Changes in Length of Grandparenthood in Finland 1790-1959

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Abstract

The importance of grandparents for their grandchildren is well-studied in several disciplines, and studies are now also addressing the potential effects of grandchildren on grandparental wellbeing. Any such effects are limited by the time grandparents share with their grandchildren. Changing child mortality rates, grandparental longevity, and childbearing patterns may have profoundly altered the length of grandparenthood across the demographic transition, but this has received little scientific attention. Using a genealogical dataset from Finland, we investigate changes in this shared time, from the late 18th to mid-20th century. We found the number of shared years between grandparents and grandchildren was low until roughly the onset of industrialisation in Finland, after which point shared time increased rapidly, from both the grandchild and grandparent perspectives. Understanding changing patterns in the opportunity for intergenerational transfers between grandparents and grandchildren has implications for several fields of study, including biology, demography, sociology, health studies, and economics.

Keywords: ageing**,** demographic transition, intergenerational relations, mortality

Introduction

Although human residence patterns have varied dramatically both through time and space, in most societies large family units with close interactions between generations have traditionally been common, even if not all members or generations necessarily lived under the same roof. Living in close proximity to kin offers the chance for positive and negative interactions. Grandmothers in particular are key members of the family, often providing care to their grandchildren: in evolutionary literature, grandmother presence is known to have increased grandchild survival (Beise 2005; Lahdenperä et al. 2004; Sear and Coall 2011; Sear and Mace 2008; Voland and Beise 2002), whilst the presence of a grandmother is also associated with better nutritional status (Hawkes, O'Connell and Blurton Jones 1997; Sear, Mace and McGregor 2000), for example by encouraging their daughter to breastfeed (Mueffelmann et al. 2015). Furthermore, the mental health and cognitive abilities of grandchildren may be affected by the grandmother (Coall and Hertwig 2010; Tanskanen and Danielsbacka 2012).

The potentially beneficial effects of grandmothers to grandchildren may be greatest during the most sensitive periods during child development e.g. weaning (Sear and Mace 2008). For example, in historical Finland, the presence of grandmothers was associated with improved grandchild survival during ages 2-5 (Lahdenperä et al. 2004). A few studies have also shown that in some circumstances, grandmother presence may be associated with negative outcomes for the grandchildren, such as reduced survival (Voland and Beise 2002; Strassmann 2011). Though there is less information on the effects provided by grandfathers - in part because it can be difficult to distinguish between effects of grandfathers and effects arising from grandmother involvement (Tanskanen and Danielsbacka 2012) - it is not completely lacking. Whilst survival of grandchildren was not always affected by grandfather presence in historical populations, for instance, there are still studies that have found (positive or negative) associations between their presence and child survival outcomes (Sear and Coall 2011; Sear and Mace 2008). There is also some limited evidence of grandfathers being as important as grandmothers to grandchild development in contemporary society (Sear and Coall 2011).

Interactions in a grandparent-grandchild dyad are not, however, one-way. Presence of grandchildren can lead to both health benefits and costs for grandparents (Hilbrand et al. 2017), and for grandmothers this can depend on their care 'work-load' and socioeconomic status (Di Gessa, Glaser and Tinker 2016a). The potential effects can differ between study populations. For example, grandmothering has been associated with a greater risk of coronary heart disease in the US (Lee et al. 2003), but also with better health in general in Europe (Di Gessa, Glaser and Tinker 2016b), whilst mental health of both grandmothers and grandfathers can be both positively and negatively affected by looking after grandchildren (Kim, Kang and Johnson-Motoyama 2016). Relatively little is known of the physical health effects of childcare on

grandfathers, however, possibly due to lack of data on the intensity of grandfathering (Di Gessa, Glaser and Tinker 2016b). Furthermore, such impacts of grandparenting on grandparent health are not particularly well-studied in developing countries or for more traditional hunter-gatherer societies.

