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Research Article

Oh half-brother, where art thou? The boundaries of full- and half-sibling interaction

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Contents

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Oh half-brother, where art thou? The boundaries of full- and half-sibling interaction

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Abstract

BACKGROUND
Research indicates that both full- and half-siblingships develop enduring social relationships, if the siblings have the opportunity to interact during childhood and adolescence.

OBJECTIVE
To estimate: (1) how much time half- and full-siblings are exposed to each other during childhood and adolescence; (2) how half-sibling exposure is conditional on birth spacing and residency; and (3) how parents' social vulnerability is associated with different levels of lifetime exposure to half-siblings.

METHOD
Swedish register data is used to calculate exposure to half-siblings based on birth spacing and registered residency for all full- and half-siblings in the 1994 birth cohort.

RESULTS
A substantive share of half-siblings are less exposed to each other due to lengthy birth spacing and residency patterns. By age 18, 26% of the birth cohort have had a half-sibling who is also no older than 18 for at least one year; 13% of the birth cohort have had a half-sibling who is no older than 18 for up to 10 years; 8% of the birth cohort have been registered in the same dwelling as another half-sibling for eight years or more. Parents' social vulnerability does not predict exposure to halfsiblings among the population that has at least one half-sibling by age 18.

CONCLUSION
Even though half-siblings constitute a large share of all siblings, full-siblings will likely make up the vast majority of the siblingship-like relationships because so many halfsiblings are unable to interact during childhood or adolescence due to extensive age differences and/or because they do not coreside.

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1. Introduction

Siblingship is one of the strongest and most enduring types of social relationship (Rossi and Rossi 1990). Siblings influence each other during childhood and support each other in adulthood (White and Riedmann 1992). Parental separation and childbearing with new partners or multi-partner fertility (MPF) have increased (Thomson 2014). Therefore, the proportion of a given individual's siblings who are the progeny of both parents has decreased and the proportion linked via only one parent has increased. This has spurred research on the extent to which half-siblings are likely to form siblingship relationships similar to those of full-siblings (Tanskanen and Danielsbacka 2019).

The main approach to answering this question has been to compare the closeness and support of full- and half-siblings, with findings showing that half-siblings report lower emotional closeness and contact and living at greater geographic distances in adulthood than full-siblings (Ahrons 2007; Anderson 1999; Danielsbacka et al. 2015; Danielsbacka and Tanskanen 2015; Ganong and Coleman 1988; Kersting and Feldhaus 2016; Steinbach and Hank 2018; Tanskanen et al. 2017; Tanskanen and Danielsbacka 2014; Tanskanen and Rotkirch 2018).

One important prerequisite for affinity is some form of repeated social interaction, but the potential for interaction differs between full- and half-siblings. Thus, as highlighted by recent research (Cancian, Meyer, and Cook 2011, see Wiemers et al. 2019 regarding step-relations), variations in coresidence patterns and birth spacing are decisive proximate causes of the nature of half-sibling social relations. Few studies have quantified the extent to which patterns of coresidency and birth spacing regulate half-siblings' opportunities to interact.

This study provides a population perspective on the question of siblingship relationships in a context of high MPF. We use Swedish register data to describe how birth spacing and coresidence of full- and half-siblings affect how many years a given child is exposed to their half-sibling up to age 18. We also analyze differences between children with much and little exposure to their half-sibling with respect to sibling size, antecedence (i.e., maternal or paternal half-siblingship), and parental socioeconomic position.

This paper's demographic approach complements the theoretical models used to explain qualitative differences between full- and half-siblingship. Prevailing explanations rest on a combination of (a) evolutionarily derived altruism towards close kin (Pollet 2007) and (b) cultural scripts governing behavior between step- and half-kin (Poortman and Voorpostel 2009; Cherlin 1978). The biological foundations that influence relationship formation are assumed to not vary across human populations. Institutional contexts regarding half-siblings can be similar across large socio-cultural entities. For this reason, these theories are not directly applicable (i.e., without added

supportive hypothesis) when explaining differences in half-siblingship closeness between populations (Thomson, Dahlberg, and Svallfors 2019). Measures of the proximate determinants of exposure to half-siblings are advantageous in this respect because they may vary between regions and sub-groups.

