Covid-19: How demographic analysis can contribute to monitoring of the Covid-19 pandemic & formation of policy

Strand organiser: Emeritus Professor Philip Rees (University of Leeds)

9.15am Tuesday 14 September: Covid-19: Impacts on families, fertility & vaccine hesitancy

Impact of Covid-19 and lockdowns on fertility
Dermot Grenham

Much attention has been paid, quite rightly, to the impact of Covid-19 on mortality. Less attention has been paid to the possible impact the virus and the various policy responses such as lockdowns will have on fertility although there has been a number of articles appearing in the press already. Early evidence shows that experience has varied between countries with some countries seeing a clear drop in the number of births in late 2020 and early 2021 compared to previous years while in others there has apparently been no impact. However, experience has not been uniform, and it is still too early to be able to say with confidence what the eventual impact will be. The focus will be on the number of births rather than fertility rates. The aim of this presentation will be to provide a descriptive analysis of fertility changes, or lack of them, in a range of countries and to indicate possible further areas of study to enable a clearer understanding of the causes, both remote and proximate, of the fertility experience. The presentation will also discuss whether the changes are a matter of timing or quantum. Where possible and relevant a comparison will be made to the impact on fertility of the financial crisis in 2007-2008.

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Changing living arrangements, family dynamics and stress during lockdown: evidence from four birth cohorts in the UK
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This paper provides an overview of the changes in living arrangements during the Covid-19 pandemic, drawing upon recently available data from five large scale nationally representative surveys, including the second wave of Understanding Society Covid-19 Study, conducted in May 2020 and the special Covid-19 surveys conducted with the participants of the 1958, 1970, 2000-01 British birth cohorts and Next Steps (born in 1989-90). The paper then explores the impact of the unexpected changes in living arrangements and mental health, as measured by self-reported stress and interpersonal conflict. For most of the respondents (95.5%) their living arrangements during the three months since 1st March 2020 had not changed. Just over 2% had changed their address and a further 1.5% reported other people had moved in, whilst under 1% reporting people moving out. However, the likelihood of having changed living arrangements varied significantly by age with one in seven of those aged 20-24 reporting a change in living arrangements. People aged 16-29 accounted for over half (57%) of all respondents reporting that they had moved themselves. By contrast, respondents in mid-life (45-59) and early later life (60-74) accounted for the majority of respondents reporting other people had moved in or out. Analysis of the cohort data confirmed this picture. Logistic regression models provide strong evidence that those individuals whose living arrangements have changed as a result of the covid-19 pandemic have a higher likelihood of reported increased stress and family conflict than those whose living arrangements remained unchanged.

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Impact of the COVID-19 pandemic on support available to mothers in the UK and the USA

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The social isolation resulting from governments' responses to COVID-19 has impacted mothers' social networks, likely limiting social support. In particular, existing evidence suggests that tasks such as childcare and domestic work have fallen disproportionately on mothers. This increased burden of care may have consequences for women's socio-economic status and health. Using survey data collected in August 2020 from 1528 UK and US mothers with at least one child under 5-years, we document how support networks were different during the pandemic, compared to pre-pandemic. The majority of mothers (78%) reported less in-person contact with their emotional support network during the pandemic, however virtual interactions increased from pre-pandemic levels for 55% of women. While childcare support changed over the pandemic, for some women it increased (29%), for others it decreased (33%). Likewise, 25% of women received more domestic support, while 25% received less. Receiving less help was predicted by mother's country of residence, nativity, partnership status, co-residence of supporter and level of education. Finally, from whom women received support differed before and during the pandemic: during the pandemic support was more likely from partners but less likely from other kin. This paper demonstrates that the nature of support differed before and during the pandemic for the majority of women and identifies the significant proportion of women who are at risk of experiencing reduced support during the pandemic. But it also shows that some women experienced higher levels of some types of support during the pandemic, highlighting the diverse impacts of COVID-19.

