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Why People Born During World War II are Healthier

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Why people born during World War II are healthier[1]

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Abstract
During wars, countless people suffer, even during times without direct exposure to violence, as they are exposed to conditions such as poorer nutritional situations, stress, recessions, and sub optimally functioning health care systems. This was the situation during much of World War II in three occupied countries: France, Belgium and The Netherlands. Biological theory predicts that the health of those who were prenatally exposed to such adverse circumstances will be worse once they have reached old age. But for WWII, such effects have thus far been proven only for famines and other extreme exposures that differed from those experienced by the majority of women in these occupied countries who were pregnant during WWII. We show that – contrary to expectations – prenatal exposure to WWII in the three countries does not lead to poorer health among the older population. We even find a better health among exposed females, but demonstrate that this is due to selective mortality during infanthood among the war cohorts and to selective fertility during WWII. These selection effects are likely to be stronger during more extreme circumstances than the ones studied here. Therefore, previous research on long-term effects of such prenatal exposures may have underestimated effects. Negative health effects as a result of prenatal exposure to WWII in France, Belgium and The Netherlands – outside of the well-known effects of the Dutch famine – are absent or at most very small.

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Introduction

World War II (WWII) had enormous effects on the health of the European population: battles, bombings raids, famines and persecutions exacted a giant toll on countless people. Yet during any given moment in time, most of the civilians – and particularly those in occupied countries such as France, Belgium, and The Netherlands – in Europe experienced neither extreme levels of violence and destruction, nor famines. Nevertheless, they still went through circumstances that were clearly adverse. Food was rationed, the economy experienced a sharp recession, individuals' stress levels were often high and health care systems functioned sub optimally. A similar pattern in which most civilians at any specific moment in time do suffer, but do not directly experience violence or famine, applies to a substantial share of more recent and contemporary wars, too.

We know from a growing body of research that prenatal exposure to adverse circumstances can affect human capital and health outcomes of the prenatally exposed throughout their entire lives (Almond & Currie, 2011). This has been demonstrated for extreme circumstances including famines (Chen & Zhou, 2007; Jürges, 2013; Roseboom et al., 2000) and large-scale destruction through war-bombings (Akbulut-Yuksel, 2014b), as well as for less extreme circumstances such as fasting (Almond & Mazumder, 2011; Van Ewijk, 2011). This means that inferior conditions such as those resulting from wars might negatively affect large parts of a population until many decades later.

This paper investigates the effects of prenatal exposure to the WWII-conditions that were experienced by the majority of women who were pregnant during the war in the occupied countries Belgium, France, and The Netherlands. We do not search for specific groups for which long-term effects exist. It has been proven by now that famines during WWII such as those in Greece, Leningrad and the western part of The Netherlands during the final war months affect the health of the prenatally exposed (Barber & Dzeniskevich, 2005; Neelsen & Stratmann, 2011; Scholte et al., 2015). Our focus, instead, is on the less extreme circumstances that were experienced during many more pregnancies, but that have been studied much less. We investigate whether the later-life health of the cohorts born during the war was poorer than expected due to their exposures. Within these cohorts, we do not try to isolate specific subgroups for which the WWII-exposure may or may not have been more extreme. Our focus is on health at older ages, and we study this using three waves of the European Survey of Health, Aging, and Retirement (SHARE).

In this way, we aim to show whether and how the health of current generations of elderly Europeans is still affected by their prenatal experience of WWII. Moreover, by focusing on less extreme (but still clearly adverse) conditions than those that are often studied in the fetal origins literature, we aim to find out more about the long-term effects of more commonly experienced exposures. In contemporary wars, the general audience's focus is mostly on those directly affected by violence and famines. But at any specific moment, most people – and of particular relevance here: most expectant women – do not experience such extreme conditions. Therefore, in the long run, a much larger group of people will have been exposed to milder forms of warlike circumstances. We know little about whether and how their later-life outcomes are impaired.

Previous literature

Most literature on the long-term effects of early-life exposure to warlike circumstances focused on famines during WWII. Prenatal famine exposure has been linked to a wide range of health impairments among adults (see Lumey et al., 2011 for a review). Most of this literature comes from the field of epidemiology, although a few studies by economists have looked at prenatal famine exposures during WWII, demonstrating negative effects on education and labor market outcomes (Neelsen & Stratmann, 2011; Scholte et al., 2015). Van den Berg et al. (2015) also look at famine exposure, but focus on famines experienced during childhood. Kesternich et al. (2015) investigate how childhood exposure to the German famine that started shortly after the war affects behavioral outcomes later in life.

Akbulut-Yuksel (2014b) shows that prenatal exposure to the intense aerial bombardments that destroyed almost half of the housing stock in German cities led to a wide range of health problems in adulthood. Other researchers investigated the long-run effects of exposure to WWII during childhood. Ichino & Winter-Ebmer (2004) and Akbulut-Yuksel (2014a) show that WWII-exposure on school-aged German children led them to receive less education and have lower incomes later in life. This is due to the reduced access to schools, mainly resulting from destruction by bombardments. Some other papers looked at the effects of early-life exposure to wars in developing countries, particularly Africa. Most of these papers focused on exposure to war during childhood and on intense conflict and combat exposures (Akresh, Bhalotra et al., 2012; Akresh, Lucchetti et al., 2012; Bundervoet et al., 2009).

Kesternich et al. (2014) show that exposure to WWII in childhood increases the likelihood of suffering from diabetes, depression, or a poor self-rated health among elderly people. Their analyses include people from thirteen different countries, several of which saw extreme rates of civilian casualties (e.g. Germany, Poland), dispossessions (e.g. Czech Republic) or famines (e.g. Greece, post-war Germany). (Note that up to 2.8% of the Greek population died during its famine (Neelsen & Strattman, 2011), compared to only 0.2% for The Netherlands, which is due to the localized nature and short period of the Dutch famine.) Their results are therefore mainly due to extreme circumstances. Like them, we also focus on outcomes at advanced ages and use data from the SHARE-survey (although they use wave 3, whereas we use waves 1, 2 and 4). But unlike their paper, we focus on the non-extreme circumstances that were experienced by the majority of the pregnant women in the occupied Western-European countries. And we focus on prenatal exposure rather than exposure during childhood. One paper that also focuses on prenatal war exposure is Lee (2014), who finds that people who had been in utero during the Korean War have worse human capital and health outcomes at age 40-50. A difference with our paper is that Lee explicitly focuses on the most intense types of war exposures.

Background and pathways for effects

Medical theory predicts strong long-term effects for exposures *in utero* and relatively smaller effects for exposure during later periods in childhood. During the fetal stage, the human body goes through critical growth periods during which organs are formed or experience rapid growth. During these periods, the body is highly vulnerable to experiencing adverse circumstances (Barker, 1997). And adverse health effects may only reach their peak when the prenatally exposed person ages (Barker, 2002).

If we exclude famines and direct exposure to extreme violence and destruction, there are four channels through which exposure to warlike circumstances is likely to affect long-term health outcomes of people who were prenatally exposed to them. First, even outside of famines, the nutritional situation in the three occupied countries that we study was clearly sub optimal. In each of them, food was rationed throughout the war. The average daily ration in France in 1941-1944 was limited to 1180 kcal (Mouré, 2010). This is considerably less than the recommended amount for non-pregnant women of 2,000 kcal. For pregnant women, generally higher amounts are recommended. For Belgium and The Netherlands, the average daily rations were 1400 and 1800 kcal, respectively. Furthermore, the quality of nutrition decreased as several types of food such as meat, dairy, fat, eggs and bread became rationed (see Egle, 1943). Malnutrition in France led to anemia, vitamin deficiencies and diseases (Mouré, 2010). Prenatal exposure to poor nutrition can hamper fetal growth and may lead to damage to fetal organs. Prenatal malnutrition has been shown to lead to a wide range of diseases – most of which only show up at older ages, including coronary heart disease, type-2 diabetes and hypertension (Roseboom et al., 2011) and it has also been shown to lead to higher mortality rates among the elderly (Lindeboom et al., 2010). Moreover, it can negatively affect the cognitive performance of the offspring (De Rooij et al., 2010).

Second, stress levels were likely to be elevated during WWII as a result of occupation and repression, as well as the fear of air raids and combat. Experiencing stress leads to increased levels of corticotropin-releasing hormone (CRH). High CRH-levels prepare the fetus for a likely preterm birth. Maturation of the tissue is sped-up, while fetal growth is reduced (Hermann et al., 2001; Hobel & Culhane, 2003). Prenatal stress exposure increases the responsiveness of the hypothalamic-pituitary-adrenal axis, which controls the body’s hormonal reactions to stress. As a result, the prenatally exposed become more likely to develop hypertension later in life (Seckl & Holmes, 2007). Prenatal exposure moreover affects neurological development and can therefore lead to cognitive and emotional behavioral problems, and even to schizophrenia (Cotter & Pariante, 2002; Van den Bergh et al., 2005). Van Os & Selten (1998) show that schizophrenia was more common among those who were in utero during the 1940 German invasion in The Netherlands, which they attribute to stress.

Third, the occupied countries experienced a severe economic downturn during the war years. GDP in 1944 had contracted by 52%, 49% and 20% compared to 1939 for France, The Netherlands and Belgium, respectively (Maddison, 2011) In studies on prenatal exposure to economic crises, recessions are regarded as a proxy for poor general circumstances (poor nutrition, high stress levels). Studies into early life effects of economic crises in the late 19th and early 20th centuries found negative effects on later-life health outcomes (Banerjee et al., 2010; Yeung et al., 2015). But studies on later crises found no effects (Cutler et al., 2007; Lindeboom & Van Ewijk, 2013) or even positive effects (Dehejia & Lleras-Muney, 2004). Perhaps malnutrition, stress and epidemics were the most relevant effects of economic crises that took place longer ago, whereas nowadays, parental health behavior improves in recessions as the opportunity costs of health are reduced (Dehejia & Lleras-Muney, 2004). It is hard to say which process will dominate for WWII, especially because the channels through which economic crises affect prenatal health are closely intertwined with the previously discussed channels of nutrition and stress.

Fourth, health care systems tended to function sub-optimally during WWII. Hospital staffing may have been affected by persecutions. Supply lines may have been severed and drugs, medical supplies and staff diverted to the occupying country. At the same time, demand for care may have been higher due to the war circumstances, putting extra strain on the health care system.

Data and Methodology

Our main data source is the Survey of Health, Aging, and Retirement in Europe (SHARE). SHARE is a longitudinal survey study among individuals aged 50 and older. The first wave of SHARE took place in

2004/05 and included a nationally representative sample from eleven countries: Belgium, The Netherlands, France, Germany, Austria, Greece, Denmark, Sweden, Switzerland Italy and Spain. Subsequent waves took place in 2006, 2008 and 2011. Wave 3 (SHARELIFE) had a different setup and goal than the other waves and the variables that were collected differed from the other waves. We therefore use the data from waves 1, 2 and 4. We start with the sample of SHARE 1 respondents who were age 50 or older. Most SHARE 1 data collection took place in 2004, so that our youngest respondents were born in 1954. We take a 20-year period as our observation period. As our exposure variable refers to the situation in utero, we limit our sample to those for whom the in utero period started no earlier than 1934, so that the oldest people in our wave 1 sample are 70. (We assume an average gestational period of 9 months.) The people in our sample are hence born in October 1934 or later. Extending the sample to even older people might lead to an increasingly selective sample due to mortality. We add respondents from SHARE 2 who were born during the same time period. SHARE 2 additionally over sampled individuals born in 1955 and 1956 to keep the sample representative for the population age 50 and older. We also include respondents from SHARE 2 who were born in 1955 and 1956. Respondents who are new in wave 4 are only added if they were born between 1934 and 1956, to avoid ending up with low numbers of people from cohorts that were born long after our exposed group. We include countries that appeared in at least two of the SHARE waves.

We focus on countries where the general population was clearly exposed to the types of adverse circumstances described above, but where the exposure was not of the extreme kind for which it is already well-known that it leads to adverse long-term effects. Germany, where almost half of the housing stock was destroyed and where direct mortality rates were very high is excluded for this reason, and Austria is excluded for the same reason. (We distinguish between direct mortality as a result of WWII, which includes combat death and deaths through bombings, murders and other acts of violence and indirect mortality which refers to increased mortality rates as a result of adverse circumstances.) Greece is excluded from our sample since virtually the entire country suffered from a famine that lasted for a long time period (about 1.5 year) and that killed a substantial share of its population.

