Longevity: Early-life Conditions, Social Mobility and Other Factors that Influence Survival at Old Age

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Programme Committee: Tommy Bengtsson, chair (Lund University), Juan Merlo (Lund University), and Geraldine P. Mineau (University of Utah).

Seminar Report

The importance of conditions in early life for health and mortality in later life is well-known from the existing literature on developing countries but also from studies in historical demography. Epidemiologists and demographers studying the mortality decline in the 1920s and 1930s were well aware of the connection between early-life conditions and mortality later in life. Analyzing aggregated data they noticed that mortality for infants and children went down much earlier than for adults. Each generation seems to experience the same relative mortality from childhood to old age. Studies of urban France and Sweden also emphasize the importance of cohort factors in explaining the mortality decline. Other studies, however, question cohort factors as main causes and imply that factors that vary over the life course, such as income and improvements in public health and medicine, are more important than conditions in childhood. While the studies mentioned above all made use of aggregated data, more and more studies, both within medicine and historical demography are conducted at the individual level stimulating the field to expand rapidly.

The extensive research during the last decade has shown that early-life conditions, life course transitions (e.g., social mobility), prevailing living conditions and genetic factors influence mortality in later life. Only by taking all these variables into consideration simultaneously, can one correctly assess their relative importance on health and mortality. This in turn has strong implications not only for research concerning the importance of early-life conditions on mortality later in life, but also for research on the long-term mortality development in general. The research questions posed are clearly multi-disciplinary, linking social sciences and history with epidemiology and social medicine. Hence, the aim of the seminar was to bring together researchers in the field of historical demography and mortality to discuss what importance early-life conditions, social mobility and other factors have on survival to older ages. It also explored the potentials of using historical databases for other research agendas than historical demography and promoted research on the mortality decline and the increase on longevity.

Papers were sought that:

- were based on on-going research and new findings;
- investigated differentials in mortality according to experienced early-life conditions
- used longitudinal data from different settings: Canada, China, Denmark, England and Wales, Italy, Sweden, and USA.

Twelve papers were presented and discussed.

Tim Bruckner discussed the hypothesis of a "diminished entelechy" which implies that birth cohorts subjected to virulent environmental insults early in life do not realize their otherwise expected lifespan. To test this hypothesis, male and female births from three data sets were studied: Sweden between 1751 and 1912, Denmark from 1835 to 1913 and England and Wales from 1841 to 1912. They measured the association between mortality in the first five years and life expectancy at age five. The results presented support the initial hypothesis, meaning that suffering relatively virulent environmental insults during infancy reduces the subsequent lifespan. Positive intra-cohort associations between infant mortality and subsequent mortality for the 1 to 5 and 5 to 20 year age groups were found, but not for mortality in older ages.

Gerard J. Van den Berg used indicators of conditions early in life exogenous to mortality later in life to analyze their effects on individuals' lifespan. By using the Danish Twin Registry Data, the authors analyzed the survival of twin pairs born in Denmark between 1870 and 1930 from birth until their death or until the end of observation. The data provide information on the cause of death. Annual GNP and time series on inflation, unemployment, infant mortality, and food prices were included in the analysis in order to capture the conditions during childhood. It was underlined that the cycle at birth has a significant effect. On average, being born in a recession implies a higher mortality rate later in life. Food price deviations in the birth year are shown to have no sizeable or significant effect on the mortality rate later in life. However, the effect of the business cycle at birth on the mortality rate due to cardiovascular diseases was large and significant; this did not hold true for cancer mortality.

Alberto Palloni proposed to integrate perspectives deriving from different domains to study the persistence of adult health and mortality and socioeconomic inequalities into the same framework. The model presented foresees specific procedures to estimate a) the degree to which social mobility or lack thereof is influenced by early health conditions, and b) the contribution of early health status to observed adult health differentials. The data used are from the 1958 British Cohort Study (National Child Development Study, NCDS). The final estimates derived from the models were transformed and used as input in a Monte Carlo simulation study of social and health mobility. It emerged that early child health has an important, albeit not the most important, role in the determination of adult social class positions.