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How does the framing and communication of COVID-19 vaccine side-effect risks affect vaccination intentions? A randomized trial of 10,000 adults from the United States and the United Kingdom

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Vaccine hesitancy is a major hurdle for stopping the COVID-19 pandemic. Fear of vaccine side effects has paused global vaccination efforts and increased vaccine hesitancy, but as yet there is no rigorous evidence on how the communication of vaccine side-effect risks to the public influences vaccine intentions. We are conducting a randomized experiment to assess how the framing and communication of vaccine side-effect information affect individuals' vaccination intentions among 10,000 adults from the United States and the United Kingdom. Our study experiment will be administered online to participants recruited through Prolific, a research platform for conducting web-based studies. Individuals will be told that the study seeks to understand willingness to take future COVID-19 vaccines and then receive information on the side-effect rate of a hypothetical COVID-19 vaccine. We will randomize individuals into one of six experimental arms that vary in the framing of the vaccine side effect rate: a control arm where individuals are simply told the probability of serious adverse events and treatment arms that vary the scaling of the risk (e.g. 1 per million versus 100 per 100 million) and whether the risk is presented in comparison to the risk of mortality from COVID-19 and other common causes. We will then ask individuals their willingness to take the hypothetical COVID-19 vaccine and secondarily, their perceived safety of the vaccine. These results will provide the first experimental evidence on how the communication of COVID-19 vaccine risks may impact the public's willingness to be vaccinated and can inform future efforts to increase vaccination rates.

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Midday Tuesday 14 September: Covid-19: Impacts of ethnic, socio-economic & spatial factors

Improving local ethnic population estimates for England to monitor infections, deaths and vaccinations before and during the Covid-19 pandemic
Philip Rees, Paul Norman; University of Leeds

Epidemiologists and health planners use local Covid-19 rates in their models and vaccination programmes. To match the detailed statistics on Covid-19 infections and deaths (rate numerators), good estimates of the populations at risk (rate denominators) are needed. Often, populations from the 2011 Census have been used, resulting in over-estimation of rates because of 2011-2021 population growth. Rates by sex, age ethnicity are needed as analyses have revealed important differences between ethnic groups. ONS Surveys in 2020 and 2021 record ethnicity in both numerators and denominators but are reliable for regions only. An ONS study that survived forward individuals classified by ethnicity in the 2011 Census to 2020-21 provided populations at risk with rich co-variates but missed out additions to the population through births and immigration. In this paper, we improve knowledge of local ethnic populations by adjusting projected local ethnic populations (ETHPOP) to match local population estimates without ethnicity (MYEPOP). The resulting estimates were geo-converted to health administrative areas for use by Public Health England. The method's accuracy was tested by comparing the 2019 ethnic compositions of region/age populations in ETHPOP/MYEPOP with Annual Population Survey (APSPOP) estimates. In England, shares of most ethnic groups were very similar. However, the White share was 1.4% higher in the APSPOP estimates and the Mixed Share was 0.7% lower than in the ETHPOP/MYEPOP estimates. Therefore, the ETHPOP/MYEPOP estimates were adjusted to agree with the APSPOP survey results. For 2020 and 2021, no mid-year population estimates were available at time of writing, so sub-national projected populations (ONS SNPP) were substituted. We demonstrate the difference that these new estimates make to Covid-19 rates for local areas. However, the "shelf life" of our estimates will be short. They should be revised once the MYEPOPs for 2020 and 2021 and the 2021 Census populations are available.

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The contribution of socio-demographic variables to COVID-19 cases and deaths in Indonesia: A spatial modelling approach
Ayesha Tantriana & Yolanda Wilda Artati; BPS-Statistics Indonesia

Understanding the contribution of socio-demographic factors to the incidence of COVID-19 is crucial in effectively controlling the transmission. In this study, the global and local spatial association between the key socio-demographic variables and COVID-19 cases and deaths were analyzed using the spatial regression models. Using 11 socio-demographic variables, the spatial regression modelling and mapping were implemented using Geographically Weighted Regression (GWR). The COVID-19 cases and deaths data were retrieved for 2nd March 2020 to 14th March 2021 from the Indonesian COVID-19 hub site, while the independent variables were obtained from official statistics produced by BPS-Statistics Indonesia. The results shows that the GWR model best explains the spatial distribution of COVID-19 in Indonesia, which represent 78 percent of confirmed cases and 72 percent of reported deaths at province level. The influences of the selected variables on both the cases and deaths were found highest in Java islands, which include the capital city, Jakarta. Our analysis reveals that the selected demographic and socio-economic components, including total population, age structure, poverty, income, are the key factors in determining COVID-19 infections and deaths.