We find that in a country with a high incidence of MPF, long-term interaction with half-siblings across the life course is fairly limited. By age 18, 26% of the 1994 birth cohort had a half-sibling who was also no older than 18 and 13% had a half-sibling for up to ten years. By age 18, about 8% of the full 1994 birth cohort (and 30% of those with a half-sibling) lived with a half-sibling and had had a half-sibling registered in their dwelling for 8 years or more. Among children who have at least one half-sibling by age 18, parental socioeconomic background does not substantially predict the amount of exposure to half-siblings.

The descriptive findings in this paper highlight that while half-siblings are a large share of all siblings, full-siblings will continue to make up the lion's share of the siblingship-like relationships because half-siblings often are not exposed to each other during childhood or adolescence due to birth spacing and/or because they do not live in the same household. We conclude that estimates of half-sibling incidence should not rely on cross-sectional data and that the total exposure time to half-siblings during childhood and adolescence is a useful measure for understanding the experience of half-siblingship from the child's perspective. Producing such statistics is a challenging task (White 1998; Manning, Brown, and Stykes 2014; Brown and Manning 2009; Wolfe et al. 1996) and therefore administrative registers are a useful addition to survey sources (e.g., Huinink et al. 2011; Kalmijn et al. 2018) in the study of half-siblingship.

2. Theory and previous research

2.1 Sociocultural, evolutionary, and population perspectives on full- and half-siblingship

Evolutionary psychology maintains that individuals are more likely to develop close relations with genetically close others (Hamilton 1964). Human capacity for altruistic and reciprocal behavior is adaptive only as long as it is directed at close kin who can pass on the genotype to the next generation (Kaplan, Gurven, and Hooper 2009). Patterns that support the theory of inclusive fitness have been found in human and non-human populations. Primates rarely extend altruistic behavior beyond kin. Most highly cooperative communities, such as beehives, consist solely of biologically full siblings, suggesting that advanced cooperation and interaction and biological relatedness is fundamentally correlated (Chapais 2009). Closeness and the investment of resources are

often found to be lower in non-biological families than biological families (e.g., van Houdt, Kalmijn, and Ivanova 2018). Accordingly, half-sibling relationships should be characterized by less affection than full-sibling relationships, since the former dyad shares a quarter of its genetic material and the latter around half (Tanskanen and Rotkirch 2018).

Another research tradition emphasizes the importance of institutions. According to Cherlin (1978), step-relations and other forms of complex relations are incomplete institutions. Lacking the guidance of normative beliefs and expectations, individuals remain ambivalent about their relationships. Empirical studies have found a lack of consensus between stepfamily members with regard to roles and responsibilities (Ganong and Coleman 1988). Step- and half-siblings are often depicted in terms of negative or stigmatizing stereotypes (Hadfield and Nixon 2013). Moreover, institutions such as schools, healthcare, and marital and custodianship law are aligned to cater for marital couples and nuclear families and create problems for other forms of household structure and perpetuate their status as secondary (Mason, Fine, and Carnochan 2004). Countries such as Sweden, where the present study takes place, employ individualized taxation and transfers to individual custodians rather than family units (Thévenon and Neyer 2014). Such policies have been suggested to more readily accommodate reconstituted households (Nieuwenhuis and Maldonado 2018). Yet in Sweden, marital status and biological ties are decisively important in legal custodianship (Björnberg 2001): Separate bodies of family and property law regulate marital and non-marital unions (Wells and Bergnehr 2014). Qualitative research indicates that half-siblingships are perceived as undefined and indefinite relationships without established rights and responsibilities attached to then (Bäck-Wiklund and Johansson 2012).

