie et Biologie Evolutive, CNRS, Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the International Union for Conservation of Nature (IUCN), as well as Stockholm University, Uppsala University and University of Oslo, Species 360 and Conservation Science Alliance.

Initiative 2: Spans research on the causes, consequences and dynamics of health, treatment, **well-being and survival at ages above 90**. Continued progress in life expectancy and improving health will increasingly depend on trends after age 90 and in the longer run after age 100. Hence it is crucial to study the health, treatment, well-being and survival of the rapidly growing numbers of those 90+. This can be done in Denmark better than in any other country because of the extensive and highly accurate registry data available. This research is led by researchers from HEALTH collaborating with researchers from NAT, SAM, DEM and HUM and with international partner institutions.

Initiative 3: Expands research using data from SHARE and other sources, including cultural treats, on the **dynamics of health at ages 50-90**. This research further develops research on male-female differences in health and survival.



Initiative 4: Develops theoretical and applied research on **forecasting the dynamics of population aging** in Denmark. CPop has developed powerful methods of forecasting life expectancy and other aspects of population change internationally, including a strong focus on Denmark. Our research challenges and presents alternative to often used weak, outdated methods, and puts a great emphasis on the policy implications of the changing structure of the aging population in Denmark and internationally. CPop DEM is leading this initiative.

Initiative 5: The consequences of demographic change and intergenerational transmissions are not distributed equally across social class (e.g. socioeconomic status, income or education), gender and ethnic groups. This leaves a fundamental question: **How do policy interventions and individual life choices interact with demographic change?** Trying to answer this question, initiative 5 involves four broad themes: 1) Policy interventions in a life-cycle perspective (especially family policy, human capital policy, old age policies such as care delivery and pensions). This includes both policy design, policy evaluation and developing policy recommendations. 2) Intergenerational relations, transmissions, and interactions. This includes both generational conflicts as well as the social and economic dynamics of inter-generational transfers. 3) Political demography, globally and holistically. This includes comparative studies on how demographic change influences political and public policy processes and how this in turn leads to feedback effects, as well as comprehensive, interdisciplinary research on the lived lives of the old and very old in rich societies. 4) What is the dynamics and interaction between health and wealth of the individuals and nations? This initiative involves research from SAM and all other CPop units.

### 3.2 Publications

CPop researchers published in less than four years around three hundred peer reviewed contributions, including more than 250 peer reviewed articles. Some of them in prestigious scientific outlets such as Science, PNAS, Demography, International Journal of Epidemiology, PlosOne, Social Policy and Administration, or Journal of Development Economics.



Table 5: Peer reviewed publications summary

| <b>Publications, peer reviewed</b>                              | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>2021*</b> |
|---|-------------|-------------|-------------|--------------|
| <b>Publications of CPop Affiliates</b>                          |             |             |             |              |
| Contribution to journal - Journal article                       | 35          | 65          | 87          | 61           |
| Other contribution to journal – Letter/ Review/ Comment/ Debate | 4           | 5           | 3           | 2            |
| PhD Thesis  | -           | 2           | 4           | 1            |
| Chapter in Book/Encyclopedia                                    | 1           | 19          | 11          | 15           |
| Book - Edited volume/ Monograph                                 | 1           | -           | 2           | 2            |
| <b>- Out of Which Publications with CPop Dem authors</b>        |             |             |             |              |
| Contribution to journal - Journal article                       | 17          | 22          | 29          | 18           |
| Other contribution to journal – Letter/ Review/ Comment/ Debate | 1           | 2           | -           | 2            |
| PhD Thesis  | -           | 1           | 4           | 1            |
| Chapter in Book/Encyclopedia                                    | -           | 2           | 1           | 2            |
| Book - Edited volume/ Monograph                                 | -           | -           | -           | -            |

\* As of May 2021.

Although it is extremely hard to point to just a few highlights from nearly three hundred peer-reviewed publications produced by CPop researchers between 2018 and 2021, below are presented papers and monographs that exemplify academic excellence, crossdisciplinarity and successful collaboration of CPop researchers. They also represent the wide range of focus of CPop affiliates as well as capacity of our early career and senior affiliates to lead papers as first or last authors in prestigious scientific outlets.



## Highlights

1. Skakkebaek, N., **Lindahl-Jacobsen, R.**, ..., Hart, R.J. & Juul A. (2021). Environmental factors in declining human fertility. *Nature Reviews Endocrinology*.
2. **Aburto, J.M., Schöley, J., Kashnitsky, I.**, Luyin Zhang, Charles Rahal, **Missov, T.I.**, Melinda C. Mills, Jennifer B. Dowd, Ridhi Kashyap. 2021. Quantifying impacts of the COVID-19 pandemic through life expectancy losses: a population-level study of 29 countries. *International Journal of Epidemiology*. [Link](#).
3. **Colchero, F., Aburto, J.M.**, Archie E.A., ..., **Conde D.A.**, ..., **Staerk, J.**, ..., **Vaupel, J.W.**, Alberts, S.C. (2021). 'The Long Lives of Primates and the 'Invariant Rate of Ageing' Hypothesis'. *Nature Communications* 12, 3666. [Link](#).
4. Goerres, A., & **Vanhuyse, P.** (Eds.) (2021). *Global political demography: The politics of population change*. Palgrave Macmillan. [Link](#).
5. **Aburto, J. M., Kristensen, F. F., & Sharp, P. R.** (2021). Black-white disparities during an epidemic: Life expectancy and lifespan disparity in the US, 1980–2000. *Economics and Human Biology*, 40, [100937]. [Link](#).
6. **Daysal, N. M.**, Simonsen, M., **Trandafir, M.**, & Breining, S. N. (2020). Spillover effects of early-life medical interventions. *Review of Economics and Statistics*. [Link](#).
7. **Aburto, J. M., Villavicencio, F., Basellini, U., Kjærgaard, S., & Vaupel, J. W.** (2020). Dynamics of life expectancy and life span equality. *Proceedings of the National Academy of Sciences of the United States of America*, 117(10), 5250-5259. [Link](#).
8. **Bergeron-Boucher, M., Aburto, J.M.**, van Raalte, A. (2020) Diversification in causes of death in low-mortality countries: emerging patterns and implications. *BMJ Global Health* 2020:5, e002414. [Link](#).
9. **Simonsen, P.** 2019. Poetry and Age. In D. Gu, & M. E. Dupre (Eds.), *Encyclopedia of Gerontology and Population Aging* Springer
10. **Colchero, F., Jones, O. R., Conde, D. A.**, Hodgson, D., Zajitschek, F., Schmidt, B. R., Malo, A. F., Alberts, S. C., Becker, P. H., Bouwhuis, S., Bronikowski, A. M., De Vleeschouwer, K. M., Delahay, R. J., Dummermuth, S., Fernández-Duque, E., Frisenvaenge, J., Hesselsøe, M., Larson, S., Lemaître, J-F., ..., **Baudisch, A.**, ..., Gaillard, J-M. (2019). The diversity of population responses to environmental change. *Ecology Letters*, 22(2), 342-353. [Link](#).
11. **Conde, D. A., Staerk, J., Colchero, F., da Silva, R., Schöley, J., Baden, H. M., Jouvet, L., Fa, J. E., Syed, H., Jongejans, E., Meiri, S., Gaillard, J-M., Chamberlain, S., Wilcken, J., Jones, O. R., Dahlgren, J. P., Steiner, U. K., Bland, L. M., Gomez-Mestre, I., ...**Baudisch, A., Vaupel, J. W.** (2019). Data gaps and opportunities for comparative and conservation biology. *Proceedings of the National Academy of Sciences of the United States of America*, 116(19), 9658–9664. [Link](#).**
12. **Rizzi S.**, Halekoh U., Thinggaard M., Engholm G., Christensen N., Johannesen T.B., **Lindahl-Jacobsen R** (2019). How to estimate mortality trends from grouped vital statistics. *Int J Epidemiology*.48(2):571-582. [Link](#).



13. Zarulli, V., Barthold Jones, J. A., Oksuzyan, A., Lindahl-Jacobsen, R., Christensen, K., & Vaupel, J. W. (2018). Women live longer than men even during severe famines and epidemics. *Proceedings of the National Academy of Sciences of the United States of America*, 115(4), E832-E840. [Link](#).
14. Barbi, E., Lagona, F., Marsili, M., Vaupel, J. W., & Wachter, K. W. (2018). The plateau of human mortality: Demography of longevity pioneers. *Science*, 360(6396), 1459-1461. [Link](#).



1. Skakkebæk, N., Lindahl-Jacobsen, R., ..., Hart, R.J. & Juul A. (2021, forthcoming). Environmental factors in declining human fertility. *Nature Reviews Endocrinology*.

### ➞ What explains increasing infertility?

During the past half century there has been a severe decline in child births, which will lead to significant population declines in industrialized countries. A crucial question is whether the development can be explained by economic and behavioral factors alone, as suggested by demographic reports, or whether biological factors are also involved.

We present data suggesting that human reproductive health is deteriorating in industrialized countries. Infertility and the need for assisted reproduction due to poor semen quality and/or oocyte failure are now major health issues. Other indicators of declining reproductive health include a world-wide increasing incidence in testicular cancer among young men and alterations in twinning frequency. There is also evidence of parallel declines in rates of legal abortions, revealing a significant deterioration in total conception rates among young women.

Subtle alterations in fertility rates were already visible around 1900; and most industrialized countries now have rates below sustainability levels. We hypothesize that these reproductive health problems are partially linked to increasing human exposures to chemicals originating directly or indirectly from fossil fuels. If the current infertility epidemic is indeed linked to such exposures, decisive regulatory action underpinned by unconventional, interdisciplinary research collaborations will be needed to reverse the trends.

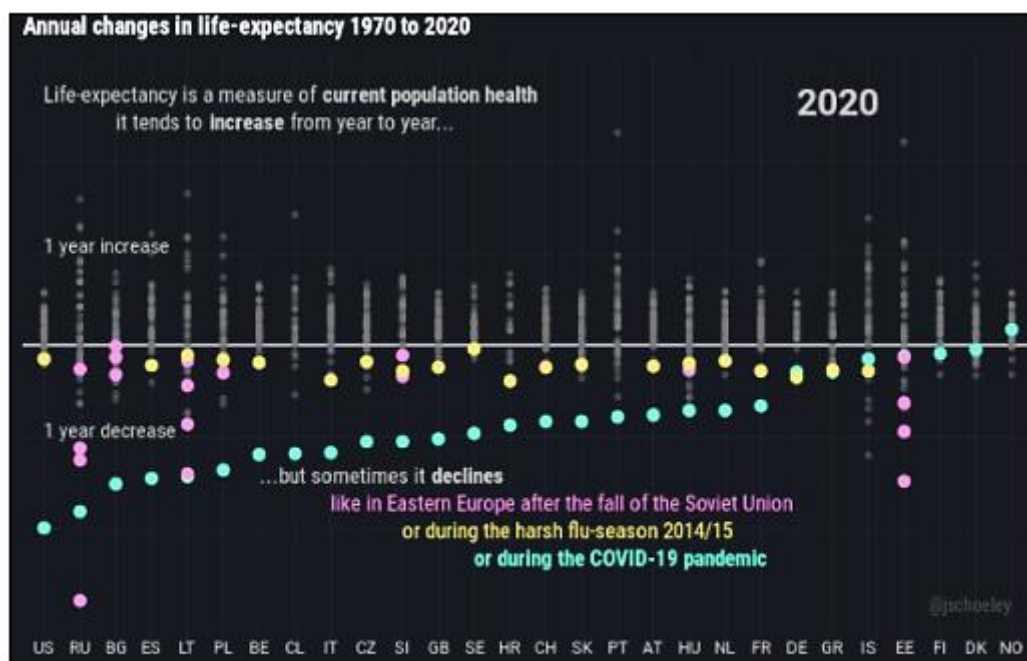




2. Aburto, J.M., Schöley, J., Kashnitsky, I., Zhang, L., Rahal, C., Missov, T., Mills, M.C., J. B. Dowd, R. Kashyap. 2021 (under review). Quantifying impacts of the COVID-19 pandemic through life expectancy losses: a population-level study of 29 countries. *International Journal of Epidemiology*. [Link](#).

➞ **How important were life expectancy losses in the 2020 pandemic year and which age groups contributed to the trend?**

Variations in the age patterns and magnitudes of excess deaths, as well as differences in population sizes and age structures make cross-national comparisons of the cumulative mortality impacts of the COVID-19 pandemic challenging. Life expectancy is a widely used indicator that provides a clear and cross-nationally comparable picture of the population-level impacts of the pandemic on mortality. Life tables by sex were calculated for 29 countries, including most European countries, Chile and the USA for 2015-2020. Life expectancy at birth and at age 60 for 2020 were contextualized against recent trends between 2015-19. Using decomposition techniques, we examined which specific age groups contributed to reductions in life expectancy in 2020 and to what extent reductions were attributable to official COVID-19 deaths. Life expectancy at birth declined from 2019 to 2020 in 27 out of 29 countries. Males in the USA and Bulgaria experienced the largest losses in life expectancy at birth during 2020 (2.1 and 1.6 years respectively), but reductions of more than an entire year were documented in eleven countries for males, and eight among females. Reductions were mostly attributable to increased mortality above age 60 and to official COVID-19 deaths. The COVID-19 pandemic triggered significant mortality increases in 2020 of a magnitude not witnessed since WW-II in Western Europe or the breakup of the Soviet Union in Eastern Europe. Females from 15 countries and males from 10 ended up with lower life expectancy at birth in 2020 than in 2015.



**Figure 1.** Annual changes in life expectancy 1970 to 2020.

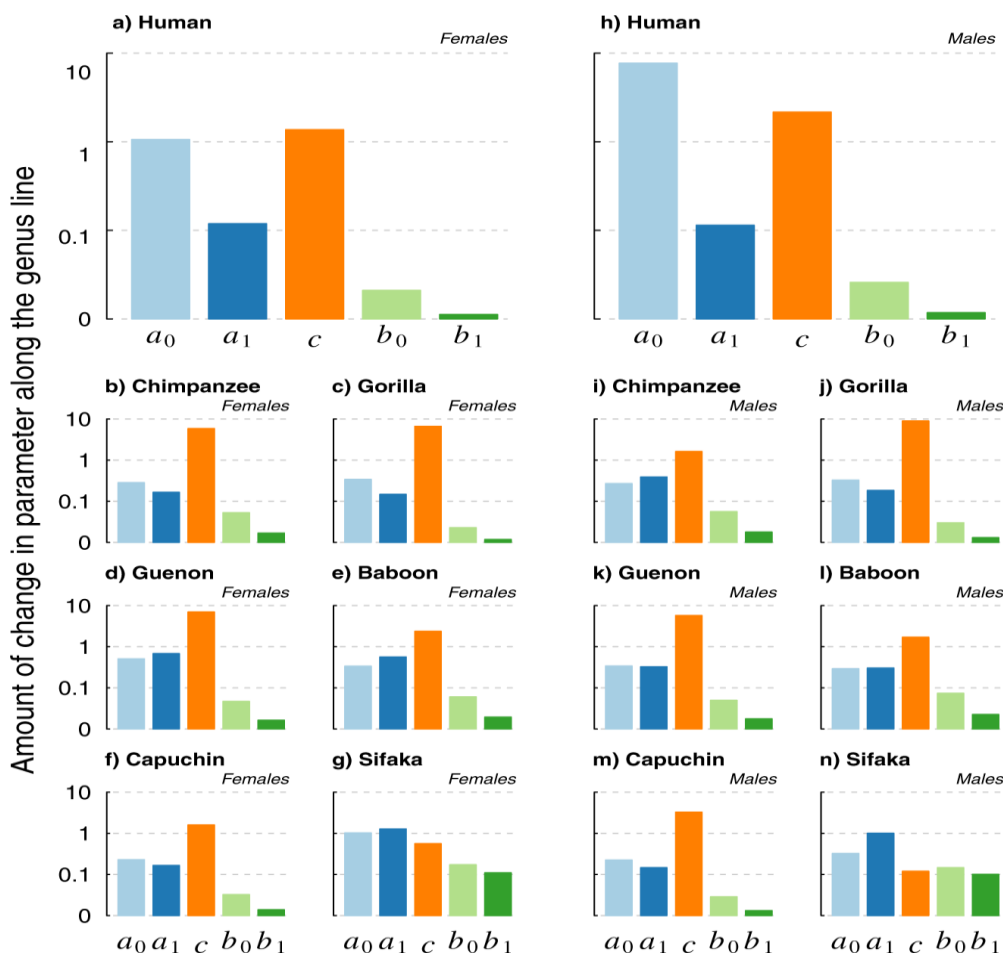
Source: [@jschoeley](#).



3. F. Colchero, J.M. Aburto, E.A. Archie, ..., D.A. Conde, ..., J. Staerk, ..., J.W. Vaupel, S.C. Alberts. (2021). 'The Long Lives of Primates and the 'Invariant Rate of Ageing' Hypothesis'. *Nature Communications* 12, 3666. [Link](#).

➞ Is it possible to slow the rate of ageing, or do biological constraints limit its plasticity?

This study tests the 'invariant rate of ageing' hypothesis, which posits that the rate of ageing is relatively fixed within species, with a collection of 39 human and nonhuman primate datasets across seven genera. The authors found that variation in the rate of ageing within genera is orders of magnitude smaller than variation in pre-adult and age-independent mortality. Changes in the rate of ageing, but not other mortality parameters, produce striking, species-atypical changes in mortality patterns. The findings support the invariant rate of ageing hypothesis, implying biological constraints on how much the human rate of ageing can be slowed.



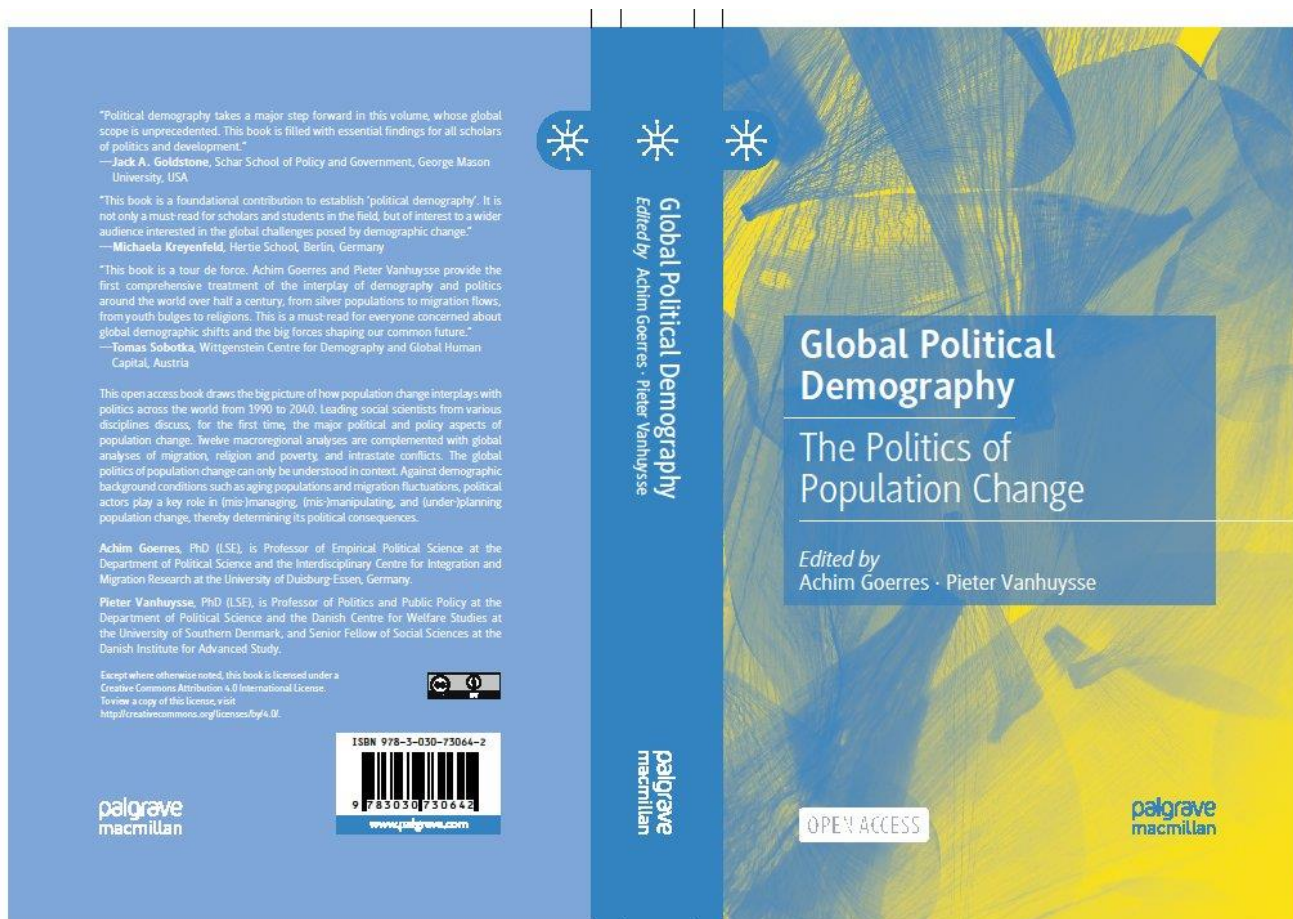
Pre-adult and age-independent mortality parameters ( $a_0$ ,  $a_1$ , and  $c$ ) vary several orders of magnitude more, within each genus, than the ageing parameters ( $b_0$  and  $b_1$ ). Colours:  $a_0$  (light blue),  $a_1$  (dark blue),  $c$  (orange),  $b_0$  (light green) and  $b_1$  (dark green). Values were calculated by numerically solving the path integral in Eq. (9) (see 'Material and Methods') for each parameter along each genus line. The y-axes were scaled by the logarithm base 10 to improve interpretability. **a–g** depict results for females, and **h–n** for males (Source data are provided as a [Source Data File](#) and available in Supplementary Table 4).