Our sample of exposed countries includes Belgium, France and The Netherlands. These three countries experienced roughly comparable circumstances during WWII. All three were occupied by Germany in spring 1940 and (depending on region within the country) were liberated between June 1944 and May 1945. Each experienced the previously described adverse circumstances: reduced food quantity and quality, stress, economic contraction and health care systems that functioned sub optimally. Moreover, as our exposure variable is determined based on country, year and month of birth, it is important that none of these three countries saw major border changes after the war.[2] This means that e.g. "born in Belgium" refers to the same thing, irrespective of whether the respondent was born in 1938, 1943 or 1950. This is unlike e.g. Poland (which was added to SHARE in wave 2 and which did experience major border changes). Similarly, the Czech Republic's territory has not been constant over time. Note that in The Netherlands, a famine occurred in the winter of 1944/45. This famine (unlike the Greek famine) was localized in only a part of the country (the West) and was relatively short: ca. 0.5 year. The share of the total population that perished was relatively low: during the Greek famine, this share was up to 14 times higher. Because we worry that our estimates might be driven by the Dutch famine, we run analyses in which we estimate effects separately by country and by country*year.

Denmark is another country that was included in SHARE and that was occupied by Germany. But unlike the included occupied countries, the Danish population suffered relatively little, especially during the period till August 1943 in which it kept its own government and thus relatively much autonomy. Denmark is considered to be the country that suffered the least of all European war combatants (Giltner, 2001).

Spain is excluded from our sample since another war (the Civil War) occurred during the time period we cover. Italy is excluded because the time period during which adverse exposure to WWII

[2] Persons whose reported birth year, birth month or country of birth changed between waves or was missing were excluded from analysis.

occurred is hard to define, since WWII ended with a civil war. Moreover, during the earlier war year, there was no occupation-related stress and food rations were more generous than in the occupied countries. The remaining SHARE-countries, Sweden and Switzerland stayed neutral throughout the war.

Besides the SHARE data, in some analyses we use data from the Human Mortality Database (HMD). The HMD contains birth and mortality data by country, age, birth year and sex for each of the countries in our sample. The HMD-data allow us to analyze whether the circumstances in the three occupied countries indeed deteriorated substantially during the war years. Figure 1 shows the life expectancy at birth for these countries and – for comparison – for the two neutral countries that are available in the SHARE-data.[3] The figure shows life expectancies at birth for females. Females are less likely to die in combat than men and moreover, females are the relevant group when we study exposures during pregnancy. We run a regression separately for each country of female life expectancy at birth on birth year (which runs from 1934-56)[4] and compare the actual data to the long-term trend. The strongest drop occurred in France in 1944, when female life expectancy was 12.1 years below trend. But also in e.g. 1943, French life expectancy was 7.1 years lower than expected. In each of the three countries, life expectancy dropped below its long-term trend in each of the war years – and not only in the years during which the invasion and liberation campaigns took place and which therefore saw most combat. In contrast, for the neutral countries, no substantial drops in life expectancy show up.

In our analyses of later-life health outcomes on prenatal exposure, we focus on five dependent variables that measure health at old age across several important dimensions. The first variable is cognitive performance. The interviewer read a list of ten words to the respondent and respondents immediately had to repeat as many of the words as they were able to remember. A few minutes later, during which other cognitive performance tasks were completed, respondents again had to

[3] Life expectancy at birth indicates how many years a newborn child would live if the age-specific mortality rates at the moment of its birth would stay constant throughout its life. Age-specific mortality rates indicate, for each age k, the probability that a k-year old person will die in a one-year time interval.

[4] Lindeboom & Van Ewijk (2015) show that the pattern of results is robust against taking a broader range of cohorts (1920-1965).

repeat as many words as possible from the same list. We measure cognitive performance as the sum of both tests: learning and delayed recall. Second, self-reported health is measured using a binary variable indicating a fair or poor self-reported health. Third, we employ a binary variable indicating whether the respondent was hospitalized in last 12 months. Fourth, we take respondents' number of visits to a general physician (GP) in last 12 months. Fifth, physical limitations are defined as having one or more limitations with activities of daily living (ADL) or instrumental activities of daily living (IADL).[5]

Our main analyses follow the equation:

(1) $Health_{iwc} = \alpha + \beta Z_{iwc} + \varphi_1 WWII_{iwc} + \varphi_2 D45\_46_{iwc} + \mu_w + \theta_c + \xi_i + \varepsilon_{iwc}$

in which $Health_{iwc}$ indicates the health of person i from country c in wave w. μ_w are wave fixed effects; θ_c are country of birth fixed effects and ξ_i are individual random effects. To deal with clustering of the error terms ε_{iwc}, we use panel robust standard errors. In line with most of the literature on long run effects we run our regressions separately for males and females. $WWII$ is a dummy variable indicating whether a respondent was prenatally exposed to the war. It takes on the value 1 for people who were born no earlier than May '40 and conceived no later than April '45, and the value 0 otherwise.[6] We additionally include a dummy variable $D45\_46$ for people conceived between May 1945 and Dec. 1946 (i.e. born between Feb. '46 and Sept. '47). The reason for this is that the post-war period did not immediately see a return to pre-war conditions: food was still rationed and there were considerable flows of refugees. Z measures trends in health over time. We need to filter these out in order to separate effects of WWII-exposure from non-war related effects of age or birth year. Health changes with both age and (for a given age) with birth year. We therefore

[5] ADL include dressing, including putting on shoes and socks; walking across a room; bathing or showering; eating, such as cutting up your food; getting in and out of bed; using the toilet, including getting up or down. IADL include using a map to figure out how to get around in a strange place; preparing a hot meal; shopping for groceries; making telephone calls; taking medications; doing work around the house or garden; managing money, such as paying bills and keeping track of expenses.

[6] We do not know month of conception but assume a 9-month gestation length for each respondent.

correct for trends using four different specifications for Z: age at the time of the interview; age and age squared; year of birth; age and year of birth.

Results

Table 1 shows our main results. Contrary to expectations, we do not find that those older people who had prenatally experienced WWII have worse health. For females, for three of the five health variables, we even find a significantly *better* health among the exposed: cognitive performance, number of GP visits and whether the respondent had any physical limitations. For the other two variables, a fair or poor self-reported health and the whether the respondent had been hospitalized recently, the point estimates also suggest a better health, but these estimates are not significant. For males, no estimate reaches significance, although most of the point estimates go into the same direction as for females.

We next run the same regression in difference-in-differences form following equation (2).

$$(2)\quad Health_{iwc} = \alpha + \beta Z_{iwc} + \varphi_1 WW2_{iwc} + \varphi_2 D45\_46_{iwc} + \varphi_3 occupied_c * WWII_{iwc} + \varphi_4 occupied_c * D45\_46_{iwc} + \mu_w + \theta_c + \xi_i + \varepsilon_{iwc}$$

As control countries, we take Sweden and Switzerland. These are the only two neutral countries included in the SHARE waves and therefore did not experience the same wartime exposures as Belgium, France and The Netherlands. Moreover, both countries provide a good counterfactual to the occupied countries, since they are geographically and culturally close and generally experienced the same pre- and post-war trends (a declining pre-war fertility trend and a post-war baby boom). Due to their closeness to the warring countries, it is possible that some of the adverse exposures discussed for the occupied countries also occurred in the neutral countries, albeit in a weaker form. Food was rationed in both Sweden and Switzerland (Egle, 1943) and there may have been an additional strain on the health care system due to refugees and severed (medical) supply lines. Therefore, the coefficient of interest in the difference-in-differences regression (φ_3) may be attenuated. We therefore prefer the estimates of (1). The results in Table 2 confirm that there are no negative health effects of prenatal WWII-exposure (see panel A). The coefficients for females are no longer significant, but this seems due to the fact that most point estimates for the neutral countries (panel B) suggest a better than expected health among the war cohorts for these countries as well. Moreover, for the occupied countries, 8 out of 10 point estimates still do suggest a better health among the prenatally exposed. The probability of getting at least 8 coefficients into this same direction is 5.5%.

In the subsequent step, we return to equation (1), but now investigate heterogeneity in effects between countries by interacting the exposure dummy and the dummy for being conceived between May 1945 and December 1946 with a country dummy. Table 3 shows the results from the specifications that control for either age and age squared, or age and year of birth. For none of the three occupied countries, there are negative health effects of prenatal WWII-exposure. The pattern of positive, and in many cases significant, point estimates for females shows up for each of the three countries.

Since the type of war exposure is likely to differ between the war years (e.g. due to the invasions in 1940, and liberation campaigns in 1944/45), we next define the exposure dummy separately for each war year. WWII started in May 1940, so that people born in January till April 1940 were not yet prenatally exposed to the war. WWII officially ended in Europe in early May 1945, so that people born after January 1946 were not prenatally exposed to the war. We define 6 war year dummies: 1940-1944 are dummy variables for being born between May of the respective year and April of the following year. 1945 is a dummy variable for being born between May 1945 and January 1946. We again include a dummy variable for people conceived born between February 1946 and September 1947 (who were calculated to have been conceived between May 1945 and December 1946). The results are reported in Table 4. For none of the war years we find consistent evidence for negative effects of prenatal exposure. For females, we find better cognitive scores, fewer limitations and fewer GP visits for people exposed throughout the various war years. For males, a few significant estimates do show up, but there is no consistent pattern in this, so that this is likely due to multiple testing and chance: there is no clear evidence for decreased health resulting from prenatal WWII-exposure.

Figures 2 shows the results from regressions in which all countries are included, but in which the exposure variable is defined separately by combination of year*country. The figure shows the results for females. The results for males are similar (see Appendix Figure 1). A priori, we expected that originally hypothesized negative health effects might be driven by the Dutch 1944-45 famine. However, even for the Netherlands for these years, no negative health effects show up. It should be noted that the Dutch famine only affected part of the country (the western part) and that our sample includes people from all parts of the country, which may explain the difference with previous literature.[7] Moreover, the famine lasted from December 1944-April 1945, so that those who had been prenatally exposed to the Dutch famine are spread between the group captured by our 1944 dummy and the group captured by our 1945 dummy. And both these categories also include people who were not in utero during the time period of the Dutch famine. For Belgium and France as well, no patterns of negative health effects among the exposed show up. Estimates indicating significant health improvements show up for exposures in various years, with some of the strongest effects occurring for France in 1943. This was a year that was militarily among the quietest of the war years.

Alternative samples

It might be possible that our results of no worse health (and potentially even better health) among the exposed are biased due to specific characteristics of the post-war cohort. During the liberation time, there might have been selective fertility. Our dummy indicating conceptions between May 1945 and December 1946, however, already dealt with this possibility. But it is also conceivable that the included 1950s cohorts are systematically different, since these people were part of the baby boom generation and moreover are relatively young – and therefore healthy – compared to the rest of the sample in a way that our model might potentially not sufficiently capture. We therefore run

[7] Note that the waves of SHARE that we use do not include information on region of birth. Moreover, it is not our goal to prove that effects of famines exist: this has been proven convincingly by many previous studies.

regressions in which we exclude all those born after 1950. As columns (1) and (3) of Table 5 show, this does not change our results. (Note that we also ran regressions in which we excluded all those born after WWII. This considerably limits our sample size, increases our standard errors and leaves us with no control group born after the exposure period. Like our other estimates, these results show no adverse health effects of prenatal exposure.)

Another possibility that we need to investigate is that our results may be driven by effects on older cohorts. Everyone in our sample who was born before the war was exposed to WWII during childhood. Kesternich et al. (2014) demonstrate that childhood exposure to WWII leads to a wide range of negative effects among elderly people. However, we believe that the absence of negative health effects of prenatal exposure that we find is not an artifact of stronger negative health effects on older cohorts. There are four reasons for this: first, we study another type of exposure than Kesternich et al. Their results are mainly driven by exposure to extreme circumstances such as wide-scale destruction and famines as they also include countries such as Germany, Greece and Poland. Second, most of the body's critical growth phases occur during the fetal stage, so that biologically, one would expect stronger effects of prenatal than of postnatal exposure.[8] Third, Figure 3 shows the average cognitive performance (the variable for which we most consistently found positive estimates) for females across cohorts. There was no dip from the long-term trend among the pre-war years. For other variables, the pattern is the same. Fourth, columns (2) and (4) of Table 5 show regressions in which people born before May 1940 have been excluded. No consistent pattern of a better than expected health among the prenatally exposed shows up.

Selective mortality and selective fertility

[8] In addition, certain measures were taken in an attempt to keep damage to children limited. These were founded in knowledge from the First World War on the damaging effects that malnutrition had on children. Eglé (1943) in her contemporary review of rationing during WWII for example lists that in The Netherlands, full-fat milk was only made available to children under 14. And in France, families with many children received additional rations (above those that were calculated per capita). Similar measures may also have somewhat alleviated the situation for pregnant and lactating women, who also received higher rations.

The important question to answer now is why – contrary to expectations – no adverse health effects – and seemingly even some positive health effects occur. Two likely explanations are that this is the result from either selective mortality or selective fertility. Perhaps prenatal WWII-exposure did have a negative health effect but this is not visible anymore at older ages, as the least healthy people have already died before that moment as a result of their exposure to wartime conditions. Note that this would be in contradiction to "classical" fetal programming theory, as this theory predicts that effects mainly show up when people have reached more advanced ages.

