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CHILDREN OF UNKNOWN FATHERS: PREVALENCE AND OUTCOMES IN SWEDEN

by

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Children of unknown fathers: Prevalence and outcomes in Sweden

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1. Introduction

In most countries, there are a non-negligible number of individuals who have no father noted on their birth certificate, simply "father unknown". Very little is, however, known about the background of these individuals and how they fare in life. This is because digitalized information on them for modern days[1] is rarely available outside the Nordic countries and because, when it is available, these individuals typically drop out of the analysis as they have missing values on all variables for the father. This paper uses a unique large Swedish data set on about 420,000 children born in 1955-1967, in which we observe if the biological parents are known or not, to study the background and outcomes of those with unknown fathers. We examine both short run outcome measures, such as child mortality and educational attainment, and more long-run measures as earnings in 1999 and longevity.

There are several important reasons for studying the background and outcomes of children with unknown fathers. First of all, as very little is known about these individuals, a thorough description should be valuable. Who are they? Who are their mothers? How do they fare in life? Further, in the family-structure literature, not only has it been argued that it is beneficial for children to live with married parents (see e.g. Waite & Gallagher, 2000), it has also been suggested that it is more favorable for children to live with biological parents than in a step family or with adoptive parents (see e.g. Case, Lin & McLanahan, 2000). Therefore, it should be of interest to compare the outcomes of children with unknown fathers to those of children who have a known biological father and have lived with him, and, in particular, to those of children who have not lived with their known biological father, that is, children who grew up with a single biological mother, with a step father or whose father died. Finally, the issue of whether it matters for children to know their biological origin is interesting from a social-policy perspective and has come into focus for other groups of children than those we study,

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[1] There are digitalized historical data, for example, in the Umeå Demographic Data Base, which include children with unknown fathers, see www.ddb.umu.se for information about the data base and publications using it.

namely those who are adopted or conceived through sperm or egg donation. It has been argued that it is vital for children to obtain information about the identity of their biological parent(s) and in Sweden this right is granted by law since 1985. (Also, according to the United Nations Convention on Children's Rights article 7, all children should have the right to know their origin.)

Why would a Swedish child have an unknown father? Typically, as 'the presumption of paternity' applies for children of married parents, these children have unmarried mothers who also are very young. The mother is, moreover, unlikely to be cohabiting[2] with the father since the Municipal Social Welfare Board (MSWB) has not succeeded in establishing the paternity, neither by acknowledgement nor by judgment, which it is obliged by law to do. Even when the mother does not cohabit with the father, paternity is usually established by acknowledgement (Saldéen, 1981). Before 1970—during our study period—a man was adjudged to be the father if it could be proved that he had had sexual intercourse with the child's mother at the time of conception and he could not show that it was 'improbable' that he was the father (Agell & Saldéen, 1991). Thus, it is likely that the mother of a child whose father is unknown either does not know the man's name, or is unwilling to report it because he is married or because she does not want to have anything to do with him.

The fraction of children with unknown father declined over cohorts from about 2.7 percent among children born in 1955 to about 1.2 percent among those born in 1967 (see Figure 1). (This may seem a small fraction but it is, of course, higher—about 10-20 percent— if related to children born to young single women). Most likely, the decline is the combined result of greater availability of contraception, liberalized rights to abortion[3], better sex-

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[2] In Sweden the upsurge in consensual unions did not start until the late 1960s; at the time our cohorts were born it was much less common (Hoem & Hoem, 1988).

[3] Abortion has been free and on demand in Sweden since 1975. In the 1950s and 1960s abortion could be granted through a certificate signed by two doctors, one gynaecologist and one psychiatrist, on medical and socio-medical grounds, but in the period up to 1975 the medical personnel became more flexible in applying the regulations (Santow & Bracher, 1999).

education and greater ability of the MSWB to ascertain paternity, for example, through DNA testing. Interestingly, this trend parallels a larger increase in childlessness among men than among women[4] which may, in turn, be consistent with the explanation for unknown father mentioned above that the mother does not want to have anything to do with the man.

The purpose of this paper is to examine these issues and to provide a thorough empirical description; assessing causality is not within the scope of our paper. We begin by describing our data and sample as well as displaying the means and frequencies. Next, we present our regression results. A concluding discussion ends the paper.

2. Data

2.1 Data, sample and variables

Our data set is based on information from several registers held by Statistics Sweden. The starting point is a random sample of children born in Sweden between 1955 and 1967. From this sample we exclude all persons who have at least one biological parent born abroad and in all our analyses, except that of child mortality, we condition on the individuals being alive at least until the month they turned 18. To identify the individual's childhood family relations, and, especially, children of unknown fathers, we need a large sample and information on the biological relationship between the sample person and the adults in the household, information which we obtain from The Swedish Multi-Generational Register (SMR). These requirements leaves us with a sample of about 420,000 individuals born in Sweden in 1955-1967 to Sweden-born parents, of which almost 8,000 have an unknown father.[5] Since our focus, as mentioned, is on comparing these children to those who have a known father but have not lived with him, we have excluded about 6,000 children whose biological mothers

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[4] Among Swedish men born in 1958 21.2 percent were childless at age 50 compared to 16.7 percent among those born in 1940. Among women born in 1958 13.8 were childless age 45 compared to 11.2 percent among those born in 1940 (Population Statistics various years, Statistics Sweden).