Family systems theory emphasizes that a supportive and functioning family environment lays the grounds for enduring close relationships (Poortman and Voorpostel 2009). Families with half-siblings, in Scandinavia and elsewhere, tend to be more unstable (Lappegård and Thomson 2018). Socio-economic position is positively associated with union stability (Jalovaara and Andersson 2018): the prevalence of re-constituted families is larger in low SES groups and vulnerable groups than in high SES groups and affluent groups (Turunen 2011). Children growing up with half-siblings (Turunen 2014) or ever-separated families (Jonsson and Gähler 1997) tend to have lower educational attainment. All in all, institutional and family system perspectives predict that the development of reciprocity and trust is hampered among half-siblings, resulting in less intimate relationships.

Social interaction is fundamental to both biological and sociocultural explanations of siblingship affinity. Within a family systems framework, having the opportunity to interact is a necessary condition of siblingship affinity. Whether due to extensive spacing or lack of day-to-day contact as a result of living apart, half-siblings may be

less able to influence each other in the type of dynamics thought to produce strong siblingship relations (Goetting 1986). Informal institutions regarding, for example, the expected level of support and inclusive behavior toward kin (Cherlin 2004) may influence how full- and half-siblings relate to each other. Yet, the amount of social interaction between siblings will influence the nature of both types of relationship. Interaction is essential to kin selection theory. The identification of genetic closeness occurs either through repeated interaction in general or by identifying others who interact frequently with known biological kin, i.e., those whom the mother/father treats as close kin (Lieberman, Tooby, and Cosmides 2007). Thus, the variance in exposure is consequential for the degree to which the increasing population of half-sibling dyads will generate siblingship-like relationships.

2.2 Determinants of half-sibling exposure

Gendered custodial residency patterns are a salient factor that determines exposure to other siblings. Because mothers care for children more often than fathers after (and before) separation, children more often live with their maternal half-siblings than their paternal half-siblings. Even with the diffusion of alternating-residence custodial arrangements, maternal half-siblings are more likely to interact with one another (van der Heijden et al. 2016). For higher-order births with the same partner, parity progression is often rapid due to financial motivations and ideals favoring closely spaced siblings (Henz and Thomson 2005). Between-partner birth spacing, however, most often includes the process of union separation and/or re-partnering. This dynamic favors greater birth spacing between half-siblings (Kreyenfeld et al. 2017). In contrast to full-siblings, half-siblings are often separated following union dissolution. These dynamics are often taken for granted, yet they are central to the repeated interaction of half-siblings that is needed to create siblingship-like relationships, and they may vary between populations.

2.3 Measures of half-sibling exposure

Half-siblingship is the product of MPF and from the parents' perspective is therefore preceded by separation, single parenthood, or the death of a partner. As rates of divorce and single parenthood differ greatly between countries, the occurrence of half-siblingship is very varied (Kreyenfeld et al. 2017). In the United States, every second child born out of wedlock to urban mothers, every fifth child experiencing parental divorce, and every third child born to mothers on welfare will have a half sibling at

some point (Carlson and Furstenberg 2006; Cancian and Meyer 2006). Nationally representative data suggests that 13% of all children reside with a half-sibling (Kennedy and Fitch 2012; Manning et al. 2014), with higher estimates found in other sources (e.g., Tillman 2008). In Sweden, Thomson (2014) has reported that every fourth child has at least one half sibling by age 15. Maternal half-siblingship has been estimated at about 12% in Australia, 23% in the United States, and 16% in Norway (Thomson et al. 2014), 12% in West Germany, 23% in East Germany, and 14% in Finland (Kreyenfeld and Jalovaara 2018). Between 17% and 23% have a paternal or maternal half-sibling in the United States (Dorius 2011; Guzzo and Furstenberg 2007; Monte 2018). Register data supports similar incidence rates for paternal half-siblings in Norway (Lappegård and Rønsen 2013; Lappegård and Thomson 2018).

