Health and mortality

Strand organiser: Dr. José Manuel Aburto (LSHTM & University of Oxford)

1:30 - 3:00 Monday 11 September: COVID-19

COVID-19 mortality by race and ethnicity in US metropolitan and nonmetropolitan areas, March 2020 to February 2022

Dielle J. Lundberg, Elizabeth Wrigley-Field, Ahyoung Cho, Rafeya Raquib, Elaine O. Nsoesie, Eugenio Paglino et al

Prior research has established that Hispanic and non-Hispanic Black residents in the United States experienced substantially higher COVID-19 mortality rates in 2020 than non-Hispanic White residents due to structural racism. In 2021, these disparities decreased. In this paper, we assess to what extent national decreases in racial and ethnic disparities in COVID-19 mortality between the initial pandemic wave and the subsequent Omicron wave reflect reductions in mortality versus other factors such as the pandemic's changing geography. From March 1, 2020 through February 28, 2022, 977,018 death certificates of U.S. adults 25 years and older included a mention of COVID-19. The proportion of COVID-19 deaths among adults residing in nonmetropolitan areas increased over time and peaked during the Delta wave (initial wave: 5.4%; Delta wave: 23.4%; Omicron wave: 21.5%). The national disparity in age-standardized COVID-19 death rates for non-Hispanic Black compared to non-Hispanic White adults decreased by 293 deaths per 100,000 person-years between the initial and Omicron waves. After standardizing for age as well as racial and ethnic differences in geographic residence across metropolitan and nonmetropolitan areas, increases in non-Hispanic White death rates explained 40.7% of this reduction, and 19.6% was explained by shifts in mortality to nonmetropolitan areas where a disproportionate share of non-Hispanic White adults reside. The remainder was explained by decreases in non-Hispanic Black death rates. For Hispanic compared to non-Hispanic White adults, the national decrease in disparities was fully explained by increases in non-Hispanic white mortality and shifts in mortality to nonmetropolitan areas.

Email: acstokes@bu.edu

Excess mortality by cause of death during the COVID-19 pandemic in England and Wales

Ridhi Kashyap[1], Andrea Tilstra[1], Jonas Schoeley[2], Jose Manuel Aburto[1,3], Colin Angus[4], Jennifer Beam Dowd[1]
[1]University of Oxford, [2]Max Planck Institute for Demographic Research,[3] LSHTM, [4]University of Sheffield

England and Wales experienced one of the most significant magnitudes of excess mortality within Europe during the COVID-19 pandemic, resulting in nearly one year of loss in period life expectancy in 2020. This paper examines trends in excess mortality by cause of death over the course of 2020 and 2021 using detailed death registration data from the Office of National Statistics. We develop a state-of-the-art compositional data analysis method to disaggregate excess mortality by cause of death. Across cancer, no systematic patterns of excess mortality were observed, whereas in cardiovascular mortality, excess mortality was observed in 2020 for men, and by 2021 for both men and women. Flu and pneumonia deaths remained below expected mortality throughout the pandemic, and contrasting sharply with patterns observed in the US, the pandemic also witnessed sharp decreases in suicide and substance-related deaths in England and Wales.

Email: ridhi.kashyap@nuffield.ox.ac.uk

Pre-pandemic trajectories of depressive symptomatology and their relation to depression during the COVID-19 pandemic: A longitudinal study of English older people

Jingmin Zhu, Paola Zaninotto, Giorgio Di Gessa - University College London

Background: Although the COVID-19 pandemic has impacted depression, evidence on the role of pre-pandemic history of depression remains limited. Methods: We employed data from waves 4-9 of the English Longitudinal Study of Ageing (from 2008/9 to 2018/9). We used latent class analysis on 3,925 English older adults aged 50 and older to classify respondents according to their trajectory profiles of elevated depressive symptoms (EDS). Fully adjusted logistic regression models were then used to examine the associations between these trajectories and EDS during the COVID-19 pandemic (June/July and November/December 2020). Results: We identified four

classes of pre-pandemic trajectories of EDS. About 5% were classed as 'Enduring EDS', 4% as 'Increasing EDS', 8% as 'Decreasing EDS', and 83% as 'Absence of EDS'. Compared with respondents with absence of EDS, those with EDS history were more likely to also have EDS during the COVID-19 pandemic, particularly if they had had enduring or increasing EDS in the previous 10 years. Moreover, the frequency of episodes of EDS was more crucial in predicting the risk of EDS during the COVID-19 pandemic than the timing of last episode of EDS. Conclusions: Pre-pandemic trajectories of EDS are an important risk factor for older adults' mental health, particularly in the context of the COVID-19 pandemic crisis. Older people with histories of enduring or increasing EDS should receive particular attention from policymakers when provisioning post-pandemic health and well-being support.