[5] Not included in this sample are 632 persons with two unknown biological parents, 628 persons with unknown mothers, 571 persons whose biological parents both died before the sample person turned 18 and 6,093 persons whose mother died before they turned 18.

died before they turned 18. Trends for this group are, however, included in Figure 1.[6] To obtain longitudinal measures of childhood family structure, we use information on the rearing parents from the Censuses in 1960, 1965, 1970, 1975 and 1980 which we match with the SMR to assess the biological relationship, or lack thereof, between the child and the rearing parent(s). In order to study adult outcomes, this information is combined with data on education and earnings in 1999 from educational and income registers at Statistics Sweden.

On the basis of the information from the SMR we classify the individuals in our sample according to whether they have known and alive biological parents as follows: **A**) persons with known parents whose parents were alive at age 18, **B**) persons with known parents whose fathers died before they turned 18, and **C**) persons with known mothers but unknown fathers.

In addition, for each sampled individual we combine information from three Censuses in such a way that no individual is older than 15 years the last time family structure is classified. When doing so we distinguish between **I**. children who were observed living with two rearing parents in three Censuses and, **II**, those who were not (Table 1, panel A). Among those who grew up with two census parents we differentiate between (1) those who lived with two biological parents, (2) those who lived with their biological mother and a step, adoptive or varying[7] father, (3) those who lived with their biological father and a step, adoptive or varying mother and (4) those who lived with two adoptive parents in three censuses. Further, all children who lived with two rearing parents in three censuses but in varying combinations of the four above have been classified as (5) "others", which also include those living with two foster parents. Lastly, among those not living with two census parents we distinguish between (1) those who lived with a single biological mother in three censuses and (2) "others" which

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[6] For more information on the characteristics and outcomes of this group of children, see Author (2010).
[7] "Varying" father or mother means that the child had a rearing father or mother in three censuses but that this person varied

include those living with two rearing parents in one or two censuses only and those living with a single biological father.

By combining this information with that on whether the biological parents are known and were alive when the child turned 18, we bring a new dimension to the study of family structure. Table 1, panel A and B displays the three by seven groups and the number of individuals in our sample in each group. Two cells are empty by definition (EBD) and others include very few individuals and the numbers have therefore been put in parentheses. Since these cells taken together include only 0.3 per cent of the sample they are left out (LO) in Table 3-9.

We measure outcomes in five ways: child and youth mortality (death before age 18), educational attainment (years of schooling), completion of high school (*gymnasium*), earnings in 1999 and longevity up to 1999. We define years of schooling as the number of years of study generally associated with the highest level of education attained in 1999. As explanatory variables for these outcomes we use gender, year of birth, family structure, biological mother's age at birth and her education. The latter variable is defined in the same way as years of schooling for the individual but in 1970.

2.2 Means and frequencies

In the following we present means and frequencies for our sample with a focus on children with unknown fathers. Table 1, panel B shows that a larger fraction of these children than of those with known biological parents grew up with adoptive parents, with their biological mother and a step/varying father or among "Others with two census parents".[8] Also, as expected, the biological mothers of these children were considerably younger when giving birth than the mothers of those with known biological parents (Table 2, panel A). (This

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[8] Among children with unknown fathers there were 167 (about 2 %) whose mother died before they turned 18. Compared to other children with unknown father these children had lower earnings, lower mortality and the median age of their mother at birth was higher. Other differences were not statistically significant.

difference is statistically significant at p<.01. Hereafter, whenever we point out a difference in means or coefficients, it is statistically significant at least at p<.05.) In fact, about 20 percent were below age 19. The mothers also had less education than the biological mothers of children with known and alive parents but more than those whose father had died (Table 2, panel B).

Further, recent studies point to an association between family structure and child's sex (Lundberg & Rose, 2003; Leigh 2009) and this is also what we see in Table 3. Surprisingly, among those with unknown fathers the percentage female is lower than among those with known biological parents. This is intriguing and hard to come up with an explanation for. Perhaps, if the mother finds the father "unsuitable" and does not want to have anything to do with him, she may be even less inclined to report his name if the child is a boy, since the man would be a bad role model.

