

Health & mortality 1 — Mortality measurement, life expectancy and inequalities

Excess mortality in a haystack: Modelling measurement error improves estimates of the death tolls and consequences of epidemics

Hampton Gaddy – LSE/University of Oxford

Excess mortality estimates are noisy indicators of epidemic mortality. This creates two problems for existing literature: the precision of epidemic death toll estimates is often overstated and the size of the social, political, economic, and health effects of epidemics is often underestimated. Solutions to both of these problems lie in the fact that the error of an excess mortality estimate is fairly predictable: it tends to be larger in communities with small population sizes, high baseline mortality, overdispersed baseline mortality, little baseline data, and long epidemic periods. Using those variables, one can derive the expected error of three common excess mortality estimators and use estimates of that error to refine estimates of epidemic mortality and its consequences. Examples from the 1918 influenza pandemic show the importance of accounting this error. The confidence intervals on many existing estimates of the pandemic's mortality in European countries are too narrow by a factor of at least 1.5 to 5. Using simulation extrapolation (SIMEX) to correct for attenuation bias suggests that recent estimates of the pandemic's effect on the decline in educational achievement of children in the United States and the decline in right-wing voter share in Weimar Germany underestimated its effect by 10% and 20%, respectively.

Not too many options. How age-at-death distributions shape life expectancy levels over time?

Jesus-Daniel Zazueta-Borboa - University of Oxford, Wen Su - University of Oxford, Ugofilippo Basellini - Max Planck Institute for Demographic Research, Antonino Pollizi - Max Planck Institute for Demographic Research, Jennifer B. Dowd, University of Oxford

How long are we going to live? This is a central demographic question with significant social and economic implications. Traditionally, demographic research has approached it by examining trends in life expectancy, often yielding contrasting views: some argue that life expectancy is approaching a biological limit, while others contend that it can continue to rise indefinitely. Yet a key element is missing from this debate: different populations can achieve the same level of life expectancy while exhibiting markedly different age-at-death distributions. Recognizing this expands our understanding of longevity trends—not only by focusing on life expectancy itself, but by considering the diverse pathways through which populations reach similar life expectancy levels. We will use period and cohort life tables for HMD countries, with the goal of including period life tables from UN WPP 2024. We will perform statistical analysis to model the average-at-death distribution for a certain life expectancy level, and we will compare how much countries, when they have this level of life expectancy, deviate from this average.

Assessing United States mortality at fixed life expectancy thresholds

Antonino Polizzi - Max Planck Institute for Demographic Research, Leah Abrams - Department of Community Health, Tufts University, Jennifer Beam Dowd - Leverhulme Centre for Demographic Science, University of Oxford, Neil Mehta - Department of Epidemiology, University of Texas Medical Branch, Mikko Myrskylä - Max Planck Institute for Demographic Research

Historical and recent trends in United States (US) mortality have received considerable attention in the academic and non-academic literature. Much of the existing research compares the levels and trends of age-specific mortality in the United States and other countries at a given point in time, despite dramatic differences in life expectancy levels between these countries. Here, we offer an alternative assessment of US mortality rates by using fixed life expectancy thresholds. Using data from the Human Mortality Database, we compare age-specific mortality rates in the United States with those in high-income peer countries when the countries reached fixed levels of life expectancy. Focusing on the last ten life expectancy thresholds reached by the United States, we observe considerable variation in how countries reached each life expectancy threshold. Using counterfactual analysis, we present different scenarios under which the US could reach higher life expectancy thresholds.

Analyzing the health transition through convergence in cause-specific subnational mortality in Mexico

Ana C. Gomez-Ugarte - Max Planck Institute for Demographic Research, Ugofilippo Basellini - Max Planck Institute for Demographic Research, Carlo G. Camarda - Institut national d'études démographique (INED), Emilio Zagheni - Max Planck Institute for Demographic Research, Fanny Janssen - Aging and Longevity, Netherlands Interdisciplinary Demographic Institute - KNAW/University of Groningen