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The spatiotemporal pattern of COVID-19 mortality and its relationship with socioeconomic and environmental factors in England

Zhiqiang Feng; Scottish Centre for Administrative Data Research, School of Geosciences, University of Edinburgh

This paper investigated the spatiotemporal pattern of COVID-19 mortality and its socioeconomic and environmental determinants in the first and second waves of the pandemic in England. The COVID-19 mortality data was acquired from the Office for National Statistics (ONS) including monthly numbers of deaths for middle super output areas (MSOAs) from March 2020 to March 2021. Demographic, socioeconomic, and environmental variables were selected based on a review of literature and were collected from ONS, UKDS, DEFRA, and MHCLG sources. Confirmed COVID-19 cases for local authorities were collected from Public Health England (PHE). SaTScan was used in the analysis of spatiotemporal pattern of COVID-19 mortality and geographically weighted Poisson regression (GWPR) was used to investigate the association with socioeconomic and environmental factors. The results show that there was significant spatiotemporal variation in hotspots of COVID-19 deaths with the hotspots moving from regions where the COVID-19 outbreak initiated and then spreading to other parts of the country. At the end of the first and second waves the limited number of hotspots were scattered across northwest and southeast England. The GWPR analyses were carried out separately for first wave and second waves. It was found that age composition, ethnic composition, deprivation, care home residence and pollution were all related to COVID-19 mortality. Although the relationship varied over space, the association with these factors was fairly consistent over the first and second waves.

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Understanding changing spatial mobility during the Covid crisis: Mapping daily activities in Stockholm in 2019, 2020 and 2021

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The analysis maps how daily spatial behaviour in metropolitan Stockholm changed when restrictions were first imposed in 2020, comparing them with a pre-restriction benchmark from 2019, and then examining 2021 behaviour to explore whether there were durable changes or if fatigue set in to weaken the impact of restrictions on behaviour. It is based on a mobile phone NDR all-age dataset from a major (anonymous) provider which gave finely-grained geographical data in urban areas with high mast densities. The results show that the restrictions led to (a) a concentration of daily activities around home; (b) a change from 'normal' that outweighed seasonal and monthly differences in activity; and (c) the continued effectiveness of restrictions through lockdown as activity patterns in March 2021 were similar to March 2020. The use of socio-demographic and land use data attached to home location shows that the changes in behaviour between 2019 on one hand and 2020 and 2021, on the other, were greatest for those areas outside the urban core where daily-activity spaces were larger and for areas with high amounts of green space and water. The analysis demonstrates the utility of mobile phone data for understanding aggregate daily routines across populations, in near real time, and suggests that social groups in more peripheral areas made relatively large changes in behaviour in comparison to other places.

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4.30pm Wednesday 15 September: Covid-19: Basic genetics & impact on mortality (75-minute session)

The Covid-19 pandemic: A geneticist's perspective

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Information on the biological basis of the Covid-19 pandemic, and of the virus that has caused all our troubles, has been largely inaccessible to non-specialists. As a geneticist with experience in both virology and the

genetics of populations, I address this situation by describing the technical details in plain language: the anatomy, growth, and genetics of viruses, and how they cause disease; the design of current vaccines and aspects of the immune response; the rapid evolution of the virus and prospects for the pandemic's future. The SARS-CoV-2 virus is unique in human history. Its effects are highly variable, ranging from no symptoms at all, to flu-like illnesses, to severe pneumonia. It is 20 times more lethal than seasonal influenza. There is to-date no cure; treatment continues to be mainly palliative. A central difficulty in stemming the pandemic is that the virus is remarkably contagious, due to its unique mode of person-to-person transmission by micro-droplet aerosols, and to the presence of non-symptomatic but infectious carriers. These aspects have hindered traditional track-and-trace methods from containing the pandemic. Effective antiviral vaccines became available in early 2021, a year after the pandemic's onset. Their effects in stemming the pandemic remain unknown. Knowledge of the pandemic's biological and genetic details may serve to inform other areas of inquiry, including impacts on human populations, public health and medical practice, economics, and social cohesion. This paper provides key genetic and immunological knowledge tailored for social scientists.