Selective mortality

To investigate the selective mortality explanation, we use aggregate data from the Human Mortality Database to show how the probability of reaching one's birthday in 2004 (the year of the first SHARE-wave) develops across cohorts. We run a regression separately by country of this probability on a quadratic function in birth year, which runs from 1934-1956. The war years and immediate post-war years are dummied out, so that the time trend calculated is based on 1934-1939 and 1948-1956. For women (Figure 4), the probability of surviving till 2004 is lower than one would expect based on the trends for women born in the occupied countries toward the end (and in the beginning) of WWII. Belgian females born during the war have a 1.6 percentage point (pp) lower chance of living till their birthday in 2004 (ranging from 0.8 pp for those born in 1943 to 2.9 pp for the 1945 birth cohort). For France, the effect is 1.8 pp (ranging from 0.6 pp in 1941 to 3.7 pp in 1945) and for The Netherlands, the effect is 1.7 pp (ranging from 0.9 pp in 1941 to 3.2 pp in 1945). All effects are highly significant. This pattern does not appear for the occupied countries. For males, the pattern is similar (Appendix Figure 2). If we assume that it is mainly the weakest people who die, then this shows that some selective mortality related to prenatal exposure is taking place.

However, if we condition on having reached age 2, and thus focus only on mortality between age 2 and 2004, the pattern for the occupied countries completely disappears and is not significant anymore for any war year: people who had been exposed to WWII in utero and who survived till age

2 are no more likely to die before 2004 than one would expect based on the long-term trend. (See Figure 5 for females and Appendix Figure 3 for males.) This means that selective mortality may contribute to the unexpected sign of many of our estimates, but also that all selective mortality takes place during infanthood. The increased mortality during later life stages predicted by the fetal origins hypothesis does not show up. Prenatal exposure to WWII leads to immediate mortality increases, but does not affect long-term mortality patterns.[9]

We analyze whether selective mortality might have masked negative long-run health effects in our analyses on the SHARE sample: the current SHARE-sample includes only people who managed to survive their first few live years. If the unhealthiest people could not be included since they had already died, then the counterfactual health of the people in our sample would have been better than assumed. Negative health effects on these people would then have been masked.

Based on the previous analysis, we know the excess mortality before 2004 by country and sex for each of the birth cohorts 1940-1945. We proportionally add respondents to our sample for each birth cohort*country*sex combination.[10] For our binary dependent variables (a fair/poor self-reported health, being hospitalized, having one or more limitations) we assign these people a bad health. For the continuous variable cognitive performance, for each country*sex combination, we take the 10th percentile value of all respondents born during the war and assign the added respondents this value. For the number of GP visits, we take the value corresponding to the 90th percentile. Next, we regress

[9] Similar results were shown in Lindeboom & Van Ewijk (2015). They argue that the pattern of "culling" (i.e. selective mortality of weaker individuals) in the first few years of life means that effect estimates of prenatal exposures in many studies may have been downward biased.

[10] The numbers of respondents to be added are calculated as $Excess\_mort_{cjs}/(1-Excess\_mort_{cjs})$, with $Excess\_mort_{cjs}$ being the deviation from trend in the share of birth cohort j from country c that did not survive till 2004. (See Figure 4 and Appendix Figure 2 for the analyses that lead to the corresponding numbers.) This ratio is calculated separately for males and for females. The numbers of respondents that are added are rounded to the nearest integer for each country*birth year*sex combination.

Our sample consists of three SHARE-waves. We proportionally allocate the added respondents to each of the three waves, so that the distribution of added respondents over the three waves is the same as the distribution of the actual respondents over the three waves.

The analyses using Human Mortality Database data on which we base the numbers of respondents to be added are based on birth year, without taking into account birth month. We similarly add people based on their birth year (not birth month) and assume that all respondents that are added in this way are prenatally exposed to WWII. This means that no people are added who are classified as being born in the first months of 1940 and who were hence not exposed. This approach is based on the assumption that the increased mortality rates can only come from people who were actually exposed.

these health outcomes on prenatal WWII-exposure following equation (1), but this time including these additional respondents to compensate for selective mortality.[11] Note that this is a very conservative approach, as we assume that all who have died before 2004 as a result of WWII would have had a poor health if they would still have been alive. To the extent that this is not the case, we may over correct for selective mortality. Table 7 shows the results from the regressions that included these additional respondents. For males, there is now evidence that exposure may increase the chance of being hospitalized at older ages, but results for the other four outcomes remain insignificant, suggesting that they are not affected by prenatal WWII-exposure. For females, there is still no proof that prenatal WWII-exposure leads to a worse later-life health – even when using this conservative approach. For cognitive performance, the results still show better scores for those who had been prenatally exposed.

Selective fertility

It is possible that people conceiving during WWII differed systematically from those conceiving in earlier or later years. People may have postponed pregnancies till after the bad years were over, or may not have been able to conceive due to hardship (e.g. women may not have had their menstrual cycles) or had miscarriages.[12] We study selective fertility during WWII using information on characteristics of respondents' parents. Before we proceed it is good to add that the evidence of the previous subsection suggests that after conditioning on survival up to the age of 2 much, if not all, of the life expectancy differences between the exposed and the non-exposed is removed. The calculations in the Human Mortality Database are based on those who have been conceived in wartime. In the presence of strong fertility effects one would therefore have expected to see in Figure 5 that the exposed would have *higher* life expectancy. As this is not visible in Figure 5, one can already conclude that the selective mortality effects dominate the overall effects and that selective

[11] Note that we cannot run specifications that correct for age, since we cannot reliably assign a month of birth, and therefore an age to the added respondents.
[12] Rooseboom and Knol (2010), find that during the Dutch famine about half of the women did not menstruate.

fertility plays a less prominent role. Nevertheless, it is interesting to see whether the parents of the exposed were systematically different from the non-exposed.

The SHARE survey asks respondents about the age at which their parents died or, if these were still alive, what their age was at that moment. The age people attain (their longevity) is a strong indicator for their overall health. We therefore study selective fertility by comparing the longevity of parents whose pregnancies did versus did not overlap with the adverse years of WWII.[13] For this analysis, we first establish the age at which respondents' parents died. For parents who were still alive during the last survey wave in which a respondent was observed, we add their remaining life expectancy, which we calculate from the Human Mortality Database. (E.g. an 88-year old French male in 2011 has an expected remaining life expectancy of (say) 5.3 years.) Next, we estimate ordinary least squares regressions of the longevity of respondents' mothers/fathers on whether respondents had been prenatally exposed to adverse WWII-conditions. We add as covariates the sex and country of the respondent, as well as the respondent's birth year in order to adjust for time trends in parental longevity. (Note that we cannot correct for both age and birth year of respondents in one regression now, since we have only one observation from a single moment in time per respondent.) These analyses show whether fathers and mothers whose children were in utero during the adverse WWII-years had a worse or better health than parents conceiving in earlier and later years.

Other indicators for parental health and socioeconomic status come from SHARE wave 3 (which is otherwise not used in the present research). In this wave, respondents were asked about characteristics of their parents when they themselves were age 10. These included: whether the biological father was present in the household at that time and whether the parents smoked, drank heavily, or had mental health problems. These variables are taken as dependent variables in similar regressions to the ones on parental longevity. The sample size in the regressions utilizing information

[13] We do need to make the assumption that being pregnant during WWII does not directly affect parents' longevity, but this seems a reasonable assumption.

from SHARE wave 3 is smaller, since only respondents can be included who appeared both in wave 3 and in at least one other wave.

Our analyses demonstrate that the mothers of the exposed had a somewhat higher longevity than the mothers of unexposed persons. For fathers, we find no such difference (see Table 8). Also, the parents of the exposed were less likely to smoke or drink heavily. These results suggest that part of the positive association we find between prenatal WWII-exposure and good health at older ages is due to selective fertility.[14]

We further investigate the possibility that selective fertility is the reason why we find no negative health effects of prenatal exposure by adding the characteristics of respondents' parents as covariates to our main regressions (see equation (1)). We additionally add a set of dummy variables as covariates indicating the occupation of the household's main breadwinner when the respondent was 10 years old. We find that the estimated effects of prenatal exposure on older people's health do not change into negative health effects (see Tables 9-11). However, several coefficients do get closer to zero. This suggests that indeed some of the unexpected association between prenatal WWII-exposure and a better health at older ages may be a result of selective fertility. Yet it should be noted that the better cognitive performance among exposed females remains virtually unattenuated.

The relative importance of selective mortality and selective fertility

The results from the previous section suggest that both selective mortality effects and selective fertility effects may have led to our somewhat unexpected findings. We also noted from the mortality selection analyses that the selective mortality channel is likely to be dominant. To further examine the relative importance of both channels we proceed with a very rough and conservative test. Ideally, we would have liked to combine the selective fertility analyses of Tables 9-11 with the selective mortality analysis of Table 7. However, this is not possible, because for the selective mortality analyses we added "respondents" of whom we do not observe the characteristics of their

[14] Alternatively, the more favorable parental characteristics among the exposed may (partially) result from selective mortality if mortality rates were highest among children from parents with unfavorable characteristics.

parents. One way to get a rough indication is to combine the information from Table 1 with Tables 7 and 9. Table 1 provides estimates that are both subject to selective mortality and selective fertility. Table 7 corrects for selective mortality. The difference between columns (1) and (5) of Table 7 and columns (4) and (8) of Table 1 gives an indication of the effect of selective mortality. E.g. for self-reported health for females, this effect would be 1.777 percentage points (0.578 – (-1.199)). Now when adding this amount to the coefficient of Table 9, we get 1.107 (-0.670+1.777). We can of course not calculate standard errors, but at unchanged standard errors, none of the estimates for females would significantly point to a worse health as a result of prenatal exposure to WWII. For cognitive performance, the results would even show a better health among the exposed which is significant at the 5%-level. For males, the effects on hospitalizations and on self-reported health would be significant at the 5% and at the 10%-level, respectively, in both cases pointing toward a worse health among the prenatally exposed. But the results for the other three outcomes would not be significant at conventional levels.

Note that this is a highly conservative approach, as the Table 9 results may partially already incorporate a correction for selective mortality (see footnote 14), while the Table 7 results may have over corrected for selective mortality if not all who died before 2004 due to WWII would have had a poor health at older ages if they would still have been alive. These results therefore suggest that if we would be able to simultaneously correct for selective fertility and selective mortality, there would still be no proof that prenatal WWII-exposure leads to a worse later-life health.

Conclusion

Violence during wars is what captures the headlines. But at any given time, a large share of the populations of countries at war usually does not experience violence, but still suffers substantially. Supply lines are severed, leading to reduced food quantities and qualities; stress levels are high; the economy is in a recession and health care systems may collapse. This wide-scale suffering is less likely to grab the headlines. Once the war is over, however, biological theory leads to the hypothesis that the effects of this suffering linger among those who had been prenatally exposed and lead to worse health at older ages.

During World War II, the populations of countries like Belgium, France and The Netherlands evidently suffered from the war during five years of occupation. Most of this period was not characterized by direct exposure to extreme levels of violence, nor was the food situation so bad that it can be characterized as a famine. It is now known that exposure to famines and other extremely adverse conditions, such as very large-scale destruction during WWII led to poorer health among those who had been prenatally exposed to them. But little is known about the long-term effect of the less-extreme conditions that characterized most of the war period in the occupied countries and that were thus experienced by the majority of women who were pregnant during the war in these countries.

We demonstrate that prenatal exposure to WWII in Belgium, France and The Netherlands has no substantial negative effects on health at ages 50 and older. Many of our estimates even show a better health among older people who had been exposed. We demonstrate that this unexpected result is probably due to selective mortality at young ages and to selective fertility, in the sense that healthier people were more likely to become pregnant and give birth during WWII. In the same way that our initial estimates were biased toward finding a better health due to prenatal exposure, previous research on prenatal exposure to other (more extreme) historical circumstances may also have suffered from the same bias. Selective mortality and selective fertility may mean that long-term effects of prenatal exposures in existing research may have been under estimated.

Even when we take selective mortality and selective fertility into account, we find no evidence that prenatal exposure to WWII leads to the expected long-term health damage. Previous research showed that prenatal exposure to the extreme circumstances (famines, destruction) that some groups of people experienced during WWII negatively affects their health at older ages. Apparently, the circumstances experienced by the majority of European civilian populations (that were evidently adverse, although in a less extreme sense) did not lead to similar long-term health damage.