The convergence-divergence framework provides a valuable lens for understanding the dynamics of mortality inequality over time, yet its application remains limited in low- and middle-income countries (LMICs), where health transitions are often shaped by structural inequalities. Mexico, a country with large socioeconomic disparities and diverse epidemiological patterns at the subnational level exemplifies the complexity of health transitions in LMICs. This study applies the convergence-divergence approach to subnational mortality trends across 32 Mexican states from 1990 to 2019 to analyze patterns of mortality convergence and divergence by sex. Using a decomposition approach, we identify the states and causes of death that most significantly drove the observed trends. Results show an overall trend of convergence between 1990 and 2019, interrupted by three short periods of divergence. Convergence was primarily driven by substantial declines in mortality from communicable diseases in the most marginalized states. However, this convergence was offset by rising mortality from diabetes, particularly in high-marginalization states, where diabetes mortality continues to increase. Notably, convergence was also driven by increases in violent deaths in relatively advantaged states, highlighting that convergence can arise not only from improvements in mortality but also from adverse shocks in vanguard states. Despite overall improvements in mortality, the order of the subnational mortality gradient remained relatively stable over time, as less advantaged states continued to experience adverse mortality conditions from non-communicable diseases. These findings reveal that stages of convergence and divergence in Mexico have different drivers than those observed in high-income countries, highlighting the need for context-specific models of health transition in LMICs.

Health & mortality 2 — International perspectives on health inequalities, care-seeking, and mortality transitions

Does it take two? A cross-national study of healthcare agency in high-income settings

Klarriness Pacheco Tanalgo & Chia Liu - University of St Andrews

Healthcare decision-making within partnerships remains understudied in high-income countries, where individual agency is assumed. Using data from the Generations and Gender Survey (GGG-II) across five high-income countries in Western Europe and East Asia, this study examines the individual and relational determinants of joint versus sole healthcare decision-making among 11,158 partnered adults aged 40–59 using sex-stratified binary logistic regression models. Results reveal a distinct geographical difference in healthcare agency: respondents in East Asian contexts report significantly higher probabilities of joint decision-making compared to their Western European counterparts. While there is a consistent gendered reporting gap – where males are significantly more likely to report joint decision-making than females – the influence of partner characteristics is highly gendered. For women, higher educational attainment relative to their partner and the presence of a sole-earning spouse are associated with lower odds of joint decision-making; for men, these dyadic gaps are not significant. These findings challenge the assumption of universal individual agency in high-income countries and highlight the persistent role of partner dynamics in shaping healthcare agency in middle age.

Revisiting the dual achievement: cohort life expectancy and lifespan inequality in Latin America and high-income countries

José Andrade - Max Planck Institute for Demographic Research, Héctor Pifarré i Arolas - University of Wisconsin-Madison

This study revisits the “dual achievement” of increasing life expectancy alongside declining lifespan inequality by comparing long-term mortality trends in Latin America and high-income countries. In high-income settings, gains in longevity have historically been accompanied by more equal ages at death, reflecting simultaneous improvements in both survival and lifespan equality. Whether this pattern holds in regions with higher inequality and more volatile mortality conditions, such as Latin America, remains an open question. Using cohort data for individuals born between 1841 and 2000, we analyze changes in life expectancy and

lifespan inequality across both regions. Mortality data were obtained from the Latin American Mortality Database and the Human Mortality Database, supplemented with projections from the UN World Population Prospects (2024). Lifespan inequality, was decomposed by age using the Horiuchi et al. (2008) method to identify age-specific contributions. Results show that lifespan inequality has declined in both regions since the late 19th century, although it has remained consistently higher in Latin America. While declines began earlier in high-income countries, Latin America experienced a later but more rapid reduction, largely driven by improvements in infant and child mortality. At comparable levels of life expectancy, Latin America generally exhibits steeper reductions in inequality, except at the highest levels. Overall, the findings suggest that Latin America has followed the dual achievement pathway, though future progress will depend on continued mortality improvements across age groups.

Health & mortality 3 — Computational, AI and modelling innovations in population health

The glass is half empty: The role of highly automatable jobs in shaping drinking behaviours in Russia Mariia Vasiakina & Christian Dudel - Max Planck Institute for Demographic Research (MPIDR)

Objectives. Recent research suggests that automation may harm workers' health by increasing the risk of job displacement and requiring constant skill adaptation. However, the relationship between automation risk and adverse health behaviors, such as alcohol consumption, remains largely overlooked, despite its potential role as a key mechanism linking automation exposure to broader health outcomes. To fill this gap, we investigate the relationship between high automation risk – arising from the concept of routine task intensity (RTI) and measured at the occupational level – and multiple drinking behaviors, including alcohol use, active drinker status, and total monthly alcohol consumption (measured in grams of pure ethanol) among male and female workers in Russia.

