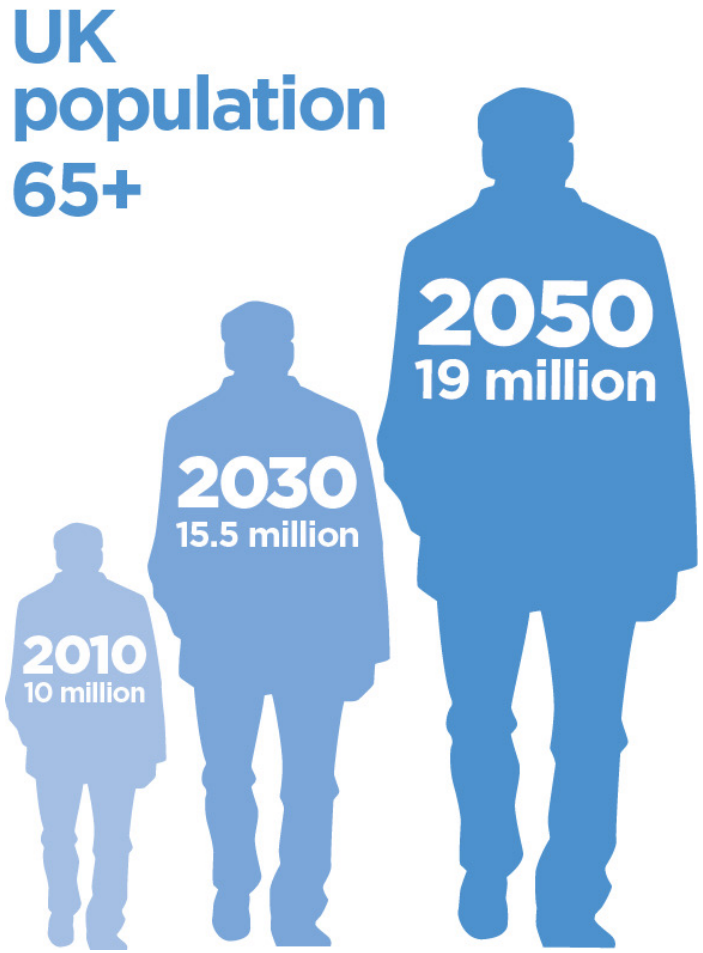
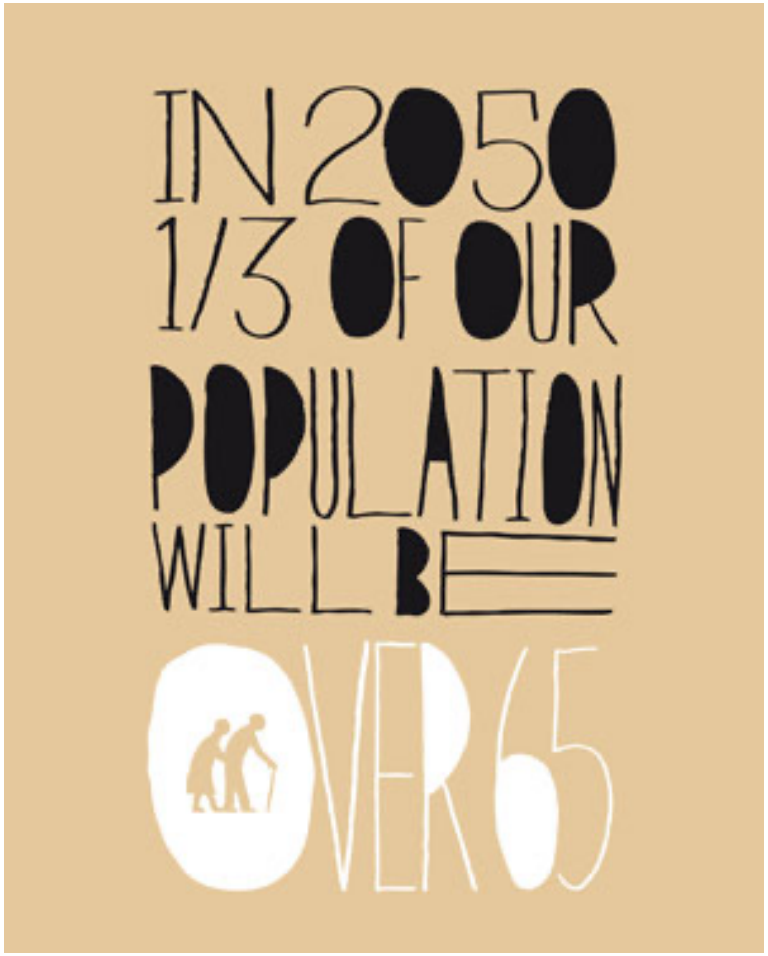
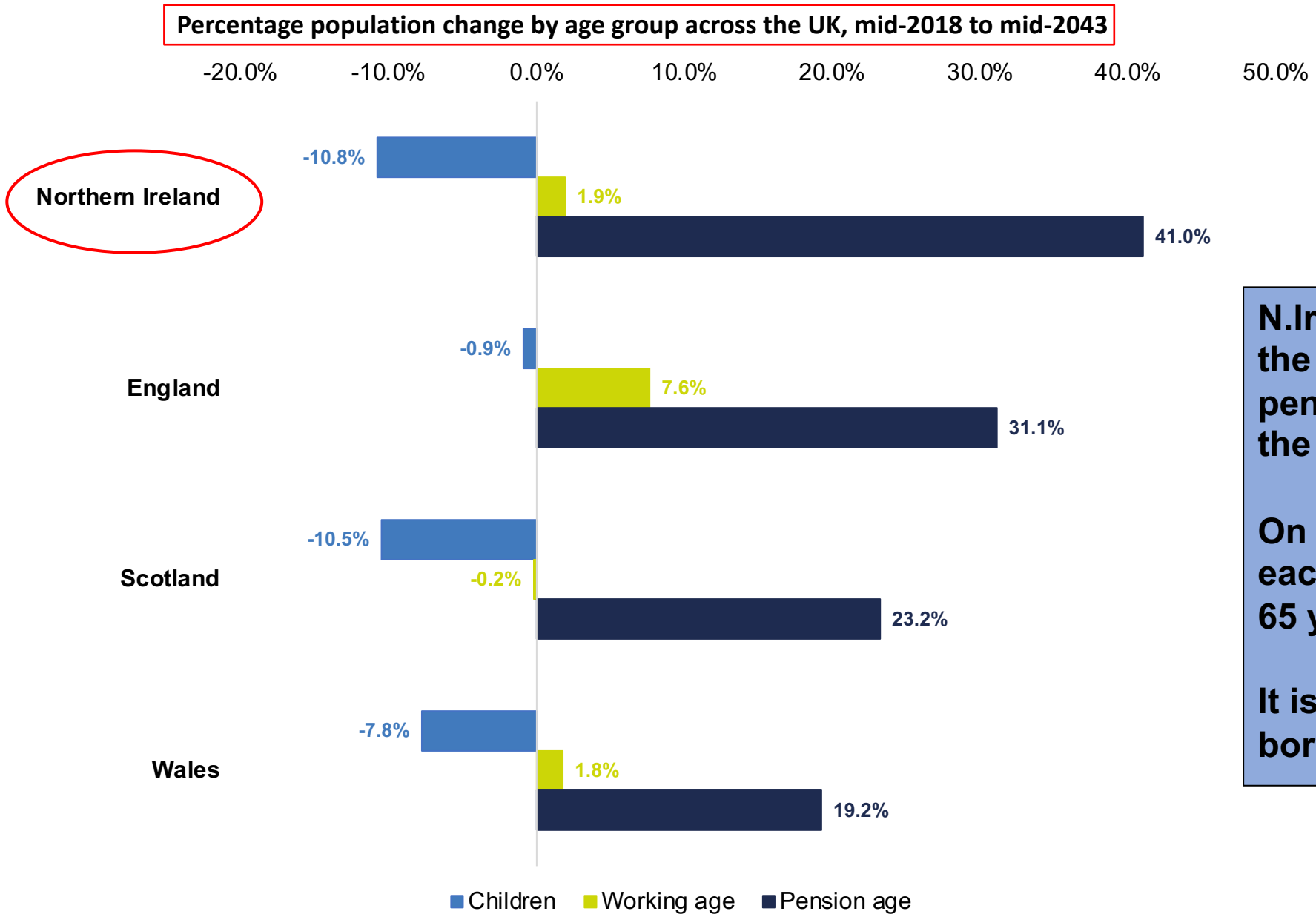
Prof Frank Kee
Scientific Director
Queen's University Belfast