This finding may have important implications for more recent wars, too. It is known that children born to mothers who experienced extreme wartime conditions tend to have more health problems throughout their life courses. So one would for example expect children born in a beleaguered city to suffer more often from health problems later in life. But in many conflicts, at any specific time point, most civilians do not suffer from extreme levels of violence and destruction, nor from famines. The suffering they do experience may drive up infant mortality rates, but the children that do survive apparently tend to recover from their bad prenatal circumstances and not to suffer from negative health consequences later in their lives.

References

Akbulut-Yuksel, M. (2014a). Children of War: The Long-Run Effects of Large-Scale Physical Destruction and Warfare on Children. *Journal of Human Resources*, 49 (3): 634-662.

Akbulut-Yuksel, M. (2014b), *War during Childhood: The Long Run Effects of Warfare on Health*, Working Paper.

Akresh, R., Bhalotra, S., Leone, M., & Osili, U. O. (2012). War and stature: growing up during the Nigerian Civil War. *The American Economic Review*, 273-277.

Akresh, R., Lucchetti, L., & Thirumurthy, H. (2012). Wars and child health: Evidence from the Eritrean–Ethiopian conflict. *Journal of Development Economics*, *99*(2), 330-340.

Almond, D., & Currie, J. (2011). Killing me softly: The fetal origins hypothesis. *The Journal of Economic Perspectives*, 25(3), 153-172.

Banerjee A, Duflo E, Postel-Vinay G, Watts T. (2010). Long-run health impacts of income shocks: wine and phylloxera in nineteenth-century France. *The Review of Economics and Statistics*, *92*(4), 714-728.

Barber J, Dzeniskevich A. (2005) *Life and Death in Besieged Leningrad, 1941–44*. Basingstoke: Palgrave Macmillan.

Barker, D.J.P. (1997), Fetal nutrition and cardiovascular disease in later life. *British Medical Bulletin, 53*(1) 96-108.

Barker, D.J.P. (2002), Fetal programming of coronary heart disease. *TRENDS in Endocrinology & Metabolism, 13*(9), 364-368.

Börsch-Supan A, Brandt M, Hunkler C, Kneip T, Korbmacher J, Malter F, Schaan B, Stuck S, Zuber S. (2013). Data resource profile: the Survey of Health, Ageing and Retirement in Europe (SHARE). *International Journal of Epidemiology, 42*(4), 992-1001.

Bundervoet, T., Verwimp, P., & Akresh, R. (2009). Health and civil war in rural Burundi. *Journal of Human Resources*, *44*(2), 536-563.

Chen Y, Zhou L-A. (2007) The long-term health and economic consequences of the 1959–1961 famine in China. *Journal of Health Economics, 26*(4), 659–681.

Cotter D, Pariante CM. (2002) Stress and the progression of the developmental hypothesis of schizophrenia. *British Journal of Psychiatry, 181*, 363-365

Cotter D, Pariante CM. (2002) Stress and the progression of the developmental hypothesis of schizophrenia. *British Journal of Psychiatry, 181*, 363-365

Cutler DM, Miller G, Norton DM. (2007). Evidence on early-life income and late-life health from America's Dust Bowl era. *Proceedings of the National Academy of Sciences*, *104*(33), 13244-13249.

Dehejia R, Lleras-Muney A (2004), Booms, Busts and Babies Health, *Quarterly Journal of Economics*, 119:1091–1130.

Egle M. (1943) Wesen und Formen der Verbrauchsrationierung in Europa. *Weltwirtschaftliches Archiv,* 58(2), 305-334.

Giltner P (2001) The Success of Collaboration: Denmark's Self-Assessment of its Economic Position after Five Years of Nazi Occupation. *Journal of Contemporary History* 36:3 (2001) 485-506.

Godfrey K.M., Barker D.J.P. (2001) Fetal programming and adult health. *Public Health Nutrition, 4*, 611–624.

Human Mortality Database. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org or www.humanmortality.de (data downloaded on Oct. 31, 2013).

Ichino, A., & Winter-Ebmer, R. (2004). The long-run educational cost of World War II. *Journal of Labor Economics*, *22*(1), 57-87.

Jürges, H. (2013). Collateral damage: The German food crisis, educational attainment and labor market outcomes of German post-war cohorts. *Journal of Health Economics*, *32*(1), 286-303.

Kesternich, I., Siflinger, B., Smith, J. P., & Winter, J. K. (2014). The effects of World War II on economic and health outcomes across Europe. *Review of Economics and Statistics*, *96*(1), 103-118.

Kesternich, I., Siflinger, B., Smith, J. P., & Winter, J. K. (2015). Individual behavior as a pathway between early-life shocks and adult health: evidence from hunger episodes in post-war Germany. *The Economic Journal*.

Lee, C. (2014). In utero exposure to the Korean War and its long-term effects on socioeconomic and health outcomes. *Journal of Health Economics*, *33*, 76-93.

Lindeboom M, Portrait F, Van den Berg GJ. (2010), Long-run Effects on Longevity of a Nutritional Shock Early in Life: The Dutch Potato Famine of 1846-1847*, Journal of Health Economics, 29*(5), 617-629.

Lindeboom M, Van Ewijk R. (2015), Babies of the War: The effect of war exposure early in life on mortality throughout life. *Biodemography and social biology*, *61*(2), 167-186.

Lumey LH, Stein AD, Susser E. (2011). Prenatal famine and adult health. *Annual Review of Public Health*, *32*, 237–262.

The Maddison-Project, http://www.ggdc.net/MADDISON/Historical_Statistics/vertical-file_02-2010.xls

Mouré, K. (2010) Food Rationing and the Black Market in France (1940–1944). *French History,* 24(2), 262-282.

Neelsen S, Stratmann T. (2011). Effects of prenatal and early life malnutrition: Evidence from the Greek famine. *Journal of Health Economics*, *30*(3), 479-488.

Roseboom, T., Van de Krol, R. (2010). *Baby's van de Hongerwinter*, Augustus, Amsterdam.

Roseboom T J, Painter RC, Van Abeelen AF, Veenendaal MV, De Rooij SR. (2011). Hungry in the womb: what are the consequences? Lessons from the Dutch famine. *Maturitas*, *70*(2), 141-145.

Scholte, R. S., van den Berg, G. J., & Lindeboom, M. (2015). Long-run effects of gestation during the Dutch Hunger Winter famine on labor market and hospitalization outcomes. *Journal of Health Economics*, *39*, 17-30.

Seckl JR, Holmes MC. (2007), Mechanisms of Disease: glucocorticoids, their placental metabolism and fetal ‘programming’ of adult pathophysiology, *Nature Clinical Practice Endocrinology & Metabolism, 3*, 479–488.

Van den Berg GJ, Lindeboom M, Portrait F. (2006), Economic conditions early in life and individual mortality, *The American Economic Review 96*, 290-302.

Van den Berg, G. J., Pinger, P. R., & Schoch, J. (2015). Instrumental variable estimation of the causal effect of hunger early in life on health later in life. *The Economic Journal*.

Van den Bergh BR, Mulder EJ, Mennes M & Glover V (2005), Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review. *Neuroscience & Biobehavioral Reviews 29*, 237–258.

Van Os J, Selten JP. (1998) Prenatal exposure to maternal stress and subsequent schizophrenia: the May 1940 invasion of the Netherlands. *British Journal of Psychiatry, 172*(4), 324-326

Yeung, G. Y., Van den Berg, G. J., Lindeboom, M., & Portrait, F. R. (2014). The impact of early-life economic conditions on cause-specific mortality during adulthood. *Journal of Population Economics*, *27*(3), 895-919.

Table 1: Prenatal exposure to WWII and health at old age

	Mean	Females				N	Males				N
	(SD)	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	
Cognitive	9.5	0.418***	0.204**	0.423***	0.422***	10,700	0.010	-0.140	0.015	0.015	9,239
performance	(3.3)	(0.097)	(0.102)	(0.097)	(0.097)		(0.100)	(0.107)	(0.100)	(0.100)	
Fair / poor	26.0	-1.139	0.275	-1.198	-1.199	10,805	-1.333	-1.344	-1.325	-1.321	9,412
self-rep. health	(43.8)	(1.382)	(1.450)	(1.383)	(1.383)		(1.407)	(1.477)	(1.409)	(1.409)	
Hospitalized in	12.7	-0.695	-0.516	-0.675	-0.665	10,785	0.524	0.754	0.534	0.540	9,386
past year	(33.3)	(0.894)	(0.963)	(0.894)	(0.894)		(0.994)	(1.069)	(0.996)	(0.996)	
Number of	4.0	-0.403**	-0.304*	-0.407**	-0.407**	10,747	-0.103	-0.114	-0.107	-0.107	9,357
GP visits	(4.9)	(0.160)	(0.164)	(0.160)	(0.160)		(0.145)	(0.154)	(0.146)	(0.146)	
Having 1 or more	14.5	-2.761**	-1.128	-2.876**	-2.885**	10,789	-0.894	0.421	-0.918	-0.919	9,419
limitations	(35.2)	(1.149)	(1.199)	(1.149)	(1.149)		(1.069)	(1.118)	(1.071)	(1.071)	
Wave dummies		X	X	X	X		X	X	X	X	
Country dummies		X	X	X	X		X	X	X	X	
Age		X	X		X		X	X		X	
Age^2			X					X			
Year of birth				X	X				X	X	

Sample sizes pertain to each of the regressions in their respective rows. All specifications additionally include a dummy for respondents conceived between May '45 and Dec. '46.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Prenatal exposure to WWII and health at old age - Difference-in-differences

	Females				N	Males				N
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	
A. Occupied countries										
Cognitive performance	0.160	0.146	0.154	0.160	15,305	-0.069	-0.075	-0.071	-0.070	13,191
	(0.151)	(0.151)	(0.151)	(0.151)		(0.156)	(0.156)	(0.156)	(0.156)	
Fair / poor self-rep. health	1.509	1.591	1.541	1.523	15,451	-0.494	-0.490	-0.482	-0.495	13,396
	(2.021)	(2.022)	(2.021)	(2.022)		(2.015)	(2.015)	(2.014)	(2.015)	
Hospitalized in last year	-0.163	-0.146	-0.151	-0.173	15,428	-1.974	-1.961	-1.960	-1.978	13,369
	(1.381)	(1.381)	(1.381)	(1.381)		(1.609)	(1.610)	(1.609)	(1.609)	
Number of GP visits	-0.254	-0.249	-0.252	-0.250	15,380	-0.103	-0.114	-0.107	-0.107	13,329
	(0.214)	(0.214)	(0.214)	(0.214)		(0.145)	(0.154)	(0.146)	(0.146)	
Having 1 or more limitations	-1.526	-1.443	-1.519	-1.446	15,443	1.009	1.046	1.010	1.010	13,394
	(1.680)	(1.680)	(1.679)	(1.680)		(1.503)	(1.505)	(1.503)	(1.503)	
B. Neutral countries										
Cognitive performance	0.211*	0.002	0.219*	0.212*	15,305	0.051	-0.105	0.052	0.050	13,191
	(0.123)	(0.125)	(0.123)	(0.123)		(0.124)	(0.127)	(0.124)	(0.124)	
Fair / poor self-rep. health	-0.295	-0.289	-0.268	-0.287	15,451	-0.693	-0.680	-0.694	-0.683	13,396
	(2.231)	(2.231)	(2.231)	(2.232)		(2.322)	(2.323)	(2.323)	(2.324)	
Hospitalized in past year	-0.416	-0.113	-0.420	-0.393	15,428	2.271*	2.668**	2.287*	2.313*	13,369
	(1.111)	(1.139)	(1.111)	(1.111)		(1.326)	(1.358)	(1.327)	(1.326)	
Number of GP visits	-0.030	0.050	-0.038	-0.040	15,380	-0.139	-0.112	-0.144	-0.144	13,329
	(0.159)	(0.163)	(0.159)	(0.159)		(0.128)	(0.131)	(0.128)	(0.128)	
Having 1 or more limitations	-0.641	0.711	-0.753	-0.833	15,443	-1.662	-0.586	-1.683	-1.684	13,394
	(1.339)	(1.363)	(1.340)	(1.341)		(1.174)	(1.193)	(1.175)	(1.175)	
Wave dummies	X	X	X	X		X	X	X	X	
Country dummies	X	X	X	X		X	X	X	X	
Age	X	X		X		X	X		X	
Age^2		X					X			
Year of birth			X	X				X	X	

Sample sizes pertain to each of the regressions in their respective rows. Panel A. shows interaction effects "born ≥ May 1940 & conceived ≤ April 1945" * "Occupied country". Panel B. shows the main effects for "born ≥ May 1940 & conceived ≤ April 1945" .
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 3: Prenatal exposure to WWII and health at old age - effects by country