Next we examine outcomes and start by those in childhood. Among childhood outcomes we focus on mortality, which is of particular interest since illegitimate children and those born out of wedlock have been found to have higher mortality in historical data for Sweden (Brändström, Edvinsson & Rogers 2002). Very remarkably and disquieting, we find the same pattern in our sample (Table 4): Individuals with an unknown father have higher mortality than those with known and alive biological parents at all ages below 18, that is, before age 2, before age 5 and especially between ages 12 and 18. This may indicate a lack of proper care or low levels of self esteem and well being leading to self destructive behavior. Since their mortality rates, in relation to children with known and alive parents, are particularly high for ages 12-18 we present these in Table 4. Clearly, children of unknown fathers have higher mortality than other children with the same family structure. Mortality is seen to be particularly high – about 4 per cent -- for those with unknown fathers who lived with their biological mother and a step or adoptive father and is significantly higher than the 1.9 per cent

among those with the same family structure and known and alive biological parents. In fact, except among adoptees, all differences between children of unknown fathers and those in column A and B with the same family structure are statistically significant. When it comes to child mortality before the age of 5 (table not presented here), it is significantly higher for children of unknown fathers than for children of known parents. However, comparing across family structures, children of unknown fathers have significantly higher mortality before age 5 only among those who grew up in "Others not with two census parents" and not among adoptees, for example. The fact that among adopted children, those with unknown fathers do not have higher mortality is important since it suggests that their mothers did not neglect their health during pregnancy.

Examining outcomes for young adults as measured by educational attainment (given that they were alive at age 18 and in 1999), we see in Table 5, panel A that the average years of schooling is indeed lower among individuals with unknown fathers than among those with known biological parents. A category which stands out as having few years of schooling is the "Others with two census parents", particularly if their father is unknown. Interestingly, among those who grew up with adoptive parents there is no difference in average years of schooling between those with unknown fathers and those with known and alive biological parents.

When we instead measure educational attainment by whether the individual completed high school (*gymnasium*), these differences are more pronounced; the percentage with completed high school is considerably lower among those with an unknown father than among those with known and alive biological parents. If we compare across family structures we see that children of unknown fathers living in "Others with two census parents" and in "Others not with two census parents" had lower probability of completing high school than children of known and alive parents (group A) in the same family structures. Among those

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who grew up with adoptive parents there is, as before, no difference between those with an unknown father and those with known and alive biological parents.

Turning to long run outcomes in terms of earnings in 1999, we observe similar differences: individuals with unknown fathers have lower earnings than those whose parents were known and alive (Table 6, panel A). Also, the children of unknown fathers in the two "others" categories stands out as having particularly low earnings. As before, among the adopted, those with unknown fathers did not do worse than those with known and alive biological parents.

Finally, we turn to longevity. As we have seen that child and youth mortality is higher for children of unknown fathers at all ages before 18, examining mortality in adulthood is called for. We do that by conditioning on the individual being alive at age 18 and measure longevity by age in 1999 if alive then or if dead before 1999 by age at death. We find that the children of unknown fathers indeed have shorter longevity than those with known and alive biological parents (Table 6, panel B). (The difference between 37.7 and 38.1 is significant at $p<.01$). Also interesting is the fact, that children of unknown fathers who were adopted had equal, or even higher, survival chances as those who lived with two biological parents. Importantly, closer examination reveals that excess mortality among those with unknown fathers is confined to males; females do not have higher mortality than those with known biological parents.[9]

Given that most of the results presented so far point to adverse outcomes for children of unknown fathers it is interesting to study how much of the differences in outcomes remain after we control for background characteristics through multivariate analysis in the next section.

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[9] Male mortality is, in fact, higher in all groups ($p<.01$), including group IA1, except among those who lived with a biological dad and step mother. For those who lived with adoptive parents or "others" with two census parents the sex difference in longevity is smaller, significant only at $p<.10$.

3. Results from multivariate analysis

3.1 Cross-section analysis of outcomes by relationship to biological parents

We begin by comparing short run outcomes for children of unknown fathers (group **C**) to those of children with known biological parents among which we distinguish between children whose parents were alive when they turned 18 (group **A**, reference group) and those whose fathers died before they turned 18 (group **B**). Starting by estimating cross-section regressions for child and youth mortality, we see that children of unknown fathers have significantly higher mortality before age 18 than the two groups with known biological parents in all four models (Table 7, panel A). Turning to educational attainment as measured by years of schooling, it is clear from Table 7, panel B that children of unknown fathers have fewer years of schooling than those with known and alive parents in all models. The difference compared to those whose father died is, however, only significant in Model 1 and 2. Next, when it comes to completion of high school (*gymnasium*), we find a similar pattern (Table 7, panel C): Children of unknown fathers have a lower probability than those in the reference group to complete high school in all models, but when we control for mother's education in Model 4 it is equally low among those whose father died.

Turning to adult outcomes as measured by earnings in 1999, we see that children of unknown fathers have significantly lower earnings than both the reference group and group B in all four models (Table 8, panel A). Further, looking at longevity, it is clear from Table 8, panel B that children of unknown fathers have higher mortality than those of known and alive parents in all models. Their mortality is also higher than that of group B in Model 1-3 but once we control for mother's education in Model 4 the difference is no longer significant. Interestingly, since we saw above that among those with unknown fathers excess mortality is confined to boys, we include interactions between gender and group B and C, respectively, in Model 5. In line with our expectation, we find that that the estimate for father unknown

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becomes more negative and significantly larger in magnitude than that for group B. Also, the interaction term is large and positive which implies that among children of father unknown girls do not have higher mortality than the reference group.