Societal transformation facing N.Ireland





QUEEN'S UNIVERSITY BELFAST



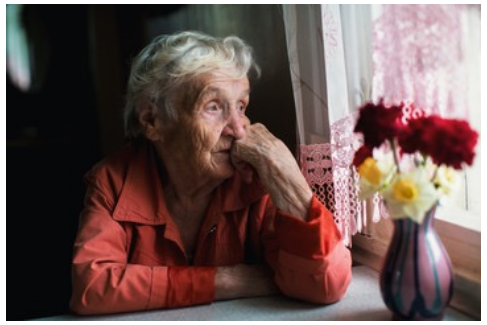
N.Ireland is projected to have the largest increase in the pension age population across the UK ***(NISRA 2019)***

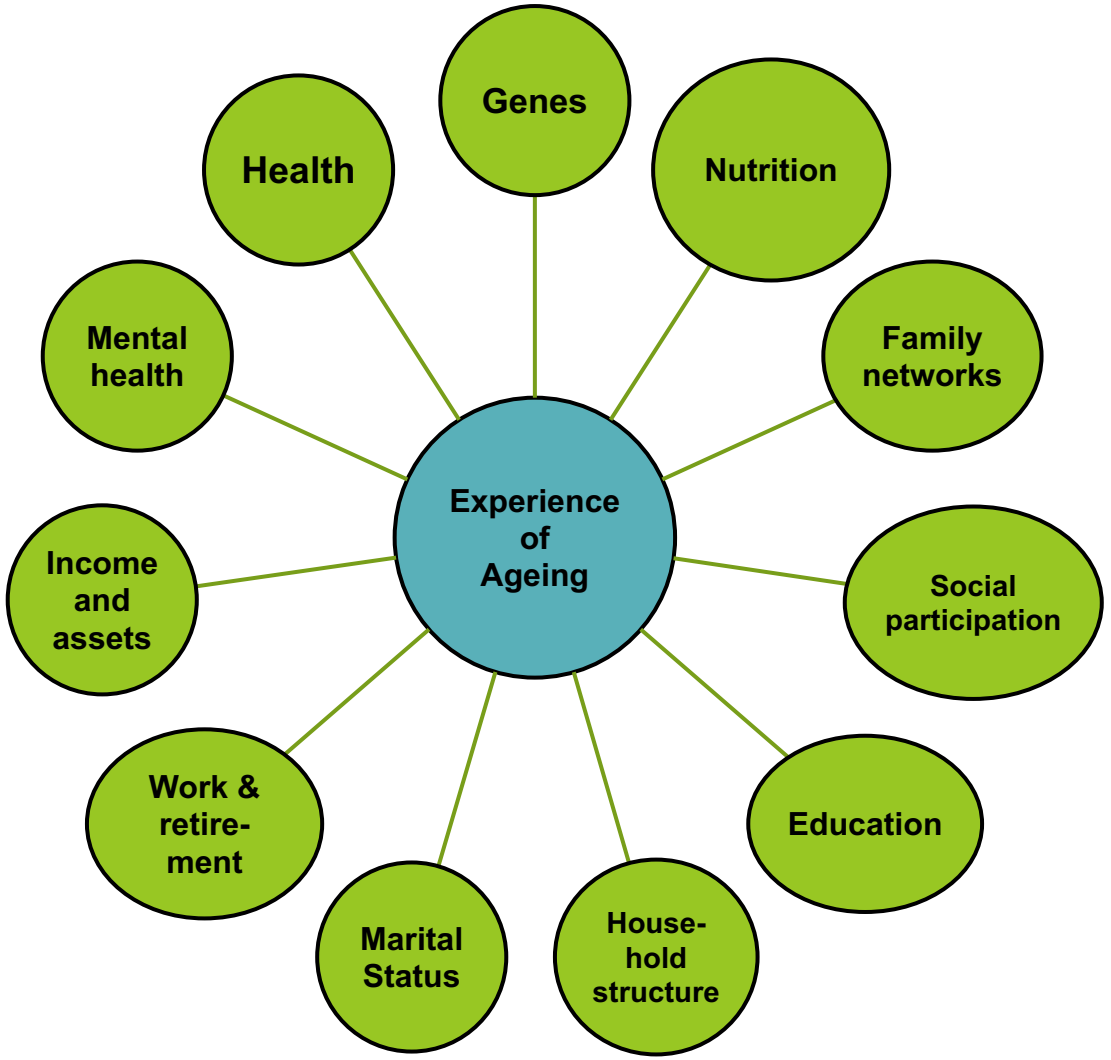
On average 18% of people in each council area are aged over 65 years old

It is estimated 1 in 3 children born today will reach 100 yrs

Source: 2018-based population projections for Northern Ireland, NISRA, 2019

Trajectory of Ageing





QUEEN'S UNIVERSITY BELFAST

NICOLA
Understanding Today for a Healthier Tomorrow

NICOLA – a vital resource for science and policy

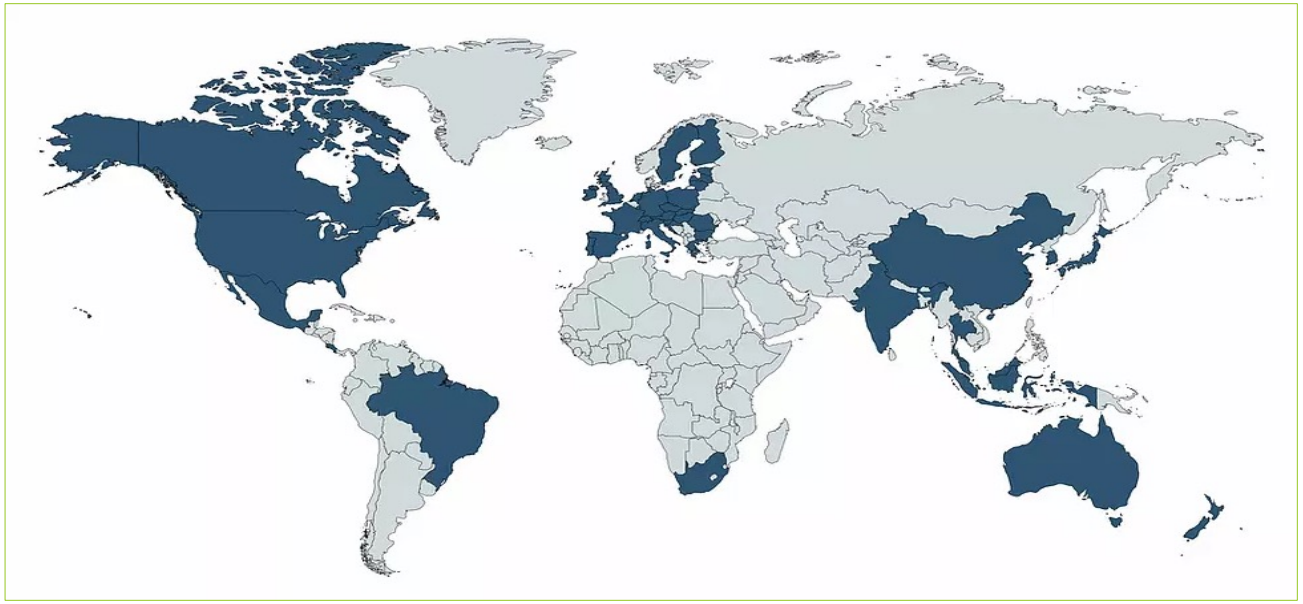
NICOLA is the…Northern Ireland Cohort for the Longitudinal Study of Ageing

- N.Ireland's largest longitudinal public health cohort study
- Stratified random sample of ~8500 men / women aged 50+
- Explores why and how social, economic and biological factors are changing the lives of older people
- Longitudinal: repeated interviews approx. every 2-3 years, health assessment every 4-5 years
- Provides evidence based research on ageing
- Unique focus: Legacy of "The Troubles", nutrition, eye health