Email: jingmin.zhu@ucl.ac.uk

Sex inequalities in the disruption of the long-term psychological distress trajectories during the COVID-19 pandemic: Evidence from three British birth cohorts
Darío Moreno-Agostino [1, 2], Helen L. Fisher[2], Alissa Goodman[1], Stephani L. Hatch[2], Craig Morgan[2], Marcus Richards, Jayati Das-Munshi[2], George B. Ploubidis[1,2], [1]University College London, [2]King's College London

Evidence suggests that the population's psychological distress levels have increased with the COVID-19 pandemic onset compared to pre-pandemic levels, with women being disproportionately impacted. However, there is a lack of evidence on the impact of the pandemic relative to pre-existing long-term distress trends. We analysed whether long-term pre-pandemic psychological distress trajectories were disrupted during the pandemic, and whether these changes were different across generations and by sex assigned at birth. We used data from three British birth cohorts born in 1946, 1958, and 1970, respectively, with follow-up data on 16,389 participants spanning up to 40 years. We used psychological distress factor scores, as measured by validated self-reported questionnaires. By September/October 2020, distress levels had reached or exceeded the levels of the peak in the pre-pandemic life-course trajectories, with larger increases in younger cohorts (standardised mean differences [SMD] and 95% confidence intervals of $SMD_{1946,pre-peak} = -0.02$ [$-0.07, 0.04$], $SMD_{1958,pre-peak} = 0.05$ [$0.02, 0.07$], and $SMD_{1970,pre-peak} = 0.09$ [$0.07, 0.12$] for the 1946, 1958, and 1970 birth cohorts, respectively). Increases in distress were larger among women than men, widening pre-existing sex inequalities. Pre-existing long-term psychological distress trajectories of adults born between 1946 and 1970 were disrupted during the COVID-19 pandemic, particularly among women, who reached the highest levels ever recorded in up to 40 years of follow-up data. This may impact future trends of morbidity, disability, and mortality due to common mental health problems among adults aged 50 years and above in the UK.

Email: d.moreno@ucl.ac.uk

4:45 - 6:15 Monday 11 September: Recent life expectancy trends

Exploring the sex difference in life expectancy and cause of death in India: Decomposition analyses from 1991 to 2019
Saddaf Naaz Akhtar – University of Southampton, T. Muhammad - International Institute for Population Sciences Mumbai, Krishna Kumar - Jawaharlal Nehru University, New Delhi

The present study aims at understanding which age groups and cause of deaths have mostly contributed to the changes in the sex gap in life expectancy from 1991-2019 in India using the data from Sample Registration System Reports and Global Burden Diseases. We have performed two decomposition approaches-United Nations (1982) and Preston, Heuline and Gulliot (2001). This study demonstrates that trend in the sex differentials in life expectancy can be affected by sex differences in the age pattern of mortality attributed to specific causes of death among men and women which has significantly changed during the last three decades. CVD makes the most positive contributions, followed by transport injuries, digestive, chronic respiratory, respiratory infections, and so on. In 2011, sex-specific mortality from CVD, transport injuries, digestive, chronic respiratory, and respiratory infections most likely explained the peak of male disadvantage in life expectancy. Unintentional injuries, on the other hand, are narrowing the gender gap in life expectancy from 2016-2019. Since infant and child mortality are still high in India as compared with those in developed countries, causes of death due to nutrition deficiency and enteric infections that contribute to the sex gap in life expectancy should be prioritised in policies and programs.