The extent of the potential effects of grandparents and grandchildren on each other are limited by the number of years a grandchild has a living grandparent. Indeed, variation in the duration of grandparent-grandchild shared time may even explain some of the heterogeneity in the results regarding effects on grandparents and grandchildren, and it is therefore of great importance; in societies with longer shared time, direct care effects are likely to be greater than in populations where shared time is much more limited. The length of grandparenthood is likely to vary not only between individuals, but also through time and space. In particular, decreasing fertility rates, decreasing childhood mortality, and increasing lifespan in relation to industrialisation and the accompanying demographic transition all may have affected the number of years grandchildren and grandparents co-existed. Any changes in the length of grandparenthood could have altered the costs or benefits of grandparenthood for both the grandchild and grandparent. Understanding such changing patterns in the opportunity for intergenerational transfers between grandparents and grandchildren is of importance for several fields, including population health, demography, economy, sociology, and biology (Leopold and Skopek 2015), in particular for evolutionary studies into family formation. For example, effects on grandchild survival might have changed between pre-industrial and industrial society, with the advent of effective healthcare and hygiene measures. However, studies on the length of time a grandchild has at least one living grandparent have thus far been hampered by a lack of detailed information on the mortality of both grandparents and grandchildren or on the number of grandchildren that they may have (Margolis 2016; Uhlenberg 2004). Estimates of shared time have thus not gone beyond the 20th century.

Using historical church records to construct an extensive multi-generational dataset on births and deaths from Finland, we investigate for the first time, to our knowledge, how the length of grandparenthood has changed over an extensive period of time, from 1790s until the cohorts born in 1950s (170 years). This period in Finland coincided, initially, with the typically high fertility and infant mortality rates of the pre-healthcare era (Scranton, Lummaa and Stearns 2016). Industrialisation and the demographic transition began largely from the 1870s/1880s (Hjerppe 1989, Scranton et al. 2016), and by our last study decade in the mid-20th century the average family size per woman had more than halved, childhood mortality had radically reduced, and life expectancy in adulthood had also risen. Our dataset thus offers an exceptional opportunity to investigate the length of grandparenthood under vastly different living conditions within the same country. We first quantify the proportion of grandchildren in each birth cohort who had any grandparent available at all to them at birth. Second, we investigate changes in the number of years grandchildren had at least one grandmother or grandfather available across the different stages of the

demographic transition - these were done in separate analyses. Though grandfathers did not provide survival benefits to grandchildren in historical Finland (Lahdenperä, Russell and Lummaa 2007), we still investigate how their shared time with grandchildren has changed across the demographic transition and beyond, as they are too often overlooked in studies relating to grandchild outcomes. Finally, we investigate from the grandparental perspective how the potential time for grandparent-grandchild relationships changed through time, quantifying how many years a grandparent would have grandchildren to potentially care for.

Methods

The Lutheran church has kept records of births, deaths, marriages and dispersal events in Finland for tax purposes for centuries, and from 1749 onwards these covered all individuals in the country (Gille 1949). We have used such publicly-available church records, as well as published genealogies, for eight parishes of Finland (Hiittinen, Kustavi, Rymättylä, Tyrvää, Pulkkila, Ikaalinen, Jaakkima, and Rautu) to construct pedigrees that follow the life events of known individuals from birth to death across a maximum of 15 generations (Bolund et al. 2015; Pettay et al. 2016). Much of the data pre-dates industrialisation (Bolund et al. 2015), which began in Finland towards the end of the 19th century (Hjerppe 1989).

For this study, we included individuals born between 1790 and 1959 for whom the identities of both grandmothers are known (n = 10,257; n = 3,049 grandmothers), with 9,640 individuals also having known identities for both grandfathers (n = 2,848 grandfathers). We separated individuals into ten-year birth cohorts (i.e. 1790-1799, 1800-1809 and so on), to quantify any changes in the length of grandparenthood alongside changing conditions with time. Sample size between cohorts varied from 137 to 1501. Finland experienced great upheaval during the study period: a war between Sweden (to which Finland belonged) and Russia during 1808-1809 led to Finland becoming a part of the Russian Empire; there was a major famine 1867-1868 (Hayward et al. 2012); Finland gained independence in 1917, and then civil war broke out the following year; and eastern regions of the country were ceded to the Soviet Union following a series of wars from 1939-1944.

We calculated the length of grandparenthood separately for each individual as the number of years that an individual (i.e. grandchild) shared with whichever grandmother (or grandfather) lived longer. For example, if one grandmother died at individual age 4 and the other at age 10, and the individual lived beyond 10 years, the number of shared years for this individual would be 10. The length of time was calculated across the individual's lifespan, not just during childhood. If the death date of the focal individual or any of the grandparents was unknown, the length of grandparenthood was censored at the point (age) when all parties were last recorded as being still alive (or of known death status) by the Church (grandmother

analysis n = 2,354; grandfather analysis n = 1,869). Of the study individuals, 5.1% (n = 528) had no information on grandmothers available at birth, and 4.9% (n = 475) for grandfathers, leading to them being censored already at this point (shared time of 0 years).