"Understanding today for a healthier tomorrow …"

Cross-cohort venture

- Designed to complement TILDA - provide an 'all-Ireland' perspective of the social, behavioural, economic, and environmental aspects of ageing
- Designed to allow comparability with ELSA and HRS (US)
- Focus on building a resource to complement existing ageing cohorts in the global Integrative Analysis of Longitudinal Studies of Ageing (IALSA) network



Key questions being addressed

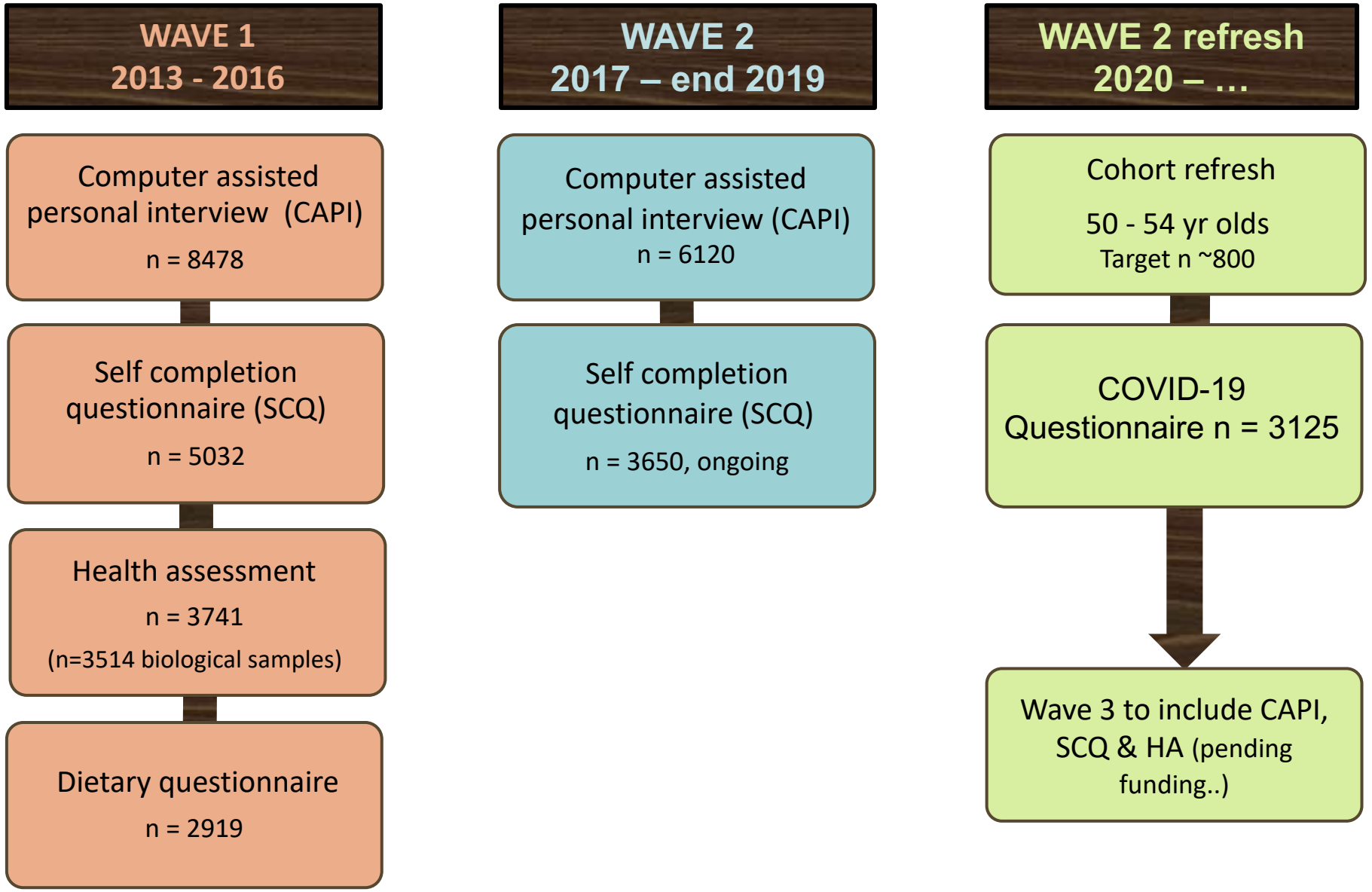
- **How can we best maintain and maximise independence and the health and wellbeing of older people?**

- **How do we organise and fund the delivery of care services for older people and make adequate pension provision?**

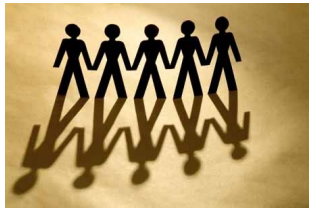
- **What are the consequences for the labour market and employment, with an increasing population of people reaching the conventional retirement age?**

Core issues: labour market participation, trajectory of wealth and savings, pension policy reforms, social care needs and costs, frailty issues, digital inclusion, cognitive function and dementia, changes in household and family structures, social isolation, loneliness, subjective wellbeing, transport and access

Stages of NICOLA Data Collection



Data Available



Socio-demographic factors

- Age
- Gender
- Education
- Childhood health
- Marital status & history
- Religion

Lifestyle behaviours

- Dietary intake
- Smoking
- Alcohol consumption
- Physical activity
- Sleep

Objective health measures

- Anthropometry
- Cardiovascular
- Respiratory function
- Grip strength
- Walking, balance
- Vision
- Cognitive tests
- Blood, urine

Psychological & social factors

- Social connectivity
- Social participation
- Environment / housing / transport
- Loneliness

General health

- Depression
- Anxiety
- Life satisfaction
- Stress, trauma
- Quality of life
- Cognitive function
- Hearing
- Physical health
- Chronic conditions
- Medication
- Disability / functional limitations

Economic factors

- Employment
- Job history
- Lifelong learning
- Planning for retirement

Healthcare & health service utilisation

- Informal & formal care
- Healthcare utilisation & satisfaction

NICOLA

Biochemical biorepository

Lab 1: Total Chol, HDL, LDL, triglycerides, blood glucose, HBA1c, vitamins (A,C,E)

Lab 2: Core UK Biobank panel including for example:

- Cholesterol
- Direct LDL
- HDL-cholesterol
- Triglyceride
- Apolipoprotein A
- Apolipoprotein B
- C-reactive protein
- Lipoprotein (a)

- Vitamin D
- Rheumatoid factor
- Alkaline phosphatase
- Calcium
- SHBG
- Testosterone
- Oestradiol

- Glucose
- Cystatin C
- Creatinine
- Total protein
- Urea
- Phosphate
- Urate
- Albumin

Lab 3: Genetic, epigenetic and transcriptomic data (Infinium CoreExome-24 Array)

Biochemistry biomarker harmonisation project with NIA Biomarker Network

Dietary intake (FFQ)

Biomarkers:
biological samples
genetic markers

Cognitive function

Physical function

Eye health

Cardiovascular & respiratory health

NICOLA Health Assessment

Retinal Imaging

- **Colour fundus Photographs**
- **Wide field colour images (TX200)**
- **OCT:** Infra-red retinal image