Email: S.N.Akhtar@soton.ac.uk

Long-term mortality and life expectancy trends in post-communist countries: A comparative analysis
Katarzyna Doniec and Jennifer Beam Dowd – University of Oxford

The collapse of the Soviet Union in 1989 had far reaching implications for the health of its former and satellite states. This resulted in a mortality crisis driven mainly by death in working age males from causes such as alcohol, violence, and cardiovascular diseases. However, mortality trends in these countries since the 1990s have not been well explored. We analyse time trends in age-specific mortality for selected causes of death from 1990-2019 for ages 25-44, 45-54, 55-64, 65-74 and 75+ using the World Health Organization mortality data for nine Former Soviet Union (FSU) and seven satellite (non-FSU) countries. We compare these mean rates in Western European and the United States. We also analyse and compare overall life expectancy trends. Preliminary results suggest that mortality rates from most causes declined substantially for both FSU and non-FSU countries, leading to gains in life expectancy. Despite these notable relative improvements, the region still lags behind the Western European mean and the United States in most groups. Surprisingly, all FSU countries except Russia have achieved lower all-cause mortality rates among younger females (25-44) than the United States. Our findings highlight a substantial rebounding of Central and Eastern European mortality since the 1990s, but with continued room for improvement compared to Western Europe.

Email: katarzyna.doniec@sociology.ox.ac.uk

Why is life expectancy in England & Wales falling behind? A decomposition approach
Jennifer Beam Dowd[1], Antonino Polizzi[1], José Manuel Aburto[1,2,3], Luyin Zhang[4], Katarzyna Doniec[1], Andrea M. Tilstra[1] - [1]University of Oxford, [2]London School of Hygiene and Tropical Medicine, [3]University of Southern Denmark, [4]Princeton University

Continued improvements in maximum global life expectancy suggest that the stagnation in life expectancy at birth recently observed in England and Wales is avoidable. Existing research on the lagging life expectancy in England and Wales has compared trends to the average of a group of peer countries. Here, we complement this research by decomposing life expectancy differences between England and Wales and 17 individual countries in Western Europe using data from the World Health Organization and the Human Mortality Database for the period 2001 to 2019. Applying the contour decomposition method, we distinguish contemporary gaps in male and female life expectancy due to (1) differences in age- and cause-specific death rates around 2001; and (2) diverging trends in these rates thereafter. Disaggregating life expectancy gaps into initial differences and differential trends allows us to disentangle whether the health of the English and Welsh is losing ground or whether there are signs of a longer-term mortality disadvantage. Our preliminary results suggest a combination of both dynamics. England and Wales has only slowly closed existing gaps in cancer and cardiovascular disease (CVD) mortality, or has lost initial advantages therein. In addition, rising rates of external-cause mortality in working ages have slowed down life expectancy gains in England and Wales. Our findings highlight the need for policy in England and Wales to focus on the health legacies of the past as well as more recent population health trends to achieve the levels of life expectancy already seen in other countries.

Email: jennifer.dowd@demography.ox.ac.uk

The influence of intra-annual mortality variation on life expectancy trends in Italian subnational territories
Isabella Marinetti and Dmitri Jdanov – Max Planck Institute for Demographic Research

The influence of short-term risk factors on longevity trends remains a largely under-investigated topic. Despite increasing attention to this topic during the last pandemic, the exact mechanisms of influence of different short-term factors on mortality trends are not known. Nevertheless, the influence of short-term risk factors on longevity trends is increasing. This is especially important for ageing populations where the growing number of elderly population increases the number of people at higher risk. Measuring the potential role of intra-annual mortality variations is important for predicting longevity trends. This paper analyses life expectancy trends in Italy and its regions over the period 2003-2019, using monthly mortality data. We employed direct standardization to obtain the standardized death rates (SDR), using the EU 2013 standard population and then we computed the percentage change of SDR by month, for each region separately. Subsequently, we used the stepwise decomposition method applied to groups of months (meteorological seasons) to investigate the contribution of each season to the change in life expectancy at the subnational level. We then analyse the contribution of each month in shaping the mortality inequalities in the country. This research will shed light on the different contributors to mortality inequalities across subnational territories and their development over

time. Moreover, the results will help in understanding whether seasonal mortality had an actual contribution in shaping the current life expectancy trends and which territories are the most affected by the increase in these short-term factors.