From the grandparent perspective (n = 7,227 grandmothers; n = 6,882 grandfathers), we calculated the number of years, again on the individual level, that a grandparent had at least one grandchild whilst still alive themselves, and also the cumulative number of years that they had grandchildren (as an indicator of how they might have to divide potential care between the grandchildren). For the number of years, we totalled all years that a grandmother was alive and had at least one grandchild, regardless of how many grandchildren were alive at the time, e.g. a year in which three grandchildren were living would only count as a single year; for the cumulative number of years, we instead summed the number of years for all grandchildren, e.g. a year in which three grandchildren were living would count as three years. Individuals were censored at the year they were last recorded if they did not have a date of death, or at 0 years if this was before the birth of their first grandchild. Birth cohort for this analysis was taken to be the cohort in which the first grandchild was born.

Analysis was conducted with R 3.3.1 (R Core Team 2016). To determine the extent to which individuals could potentially interact with grandparents, we first calculated the proportion of grandchildren who had at least one grandmother/grandfather alive at birth for each birth cohort. We then used the *Surv* and *coxph* functions from R package *survival* (Therneau 2015) and implemented cox proportional hazards models, which control for censoring. The response variable in the cox models was time spent together, with birth cohort (17-level factor) as the explanatory variable. From these models, we were able to extract the average number of years across different cohorts a grandchild could be expected to share with at least one grandmother/grandfather, the average number of years that grandparents would have grandchildren, and the average cumulative number of years a grandparent would have grandchildren, all using the *survfit* function from the *survival* package.

Results

Figure 1 shows, for each cohort, the percentage of grandchildren with at least one grandmother/grandfather alive at their birth. This has clearly increased through time: in all except one cohort before the demographic transition, less than 75% of grandchildren had at least one grandmother alive at their birth. In contrast, 93.9% of grandchildren born in the 1950s had at least one grandmother alive at birth. For grandfathers, the same value increased from 63.2% in the 1790s to 83.7% in the 1950s. Overall, between 1790 and 1959 21.4% of grandchildren were known to have died before both grandmothers had (n = 2,194), and 18.3% before both grandfathers (n = 1,765). More commonly,

individuals were pre-deceased by their grandparents: 30.7% (n = 3,153) had both grandmothers dying before themselves, and 24.7% (n = 2,381) both grandfathers.

The duration of grandparenthood ranged from 0 to a maximum of 49 years that a grandchild had at least one grandmother alive, and from 0 to 42 for grandfathers. The average duration of grandparenthood changed considerably across the study duration. The average number of years for which a grandchild had at least one grandmother alive remained relatively low (Figure 2) for a time, fluctuating around 5 years, before increasing for every cohort from 1870 onwards. It reached a high of 24 years for 1950-1959, our last birth cohort. Grandfathers, on the other hand, were rarely present during the life of grandchildren for the late 18th and much of the 19th century, averaging only a couple of years at most up to 1880. The number of years they were around to (potentially) interact with their grandchildren then increased greatly, reaching a high of 16 years for the 1920-1929 and 1930-1939 birth cohorts.

From the grandparental perspective, there were similar increases in both of the demographic markers we investigated. The number of years a grandparent had at least one living grandchild more than doubled from 12 years for grandmothers and 6 years for grandfathers in the 1790s to 27 and 16 years for grandmothers and grandfathers respectively by the 1950s (Figure 3). There was a slight decline in the number of years spent with at least one grandchild from the 1890s to 1900s – 18 to 16 years for grandmothers and 12 to 10 years for grandfathers (though the decline continued into 1910s, reaching a post-transition low of 8 years) – before a relatively fast rise to the highs of the 1950s. For the cumulative number of years, the pattern was very similar (Figure 4), increasing more than three-fold for grandmothers (1790s: 29 years, 1950s: 99 years) and more than four-fold for grandfathers (1790s: 9 years, 1950s: 39 years). Again, there was a decline after the 1890s, followed by a rapid increase from the 1920s to the 1950s.