  Multi-Colour image

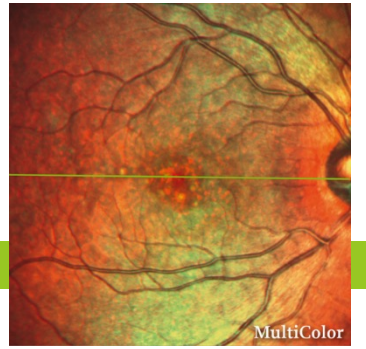
  Blue-autofluorescence

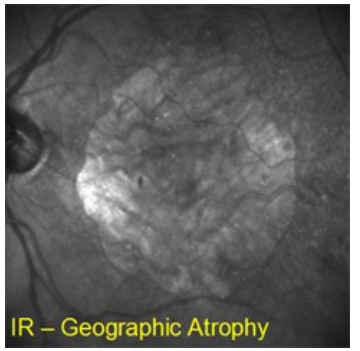
  Dual wavelength AF movie

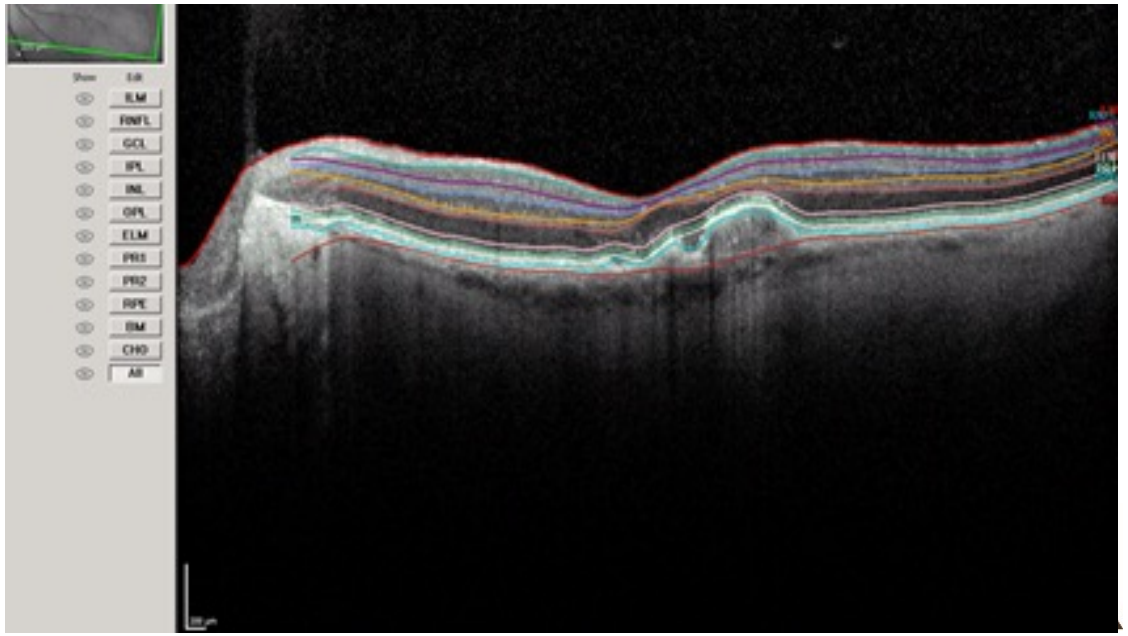
  OCT

Multimodal imaging

- enables more accurate phenotyping for earliest stages of age related macular degeneration
- enables prevalence data of new phenotypes and associated risk factor analysis







Eye health

OPO OPHTHALMIC & PHYSIOLOGICAL OPTICS
THE JOURNAL OF THE COLLEGE OF OPTOMETRISTS

Ophthalmic & Physiological Optics ISSN 0275-5408

Confocal infrared imaging with optical coherence tomography provides superior detection of a number of common macular lesions compared to colour fundus photography

Nicola B Quinn, Usha Chakravarthy, Katherine Alyson Muldrew, Barbra Hamill, Bernadette McGuinness, Ian S Young, Frank Kee and Ruth E Hogg

Centre for Public Health, Queen's University Belfast, Belfast, UK

Citation information: Quinn NB, Chakravarthy U, Muldrew KA, Hamill B, McGuinness B, Young IS, Kee F & Hogg RE. Confocal infrared imaging with optical coherence tomography provides superior detection of a number of common macular lesions compared to colour fundus photography. *Ophthalmic Physiol Opt* 2018; 38: 574–583. https://doi.org/10.1111/opo.12592

Keywords: colour fundus photography, confocal infrared reflectance imaging, optical coherence tomography, age-related pathology

Correspondence: Ruth E Hogg
E-mail address: r.e.hogg@qub.ac.uk

Received: 11 June 2018; Accepted: 6 November 2018

Abstract

Purpose: To compare diagnostic accuracy of confocal infrared reflectance (IR), with and without optical coherence tomography (OCT), to colour fundus photography (CFP) in the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA) Study.

Methods: Cross-sectional observational study of participants in NICOLA. CFP, IR and IR/OCT of 640 eyes were graded for hard, soft and reticular pseudodrusen; geographic atrophy; choroidal neovascularisation; naevus; epiretinal membrane; and haemorrhages. Test characteristics (sensitivity and specificity) for each imaging modality with respect to each retinal feature were calculated.

Results: With CFP as the reference standard, sensitivity of IR by itself ranged from 75% for RPD to 93.5% for hard drusen and specificity was above 90% for

Original Articles

Can ultra-wide field retinal imaging replace colour digital stereoscopy for glaucoma detection?

Nicola B. Quinn, Augusto Azuara-Blanco, Katie Graham, Ruth E. Hogg, Ian S. Young & Frank Kee

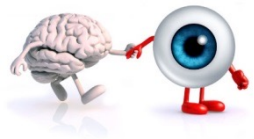
Pages 63-69 | Received 26 Nov 2016, Accepted 01 Jul 2017, Published online: 18 Sep 2017

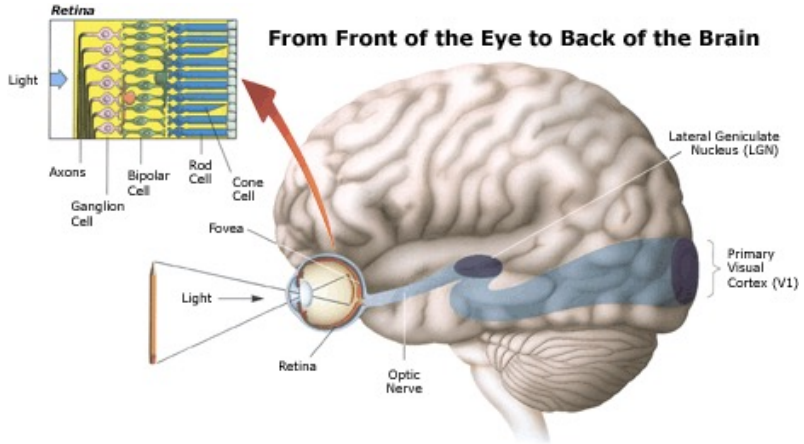
Download citation https://doi.org/10.1080/09286586.2017.1351998 Check for updates

ABSTRACT

Purpose: Ultra-wide field (UWF) retinal imaging (Optomap, Optos plc, Dunfermline, UK) is a novel technique to image the peripheral fundus. The goal of this study was to explore the potential use of UWF imaging to detect glaucoma, and specifically to evaluate the reproducibility of measures of vertical cup-to-disc ratio (VCDR) using ultra-wide field (UWF), and the agreement between UWF and standard colour digital stereoscopy (CDS).

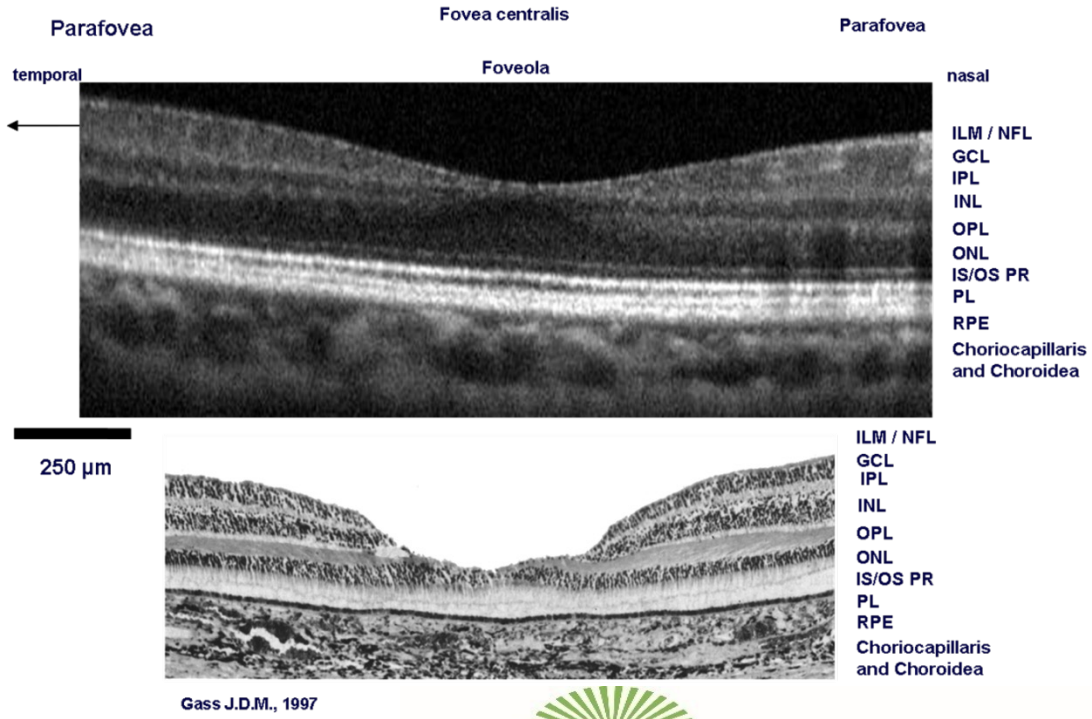
Eyes are the window to the brain!