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Comparisons of all-cause mortality between European countries and regions: 2020
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The Covid-19 pandemic has led to greater scrutiny of official mortality statistics from expert analysts, policy makers, politicians, media and inquiring citizens alike. Indeed, it has exposed to a wider audience the complexity of answering relatively straightforward questions, such as which country has suffered most acutely from the pandemic? In this paper, we explore the concept of 'excess deaths' in the context of the covid-19 pandemic during 2020. We frame our analysis around two measures: Relative Age-Standardised Mortality Rates (rASMRs), to evaluate the deviation of mortality during an observation period with the average rates of the recent past; and Relative Cumulative Age-Standardised Mortality Rates (rcASMRs), which performs a similar function but for cumulative deviation. These measures have been chosen as they allow for the greatest comparability between populations. These measures have allowed for insightful comparative analysis of mortality, especially during the pandemic. We find that patterns of excess mortality varied widely across Europe, following the spread of infection. Further to the geographical differences, variation was observed across age groups, cities and 'waves' leading to a complex picture across the continent. By the final week of the calendar year, Poland had seen the greatest cumulative deviation of all-cause mortality of any of the 26 European countries in our analysis at 11.6%. The United Kingdom, by the same measure, saw a cumulative deviation of 7.2% and was ranked as the eighth highest in Europe. In our analysis, six European countries saw cumulative mortality rates below the 2015-2019 average in 2020.

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Excess mortality in the Italian Local Labour Market Areas during the first waves of the COVID-19 pandemic
Corrado Bonifazi, Daniele De Rocchi, Frank Heins, Giacomo Panzeri; Institute for Research on Population and Social Policies of the Italian National Research Council (IRPPS-CNR)

The contribution explores excess deaths and excess mortality rates in the Italian Local Labour Market Areas since the start of the pandemic until summer 2021. The paper aims at measuring and understanding the general sex and age specific trends in a geographic context. Whereas excess deaths were concentrated during the first wave of the pandemic in Northern Italy in the subsequent waves it also spread to other Italian areas. Are there any socio-demographic and socio-economic determinants that make areas more susceptible to the mortality effects of the pandemic? Could the performance of the regionally organised National Health System have an impact? Excess deaths and excess mortality are estimated comparing the sex and age specific trend of the number of deaths and of mortality rates since the start of the pandemic with the situation in previous years. Daily mortality data by age and sex for all Italian municipalities have been published by ISTAT on a regular basis since 4 May 2020 for the period since 2011. Descriptive methods and standard demographic analysis, as well as spatial regression are applied. During the first wave of the pandemic, we observe a sharp increase in the number of deaths at the national level towards the end of March 2020. However, this increase was very much concentrated in northern Italy and especially in Lombardy (including Bergamo), the epicentre

of the COVID-19 pandemic. Due to the general lockdown and social distancing measures, the impact was mitigated in other areas, but these areas were more affected during the waves that followed.

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A relational model to assess COVID-19 impact on mortality at a sub-national scale: the case of Belgian districts
Benjamin-Samuel Schlüter, Bruno Masquelier; Université Catholique de Louvain (UCLouvain)

The COVID-19 pandemic has caused major mortality shocks in many countries, leading to a halt in life expectancy gains, and in some cases, a setback of several years. Yet few studies have investigated how to capture the shock on mortality at the subnational level to account for the substantial heterogeneity in transmission patterns and case-fatality rates. We apply a flexible statistical estimation combining Poisson regression with the TOPALS relational model within a Bayesian estimation framework to model mortality rate schedules in Belgium at the district level in 2020. From these estimates, we propose to use four metrics: mortality rate ratios (MRR), year-by-year ratios of lost years, life expectancy at age 60 years old and at birth where we also perform Arriaga decompositions. Using these different perspectives, we try to fully understand how various districts have been impacted by the pandemic. The Bayesian modelling approach provides estimates of the underlying uncertainty associated with these metrics. Our results suggest that ranking districts is difficult due to the uncertainty associated with the estimates and is dependent on the metric selected for comparison. Across districts, the excess mortality in males seems to be unrelated to that in females. Providing sub-national mortality estimates with their uncertainty is key to understand why certain areas have been hard hit in comparison to others.

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The impact of the COVID-19 pandemic on mortality in Scotland
Daniel Burns, Lucy Pilkington; National Records of Scotland

Provisional figures on the numbers of deaths in Scotland for 2020 show an 11% increase in deaths over the last year. This is compared to the average for the previous five years. National Records of Scotland have included a range of additional data from the past year regarding COVID-19 to their regular mortality analysis. These data have provided more insight into how the pandemic has affected Scotland's population, and can be broken down by excess deaths by factors such as cause, location, geography and age-group. This in turn has proved to be a key tool in informing government decisions during the pandemic.

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