4. Goerres, A., & Vanhuyse, P. (Eds.) (2021). *Global political demography: The politics of population change*. Palgrave Macmillan. [Link](#).

### ➔ How population change interplays with politics across the world from 1990 to 2040?

Leading social scientists from a wide range of disciplines discuss, for the first time, all major political and policy aspects of population change as they play out differently in each major world region: North and South America; Sub-Saharan Africa and the MENA region; Western and East Central Europe; Russia, Belarus and Ukraine; East Asia; Southeast Asia; subcontinental India, Pakistan and Bangladesh; Australia and New Zealand. These macro-regional analyses are completed by cross-cutting global analyses of migration, religion and poverty, and age profiles and intra-state conflicts. From all angles, this book shows how strongly contextualized the political management and the political consequences of population change are. While long-term population ageing and short-term migration fluctuations present structural conditions, political actors play a key role in (mis-)managing, manipulating, and (under-)planning population change, which in turn determines how citizens in different groups react.





5. **Aburto, J. M., Kristensen, F. F., & Sharp, P. R. (2021).** Black-white disparities during an epidemic: Life expectancy and lifespan disparity in the US, 1980–2000. *Economics and Human Biology*, 40, [100937]. [Link](#).

➡ **HIV/ AIDS increased lifespan disparity among blacks and slowed down life expectancy increase excessively compared to whites in the US states under study between 1980 and 1990.**

This study focuses on one of the last major epidemics in the United States: HIV/AIDS from ca. 1980-2000. Life expectancy and lifespan disparity (a measure of variance in age at death) for thirty US states were calculated, finding noticeable differences both between states and between the black and white communities. For six states lifespan disparity for blacks increased between 1980 and 1990, while life expectancy increased less than for whites. We find that we can attribute most of this to the impact of HIV/AIDS.

(a) Blacks



(b) Whites





6. **Daysal, N. M.**, Simonsen, M., **Trandafir, M.**, & Breining, S. N. (2020). Spillover effects of early-life medical interventions. *Review of Economics and Statistics*. [Link](#).

➞ **What are the effects of early-life medical treatments on the treated children and their families?**

The authors investigate the effects of early-life medical treatments on the treated children and their families. We use a regression discontinuity design that exploits changes in medical treatments across the very low birth weight (VLBW) cutoff. Using administrative data from Denmark, we establish that VLBW children have better health and higher test scores. We find that these benefits spill over to other family members: mothers enjoy better mental health and siblings have higher test scores. Maternal mental health improvements seem to be driven by better focal child health, and sibling spillovers by improved interactions within the family and parental compensating behavior.



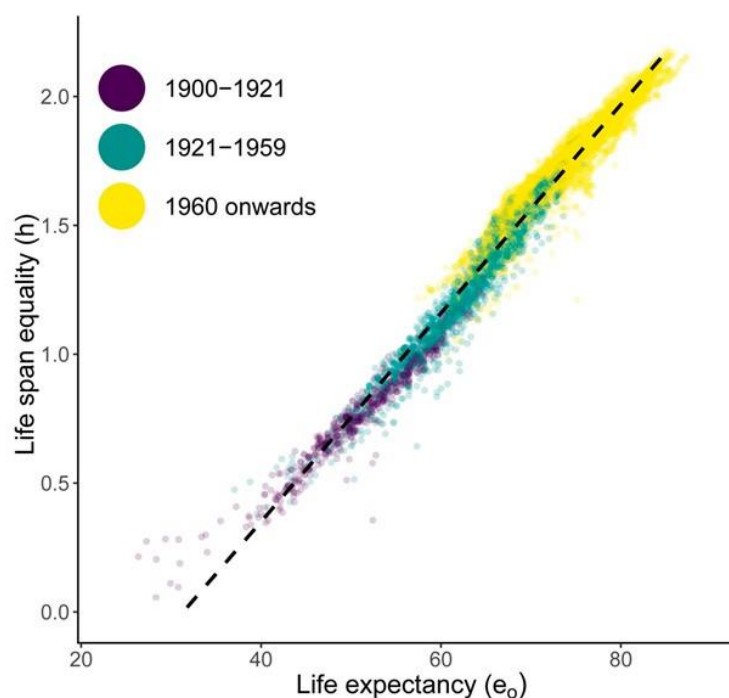


7. Aburto, J. M., Villavicencio, F., Basellini, U., Kjærgaard, S., & Vaupel, J. W. (2020). Dynamics of life expectancy and life span equality. *Proceedings of the National Academy of Sciences of the United States of America*, 117(10), 5250-5259. [Link](#).

➔ **Saving lives at ages below life expectancy is the key to increasing both life expectancy and life span equality.**

Why life expectancy and life span equality have increased together is a question of scientific interest. Both measures are calculated for a calendar year and might not describe a cohort's actual life course. Nonetheless, life expectancy provides a useful measure of average life spans, and life span equality gives insights into uncertainty about age at death. This article shows how patterns of change in life expectancy and life span equality are described by trajectories of mortality improvements over age and time. The strength of the relationship between life expectancy and life span equality is not coincidental but rather a result of progress in saving lives at specific ages: the more lives saved at the youngest ages, the stronger the relationship is.

**Association between life expectancy at birth  $e_0$  and life span equality  $h$ .**



José Manuel Aburto et al. PNAS 2020;117:10:5250-5259

PNAS

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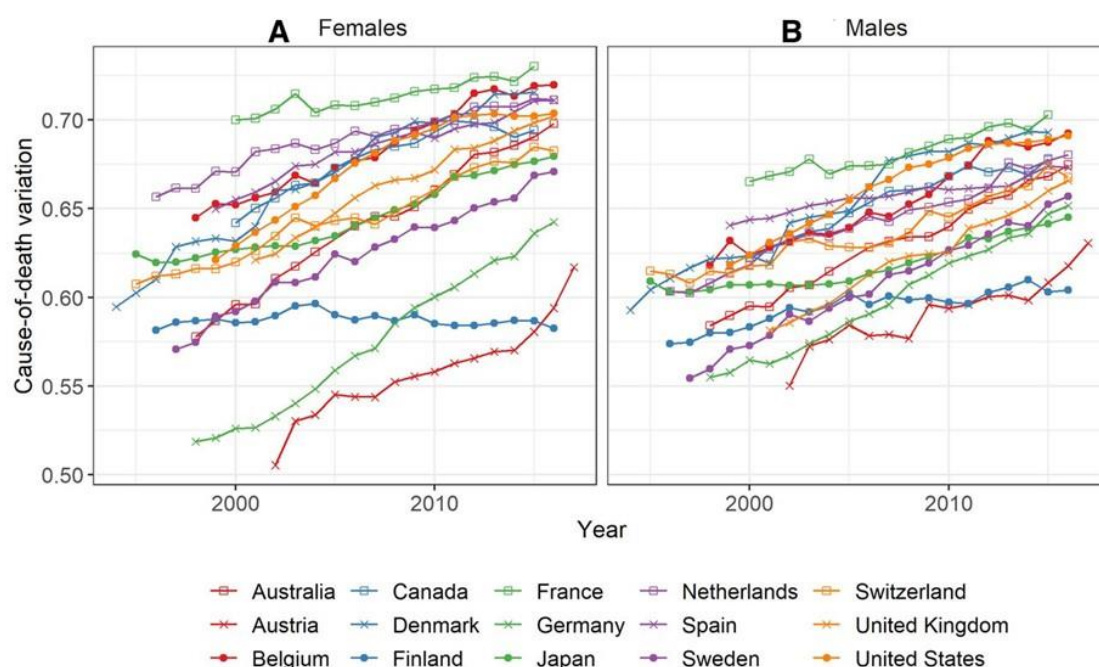


8. Bergeron-Boucher, M., Aburto, J.M., van Raalte, A. (2020) Diversification in causes of death in low-mortality countries: emerging patterns and implications. *BMJ Global Health* 2020;5, e002414. [Link](#).

➞ **The variation in causes of death is changing. We show how.**

This study pioneered the study of variation in causes of death in low mortality countries. The study shows that over the last two decades diversity in causes of death has increased. Reductions in the share of deaths from diseases of the circulatory system and increases in the share of diseases of the genitourinary system, mental and behavioral disorders, and diseases of the nervous system have led to a more complex cause-of-death distribution. Such emerging patterns bring additional challenges to healthcare systems, such as the need to research, monitor and treat a wider range of diseases. It also raises new questions concerning the distribution of health resources.

**Cause-of-death variation over time for 15 low-mortality countries, 1994–2017; (A) females and (B) males.**



Marie-Pier Bergeron-Boucher et al. *BMJ Glob Health* 2020;5:e002414



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9. Simonsen, P. 2019. Poetry and Age. In D. Gu, & M. E. Dupre (Eds.), *Encyclopedia of Gerontology and Population Aging* Springer. [https://doi.org/10.1007/978-3-319-69892-2\\_254-1](https://doi.org/10.1007/978-3-319-69892-2_254-1)

➞ **Age, aging, older ages, and the nearness of the end of life have stimulated and inspired much poetry through history poetry through history.**



This encyclopedia brings together established and emerging research findings in all relevant disciplines of gerontology and population aging. It provides comprehensive coverage of the entire breadth of the field, gives readers access to all major sub-fields and illustrates their interconnectedness with other disciplines. The more than 1,100 entries delve deep into key areas of gerontology and population aging—such as successful aging, disablement, ageism, longevity, biodemography, long-term care, and much more.

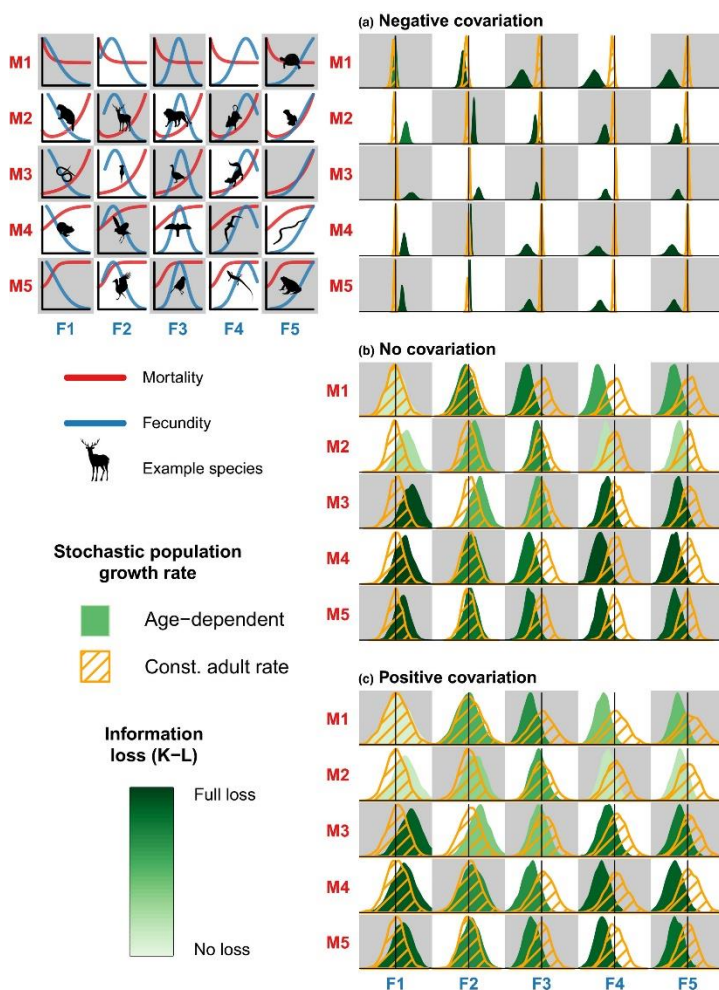
Age, aging, older ages, and the nearness of the end of life have stimulated and inspired much memorable poetry through history. While the ancients worried more about painful sudden disease and death, in recent centuries, and especially during the twentieth and into the twenty-first century when many can expect a long life in good health, we have increasingly started to be concerned with and hence write poetry about the process of aging.



10. Colchero, F., Jones, O. R., Conde, D. A., Hodgson, D., Zajitschek, F., Schmidt, B. R., Malo, A. F., Alberts, S. C., Becker, P. H., Bouwhuis, S., Bronikowski, A. M., De Vleeschouwer, K. M., Delahay, R. J., Dummermuth, S., Fernández-Duque, E., Frisenvaenge, J., Hesselsoe, M., Larson, S., Lemaître, J-F., ... , Baudisch, A., ..., Gaillard, J-M. (2019). The diversity of population responses to environmental change. *Ecology Letters*, 22(2), 342-353. [Link](#).

➔ **How the age-dependency in demographic rates and the year-to-year interactions between survival and fecundity affect stochastic population growth rates?**

The current extinction and climate change crises pressure us to predict population dynamics with ever-greater accuracy. Although predictions rest on the well-advanced theory of age-structured populations, two key issues remain poorly explored. Specifically, how the age-dependency in demographic rates and the year-to-year interactions between survival and fecundity affect stochastic population growth rates. We use inference, simulations and mathematical derivations to explore how environmental perturbations determine population growth rates for populations with different age-specific demographic rates and when ages are reduced to stages. We find that stage- vs. age-based models can produce markedly divergent stochastic population growth rates. The differences are most pronounced when there are survival-fecundity-trade-offs, which reduce the variance in the population growth rate. Finally, the expected value and variance of the stochastic growth rates of populations with different age-specific demographic rates can diverge to the extent that, while some populations may thrive, others will inevitably go extinct.



Densities of the average population growth rates and derived by using the fully age-dependent and the one-adult-stage models, respectively. We modelled three scenarios: (a) negative yearly covariation between survival and fecundity (i.e. a trade-off) as a function of environmental shocks; (b) no covariation between demographic rates; and (c) positive covariation between survival and fecundity. The tones of green on the density of correspond to the level of Kullback–Leibler (K–L) information loss when predicting the density of with. The first panel on the left shows the 25 combinations of age-specific mortality and fecundity tested. The silhouettes in each panel indicate species for which the trends in mortality and fecundity can roughly be described by the trajectories in the matching plot. These are only for reference purposes and are not intended as an accurate depiction of the species' demographic rates.

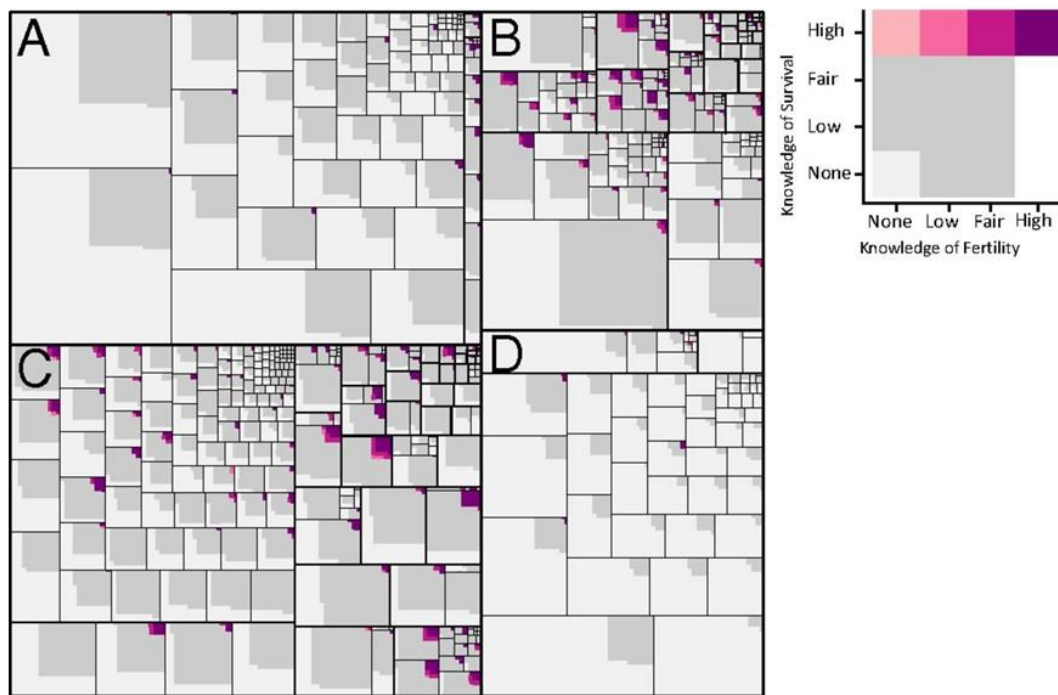


11. Conde, D. A., Staerk, J., Colchero, F., da Silva, R., Schöley, J., Baden, H. M., Jouvet, L., Fa, J. E., Syed, H., Jongejans, E., Meiri, S., Gaillard, J.-M., Chamberlain, S., Wilcken, J., Jones, O. R., Dahlgren, J. P., Steiner, U. K., Bland, L. M., Gomez-Mestre, I., ...Baudisch, A., Vaupel, J. W. (2019). Data gaps and opportunities for comparative and conservation biology. *Proceedings of the National Academy of Sciences of the United States of America*, 116(19), 9658–9664. [Link](#).

- The Demographic Species Knowledge Index that classifies the demographic information for 32,144 tetrapod species was developed.

Demographic information provides an indispensable bedrock for insights to tackle species sustainable management and deepens understanding of ecological and evolutionary processes. We found comprehensive information on birth and survival for only 1.3% (613) of the species and show the major potential of zoos and aquariums to significantly increase our demographic knowledge.

**Simplified version of the landscape of demographic knowledge for tetrapods**



Dalia A. Conde et al. PNAS 2019;116:19:9658-9664

PNAS



12. Rizzi S., Halekoh U., Thinggaard M., Engholm G., Christensen N., Johannesen T.B., Lindahl-Jacobsen R (2019). How to estimate mortality trends from grouped vital statistics. *International Journal of Epidemiology*.48(2):571-582. [Link](#).

➞ **Authors developed a novel method to smooth mortality surfaces from death counts observed in coarse age groups.**

Mortality data at the population level are often aggregated in age classes, for example 5-year age groups with an open-ended interval for the elderly aged 85+. Capturing detailed age-specific mortality patterns and mortality time trends from such coarsely grouped data can be problematic at older ages, especially where open-ended intervals are used.

To solve this, the authors propose the penalized composite link model (PCLM) for ungrouping to model cancer mortality surfaces. The PCLM produces detailed smooth mortality surfaces from death counts observed in coarse age groups with modest assumptions, that is Poisson distributed counts and smoothness of the estimated distribution. Hence, the method has great potential for use within epidemiological research when information is to be gained from aggregated data, because it avoids strict assumptions about the actual distributional shape.