OCT in the NICOLA study offers individual neural layer thickness which can be correlated with cognitive tests.

In Vivo SD-OCT versus Histology



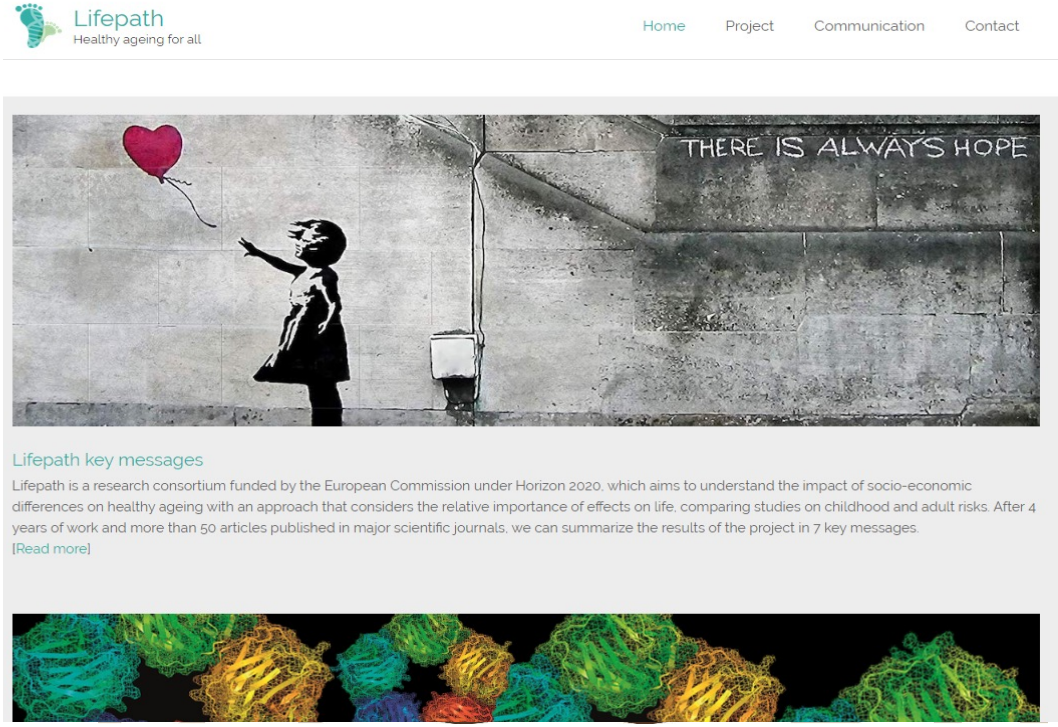
NICOLA

LifePath Consortium

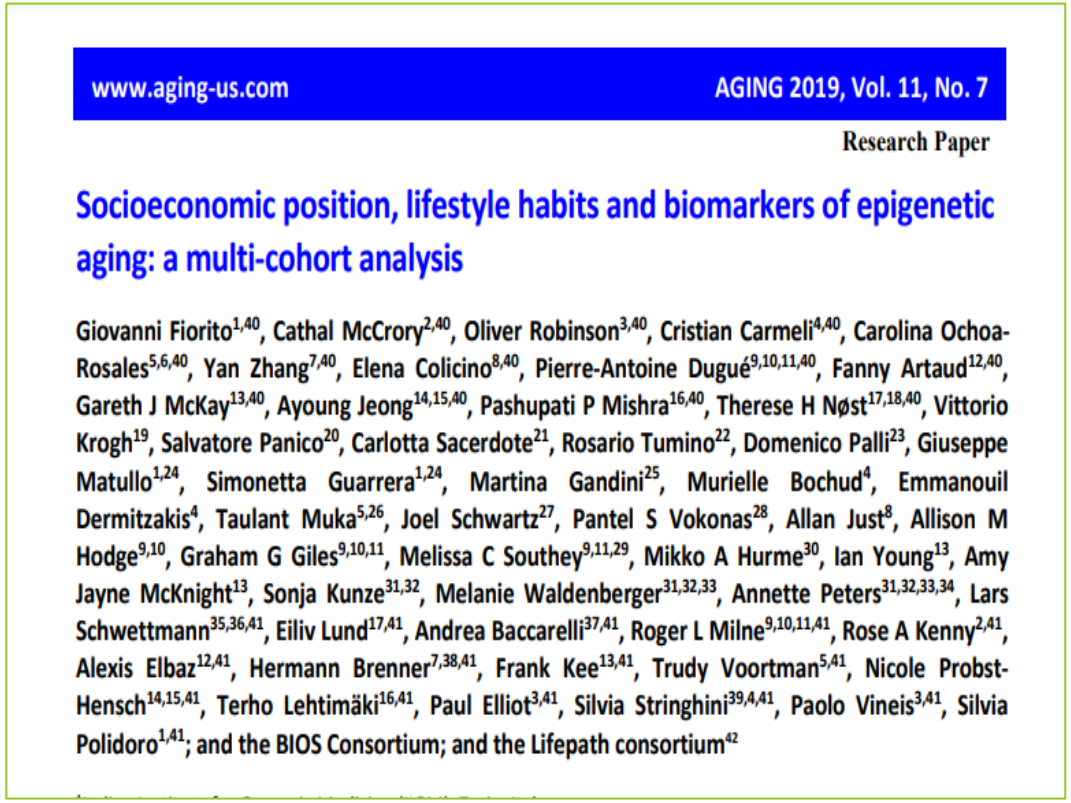
- Aim of LIFEPATH: To investigate the biological pathways underlying social differences in healthy ageing
- Meta-analysis of epigenome-wide association data
- Analysis of NICOLA methylation data

Other ongoing genomic collaborations:

- **Genetic Investigation of Anthropometric Traits (GIANT)**
- **Global Lipids Genetic Consortium (GLGC)**



Epigenetic clock and ageing



www.aging-us.com AGING 2019, Vol. 11, No. 7

Research Paper

Socioeconomic position, lifestyle habits and biomarkers of epigenetic aging: a multi-cohort analysis

Giovanni Fiorito[1,40], Cathal McCrory[2,40], Oliver Robinson[3,40], Cristian Carmeli[4,40], Carolina Ochoa-Rosales[5,6,40], Yan Zhang[7,40], Elena Colicino[8,40], Pierre-Antoine Dugué[9,10,11,40], Fanny Artaud[12,40], Gareth J McKay[13,40], Ayoung Jeong[14,15,40], Pashupati P Mishra[16,40], Therese H Nøst[17,18,40], Vittorio Krogh[19], Salvatore Panico[20], Carlotta Sacerdote[21], Rosario Tumino[22], Domenico Palli[23], Giuseppe Matullo[1,24], Simonetta Guarrera[1,24], Martina Gandini[25], Murielle Bochud[4], Emmanouil Dermitzakis[4], Taulant Muka[5,26], Joel Schwartz[27], Pantel S Vokonas[28], Allan Just[8], Allison M Hodge[9,10], Graham G Giles[9,10,11], Melissa C Southey[9,11,29], Mikko A Hurme[30], Ian Young[13], Amy Jayne McKnight[13], Sonja Kunze[31,32], Melanie Waldenberger[31,32,33], Annette Peters[31,32,33,34], Lars Schwettmann[35,36,41], Eiliv Lund[17,41], Andrea Baccarelli[37,41], Roger L Milne[9,10,11,41], Rose A Kenny[2,41], Alexis Elbaz[12,41], Hermann Brenner[7,38,41], Frank Kee[13,41], Trudy Voortman[5,41], Nicole Probst-Hensch[14,15,41], Terho Lehtimäki[16,41], Paul Elliot[3,41], Silvia Stringhini[39,4,41], Paolo Vineis[3,41], Silvia Polidoro[1,41]; and the BIOS Consortium; and the Lifepath consortium[42]

Fiorito et al 2019; BIOS Consortium; Lifepath consortium. Socioeconomic position, lifestyle habits and biomarkers of epigenetic aging: a multi-cohort analysis. Aging (Albany NY). 2019 Apr 14;11(7):2045-2070. doi: 10.18632/aging.101900.

