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What is the link between mothers' level of education and low birthweight?

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Mothers with a low level of education or from a disadvantaged background have low birthweight babies more often than other women, and low birthweight is itself linked to a risk of ill-health in childhood and even in adult life. Using data from the Elfe child cohort study, which is following the lives of 18,000 children born in 2011, Lidia Panico, Maxim Tô and Olivier Thévenon explore the relationship between family socioeconomic status and newborn health.

The chance of achieving good health depends on physical traits and genetic characteristics, but also on the individual's social and economic context. The early years of life are key to shaping lifelong health trajectories.[1] Social inequalities in health appear from the earliest moments in life, as shown by the large differences in prematurity and low birthweight, which vary substantially according to the parents' socioeconomic status.[2] These health indicators provide information on how the pregnancy progressed, but they also appear to influence the risk of ill-health in childhood and even in adult life. While part of this relationship is probably linked to other factors affecting both postnatal and future health, there also appears to be a causal connection.

We examine here the link between the socioeconomic characteristics of households and newborn health in France using data collected for the Elfe child cohort study, which is following the lives of over 18,000 babies born in France in 2011 (see box).

Birthweight: an indicator of newborn health

A newborn who weighs less than 2.5 kg at birth is considered to have low birthweight. According to data from the Perinatal Survey 2010, 6.4% of all live births in metropolitan France are born at a low birthweight.[4] Gestational age is another indicator of newborn health. In France, 6.6% of babies are born before 37 weeks of pregnancy (counted since the last menstrual period), the cut-off point generally used to define premature birth. [4] The proportion of low birth weight measured in France is similar to the OECD average in 2010.[5]

Only birthweight will be studied here, as the Elfe data currently available cannot be used to analyse very preterm births (see box).

Risk of low birthweight is higher among mothers with a low level of education

There are different ways to measure a household's socioeconomic position, including educational level, measured here by the highest qualification obtained. The lower the mother's educational level, the greater the risk that she will have a low birthweight baby (Figure 1). For mothers with no qualifications, the risk is 50% higher than for mothers with a high-school diploma (the

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The Elfe survey and our analysis sample

The Etude Longitudinale Française depuis l'Enfance (Elfe), a survey conducted jointly by INSERM and INED, is France's first large scale generalist child cohort study.[3] It follows a sample of over 18,000 children born in 2011, and is representative of all children (excluding very preterm infants) born in metropolitan France in that year to mothers who were at least 18 years of age. The children will be tracked from birth until their 20th birthday. Elfe takes a multidisciplinary approach to explore different aspects of the children's lives – environmental exposures, family life, living conditions – and to assess their influence on the children's physical and psychological development, their health and socialization.

The study includes repeated questionnaires with the parents, the collection of biological samples, and linkage to maternity notes and other data sources at different points in each child's life, including shortly after birth in the hospital, at age two months, on their first birthday, etc. In the analyses presented here, we include all singleton births whose mothers were successfully interviewed at both the maternity hospital and for the 2-month survey. This gives us a sample of just over 15,000 babies.

Parallel to Elfe, severely premature babies born before 34 weeks gestation were included in a twin study (Epipage 2) focusing exclusively on the outcomes of very preterm infants. While information on all births will be assembled at a later date, we were only able to analyse data for children born at 34 weeks gestation or more, who account for around 98% of all live births in 2010. [4] For this reason, our sample is not representative of all live births in France, as it excludes very premature babies (just under 2% of all live births in France in 2010). These children also very often have a low birthweight, so their exclusion distorts the sample of low birthweight babies. However, while there is a relationship between socioeconomic status and early prematurity, it is relatively modest when compared to moderate and late prematurity, so the exclusion of these very preterm babies should not considerably affect the relationships presented here.

We also used information from the Millennium Cohort Study, a similar project conducted in the United Kingdom, which is following around 18,000 children born in 2001. From this total sample, only singleton births at more than 33 weeks gestation to mothers aged 18 or over were included to ensure comparability between the two countries.

reference category).[(1)] By contrast, mothers with tertiary qualifications (such as a university degree or a further education diploma) are around 25% less likely to have a low birthweight baby than mothers with only a high-school diploma.