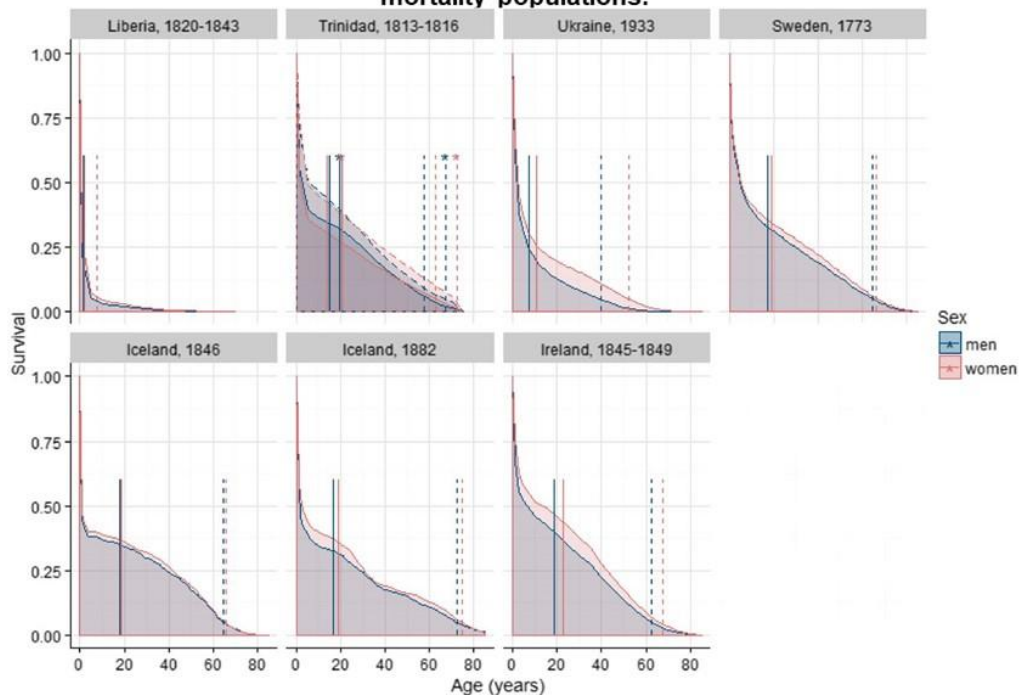


13. Zarulli, V., Barthold Jones, J. A., Oksuzyan, A., Lindahl-Jacobsen, R., Christensen, K., & Vaupel, J. W. (2018). Women live longer than men even during severe famines and epidemics. *Proceedings of the National Academy of Sciences of the United States of America*, 115(4), E832-E840. [Link](#).

### ➞ Women live longer than men even during severe famines and epidemics

Women live longer than men in nearly all populations today. Some research focuses on the biological origins of the female advantage; other research stresses the significance of social factors. This paper studied male–female survival differences in populations of slaves and populations exposed to severe famines and epidemics. The findings highlight that even when mortality was very high, women lived longer on average than men. Most of the female advantage was due to differences in mortality among infants: baby girls were able to survive harsh conditions better than baby boys. These results support the view that the female survival advantage is modulated by a complex interaction of biological environmental and social factors.

**Survival curves (shaded areas), life expectancies (solid vertical lines), and ages at which only 5% of a synthetic same-sex cohort would still be alive (dashed vertical lines) for seven high-mortality populations.**



Virginia Zarulli et al. PNAS 2018;115:4:E832-E840

PNAS

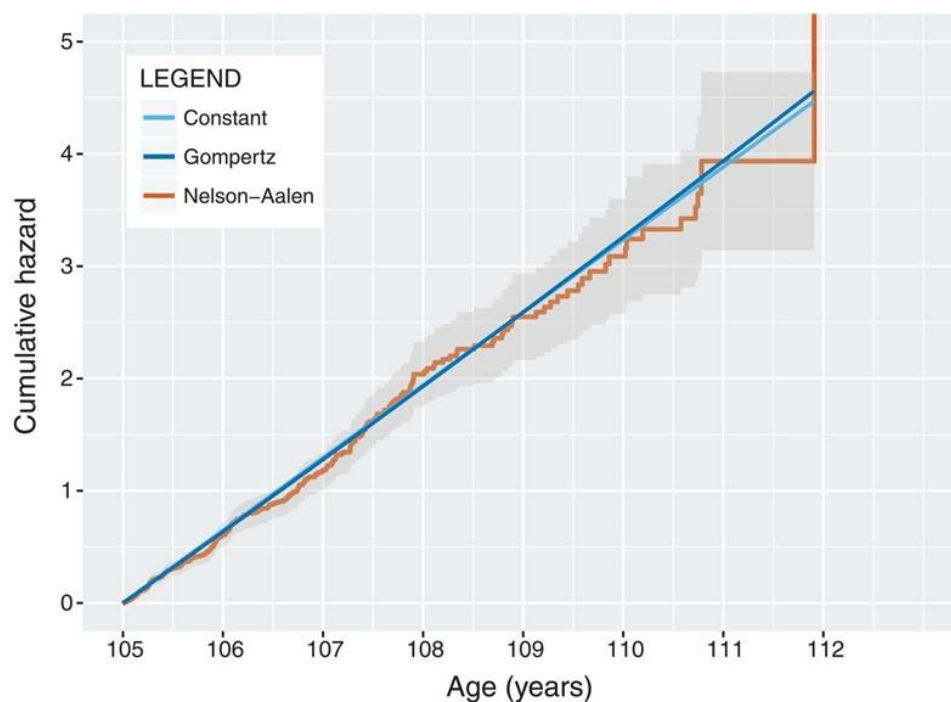


14. Barbi, E., Lagona, F., Marsili, M., **Vaupel, J. W.**, & Wachter, K. W. (2018). The plateau of human mortality: Demography of longevity pioneers. *Science*, 360(6396), 1459-1461. [Link](#).

➞ **Mortality rates level off at extremely high age**

The demography of human longevity is a contentious topic. On the basis of high-quality data from Italians aged 105 and older, Barbi et al. show that mortality is constant at extreme ages but at levels that decline somewhat across cohorts. Human death rates increase exponentially up to about age 80, then decelerate, and plateau after age 105. The estimated hazard rates from data on all inhabitants of Italy aged 105 and older between 2009 and 2015 (born 1896–1910), are free from artifacts of aggregation that limited earlier studies and provide the best evidence to date for the existence of extreme-age mortality plateaus in humans.

**Fig. 2 Cumulative hazard beyond age 105 for the cohort of Italian women born in 1904, as determined by the Nelson-Aalen estimator.**



Elisabetta Barbi et al. *Science* 2018;360:1459-1461

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**Science**  
AAAS



### 3.3 PhD Students and Graduates

Educating a new generation of researchers is an important part of CPop's mission. Between 2018 and mid-2021, thirteen PhD students were working on their dissertation under main supervision of CPop Affiliates. As of mid-2021, CPop hosts 3 PhD students. All PhD students of CPop have been financed through external research grants.

#### List of CPop PhD graduates

2018

**Pascariu, M. D.** (2018). *Modelling and forecasting mortality*. Faculty of Health Sciences. University of Southern Denmark.

2019

**Medford, A.** (2019). *Maximum Life expectancy and lifespans: Insights from Extreme Value Theory*. Faculty of Health Sciences. University of Southern Denmark.

**da Silva, R.** (2019). *Demographic data analyses enhance biodiversity conservation and sustainable international trade in fish, corals, turtles and tortoises*. Syddansk Universitet. Faculty of Science. University of Southern Denmark.

2020

**Torres, C.** (2020). *Life expectancy in urbanizing contexts: Patterns and causes of changes in mortality in historical populations*. Faculty of Health Sciences. University of Southern Denmark.

**Kashnitsky, I.** (2020). *Changing regional inequalities in ageing across Europe*. University of Groningen.

**Aburto, J. M.** (2020). *On the relationship between life expectancy and lifespan equality*. Faculty of Health Sciences. University of Southern Denmark.

**Basellini, U.** (2020). *New Approaches in Mortality Modelling and Forecasting*. Faculty of Business and Social Sciences

**Baden, H.M.** (2020). *Demographic ageing in plants*. Faculty of Science. University of Southern Denmark.

**Römer, G.** 2020. *Variation of demographic traits across the tree of life*. Faculty of Science. University of Southern Denmark.

**Kjærgaard, S.** (2020). *New mortality forecasting models and their application*. Faculty of Health Sciences. University of Southern Denmark.

2021

**Strozza, C.** (2021). *Understanding health dynamics among the oldest-old*. Faculty of Health Sciences. University of Southern Denmark.



**Frehr Kristensen, F.** (2021). *Essays in Health and Demographic economics*. Faculty of Business and Social Sciences. University of Southern Denmark.

### 3.4 External funding

CPop affiliates across units have been successful in acquiring external funding. In total, 21 CPop affiliates have been principal investigators of external grants in the period 2018-2021, some have been PIs of multiple grants. The total amount of external funding that CPop affiliates have acquired and that have been running in the period 2018-2021 is 144 million DKK (19,4 Mio EUR).

CPop DEM affiliates have been principal investigators of 14 external research grants during the period 2018 – 2021. While some grants started before the foundation of CPop, most have been acquired after CPop's establishment. The total budget of the grants for their entire duration reached 46 million DKK (6,2 Mio EUR). Major grants will continue beyond 2021 such as James Vaupel's ERC Advanced Grant, Rita da Silva's Villum Fund grant and Angela Chang's grants which will start in 2022 (see Table 6 for more details). We are hoping for a success of our numerous grant applications to secure more external funding for the coming years (see Table 7).



Table 6: External funding, granted and running in and beyond the period 2018 – 2021

| Principal investigator          | Project name  | Funder  | Start date | End date   | Total amount granted (in thousand DKK) |
|---------------------------------|---|---|------------|------------|--|
| CPop DEM                        |   |   |            |            |  |
| James W. Vaupel                 | Unequal Lifespans   | EU - Horizon 2020, ERC Advanced Grant             | 01/01/2021 | 31/12/2025 | 18,622                                 |
| James W. Vaupel                 | Excess deaths and life-years lost due to the Covid-19 pandemic in Denmark   | ROCKWOOL Fonden                                   | 01/06/2020 | 31/12/2023 | 8,128                                  |
| James W. Vaupel                 | Challenges to Implementation of Indexation of the Pension Age in Denmark  | ROCKWOOL Fonden                                   | 01/01/2020 | 31/12/2022 | 4,054                                  |
| James W. Vaupel                 | Longevity Update  | AARP - American Association of Retired Persons    | 20/05/2019 | 12/12/2019 | 166                                    |
| James W. Vaupel                 | AXA Chair in Longevity Research   | AXA Research Fund                                 | 01/12/2018 | 15/03/2025 | 16,397                                 |
| James W. Vaupel                 | AARP Longevity Update   | AARP  | 01/03/2018 | 20/12/2018 | 384                                    |
| James W. Vaupel                 | Male/Female Project 1 "Demography of Sex differences in Health and Survival"  | NIH - National Institute of Health                | 15/09/2016 | 30/04/2021 | 6,365                                  |
| Marie-Pier Bergeron Boucher     | Coherent mortality forecasts by cause of death and disability level   | The SCOR Corporate Foundation for Science         | 01/01/2020 | 31/3/2022  | 484                                    |
| Jana Vobecká & Virginia Zarulli | EDSD support to international lecturers 2018  | European Association for Population Studies EAPS  | 26/10/2018 | 01/10/2019 | 37                                     |
| Ana Rita da Silva               | Villum Family Support - Submerging into demography  | Villum Fonden                                     | 08/11/2020 | 31/12/2021 | 30                                     |
| Ana Rita da Silva               | Submerging into demography – a new perspective to fill knowledge gaps for conservation of aquatic species                               | Villum Fonden                                     | 21/12/2019 | 31/07/2023 | 2,500                                  |
| Marius Pascariu                 | SCOR, "Modelling and forecasting age specific death rates at older ages   | The SCOR Corporate Foundation for Science         | 01/03/2016 | 28/02/2019 | 2,000                                  |
| Virginia Zarulli                | Life length and life disparity research network   | Uddannelses- og Forskningsministeriet             | 01/03/2020 | 31/12/2020 | 286                                    |
| Angela Chang*                   | Measuring experienced disease burden (ExpBoD): estimating the socio-economic, psychological, healthcare and welfare impacts of diseases | EU - Horizon 2020, Marie Skłodowska-Curie actions | 01/03/2022 | 28/02/2025 | 1.634                                  |
| Angela Chang*                   | Measuring experienced disease burden (ExpBoD): estimating the socio-economic, psychological, healthcare and welfare impacts of diseases | Uddannelses- og Forskningsministeriet             | 01/04/2022 | 31.03.2025 | 2.880                                  |



|                          |   |   |            |            |       |
|--------------------------|---|---|------------|------------|-------|
| Angela Chang*            | Measuring experienced disease burden (ExpBoD):<br>estimating the socio-economic, psychological, healthcare<br>and welfare impacts of diseases   | Helsefonden   | 01/03/2022 | 28/02/2025 | 400   |
| CPop SAM                 |   |   |            |            |       |
| Volha Lazuka             | Dynamics in health and human capital formation and<br>performance in a long-term perspective with<br>interventions and data from Denmark and Sweden   | Talent Track Excellence<br>Fellow programme, SDU<br>SAM | 01/01/2021 | 31/12/2023 | 240   |
| Volha Lazuka             | How and to what extent public institutions and scientific<br>knowledge contributed to the remarkable improvements<br>in life expectancy and growth in 19th-20th-century                                       | Wallander and Hedelius<br>fellowship                    | 01/03/2020 | 28/02/2023 | 1,261 |
| Volha Lazuka             | Sex education in school ages and its effects throughout<br>women's life in 1930-2017  | Ebbe Kock foundation                                    | 01/08/2021 | 31/12/2022 | 228   |
| Volha Lazuka*            | The Dynamic Impacts of Child Health and Skills<br>Enhanced by School Interventions across the Life<br>Course  | EU - Horizon 2020, Marie<br>Skłodowska-Curie actions    | 2022       | 2025       | 1,542 |
| Christian Møller<br>Dahl | Inside the black box of welfare state expansion: Early-life<br>health policies, parental investments and socio-economic<br>and health trajectories  | Uddannelses- og<br>Forskningsministeriet                | 01/01/2019 | 31/12/2023 | 2,490 |
| Giovanni<br>Mellace      | Causal Inference with Multiple IVs: Using Mendelian<br>Randomization to Estimate the Causal Effects of<br>Cannabis and Alcohol on Labor Productivity and of<br>Creativity and Risk Taking on Entrepreneurship | Uddannelses- og<br>Forskningsministeriet                | 01/09/2019 | 31/08/2023 | 4,168 |
| Jørgen T.<br>Lauridsen   | SHARE - Roadmap   | Uddannelses- og<br>Forskningsministeriet -<br>UFM       | 01/01/2021 | 31/12/2024 | 4,867 |
| Jørgen T.<br>Lauridsen   | Final establishment of a Danish SHARE data<br>infrastructure  | Carlsbergfondet   | 01/01/2021 | 31/12/2024 | 2,500 |
| Jørgen T.<br>Lauridsen   | SHARE bølge 9 - Konsortium bevilling  | SHARE Konsortium<br>AU/KU/CBS/AAU/RUC                   | 01/01/2021 | 31/12/2022 | 1,450 |
| Jørgen T.<br>Lauridsen   | SHARE - Helsefonden   | Helsefonden (tidl.<br>Sygekassernes Helsefond)          | 01/01/2020 | 31/12/2023 | 550   |
| Jørgen T.<br>Lauridsen   | SHARE - VELUX   | Velux fonden  | 01/01/2020 | 31/12/2023 | 3,600 |
| Jørgen T.<br>Lauridsen   | Establishment of a Danish SHARE data infrastructure   | Carlsbergfondet   | 01/01/2019 | 31/12/2020 | 5,000 |
| Jørgen T.<br>Lauridsen   | Social ulighed i demens samt identificering af<br>forebyggende faktorer for kognitiv dysfunktion  | Helsefonden (tidl.<br>Sygekassernes Helsefond)          | 01/01/2019 | 31/08/2023 | 400   |



|                       |   |   |            |            |       |
|-----------------------|---|---|------------|------------|-------|
| Jørgen T. Lauridsen   | SHARE   | Tryghedsgruppen                                   | 01/01/2019 | 31/12/2023 | 1,500 |
| Keith Andrew Meyers   | Marie Curie - Keith Meyers  | EU - Horizon 2020, Marie Skłodowska-Curie actions | 01/01/2021 | 31/12/2022 | 1,554 |
| Klaus Petersen        | Neoliberalism in the Nordics: Developing an absent theme  | Riksbankens Jubileumsfond                         | 01/01/2020 | 31/12/2025 | 3,285 |
| Lars Lønstrup         | Inequality in Life Span and the Macroeconomy: A Theoretical Inquiry   | Uddannelses- og Forskningsministeriet             | 01/09/2019 | 28/02/2022 | 756   |
| Paul Richard Sharp    | MSCA - Elena Korchmina - Paul Sharp - DEAR  | EU - Horizon 2020, Marie Skłodowska-Curie actions | 01/08/2021 | 31/07/2023 | 1,634 |
| Paul Richard Sharp    | Ninth CEPR Economic History Symposium 2021 - Carlsberg  | Carlsbergfondet                                   | 01/01/2021 | 31/12/2022 | 60    |
| Paul Richard Sharp    | Mapping the Human Capital of the Nordic Countries   | Carlsbergfondet                                   | 01/02/2020 | 31/01/2022 | 1,967 |
| Paul Richard Sharp    | A land of Milk and Butter: How Elites Created the Modern Danish Dairy Industry  | Landbrugets Kulturfond                            | 05/01/2020 | 30/06/2021 | 20    |
| Paul Richard Sharp    | Land of Milk and Butter: How elites created the modern Danish Dairy Industry  | Carlsbergfondet                                   | 05/01/2020 | 30/06/2021 | 71    |
| Paul Richard Sharp    | Conflict and Development  | Uddannelses- og Forskningsministeriet             | 01/08/2019 | 31/12/2023 | 5,437 |
| Peter Sandholt Jensen | Socio-economic Effects of Vaccines (SEV) Research Infrastructure  | Carlsbergfondet                                   | 01/01/2021 | 30/06/2024 | 82    |
| Pieter Vanhuysse      | Building sustainable societies with intergenerationally just policies? A multidimensional analysis for Denmark and 31 OECD countries, 1995 - 2015 | Carlsbergfondet                                   | 01/08/2021 | 31/07/2022 | 1,009 |
| CPop NAT              |   |   |            |            |       |
| Dalia Amor Conde      | Donation fra Species360 - Dalia Amore Conde   | Species360  | 01/03/2018 | 31/08/2022 | 2,502 |
| Dalia Amor Conde      | Samarbejdsaftale mellem Species360 og SDU   | Species360  | 01/03/2017 | 31/12/2021 | 4,331 |
| Fernando Colchero     | Demography, population dynamics and movement projects for the Karisoke Mountain Gorilla Project.  | Dian Fossey Gorilla Fund International            | 01/10/2019 | 30/09/2020 | 235   |
| Gesa Römer            | travel stipends to the OIKOS conference in Island   | Nordic Society OIKOS                              | 01/10/2019 | 30/06/2020 | 5     |
| Gesa Römer            | Oikos Travel Grant - Stina Edelfeldt og Gesa Römer  | Nordic Society OIKOS                              | 20/02/2018 | 22/02/2018 | 6     |
| Johan Dahlgren        | Towards more realistic predictions of the effects of climate and land use changes on species distributions  | Sveriges forskningsråd (Vetenskapsrådet) FORMAS   | 01/01/2017 | 31/12/2019 | 100   |
| Johan Dahlgren        | SEAD-Plant: Stage, Environment and Age-dependent Demography of Plants   | Uddannelses- og Forskningsministeriet             | 01/11/2016 | 31/10/2020 | 7,036 |



|            |  |   |            |            |       |
|------------|--|---|------------|------------|-------|
| Owen Jones | Could senescence be adaptive? causes and consequences of aging across the tree of life | EU - Horizon 2020, MSCA - Marie Skłodowska-Curie actions, Individual Fellowship | 01/05/2017 | 31/08/2019 | 1,491 |
| Owen Jones | Modelling demographic responses to climate change across the animal and plant kingdoms | Uddannelses- og Forskningsministeriet   | 01/12/2016 | 31/07/2020 | 2,547 |

\*External funding granted with a start date in 2022.