Discussion

Over a 170 year period, the number of years grandparents and grandchildren had both been alive at the same time greatly increased. This large and near-continuous increase in the number of years grandparents (both grandmothers and grandfathers) were available for their grandchildren, and the number of years a grandparent had grandchildren, coincided with the onset and progress of the demographic transition (Scranton et al. 2016) and industrialisation in Finland, which brought about decreases in child mortality and fertility rates (Liu, Rotkirch and Lummaa 2012). It may be that an increasing presence of grandparents in early childhood because of increasing grandparental lifespan had as much a role in this expansion of shared time as decreasing childhood mortality. The largest declines in grandparenting time from the grandchild's perspective, and in the proportion of individuals with a living grandmother/grandfather at birth, occurred in the 1930s and 1940s and may therefore be related to increased mortality from war. The effect of the large famine of 1866-1868 can also be seen in Figure 1. The late 19th century decreases in both the number of

223 years and number of cumulative years a grandparent had a grandchild (Figure 3 & 4) could be linked to a
224 wide range of demographic rates changing at different pace in the early period of the transition, including
225 age at first birth, number and proportion of surviving children and grandchildren, and longevity. This
226 requires further investigation.

227 The amount of time a grandchild has a grandparent for offers - and limits - opportunities for interaction.
228 However, though the potential time for grandparenting has increased - nowadays grandparents are more
229 likely to survive throughout their grandchildren's childhood and grandparents are both healthier later in life
230 - this does not necessarily indicate grandparents are able and willing to invest more actual time with their
231 grandchildren. Families are no longer confined to small geographical areas, and the further away kin are,
232 the less face-to-face contact they may have (Mulder and van der Meer 2009), though help can also occur
233 through different routes e.g. economic support. Despite relatively short average shared times between
234 grandmothers and grandchildren in the 19th century, they still encompassed a critical period (early
235 childhood) for survival of grandchildren in pre-industrial Finland (Lahdenperä et al. 2004).

236 The nature of potential grandparental effects has also changed since the onset of the demographic
237 transition, diminishing the importance of this increasing shared time in evolutionary terms: with reduced
238 pressure from infant mortality, grandparents in contemporary industrialised societies are no longer
239 important for child survival. However, only judging the importance of the grandparent-grandchild
240 relationship by evolutionary fitness benefits underplays any developmental benefits on long-term
241 outcomes that arise from having living, caring grandparents, and ignores the benefits to the grandparents
242 themselves. Indeed, it may be that shared time is only beneficial to grandchildren's cognitive development
243 and physical and mental health up to a point (transfer of resources could still continue though e.g. money),
244 after which the grandparents become the main beneficiaries of the relationship (e.g. their own mental
245 health). Shared time should, therefore, not be dismissed as irrelevant, nor should the relationship between
246 grandchildren and grandparents only viewed from one perspective in contemporary societies.

247 Of course, it cannot be assumed that all grandparents are equal and have always been equal in their
248 contributions to grandchild outcomes. Studies of pre-industrial Finland, for example, indicate that
249 grandfathers had no assessable direct effects on the survival of their grandchildren (Lahdenperä, Russell
250 and Lummaa 2007) whilst grandmothers did (Lahdenperä et al. 2004). In contemporary societies, the
251 situation is somewhat different, with a growing body of literature on the potential effects and benefits of
252 grandfathers. Effects could also differ by grandparental lineage (maternal/paternal), a distinction often
253 made in historical populations - usually in regards to grandchild survival (see Sear and Mace 2008) - but less
254 so in post-transition societies (Sear and Coall 2011). Though this is outside the focus of this study,

distinguishing between the shared time of grandchildren and their paternal or maternal lineages or combinations of different grandparents would be a highly interesting avenue of research.

We have shown how grandparenting time has changed across the demographic transition and alongside industrialisation. Future work could investigate the potential causes of these increases, whether they are due more to decreasing childhood mortality or increasing grandparent longevity, and how recent changes in fertility patterns (i.e. changing marital and childbirth ages, as well as fertility rates themselves) might also affect the duration and consequences of this relationship. Though the effects of grandparents on their grandchildren differ between contemporary and historic populations, the length of shared time is still relevant. With ageing populations, the duration of this relationship will become of greater social and economic importance: the longer the duration, the more grandparents could benefit from their grandchildren in addition to their children in terms of care and support (physical and financial) in their old age, but conversely the more grandchildren could compete with old and vulnerable grandparents for limited parental resources.