Methods. We combine individual-level data from the Russian Longitudinal Monitoring Survey (2017–2021) with occupational task content data based on the International Standard Classification of Occupations (ISCO-08) and apply panel regression techniques to investigate the relationship of interest. We also explore whether self-reported job insecurity, low labor market viability, and dissatisfaction with growth opportunities at work may serve as transmission mechanisms between automation risk and drinking behaviors. Finally, we test whether additional physical (e.g., manual handling, awkward postures, vibration exposure) and psychosocial (e.g., high job demands, limited autonomy, low social support from supervisors or colleagues) workplace stressors act as moderating factors in our analysis, amplifying the psychological strain associated with automation-related displacement risk and thereby increasing the likelihood that workers adopt certain coping mechanisms, such as alcohol consumption.

Results. Our findings show that high automation risk is positively related to all examined drinking behaviors among women, while no significant effect is found among men. Our results also indicate that, in the Russian context, dissatisfaction with growth opportunities at work is a key pathway linking high automation risk to both active drinker status and total alcohol consumption among women. Finally, high physical exposure at work tends to moderate the relationship between high automation risk and alcohol use in the female subsample.

Discussion. Overall, we demonstrate that adverse health behaviors might be a plausible mechanism through which automation risk affects workers' health. In addition, our findings underscore the presence of gender-specific occupational and sectoral segregation in the Russian labor market, thereby providing a foundation for more targeted future research.

Microbial signatures of disease: Classifying diabetes with microbiome data in a US cohort Ekaterina Degtiareva, Andrea Tilstra, Charles Rahal, Jennifer Dowd - Leverhulme Centre for Demographic Science, University of Oxford

This study asks whether gut microbiome data improve the classification of diabetes beyond established sociodemographic and clinical risk factors in a population-based setting. We use the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative US cohort with rich life-course, demographic, and health measures, now linked to 16S rRNA sequencing of the gut microbiome. Our analytic

sample includes 1,384 adults with microbiome data and harmonised diabetes measures.

We first construct and document a microbiome feature set designed for population science applications, including alpha diversity (e.g., Shannon), beta diversity summaries, relative abundances of common taxa, and inferred functional profiles (pathway-level features). We then estimate a benchmark logistic regression model and compare it to several machine learning classifiers—penalised regression (LASSO), random forest, gradient boosting (XGBoost), and support vector machines—trained on (i) traditional risk factors only and (ii) risk factors plus microbiome features. Model performance is assessed using out-of-sample AUROC, F1 score, sensitivity, specificity, and calibration diagnostics.

Preliminary results suggest that, in this general-population sample, adding microbiome-derived features yields little to no incremental predictive value over conventional predictors, despite clear between-person variation in microbiome composition. This null finding is substantively important given both the current enthusiasm around microbiome “signals” and the practical challenges of specifying stable, interpretable features from high-dimensional sequencing data. By providing a transparent feature-construction pipeline and rigorous validation framework, this study helps calibrate expectations about the predictive utility of 16S microbiome data for metabolic disease classification and offers a template for integrating complex biosocial data into population science.

Health & mortality 4 — Social determinants of health in high income countries

UK trends in cardiovascular disease risk factors

Mary K. Roberts, Jennifer Dowd, Jesus Daniel Zazueta Borboa, Wen Su - Leverhulme Centre for Demographic Science

Cardiovascular disease (CVD) remains a leading cause of mortality in the United Kingdom. While there were improvements in CVD mortality over recent decades, progress has stalled in recent years. CVD is strongly influenced by modifiable clinical and lifestyle risk factors. Understanding trends in these risk factors is essential for interpreting changes in CVD mortality and identifying emerging inequalities. This study aims to examine long-term trends in clinical CVD risk factors in England from 1993 to 2024, and to assess how these patterns vary across sociodemographic groups. Data are drawn from the Health Survey for England, a household survey of individuals aged 16 years and over, which includes both self-reported information and objective clinical measurements. We will estimate age-standardised prevalence of individuals exceeding established clinical cut-points for major CVD risk factors: systolic blood pressure (≥ 130 mmHg), diastolic blood pressure (≥ 80 mmHg), body mass index (≥ 30 kg/m²), waist circumference (≥ 102 cm in men; ≥ 88 cm in women), total cholesterol (≥ 6.2 mmol/L), and glycated haemoglobin (HbA1c ≥ 48 mmol/mol [$\geq 6.5\%$]). Analyses will incorporate survey weights to ensure national representativeness. Prevalence estimates will be stratified by sex, region, and educational attainment to examine disparities and temporal trends across population subgroups. By providing a comprehensive overview of changes in major CVD risk factors over three decades, this study aims to inform public health policy and contribute to understanding the drivers of persistent CVD burden and inequalities in England.