Table 7: External funding, submitted applications under review, as of June 2021

| Principal investigator               | Project name  | Funder   | Submission Date | Expected Start date | Expected End date | Total amount applied (in thousand DKK) |
|--------------------------------------|---|--|-----------------|---------------------|-------------------|--|
| Annette Baudisch                     | Born Once - Die Once  | EU - Horizon 2020, ERC Consolidator Grant              | 20/04/2021      | 01/06/2022          | 31/05/2024        | 14,900                                 |
| Virginia Zarulli and Angela Chang    | A measurement framework for gender inequality in health   | Danmarks Frie Forskningsfond (DFF), Inge Lehmann RP1   | 17-06-2021      | 01-03-2022          | 31-05-2025        | 2,000                                  |
| Jes Søgaard and Julia Callaway       | Healthy Ageing  | ROCKWOOL Fonden  | 01/09/2021      | 01/01/2023          | 31/12/2025        | 6,443                                  |
| Virginia Zarulli                     | INHEALTH - Longer healthy life, but for how many? Developing a framework to measure healthy life inequality among individuals | Danmarks Frie Forskningsfond (DFF), Sapere Aude        | 23/03/2021      | 01/04/2022          | 31/03/2026        | 6,190                                  |
| Christian Møller Dahl                | Project Grants in Bioscience and Basic Biomedicine 2020 - IVØ-part  | Novo Nordisk Fonden, Bioscience and Basic Biomedicine  | 02/09/2020      | 01/01/2021          | 31/12/2023        | 200                                    |
| Paul Richard Sharp                   | Marie Curie - Chris Absell  | EU - Horizon 2020, Marie Skłodowska-Curie actions      | 09/2021         | 01/08/2022          |                   | 1,633                                  |
| Silvia Rizzi                         | PreDesTinED: Premature Deaths of Despair tincturing Europe and Denmark  | Danmarks Frie Forskningsfond (DFF), Inge Lehmann       | 01/09/2021      | 01/08/2022          | 31/07/2024        | 2,448                                  |
| Fernando Colchero and Dalia A. Conde | Discovering the primate's tree of life hidden demography (DemoLife)   | Villum Fonden: Synergy – Initiation Project Grant 2021 | 02/03/2021      | 01-01-2022          | 31/12/2022        | 2,921                                  |
| Morgane Tidiere                      | The unsuspected potential of zoo data for conservation biology  | Villum Experiment 2021                                 | 17-03-2021      | 01-01-2022          | 31-12-2023        | 1,512                                  |
| Johan Dahlgren                       | ECODEMO - Employing Cross-scale Demography to Predict Ecological Consequences of Global Environmental Change                  | EU - Horizon 2020, ERC Consolidator Grant              | 18-04-2021      | 01-06-2022          | 31-05-2027        | 18,286                                 |



## Highlights

Highlights of external research grants below present a selection of interdisciplinary research projects funded by Danish and international funders. We feature here major projects of early career (Post-Docs, Assistant Professors) and senior affiliates of CPop who are principal investigators on the grants:

- with Early Career Researchers as a PI

### **How and to what extent public institutions and scientific knowledge contributed to the remarkable improvements in life expectancy and growth in 19th-20th-century**

Principal investigator: Volha Lazuka  
Budget: 1,260,000 DKK  
Funder: Wallander and Hedelius fellowship (Sweden)  
Duration: 01/03/2020 – 28/02/2023



How and to what extent public institutions and scientific knowledge contributed to the remarkable improvements in life expectancy and growth in 19th-20th-century Sweden and in other Scandinavian countries? Causal studies answering these questions are extremely scarce and leave mechanisms unclear. In filling this gap, my research project exploits pillar health reforms in Sweden by utilizing causal methods to multisource microdata. In the 19th century, it investigates significances of a smallpox vaccination campaign and of incremental medical innovations. In the 20th century, it explores long-run economic impacts of important public reforms targeting children and recent successes with chronic diseases among the elderly.

### **Coherent mortality forecasts by cause of death and disability level**

Principal investigator: Marie-Pier Bergeron Boucher  
Budget: 484,000 DKK  
Funder: The SCOR Corporate Foundation for Science  
Duration: 01/01/2020 - 31/03/2022 (incl. maternity leave break)

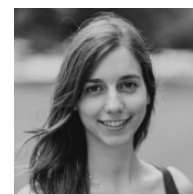


The objective of the project is to develop more accurate and robust methods to forecast mortality for disaggregated data. More precisely, mortality will be forecast by 1) cause of death and 2) years of life lived with and without disability (healthy life expectancy).



## Submerging into demography: a new perspective to inform the conservation of aquatic species

Principal investigator: Rita Da Silva  
Budget: 2,500,000 DKK  
Funder: Villum Fonden  
Duration: 21/12/2019 - 31/07/2023



Human threats are causing species extinctions at increasing rates, especially in aquatic environments. These extinctions are driven by a crisis in animal population dynamics, where death rates exceed birth rates. Exploring and understanding these demographic patterns is crucial to help threatened species recover and avoid further extinctions.

The research proposed will use innovative methods to increase knowledge of demographic patterns for freshwater and marine fish - an urgent need for these poorly known but economically important species. By studying captive populations under a novel framework, I will obtain unprecedented insights into the traits that determine the death and reproductive rates of aquatic populations. I will implement state-of-the-art statistical models to quantify age-specific mortality and fertility trends across species and understand how this information can help us forecast the effects of fishing, a key threat to the survival of fish species worldwide. In addition, this project will provide robust information to advance the fields of demography (including innovative theories of aging) and conservation biology.

- with Senior Researcher as a PI

## Unequal Lifespans: Inequalities in Lifespans before and after Retirement: Trailblazing Demographic Theory and Analysis

Principal investigator: James Vaupel  
Budget: 18,622,000 DKK  
Funder: EU - Horizon 2020, ERC Advanced Grant  
Duration: 01/01/2021 – 31/12/2025



How unequal are lifespans at older ages? How unequal will they be in the future? The length of life is often summarized by life expectancy, but the mean does not capture the spread. Distributions of lifespans need to be analyzed and forecast. Given the relevance of such research—for assessing pension reforms and other social and health policies—it is remarkable how little demographic modeling has been devoted to inequalities at older ages in individual lifespans. The research proposed here has three audacious ambitions and bold theoretical thrusts: (1) broaden discourse and conceptually shift thinking about retirement to include individual lifespan inequalities, (2) developing the demographic theory of old-age mortality, test the hypothesis that substantial progress is being made in cutting death rates after age 90, and (3) develop an innovative theory-based forecasting method based on 8 strong regularities of mortality trajectories at older ages that goes well beyond the state of the art to predict lifespan distributions (and inequalities)—and to quantify the uncertainties in these predictions. Preliminary research, mostly on Denmark but also some on Sweden, France and Japan, to prepare this application produced findings that surprised me. The probability of dying after age 50 but before retirement age was higher than I suspected. The likely growth in the number of people above age 90 astonished me. Rates of improvement in mortality after age 100 in France and Japan



were much greater than published estimates for Denmark or Sweden. Current forecasting methods appear inadequate to capture likely reductions in death rates at the ages when most people die. These preliminary findings suggest that the daring theory-based, theory-building program of analysis of 40+ countries/regions proposed here will open new perspectives for research on lifespans at older ages as well as providing novel, highly-relevant input to discussions of the challenges of raising retirement ages.

### SEAD-Plant: Stage, Environment and Age-dependent Demography of Plants

Principal investigator: Johan Dahlgren

Budget: 7,036,000 DKK

Funder: Uddannelses- og Forskningsministeriet

Duration: 01/11/2016 – 31/10/2020



How do plants age? It is poorly known how plant mortality and fertility are affected by age, including whether plants generally even show “demographic senescence” (the gradually increasing mortality and decreasing fertility with age observed in several animal groups). Classical evolutionary theories of aging predict that demographic senescence should occur in all organisms. However, this is not supported results of current age-based plant demographical studies. Within SEAD-Plant we find that plant ageing varies substantially (even regarding whether effects of age are positive or negative for plant fitness) among species, populations within species and even among years, and that interactions between age, stage and environment need to be understood in order to understand the evolutionary drivers of senescence and the drivers of population dynamics. The latter is necessary to make better forecasts of effects of environmental change such as climate change and other global environmental changes, on plant population sizes and distributions.

Project team included Stina Edelfeldt (PostDoc), Juliawati Binti Azali (Lab Assistant), and PhD students Maria Baden and Ditte Tholstrup. Also, former EDSD student Julia Pilowski has worked on the topics of the project and contributed to the publications.

Project output:

1. Wiig Tholstrup, D., Halvorsen, R., Dahlgren, J. P., (2021). Age matters: Demographic senescence in the moss *Polytrichastrum formosum*. *Journal of Ecology*, (online version – will be included in issue later), [Link](#)
2. Baden, H. M., Roach, D. A., Schweingruber, F., Reitzel, K., Lundgreen, K., Dahlgren, J. P. (2021). The effects of age on the demography of a perennial plant depend on interactions with size and environment. *Journal of Ecology*, Volume 109, Issue 2, 1068-1077. [Link](#)
3. Pilowsky, J. A., Dahlgren, J. P. (2020). Incorporating the temporal autocorrelation of demographic rates into structured population models. *Oikos*, Volume 129, Issue 2, 238-248, [Link](#)
4. Morris, W. F., Ehrlén, J., Dahlgren, J. P., Loomis, A. K., Louthan, A. M. (2020). Biotic and anthropogenic forces rival climatic/abiotic factors in determining global plant population growth and fitness. *Proceedings of the National Academy of Sciences of the United States of America*, 117 (2), 1107-1112. [Link](#)
5. Edelfeldt, S., Lindell, T., Dahlgren, J. P. (2019). Age-independent adult mortality in a long-lived herb. *Diversity*, Volume 11, Issue 10, Article number 187, [Link](#)



6. Edelfeldt, S., Bengtsson, K., Dahlgren, J. P. (2019). Demographic senescence and effects on population dynamics of a perennial plant. *Ecology*, Volume 100, Issue 8. [Link](#)

7. Sherman, D. A., Dahlgren, J. P., Ehrlén, J. García, M. B. (2019). Sex and the cost of reproduction through the life course of an extremely long-lived herb. *Oecologia*, 191, 369-375. [Link](#)

### 3.5 Teaching

Most CPop affiliates are engaged in graduate and undergraduate teaching. Additional interdisciplinary teaching initiatives were organized by CPop affiliates. Those are listed in more detail below.

#### European Doctoral School of Demography

CPop was hosting for two consecutive years the international [European Doctoral School of Demography](#) (EDSD) in collaboration with Max Planck Institute for Demographic Research and several European universities. The mission of EDSD is to provide new doctoral students at European universities with an opportunity to pursue advanced studies in demography—and hence to help educate the next generation of demographers. Every year, by contributing lecturers for the program and funding for the students, the EDSD consortium of European demography institutes and departments enables EDSD to present advanced courses to a cohort of doctoral students who benefit from studying together and from getting a deep understanding of demographic research. In the academic year 2018/19, SDU was hosting 15 students of 10 different nationalities. Teaching was provided by CPop researchers and 15 visiting lecturers from European, US, and Australian Universities.

In the past two academic years, EDSD has been hosted by the Centre for Population Studies of Autonomous University in Barcelona. CPop has been fully supporting scholarships of three promising students during the eleven months course in Rostock and Barcelona in 2019/2020 and five students in 2020/2021 academic years. Some of them became future CPop PhD students. CPop will support again five students in the upcoming cohort. Every year, CPop DEM unit members are contributing lectures to the program.

*Poster advertising the EDSD programme hosted by CPop SDU in Odense.*

#### Talent Programme ‘Radical Rethink!’

CPop researcher Annette Baudisch initiated and developed together with an interdisciplinary group of CPop researchers a new SDU Talent Programme “**Radical Rethink! The Future of Aging Societies**”. Radical Rethink! was a one-year extra-curricular talent programme for ambitious and forward-looking students who wished to integrate their unique abilities within interdisciplinary talent teams. Student teams were challenged to create new ideas that breach boundaries and paradigms to approach solutions of burning issues in aging societies of the 21<sup>st</sup> century.



Radical Rethink! saw its first student cohort in 2019 with innovative interdisciplinary teaching program contributed by lecturers from across SDU faculties, including CPop affiliates Annette Baudisch, Peter Simonsen, Pieter Vanhuysse, James Vaupel, and Rune Lindahl-Jacobsen.

[Read more about Radical Rethink!](#)

### Teaching and supervision overview

CPop core and affiliated researchers have been engaged in teaching a large number of courses and in supervision of undergraduates in all four faculties. An overview of courses taught by CPop affiliates is in Appendix 2.

**EUROPEAN DOCTORAL SCHOOL OF DEMOGRAPHY**

THE EDSO IS AN INNOVATIVE COLLABORATION OF DEMOGRAPHIC INSTITUTES AND UNIVERSITY DEPARTMENTS ACROSS EUROPE. ITS MISSION IS TO EDUCATE THE NEXT GENERATION OF DEMOGRAPHERS. — **IT IS FREE AND YOU GET FULL FELLOWSHIPS.**

| 1 FREE EDUCATION  | 2 FIND A JOB AFTER  | 3 APPLY NOW  |
|---|---|--|
| In demography at great locations. Odense, Denmark in 2018. No tuition, full scholarships. | Job recruitment through the network across Europe and globally. | For Sep 2018 admission. Details about the requirements: <a href="http://WWW.EDS-DEMOGRAPHY.ORG">WWW.EDS-DEMOGRAPHY.ORG</a> |

FOR FURTHER INFORMATION GO TO [WWW.EDS-DEMOGRAPHY.ORG](http://WWW.EDS-DEMOGRAPHY.ORG)

“WHERE YOUR INTERESTS AND ASPIRATIONS MEET THE OPPORTUNITIES IN AN INTERNATIONAL ENVIRONMENT”  
Virginia Zauli, Italy

“EDSO INTRODUCED ME TO A WORLDWIDE RESEARCH NETWORK.”  
Jonas Schöley, Germany

Previous EDSO students now working at MaxQ



### 3.6 Outreach

CPop aspires to create significant value for society through close and continued interaction with relevant stakeholders (including policy makers and policy analysts, leaders of non-governmental organizations, journalists and students) at many different levels and in many different forms to communicate findings and to receive feedback.

Initially, it was planned to create an Impact Unit within CPop DEM (Kernel). This unit was supposed to consist of a devoted staff of three professionals who would support and coordinate the portfolio of outreach activities, and secure close collaboration with private external funders. This unit was expected to be established by a new CPop director in 2019 (see more detail on CPop Governance in Section 2.2). As the Governor of CPop decided not to nominate a CPop Director, also the establishment of the Impact unit did not materialize. Despite these exogenous constraints, CPop has various outreach initiatives. Some of these initiatives are coordinated by the CPop Chief Academic Administrator, the CPop DEM Director or CPop researchers themselves.

A diverse portfolio of **outreach activities** has been going on since 2018 with a selection presented below:

1. Applied research on **forecasting population dynamics of longer, healthier lives** and development of models of forecasting and policy analysis that can be used to provide better information on trends in Denmark and internationally. The impact of population change is so great for Danish society—and for the Danish government, pension organizations, insurance firms, financial institutions, and businesses more specifically—that use of more powerful methods of forecasting would be highly beneficial.
  - a. through collaboration with industry: research projects funded by foundations of the major insurance companies ((SCOR, AXA), and pension interest group (AARP).
  - b. through workshops with wide professional audience: in December 2018, CPop DEM organized Workshop on Forecasting Danish Life Expectancy and Age at Retirement. The aim of the workshop was to compare the performance of the models used by Danish public policy with alternatives that could deliver more accurate forecasts. Among the presenters were key persons from Statistics Denmark, the DREAM group producing official Danish forecasts, ATP and SCOR insurance companies and researchers from Aarhus and Copenhagen universities as well as CPop researchers.

➞ James Vaupel, Marie-Pier Bergeron Boucher, Søren Kjærgaard, Marius Pascariu, Anthony Medford, Silvia Rizzi, Jesus Alvarez Martinez

2. Applied research on **conservation of endangered species**: together with [Species 360](#) and its Conservation Science Alliance CPop researchers analyze population data from the zoos and aquariums to deliver missing information critical to assessing species life histories. They provide analytical tools and data for better calibration of conservation efforts for endangered species.

➞ Dalia Amor Conde, Johanna Stärk, Rita da Silva, Morgane Tidière, Fernando Colchero



3. Policy analyses of the **social, economic and health consequences and policy implications of changing population dynamics** in Denmark and internationally.

Research on intergenerational resource transfers and the welfare state has been presented to high level EU policy makers.

➞ Pieter Vanhuysse

4. Serving in various public expert committees and advisory boards. As an example, CPop is represented in the Reference Group for National Warning System for Handling COVID-19 in Denmark.

➞ Jes Søgaard

Extensive media presence: CPop researchers and their research was cited in 130 articles in newspaper, radio and TV outlets that range from Odense Ugeavisen to The Times in 2018, in 168 articles in 2019 and in 189 different articles and other media in 2020. By mid-2021, this number is reached already 282. Many of the articles were re-published by different media outlets thus the overall media occurrence exceeds the above numbers.

As outreach and societal relevance is at the core of CPop mission, significant efforts have been made to establish **research outreach channels**:

- **Twitter**: our Twitter account is targeting scientific community, journalists and interested public with our research news, and other news from CPop since 2019. By mid-2021 CPop Twitter has more than 1,000 followers and 500 tweets, [link](#).
- **Website**: our website is showcasing our research, news, events and much more in a re-designed format since early 2020, [link](#).
- **Partnering** in research dissemination with *Population Europe*, a network of Europe's leading research centres in the field of policy-relevant population studies, and *The Conversation*, an independent source of news and views, sourced from the academic and research community and delivered direct to the public.

## Highlights

### Jes Søgaard as a member of the Reference Group for National Warning System for Handling COVID-19 in Denmark

Jes is building on his expertise and experience as a health economist and health service researcher and on the finding of CPop's research on the excess death due to the COVID-19 pandemics. Together with other 11 expert he advises the Government on the warning system, risk levels, closure and reopening strategies and priorities for Denmark during the COVID-19 pandemics.



Initially, the Group was to contribute to the development of a national alert system and in particular to a link between infection levels and prevalence and various measures (restrictions, etc.) to limit the pandemic



impact. Since the turn of the year (2020/21), the task has been to advise on resp. prepare proposals for “opening strategies”, i.e. in what order and speed with which the various restrictions are to be relaxed. The Group members have also contributed with advice on local interventions at regional, municipal and parish level. Finally, they have also advised / commented on various changes and adaptations in the Epidemic Act.

Jes is Professor and a Director of CPop DEM.

### **Dalia Amor Conde as a co-founder of the “Conservation Science Alliance”**

Dalia’s research is highly applied and policy focused and together with the non-profit organization Species360 she has initiated the “Conservation Science Alliance”, which brings together researchers, zoos, aquariums and international nature conservation organisations with the common goal of saving species from extinction.




To give just few examples: Dalia works directly with the Convention on International Wildlife Trade (CITES) to support their action against illegal wildlife trade. With the IUCN Red List she works on making species information more available to the conservation community. She is able to communicate in a truly engaging way. She includes her students in her work and inspires them by showing them that they can make a real-world impact.

For her capacity to inspire and contribute to the conservation of endangered species, she was awarded an SDU Inspiration Prize for 2021.

Dalia is an Associate Professor at CPop NAT and Species 360 Director of Science.






[Publications](#)  
[Events](#)  
[Vacancies](#)  
[Research Seminars](#)

## The Interdisciplinary Centre on Population Dynamics | CPop

CPop conducts innovative research on changes in survival, longevity, and population aging, including their policy, economic, and cultural implications.


# COVID-19 excess death research portal

[Learn more](#)




### News and events

Find out more about all our events, publications, vacancies and news and highlights from the centre. Search through all or select by research area.




### Research

CPop research spans a broad range of topics linked to ageing, longevity, and survival in human and non-human species. Learn more about CPop research areas and projects.



### About the centre

CPop is an interdisciplinary cross-faculty collaboration between researchers drawn from demography, public health, biology, mathematics, economics, political science and humanities.




### Our contribution to the sustainable developmental goals


Find out how interdisciplinary CPop research aligns with and contributes to the Sustainable Development Goals.

- Our research seminars
- Our people
- Publications
- Teaching
- Vacancies
- Get in touch


#### Tweets by @CPop\_SDU



CPop SDU Retweeted



**Prof. Feynman**  
@ProfFeynman  
Don't be impressed by money, followers, degrees, and titles.  
Be impressed by kindness, integrity, humility, and generosity.