Across countries, measures of cumulative experience of divorce and stepfamily formation reveal high levels of family complexity (Andersson 2002). We know of two studies that analyze the development of half-siblingship across the life course. Using a sample of unmarried mothers in receipt of welfare, Cancain and colleagues (2011) show a 60% accumulation of half-siblingship from birth to age 10. Moreover, they find that MPF in one parent is positively correlated with MPF in the other. In a sample of adults, Tanskanen and Danielsbacka (2019) find that 40% of respondents with half-siblings report never having resided with them.

This paucity of research may largely be due to the high data demands necessary to measure half-siblingship across the life course. The plastic nature of complex families and reliance on modules focusing on household members make it difficult to capture the full set of half-siblings. The incidence of half-siblings inferred from data with a parental perspective (MPF) suffers from the same problem (Monte 2018) and often only uses data on one parent. Methodological advances such as the childhood residential calendar of National Longitudinal Survey of Youth (Bloome 2017) and multi-actor prospective panel designs such as PAIRFAM (Huinink et al. 2011) and OKiN (Kalmijn et al. 2018) may overcome many of these problems (Tanskanen and Danielsbacka 2019). Nonetheless, response rates, half-sibling/MPF under-reporting, and attrition will remain an issue for generalizability. Sample sizes will limit the degree to which sub-group heterogeneity can be analyzed (Aughinbaugh 2004; Juby and Le Bourdais 1999; Müller and Castiglioni 2015; Wolfe et al. 1996). Considering the many obstacles to assessing the basic incidence of half-siblingship, our study contributes to this literature by providing a broad descriptive account of half-siblingship as it develops from birth through childhood and adolescence.

2.4 Socioeconomic family of origin and half-sibling exposure

Previous research shows a strong negative SES gradient in MPF (Monte 2018; Thomson et al. 2014). From the perspective of the child, children with half-siblings are more likely to grow up with parents in vulnerable social positions or at risk thereof (Cancian and Meyer 2006; Jonsson and Gähler 1997). It is not known whether parental vulnerability among MPF men and women is correlated with factors that influence lifetime exposure to half-siblings, such as gender of the MPF parent, birth spacing, and coresidency patterns. For example, the prevalence of MPF is relatively high among men with high incomes (Lappegård and Rønsen 2013), age at first birth is predictive of a more stable financial situation above and beyond family structure, and a later age at first birth shortens the spacing between children born to different parents (Holland and Thomson 2011). Therefore, within the population who ever have a half-sibling, the association with parental vulnerability may vary among those with little or much exposure to their half-sibling. If half-sibling exposure differs systematically by socioeconomic origin, then the nature of half-sibling relationships could differ by socioeconomic origin. Stratified patterns of kin relations are a relevant aspect of a demographic phenomenon (McLanahan and Percheski 2008). Therefore, we provide a brief description of the differences between children from vulnerable and non-vulnerable families in years with siblings and years coresiding with siblings.

3. Method

3.1 Data and sample

We use Swedish administrative registers to link all full- and half-siblings to the 1994 anchor birth cohort (N = 116,843). This cohort was chosen because it is the most recent that we can follow until adulthood. Deceased anchor children are excluded from the sample. Older and younger full- and half-siblings are followed to age 18. We include the full cohort and do not differentiate between sibling order within the parental couple or offspring order of either parent. Appendix Figure A-1 shows sibling set size.

3.2 Analytical approach

In the first and main part of our analysis we examine how much time half- and full-siblings are exposed to each other during childhood and adolescence. We count the

years individuals have a living half-sibling and we count the years individuals reside with half-siblings from age 0 to age 18.