	Females						Males					
	Belgium		France		Netherlands		Belgium		France		Netherlands	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cognitive performance	0.145	0.360**	0.327**	0.532***	0.120	0.361**	-0.140	0.013	-0.234	-0.091	-0.034	0.137
	(0.163)	(0.159)	(0.156)	(0.153)	(0.178)	(0.176)	(0.167)	(0.163)	(0.168)	(0.165)	(0.184)	(0.179)
Fair / poor self-rep. health	1.612	0.188	1.061	-0.292	-2.204	-3.835	-3.123	-3.118	-2.699	-2.701	2.245	2.255
	(2.296)	(2.260)	(2.308)	(2.269)	(2.396)	(2.343)	(2.275)	(2.234)	(2.381)	(2.348)	(2.490)	(2.439)
Hospitalized in past year	-0.420	-0.573	-0.959	-1.126	-0.091	-0.217	2.367	2.154	-1.293	-1.509	1.047	0.819
	(1.602)	(1.567)	(1.482)	(1.440)	(1.449)	(1.395)	(1.730)	(1.686)	(1.768)	(1.740)	(1.588)	(1.520)
Number of GP visits	-0.096	-0.196	-0.307	-0.402**	-0.531***	-0.645***	0.111	0.117	-0.183	-0.174	-0.294	-0.287
	(0.366)	(0.366)	(0.192)	(0.188)	(0.192)	(0.183)	(0.303)	(0.301)	(0.219)	(0.215)	(0.199)	(0.190)
Having 1 or more limitations	3.088	1.384	-2.930*	-4.511***	-3.790**	-5.783***	0.958	-0.344	0.424	-0.813	-0.183	-1.664
	(2.086)	(2.058)	(1.719)	(1.691)	(1.920)	(1.880)	(1.904)	(1.873)	(1.721)	(1.704)	(1.715)	(1.673)
Wave dummies	X	X	X	X	X	X	X	X	X	X	X	X
Country dummies	X	X	X	X	X	X	X	X	X	X	X	X
Age	X	X	X	X	X	X	X	X	X	X	X	X
Age^2	X		X		X		X		X		X	
Year of birth		X		X		X		X		X		X

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Prenatal exposure to WWII and health at old age - by year of exposure

	Females (1)	Females (2)	Males (3)	Males (4)	Females (1)	Females (2)	Males (3)	Males (4)
	Cognitive performance				Fair/poor self-reported health			
1940	0.008	0.160	-0.025	0.083	-0.428	-1.470	-5.679*	-5.657*
	(0.203)	(0.203)	(0.230)	(0.229)	(3.234)	(3.219)	(3.172)	(3.160)
1941	0.250	0.438**	-0.141	-0.008	1.459	0.202	2.629	2.643
	(0.212)	(0.211)	(0.231)	(0.228)	(3.107)	(3.083)	(3.103)	(3.081)
1942	0.196	0.407**	-0.459**	-0.295	3.995	2.587	5.970**	5.999**
	(0.201)	(0.198)	(0.208)	(0.205)	(2.980)	(2.948)	(3.010)	(2.974)
1943	0.195	0.433**	0.126	0.290	-1.041	-2.644	-7.275***	-7.268***
	(0.197)	(0.194)	(0.202)	(0.198)	(2.665)	(2.619)	(2.601)	(2.559)
1944	0.444**	0.686***	-0.155	0.019	0.132	-1.500	-4.166	-4.147
	(0.195)	(0.192)	(0.193)	(0.189)	(2.703)	(2.657)	(2.715)	(2.669)
1945	0.049	0.297	-0.184	-0.003	-2.658	-4.377	0.820	0.859
	(0.223)	(0.220)	(0.229)	(0.226)	(2.932)	(2.888)	(3.221)	(3.183)
	Hospitalized in past year				Number of GP visits			
1940	-0.543	-0.641	1.693	1.590	-0.299	-0.371	-0.576*	-0.576*
	(2.048)	(2.032)	(2.399)	(2.380)	(0.333)	(0.332)	(0.333)	(0.332)
1941	-0.403	-0.567	4.903**	4.758**	-0.184	-0.271	0.086	0.091
	(1.976)	(1.946)	(2.356)	(2.333)	(0.354)	(0.351)	(0.328)	(0.322)
1942	-1.897	-2.071	1.219	1.060	-0.034	-0.132	0.237	0.239
	(1.823)	(1.791)	(2.069)	(2.038)	(0.401)	(0.400)	(0.316)	(0.311)
1943	-1.516	-1.690	-1.847	-2.035	-0.427	-0.538*	-0.347	-0.338
	(1.688)	(1.641)	(1.868)	(1.826)	(0.314)	(0.311)	(0.253)	(0.248)
1944	1.061	0.880	-1.643	-1.826	-0.306	-0.419*	-0.105	-0.099
	(1.831)	(1.787)	(1.842)	(1.790)	(0.243)	(0.238)	(0.336)	(0.334)
1945	0.241	0.113	0.960	0.803	-0.583**	-0.702**	-0.038	-0.038
	(2.074)	(2.038)	(2.318)	(2.278)	(0.290)	(0.286)	(0.300)	(0.297)
	Having 1 or more limitations							
1940	-1.377	-2.650	-1.317	-2.230				
	(2.660)	(2.650)	(2.402)	(2.397)				
1941	-0.676	-2.145	1.594	0.451				
	(2.492)	(2.478)	(2.304)	(2.290)				
1942	0.305	-1.350	3.740	2.340				
	(2.448)	(2.420)	(2.313)	(2.289)				
1943	-1.803	-3.717*	1.307	-0.119				
	(2.104)	(2.070)	(2.104)	(2.072)				
1944	-0.318	-2.261	-1.274	-2.778				
	(2.235)	(2.198)	(2.028)	(1.996)				
1945	-3.243	-5.374**	-2.297	-3.844*				
	(2.417)	(2.376)	(2.163)	(2.127)				
Wave dummies	X	X	X	X	X	X	X	X
Country dummies	X	X	X	X	X	X	X	X
Age	X	X	X	X	X	X	X	X
Age^2	X		X		X		X	
Year of birth		X		X		X		X

1940-1944 are dummy variables for being born between May of the respective year and April of the following year. 1945 is a dummy variable for being born between May 1945 and January 1946. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Prenatal exposure to WWII and health at old age: different sub samples

	Females		Males	
	1934-'50	1940-'56	1934-'50	1940-'56
	(1)	(2)	(3)	(4)
Cognitive performance	0.380***	-0.006	-0.017	-0.199
	(0.101)	(0.191)	(0.104)	(0.204)
Fair / poor self-rep. health	-0.141	0.253	-1.319	-0.069
	(1.413)	(2.547)	(1.455)	(2.675)
Hospitalized in past year	-0.408	0.066	0.167	-2.216
	(0.909)	(1.705)	(1.035)	(1.928)
Number of GP visits	-0.285*	-0.097	-0.161	-0.061
	(0.160)	(0.277)	(0.154)	(0.268)
Having 1 or more limitations	-2.246*	-0.440	-0.495	1.309
	(1.175)	(2.096)	(1.094)	(1.915)
N	7,641	8,644	6,778	7,521

The samples for each regression only include persons born in the cohorts indicated at the top of the column. Each regression includes wave and country dummies and controls for age and year of birth. The indicated sample sizes are for the regressions with self-reported health as the dependent variable. Due to missing values, sample sizes of regressions with other dependent variables are marginally lower. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Prenatal exposure to WWII and health at old age - effects by country: different sub samples

	Females						Males					
	Belgium		France		Netherlands		Belgium		France		Netherlands	
	1934-'50	1940-'56	'34-'50	'40-'56	'34-'50	'40-'56	1934-'50	1940-'56	'34-'50	'40-'56	'34-'50	'40-'56
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cognitive	0.534***	-0.170	0.480***	0.072	0.070	0.075	-0.057	-0.185	-0.123	-0.370	0.151	-0.041
performance	(0.172)	(0.234)	(0.167)	(0.228)	(0.190)	(0.240)	(0.173)	(0.242)	(0.175)	(0.247)	(0.193)	(0.258)
Fair / poor	1.589	1.048	0.728	2.783	-3.172	-3.432	-2.679	-3.121	-3.026	-0.200	2.152	3.456
self-rep. health	(2.393)	(3.161)	(2.413)	(3.169)	(2.543)	(3.217)	(2.419)	(3.240)	(2.521)	(3.327)	(2.633)	(3.344)
Hospitalized in	-0.324	0.550	-1.170	-0.716	0.412	0.341	2.170	-0.779	-1.840	-4.381*	-0.027	-1.825
past year	(1.654)	(2.175)	(1.547)	(2.096)	(1.480)	(2.001)	(1.806)	(2.401)	(1.882)	(2.400)	(1.653)	(2.266)
Number of	-0.375	0.452	-0.155	-0.139	-0.318*	-0.621**	-0.024	0.270	-0.257	-0.104	-0.208	-0.397
GP visits	(0.385)	(0.421)	(0.194)	(0.319)	(0.184)	(0.300)	(0.324)	(0.380)	(0.233)	(0.311)	(0.216)	(0.290)
Having 1 or more	2.157	3.855	-4.410**	-1.268	-4.722**	-4.007	-0.102	1.900	0.131	1.832	-1.619	0.054
limitations	(2.192)	(2.747)	(1.837)	(2.454)	(2.062)	(2.612)	(2.026)	(2.476)	(1.809)	(2.337)	(1.810)	(2.360)

The samples for each regression only include persons born in the cohorts indicated at the top of the column. Each regression includes wave and country dummies and controls for age and year of birth. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Prenatal exposure to WWII and health at old age - respondents added to compensate for selective mortality

	Females					Males				
	All countries	Belgium	France	Netherlands	N	All countries	Belgium	France	Netherlands	N
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	
Cognitive performance	0.314***	0.290*	0.367**	0.277*	10,728	-0.082	-0.119	-0.163	0.053	9,262
	(0.096)	(0.162)	(0.152)	(0.165)		(0.098)	(0.160)	(0.166)	(0.166)	
Fair / poor self-rep. health	0.578	1.664	1.770	-2.060	10,822	0.643	-0.795	-1.041	4.145*	9,416
	(1.390)	(2.269)	(2.280)	(2.362)		(1.422)	(2.270)	(2.378)	(2.459)	
Hospitalized in past year	1.133	0.945	0.976	1.564	10,822	2.363**	4.318**	-0.059	2.639	9,416
	(0.939)	(1.666)	(1.552)	(1.490)		(1.039)	(1.785)	(1.834)	(1.608)	
Number of GP visits	-0.248	-0.026	-0.201	-0.549***	10,784	0.059	0.377	-0.029	-0.205	9,386
	(0.159)	(0.366)	(0.195)	(0.169)		(0.142)	(0.294)	(0.220)	(0.158)	
Having 1 or more limitations	-0.720	3.247	-2.129	-3.525*	10,822	1.349	2.537	0.866	0.537	9,416
	(1.185)	(2.122)	(1.793)	(1.959)		(1.123)	(2.003)	(1.817)	(1.778)	
Wave dummies	X	X	X	X		X	X	X	X	
Country dummies	X					X				
Year of birth	X	X	X	X		X	X	X	X	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Prenatal exposure and parental characteristics

	Longe-vity mother	Longe-vity father	When age 10: Father present	Parents smoked	Parents drank heavily	Parents had mental health problems
	(1)	(2)	(3)	(4)	(5)	(6)
All exposed	0.799**	-0.566	-0.013	-0.031**	-0.019**	0.004
	(0.356)	(0.381)	(0.011)	(0.015)	(0.009)	(0.005)
Belgium	0.317	-0.613	-0.016	-0.038	-0.008	0.005
	(0.630)	(0.662)	(0.016)	(0.026)	(0.016)	(0.008)
France	0.999*	-0.743	-0.022	-0.034	-0.022	0.007
	(0.562)	(0.621)	(0.021)	(0.031)	(0.019)	(0.007)
Netherlands	1.006*	-0.306	-0.001	-0.023	-0.029***	0.000
	(0.581)	(0.621)	(0.016)	(0.021)	(0.010)	(0.011)
1940	1.122	-0.723	-0.026	-0.061*	-0.030*	-0.003
	(0.841)	(0.883)	(0.025)	(0.035)	(0.017)	(0.010)
1941	0.550	-0.699	-0.027	-0.009	-0.006	0.015
	(0.791)	(0.838)	(0.024)	(0.032)	(0.019)	(0.013)
1942	-0.100	-0.888	-0.036	-0.082**	-0.021	-0.006
	(0.736)	(0.790)	(0.024)	(0.034)	(0.018)	(0.009)
1943	1.503**	-0.561	-0.016	-0.068**	-0.009	-0.003
	(0.662)	(0.776)	(0.021)	(0.032)	(0.018)	(0.009)
1944	0.769	-0.834	0.007	0.017	-0.020	0.026*
	(0.702)	(0.737)	(0.018)	(0.029)	(0.017)	(0.014)
1945	0.909	0.461	0.023	0.020	-0.034*	-0.010
	(0.731)	(0.838)	(0.019)	(0.034)	(0.019)	(0.010)
Total N	9,706	9,541	5,067	5,166	5,166	5,166