[Embed](#)[View on Twitter](#)

[Follow](#)







### 3.7 International collaboration

CPop strives to strengthen SDU's internationalization efforts by establishing close partnerships with international research institutes, through common research projects and publication, through exchange of visiting researchers as well as through long-term formalized research collaborations.

As few examples we can mention the collaborations on the evolutionary demography of ageing with the Primate Life Histories Working Group (multiple universities), with the Department of Zoology at the University of Oxford, with the Laboratoire de Biométrie et Biologie Evolutive, CNRS, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the International Union for Conservation of Nature (IUCN), as well as Stockholm University, Uppsala University and University of Oslo. Since November 2020 Annette Baudisch collaborates with Santa Fe Institute of Complex Systems on theory of birth, ageing, and death.

On the excess death and life years lost related to the COVID-19 pandemics our team collaborates with the Max Planck Institute on Demographic Research in, Oxford's Leverhulme Centre for Demographic Science, and The Demographic Studies Center (CED) in Barcelona.

### 3.8 Prizes and Awards

Over the years, CPop affiliates received many prestigious awards for their research, research communication, life-long contribution to their field and for societal impact. Below is an overview of the recipients and their awards.

2021

#### 2021 Inspiration Prize

**Dalia A. Conde** received the received the SDU 2021 Inspiration Prize for her inspiring work on nature conservation, where she has participated in the work of launching 'The Conservation Science Alliance', which brings together researchers, zoos, aquariums and international nature conservation organisations with the common goal of saving species from extinction.

The Inspiration Prize is awarded to a group of staff and/or students who have made a special effort to work with the UN's 17 Sustainable Development Goals.





### Knight of the Order of Dannebrog

**James W. Vaupel** has been knighted for his contribution to research at the University of Southern Denmark. The order is given to outstanding citizens of the Danish state for contributions to science, art, business, civil and military service by Her Majesty Queen Margrethe II of Denmark ([The Royal Order of Dannebrog](#)).



### Knight of the Order of Dannebrog

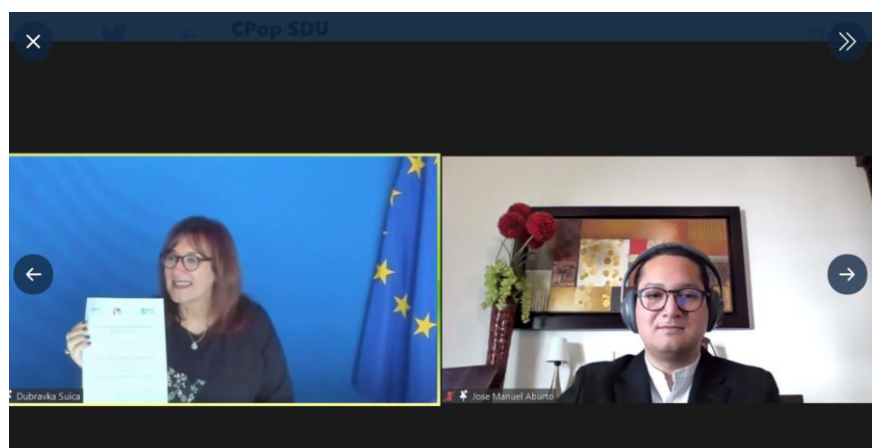
**Donald E. Canfield** has been knighted for research at the University of Southern Denmark.. The order is given to outstanding citizens of the Danish state for contributions to science, art, business, civil and military service by Her Majesty Queen Margrethe II of Denmark ([The Royal Order of Dannebrog](#)).



### European Demographer Award 2021

**José Manuel Aburto** has been honored with the European Demographer Award for his outstanding contribution to research on lifespan inequalities. A PhD graduate from CPop (2020, main supervisor James Vaupel), José Manuel has an impressive number of publications in peer-reviewed journals, including as lead author in *Proceedings of the National Academy of Sciences*, *Demography*, *Population Studies* and *Demographic Research*.

The awarding ceremony for the European Demographer Award was held online, in the presence of Dubravka Šuica, the Vice President of the European Commission.





2020

### Student Presentation Award, Actuarial Research Conference 2020

**Jesús-Ádrian Álvarez** was awarded a Student Presentation Award for the best presentation at the Actuarial Research Conference 2020. The prize was awarded for his paper "Unravelling the Contribution of Financial and Longevity Risks to Stochastic Changes in Life Annuities" at a major conference for actuarial research, where academics and industry actuaries present novel developments and ideas. This year, the conference was hosted online by the College of Business of the University of Nebraska.



2019

### Knight of the Order of Dannebrog

**Klaus Petersen** has been knighted for his contribution to research at the University of Southern Denmark. The order is given to outstanding citizens of the Danish state for contributions to science, art, business, civil and military service by Her Majesty Queen Margrethe II of Denmark (The Royal Order of Dannebrog).



### Arbejderhistorieprisen

**Nicklas Freisleben Lund**, CPop affiliate from CPop HUM received 'Arbejderhistorieprisen' for his PhD-thesis "In Ambivalent Battle. The Strike and the Novel 1850-1950 that examines the literary history of strikes.

*Arbejderhistorieprisen* is an annual academic prize awarded by the Worker's Museum, The Workers' Movement's Library and Archive and The Danish Society for Working-Class History. The prize is awarded to a master or PhD-thesis that deals with topics related to Danish or International working-class history.

Read more [here](#).

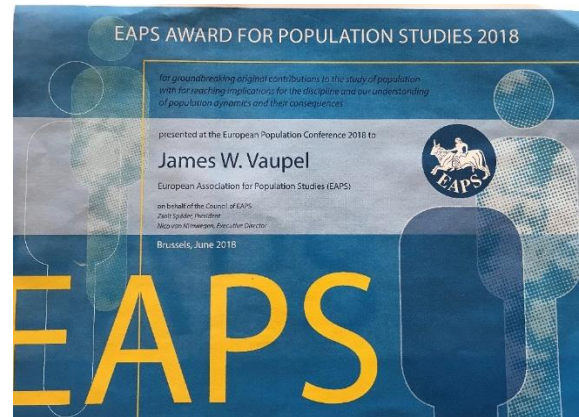




2018

### European Association for Population Studies (EAPS) Award for Population Studies

**James W. Vaupel** received this highest award of the European Association for Population Studies on 9 Jun 2018. James Vaupel has been the third recipient in the Prize's history.

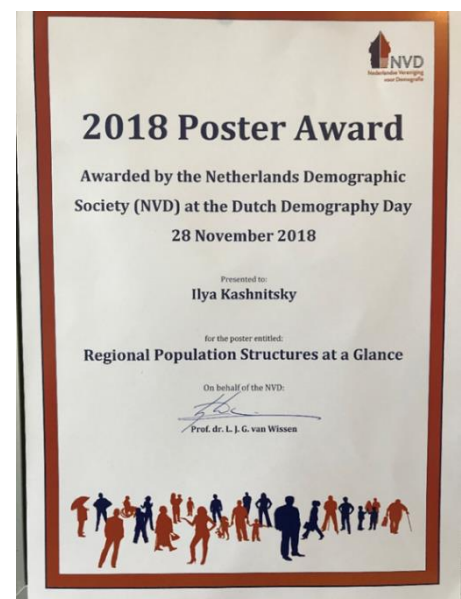
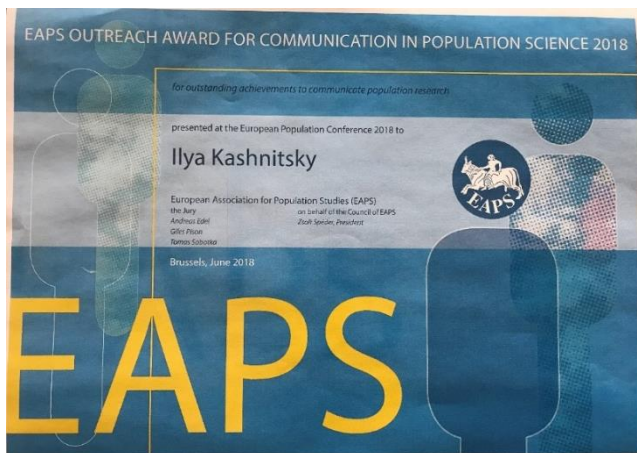


### European Association for Population Studies (EAPS) Outreach Award for Communication in Population Science

**Ilya Kashnitsky** (Recipient), Jun 2018

### Netherlands Demographic Society 2018 Poster Award

**Ilya Kashnitsky & Jonas Schöley** (Recipient), 23 Nov 2018



### Population Association of America Annual Conference PAA 2018 Poster Session Winner

**José Manuel Aburto** (Recipient), 28 Apr 2018





## 4. Building Interdisciplinary Research and Collaboration

CPop is a centre that reaches across disciplines and connects researchers across topics, methods used and scientific paradigms. CPop strives for interdisciplinarity in all its core business. The interdisciplinary research collaboration is reflected in our publications and external funding (see Section 3.2 and 3.4 and publication Highlights in the same sections). Through CPop DEM we cultivate connections between CPop faculty units and facilitate interdisciplinarity by organizing seminars, workshops, and teaching activities.

**Cross-disciplinary research teams** were created over the years around various research projects and publications. To mention just a few:

- CPop established a lasting collaboration between biodemographers and mathematicians **studying regularities and common structures in longevity**, mortality and lifespan inequality of both human and non-human populations. This resulted in several collaborative research projects and numerous publications (see f.ex. Highlighted publication 3, 10, 11 presented in Section 3.2).
- Epidemiologists, statisticians and demographers work together on **new insights regarding the male-female mortality differences and improved methods for studying mortality in extremely old ages** (see f.ex. Highlighted publication 7, 12, 13 presented in Section 3.2).
- Recently, demographers, economists and political scientists of CPop have joined in a project focusing on the **quantification of excess death due to COVID-19 and the impact of policy** on mitigating the impact of the pandemics.

**The CPop Research Seminars** provide a well-attended lively forum for scholars from across disciplines to discuss in-progress research on social, cultural, biological, epidemiological, and demographic aspects of ageing, longevity, inequalities, and related issues both for human and non-human populations. The profile and focus reflect the research interests of CPop affiliates. The CPop Research Seminars welcome presentation on a wide variety of topics including biodemography, conservation demography, health economics, epidemiology and public health issues, literary studies, welfare state studies and comparative politics. The long-term goal is to cultivate a broad and interdisciplinary forum for discussion and research advancement into causes and consequences of ageing. Presenters include CPop affiliates and guests. Typically, we hold 27 seminars per academic year.

**CPop Retreat** was organized in February 2020, right before the first COVID-related lock-down. We discussed together what we want CPop to be, how we can achieve it, and how we can sustain it. We talked about what is CPop identity, which interdisciplinary ideas and projects we want to engage in, and how we can achieve societal impact with CPop. Not least, we had a good informal time together...

















## 5. Sustainable Development Goals

CPop joined the initiative of the University of Southern Denmark and supports the Sustainable Development Goals by conducting basic and applied research that advances knowledge and provides tools for monitoring and implementation of the Sustainable Development Goals. Below is a summary of CPop contribution to the Goals.

|  |   |
|--|---|
| <b>3</b> GOOD HEALTH AND WELL-BEING<br> | <p>3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being</p> <p>CPop is monitoring and analyzing the trends of mortality by cause of death. Its research on mortality forecasting, inequalities in health and survival, gender lifespan inequalities, social lifespan inequalities can inform policy makers on trends and prospects of mortality from non-communicable diseases.</p>  |
| <b>4</b> QUALITY EDUCATION<br>         | <p>4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development</p> <p>CPop studies contributions of literature and other art forms to mediating, understanding, and rethinking ageing in society.</p>   |
| <b>5</b> GENDER EQUALITY<br>          | <p>5.1 End all forms of discrimination against all women and girls everywhere</p> <p>CPop is committed to tackling sexism and gendered ageism in cultural artefacts, social policy, institutions, and society by identifying and bringing attention to biological, social and cultural differences between the genders throughout the life course.</p>  |
|  | <p>5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate</p> <p>CPop challenges the widespread assumption that only paid work contributes to the wealth of a nation, by including a focus on caring responsibilities and domestic work, with important implications for social policy.</p> <p>5.C Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels</p> <p>CPop produces multidisciplinary research engaging with gender differences in life course and how these impact women's and men's ageing; these findings are of great relevance for policy and legislation.</p> |



|   |  |
|---|--|
| <b>10</b> REDUCED INEQUALITIES<br>                     | 10.2 By 2030, empower and promote the social, economic and political inclusion of all  |
|   | CPop studies lifespan inequality, gender inequality in life expectancy, and its links to pensions. Thus, creates policy-relevant knowledge on differences within population that can impede inclusion.   |
|   | 10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard   |
|   | CPop studies intergenerational equity, early childhood investment and ways through which welfare states and their policies can reduce inequalities of outcome and opportunities.   |
|   | 10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality  |
| <b>11</b> SUSTAINABLE CITIES AND COMMUNITIES<br>      | CPop studies intergenerational equity, early childhood investment and other welfare state provisions and their impact on society and its segments.   |
|   | 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries  |
|   | CPop is developing forecasting methods to better assess future needs and capacities for changing population size and structure. It is useful in settlement planning and management for cities, regions and countries.  |
| <b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION<br> | 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage   |
|   | CPop works towards safeguard of natural heritage by filling the gaps in knowledge about animals and plants life spans, reproduction and mortality using modelling and data from wild and captive populations.  |
| <b>13</b> CLIMATE ACTION<br>                         | 12.2 By 2030, achieve the sustainable management and efficient use of natural resources  |
|   | CPop is supporting sustainable management efforts and increased efficiency in use of natural resources by filling the gaps in knowledge about species life spans, reproduction and mortality using modelling and data from wild and captive populations.       |
| <b>13</b> CLIMATE ACTION<br>                         | 12.2 By 2030, achieve the sustainable management and efficient use of natural resources  |
|   | CPop is supporting sustainable management efforts and increased efficiency in use of natural resources by filling the gaps in knowledge about species life spans, reproduction and mortality using modelling and data from wild and captive populations.       |
| <b>13</b> CLIMATE ACTION<br>                         | 13.2 By 2030, increase resilience and reduce vulnerability to climate change and its impacts, including through education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning |
|   | CPop is raising awareness of endangered species conservation by filling the gaps in knowledge about species life spans, reproduction and mortality using modelling and data from wild and captive populations.   |
| <b>13</b> CLIMATE ACTION<br>                         | 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning  |
|   | CPop is raising awareness of endangered species conservation by filling the gaps in knowledge about species life spans, reproduction and mortality using modelling and data from wild and captive populations.   |



|  |  |
|--|--|
| <div> <div>14</div> <div>LIFE BELOW WATER</div>  </div> | <p>14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans</p>   |
|  | <p>CPop is increasing demographic knowledge of poorly studied species and providing analytical tools to successfully manage populations in their environment and reintroduce endangered species from captivity, e.g. corals.</p>   |
|  | <p>14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics</p>   |
|  | <p>CPop is developing tools that rely on accurate knowledge of life cycles and demography to contribute to science-based management plans to protect and restore fish stocks.</p>  |
|  | <p>14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries</p> |
| <div> <div>15</div> <div>LIFE ON LAND</div>  </div>   | <p>CPop contributes to increasing scientific knowledge on endangered species demography and life history, while exploring the contribution of captive populations to improve management of species of conservation and commercial value (e.g. fisheries).</p>  |
|  | <p>15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species</p>   |
|  | <p>CPop gathers and models population data and studies population dynamics of endangered species. This is essential for conservation efforts of endangered species.</p>  |
|  | <p>15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products</p>   |
|  | <p>CPop is not only increasing demographic knowledge and developing analytical tools for management and conservation but is working closely with international organizations such as the Convention on International Trade of Endangered Species (CITES) to better inform the trade of endangered species.</p>   |



## Conclusion

CPop fulfilled major goals set up upon its foundation, namely, to cultivate interdisciplinary research and collaboration that furthers understanding of the causes and consequences of population change, especially population ageing in human and non-human populations and its policy implications.

CPop researchers published a large number of excellent publications in prestigious research outlets, received awards for their research both in the form of prizes and external grants. Their external grants include some of the most prestigious funding achievable in the European research context (ERC Advanced Grant, Marie Curie fellowships).

CPop researchers developed innovative interdisciplinary teaching programmes and were engaged in a number of teaching initiatives at SDU and in international collaborations. CPop has been educating a new generation of PhD students, thirteen in total.

CPop has encountered some deviations from the initial plans, the major ones were linked to the SDU governance decision not to nominate a new CPop Director in mid-2019. This led to changes in governance structure of CPop and to alternations of plans regarding the establishment of the Impact unit and initiation of some formal international collaborations. Despite of these limitations, CPop has been able to prosper and generate large amount of external funding both by junior and senior affiliates, now making up for 44 % of the Centre's income.

CPop researchers and administrators worked successfully to reach out and disseminate their research to policy makers and wider public. Thus, Interdisciplinary Centre on Population Dynamics has become a recognized brand of excellent research within SDU both in Denmark and internationally.





## Part II. Goals and Strategies beyond 2021







## CPop Goals and Strategies

CPop plans to continue beyond 2021 as a network of interdisciplinary scholars interested in causes and consequences of population ageing and increasing longevity. Additional research in cross-disciplinary topics will include fertility, fecundity and generational demography. CPop will continue its focus on excellent research, research dialogue and collaboration through common CPop events, generation of external funding, teaching, and research outreach and dissemination. Below are outlined the future goals and strategies of CPop units.

## CPop DEM

CPop DEM intends to continue as an SDU Centre of Excellence and has strong ambitions, clear goals and concrete strategies for many years ahead. Our goals include excellent academic research, new teaching initiatives, and a vision for developing further research outreach.

### Academic goals and strategies

CPop DEM shall continue to maintain a position as one of the leading academic groups of demographers in the world. It will also continue to maintain a core function in research on population studies and research at SDU.

### Areas of research

CPop DEM has for years been excellent in both formal demography and analytical quantitative population studies. In particular, we have focused on the studies of ageing populations, longevity and mortality, population forecasting, on the study of inequalities (both sex and socio-economic status (SES)), and in visualizations of complex data structures. As a result, our researchers publish in the best journals. We attract major grants and want to continue this track.

For the last two years, CPop DEM also pursued more applied research, and now we publish studies on and attract grants for studies of optimal pension systems, i.e., both efficient, sustainable, and fair across sex and SES, and on covid-19 excess deaths studies.

We shall continue an academic strategy with a focus on theories, methodologies and rigorous yet visionary applications, some of which find direct policy relevance in Denmark and other countries.

So far CPop and CPop DEM have focused mainly on the scientific study of ageing populations and associated implications related to mortality and deaths. We have decided that, as for our goals above, we need to rest on more than one leg. So, in the coming years we shall broaden our focus and include the study of the beginning of life – fertility and births.

### Funding strategies

For our research, CPop DEM heavily relies on external funding. Beyond providing financial security, growth and flexibility, external grants allow us to sharpen our ideas and remain competitive.

Senior professor James W. Vaupel has been a driving force in our successful development. He has acquired major grants, including an ERC Advanced Grant. He will continue his academic leadership role in our team.



At the same time, CPop DEM fosters the leadership potential of our younger staff, actively encouraging and supporting grant applications and PI roles for all research staff members above the PhD level.

The external funding plan for CPop DEM is shown in the table below. We expect that CPop DEM researchers will apply for external grants in Danish and international schemes of both public and private funders. In 2021, Virginia Zarulli, Silvia Rizzi, José Manuel Aburto, and Angela Chang applied for external funding in the Danish Independent Research Fund (DFF). Virginia passed into the final interview round of a prestigious Sapere Aude grant scheme of DFF. Annette Baudisch applied for an ERC Consolidator Grant. Her application on birth and death, connecting the beginning with the end of life, succeeded in the first round of the highly competitive selection process and she is preparing for an interview in the second round. The results of these grant applications will be known later this year and in early 2022.