We count the years an anchor child has had a living half-sibling who is also no older than 18. In particular, we count years spent with a specific sibling as opposed to time spent with any half-sibling (e.g., Cancian, Meyer, and Cook 2011, Figure 1). At every age, we calculate the proportion of the anchor cohort that has had a living half-sibling for k number of years (A_k in Table 1).

We use information on registered residence to estimate sibling coresidency status. Residential registers denote what housing unit an individual is registered at. An individual can only be registered in one dwelling at a given point in time. The dwelling data contains no other information, such as whether children alternate residence or whether parents practice joint custody. If, for example, a child a given year is registered with a mother and their maternal half-sibling is also registered with this mother, then the half-sibling pair are assumed to coreside (C_k in Table 1). If the index child's maternal half-sibling was instead registered with that half-sibling's father, then that half-sibling pair are assumed to not coreside. An intermediate situation may occur when, for example, a child is registered with its mother, and his/her paternal half-sibling is registered with the (shared) father (B_k in Table 1). We assume that this situation presents a greater possibility for contact between the index child and its paternal half-siblings than if the half-sibling resided with their (non-shared) mother, but a lower chance of contact compared to if the index and half-sibling were coresiding.

Table 1: Half-sibling exposure

Measure	Half-sibling status
A_k	Half-sibling alive and not older than 18
B_k	A + Half-sibling registered with shared parent but not with the anchor child
C_k	A + Half-sibling registered at own dwelling (half-sibling coresides with anchor)

$_k$ = Years of exposure.

In the second part of our analysis we describe the parents' fertility regime and the sibling composition for children who have many and few years of exposure to their half-siblings. We present the parental and sibling characteristics of anchor children who are in a high-end sibling exposure group (C_k and more in Table 1) and have coresided eight years or more with a half-sibling, compared with all others. We measure the birth spacing between the anchor child and the closest half-sibling. We measure the incidence of half-siblingship on the maternal and paternal side and both sides. We also measure the number of maternal/paternal childbearing partners, the number of full and

maternal/paternal half-siblings, the anchor child's sibling position (younger, older, or both), and full- and half-sibling composition.

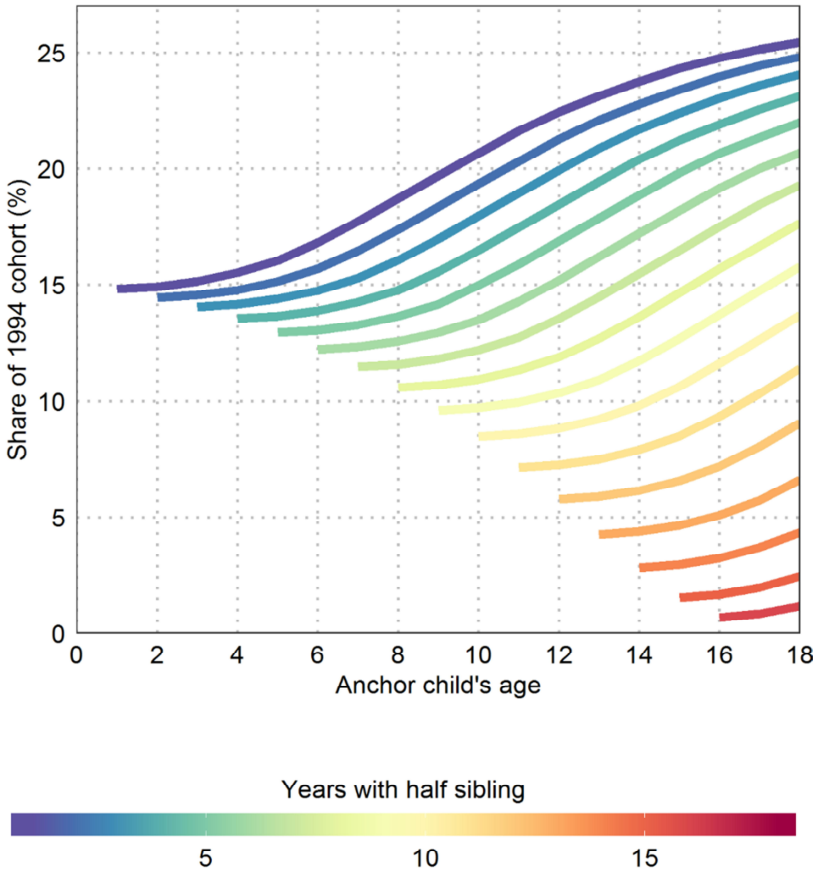
In the third part of our analysis we analyze parental socioeconomic origin by the length of exposure to half-siblings. We construct three measures of parental socioeconomic origin. We use a dummy which takes the value 1 if both of the anchor child's parents have an educational level no higher than basic mandatory school. We rank age-specific disposable income, taking the average of the residential parent between ages 37–42 or the closest available date. Finally, we construct a measure of parental vulnerability, as indicated by a dummy taking the value 1 if one or both parents have repeatedly been in receipt of social benefits.