Table shows regressions of charateristics of respondents' parents on prenatal exposure status. Each column within a panel shows a separate regression. The sample for each regression includes both female and male respondents. All regressions control for respondents' year of birth. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 9: Prenatal exposure to WWII and health at old age - adjusting for parental characteristics

	Females						Males					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cognitive performance	0.422***	0.365***	0.410***	0.458***	0.427***	0.386***	0.015	0.181*	-0.109	-0.033	-0.049	-0.011
	(0.097)	(0.106)	(0.126)	(0.129)	(0.127)	(0.131)	(0.098)	(0.108)	(0.128)	(0.130)	(0.129)	(0.138)
Fair/poor self-rep. health	-1.199	-0.772	0.130	-0.155	0.248	-0.670	-1.321	-1.203	1.603	1.116	1.431	1.389
	(1.362)	(1.486)	(1.823)	(1.828)	(1.802)	(1.925)	(1.375)	(1.506)	(1.809)	(1.821)	(1.811)	(1.938)
Hospitalized in past year	-0.665	-0.135	0.363	0.396	0.123	0.046	0.540	1.115	0.844	0.823	0.990	1.744
	(0.883)	(0.972)	(1.140)	(1.142)	(1.125)	(1.221)	(0.960)	(1.066)	(1.231)	(1.231)	(1.215)	(1.351)
Number of GP visits	-0.407**	-0.286*	-0.169	-0.193	-0.143	-0.158	-0.107	-0.119	0.041	0.021	0.048	-0.003
	(0.160)	(0.167)	(0.223)	(0.224)	(0.217)	(0.209)	(0.142)	(0.151)	(0.195)	(0.194)	(0.192)	(0.218)
Having 1 or more limitations	-2.885**	-2.590**	0.002	0.053	0.120	-0.122	-0.919	-1.095	-0.469	-0.565	-0.154	-0.100
	(1.129)	(1.209)	(1.516)	(1.516)	(1.486)	(1.594)	(1.040)	(1.136)	(1.345)	(1.351)	(1.360)	(1.484)
Parental longevity	No	Yes	No	No	No	Yes	No	Yes	No	No	No	Yes
Parental occupation (main breadwinner)	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Biological father in household	No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes
Parental smoking/drinking/mental health	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
N	10,805	8,882	6,616	6,607	6,752	5,754	9,412	7,661	5,514	5,509	5,594	4,684

Each regression controls for age and year of birth. Sample sizes indicate the maximum for the regressions in the respective columns. Differences in sample sizes between regressions in the same column are small: cf. Table 1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Prenatal exposure to WWII and health at old age - adjusting for parental characteristics - effects by country

	Females			Males		
	Belgium	France	Netherlands	Belgium	France	Netherlands
	(1)	(2)	(3)	(4)	(5)	(6)
Cognitive performance	0.343	0.502**	0.327	0.017	-0.286	0.182
	(0.212)	(0.234)	(0.217)	(0.220)	(0.261)	(0.225)
Fair / poor self-rep. health	-0.147	1.606	-3.135	-0.864	1.446	3.879
	(3.026)	(3.532)	(3.127)	(2.793)	(3.965)	(3.182)
Hospitalized in past year	0.576	-0.054	-0.452	5.634**	-1.784	-0.024
	(2.190)	(2.223)	(1.601)	(2.188)	(2.691)	(1.891)
Number of GP visits	0.160	-0.161	-0.496**	0.471	-0.313	-0.296
	(0.478)	(0.296)	(0.225)	(0.449)	(0.315)	(0.214)
Having 1 or more limitations	3.547	0.783	-4.889**	1.196	0.258	-1.894
	(2.806)	(2.624)	(2.431)	(2.587)	(2.734)	(2.054)

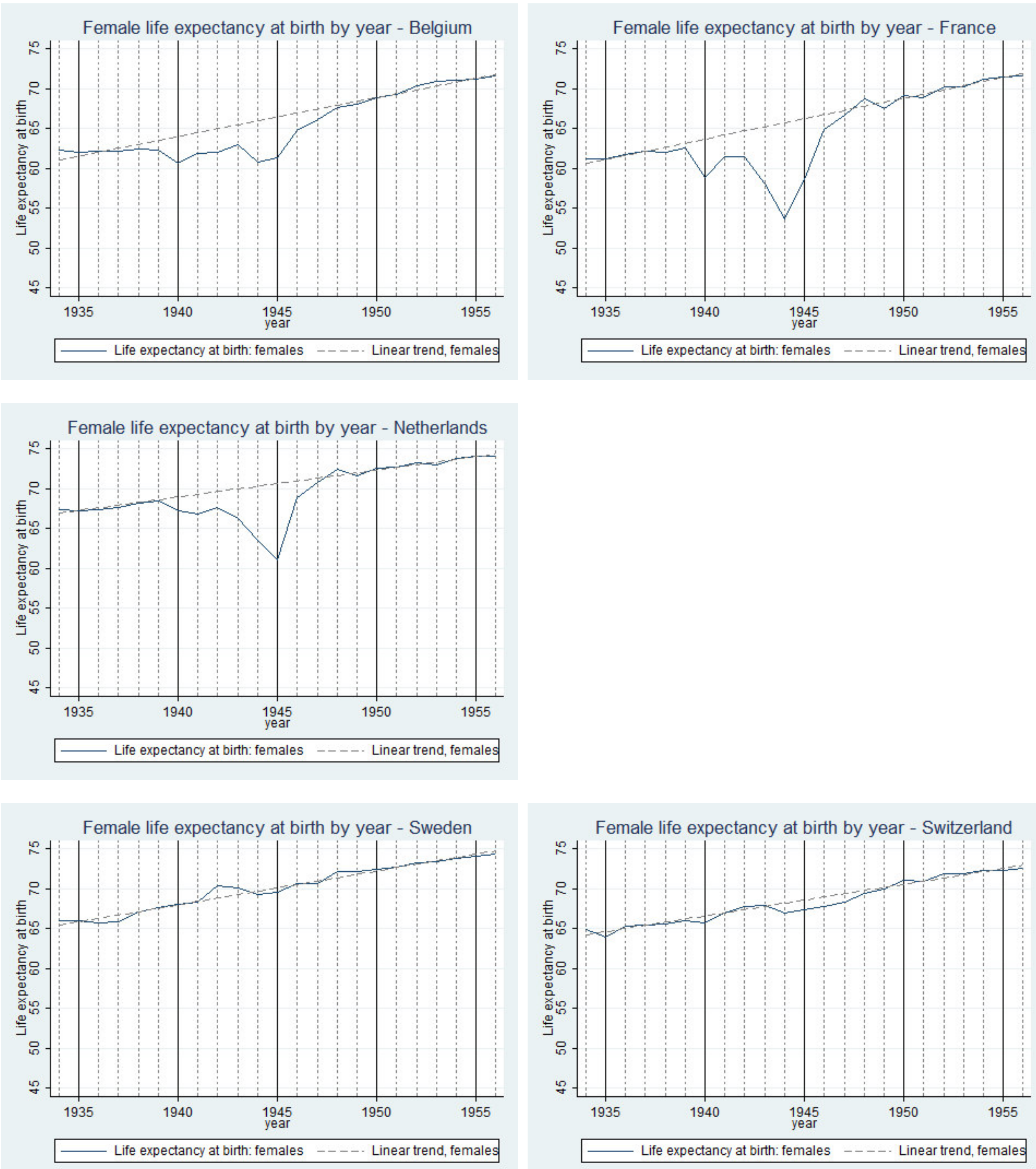
Each regression controls for age and year of birth. Each row within a panel (females/males) shows results from one single regression. Each regression controls for all available parental characteristics. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Prenatal exposure to WWII and health at old age - adjusting for parental characteristics - effects by year

	Females					Males				
	Cognitive performance	Fair/poor self-rep. health	Hospita-lizations	Number of GP visits	Limitations	Cognitive performance	Fair/poor self-rep. health	Hospita-lizations	Number of GP visits	Limitations
1940	0.019	-3.413	-2.017	0.113	-0.743	-0.130	2.436	2.901	-0.368	-4.829*
	(0.286)	(3.940)	(2.402)	(0.691)	(3.385)	(0.286)	(4.283)	(2.958)	(0.328)	(2.670)
1941	0.356	-4.246	0.666	-0.180	-1.452	0.025	7.564*	6.412**	0.259	2.193
	(0.301)	(4.038)	(2.737)	(0.405)	(3.700)	(0.346)	(4.288)	(2.794)	(0.348)	(3.417)
1942	0.196	6.838	-0.899	0.314	0.025	0.107	9.648**	-1.576	0.090	1.932
	(0.278)	(4.441)	(2.349)	(0.620)	(3.491)	(0.294)	(4.547)	(2.533)	(0.340)	(3.289)
1943	0.392	2.044	-2.117	-0.433	1.028	0.045	-3.131	-1.233	-0.208	2.577
	(0.273)	(3.869)	(2.428)	(0.287)	(3.212)	(0.236)	(3.476)	(2.487)	(0.331)	(3.318)
1944	0.645***	-4.151	3.074	-0.073	0.124	0.102	-5.584	2.135	0.046	-1.543
	(0.241)	(3.500)	(2.450)	(0.296)	(2.865)	(0.265)	(3.435)	(2.963)	(0.741)	(2.614)
1945	0.621**	-1.658	1.145	-0.711*	-0.243	-0.313	-1.406	2.260	0.138	-2.077
	(0.279)	(4.393)	(2.808)	(0.386)	(3.468)	(0.311)	(4.059)	(3.027)	(0.381)	(3.201)
N	5713	5754	5747	5736	5752	4622	4684	4680	4669	4683

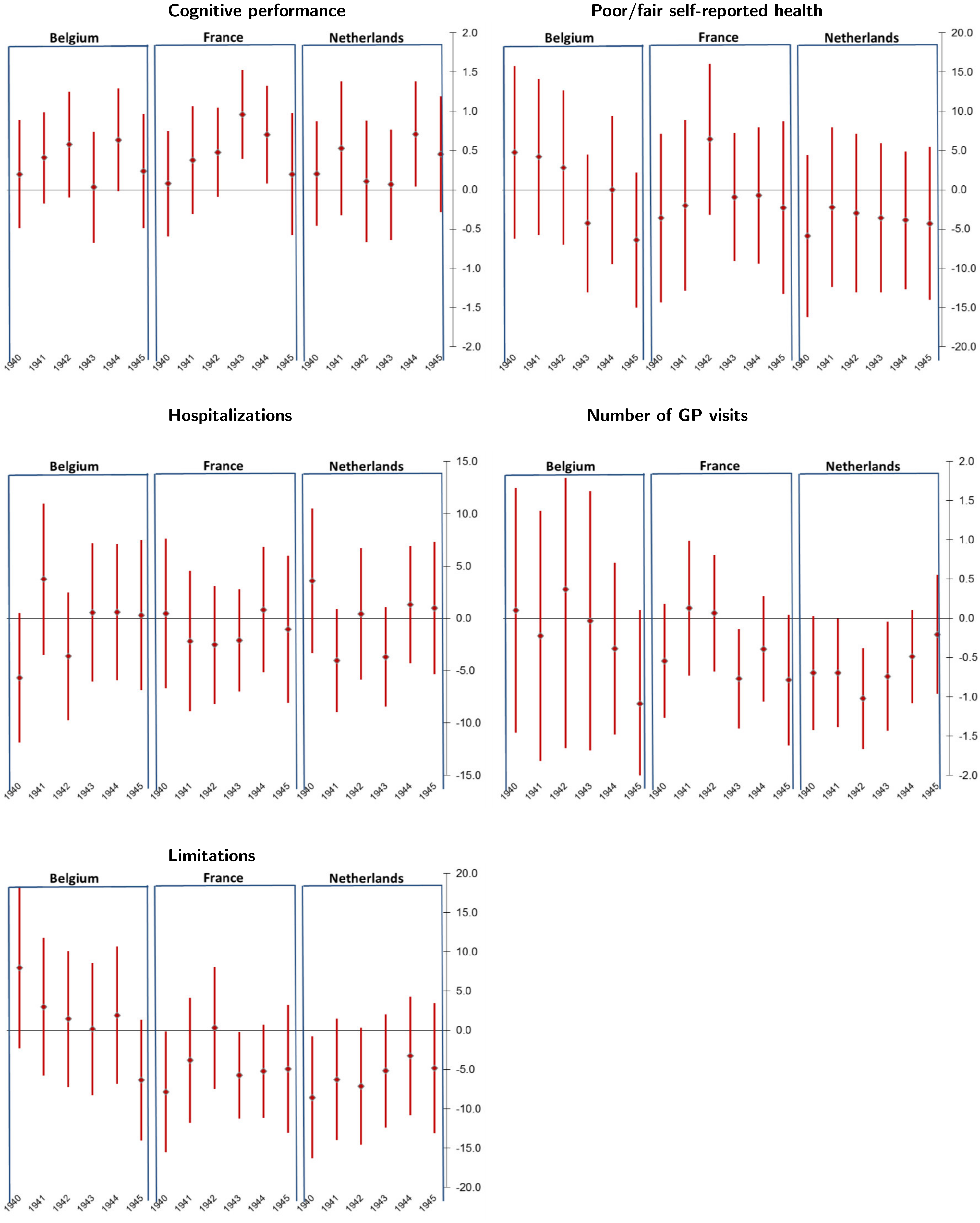
Each regression includes wave and country dummies and controls for age and year of birth. Each column shows results from a separate regression. Each regression controls for all available parental characteristics. 1940-1944 are dummy variables for being born between May of the respective year and April of the following year. 1945 is a dummy variable for being born between May 1945 and January 1946. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Female life expectancy at birth by birth year