Table 8: Expected external grants applications by CPop DEM researchers beyond 2021

| 510: Fundingplan - tentativ   | 2021       | 2022       | 2023      | 2024       | 2025      | 2026       | 2027      | 2028       |
|-------------------------------|------------|------------|-----------|------------|-----------|------------|-----------|------------|
| DFF - RP1                     | 2.880.000  | 2.880.000  | 2.880.000 | 2.880.000  | 2.880.000 | 2.880.000  | 2.880.000 | 2.880.000  |
| DFF - RP2                     |            | 6.192.000  |           | 6.192.000  |           | 6.192.000  |           | 6.192.000  |
| DFF - RP1 Inge Lehmann        | 5.366.496  |            |           |            |           |            |           |            |
| DFF - Sapere Aude             | 6.190.272  | -          | 6.192.000 |            | 6.192.000 |            | 6.192.000 |            |
| DNRF - CoE                    |            |            |           | 12.500.000 |           |            |           |            |
| ERC - Starting Grant          |            | 11.000.000 |           | 11.000.000 |           | 11.000.000 |           | 11.000.000 |
| ERC - Consolidator Grant      | 14.900.000 |            |           |            |           |            |           |            |
| MSCA Postdoctoral Fellowships |            | 1.600.000  | 1.600.000 | 1.600.000  | 1.600.000 | 1.600.000  | 1.600.000 | 1.600.000  |
| Frontiers of Knowledge Awards | 2.980.000  |            |           |            |           |            |           |            |
| Rockwool                      |            | 6.500.000  |           |            | 7.000.000 |            |           | 7.000.000  |

### Teaching goals and strategies

CPop DEM is and will remain an active partner in the European collaboration to educate the next generation of demographers in the European Doctoral School of Demography. We teach in this program, we sponsor up to a handful of students (a total of 20 doctoral students are yearly admitted to the 10-months programme out of 100 applicants), and we recruit almost all our Ph.D. students from this program.

We have taught in Master's programmes in both Health and Social Sciences and offered an SDU talent programme on radically rethinking ageing societies.

However, we need to teach more. Our young staff must gain teaching experience to progress in their careers and they long for teaching opportunities. We need demography teaching at master's level in social science and policy programmes to educate future Danish officials at all levels of the Danish administration, so decision makers are prepared to know, understand and handle the demographic challenges of the future, which fundamentally drive any society. All other Nordic countries and all influential European countries have a demography programme and/or a demography centre. We need to get Demography back on the Danish knowledge map, as it once was 30 years ago. Last not least, we need to earn revenues from a Master's programme.



### Master's programme in Population Studies

We have started the process for accreditation and establishment of a new two-year Master's programme in Population Studies at SDU. We plan on admitting students in September 2023; 20 students the first year, then 30, and from 2025 40 students each year. In 2025 we shall add a Professional Master's programme. And in the Summer 2022, we shall start a Summer School.

### Research outreach and Societal Value

Reaching out and giving societal value has been a goal since CPop's establishment in 2018. This includes providing popular summaries of our research to the social and press media in Europe and Denmark. Research outreach is also an important element of many external grants of CPop DEM.

However, reaching out and creation of societal value is much more than the press and social media.

As the Dream Group for the government in economic planning<sup>2</sup>, or Pension Research Centre (PeRCent)<sup>3</sup> at the Copenhagen Business School for the Danish pension funds and insurance companies on social investments, our vision is to eventually obtain a similar role in the area of demography and population studies, acquiring funding for it and other credit from provision of societal value. We are working on a strategy to fulfill this vision.

### Staffing and Governance

CPop DEM has survived the difficult threshold of reaching a critical mass of scholars and our support team of three (chief administrative officer, data manager and centre secretary), and currently four (administrative assistant on teaching programs), is very good and efficient in supporting CPop, CPop DEM administration and external projects.

We have two professors, a director and three associate professors. We have five and a half assistant professors, with José Manuel Aburto on a part time leave to Oxford University. We have two postdocs, and three PhD students, and three pre-doctoral research assistants planning their PhD projects. We expect to hire additional PhD students in 2022.

We multiply our resources by extensive collaboration with colleagues within CPop but also at many other universities.

We have a clear governance with a director who refers directly to the Dean of the Faculty of Business and Social Sciences and who chairs the Academic Coordinating Committee of CPop with the leader of each of the five units other than CPop DEM.

Our strategy above lays out our ambitious yet realistic plans for achieving external funding. Still there always remains uncertainty. We plan to set up a teaching programme in 2023 that, if successful, will generate revenues from 2025. We have some savings. Yet, without support from Frirumspulje from 2022 onwards, the delay in earnings from teaching and the natural uncertainty in our plans, we need additional financial support from the faculties involved with CPop over the coming years to evolve into a sustainable self-standing Danish Centre for Population Research of CPop SDU. We count with covering the transitional phase to sustainability by contributions from the three faculties (SAM, HEALTH, NAT) each contributing two million kr. over two years and one and half million kr. over three years.

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<sup>2</sup> Danish Research Institute for Economic Analysis and Modelling (see more information on the centre [here](#)).

<sup>3</sup> Pension Research Centre (PeRCent) (see more information on the centre [here](#)).



## CPop HUM

Our plan and vision is to participate in the centre and join larger interdisciplinary ventures to the extent that other centre members find it meaningful. The HUM unit will continue to focus on research into the arts of ageing. Emphasis is on literature, art, film, media and other creative, cultural phenomena subject to interpretation. These are studied in relation to topics connected to the consequences and characteristics of new forms of life, identity formation and lifestyles associated with longer, healthier lives. This is crucial for understanding how individuals perceive themselves as they age, are perceived by and relate to others and how this may affect society and the welfare state. This research emphasizes both the uniquely felt experience of ageing and how individuals interpret and account for this experience of participating in a specific generation and the ways in which more and more individuals age in creative, even artistic ways.

CPop HUM intends to focus on research that fosters collaborative work across scientific and research disciplines through participation in CPop workshops, seminars, and networking.

### Staffing

The CPop affiliation of Peter Simonsen, the Head of CPop HUM unit and member Anita Wohlmann will no longer be co-financed by the Faculty of Humanities beyond 2021. Post doc Ella Fegitz support through CPop Frirumspulje fund extends to September 2023 due to the delayed onset of consumption of the funds.

### Research projects

Peter Simonsen intends to work on getting external funding for his project “Reading Retirement”. Retirement is complexly motivated, follows many patterns and paces, yet tends to be rigidly conceptualized, by the public and at the political level, as involving full retirement from work to post work at a fixed age and issues related to health and wealth: how to finance the life and health of an unproductive citizen, and for how long? In these highly pertinent discussions and their related health-economic, social scientific and demographic research traditions, rarely do we hear about: the meaning of retirement and how it feels to retire for the individual? But what is the cultural significance of retirement and what role does culture play in retirement? I plan to investigate these answers through an analysis of a large archive of contemporary literary representations of retirement.

Ella Fegitz will work on her book project: ‘Women and the push and pull of work in old age: femininity and the entrepreneurial self’. The aim of the project is to contribute to theoretical debates and empirical research in the fields of feminist cultural studies and cultural gerontology. The project concerns a shift in the cultural construction of ageing femininity away from stereotypical representations of the ageing woman as vulnerable and dependent, and towards a normalization of ‘active ageing’ in the shape of work in old age. Employing textual analysis as key research method, the project provides an interdisciplinary examination of the construction of ageing femininity in relation to work and retirement in policy discourses and media representations in the UK.



## CPop HEALTH

The CPop Health Unit focuses on causes and consequences of the decreasing fertility and the increasing longevity and the direct or indirect factors influencing both demographic measures.

### Future research

Research on population dynamics, including research on the dynamics of health and influence on fertility and survival using survey and registry data; research on development and ageing; Research on inequality in ageing and health; successful ageing.

### *Main research topics for 2021-2025*

- Understanding the reproduction paradigm of humankind in the Anthropocene
- Fecundity as a biomarker for health and survival
- Healthy life expectancy and successful ageing
- Sex differences in mental health and effects on survival

### Staff

Professor Rune Lindahl-Jacobsen

Associate professor Linda Juel Ahrenfeldt

Associate professor Maarten Wensink

PhD student Camilla Riis Nielsen

### Funding

CPOP-HUB is co-funded by Faculty of Health Sciences – funding will expire in February 2022. We will apply for additional funding for the mentioned projects including the following funds: Novo Nordisk Foundation (mental health research), Lundbeck foundation (mental health research) and Rockwool foundation (Fertility decline).



## CPop SAM

The CPop Business and Social Sciences unit (CPop SAM) focuses on research on consequences of ageing and longevity for public health and on the interplay between demographics, economics, politics and policies.

### Research

Research on population dynamics, including research on the dynamics of health and survival using, e.g., SHARE data; research on the historical and ongoing patterns behind the health and wealth of individuals and nations in order to identify deep determinants of the most vital aspects of populations dynamics; and research on the interplay between demographics, politics and policy which aims to evaluate and develop policy solutions to demographic change, and to understand how relevant societal actors react to it.

Main research topics for 2021-2025

- Intergenerational justice and transfers
- Public health and population dynamics
- Family policy and family transformations
- Qualitative approaches to ageing and agism

### Staff

Professor Paul Sharp

Professor Pieter Vanhuysse

Professor Klaus Petersen

Part-time Professor Robert Gal (until 2022)

Associate Professor Mircea Trandafir

Assistant Professor Nina Boberg-Fazlic (co-financed by Peter Sandholt Jensen's DFF grant, until 2024)

Assistant Professor Volha Lazuka (until ??)

Assistant Professor Seetha Menon (until ??)

PostDoc Stine Jensen (co-financed with DARC III, Department of Public Health) (until 2022)

PostDoc Anne Hagen Berg (until 2022)

PostDoc Isabella Trifan (until 2021)

Research Assistant Frederik Pfeiffer (until 2021)

### Funding

CPop SAM is co-funded by Faculty of Business and Social Sciences – funding will expire in 2023. Senior researchers are financed by respective departments. External grants will be applied for.



## CPOP NAT

Researchers at CPOP NAT focus on developing and using demographic and population dynamics methods to address topics in evolutionary biodemography, applied biodemography, and life history evolution.

### Research

Among our ongoing and future projects, we will keep working on testing evolutionary theories of senescence and sex differences among tetrapods. Our work on these topics has resulted in several manuscripts published in high impact factor journals such as Nature, PNAS, Nature Communications, Ecology Letters, among others. We are uniquely positioned to further this goal, by having access to some of the most important and extensive databases for comparative analysis (ZIMS, COMADRE, COMPADRE). In addition, we are extending these methods to plants by establishing collaborations with international botanical gardens combined with citizen science projects to digitize historical botanical garden records. Furthermore, we will continue our work on conservation of endangered species and species management, which includes work on international trade of endangered species, the effect of international legal and illegal wildlife trade on the probability of zoonotic disease outbreaks, and the effects of climate and other environmental change on population dynamics. Finally, we will continue to develop state of the art statistical and mathematical models for demography and population dynamics, by extending the tools we have developed to modelling age-specific fertility and population dynamics in stochastic environments.

### Funding

The four CPOP NAT professors are supported by faculty funds and Species360. PhDs and postdocs are supported by various means including Species360 and individual project grants.

In the next few years, we aim to obtain additional grant funding to support our work and maintain or grow the size of our unit. To do this we will apply to sources such as the Independent Research Fund Denmark (Frie Forskningsfond), the European Research Council (e.g. Marie Curie Fellowships, European Cooperation in Science and Technology), and private foundations such as Villum and Novo Nordisk. Typically, these grant instruments will support 1-2 postdocs or PhD students for 3-5 years. Each professor will aim to submit at least one application per year.

We will also continue to attract excellent candidates to the CPOP NAT team by supporting applications to junior fellowships such as the Marie Skłodowska-Curie Fellowships.



# Appendix







## Appendix 1: CPop Founding Document

Version from February 2018

### **CPOP**

#### *The SDU Center on Population Dynamics*

##### RESUMÉ:

*What are the causes and consequences of the unprecedented demographic changes faced by Denmark and almost all other advanced societies in the world due to ageing populations? This will be the driving research question of the proposed Center on Population Dynamics (CPOP).*

*The current MaxO Center was evaluated in 2017 as the world's top research program on the biological and biomedical demography of ageing. Building on this foundation, CPOP will expand into a truly multidisciplinary initiative with substantive participation of four SDU faculties and a multi-faceted research agenda that address the societal and human consequences of the rapidly on-coming demographic changes. This will enable:*

- *Influential, innovative research on the dynamics of ageing populations and the causes, characteristics and consequences of longer, healthier lives.*
- *Trailblazing, cross-disciplinary educational and outreach activities that demonstrate the relevance and value of SDU to society.*

*Societal impact and application of research results will be a core mission of CPOP alongside with research at the highest international level, recruitment of world-class researchers and interdisciplinary education programs. The clear ambition is that the focus on societal impact and interdisciplinary research will be at a level hitherto unseen in Denmark.*

*CPOP will be headed by one of the most influential pioneers in demographic research, Professor James Vaupel. He will lead a center that includes scholars from four faculties of SDU and has at its core formalized cooperation with 3-5 Max Planck Institutes.*



## PROJECT DESCRIPTION

### Contribution (Den forventede værdiskabelse ved projektet)

*The consequences of aging are of utmost importance to society. Understanding of and capability to address the challenges posed by longer, healthier lives require insightful, cross-disciplinary research. CPOP will therefore build on the success of MaxO and expand from the current MaxO into a unique four-faculty virtual institute with scholars from four faculties of SDU as well as formalized cooperation with 3-5 Max Planck Institutes.*

*Specifically, the **goals** of CPOP are:*

- 1. To publish ground-breaking, interdisciplinary research in widely read journals with extensive press coverage, leading to widespread citations, international awards and prestigious external grants.*
- 2. To create unique interdisciplinary educational activities that will develop the talent of our students and educate them about the causes and consequences of longer, healthier lives.*
- 3. To create direct value for society by becoming a paradigm of how university programs can reach out to the public with applied and relevant research on, e.g., forecasting population dynamics, thereby shaping the future of our society.*
- 4. To look beyond our borders and strengthen SDU's internationalization efforts by establishing close and formal partnerships with 3-5 Max Planck Institutes.*

### Activities (De bærende og overordnede forskningsaktiviteter i projektet)

*The activities envisioned to achieve the four goals above will be outlined in the following.*

#### Goal 1: Excellent Interdisciplinary Research

*It is a clear ambition that the research undertaken in CPOP should result in interdisciplinary research that:*

- is published in the very best multi-disciplinary journals (e.g., Nature, Science and PNAS) and university presses*
- results in numerous citations and widespread academic and societal impact*
- leads to international recognition in the form of awards and prizes*
- results in prestigious external grants, including CoEs and ERC grants*

*In order to fulfill these goals, interdisciplinary research initiatives focusing on the causes and consequences of longer, healthier lives will be developed by building on the following **research areas in four of the Faculties of SDU:***

**SUN:** *Research on the causes and consequences of longer, healthier lives based on large-scale, longitudinal, population-based studies and resources such as The Danish Twin Register, The 1895, 1905, and 1915-Cohort Studies, The Long-Life Family Study and SHARE (Survey of Health, Aging and Retirement in Europe). Human health and mortality trajectories are studied through multidisciplinary research combining methods from epidemiology, demography, public health, clinical medicine, genetics, statistics and bioinformatics. The*



research has a focus on male-female health-survival differences, the influence of familial factors, and on health and survival among nonagenarians and centenarians.

**NAT:** Research on the demography of animals and plants with particular focus on life history and evolutionary patterns of ageing, how the environment (including climate) drives population dynamics, and on species conservation. Development of statistical demographical models that allow novel data analysis: Mathematical modeling (stochastic analysis, probability theory and numerical analysis of differential equations), big data analytics (data mining and clustering analysis), and applied statistics (extreme value statistics, Bayesian inference, computational statistics and missing value analysis).

**SAM:** Research on population dynamics, including research on the dynamics of health and survival using, e.g., SHARE data; research on the historical and ongoing patterns behind the health and wealth of individuals and nations in order to identify deep determinants of the most vital aspects of populations dynamics; and research on the interplay between demographics, politics and policy which aims to evaluate and develop policy solutions to demographic change, and to understand how relevant societal actors react to it.

**HUM:** Research in the new cultures of ageing in literary as well as in media and communication studies on a number of topics related to the consequences and characteristics of new forms of life, identity formation and lifestyles associated with longer, healthier lives. This is crucial for understanding how individuals perceive themselves as they age, are perceived by and relate to others and how this may affect society and the welfare state. This research emphasizes the uniquely felt experience of ageing and how individuals interpret and account for this experience of participating in a specific generation.

To achieve the goals laid out above, CPOP will propose and develop **several interdisciplinary research initiatives** based on the above research strengths. Four specific initiatives are proposed below. These all involve at least two faculties and research collaboration with one or more Max Planck Institutes.

**Initiative 1:** Further develop the highly successful MaxO research on the evolutionary demography of aging, with a focus on analyses of the distribution of lifespans for humans and across other species and with increased emphasis on conservation demography of endangered species. This research would be led by researchers in NAT working with researchers in SUN and SAM and in close collaboration with the Max Planck Institute for Evolutionary Biology in Plön.

**Initiative 2:** Launch a program of research on the causes, consequences and dynamics of health, treatment, well-being and survival at ages above 90, with emphasis on centenarians. Continued progress in increasing life expectancy and improving health will increasingly depend on trends after age 90 and in the longer run after age 100. Hence it is crucial to study the health, treatment, well-being and survival of the rapidly growing numbers of those 90+. This can be done in Denmark better than in any other country because of the extensive and highly accurate data available. This research would be led by researchers in SUN collaborating with researchers in NAT, SAM and HUM and with the Max Planck Institute of Research in Rostock and perhaps the Max Planck Institute for Biology of Ageing in Cologne.

**Initiative 3:** Expand research using data from SHARE and other sources, including cultural artifacts, on the dynamics of health at ages 50-90. This initiative could be led by researchers in SAM working closely with researchers from the Max Planck Institute for Social Law and Social Policy in Munich. Researchers from SUN and HUM would also be involved as well as researchers at the Max Planck Institute for Demographic Research in Rostock. Some of this research would further develop productive current research on male-female differences in health and survival.



***Initiative 4:*** Launch applied research that both focuses on forecasting the dynamics of population aging in Denmark and the likely social and cultural consequences and policy implications and critically engages public discourse on these questions. MaxO has developed considerable strength in developing more powerful methods of forecasting life expectancy and other aspects of population change. We propose expansion and development of this research to include applied research focused on Denmark—and with possible application to other countries as well. Current population forecasts for Denmark are based on weak, outdated methods, and greater attention should be given to the policy implications of the changing structure of the Danish population. This initiative would involve research from all four faculties as well as researchers from the Max Planck Institute for Demographic Research in Rostock.

*Note: Although HUM would not take the lead on any of these initiatives, HUM would play a major role in the research of Initiatives 2, 3 and 4.*

## Goal 2: Innovative and Interdisciplinary Education Programs

*An important goal of CPOP 2 is to develop unique, innovative, interdisciplinary educational activities to educate students about the causes and consequences of longer, healthier lives and other topics related to population dynamics, including population forecasting and understanding of the consequences and policy implications of population change. This goal will be achieved through a number of different educational activities including:*

- *New cross-disciplinary elements, courses and profiles that will be developed in existing programs of study for bachelor's and master's students who are interested in getting a broad perspective on the dynamics of population aging and the social, economic and health consequences and policy implications.*
- *Continuation and further development of the current SDU talent program in aging (scheduled to start in 2018).*
- *Continued contribution to EDSD (the European Doctoral School of Demography).*
- *A new joint 3+5 Ph.D. program for students who wish to study a discipline in a Faculty and have supplementary cross-disciplinary education and Ph.D. research on the dynamics of population aging. Students will be enrolled in and follow a Ph.D. program in their own Faculty but will participate in joint cross-disciplinary activities. Enrolling students right after their bachelor programs will allow us to attract the best talents worldwide at an early stage and at the same time give them sufficient time to participate in cross-disciplinary activities throughout their Ph.D. program.*
- *A new two-year post.doc program that will enable students from different disciplines to get a broader understanding of the dynamics of population aging and the social, economic and health consequences and policy implications.*

## Goal 3: Diversified and Impactful Outreach

*CPOP aspires to create significant value for society and become a new paradigm of how university programs can reach out to the public by engaging in new ways with society and stakeholders in solving problems related to aging.*



*This requires close and continued interaction with relevant stakeholders (including policy makers and policy analysts, leaders of non-governmental organizations, journalists and students) at many different levels and in many different forms to communicate findings and to receive feedback.*

*The diverse portfolio of **outreach activities** will include:*

- Applied research on forecasting population dynamics of longer, healthier lives that can be used to provide better information on trends and implications in Denmark and to develop models of forecasting and policy analysis that can be applied in other countries as well. The impact of population change is so great for Danish society—and for the Danish government, pension organizations, insurance firms, financial institutions, and businesses more specifically—that use of more powerful methods of forecasting would be highly beneficial. Furthermore, state-of-the-art forecast for Denmark will be published in an annual report and presented at recurring event for, e.g., policymakers, media and pension funds.*
- Policy analyses of the social, economic and health consequences and policy implications of changing population dynamics in Denmark, e.g., the implications for age at retirement or for redistributing work. Analyses and recommendations will be published in an annual report and presented at recurring event for policymakers, media and relevant stakeholders.*
- Events and workshops for policymakers, sponsors and other relevant stakeholders on specialized topics of interest. CPOP will take advantage of its membership in Population Europe (population-europe.eu), of which Vaupel is Chair of the Board of Trustees, to reach out to a broader European audience.*
- Extensive media presence.*
- Development of relevant professional education programs for a Danish and an international audience. CPOP will thus aspire to become the world's preeminent place for professional education in population dynamics.*

*Outreach activities will be coordinated and supported by a professional Impact Unit devoted to ensure a close and innovative dialogue with stakeholders. The members of the Impact Unit will all have a research background within the relevant research areas in order to be able to support the research environments in the above-mentioned outreach activities.*

#### **Goal 4: World-Class International Partnerships**

*To strengthen SDU's internationalization efforts, CPOP will establish close and formal partnerships with 3-5 of the following Max Planck Institutes as described under the initiatives above:*

- Max Planck Institute for Demographic Research, Rostock*
- Max Planck Institute for Social Law and Social Policy, Munich*
- Max Planck Institute for Evolutionary Biology, Plön*
- Max Planck Institute on Biology of Ageing, Cologne.*
- Max Planck Institute for the Science of Human History, Jena*



MaxO already has ties to the Institutes in Rostock, Munich and Plön, which can be strengthened, while ties with the Institutes in Cologne and Jena will have to be explored.