This striking finding gives cause for a closer examination of the relationship between unknown father and early death, on the one hand, and missing values on years of schooling or earnings, on the other hand. Such an inspection reveals that children of unknown fathers were overrepresented among those with missing values on years of schooling and earnings; about 7 percent and 5 percent, respectively, compared to 2 percent of the whole sample. As indicated above, they were also overrepresented among those who died before the age of 45; 9.5 percent of them did compared to 1.2 percent among the other children. Furthermore and unsurprisingly, among those who died prematurely about 35 percent have missing values on years of schooling and 83 percent missing values on earnings in 1999. Thus, the results above on education and earnings give a too rosy picture of the outcomes of children of unknown fathers. In the next section we investigate if these patterns remain when we take account of childhood family structure.

3.2 Cross-section analysis of outcomes by relationship to biological parents and family structure

We now compare outcomes of children of unknown fathers who experienced a particular family structure to those of children with known biological parents with the same family structure. We estimate cross-section regressions and present one model for each outcome in which we control for gender, year of birth, biological mother's age at birth and education. To facilitate comparison across family structures (that is, across rows) we present the resulting estimates in an unconventional matrix form. Beginning by outcomes during childhood and youth, it is clear from Table 9, panel A that children of unknown father have a higher risk of dying before age 18 in all family structures (significant at least at p<.05), except among those

who lived with Adoptive parents, and particularly among those who lived in "Others not with two census parents".

Turning to educational attainment, we find that children of unknown fathers have fewer years of schooling among those who lived in "Others, not with two census parents" (compared to group A but not B) but more schooling than those who lived with a biological mother and a step/adoptive/ varying father, while there was no significant differences in the other family structures (Table 9, panel B). We should, however, remind ourselves that many among those with unknown fathers had missing values on education. For this reason and because the pattern are the same as those for years of schooling, we refrain from presenting our results on completion of high school. Instead, we turn outcomes in adulthood as measured by earnings in 1999. We see that there were few cases in which children of unknown fathers had significantly lower earnings compared to those with known and alive parents, only among those living in "Others, not with two census parents" and compared to those whose father died only among those living with a single mother (Table 9 panel C). However, the caveat about missing values is in place here too.

Finally, we compare longevity across family structures. We find that longevity is significantly shorter among the children of unknown fathers who grew up with their biological mother and a step/adoptive/varying father and among those who lived with a single biological mother than among the other children in these family structures (Table 9, panel D). By contrast, among adoptees, children of unknown fathers had significantly lower mortality than those whose biological parents were known and alive and the same holds for those who grew up among "Others with two census parents".

4. Concluding discussion

This paper has examined the background and outcomes of children of unknown fathers, a group about whom very little is known. We used a unique data set based on the Swedish Multigenerational Register combined with information from the Censuses as well as educational and income registers at Statistics Sweden comprising a sample of almost 427,000 individuals born in 1955-67 to Sweden-born parents. We measured outcomes in childhood and in adulthood by child mortality, educational attainment, annual earnings and longevity. The percentage with an unknown father decreased over cohorts, from about 2.7 percent in the oldest cohort to about 1.2 in the youngest. We found that these children, on average, had very young mothers, that a large fraction of them are given away for adoption and that boys are overrepresented among them. Our results show that they had higher mortality during childhood and adolescence, that is, a higher risk of dying at all ages before 18, in all groups except among adoptees, and after control for background factors. In addition, they had higher mortality after age 18, almost 10 percent died before age 45 which is quite an extreme outcome but females did not have higher mortality and neither did the adoptees. We also found that compared to children with known and alive parents they had lower educational attainment, as measured by years of schooling or completion of high school, and lower earnings. Although these results are evidence of adverse outcomes, they nevertheless overrate the outcomes of for children of unknown fathers, since we miss information on education and earnings for individuals who died before 1999, among whom those with unknown fathers are overrepresented.

Thus, we find that children of unknown fathers do poorly in life except if they live with adoptive parents. While the high child mortality suggests negligence and lack of proper care in the home, the high mortality during adolescence and adulthood point to low levels of self-esteem and well being leading to self-destructive behavior. The causes of these

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disadvantages are, however, less clear. Most likely, it is distressing for the child not to know who his father is, not having any contact with him and being unable to answer questions about him, for example in school. It is possible also that the unfavorable child outcomes are brought about by the circumstances surrounding birth, that is, that the child is unwanted and that the mother lacks support from the father. Another possibility is that the mothers are a select group with negative characteristics. The fact that child mortality and other outcomes were not unfavorable for adoptees is, however, somewhat at odds with the latter explanation as it indicates that the mothers did not neglect their health during pregnancy. Anyway, with the available data we cannot discriminate between these possible explanations. In order to assess causality, we plan in our next paper to use data on the children that the mothers bear later in life who have a known father and compare the outcomes of these half siblings. If the disadvantages are caused by the father being unknown or the circumstances surrounding birth, we would expect the later born half siblings to do better in life. If, on the other hand, the disadvantages are caused by negative characteristics of the mother, we would expect to find little difference between the siblings.