4. Results

4.1 Half-siblingship exposure across the life course

Half-siblings may develop sibling-like relationships if there is enough extended interaction during their childhood and adolescence. The time dimension of this interaction has an upper bound that is set by birth spacing. How many siblingship-like relationships might we expect to see simply on the basis of birth spacing? The y axis in Figure 1 shows the share of the total population that has a half-sibling at a given age of the anchor child, shown on the x-axis. The color of the lines indicates how many years the anchor child has a half-sibling. About 26% have at least one half-sibling at age 18 (blue line). However, this proportion declines when taking into account how many years the half-sibling set may have interacted while under age 18. For example, to achieve a close relationship it might be necessary to interact with a half-sibling for at least 10 years before age 18. We estimate that about 13% of the population could have had this experience. Put differently, as many as 13% of the 1994 birth cohort may have developed a close relationship with a half-sibling.

Figure 1: Years with half-siblings, 1994 birth cohort (N = 116,843)

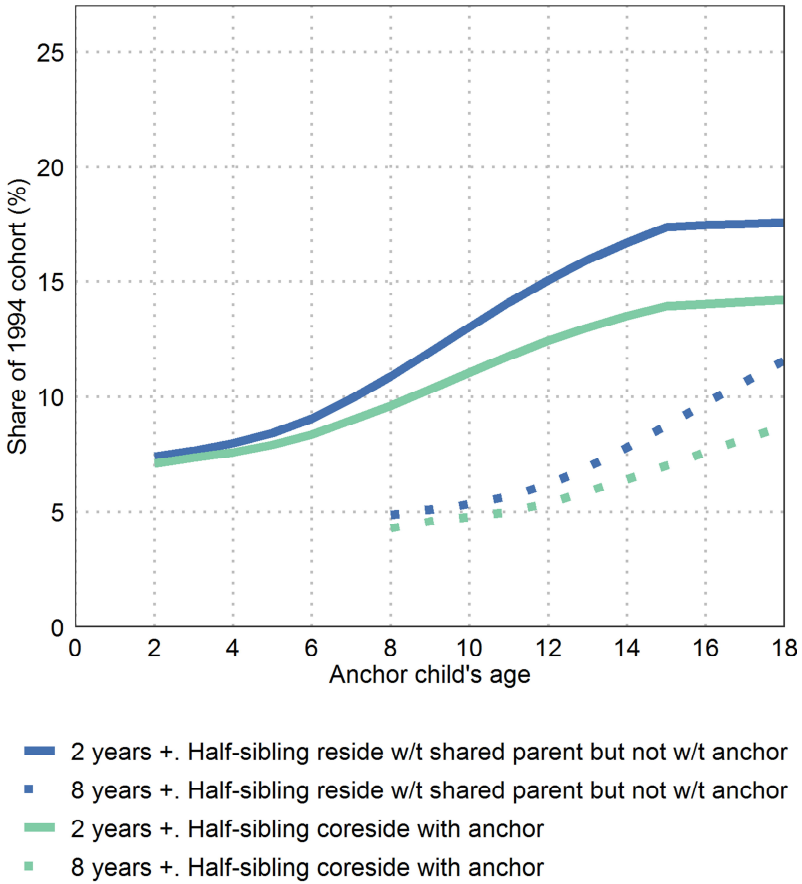


Source: STAR register data. Lines show the proportion of the cohort, at a given age, that has had a half-sibling who is no older than 18 for k number of years.