Email: marinetti@demogr.mpg.de

9:00 - 10:30 Tuesday 12 September: Methodological innovations in health and mortality

A novel approach to measure socioeconomic inequalities in mortality

Ana C. Gómez Ugarte[1], Ugofilippo Basellini[1], Carlo G. Camarda[2], Emilio Zagheni[1] - [1]Max Planck Institute for Demographic Research, Germany, [2]Institut national d'etudes demographiques, France

Commonly used measures of socioeconomic inequalities in mortality, such as the slope index and the relative index of inequality, are based on summary measures of the group-specific age-at-death distributions (e.g. life expectancy or standardized mortality rate). While this approach is informative, it ignores valuable information contained in the different distributions. We propose a novel mortality inequality measure that takes this information into account. Leveraging a metric of statistical distance, our measure is sensitive not only to changes in the means, but also to broader mortality changes that affect distributional shapes. We evaluate our measure using simulated data and under different data availability contexts. This allows us to identify possible biases in the measurement of socioeconomic inequalities when using conventional measures. Additionally, we introduce a mortality achievement index to assess overall mortality performance by combining our measure of socioeconomic inequality with a population-level central tendency measure. The index includes a weighting parameter that allows users to decide the relative importance between reducing socioeconomic inequality and overall mortality improvements, accommodating their subjective view on the egalitarian versus utilitarian perspectives on inequality. Our proposed index can be used to inform social policies aimed at reducing socioeconomic inequalities in mortality.

Email: gomezugartevalerio@demogr.mpg.de

Assessing the sensitivity of ONS's new method for mortality projections

Gauthier Dulout, Kirsten Piller, Camille Harrison, Manuela Naprta

The Office for National Statistics introduced a new method for mortality projections, using the well-established age period cohort (APC) model. It projects future mortality rates, by single year of age and sex, by fitting generalised linear models to historic morality rates. It has different models for infants –where period and cohort are interchangeable -, very old-ages – for whom less data is available -, and the remaining ages. The model parameters are then combined with expert opinions about long-term future mortality to project mortality rates forward in time. The mortality projections feed into the National Population Projections, national statistics that are used within and outside of government, for instance to form fiscal projections, to identify future demand for health and education, or to estimate the future cost of state pensions. Using a simulation approach, we examine here the sensitivity of the model to (1) the input data, by comparing model outputs after having adjusted previous years' mortality for certain age groups; and (2) a range of model assumptions, such as speed of convergence towards expert opinions.

The average uneven mortality index: Building on the "e-dagger" measure of lifespan inequality

Marco Bonetti - Bocconi University, Ugofilippo Basellini - Max Planck Institute for Demographic Research, Andrea Nigri - University of Foggia

BACKGROUND In recent years, lifespan inequality has become an important indicator of population health. Uncovering the statistical properties of lifespan inequality measures can provide novel insights on mortality analysis. METHODS We revisit the $e^\dagger$ measure of lifespan inequality, introduced in Vaupel and Canudas-Romo (2003). We generalize a result first noted in Schmertmann (2020): conditioning on surviving at least until age a, $e^\dagger(a)$ is equal to the covariance between the conditional lifespan random variable Ta and its transformation through its own cumulative hazard function. We then derive an upper bound for $e^\dagger(a)$. Leveraging this result, we introduce the "Average Uneven Mortality" (AUM) index, a novel relative mortality index that can be used to analyze mortality patterns. RESULTS The use of the AUM index is illustrated through an application to observed

period and cohort death rates from the Human Mortality Database. We explore the behavior of the index across age and over time, and we study its relationship with life expectancy. The AUM index at birth declined over time until the 1950s, when it reverted its trend, and the index generally increases over age. CONTRIBUTION We elaborate on Vaupel and Canudas-Romo's e† measure, deriving its upper bound. We exploit this result to introduce a novel mortality indicator, which enlarges the toolbox of available methods for the study of mortality dynamics. We also develop some new routines to compute e†(a) and σTa from death rates, and show that they have higher precision when compared to available functions, particularly for calculations involving older ages.