### Organization and governance (Organiseringen og samarbejdet om projektet)

CPOP is envisioned as a four-faculty virtual institute. The involved researchers will all be employed at the respective Faculties and thus refer to their respective Deans and Heads of Department, but they will also be affiliated with (or have joint appointments in) CPOP.

In the existing MaxO, the full-time core staff currently consists of two professors, eight associate professors, and twenty assistant professors, post-docs, PhD students and research associates, half in SUN and half in NAT. In CPOP additional research units will be formed in SAM and HUM to supplement the existing ones in NAT and SUN. The aggregate of the units in the four faculties together with the Kernel Unit (see below) will form a virtual four-faculty institute.

In CPOP a distinction will be made between: (1) researchers and other staff paid 100 percent by CPOP and (2) researchers who are not paid by CPOP (or only paid temporarily in connection with specific projects), but who would like to collaborate, part-time, with CPOP. The latter could be called "CPOP affiliated researchers", while people in category (1) could be referred to as "CPOP core researchers or staff".

CPOP will be headed by a director, initially James Vaupel, and two or three deputy directors. To coordinate the many research, applied research, teaching and outreach activities of the virtual four-faculty institute, to ensure productive collaboration with the Max Planck Institutes in Germany, and to ensure efficient administration of CPOP, the establishment of a coordinating "kernel unit" of population dynamics is proposed. The **Kernel Unit** would include the director, the deputy directors, some of the current core researchers of MaxO from SUN and NAT, as well as the Impact Unit and the administration of CPOP.

How to embed the Kernel Unit in the structure of SDU has to be worked out. One possibility—among other options—is to administratively place it in one of the Faculties. Alternatively, it could be an autonomous unit referring directly to the Executive Board. In any case, there should be a clear understanding that it serves all four faculties, with each faculty getting about 25% of the effort of the kernel.

To support and coordinate the portfolio of outreach activities, a professional **Impact Unit** will be formed as mentioned above. This Unit will endeavor to ensure a close and innovative dialogue with stakeholders and will be headed by one of the deputy directors in CPOP. The Impact Unit will be placed in the kernel unit and like the rest of the kernel unit will work for the entire CPOP to support activities across all four faculties.

A **Scientific Committee** will be established consisting of the director, the deputy directors, and a full or associate professor from each Faculty appointed by the Deans. The Scientific Committee will be responsible for discussing research directions and issues, launching research initiatives and overseeing and following up on the performance of the activities in the four Faculties. Specifically, we envision that a "contract" between each Faculty and the Scientific Committee of CPOP will be formulated initially, stipulating expected results and deliverables, as well as resources from CPOP for, e.g., core positions, PhDs and operating costs (including administration). The Scientific Committee will also be responsible for identifying and suggesting relevant candidates for core positions in CPOP.



*An **Advisory Board** of Max Planck Directors will also be formed, consisting of the directors of the collaborating Max Planck Institutes as well as the director of CPOP. The Board of Directors will review collaboration between CPOP and the partner Max Planck Institutes. To ensure excellence of personnel, core members of CPOP have to be recommended by both the Scientific Committee and the Board of Max Planck Directors, with, however, final decision-making authority remaining with the Deans and Rektor. The Advisory Board will also be responsible for the recurrent evaluations of CPOP.*

### Milestones (Vigtigste milepæle i projektet)

*Below, some tentative milestones are presented. A more detailed plan for milestones will, however, have to await the establishment of the Scientific Committee:*

#### 2018:

- *Official opening of the new CPOP on April 1<sup>st</sup>*
- *Deputy directors appointed and administrative set-up established*
- *Kernel including Impact Unit established*
- *Collaborations with Max Planck Institutes formalized*
- *Research initiatives launched*
- *Educational activities launched*
- *Three major articles, one from each of initiatives 1-3, submitted to major journals*
- *First forecasting report on Danish population dynamics (initiative 4) published*
- *First sponsorships and external funding secured*

#### 2019:

- *3+5 PhD School launched*
- *Three major articles, one from each of initiatives 1-3, submitted to major journals*
- *For initiative 4, first policy report and second forecasting report published*
- *Additional sponsorships and external funding secured including first major external grant (CoE, ERC, Villum Investigator, large foundation)*

#### 2020:

- *Three major articles, one from each of initiatives 1-3, submitted to major journals*
- *For initiative 4, second policy report and third forecasting report published*
- *Additional sponsorships and external funding secured including a major external grant (CoE, ERC, large foundation) secured*

#### 2021:

- *Three major articles, one from each of initiatives 1-3, submitted to major journals*
- *For initiative 4, third policy report and fourth forecasting report published*
- *Additional sponsorships and external funding secured including a major external grant (CoE, ERC, large foundation)*
- *External evaluation of CPOP*
- *Future of CPOP decided*

### Risk analysis (Risikoanalyse af projektet)

#### Collaboration with Max Planck Institutes and Approval by the Max Planck Society

*In August 2017, it was decided by the President of the Max Planck Society that MaxO – despite an excellent evaluation in 2017 – will not continue as a formal Max Planck Centre with financial support from the Max Planck Society. However, other means of cooperation were alluded to in the letter from the President. The current endeavor will therefore aim at: a) setting up formalized collaborations with 3-5 Max Planck Institutes in Germany; and perhaps b) obtaining an official approval by the Max Planck Society of this collaboration allowing us also to use the name “Max Planck” in the future.*



*While a) certainly seems feasible, we currently do not know which type of approval can be hoped for from the Max Planck Society under b). The intention is to enroll the 3-5 Max Planck Directors in a Max Planck Board of Directors for CPOP which will be responsible for the recurrent evaluations of CPOP that shall ensure that we live up to the very high standards of a Max Planck Institute. It is our hope and expectation that this set-up will also earn us an official approval from the Max Planck Society.*

#### Full Commitment of all Four Faculties

*A unique feature of this initiative is that it aspires to involve and integrate research environments from four faculties at SDU. The involvement of all four faculties will ensure that CPOP can carry out its vision of truly interdisciplinary research, education and outreach activities, and it will also distinguish this initiative from other interdisciplinary centers.*

*Integrating research environments from all four faculties so that truly interdisciplinary activities can be developed while CPOP can still maintain its focus might be a challenge. To ensure the unique four-faculty nature of CPOP, it is therefore important that all four faculties are fully committed to the initiative, that considerable efforts are spent identifying and developing research areas and initiatives in all four faculties, and that cooperation across faculties is constantly nurtured and facilitated.*

#### Sponsorships and funding

*It is an outspoken ambition that a substantial share of the funding for CPOP will be raised through external sources, in particular sponsorships from private firms or funds. Fundraising will take place as (a) an early endeavor where start-up funding is sought by direct contact to pension funds and large Danish private foundations, (b) a continuous activity for funding for the spin-off research and outreach activities of Goals 1-4 and Initiatives 1-4, and (c) high-profile, strategically timed funding of spin-off activities such as for acquiring Center of Excellence and ERC grants.*

*There is, of course, a risk that external sponsorships cannot be raised to the extent envisioned in which case, a larger share of the funding will have to be found through other sources (internal or external), or the scale of CPOP has to be reduced.*

#### Internal Balance of the Participating Units

*Participating in an interdisciplinary initiative as CPOP will expose participating researchers to a double pressure. They must devote substantial time and resources to participate in CPOP, which comes with the risk that these units will become less integrated in (or even detached from) their host environments in the Faculties.*

*To avoid this, it must be ensured that participating units have the required resources to participate, and that they are supported in this endeavor by their respective Department Heads and Deans.*

#### The long run: After 2021 (Forankringsplan)

*The clear ambition of CPOP is to continue after 2021 as a permanent SDU four-faculty virtual institute and to develop close and long-term ties to the Max Planck Society. It is therefore expected that the organizational set-up of CPOP is maintained after 2021. The faculties also agree to commit base funding in the amount of (at least) DKK 13.5 million/year after 2021, with 4 million/year from NAT, SUN and SAM, and 1.5 million/year from HUM and hopefully also TEK.*



We expect that this will enable us to raise external funding in the amount of 18.4 million/year, which will result in a total annual budget of approx. 32 million/year. See Table 1 below and Appendix A. This excludes any spin-off funding for related activities, which we assume will reach an amount of 10-15 million per year.

#### Appendix table 1:

##### Annual expenditures on core activities (from 2022 and onwards)

Numbers in DKK million.

|                 | VIP   | PhD/postdocs | TAP | Operating expenses | Total |
|-----------------|-------|--------------|-----|--------------------|-------|
|                 |       |              |     |                    |       |
| NAT             | 2.1   | 1.5          | 0.2 | 1.2                | 5     |
| SUN             | 2.1   | 1.5          | 0.2 | 1.2                | 5     |
| SAM             | 2.1   | 1.5          | 0.2 | 1.2                | 5     |
| HUM             | 1.05  | 0.75         | 0.1 | 0.6                | 2.5   |
|                 |       |              |     |                    |       |
| Kernel Research | 5     | 2            | 0.8 | 2.2                | 10    |
| Kernel Impact   |       |              | 3   | 1.4                | 4.4   |
|                 |       |              |     |                    |       |
| Total           | 12.35 | 7.25         | 4.5 | 7.8                | 31.9  |

#### Notes to Table 1:

- The Faculty Units in NAT, SUN and SAM are (on average) expected to contain 3 core VIP (each DKK 700,000 per year), 3 post.docs or PhDs (each DKK 500,000 per year), 0.5 secretary (each DKK 400,000 per year), and operating expenses in the amount of DKK 200,000 per VIP, post.doc and PhD. The faculty unit in HUM is projected to contain half of this.
- The Kernel Unit (including the impact unit) will include 7 core VIP, 4 post-docs/PhDs, 5 highly specialized TAPs (each at DKK 600,000 per year) typically with a PhD in a relevant field, one secretary, and operating expenses in the amount of DKK 200,000 per VIP, post.doc and PhD, and DKK 1.4 million for the TAPs and outreach including data access.

It is expected that 10 million of the annual external funding can be secured as a sort of “base funding” from external parties, e.g. from the pension/financial sector in return for the applied research and other services delivered by CPOP. That leaves 8.4 million/year to be secured through more traditional research grants.

Part of the base funding from the faculties will go to support the joint kernel, and part will go to support the faculty units. In Appendix A it is assumed that 6 million goes into the kernel and 7.5 million goes into the faculty units.

#### Getting there: 2018-2021 (Budget)

Activities in CPOP will have to be built up gradually. Thus, in 2018 and 2019, we expect activities in the amount of DKK 18.5 and 25 million/year, reaching the full long-run budget of approx. DKK 32 million/year in 2020.

Furthermore, external funding for CPOP will have to be gradually secured. We thus expect that an increasing share of the long run budget will be covered by external sponsorships and grants (cf. the



fundraising strategy outlined above) such that by 2022 up to DKK 18.4 million of the annual budget will be financed by external sources.

With expected co-funding from the faculties at DKK 8.5 million/year in the period 2018-2021 (2.5 million per year from NAT, SUN and SAM, and 1 million per year from HUM), totaling DKK 34 million for the period 2018-2021, this leaves DKK 40 million to be financed by the SDU's "frirumspulje" in the period 2018-2021. See Appendix A for details.

In Appendix A, the budget for the period 2018-2021 is broken down by faculties, Kernel Research and Kernel Impact. All the co-funding from the faculties have been put under the respective faculties, where a negative amount under "frirumspulje" signals that part of the co-funding will go to support the Kernel.

## Appendix A: Budget for CPOP

Appendix A:

Projekt:

MaxO

| SDU niveau                | 2018<br>t.kr. | 2019<br>t.kr. | 2020<br>t.kr. | 2021<br>t.kr. | Total<br>t.kr. |
|---------------------------|---------------|---------------|---------------|---------------|----------------|
| <b>Indtægter</b>          |               |               |               |               |                |
| Søges fra "Frirums pulje" | 10.000        | 10.000        | 10.000        | 10.000        | 40.000         |
| Medfinansiering           | 8.500         | 8.500         | 8.500         | 8.500         | 34.000         |
| Eksterne midler           | -             | 6.500         | 13.400        | 14.400        | 34.300         |
| <b>Indtægter i alt</b>    | <b>18.500</b> | <b>25.000</b> | <b>31.900</b> | <b>32.900</b> | <b>108.300</b> |
|                           |               |               |               |               | -              |
| <b>Omkostninger</b>       |               |               |               |               | -              |
| Løn                       | 14.500        | 19.000        | 24.300        | 24.800        | 82.600         |
| Drift                     | 4.000         | 6.000         | 7.600         | 8.100         | 25.700         |
| Investeringer             | -             | -             | -             | -             | -              |
| <b>Omkostninger i alt</b> | <b>18.500</b> | <b>25.000</b> | <b>31.900</b> | <b>32.900</b> | <b>108.300</b> |
|                           |               |               |               |               | -              |
| <b>Balance</b>            | -             | -             | -             | -             | -              |

**SUND**

2018 2019 2020 2021 Total



|                           | t.kr.        | t.kr.        | t.kr.        | t.kr.        | t.kr.         |
|---------------------------|--------------|--------------|--------------|--------------|---------------|
| <b>Indtægter</b>          |              |              |              |              |               |
| Søges fra "Frirums pulje" | 500          | 500          | 500          | 500          | 2.000         |
| Medfinansiering           | 2.500        | 2.500        | 2.500        | 2.500        | 10.000        |
| Eksterne midler           |              | 1.000        | 2.000        | 2.000        | 5.000         |
| <b>Indtægter i alt</b>    | <b>3.000</b> | <b>4.000</b> | <b>5.000</b> | <b>5.000</b> | <b>17.000</b> |
|                           |              |              |              |              | -             |
| <b>Omkostninger</b>       |              |              |              |              | -             |
| Løn                       | 2.500        | 3.000        | 3.800        | 3.800        | 13.100        |
| Drift                     | 500          | 1.000        | 1.200        | 1.200        | 3.900         |
| Investeringer             |              |              |              |              | -             |
| <b>Omkostninger i alt</b> | <b>3.000</b> | <b>4.000</b> | <b>5.000</b> | <b>5.000</b> | <b>17.000</b> |
|                           |              |              |              |              | -             |
| <b>Balance</b>            | -            | -            | -            | -            | -             |

| <b>NAT</b>                | <b>2018</b>  | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>Total</b>  |
|---------------------------|--------------|--------------|--------------|--------------|---------------|
|                           | t.kr.        | t.kr.        | t.kr.        | t.kr.        | t.kr.         |
| <b>Indtægter</b>          |              |              |              |              |               |
| Søges fra "Frirums pulje" | 500          | 500          | 500          | 500          | 2.000         |
| Medfinansiering           | 2.500        | 2.500        | 2.500        | 2.500        | 10.000        |
| Eksterne midler           |              | 1.000        | 2.000        | 2.000        | 5.000         |
| <b>Indtægter i alt</b>    | <b>3.000</b> | <b>4.000</b> | <b>5.000</b> | <b>5.000</b> | <b>17.000</b> |
|                           |              |              |              |              | -             |
| <b>Omkostninger</b>       |              |              |              |              | -             |
| Løn                       | 2.500        | 3.000        | 3.800        | 3.800        | 13.100        |
| Drift                     | 500          | 1.000        | 1.200        | 1.200        | 3.900         |



|                           |              |              |              |              |               |
|---------------------------|--------------|--------------|--------------|--------------|---------------|
| Investeringer             |              |              |              |              | -             |
| <b>Omkostninger i alt</b> | <b>3.000</b> | <b>4.000</b> | <b>5.000</b> | <b>5.000</b> | <b>17.000</b> |
|                           |              |              |              |              | -             |
| <b>Balance</b>            | -            | -            | -            | -            | -             |

| <b>SAMF</b>               | <b>2018<br/>t.kr.</b> | <b>2019<br/>t.kr.</b> | <b>2020<br/>t.kr.</b> | <b>2021<br/>t.kr.</b> | <b>Total<br/>t.kr.</b> |
|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <b>Indtægter</b>          |                       |                       |                       |                       |                        |
| Søges fra "Frirums pulje" | 500                   | 500                   | 500                   | 500                   | 2.000                  |
| Medfinansiering           | 2.500                 | 2.500                 | 2.500                 | 2.500                 | 10.000                 |
| Eksterne midler           |                       | 1.000                 | 2.000                 | 2.000                 | 5.000                  |
| <b>Indtægter i alt</b>    | <b>3.000</b>          | <b>4.000</b>          | <b>5.000</b>          | <b>5.000</b>          | <b>17.000</b>          |
|                           |                       |                       |                       |                       | -                      |
| <b>Omkostninger</b>       |                       |                       |                       |                       | -                      |
| Løn                       | 2.500                 | 3.000                 | 3.800                 | 3.800                 | 13.100                 |
| Drift                     | 500                   | 1.000                 | 1.200                 | 1.200                 | 3.900                  |
| Investeringer             |                       |                       |                       |                       | -                      |
| <b>Omkostninger i alt</b> | <b>3.000</b>          | <b>4.000</b>          | <b>5.000</b>          | <b>5.000</b>          | <b>17.000</b>          |
|                           |                       |                       |                       |                       | -                      |
| <b>Balance</b>            | -                     | -                     | -                     | -                     | -                      |

| <b>HUM</b>                | <b>2018<br/>t.kr.</b> | <b>2019<br/>t.kr.</b> | <b>2020<br/>t.kr.</b> | <b>2021<br/>t.kr.</b> | <b>Total<br/>t.kr.</b> |
|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <b>Indtægter</b>          |                       |                       |                       |                       |                        |
| Søges fra "Frirums pulje" | 500                   | 500                   | 500                   | 500                   | 2.000                  |
| Medfinansiering           | 1.000                 | 1.000                 | 1.000                 | 1.000                 | 4.000                  |
| Eksterne midler           |                       | 500                   | 1.000                 | 1.000                 | 2.500                  |



|                           |              |              |              |              |              |
|---------------------------|--------------|--------------|--------------|--------------|--------------|
| <b>Indtægter I alt</b>    | <b>1.500</b> | <b>2.000</b> | <b>2.500</b> | <b>2.500</b> | <b>8.500</b> |
|                           |              |              |              |              | -            |
| <b>Omkostninger</b>       |              |              |              |              | -            |
| Løn                       | 1.000        | 1.500        | 1.900        | 1.900        | 6.300        |
| Drift                     | 500          | 500          | 600          | 600          | 2.200        |
| Investeringer             |              |              |              |              | -            |
| <b>Omkostninger i alt</b> | <b>1.500</b> | <b>2.000</b> | <b>2.500</b> | <b>2.500</b> | <b>8.500</b> |
|                           |              |              |              |              | -            |
| <b>Balance</b>            | -            | -            | -            | -            | -            |

| <b>CPOP Research</b>      | <b>2018<br/>t.kr.</b> | <b>2019<br/>t.kr.</b> | <b>2020<br/>t.kr.</b> | <b>2021<br/>t.kr.</b> | <b>Total<br/>t.kr.</b> |
|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <b>Indtægter</b>          |                       |                       |                       |                       |                        |
| Søges fra "Frirums pulje" | 6.500                 | 7.000                 | 8.000                 | 8.000                 | 29.500                 |
| Medfinansiering           |                       | -                     |                       |                       | -                      |
| Eksterne midler           | -                     | 1.000                 | 2.000                 | 3.000                 | 6.000                  |
| <b>Indtægter I alt</b>    | <b>6.500</b>          | <b>8.000</b>          | <b>10.000</b>         | <b>11.000</b>         | <b>35.500</b>          |
|                           |                       |                       |                       |                       | -                      |
| <b>Omkostninger</b>       |                       |                       |                       |                       | -                      |
| Løn                       | 5.000                 | 6.500                 | 8.000                 | 8.500                 | 28.000                 |
| Drift                     | 1.500                 | 1.500                 | 2.000                 | 2.500                 | 7.500                  |
| Investeringer             |                       |                       | -                     | -                     | -                      |
| <b>Omkostninger i alt</b> | <b>6.500</b>          | <b>8.000</b>          | <b>10.000</b>         | <b>11.000</b>         | <b>35.500</b>          |
|                           |                       |                       |                       |                       | -                      |
| <b>Balance</b>            | -                     | -                     | -                     | -                     | -                      |



| <b>CPOP Impact</b>        | <b>2018<br/>t.kr.</b> | <b>2019<br/>t.kr.</b> | <b>2020<br/>t.kr.</b> | <b>2021<br/>t.kr.</b> | <b>Total<br/>t.kr.</b> |
|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <b>Indtægter</b>          |                       |                       |                       |                       |                        |
| Søges fra "Frirums pulje" | 1.500                 | 1.000                 | -                     | -                     | 2.500                  |
| Medfinansiering           |                       | -                     |                       |                       | -                      |
| Eksterne midler           | -                     | 2.000                 | 4.400                 | 4.400                 | 10.800                 |
| <b>Indtægter i alt</b>    | <b>1.500</b>          | <b>3.000</b>          | <b>4.400</b>          | <b>4.400</b>          | <b>13.300</b>          |
|                           |                       |                       |                       |                       | -                      |
| <b>Omkostninger</b>       |                       |                       |                       |                       | -                      |
| Løn                       | 1.000                 | 2.000                 | 3.000                 | 3.000                 | 9.000                  |
| Drift                     | 500                   | 1.000                 | 1.400                 | 1.400                 | 4.300                  |
| Investeringer             |                       |                       | -                     | -                     | -                      |
| <b>Omkostninger i alt</b> | <b>1.500</b>          | <b>3.000</b>          | <b>4.400</b>          | <b>4.400</b>          | <b>13.300</b>          |
|                           |                       |                       |                       |                       | -                      |
| <b>Balance</b>            | -                     | -                     | -                     | -                     | -                      |