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351

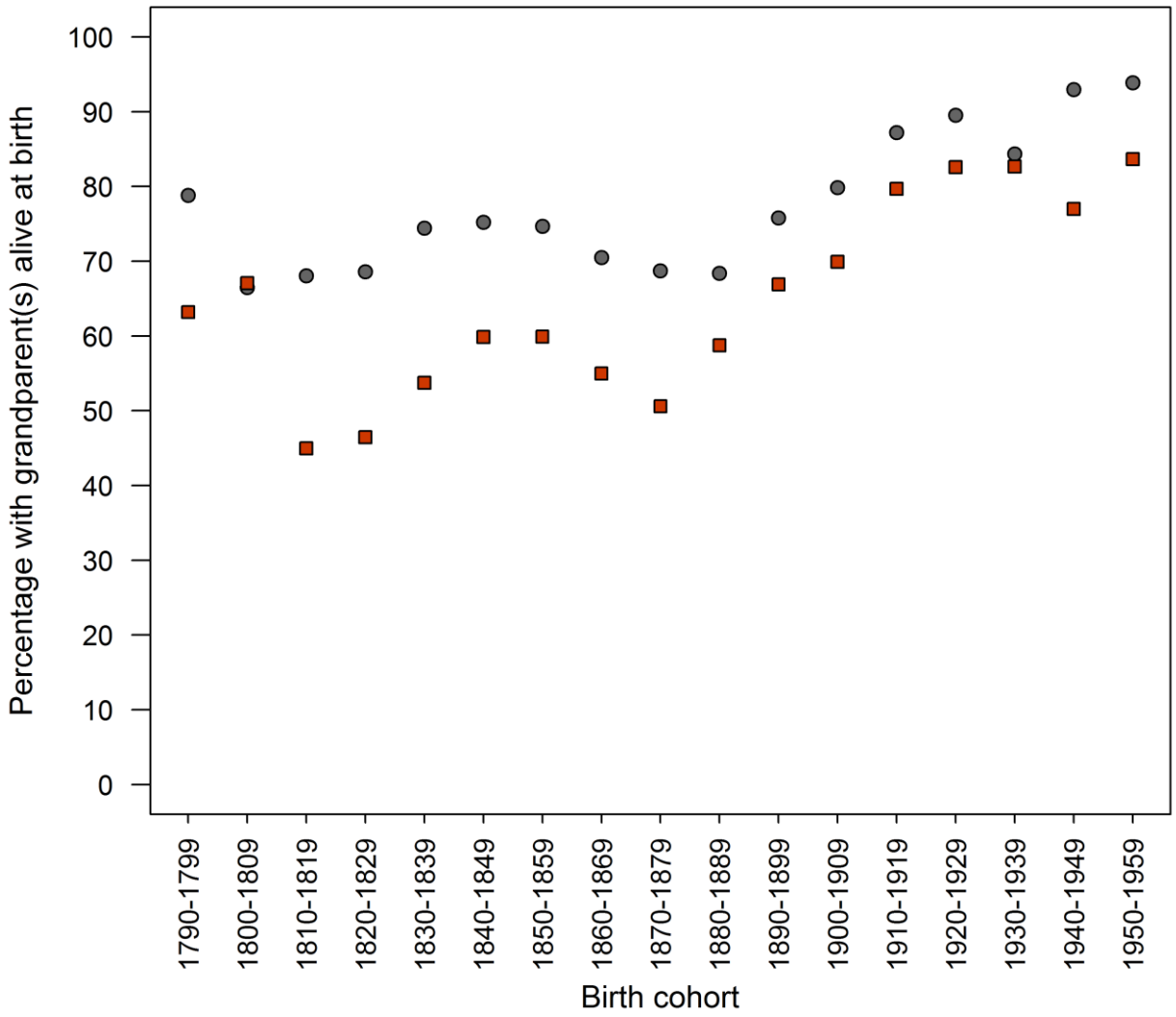
352

353 **Figure 1. Percentage of individuals with at least one grandmother or grandfather alive at birth.** Dark grey
354 circles represent grandmothers, red squares grandfathers.

355 **Figure 2. Average number of years grandchildren had a living grandparent, by birth cohort**. Solid line
356 represents average for grandmothers, and dashed line for grandfathers. 95% confidence intervals are
357 shown in colour: dark grey for grandmothers, red for grandfathers.