Email: basellini@demogr.mpg.de

A mathematical framework for dynamics in fertility and fertility lost

Antonino Polizzi[1], José Manuel Aburto[1,2,3] - [1]University of Oxford, [2]London School of Hygiene and Tropical Medicine, [3]University of Southern Denmark

Most demographic indicators can be conceived in a static and a dynamic way. Whereas static formulations indicate the values of demographic indicators at time t, dynamic formulations are concerned with changes in these values between two periods. To date, the formulation of several mathematical frameworks has helped demographers understand both static and dynamic formulations of mortality indicators better. However, it is generally less understood how changes in fertility indicators between two periods can be expressed using mathematical notation. Here, we show that changes over time in fertility indicators, such as the Net Reproduction Rate, can be expressed as a weighted sum of age-specific rates of fertility decline – and, where applicable, mortality decline. We introduce a new fertility indicator, 'f-dagger', which quantifies 'fertility lost', i.e., the average number of potential offspring never born due to mortality before the end of the reproductive period. To allow for better comparisons across time and space, we derive a version of 'f-dagger' that expresses fertility lost relative to the level of observed fertility, i.e., Gross Reproduction Rate. We find that 'f-dagger' is the only fertility indicator that decreases whenever mortality and/or fertility rates decline. We illustrate this property using simulated mortality and fertility data. Based on our theoretical findings and the results of our simulations, we argue that 'f-dagger' may be a more useful indicator of the joint mortality and fertility conditions in a population than NRR, and propose 'f-dagger' as indicator of the pace and shape of demographic transition in human populations.

Email: antonino.polizzi@nuffield.ox.ac.uk

2:45 - 4:15 Tuesday 12 September: Health and mortality inequalities

Health inequalities in midlife in the UK and USA: Comparison of two nationally representative cohorts

Charis Bridger Staatz[1], Iliya Gutin[2], George B. Ploubidis[1], Jennifer Dowd[3], Lauren Gaydosh[2], Andrea Tilstra[3], Jose Manuel Aburto[3], et al - [1]University College London, [2]The University of Texas at Austin, [3]University of Oxford

International comparisons typically show that the USA has worse health than the UK. However, previous comparisons are typically in older age, with little understanding of differences in midlife. Socioeconomic inequalities in health have been demonstrated in both countries, but how inequalities in midlife health vary across the USA and UK is not known. We compare mid-life health in the USA and UK using data from the 1970 British Cohort Study (BCS70) (N= 9,665) and the National Longitudinal Study of Adolescent to Adult Health (Add Health) (N=12,297), when cohort members were aged 34-46 and 32-42, respectively. Health is measured by sedentary time, smoking status, alcohol consumption, body mass index, self-rated health, cholesterol, blood pressure, and glycated haemoglobin (HbA1c) using modified Poisson regression. We also test whether associations vary by parental education in childhood, and household income and education level in midlife. Midlife USA adults had worse health, particularly for unhealthy levels of cholesterol (RR 1.98, 95% CI: 1.27 to 3.1), alcohol consumption (RR 2.06, 95% CI: 1.80 to 2.37) and HbA1c (RR 3.61, 95% CI 2.11 to 6.19). Sedentary behaviour and smoking were the only outcomes with lower risk in the USA. We find that for the majority of outcomes, the USA health disadvantage was confirmed in mid-life. Moreover, there were smaller socioeconomic inequalities in midlife health in the UK. This may reflect different UK social policies such as the national health service and welfare that attenuate the impact of socioeconomic inequalities on health.

Email: charis.staatz.17@ucl.ac.uk

What goes up must come down: Social gradients in emerging infectious diseases
Jordan D. Klein - Princeton University

Fundamental cause theory explains how social gradients in health persist despite changes in the societal disease burden. However, a consistent observation across the emergence of different diseases, including COVID-19 in Brazil, has been an initially inverted or null social gradient in mortality. Though some theoretical models attempt to explain this by stipulating that lack of knowledge about the disease and effective interventions prevent disparities in resources from being translated into mortality disparities, this belies the role of pre-existing inequities in the production of mortality gradients. According to Bambra's theoretical framework, social gradients in emerging infectious disease (EID) mortality are produced through four pathways: unequal exposure, transmission, susceptibility, and treatment. Using COVID-19 in Brazil as a case study, I test the hypothesis that an initially inverted social gradient in mortality is an artifact of earlier disease introduction to higher socioeconomic-status (SES) areas and that interventions accelerate but are not required to produce social gradients: while some pathways produce social gradients through intervention introduction, others operate through pre-existing social inequities already in place when novel diseases emerge. I simulate an SEIRD model of the production of social gradients in mortality over time, parameterizing pre-existing social inequities through disparities in household transmission and infection fatality rate, conceptualized respectively as the unequal transmission and susceptibility pathways, and two types of interventions, NPIs and vaccination, conceptualized respectively as the unequal exposure and treatment pathways. To examine the roles of pre-existing inequities and interventions, I simulate counterfactual scenarios consisting of no interventions, NPIs only, vaccination only, both interventions, and hypothetical scenarios where NPIs and vaccination see higher adoption in lower SES geographies. These results will have important implications for counteracting pre-existing inequities in vulnerability to EIDs through a more equitable distribution of interventions, particularly vaccination.