For siblings to interact they need to be alive at the same time and also probably to be physically adjacent to each other. One important factor that sets the limits to this interaction is the coresidence status of half-sibling pairs. Figure 2 shows the years the children spent in a different residence state than their half-siblings. Blue lines indicate that the anchor child does not have a half-sibling registered in the same dwelling, but that the half-sibling resides with their shared parent. Green lines indicate that the anchor and half-sibling are registered at the same dwelling and are assumed to coreside. Assuming that the kind of relationship that tends to emerge among full-siblings requires

sharing a household for an extended period, how many children will form such a relationship with a half-sibling? If the threshold for potential exposure is set to at least eight years or more of coresidence (dotted green line) the answer is around 8%. This group – those who reside for 8 years or more with a half-sibling – make up 30% of all those who have a half-sibling (supplementary analysis in Appendix Figure A-3).

Figure 2: Years registered at the same dwelling as half-siblings, 1994 birth cohort (N = 116,843)

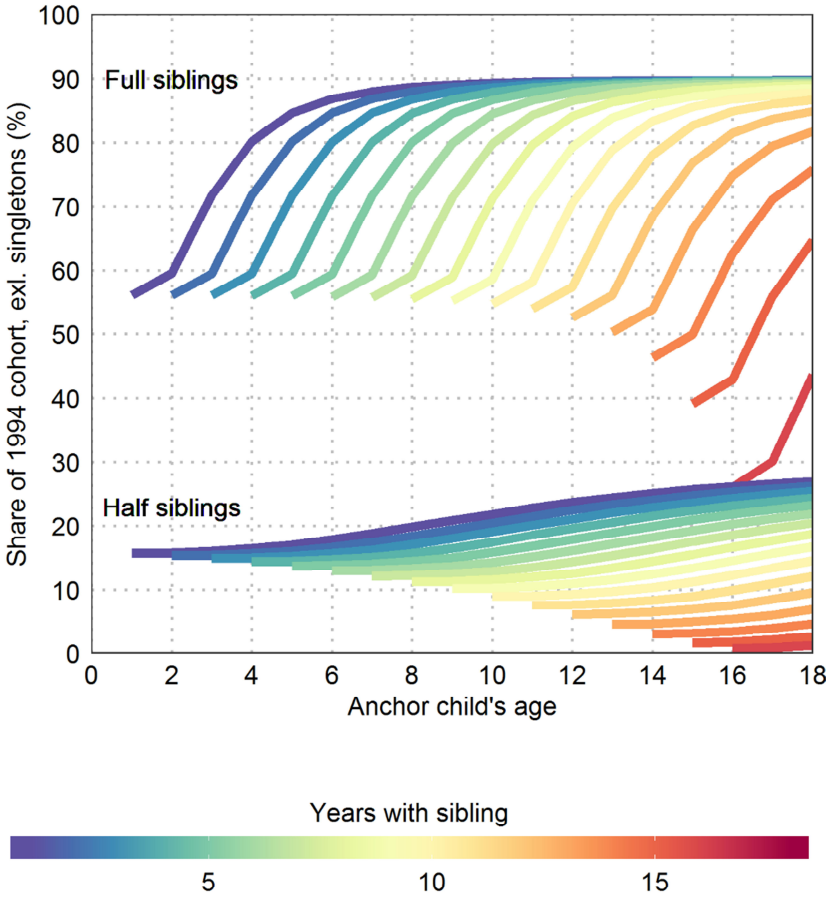