In section 2, **Geraldine Mineau** examined how early family circumstances such as parental mortality, parental fertility, religious upbringing, and parental SES may effect mortality risks later in life. These were compared to influences of adulthood circumstances. Through the analysis of a sample of 12,000 sib-pairs (first-born/last-born brother pairs and first-born/last-born sister pairs) from the Utah Population Database (UPDB), the researchers used frailty models to estimate the effect of familiar variables. Modest effects of key childhood conditions (birth order, sibship size, parental religiosity, parental SES, and parental death in childhood) were found. The strongest predictor of longevity after age 50 was familial excess longevity (a genealogically-based measure) and parental longevity.

The contribution of **Tommy Bengtsson** discussed whether socioeconomic factors during the life-course mediated the effects of the level of disease load experienced during the birth year. The data used come from five rural parishes in southern Sweden, 1829–1894 and mortality among ever-married persons in ages 50–80 years was analysed. By including random effects, the authors controlled for possible dependencies in the data due to kinship and marriage. While a negative situation during early childhood has an impact on a person's ability to accumulate wealth, no support was found for the hypothesis that the socioeconomic experience in adulthood may alter the negative influence on old age mortality originating from the disease load in the first year of life. Socioeconomic situation in adulthood simply did not influence remaining life span.

Andrew Noymer has postulated that there was selective mortality in the great 1918 influenza pandemic and that tuberculosis (TB) enhanced the risk of death from influenza. Using data from U.S. Union Army veterans he further investigated this selection hypothesis. The results were in the expected direction: exposure to a disease (in this case TB) may enhance the death risk to a different disease (i.e., influenza) later in life, even if the second disease exposure is located many years after the exposure to the first infection. The biology of these two infections rules out reverse causality or simultaneity.

Naomi Spence used the National Longitudinal Survey of Mature Women, which follows a representative sample of American women from 1967–2003, to investigate the mechanisms through which women's fertility patterns (parity and timing of first/last birth) contribute to mortality risks in later life. Findings indicated the existence of a relationship in the US, although the precise nature of the effect varies across racial groups. Early childbearing (before age 18) is associated with higher mortality over a 20-year follow-up of women in ages 45–59. Late age at first birth (after age 27) is associated with higher morality among Blacks. This later association supports a weathering hypothesis, that there are physical consequences from social disadvantages associated with minority status. Parity was found not to be related to post-reproductive morality risks among Whites; however, low parity is associated with higher mortality among Blacks.

Michel Poulain and **Luisa Salaris** presented the case of Villagrande Strisaili (Sardinia, Italy) which today exhibits high ELI (extreme longevity index) values. Despite very high infant and child mortality rates for cohorts born between 1866 and 1915, it was found that one out of five newborns reaches 80 years. Using a family reconstructed dataset, the researchers used different variables to investigate the impact of early life conditions on the probability of reaching older ages. From the analysis of the effect of month of birth and height, it emerged that these variables had a limited effect on individuals' propensity to reach older ages. To estimate the contribution of the heritable component of longevity, they considered the parents' characteristics and found no significant effects. The role of the cohort effects shows a negative correlation between level of infant and child mortality and the proportion of individuals surviving to 50 to 80 years old was found.

Alain Gagnon investigated the relation between parental death, infant mortality in sibships, and the presence of epidemics in early life. Using data from old Quebec, the analyses focus on the longevity of children born between 1680 and 1739. Covariates include regional variation, secular trends, and parental and spousal survival. Results provide no firm evidence to support a detrimental effect of early life exposure to contagious diseases. They have observed an increase in infant mortality over time to be associated with a decrease of adult mortality in the same cohorts. This is probably due to period improvements in later life health conditions and would have benefited the more recent cohorts.

Cameron Campbell discussed findings from northeast Chinese household registers. The research examines how living arrangements early in life affected mortality and, more specifically, considers whether and how the presence or absence of parents early in life affected mortality outcomes in adulthood and old age. To control for unobserved characteristics of the household fixed-effect models were estimated, comparing survival of cousins sharing the same household. Campbell and Lee found that the loss of a parent in childhood had profound effects on male adult mortality. Particularly the death of a father was shown to have longer-term consequences. Regarding mothers, the earlier the loss of the mother, the more substantial the long-term impact.