Email: jdklein@princeton.edu

The unequal impact of the COVID-19 pandemic on excess deaths: An analysis by deprivation quintile and cause of death in England
Colin Angus[1,2], Andrea M. Tilstra[2], Jonas Schöley[3], Ridhi Kashyap[2], Jennnifer Beam Dowd[2] - [1]University of Sheffield, [2]University of Oxford, [3]Max Planck Institute for Demographic Research

The enormous impact of the COVID-19 pandemic on mortality rates in England has been well documented, but less is known about the impact on socioeconomic inequalities in mortality. Data on COVID infections suggests significant differences by age, sex and deprivation groups that changed over the course of the pandemic. In addition to differences in infection risk, differences in underlying co-morbidities, access and utilisation of health care, and vaccine uptake may have impacted socioeconomic inequalities in mortality both directly and indirectly related to COVID-19. Using data on individual-level death certificates available via the ONS Secure Research Service platform, we analyse deaths in England by occurrence date, age, sex, quintile of the Index of Multiple Deprivation (IMD) and underlying cause between 2010-2022. Sex- and IMD quintile-specific General Additive Models (GAMs) are used to estimate counterfactual all-cause mortality in 2020-22. Cause-specific excess mortality was calculated using a compositional GAM. We quantify absolute and relative excess mortality by cause, sex and IMD quintile and how these varied across the successive 'waves' of the pandemic. Our study provides a comprehensive picture of inequalities in mortality in England during the pandemic, how these differ by cause, and how they evolved over the course of 2020-22. Preliminary analyses show greater excess mortality in more deprived groups and substantial IMD differences in both levels and trends of cause-specific excesses. Results will inform future approaches to reducing mortality inequalities post-pandemic and suggest mitigating actions that could be taken to protect the most deprived groups in future pandemics.

Email: c.r.angus@sheffield.ac.uk

To what extent is the association of socioeconomic position with childhood (6-23 months) stunting mediated by minimum acceptable diet in Sri Lanka?
Damith Chandrasenage[1,2], William Johnson[1], Paula Griffiths[1] - [1]Loughborough University, UK, [2]University of Kelaniya, Sri Lanka

Background: Stunting in children under 5 years of age is a major public health problem in Sri Lanka (16% in 2020)1. Aim: To investigate the extent to which the association of socioeconomic position (SEP) with childhood stunting is mediated by minimum acceptable diet (MAD) in Sri Lanka. Methods: The sample comprised 2214

children aged 6-23 months from the 2016 Sri Lankan Demographic and Health Survey. The exposure was a composite SEP measure of maternal education and household wealth. The mediator, MAD, is a WHO recommended measure of dietary diversity and frequency of infant and young child feeding. Counterfactual mediation models (adjusted for sex and age), using the G-computation formula, were developed to estimate the direct and indirect (via MAD) effects of the SEP measure on stunting. Results: Overall, 18% of children were stunted. The percentage of children who met the MAD was 60% in the stunted group and 61% in the non-stunted group. The total causal effect of the combined SEP measure on stunting was 4% (95%CI: 1, 7). There was no indirect effect of SEP on stunting via MAD, ~ 0% (95%CI: - 4, 1).   Conclusion: We found no evidence that MAD mediates the association of SEP with childhood stunting in Sri Lanka. This suggests that other mediation pathways (e.g., poor living environments) may be important to consider.