Research Aim

- To examine the association of education and lifestyle factors with biomarkers of age dependent DNAm dysregulation:
  - Stochastic epigenetic mutations (SEMs)
  - 3 epigenetic clocks (Horvath, Hannum, Levine)

- Analysis of 18 cohorts (including NICOLA) spanning 12 countries

Key Findings

- Biomarkers of age were independently associated with education and different sets of lifestyle risk factors

- Low education was an independent predictor of accelerated biological (epigenetic) aging

- Epigenetic clocks can disentangle the biological pathways underlying social inequalities in healthy aging and longevity

Early life stress, Cognitive Resiliance & Ageing

Yu, J et al., 2020
Journal of Neurology, Neurosurgery & Psychiatry

Does stress experienced during childhood and early adulthood result in "accelerated" biological ageing that correlates with poorer cognitive performance in later life?

Primary exposure

Experience of childhood/ early life stress

Individual and composite score, validated assessment scales

Novel NI exposure

Experience of Troubles related trauma

Individual and composite score, validated PTSD scale

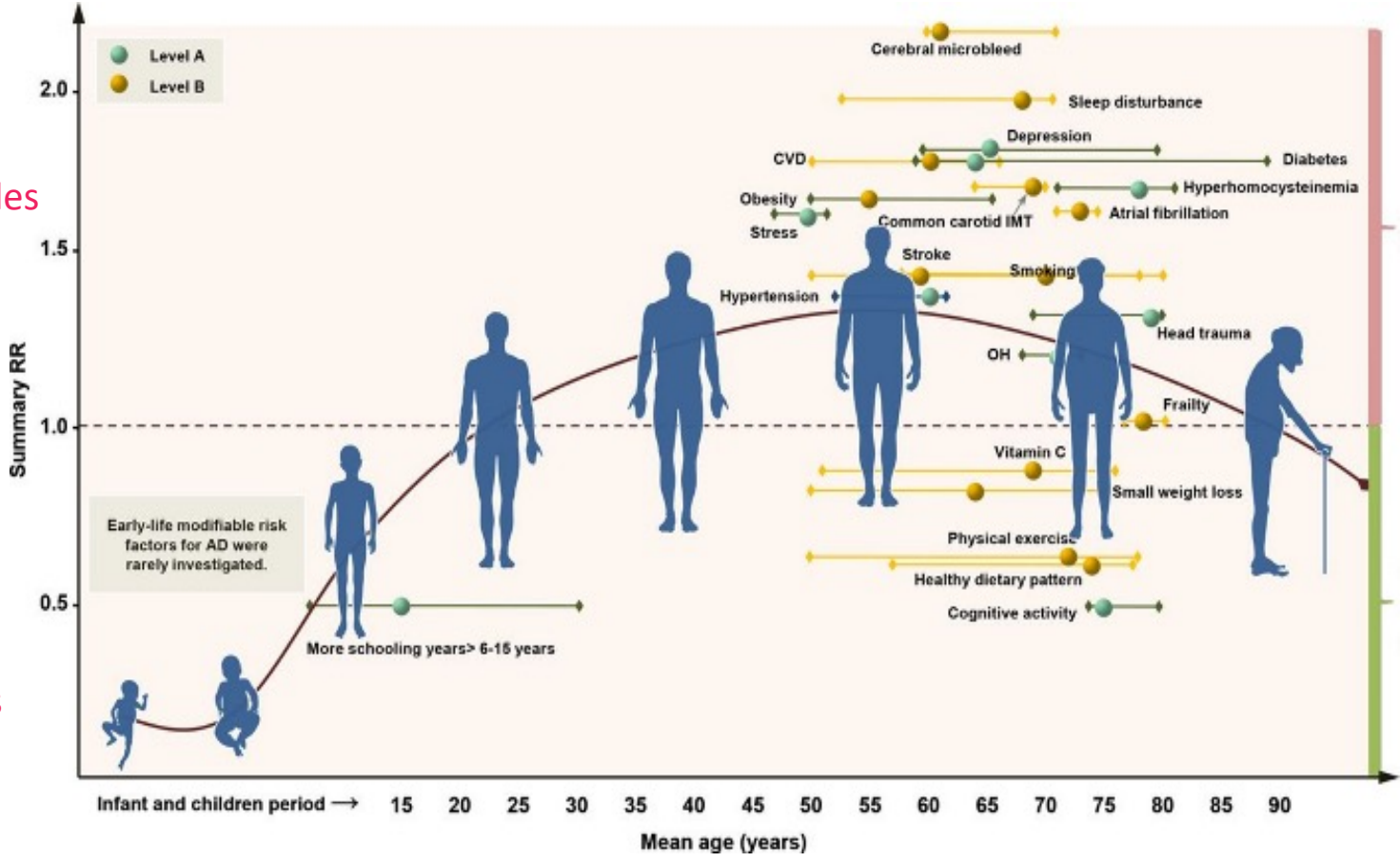
Outcome

Clinical Outcome - Cognitive performance

Global performance and individual neurocognitive domains

Biological Outcome – Bio age/ allostatic load

DNAm age / composite multi system score



Harmonizing Cognitive Assessments in Irish, English, and American Longitudinal Studies (NICOLA-HCAP)

- Aims to investigate dementia risk using a harmonised cognitive assessment protocol as part of a larger NIA funded study
- NICOLA, TILDA, Health & Retirement Study (HRS), ELSA
- 1000 NICOLA participants aged 65 yrs and over
- Cognitive and neuropsychological assessments to discriminate between normal cognitive performance, cognitive impairment and dementia
- This work will:
  - generate an extensive global dementia bioresource
  - produce internationally comparable data

SPACE: Supportive environments for **P**hysical and social **A**ctivity, healthy ageing and **C**ognitiv**E** health.

- Where we live may influence brain health and vulnerability to cognitive impairment

- Key research questions:
  - Are there specific factors which interact to make urban environments a problem for brain health ?
  - What are the best policies and interventions for promoting healthy ageing and brain health for our poorest communities ?

- SPACE research package will include:
  - collecting physical activity data using Actigraph accelerometers
  - monitoring location and travel via GPS devices