Other ways to measure socioeconomic status include looking at household income. Babies born in households in the top 40% of the income distribution are less likely to have a low birthweight than those born to households in the middle of the income distribution (Figure 1). There

Figure 1. Variation in the risk of having a low birthweight baby
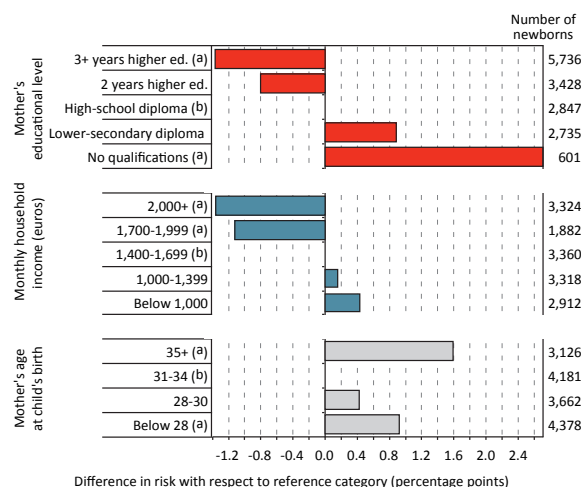
L. Panico, M. Tô, O. Thévenon, *Population & Societies* n° 523, INED June 2015.

Source: Elfe survey.

**Note:**   a: statistically significant difference
b: reference category

Interpretation: The bars indicate the risk for a woman of having a low birthweight baby (below 2.5 kg), and express the difference in percentage points with respect to the reference category: high-school diploma (for educational level), having a household income of €1,400-1,700 per month (for income), and being aged 31-34 at the time of the birth (for maternal age). Only the percentage point differences are indicated; the absolute risks for the reference categories are 5.4%, 5.3% and 4.3%, respectively, for the Elfe sample analysed here (see box). For example, among the 3,428 children born to mothers with two years of higher education, the proportion with a low birthweight is 0.8 percentage points lower than among the children of mothers with a high-school diploma (i.e. 4.7%).

is no real gradient of risk, as is observed with educational level, but rather a contrast between the top two income groups and the bottom three income groups.

The mother's age can also be a factor. The risk of a low birthweight baby is higher for mothers aged under 28 than for those aged 31-34 (Figure 1). Mother's age and socioeconomic position are partly correlated, and having a child at a young age can be a marker of social disadvantage. For women aged 35 and over, the risk of low birthweight also appears to be higher than the average (Figure 1). This age group is very heterogeneous, including mothers at both extremes of the social scale.

Of course part of the relationship between markers of the parents' socioeconomic status, such as their income or education, and their babies' health at birth might be due to other common factors. For example, a young mother is more likely to be having her first baby, while an older mother might be having her second or third child, and we know that first-born babies are often lighter at birth than second or third children. In addition, younger mothers have lower mean incomes than older mothers because they tend to have a lower educational level, but also because they are at a more junior point in their careers.

Figure 2. Risk of having a low birthweight baby by educational level
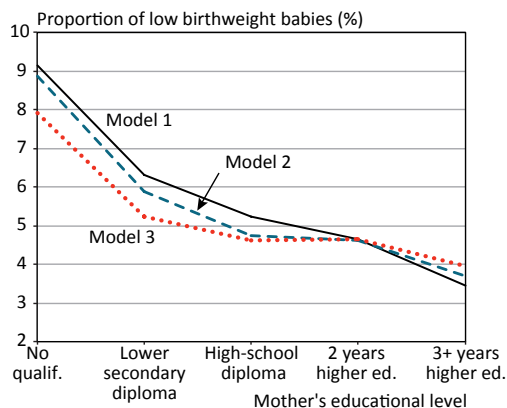
L. Panico, M. Tô, O. Thévenon, *Population & Societies* n° 523, INED June 2015.

Source: Elfe survey.

Interpretation: In model 1, we predict that 9% of babies born to mothers with no qualifications (left-hand side of the x-axis) will have a low birthweight (below 2.5 kg) if other factors (the baby's sex, whether the baby is a first-born child, the mother's age, and the height of the parents) are the same as the population average. In model 2, we predict that if, in addition to the factors mentioned, these households also had the same incomes as the population average, their probability of low birthweight would decrease slightly to just under 9%. In model 3, we assume that these mothers also had the same drinking and smoking behaviours during pregnancy as the population average, decreasing their predicted probability of having a low birthweight baby to 8%.

To isolate the influence of each characteristic and measure its effects all other things being equal, we used regression analysis to compare the predicted probability of babies being born at a low birthweight for each education group (Figure 2). Model 1 takes account of some basic control factors: birth order (whether the baby is a first child), the child's sex, the mother's age, and the height of the parents. Even when the influence of these characteristics is taken out, there are still significant differences by mother's level of education (Figure 2). These differences even appear to be accentuated with respect to Figure 1, where these factors were not taken into account: mothers with no educational qualifications are twice as likely to have a low birthweight baby as the most educated mothers.

The role of income

Markers of socioeconomic disadvantage are often interlinked, and some households accumulate several socioeconomic disadvantages. So the relationship between mother's education and her baby's health at birth could actually reflect other socioeconomic differences, such as living in a low-income household. Taking account of household income (Figure 2, Model 2), the differences by educational level narrow slightly, with a small decrease in the advantage of the most educated groups and in the disadvantage for the least

educated groups. Income thus appears to play a role in explaining the relationship between mother's education and low birthweight, but it does not fully explain these underlying differences. Note that the mother's migration status does not play a role in the disadvantage of low-educated mothers.