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Figure 1. Categories and cohorts

Table 1: Sample by relationship to biological parents and childhood family structure.

Family structure in the Censuses[c]	Bio parents known & alive[a] **A**	Bio parents known. Dad dead[b] **B**	Bio mum known, dad unknown **C**	All
A. Number of observations				
I. Two census parents:				
1. Two bio parents	304,942	4,582 [d]	EBD	309,524
2. Bio mum +adoptive, step or varying [e] dad	7,960	(760)	1,386	10,106
3. Bio dad + adoptive, step or varying [e] mum	1,732	(25)	EBD	1,757
4. Adoptive parents	1,454	(49)	1,317	2,820
5. Others	7,936	(373)	1,067	9,485
II. Not two census parents:				
1. Single bio mum	35,561	8,589	1,794	45,944
2. Others not with two census parents	37,046	1,814	2,388	41,193
All	396,631	16,192	7,952	420,775
B. Percentages				
I. Two census parents:				
1. Two bio parents	76.9	28.3[d]	EBD	73.6
2. Bio mum +adoptive, step or varying [e] dad	2.0	(4.7)	17.4	2.4
3. Bio dad + adoptive, step or varying [e] mum	0.4	(0.2)	EBD	0.4
4. Adoptive parents	0.4	(0.3)	16.6	0.7
5. Others	2.0	(2.3)	13.4	2.2
II. Not two census parents:				
1. Single bio mum	9.0	53.0	22.6	10.9
2. Others not with two census parents	9.3	11.2	30.0	9.8
All	100.0	100.0	100.0	100.0

[a] Alive when the child turned 18. [b] Died before the child turned 18. [c] In three Censuses up to age 15. [d] Dad died when child was 15-18 years old. [e] The rearing parent varies across Censuses. EBD = empty by definition.

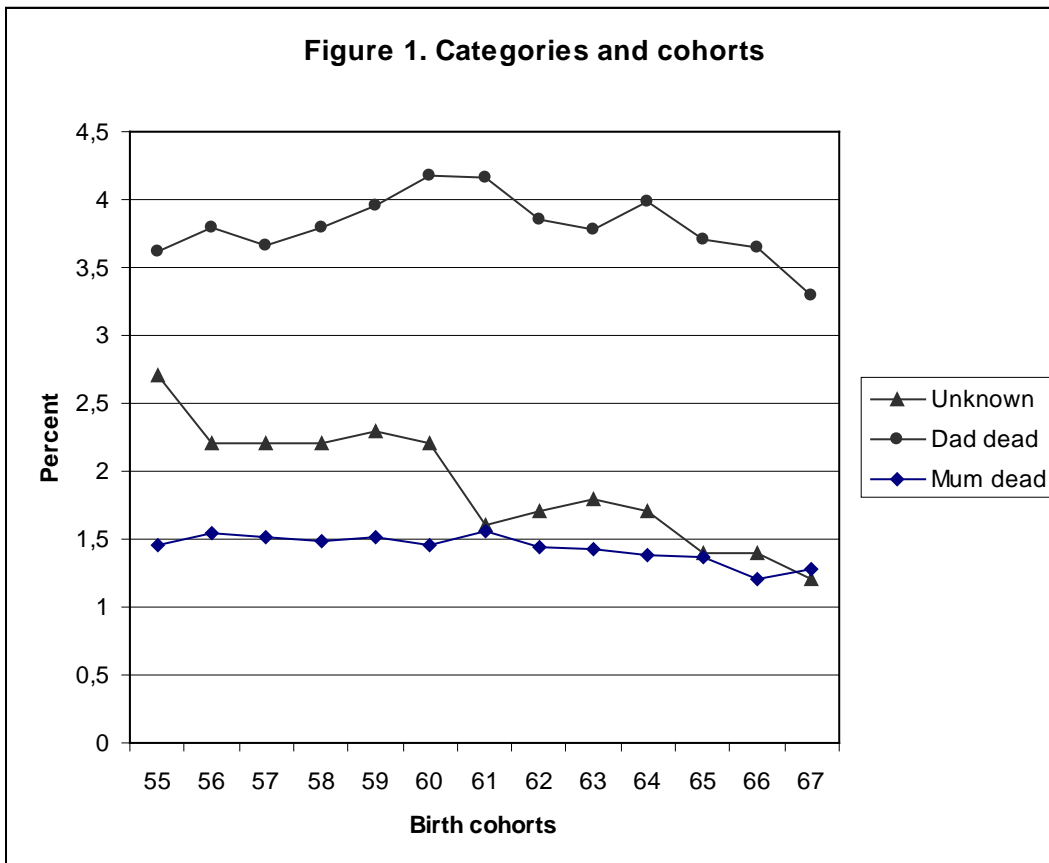**Table 2:** Characteristics of the biological mother by relationship to biological parents and childhood family structure.