E·S·R·C
ECONOMIC & SOCIAL RESEARCH COUNCIL

SPACE

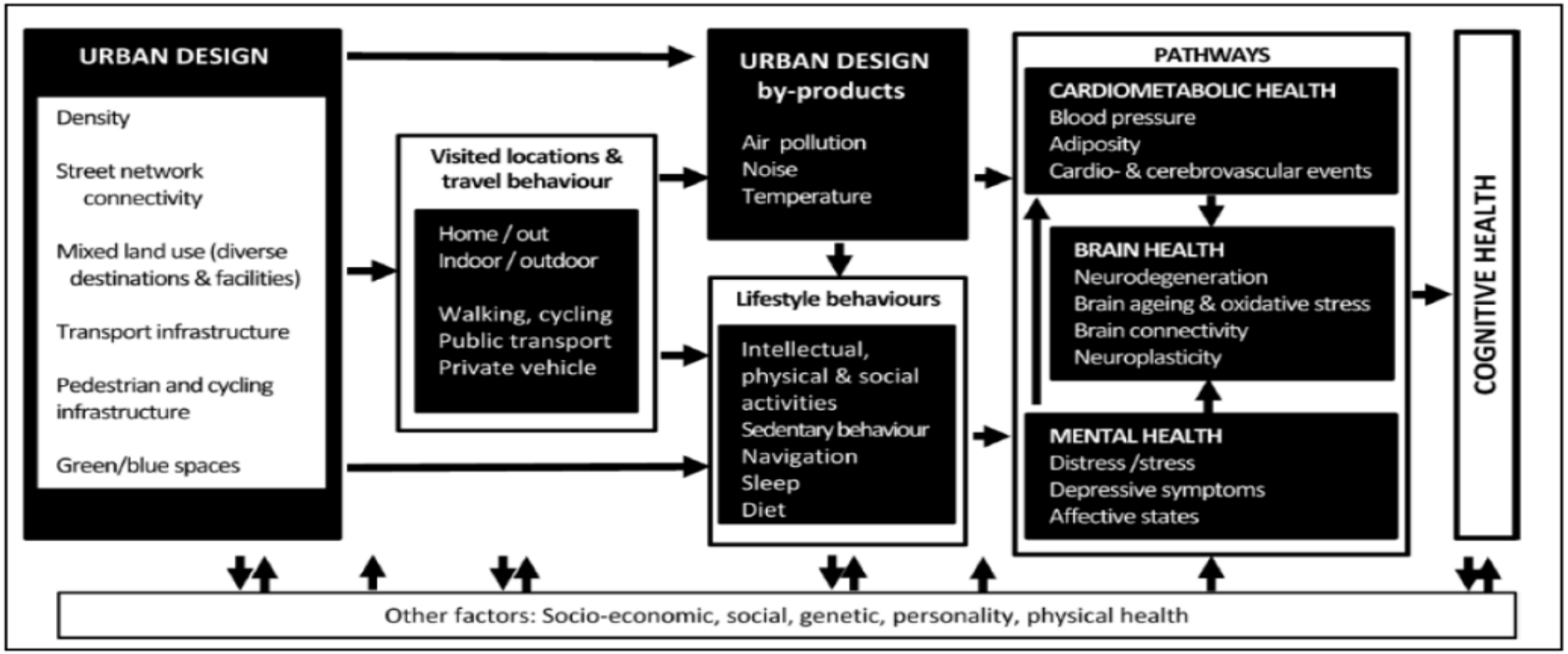


Figure 1: Conceptual model of the effects of urban design and the environment on cognitive health (Cerin et al, 2020)

Chronic Kidney Disease Genetics (CKDGen) Consortium

- With increasing incidence and a prevalence of >10 % among adults worldwide, chronic kidney disease (CKD) represents a major public health issue
- A better understanding of the genetic basis of kidney function may provide important insights into the disease
- CKDGen leaders approached us following oral presentations at the American Society of Nephrology 2018
- NICOLA is one of several population based cohorts coordinating EWAS for kidney disease
- Part of worldwide consortia for genome-wide genotype data

NICOLA

ESRC Impact Acceleration Award

- ESRC funding awarded to Cruise and Mulholland to prepare a report for Northern Ireland's Commissioner for Victims and Survivors (*Psychiatric morbidity in older adults exposed to Northern Ireland's 'Troubles': Findings from the NICOLA Study*)

- This report has used NICOLA data to provide evidence to underpin new legal frameworks for a 'victims payment' for those with long-term psychiatric morbidity relating to Troubles-related trauma exposure

- This important piece of work demonstrates the potential of the NICOLA study data resource to inform and underpin policy change

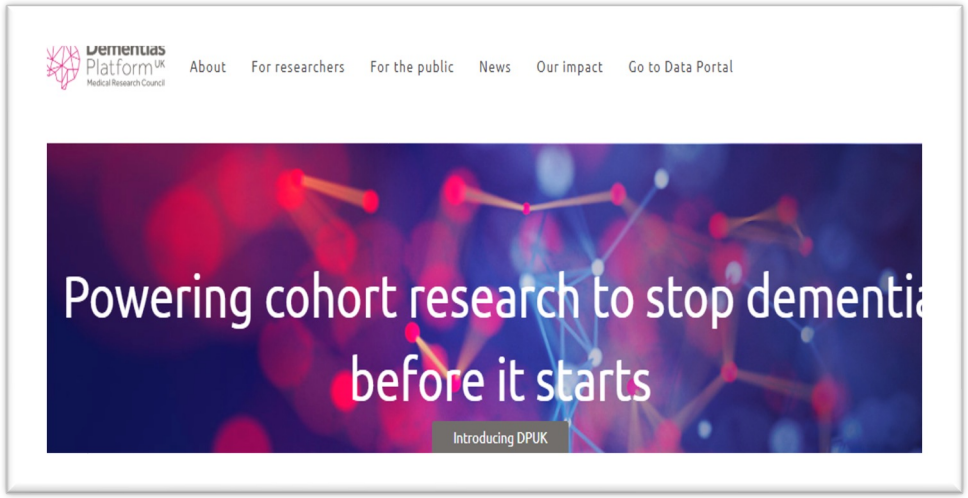
UKRI Economic and Social Research Council

NICOLA

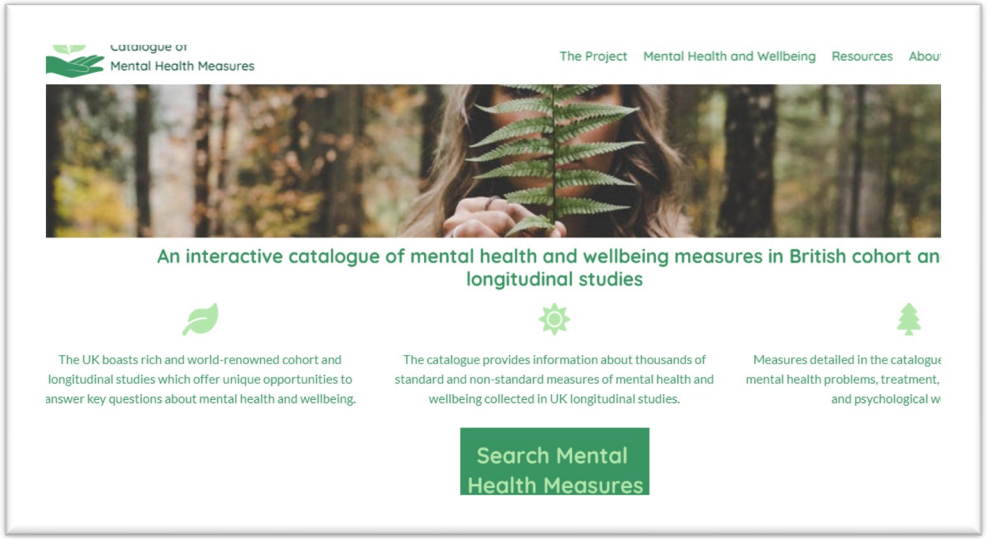
NICOLA DATA REPOSITORIES

1. **UK Data Service (www.ukdataservice.ac.uk)**

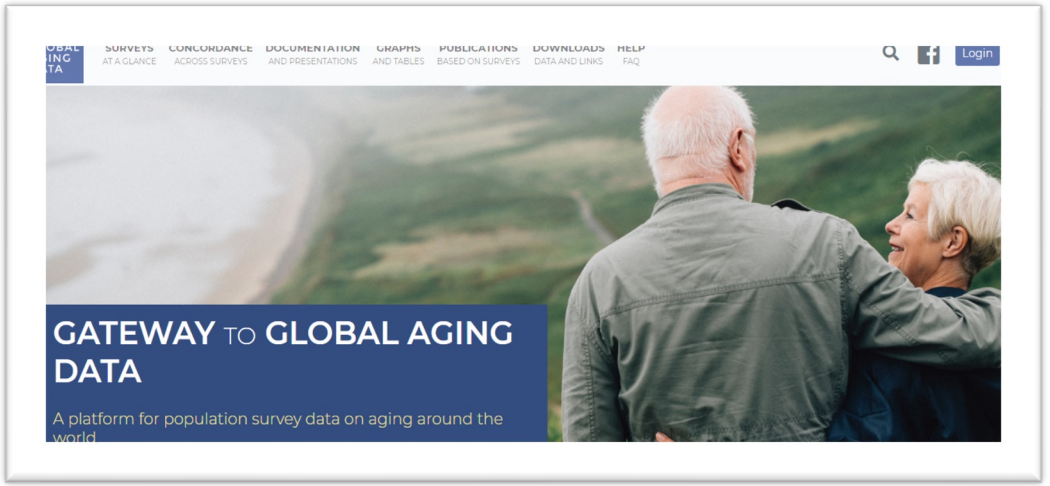
2. **Dementias Platform UK (www.dementiasplatform.uk)**