Email: d.c.chacrawarthige@lboro.ac.uk

5:30 - 7:00 Tuesday 12 September: Health outcomes over the life course

Projected patterns of long-term illness in the population of England to 2040: A microsimulation study
Max Birkett, Anna Head, Martin O'Flaherty, Laurie Rachet-Jacquet, Ann Raymond, Chris Kypridemos, Toby Watt - University of Liverpool and The Health Foundation

Research question: How are patterns of illness projected to change for the population of England between 2019 and 2040? Methods: We use IMPACTNCD, a microsimulation model which combines individual-level data on demographics, health and mortality from linked administrative data with survey responses on risk factors. The model uses epidemiological research on the associations between risk factors and disease incidence and mortality to project future levels of population ill health up to 2040. Assuming a continuation of current trends in risk factors and life expectancy, we model the life-course of individuals in England and their likelihood to develop a condition based on their risk factors. To quantify population ill health, we use the Cambridge Multimorbidity Score (CMS) – a clinically validated weighted multimorbidity index comprising of 20 major chronic conditions. Data sources: Primary care patient records from a sample of 1.7 million patients from CPRD Aurum linked with hospital data from HES and ONS mortality data along with survey responses on risk factors from Health Survey for England. Potential applications: Patterns of long-term illness are a key driver of health spending pressures. This research helps understand future healthcare needs in England. Results: Our findings indicate a 24% (22%-26%) projected increase in population ill health between 2019 and 2040 as measured by the mean multimorbidity score (CMS), with almost four-fifths of the expected rise being attributable to population ageing. We project the number of people living with major illness (mean score > 1.5) to increase by 36%, to reach 9.1m (8.8m-9.5m) in 2040.

Email: Ann.Raymond@health.org.uk

The association between the referral to treatment backlog and all cause mortality in England
Anthony Medford - University of Southern Denmark

While there have always been backlogs within the NHS due to its treatment delivery model, recent explosions in the size of the backlog and associated waiting times have caused alarm among health practitioners and the wider public. There has been much debate around what the potential impacts of the backlog could be in terms of public health. The current waiting list for hospital treatment in England is at a record high and the recent rapid increase is largely due to the COVID 19 pandemic; whether through diversion of resources to fight COVID 19 or by patients avoiding treatment at the height of the pandemic. The aim of this work is to explore the association between the size of the waiting list and the level of mortality in England in order to answer the following question. What fraction of deaths might be attributable to inordinate wait times? To answer this question we use data on daily deaths in England and NHS Referral to Treatment (RTT) wait time data. Methodologically, we apply a distributed lag model, accounting for seasonality and trend in annual mortality and assume a lag between "exposure" to backlog and the occurrence of death.

Email: amedford@sdu.dk

Subjective social status and trajectories of frailty: Findings from the English Longitudinal Study of Ageing
Lindsay Richards – University of Oxford, Asri Maharani – Manchester Metropolitan University, Patrick Präg,

Institut Polytechnique de Paris

Background: Frailty is characterised by a decline in physiological and cognitive functions as a consequence of accumulated deficits in ageing. Despite its strong association with age, there is known heterogeneity in frailty progression by socioeconomic status (SES), with worse outcomes among lower SES groups. Relatively few studies, however, have examined the role of subjective perceptions of status on frailty. Methods: We use data from the 2002–2019 surveys of the English Longitudinal Study of Ageing, involving 9,484 individuals aged 50+ at baseline. Frailty was defined using a frailty index comprised of 60 health deficits. Group-based trajectory models were used to identify latent trajectories of frailty over the eighteen-year period, and multinomial regression models were used to investigate the relationship between subjective social status and frailty trajectory membership, controlling for confounding factors. Results: Four trajectories of frailty index were retained: Low frailty (53% of participants), Progressive mild frailty (25%), Progressive moderate frailty (15%), and High frailty (6%). Descriptive findings show a socioeconomic gradient to frailty trajectories along the lines of income, wealth, social class, and neighbourhood deprivation. Multivariate analysis shows that, even after controlling for these different dimensions of socioeconomic status as well as health behaviours, higher subjective social status significantly increases the chance of being in the least frail trajectory and reduces the chance of being in one of the progressive or high trajectory groups.