Shepherds and shopkeepers: Working from home and health in the COVID-19 lockdown: Evidence from household microdata from the 2021 England and Wales Census

Nicola Shelton, Andreas Mastroavvas, Oliver Duke-Williams, Azsvin Mariathan - UCL

The 2021 Census in England & Wales was carried out in a national lockdown with recommendation to work at home. This data is unique for exploring homeworking feasibility and reality. The paper will explore the health of those working at home and out of home by occupation, industry and location. It will examine working from home and health during the COVID-19 pandemic using 2021 England and Wales Census household microdata.

The UK government identified a group of people as recommended to shield (drastically minimise contact with others including no in-person working) during periods of lockdown, many of whom were over state pension age and likely to be retired. Little is known about the health characteristics of those of working age by their occupation, industry employment location.

Certain workers in occupations and industries were more likely to have to be carried out their roles in person. This paper uses variables on employment status, occupation, industry, location, general health status and limiting long term illness to explore geographical and occupational and industry differences in health of those not in work, working from home, those with home as a depot/base (e.g. shepherds) and those working in person (e.g. shopkeepers).

The research questions being addressed are which occupations and industries employ people with poor general health and /or limiting long term illness and to what extent those with poor general health and /or limiting long term illness were more likely to be working from home or not be in paid work.

Health & mortality 4 — Social determinants of health in high income countries

Can health lifestyles explain the marriage benefit?

Andrea Tilstra - University of Oxford, Elizabeth Lawrence - University of Nevada, Las Vegas, Nicole Kapelle - Trinity College Dublin

Married people have, on average, better health outcomes than unmarried people, including self-rated health. The “marriage benefit,” or the causal interpretation of better health among married people, can be explained by economic resources, social control, or psychosocial support and strain. These explanations, however, neglect the roles of agency and identity of individuals within a marriage, which may motivate healthier behaviors. Health lifestyle theory argues that individual health behaviors do not exist in isolation but are instead clustered together and contextualized in identity. In this paper, we examine the health behaviors and lifestyles among married, cohabiting, and single people in Australia and the United States. Our data come from the 2021 waves of the Household, Income and Labour Dynamics in Australia (HILDA) Survey and the National Health Interview Survey of the United States. Restricting to individuals ages 25-64 and separately for each country, we first run Latent Class Analyses to identify health lifestyles, describing how they differ across marital status, and also across gender, education, parenthood status, and country. We will soon run a series of Oaxaca-Blinder decompositions to ascertain which is better for explaining the gap in self-rated health between marital status groups: (a) health behaviors, in isolation? or (b) health behaviors, as a composite measure? Our analyses will provide a window to understand how the social institution of marriage may shape health identity and, through that, self-rated health.

Social class and lifespan inequality in Sweden: Evidence from Birth Cohorts 1841-1920

Marcos Castillo & Martin Dribe - Lund University

How did social class shape not only average lifespan but also its predictability in historical Sweden? While literature documents socioeconomic gradients in average longevity, less is known about whether disadvantaged groups faced greater uncertainty in the timing of death, and whether this burden has long historical roots or is a modern phenomenon. This paper provides a long-run perspective on lifespan variation by social class in Sweden, using birth cohorts from 1841 to 1920.

We draw on two complementary data sources: the Swedish Death Index (1815-2022), a comprehensive register of deaths, and linked full-count censuses from 1880 to 1950, supplying occupational information to assign individuals to six social classes. To isolate adult mortality patterns, all measures are conditioned on survival to age 40. Our primary measure is life disparity, which captures average years of life lost at death and can be decomposed by age. We complement this with the Theil index and variance in age at death.

Preliminary results show lifespan variation declined substantially across cohorts for both sexes, but the pace and pattern differed markedly by class and sex. Among men, white-collar workers exhibited the highest lifespan variation in early cohorts, while farmers consistently showed the lowest. Among women, class differences were smaller but consequential at the bottom: unskilled women faced shorter average lifespans and higher variation, a double disadvantage that persisted across much of the period. These findings suggest that mortality compression into older ages was a socially uneven process, and lifespan’s predictability has long been stratified by class.