Diana Kuh presented results from the analysis of a cohort of 4,454 men and women followed since their birth in March 1946 in England, Scotland and Wales. The authors investigate to what extent cognitive ability explains the effects of early social conditions on morality risk by age 59. The analysis considers the effects of socioeconomic conditions, cognitive development and educational process on premature adult mortality. Lower survival rates were found for those who came from manual origins and effect of childhood socio-economic conditions were stronger for women than for men. Factors such as childhood cognitive development and educational process were introduced and mediated the influence of childhood social class. Lower death rates in men and women living in non manual social class households in early adult life were accounted for by adolescent cognitive ability; smoking behaviour was a less important explanation. Men with stable jobs live longer and cognitive ability, emotional stability and early occupational careers are also related to mortality in this cohort.

Finally, the contribution of **Bitte Modin** showed that individuals born inside wedlock (BIW) in early twentieth century Sweden are significantly more likely to be alive at age 80 compared to those who were born out of wedlock (BOW). The research takes this analysis one step further by examining whether the sons and grandsons of those BOW are disadvantaged compared to the corresponding descendants of those BIW. The research data were based on the UBCoS Multigeneration database consisting of 12,168 individuals born at Uppsala Academic Hospital in 1915–29 (U-F1), their children (U-F2) and grandchildren (U-F3). Results showed that sons of men and women BOW were significantly shorter and had significantly lower psychological functioning and general ability compared to sons of parent(s) BIW. A weaker, but statistically significant, disadvantage in psychological functioning and general ability was found also among the corresponding grandsons. These grandsons also had a generally higher BMI.

Papers presented at the International Seminar on Longevity:

"A Time Series Test of Diminished Entelechy in Birth Cohorts", **Tim Bruckner**, (University of California at Berkeley) and **Ralph Catalano** (University of California at Berkeley)

"Early Life Conditions and the Cause of Death Later in Life", **Gerard J. van den Berg** (Free University Amsterdam/IFAU-Uppsala), **Gabriele Doblhammer-Reiter** (University of Rostock), and **Kaare Christensen** (University of Odense)

"Early childhood health, reproduction of economic inequalities and the persistence of health and mortality differentials", **Alberto Palloni** (University of Wisconsin-Madison), **Carolina Milesi** (University of Wisconsin-Madison), and **Alyn Turner** (University of Wisconsin-Madison)

"Effects of Childhood and Middle-Adulthood Family Conditions on Later-Life Mortality: Evidence from the Utah Population Database, 1850-2002**", Ken R. Smith** (University of Utah), **Geraldine P. Mineau** (University of Utah), **Gilda Garibotti** (University of Utah), and **Richard Kerber** (University of Utah)

"Direct and indirect effects of conditions in early life on old age mortality, Southern Sweden, 1829-1894", **Tommy Bengtsson** (Lund University) and **Göran Broström** (Umeå University)

"Testing the influenza-tuberculosis selective mortality hypothesis with Union Army data", **Andrew Noymer** (University of California at Berkeley)

"Age at First Birth, Parity, and Post-Reproductive Mortality among White and Black Women in the US, 1982-2001", **Naomi Spence** (Florida State University) and **Isaac W. Eberstein** (Florida State University)

"From birth to death in a population experiencing exceptional longevity: The case of Villagrande Strisaili (Sardinia)", **Michel Poulain** (Université Catholique de Louvain), **Gianni Pes** (Università degli Studi di Sassari), and **Luisa Salaris** (Université Catholique de Louvain)

"Early familial and environmental conditions and longevity in early Québec", **Alain Gagnon** (University of Western Ontario) and **Ryan Mazan** (University of Western Ontario)

"Long-Term Consequences of Conditions in Childhood in Liaoning, China, 1749-1909", **Cameron Campbell** (University of California, Los Angeles) and **James Z. Lee** (University of Michigan, Ann Arbor)

"Explanations for the influence of early social conditions on longevity: findings from the British 1946 birth cohort study", **Diana Kuh** (MRC, University College London), **Marcus Richards** (MRC, University College London), **Rebecca Hardy** (MRC, University College London), and **Michael Wadsworth** (MRC, University College London)

"The Impact of Early Twentieth Century Illegitimacy across Three Generations: Intra-generational longevity and inter-generational health correlates", **Bitte Modin**, (Stockholm University/ Karolinska Institutet), **Ilona Koupil** (Stockholm University/ Karolinska Institutet), and **Denny Vågerö** (Stockholm University/ Karolinska Institutet)