Family structure in the Censuses[c]	Bio parents known & alive[a] **A**	Bio parents known. Dad dead.[b] **B**	Bio mum known, dad unknown C	All
A. Median age of biological mother at birth (N=420,775)				
I. Two census parents:				
1. Two bio parents	27.2	31.5[d]	EBD	27.2
2. Bio mum +adoptive, step or varying[e] dad	22.4	LO	23.0	22.6
3. Bio dad + adoptive, step or varying[e] mum	24.6	LO	EBD	24.7
4. Adoptive parents	22.2	LO	21.8	22.1
5. Others	21.0	LO	20.0	20.9
Not two census parents:				
1. Single bio mum	24.8	29.8	24.9	25.6
2. Others not with two census parents	23.7	25.7	21.4	23.6
All	26.4	29.6	22.1	26.4
B. Years of schooling of biological mother (N=410,693)				
I. Two census parents:				
1. Two bio parents	9.39	9.12[d]	EBD	9.38
2. Bio mum +adoptive, step or varying[e] dad	9.23	LO	9.19	9.23
3. Bio dad + adoptive, step or varying[e] mum	9.47	LO	EBD	9.48
4. Adoptive parents	9.02	LO	9.16	9.08
5. Others	9.03	LO	9.07	9.03
Not two census parents:				
1. Single bio mum	9.51	9.22	9.68	9.46
2. Others not with two census parents	9.49	9.03	9.28	9.46
All	9.40	9.16	9.31	9.39

Notes: see Table 1. LO = left out, small numbers. EBD = empty by definition.

Table 3. Percentage female by relationship to biological parents and childhood family structure.

Family structure in the Censuses[c]	Bio parents known & alive [a] **A**	Bio parents known. Dad dead [b] **B**	Bio mum known, dad unknown C	All (N=420,775)
I. Two census parents:				
1. Two bio parents	48.6	48.5 [d]	EBD	48.6
2. Bio mum +adoptive, step or varying [e] dad	49.9	LO	45.2	49.4
3. Bio dad + adoptive, step or varying [e] mum	44.9	LO	EBD	45.0
4. Adoptive parents	47.0	LO	46.9	46.9
5. Others	47.8	LO	46.2	47.5
Not two census parents:				
1. Single bio mum	50.0	49.4	46.2	49.8
2. Others not with two census parents	47.8	47.4	48.2	47.8
All	48.6	48.9	46.7	48.6

Notes: see Table 1. LO = left out, small numbers. EBD = empty by definition.

Table 4. Mortality between ages 12 and 18. Per thousand alive at age 11. (N=421,614)

Family structure in the Censuses[c]	Bio parents known & alive [a] **A**	Bio parents known. Dad dead [b] **B**	Bio mum known, dad unknown C	All
I. Two census parents:				
1. Two bio parents	0.013	0.020	EBD	0.013
2. Bio mum +adoptive, step or varying [e] dad	0.019	LO	0.408	0.073
3. Bio dad + adoptive, step or varying [e] mum	0.017	LO	EBD	0.017
4. Adoptive parents	0.007	LO	0.023	0.014
5. Others	0.016	LO	0.074	0.022
Not two census parents:				
1. Single bio mum	0.013	0.013	0.105	0.016
2. Others not with two census parents	0.052	0.033	0.257	0.057
All	0.017	0.016	0.188	0.020

Notes: see Table 1. LO = left out, small numbers. EBD = empty by definition.

Table 5. Educational attainment by relationship to biological parents and childhood family structure.

Family structure in the Censuses[c]	Bio parents known & alive [a] **A**	Bio parents known. Dad dead. [b] **B**	Bio mum known, dad unknown C	All
A. Years of schooling (N=404,038)				
I. Two census parents:				
1. Two bio parents	12.16	11.82 [d]	EBD	12.16
2. Bio mum +adoptive, step or varying [e] dad	11.45	LO	11.72	11.49
3. Bio dad + adoptive, step or varying [e] mum	11.82	LO	EBD	11.82
4. Adoptive parents	11.66	LO	11.67	11.66
5. Others	11.33	LO	11.28	11.32
Not two census parents:				
1. Single bio mum	11.59	11.74	11.66	11.62
2. Others not with two census parents	11.78	11.36	11.41	11.74
All	12.04	11.70	11.54	12.02
B. Percentage with completed high school *(gymnasium)* (N=404,038)				
I. Two census parents:				
1. Two bio parents	45.0	37.5 [d]	EBD	44.9
2. Bio mum +adoptive, step or varying [e] dad	30.3	LO	36.8	31.1
3. Bio dad + adoptive, step or varying [e] mum	38.1	LO	EBD	37.8
4. Adoptive parents	35.2	LO	35.4	35.2
5. Others	27.9	LO	25.2	27.4
Not two census parents:				
1. Single bio mum	34.1	35.7	35.6	34.4
2. Others not with two census parents	37.1	28.0	30.1	36.3
All	42.6	34.9	32.6	42.2

Notes: see Table 1. LO = left out, small numbers. EBD = empty by definition.

Table 6. Long run outcomes by relationship to biological parents and childhood family structure.