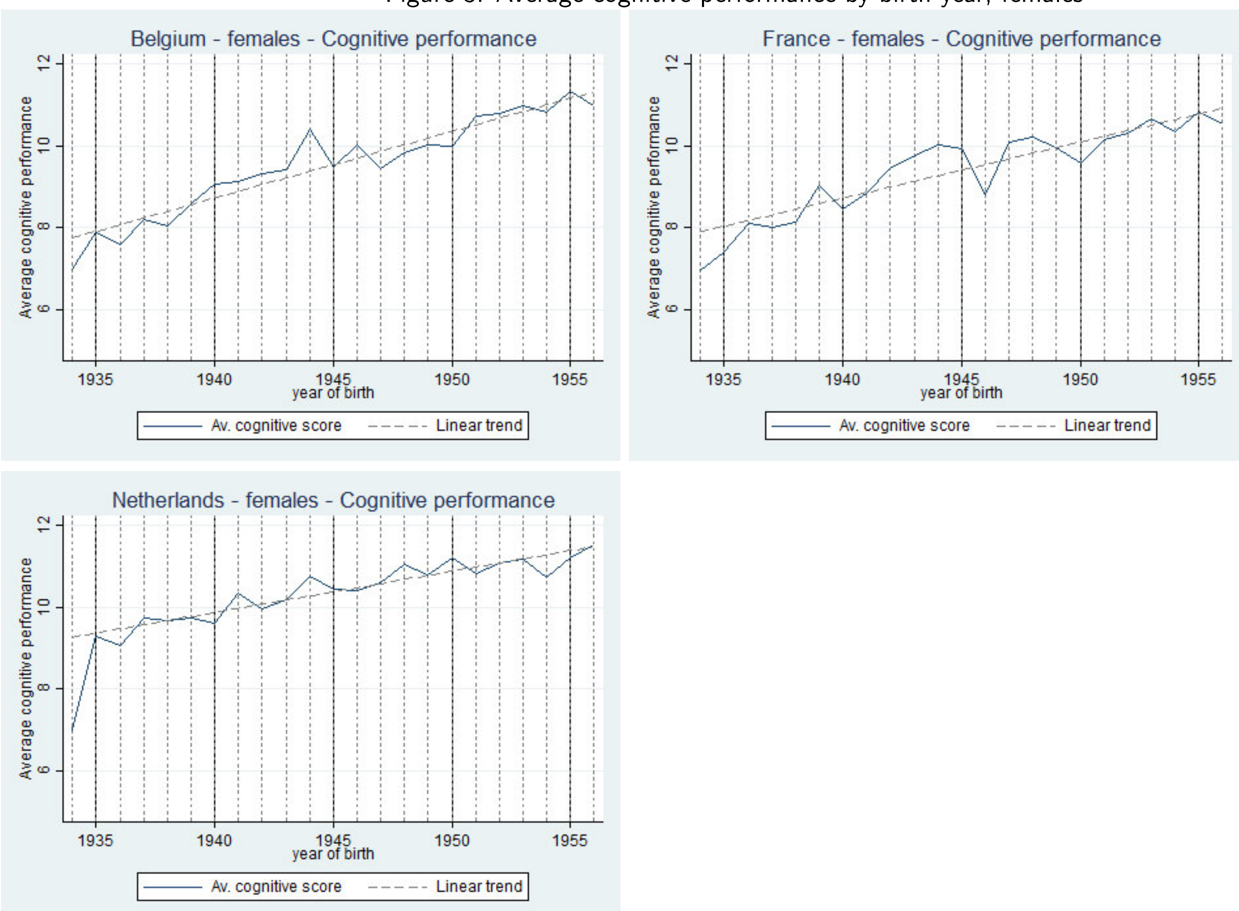
Data: Human Mortality Database. Trends are calculated based on the years 1934-1939 and 1948-1956.

Figure 2: Effects by country and year of exposure for females: 95% confidence intervals



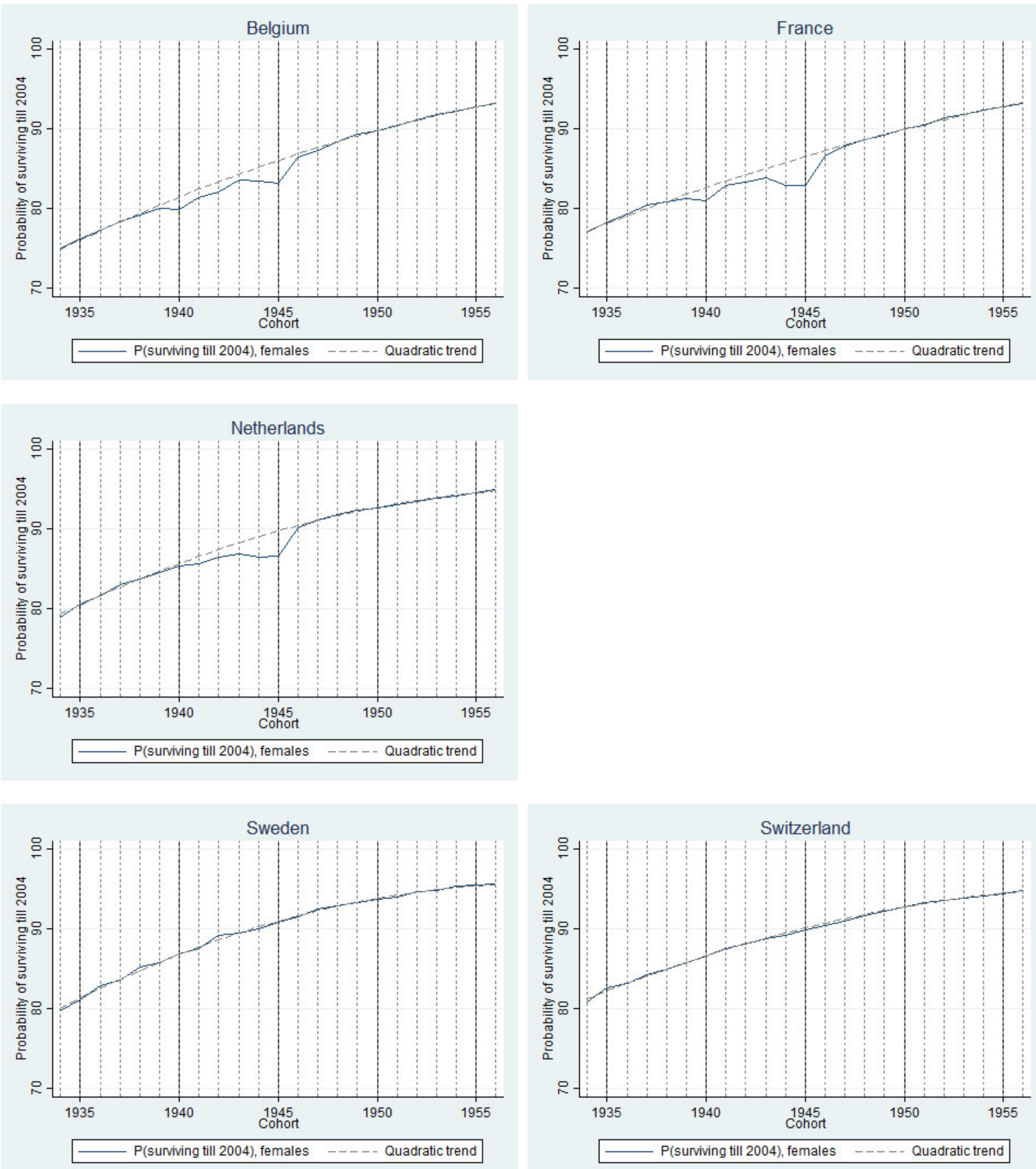
For each dependent variable, all results come from a single regression in which dummies indicating exposure per year are interacted with country dummies. Regressions control for age and year of birth.

Figure 3: Average cognitive performance by birth year, females



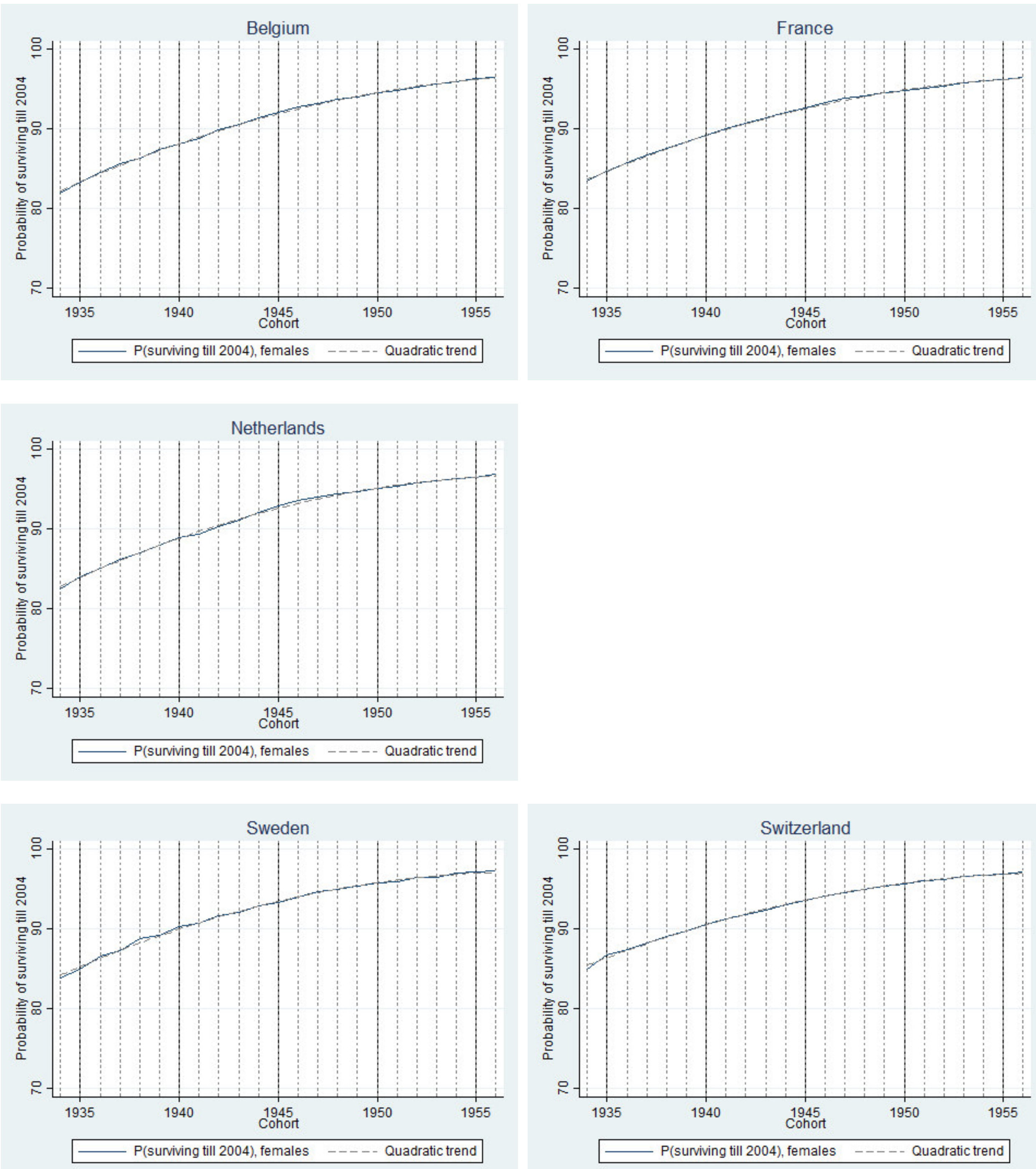
Data are pooled across the three SHARE waves. Trends are calculated based on all of the years 1934–1956.