## CPOP

### *The SDU Interdisciplinary Center on Population Dynamics*

- Revision of the Strategic document from February 2018 -

#### RESUMÉ:

*What are the causes and consequences of the unprecedented demographic changes faced by Denmark and almost all other advanced societies in the world due to aging populations? This is the driving research question of the Interdisciplinary Center on Population Dynamics (CPOP), as a successor to the former MaxO Center.*

*The MaxO Center was evaluated in 2017 as the world's top research program on the biological and biomedical demography of aging, reaching across two faculties. Building on this foundation, CPOP has expanded into a truly multidisciplinary initiative with substantive participation of four SDU faculties and a multi-faceted research agenda that address the societal, human and non-human consequences of the rapidly on-coming demographic changes. This will enable:*

- *Influential, innovative research on the dynamics of aging populations and the causes, characteristics and consequences of longer, healthier lives.*
- *Trailblazing, cross-disciplinary educational and outreach activities that demonstrate the relevance and value of SDU to society.*

*Research at **a high international level**, recruitment of world-class researchers and interdisciplinary education programs alongside with societal impact and application of research results are the core mission of CPOP.*



## PROJECT DESCRIPTION

### Contribution (Den forventede værdiskabelse ved projektet)

*The consequences of aging are of utmost importance to society. Understanding of and capability to address the challenges posed by longer, healthier lives require insightful, cross-disciplinary research. CPOP builds on the success of MaxO and expands into a unique four-faculty virtual institute with scholars from four faculties of SDU as well as cooperation with international partners.*

*Specifically, the **visions** of CPOP are:*

- 1. To publish ground-breaking, interdisciplinary research in widely read journals with extensive press coverage, leading to widespread citations, international awards and prestigious external grants.*
- 2. To create unique interdisciplinary educational activities that develop the talent of our students and educate them about the causes and consequences of longer, healthier lives.*
- 3. To create direct value for society through applied and socially relevant research on, e.g., forecasting population dynamics, thereby shaping the future of our society.*
- 4. To look beyond our borders and strengthen SDU's internationalization efforts by establishing close partnerships with international research institutes.*

### Activities (De bærende og overordnede forskningsaktiviteter i projektet)

*The activities envisioned to achieve the four goals above will be outlined in the following.*

#### Goal 1: Excellent Interdisciplinary Research

*It is a clear ambition that the research undertaken in CPOP should result in interdisciplinary research that:*

- is published in the best multi-disciplinary journals and university presses*
- results in scientific and societal impact*
- leads to international recognition*
- results in external funding*

*In order to fulfill these goals, interdisciplinary research initiatives focusing on the causes and consequences of longer, healthier lives will be developed by building on the following **research areas in four of the Faculties of SDU**:*

**SUN:** *Research on the causes and consequences of longer, healthier lives based on large-scale, longitudinal, population-based studies and resources such as The Danish Twin Register, The 1895, 1905, and 1915-Cohort Studies, The Long-Life Family Study and SHARE (Survey of Health, Aging and Retirement in Europe). Human health and mortality trajectories are studied through multidisciplinary research combining methods from epidemiology, demography, public health, clinical medicine, genetics, statistics and bioinformatics. The research has a focus on inequality in health with a special focus on male-female health-survival differences, and social differences in health and survival at older ages.*



**NAT:** Research on the demography of animals and plants with particular focus on life history and evolutionary patterns of ageing, how the environment (including climate) drives population dynamics, and on species conservation. Collection of novel data and curation of existing data on plant and animal demography and analyses of these data to address current hypotheses of eco-evolutionary drivers of the demography of species. To this end, we will utilize and develop statistical demographical models that allow novel data analysis including stochastic analysis, data mining and Bayesian inference.

**SAM:** Research on population dynamics, including research on the dynamics of health and survival using, e.g., SHARE data; research on the historical and ongoing patterns behind the health and wealth of individuals and nations in order to identify deep determinants of the most vital aspects of populations dynamics; and research on the interplay between demographics, politics and policy which aims to evaluate and develop policy solutions to demographic change, and to understand how relevant societal actors react to it.

**HUM:** Research in the new cultures of ageing in literary as well as in media and communication studies on a number of topics related to the consequences and characteristics of new forms of life, identity formation and lifestyles associated with longer, healthier lives. This is crucial for understanding how individuals perceive themselves as they age, are perceived by and relate to others and how this may affect society and the welfare state. This research emphasizes the uniquely felt experience of ageing and how individuals interpret and account for this experience of participating in a specific generation.

To achieve the goals laid out above, CPOP proposes and develops **several interdisciplinary research initiatives** based on the above research strengths. Five specific initiatives are proposed below. These all involve at least two faculties and research collaboration with international partners.

**Initiative 1:** Further develop the highly successful MaxO research on the evolutionary demography of aging, with a focus on analyses of the distribution of lifespans for humans and across other species and with increased emphasis on conservation demography of endangered species. This research is led by researchers in NAT working with researchers in SUN and Kernel and in close collaboration with international partners such as the Primate Life Histories Working Group (multiple universities), with the Department of Zoology at the University of Oxford, with the Laboratoire de Biometrie et Biologie Evolutive, CNRS, Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the International Union for Conservation of Nature (IUCN), as well as Stockholm University, Uppsala University and University of Oslo.

**Initiative 2:** Launch a program of research on the causes, consequences and dynamics of health, treatment, well-being and survival at ages above 90, with emphasis on centenarians. Continued progress in increasing life expectancy and improving health will increasingly depend on trends after age 90 and in the longer run after age 100. Hence it is crucial to study the health, treatment, well-being and survival of the rapidly growing numbers of those 90+. This can be done in Denmark better than in any other country because of the extensive and highly accurate data available. This research would be led by researchers in SUN collaborating with researchers in NAT, SAM and HUM and with international partner institutions.

**Initiative 3:** Expand research using data from SHARE and other sources, including cultural artifacts, on the dynamics of health at ages 50-90. Some of this research would further develop productive current research on male-female differences in health and survival.

**Initiative 4:** Launch applied research that focuses on forecasting the dynamics of population aging in Denmark. CPop has developed considerable strength in developing more powerful methods of forecasting life expectancy and other aspects of population change. We propose expansion and development of this research



to include applied research focused on Denmark—and with possible application to other countries as well. Current population forecasts for Denmark are based on weak, outdated methods, and greater attention should be given to the policy implications of the changing structure of the Danish population. Kernel will take lead on this initiative.

**Initiative 5:** *The generational profile, changing demographic patterns, and the relationship between generations are important structural features of modern societies shaped by and affecting public policies and individual life choices. The consequences are not distributed equally across social class, gender and ethnic groups. This leaves a fundamental question: How do policy interventions and individual life choices interact with demographic change? Trying to answer this societally relevant question, the initiative 5 involves four broad themes: 1) Policy interventions in a life-cycle perspective (especially family policy, human capital policy, old age policies such as care and pensions). This includes both policy design, policy evaluation and developing policy recommendations. 2) Intergenerational relations, transmissions, and interactions. This can include both generational conflicts as well as the social and economic dynamics of inter-generational transfers. 3) Political demography, globally and holistically. This includes comparative studies on how demographic change influences political and public policy processes and how this in turn leads to feedback effects, as well as comprehensive, interdisciplinary research on the lived lives of the old and very old in rich societies. 4) Historical and ongoing patterns behind the health and wealth of individuals and nations. It is well researched that as the economy of a country improves, so does the health of its citizens. What is less understood is whether the opposite is also true – improving national health may result in economic growth and improved wealth through a variety of channels, e.g. there will be more people able to conduct effective activities in the work force. The main research ambitions are to understand the causes and consequences of longer and healthier lives and why some individuals are left behind. This initiative will involve research from SAMF and all other CPop units.*

## Goal 2: Innovative and Interdisciplinary Education Programs

*An important goal of CPOP is to develop unique, innovative, interdisciplinary educational activities to educate students about the causes and consequences of longer, healthier lives and other topics related to population dynamics, including population forecasting and understanding of the consequences and policy implications of population change. This goal will be achieved through a number of different educational activities including:*

- *New cross-disciplinary elements, courses and profiles that will be developed in existing programs of study for bachelor's and master's students who are interested in getting a broad perspective on the dynamics of population aging and the social, economic and health consequences and policy implications.*
- *Continuation and further development of the current SDU talent program in aging 'Radical Rethink' (started in August 2019).*
- *Continued contribution to EDSD (the European Doctoral School of Demography).*

## Goal 3: Develop Interdisciplinarity

*Envisioned as center that reaches across and connects faculties, CPOP strives for interdisciplinarity in all its core business. Cross-faculty perspective will guide decisions about new hiring, new education and outreach activities. A kernel unit (see below) will facilitate connections between faculty units and promote*



*interdisciplinarity. This unit actively fosters ties with all center units by organizing seminars, workshops, teaching activities, and by doing CPOP outreach and branding.*

### Organization and governance (Organiseringen og samarbejdet om projektet)

*CPOP is a four-faculty virtual institute. The involved researchers are employed at the respective Faculties and thus refer to their respective Deans and Heads of Department, but they are also affiliated with (or have joint appointments in CPOP and refer to the respective unit heads as their closest leader. Day-to-day administrative support of each faculty unit is taken care of by the local department.*

*A CPOP **Kernel unit** is established to 1) support integrity and coherence of CPOP, 2) offer demographic expertise on population dynamics essential for fulfillment of the mission of the center, 3) provide managerial support via the Chief Academic Officer to all parts of CPOP, (in particularly to the CPOP Director, tbd), and 4) coordinate the research, applied research, teaching and outreach activities of the virtual four-faculty institute. As such, Kernel serves all four faculties and carries out trailblazing interdisciplinary research.*

*The Kernel Unit includes the head of the kernel, researchers within demography and/or the research areas of other research units, and the administration and outreach employees of CPOP. Researchers in Kernel work on interdisciplinary research and teaching in collaboration with all CPop units and advance demographic theories and methods. Expertise and perspectives in the Kernel should be inclusive of all CPOP faculties.*

*Since June 2019, Vice Chancellor appointed a Steering Board with five members representing each CPop unit to lead CPop collectively and with Rune Lindahl-Jacobsen as chair and Henrik Dam as manager. A later governance structure of CPop would include selection of a director perhaps within the setting of DIAS or SAMF faculty.*

### Full Commitment of all Four Faculties

*Integrating research environments from all four faculties so that truly interdisciplinary activities can be developed while CPOP can still maintain its focus might be a challenge. To ensure the unique four-faculty nature of CPOP, it is therefore important that all four faculties are fully committed to the initiative, that considerable efforts are spent identifying and developing research areas and initiatives in all four faculties, and that cooperation across faculties is constantly nurtured and facilitated. It must be ensured that participating units have the required resources to participate, and that they are supported in this endeavor by their respective Department Heads and Deans. To ensure commitment and capacity of CPop affiliates, incentives such as time relieves from certain faculty-duties, or other, might have to be considered.*

### Sponsorships and funding

*It is an outspoken ambition that a substantial share of the funding for CPOP will be raised through external sources, in particular sponsorships from private firms or funds. Fundraising will take place as (a) an early endeavor where start-up funding is sought by direct contact to pension funds and large Danish private foundations, (b) a continuous activity for funding for the spin-off research and outreach activities of Goals 1-4 and Initiatives 1-4,*

*There is, of course, a risk that external sponsorships cannot be raised to the extent envisioned in which case, a larger share of the funding will have to be found through other sources (internal or external), or the scale of CPOP has to be reduced.*







### The long run: After 2021 (Forankringsplan)

*The clear ambition of CPOP is to continue after 2021 as a permanent SDU four-faculty virtual institute. It is therefore expected that the organizational set-up of CPOP is maintained after 2021. To ensure the survival and success of Cpop, extensive efforts has been given and will be given into applying for external funding.*

*Overview of institutional (SDU) funding and external funding for ongoing projects and projects currently under review (as of August 2019):*

| <b>Name of unit</b> | <b>Received from Strategic Fund – SDU in in million DKK (2018-2021)</b> | <b>Received funding from external sources, ongoing projects, in millions DKK*</b> | <b>Planned funding from external sources, applications under review, in million DKK*</b> |
|---------------------|---|---|--|
| CPop - Total        | 40,0  | 71,0  | 41,1   |

\* Includes budgets for the total duration of the project. The projects have various duration, budget redistribution, and degree of involvement of CPop affiliates.

For details, please see External Funding Overview – Ongoing and Planned.



## Appendix 2: Teaching and supervision overview

Note: List of courses taught by CPop affiliates in 2019 was extracted from PURE on July 21, 2020. May not reflect the full range of courses taught by CPop affiliates as individual researchers are responsible for updating their teaching in PURE.

### **Radical Rethink! The Future of Ageing Societies**

Annette Baudisch, Pieter Vanhuyse, Paolo Caserotti, Peter Simonsen & Christian Nøhr

26/08/2019 → 30/06/2020

### **Data visualization with R**

Ilya Kashnitsky

28/01/2019 → 29/01/2019

### **Research Tools**

Ilya Kashnitsky

18/03/2019 → 20/03/2019

### **European Doctoral School of Demography**

Jesus-Adrian Alvarez

10/01/2019 → ...

### **Advanced Usage of "R" in Biomedical Science**

Ulrich Halekoh, Jacob v. B. Hjelmberg, Birgit Debrabant, Signe Bedsted Clemmensen, Martin Dalgaard Villumsen & James Oeppen

28/05/2019 → 29/05/2019

### **Decomposition Techniques in Health Research**

José Manuel Aburto

13/05/2019 → 17/07/2019

### **IAST501 Individual Project in Statistics**

Fernando Colchero

05/02/2019 → 01/06/2019

### **BAMM501: Bachelor Project in Applied Mathematics**

Fernando Colchero

01/02/2019 → 01/06/2019

### **ST523: Statistical Modelling**

Fernando Colchero

01/02/2019 → 01/06/2019

### **ST813: Statistical Modelling**

Fernando Colchero

01/02/2019 → 01/06/2019

### **BABB501: Bachelor Project in Biology (15 ECTS) - Nature management and age-structure of breeding Black-headed gull (Larus ridibundus) in Tarup-Davinde**

Owen Jones & Johan Dahlgren

07/01/2019 → 01/06/2019

### **BABB501: Bachelor Project in Biology (15 ECTS) - The Tarup-Davinde population of black-headed gull**



Johan Dahlgren & Owen Jones

07/01/2019 → 01/06/2019

**Co-Supervisor - Master thesis: Detecting wildlife laundering of chelonians through economic viability analysis**

Johanna Stärk

01/09/2019 → 01/06/2020

**BB812 Research Project III (10 ECTS) - Explaining demographic variation in the shape of mortality trajectories in plants**

Patrick Barks & Owen Jones

15/01/2019 → 07/06/2019

**BB839: Planning and evaluation of biological studies**

Owen Jones

02/09/2019 → 13/12/2019

**BB512: Population and Evolution**

Owen Jones

02/09/2019 → 13/12/2019

**Undervisnings CV**

Peter Simonsen

01/04/2019 → ...

**Kernebegreber og forskningspraksisser indenfor humanvidenskaberne**

Christian Damm Pedersen, Claus Schatz-Jakobsen, Nina Nørgaard, Peter Simonsen, Nils Arne Sørensen, Emily J. Hogg & Casper Sylvest

05/09/2019 → 05/12/2019

**Biostat II**

Martin Dalgaard Villumsen, Pia Veldt Larsen & Silvia Rizzi

21/03/2019 → 22/05/2019

**Advanced Economic History**

Anthony Wray

16/12/2019 → 16/12/2019

**Climate and Environmental Economics**

Keith Andrew Meyers

01/09/2019 → 20/12/2019

**International Economics**

Keith Andrew Meyers

01/09/2019 → 20/12/2019

**Methods 5 (social science)**

Klaus Petersen & Heidi Vad Jønsson

01/02/2019 → 31/12/2019

**Internal supervisor of Assoc Prof Dennis Spies, SDU Universitetspædagogikum / Lecturer Training Programme**

Pieter Vanhuyse

01/03/2019 → 01/01/2020

**Understanding Social Policy**

Pieter Vanhuyse

01/09/2019 → 31/01/2020

Source: A report made in Pure. 21/07/2020



**Human Capital Politics and Policies:  
Investing in People**

Pieter Vanhuyse

14/08/2019 → 31/08/2019

**Welfare Society in an International  
Perspective (guest lecturer)**

Pieter Vanhuyse

20/03/2019 → ...

**Economic Principles and Politics**

Pieter Vanhuyse

01/09/2019 → 31/01/2020

**Politics of Labor Market Change**

Peter Starke & Pieter Vanhuyse

01/02/2019 → 30/06/2019

**Economic Principles and Politics for Social  
Science**

Pieter Vanhuyse

01/09/2019 → 31/01/2020

**Internal mentor of Prof MSO Annette  
Baudisch, SDU Universitetspædagogikum /  
Lecturer Training Programme**

Pieter Vanhuyse

02/09/2019 → 30/06/2020

**Statistics**

Seetha Menon

01/02/2019 → 30/06/2021

**Internal mentor of Prof MSO Annette  
Baudisch, SDU Universitetspædagogikum /  
Lecturer Training Programme**

Pieter Vanhuyse

02/09/2019 → 30/06/2020

**Statistics**

Seetha Menon

01/02/2019 → 30/06/2021

**Internal mentor of Prof MSO Annette  
Baudisch, SDU Universitetspædagogikum /  
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Pieter Vanhuyse

02/09/2019 → 30/06/2020

**Statistics**

Seetha Menon

01/02/2019 → 30/06/2021















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