358 **Figure 3. Average number of years a grandparent had at least one living grandchild.** Grandmothers are
359 represented by dark grey, grandfathers by red.

360 **Figure 4. Average cumulative number of years a grandparent had at least one living grandchild.**
361 Grandmothers are represented by dark grey, grandfathers by red.


Percentage with grandparent(s) alive at birth
100
90
80
70
60
50
40
30
20
10
0
1790-1799
1800-1809
1810-1819
1820-1829
1830-1839
1840-1849
1850-1859
1860-1869
1870-1879
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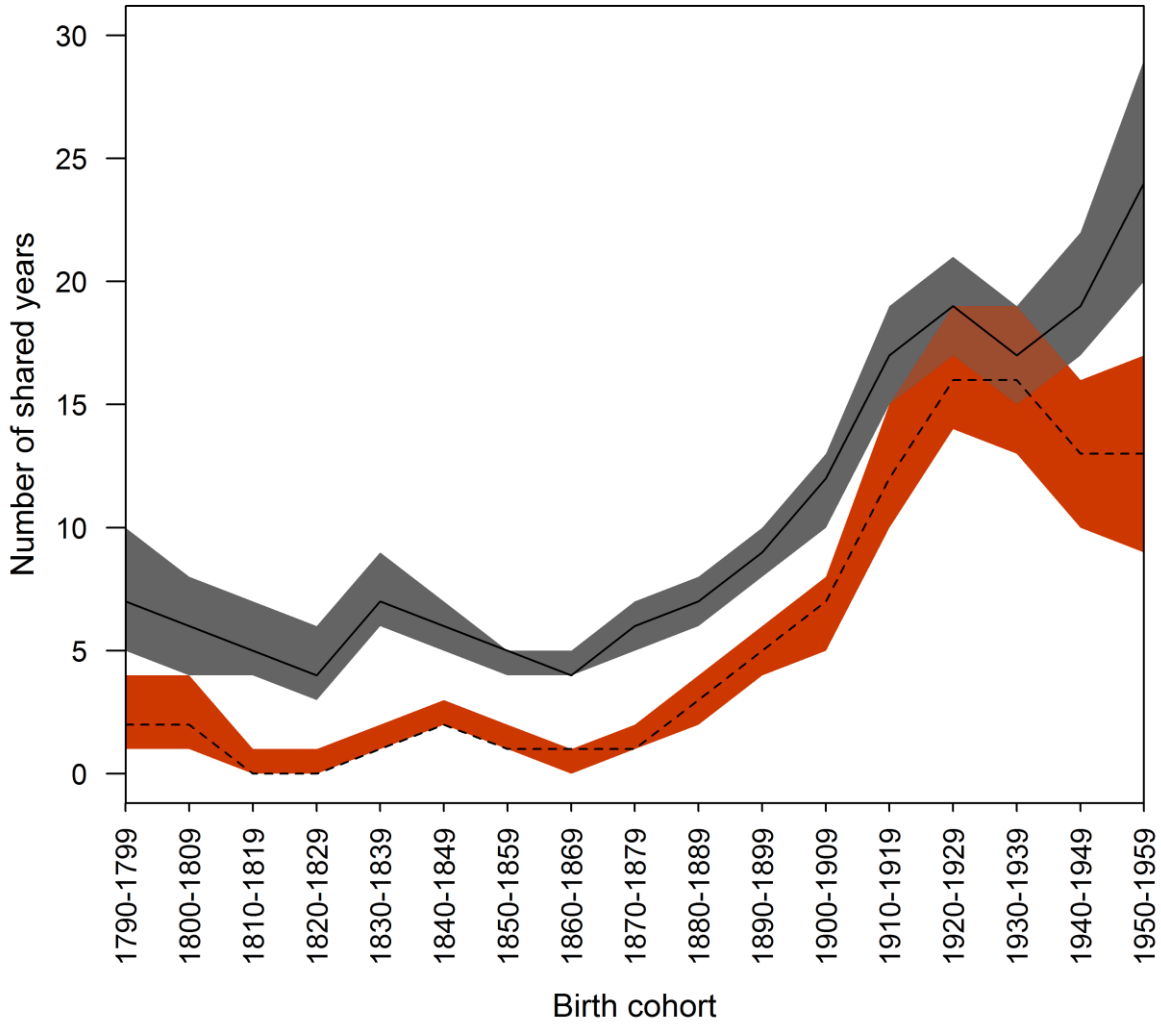
1890-1899
1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
Birth cohort