3. **Catalogue of Mental Health Measures, KCL (www.cataloguementalhealthac.uk)**



4. **Gateway to Global Aging (www.g2aging.org)**



UK Longitudinal Linkage Collaboration (LLC)

- New research infrastructure designed to inform the UK's research response to the Covid-19 pandemic
- Supports the COVID-19 Longitudinal Health & Wellbeing National Core Study
- Facilitates comparison of Covid-19 related outcomes against pre-Covid-19 baseline data from established UK cohorts
- NICOLA is one of 14 contributing studies

UK Longitudinal Linkage Collaboration

Aims:

- Opportunity to examine not just COVID-19 but the impact that 'lockdown' mitigation measures and other restrictions have had on older people in terms of physical health and mental wellbeing, lifestyle, relationships, finances, employment
- To develop centralised linkages which give comprehensive access to primary, secondary and C-19 relevant health records
- Evolve into a long-term resource for any research investigation requiring study data linked to routine records

COVID-19 research 2021

COVID questionnaire content

- Mental wellbeing
- Food / finance / income provision
- COVID related health – symptoms, use of NHS app, loss of loved ones
- Employment
- Volunteering/caring
- Social participation/connectivity
- Religious activities
- Lifestyle behaviour (physical activity, diet, sleep, alcohol, tv, smoking, vitamin use)
- Healthcare needs / access to health services
- Internet use
- COVID experiences/messages of Inspiration

AIM: To explore how COVID-19 affected health, wellbeing, lifestyle, social connections and financial situation

Response rate: 3125 participants

Selected findings:

- **Widening of socioeconomic inequalities:** COVID-19 tended to have greater impact on those living in areas of greater social deprivation, and in those with pre-existing medical conditions

- **Mental wellbeing:**
  - Just over 1 in 4 (26%) had symptoms of depression during COVID
  - Of those who showed signs of depression, more than a third were from more deprived areas, while almost a third had multi-morbidities.
  - A higher proportion of 50-64 yr olds suffered anxiety compared to older age groups
  - Those living in Belfast (*vs other town or rural area*) and those in more deprived areas reported greater levels of anxiety

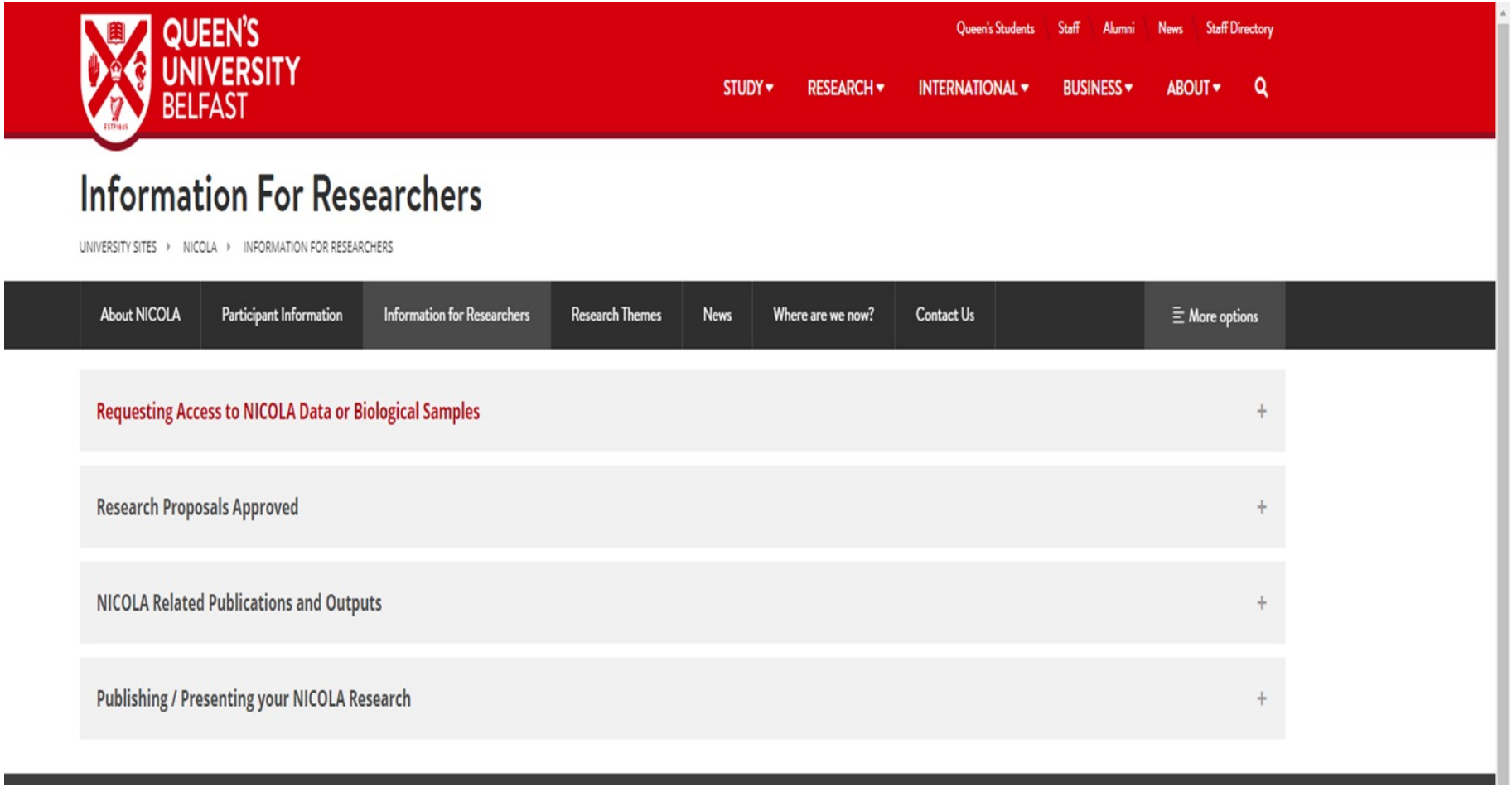
- **Sedentary behaviour:**
  - 1 in 3 participants reported weight gain
  - More than a third (39%) reported doing less physical activity
  - 44% reported sitting more than usual
  - 23% reported eating more than usual
  - 46% reported watching more TV
  - 80% reported sleeping more than usual.

- **Lifestyle behaviours:** One quarter of current smokers reported smoking more, 19% reported drinking more

- **Supplement use:** Half of older adults reported that they had started taking a health supplement during COVID, with the majority starting Vit D supplement.

NICOLA Website

https://www.qub.ac.uk/sites/NICOLA/Informationforresearchers/



Impact of NICOLA

Invaluable resource for understanding what it means to be an older person in N.Ireland

A discovery engine for researchers and policymakers that can:

- Reveal determinants of health and disease
- Maximise value through rigorous data quality and governance
- Form the basis of future age-related research projects
- Shape polices aimed at improving the health and wellbeing of older people
- Empower people to take responsibility for their health & wellbeing

NICOLA

Acknowledgements / Funders

NICOLA Team

Prof Frank Kee - Scientific Director
Prof Dermot O'Reilly - Operations Director
Prof Bernadette McGuinness - Clinical Lead
Mrs Amanda Coulter - Project Manager
Dr Charlotte Neville - Scientific Officer
Angela Scott - Data Manager
Maciej Domanski - Database Manager
Prof Amy Jayne McKnight - Biorepository

Research Leads

Prof Frank Kee – Chronic disease
Prof Jayne Woodside - Nutrition
Prof Michael Donnelly - Health
Dr Ruth Hogg - Ophthalmology
Dr Paula Devine – Sociology
Dr Sharon Cruise - Frailty
Prof AJ McKnight – Multiomics, CKD

Website: https://www.qub.ac.uk/sites/NICOLA/Informationforresearchers/

The Atlantic Philanthropies
UK Clinical Research Collaboration igniting our potential
CARDI Centre for Ageing Research and Development in Ireland
Office of the First Minister and Deputy First Minister
E·S·R·C Economic & Social Research Council
HSC Public Health Agency Research and Development
wellcome
The Wolfson Foundation
Queen's University Belfast

QUEEN'S UNIVERSITY BELFAST

NICOLA

Understanding Today for a Healthier Tomorrow

Thank You

nicola@qub.ac.uk