Figure 4: Probability of surviving till 2004, females



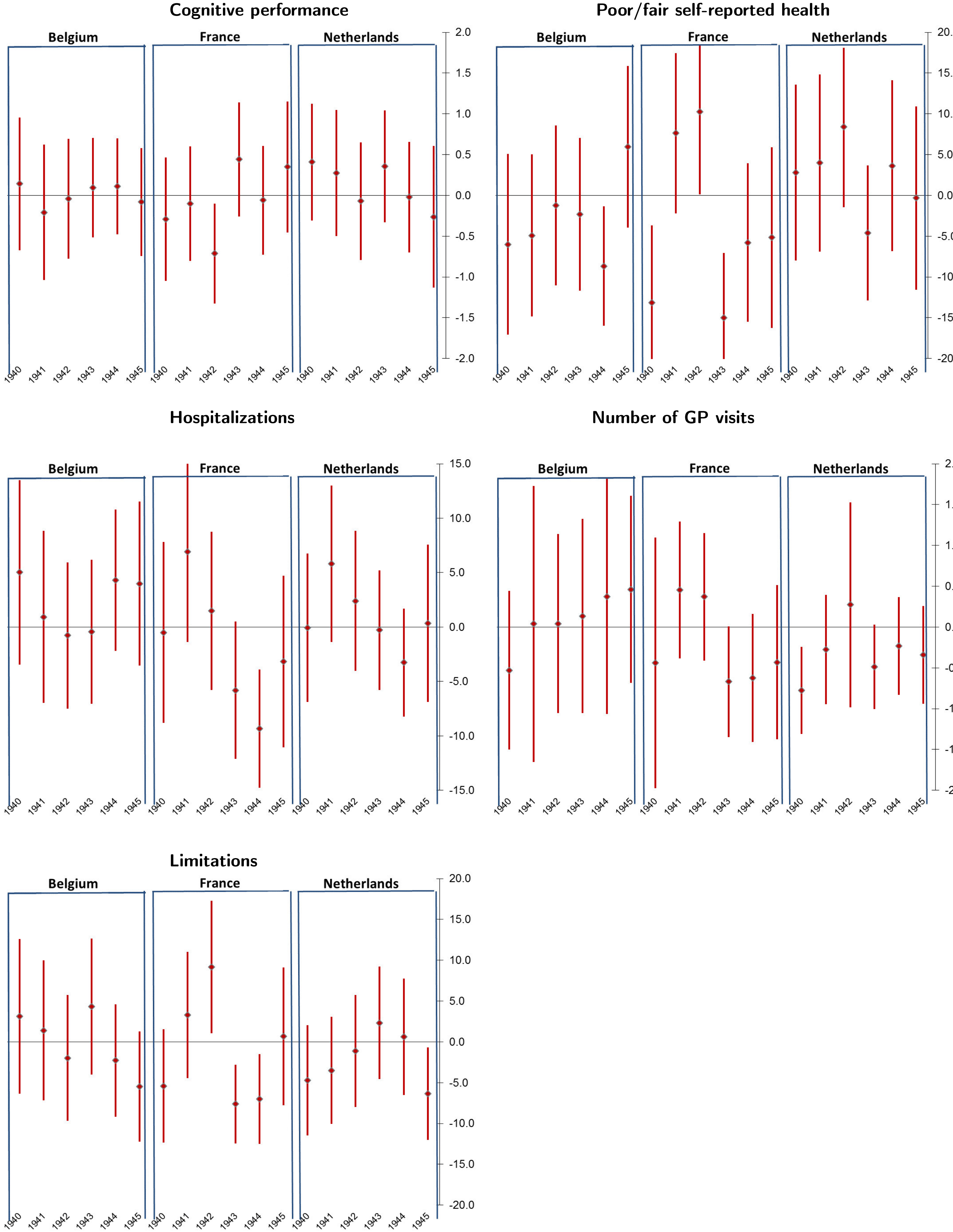
Data: Human Mortality Database. Probability of surviving till 2004 is defined as probability of surviving till one's birthday in that year. Trends are calculated based on the years 1934-1939 and 1948-1956.

Figure 5: Probability of surviving till 2004 conditional on having reached age 2, females



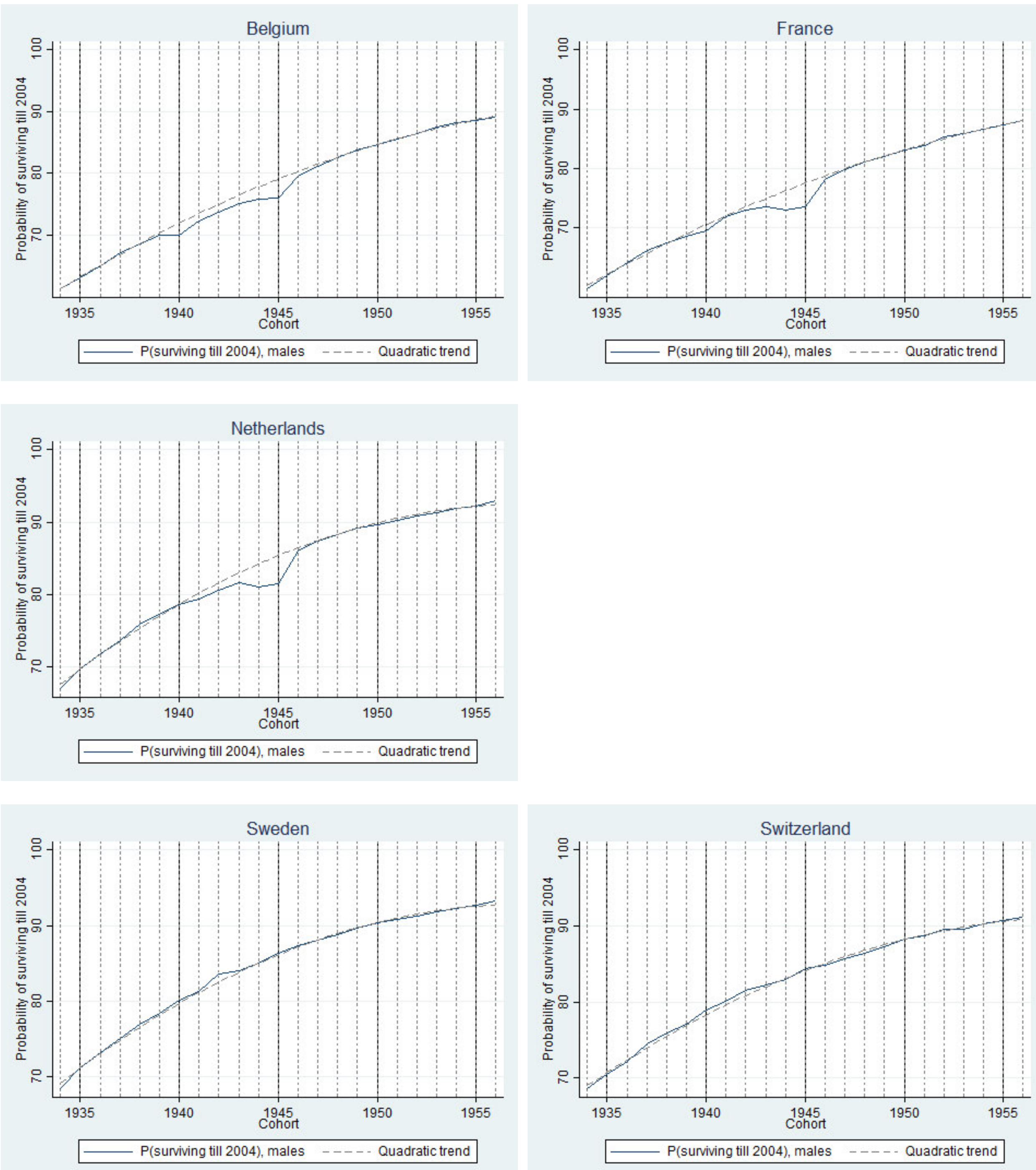
Data: Human Mortality Database. Probability of surviving till 2004 is defined as probability of surviving till one's birthday in that year. Trends are calculated based on the years 1934-1939 and 1948-1956.

Appendix Figure 1: Effects by country and year of exposure for males: 95% confidence intervals



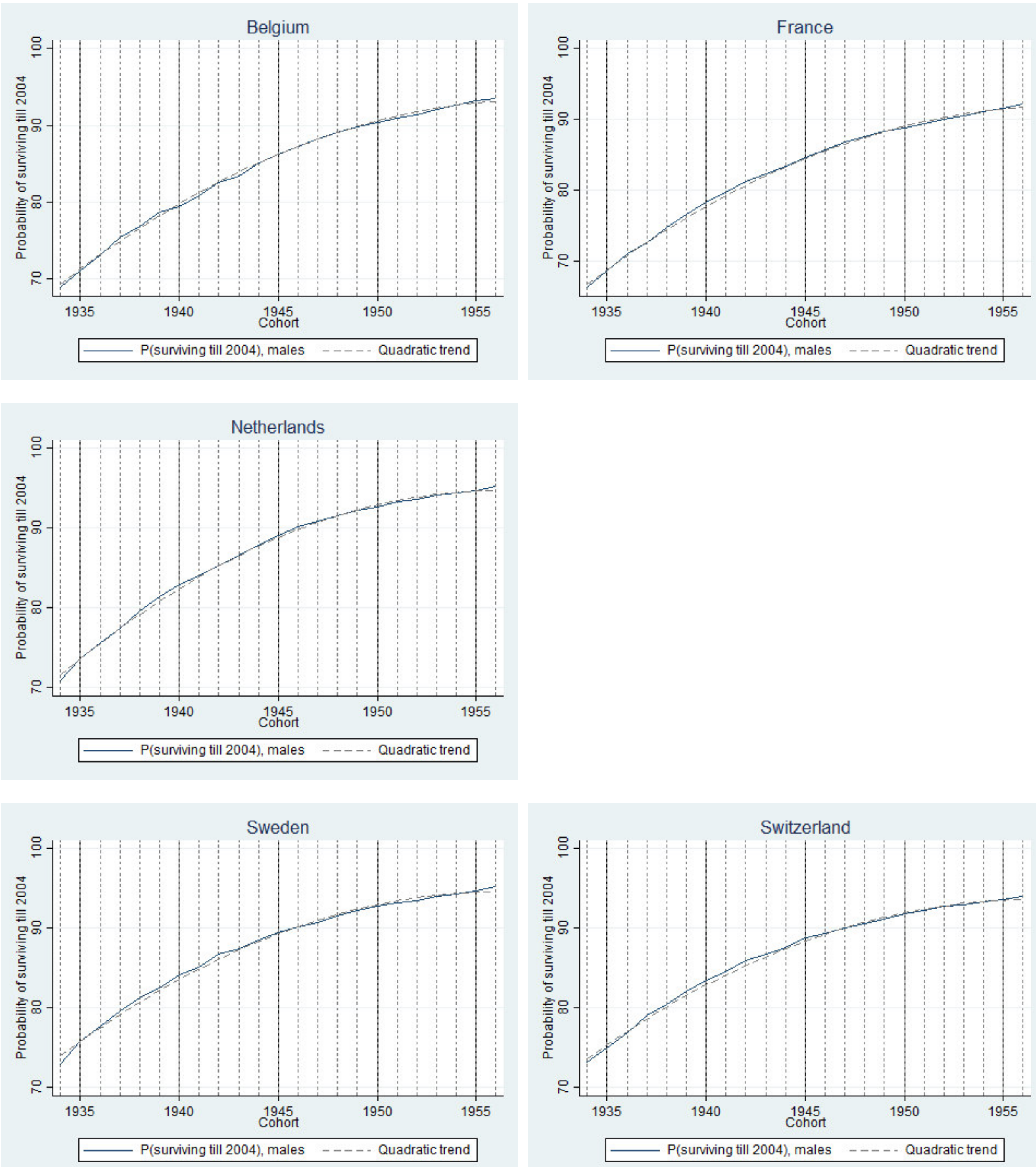
For each dependent variable, all results come from a single regression in which dummies indicating exposure per year are interacted with country dummies. Regressions control for age and year of birth.

Appendix Figure 2: Probability of surviving till 2004, males



Data: Human Mortality Database. Probability of surviving till 2004 is defined as probability of surviving till one's birthday in that year. Trends are calculated based on the years 1934-1939 and 1948-1956.

Appendix Figure 3: Probability of surviving till 2004 conditional on having reached age 2, males



Data: Human Mortality Database. Probability of surviving till 2004 is defined as probability of surviving till one's birthday in that year. Trends are calculated based on the years 1934-1939 and 1948-1956.