362


Number of shared years
0
5
10
15
20
25
30
1790-1799
1800-1809
1810-1819
1820-1829
1830-1839
1840-1849
1850-1859
1860-1869
1870-1879
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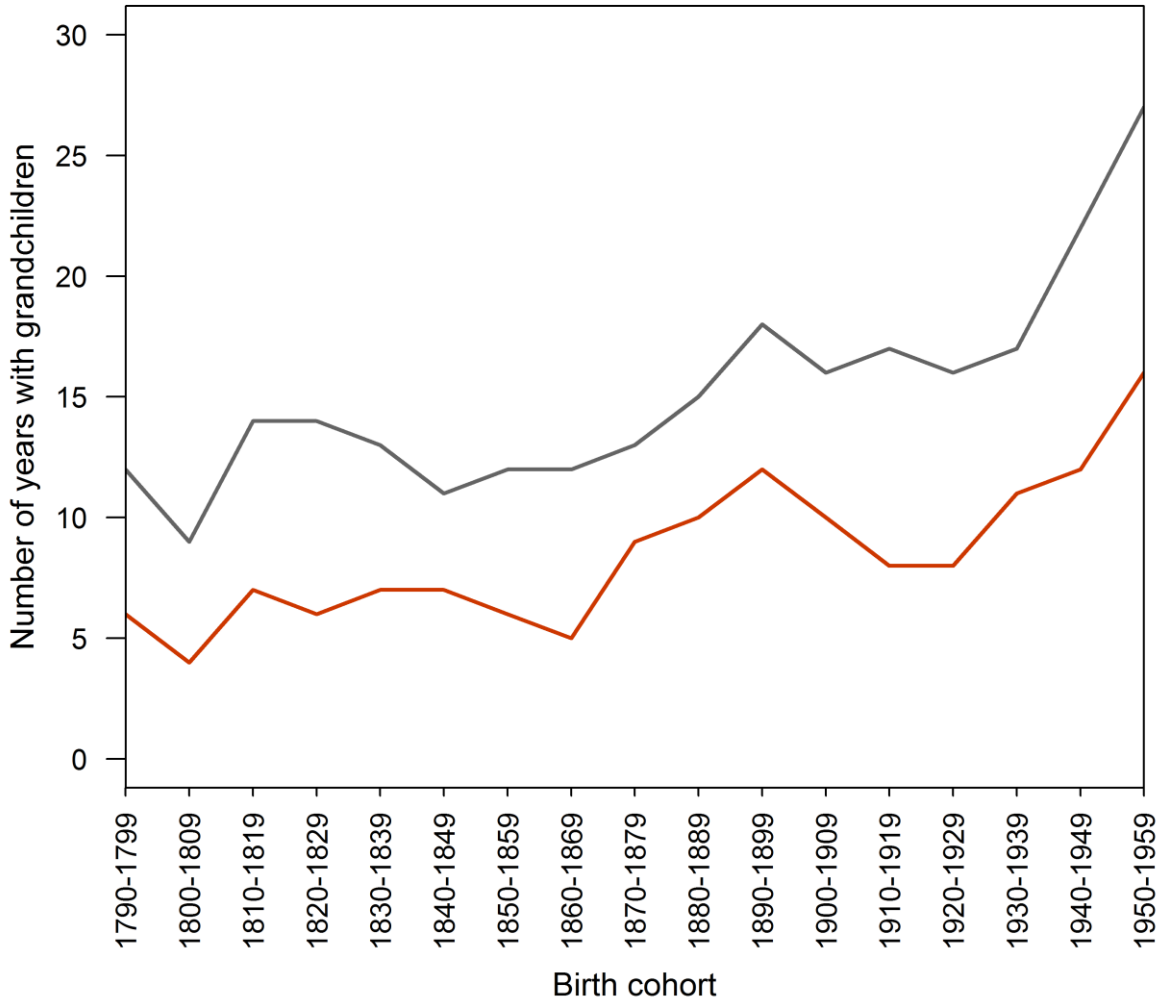
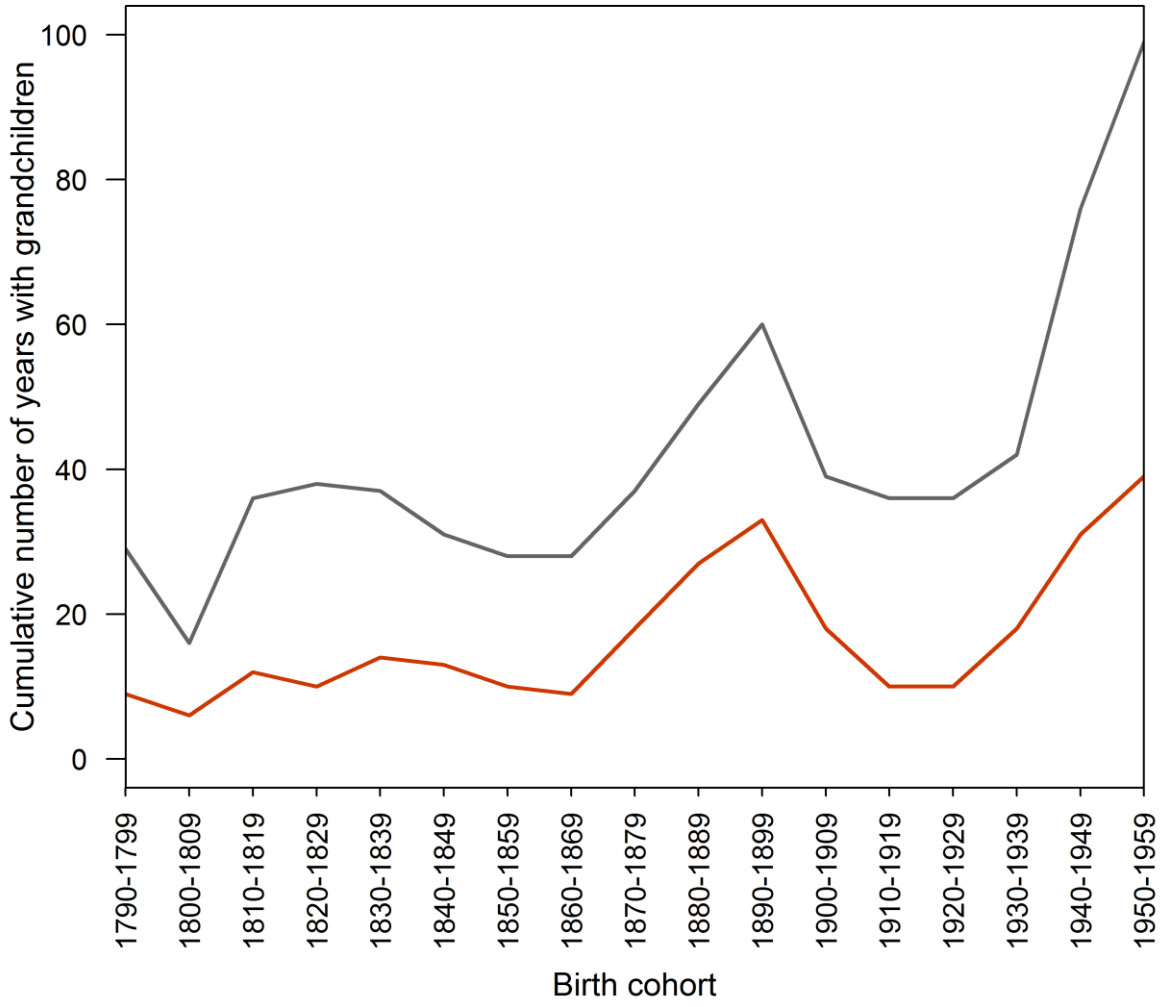
1890-1899
1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
Birth cohort

363


Number of years with grandchildren
0
5
10
15
20
25
30
1790-1799
1800-1809
1810-1819
1820-1829
1830-1839
1840-1849
1850-1859
1860-1869
1870-1879
1880-1889
1890-1899
1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
Birth cohort

364


Cumulative number of years with grandchildren
100
80
60
40
20
0
1790-1799
1800-1809
1810-1819
1820-1829
1830-1839
1840-1849
1850-1859
1860-1869
1870-1879
1880-1889
1890-1899
1900-1909
1910-1919
1920-1929
1930-1939
1940-1949
1950-1959
Birth cohort

365