Family structure in the Censuses[c]	Bio parents known & alive[a] **A**	Bio parents known. Dad dead[b] **B**	Bio mum known, dad unknown C	All
A.	**Earnings in 1999. Relative to those who lived with two known and alive biological parents (=100). (N=407,853)**			
I. Two census parents:				
1. Two bio parents	100	94.4[d]	EBD	99.9
2. Bio mum +adoptive, step or varying[e] dad	85.9	LO	92.9	86.7
3. Bio dad + adoptive, step or varying[e] mum	93.4	LO	EBD	93.2
4. Adoptive parents	84.4	LO	88.0	85.9
5. Others	82.2	LO	78.8	81.7
Not two census parents:				
1. Single bio mum	87.1	90.1	86.6	87.7
2. Others not with two census parents	89.8	80.7	79.6	88.9
All	97.2	89.8	84.7	96.7
B.	**Longevity. Age in December 1999 or age at death (N=420,775)**			
I. Two census parents:				
1. Two bio parents	38.3	38.8	EBD	38.3
2. Bio mum +adoptive, step or varying[e] dad	37.6	LO	37.0	37.5
3. Bio dad + adoptive, step or varying[e] mum	37.9	LO	EBD	37.9
4. Adoptive parents	38.3	LO	38.8	38.5
5. Others	38.5	LO	38.5	38.4
Not two census parents:				
1. Single bio mum	37.4	38.2	37.1	37.5
2. Others not with two census parents	37.3	37.8	37.6	37.4
All	38.1	38.2	37.7	38.1

Notes: see Table 1. LO = left out, small numbers. EBD = empty by definition. Earnings include zero earnings.

Table 7: Cross-section estimates of the association between youth outcomes and whether the biological parents were known and alive or not. Robust standard errors in brackets.

A.	Child mortality (N=415,979)			
	Model 1	Model 2	Model 3	Model 4
B. Known, dad dead	0.001	0.002*	0.001*	0.001*
	[0.001]	[0.001]	[0.001]	[0.001]
C. Father unknown	0.089***	0.089***	0.088***	0.088***
	[0.003]	[0.003]	[0.003]	[0.003]
Gender		Yes	Yes	Yes
Year of birth		Yes	Yes	Yes
Mum's age at birth			Yes	Yes
Mum' education				Yes
Pseudo R2	0.012	0.012	0.012	0.077
B.	**Years of schooling (N=395,102)**			
B. Known, dad dead	-0.334***	-0.334***	-0.448***	-0.356***
	[0.018]	[0.018]	[0.018]	[0.017]
C. Father unknown	-0.505***	-0.497***	-0.345***	-0.362***
	[0.026]	[0.026]	[0.026]	[0.026]
Gender		Yes	Yes	Yes
Year of birth		Yes	Yes	Yes
Mum's age at birth			Yes	Yes
Mum's education				Yes
R-squared	0.002	0.005	0.017	0.122
C.	**High school completion (N=395,102)**			
B. Known, dad dead	-0.077***	-0.077***	-0.102***	-0.089***
	[0.004]	[0.004]	[0.004]	[0.004]
C. Father unknown	-0.105***	-0.104***	-0.073***	-0.082***
	[0.006]	[0.006]	[0.007]	[0.007]
Gender		Yes	Yes	Yes
Year of birth		Yes	Yes	Yes
Mum's age at birth			Yes	Yes
Mum' education				Yes
Pseudo R2	0.001	0.005	0.012	0.077

Reference group is A, both biological parents known and alive. *** p<0.01, ** p<0.05, * p<0.1

Child mortality: Equals one if dead before age 18. Equality between the two groups is rejected at p<.01 in all models.

Years of schooling: Equality between the two groups is not rejected in Model 4.

Completion of high school: The estimates are marginal effects from a probit analysis. Equality between the two groups is not rejected in Model 4.

Table 8. Cross-section estimates of the association between adult outcomes and whether the biological parents were known and alive or not. Robust standard errors in brackets.

A.	Earnings in 1999 (N=374,722)				
	Model 1	Model 2	Model 3	Model 4	Model 5
B. Known, dad dead	-0.065***	-0.064***	-0.076***	-0.066***	
	[0.008]	[0.008]	[0.008]	[0.008]	
C. Father unknown	-0.139***	-0.150***	-0.135***	-0.137***	
	[0.013]	[0.013]	[0.013]	[0.013]	
Gender		Yes	Yes	Yes	
Year of birth		Yes	Yes	Yes	
Mum's age at birth			Yes	Yes	
Mum's education				Yes	
R-squared	0.001	0.058	0.059	0.066	
B.	Longevity (N=410,693)				
B. Known, dad dead	0.086***	0.086***	-0.115***	-0.168***	-0.110**
	[0.031]	[0.031]	[0.031]	[0.031]	[0.044]
C. Father unknown	-0.456***	-0.445***	-0.219***	-0.228***	-0.674***
	[0.063]	[0.063]	[0.063]	[0.063]	[0.094]
Gender* B. Known, dad dead					-0.118*
					[0.062]
Gender* C. Father unknown					0.957***
					[0.124]
Gender		Yes	Yes	Yes	Yes
Mum's age at birth			Yes	Yes	Yes
Mum's education				Yes	Yes
R-squared	0.0002	0.0004	0.012	0.023	0.024

Reference group is A Both parents known and alive. *** p<0.01, ** p<0.05, * p<0.1

Earnings: Dependent variable is log annual earnings in 1999. Equality between C and B in Model 3 rejected at p < .01. In Model 4 equality between B and C rejected at p<.01.