Email: lindsay.richards@sociology.ox.ac.uk

11:30 - 1:00 Wednesday 13 September: Health and mortality in early life

Exploring unaddressed double burden of malnutrition: The coexistence of stunted children and overweight and obese mothers in Sri Lanka
Dr Gaya Abeywickrama - University of Winchester

Background: Sri Lanka has been experiencing a persistently high prevalence of child undernutrition and a steady increase in overweight and obesity among women, along with a rise in non-communicable diseases. This situation has emerged as a "double burden of malnutrition", which has not been systematically investigated in Sri Lanka. Aim: To examine the risk factors associated with the double burden of malnutrition (DBM) in Sri Lanka at the household level. Methods: Multinomial logistic regression was used to estimate the risks of stunted child overweight/obese mother pairs after adjusting for selected individual, socioeconomic and geographic factors. The analysis sample considered 5,975 mother-child pairs living within the same households, who had their complete anthropometric measurements. Outcome: We used the height-for-age Z-score (stunting) for children and body mass index (BMI) for mothers as primary outcome measures. The presence of both, child stunting and maternal overweight or obesity in the same household was classified as "double burden" pairs. Results: It is revealed that DBM within the same household is emerging as a trend in Sri Lanka. Data showed that the coexistence of child stunting and overweight mother in Sri Lanka was 8.3 per cent, and the stunted child and obese mother pair was 2.8 per cent. Child's age, low birth weight status, maternal age, increased household members, delivery mode, wealth status, ethnicity and the residential province were significantly associated with double burden pairs. Ethnicity was a significant risk factor explaining the coexistence of DBM, as Muslim mothers have an elevated risk of being in a double burden child-mother pair.

Email: gaya.abeywick@gmail.com

The indirect impact of COVID-19 on antenatal care: Evidence from Madagascar DHS
Monica Magadi[1], Francis Obare[2], Neema Kaseje[3] - [1]Keele University, [2]The Population Council, Nairobi, [3]Tropical Institute of Community Health and Development (TICH) in Africa

Introduction/background: Despite growing global literature on the impact of COVID-19 on maternal, neonatal and child health (MNCH) outcomes including antenatal care (ANC), substantial knowledge gaps remain about many aspects of the impact of the pandemic on MNCH, especially in sub-Saharan Africa (SSA). This paper aims to quantify the extent to which COVID-19 impacted ANC service utilization and identify population sub-groups most adversely affected, focusing on ANC coverage, timing and frequency of visits. Data and Methods: The paper is based on secondary analysis of Madagascar Demographic and Health Survey (DHS), the first DHS in SSA to be released following the COVID-19 pandemic. Multilevel Logistic regression analysis was used to estimate the potential effect of COVID-19 on ANC and identify most at-risk population sub-groups. Preliminary results: All ANC measures considered (having no ANC, early start of ANC, adequate ANC visits) were significantly worse off

during COVID-19 than before the pandemic, and the effect of COVID-19 on ANC was not explained by the socio-economic and demographic ANC risk factors considered in our analysis, including pregnancy intention. On average across communities and regions in Madagascar, COVID1-19 was associated with a 42% increase in the odds of having no ANC, a 22% reduction in the odds of starting early ANC during first trimester, and a 22% reduction in the odds of receiving adequate ANC (at least 4 visits, starting during first trimester). Births to older mothers and to mothers with no education were disproportionately affected during COVID-19.

Email: m.m.magadi@keele.ac.uk

A trinity of replacements: Migration-adjusted replacement fertility, replacement net migration and replacement life expectancy for the UK, USA, Australia, Germany and Italy
Nick Parr - Macquarie University

This paper aims to provide new perspective on the population dynamics and prospects of populations which are open to migration. The novel analytic framework it proposes involves contrasting recently observed levels for the 'trinity' of population growth determinants (fertility, migration and mortality) to a 'migration-adjusted replacement fertility level', a 'replacement net migration level' and a 'replacement life expectancy' respectively (Parr 2021, 2023a, b). Each of these measures has a long run zero population growth implication. The focus is on the UK, USA, Australia, Germany and Italy over 2009-19. The results show the UK was 'above replacement' in every year considered: constant fertility, mortality and net migration would generate a larger than current population. Australia is far above replacement in every year. Its 'migration-adjusted replacement fertility level' shows its population would increase even if were it to experience sustained very low fertility, if net migration and life expectancy remain constant. USA is 'above replacement' for 2009-18 and slightly below replacement in 2019. As its TFR fell, the USA's replacement level for life expectancy at birth rose from 53.9 in 2009 to 84.4 in 2019. The 2019 gaps to replacement could be closed by a 2% increase to TFR, an 8% increase to net migration or a 7% increase to life expectancy at birth. Italy exemplifies a country which is generally far below replacement. National-level population growth is the product of fertility, mortality and migration. The application of the concept of replacement to national populations should consider all three processes.

Email: Nick.Parr@mq.edu.au