How maternal education influences health outcomes for individuals and those they care for is still not entirely clear. One hypothesis is that an individual's socioeconomic position, notably their level of education, may create opportunities and constraints to their ability to achieve good health. For a baby's health at birth, the mother's environment during the pregnancy is a crucial determinant of fetal growth and well-being. Educational attainment and socioeconomic background may be linked to low birthweight by a variety of mechanisms, such as maternal nutrition and smoking during pregnancy, genital tract infections, the quantity and quality of prenatal care, exposure to environmental toxins, maternal stress and other psychosocial factors during pregnancy. [2]

The effects of smoking and alcohol

In the Elfe data we were able to test for a number of these factors. Many characteristics found in the literature – such as number of prenatal health care visits, psychological problems during pregnancy, pregnancy perceived to be a difficult period for the mother, mother's working conditions etc. – did not appear to change the relationship between maternal education and low birthweight. This may mean that in France, for these aspects of pregnancy at least, the policies and infrastructures in place appear to reach and support pregnant women equally across socioeconomic groups. By contrast, smoking and drinking during pregnancy varies significantly by level of education, potentially affecting the frequency of low birthweight.

If smoking and drinking during the pregnancy are also taken into account (Figure 2, Model 3) the differences across education levels again lessen slightly, with the advantage of the most educated groups and the disadvantage of the least educated groups both decreasing moderately. This suggests that, in addition to household income, smoking and alcohol consumption during pregnancy also play a role in the relationship between mother's education and low birthweight. These behaviours appear to partly explain the higher frequency of low birthweight among the least educated group. On the other hand, for mothers with a high-school diploma or a degree in higher education, household income appears to play a greater role than smoking or alcohol consumption. However, some unexplained differences across educational levels remain, indicating that household income and tobacco and alcohol consumption during pregnancy do not account for all the observed inequalities.

Figure 3. Risk of having a low birthweight baby by educational level. Comparison between France and the United Kingdom
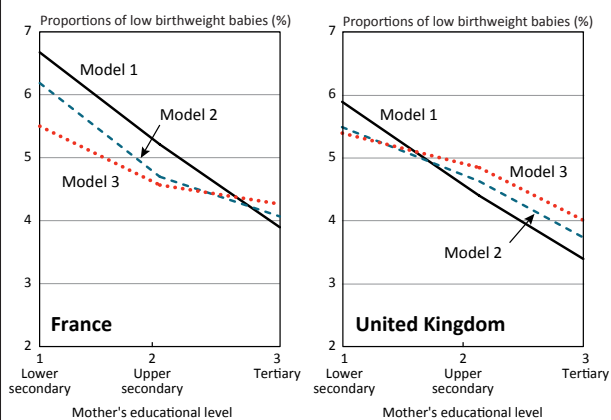
L. Panico, M. Tô, O. Thévenon, *Population & Societies* n° 523, INED June 2015.

Sources: France: Elfe survey (2011); United Kingdom: Millennium Cohort Study (2001).
Interpretation: See Figure 2.

Inequalities at birth are similar in France and in the UK

France and the UK have similar proportions of low birthweight babies (6.4 and 6.9% of all live births in 2010). [5] Socioeconomic differences in newborn health in France and the United Kingdom can be compared using data from Elfe and from a similar study, the Millennium Cohort Study, conducted in the UK (see box). Three comparable educational groups in both countries are defined for the comparison. The differences in low birthweight by educational level, estimated using the same models as before, follow the same pattern in both countries. In the UK, the largest difference is between women with a high-school diploma and those with a higher level of education, while in France, the difference between these two categories is small compared to the gap between women with a high-school diploma and those with the lowest level of education. Smoking during pregnancy may be an explanation for this: it is more frequent in France than in the UK, in particular among the least educated.

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Health inequalities exist in France from the first moments of life, and they are comparable to those observed in the United Kingdom. Inequalities in the adult population are also similar in both countries. [6] The Elfe survey will allow us to continue tracking children as they get older to see how socioeconomic inequalities in health evolve over the life course.

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Abstract

The lower a mother's educational level, the higher the risk that she will have a low birthweight baby (below 2.5kg). The risk is 50% higher for women with no qualifications than for women with a high-school diploma. Differences by educational level narrow slightly when household income and other factors such as birth order, mother's age and parents' height are taken into account, but they do not disappear. Smoking and alcohol consumption during pregnancy appear to play a role, partially explaining the higher proportion of low birthweight babies born to the least educated mothers. The variations in the risk of low birthweight by socioeconomic status are similar in France and the United Kingdom.

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