Longevity: Longevity is measured as age in 1999 if alive or else as age at death. Equality between the two groups is not rejected in Model 4 but rejected at p<.01 in Model 5.

Table 9 Cross-section estimates of the association between outcomes and whether the biological parents were known and alive by family structure. One model. Robust standard errors in brackets.

Family structure in the Censuses[c]	Bio parents known & alive **A**	Bio parents known. Dad dead **B**	Bio mum known, dad unknown **C**
A. Child and youth mortality (N=415,979)			
I. Two census parents:			
1. Two bio parents	Ref group	-0.0015** [0.0007]	EBD
2. Bio mum +adoptive, step or varying dad	0.0030*** [0.0005]	-0.0007*** [0.0002]	0.0436*** [0.0053]
3. Bio dad + adoptive, step or varying mum	0.0014 [0.0011]		EBD
4. Adoptive parents	0.0028*** [0.0010]		0.0046*** [0.0015]
5. Others	0.0042*** [0.0005]		0.0122*** [0.0029]
II. Not two census parents:			
1. Single bio mum	0.0005** [0.0002]	-0.0019*** [0.0004]	0.0109*** [0.0025]
2. Others not with two census parents	0.0994*** [0.0015]	0.0927*** [0.0068]	0.2664*** [0.0085]
B. Years of schooling (N=395,102)			
I. Two census parents:			
1. Two bio parents	Ref group	-0.348*** [0.032]	EBD
2. Bio mum +adoptive, step or varying dad	-0.539*** [0.023]	-0.523*** [a] [0.061]	-0.297*** [0.065]
3. Bio dad + adoptive, step or varying mum	-0.307*** [0.051]		EBD
4. Adoptive parents	-0.251*** [0.054]		-0.294*** [0.059]
5. Others	-0.542*** [0.023]		-0.576*** [0.066]
II. Not two census parents:			
1. Single bio mum	-0.545*** [0.012]	-0.436*** [0.023]	-0.584*** [0.053]
2. Others not with two census parents	-0.332*** [0.012]	-0.646*** [0.049]	-0.582*** [0.047]

[a] Groups I 2, 3, 4 and 5 together. [b] Groups I 2, 3, 4 and 5 together. [c] Groups II 1 and 2 together. EBD = empty by definition.*** p<0.01, ** p<0.05, * p<0.1
Controls have been made for gender, year of birth, biological mother's age at birth and education.
Child and youth mortality: Equals one if dead before age 18. Equality between group C and the two others rejected at at least p<.05 for all family structures except Adoptive parents. Adj R^2=.102
Years of schooling: Equality between group D and A rejected at p<.01 among Others not with two census parents, and among those living with Biological mother and step/adoptive/varying father. Adj R^2=.129

Table 9 continued:

Family structure in the Censuses[c]	Bio parents known & alive **A**	Bio parents known. Dad dead **B**	Bio mum known, dad unknown **C**
C. Earnings (N=374,722)			
I. Two census parents:			
1. Two bio parents	Ref group	-0.039*** [0.014]	EBD
2. Bio mum +adoptive, step or varying dad	-0.150*** [0.012]	-0.170***[a] [0.031]	-0.085*** [0.031]
3. Bio dad + adoptive, step or varying mum	-0.090*** [0.024]		EBD
4. Adoptive parents	-0.185*** [0.031]		-0.164*** [0.030]
5. Others	-0.179*** [0.012]		-0.229*** [0.036]
II. Not two census parents:			
1. Single bio mum	-0.136*** [0.006]	-0.085*** [0.011]	-0.159*** [0.027]
2. Others not with two census parents	-0.113*** [0.006]	-0.200*** [0.028]	-0.211*** [0.025]
D. Longevity (N=410,693)			
I. Two census parents:			
1. Two bio parents	Ref group	0.094* [0.055]	EBD
2. Bio mum +adoptive, step or varying dad	-0.454*** [0.045]	-0.654*** [a] [0.110]	-1.134*** [0.193]
3. Bio dad + adoptive, step or varying mum	-0.307*** [0.093]		EBD
4. Adoptive parents	0.205** [0.103]		0.705*** [0.114]
5. Others	0.423*** [0.045]		0.618*** [0.142]
II. Not two census parents:			
1. Single bio mum	-0.753*** [0.022]	-0.376*** [0.043]	-1.073*** [0.132]
2. Others not with two census parents	-0.758*** [0.022]	-0.578*** [0.092]	-0.420*** [0.105]

Log annual earnings: Adj R^2=.069

Longevity: Dependent variable is age in 1999 or if dead before then age at death given alive at age 18. Controls have been made for gender, mother's age at birth and mother's education Adj R^2=.030