Source: STAR register data. Lines show the proportion of the cohort, at a given age, with a given half-sibling coresidence status (half-sibling no older than 18). Blue lines = The anchor child's half-sibling is registered at the dwelling of the shared biological parent but not with the anchor child. Green lines = The anchor child's half-sibling is registered at the same dwelling as the anchor (the two are assumed to coreside). Solid lines = 2 years or more. Dotted lines = 8 years or more. For parsimony, the two-year and eight-year thresholds were chosen to represent a relatively short and a relatively lengthy spell.

4.2 Full- and half-siblingship exposure across the life course

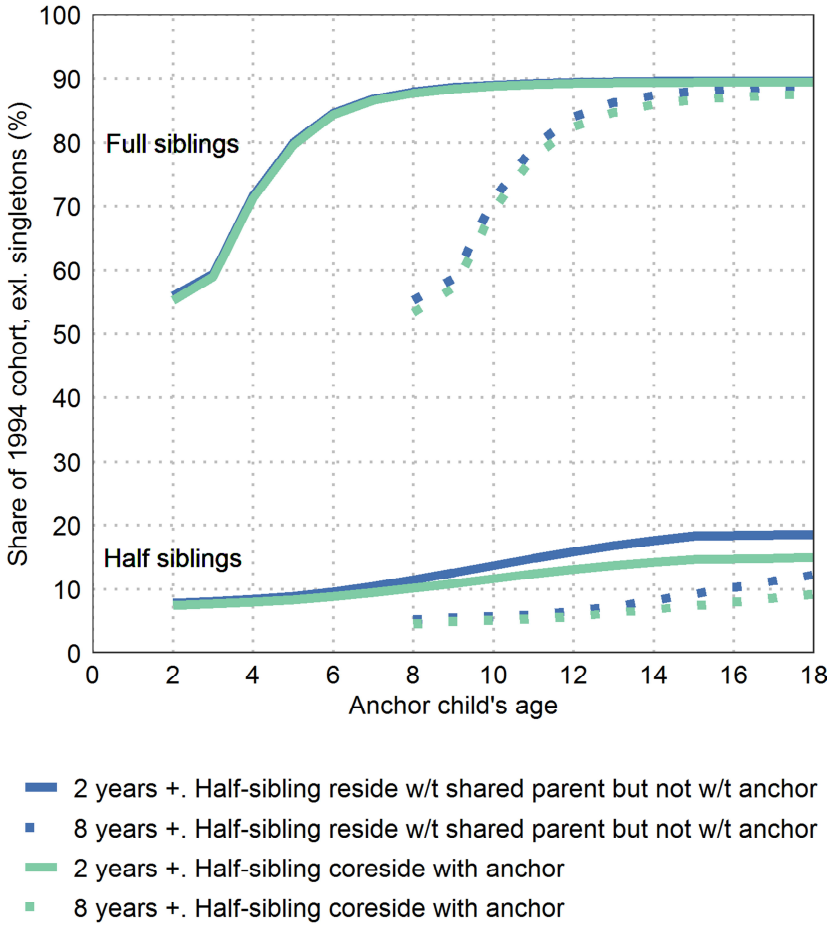
Next, we substantiate how half-sibling exposure is conditional on birth spacing and residency by comparing half- and full-siblings. Half- and full-siblings both have the potential to produce sibling-like relationships. However, the amount of interaction between full- and half-siblings differs because half-siblings have wider birth spacing and different residency patterns. Figure 3, similar to Figure 1, shows years spent with living siblings, but includes both full- and half-siblings and the population is limited to those who have at least one half- or full-sibling by age 18. Twenty-seven percent of this population has a half sibling at age 18 (blue line in top bundle), which goes down to 15% using a 10-year criterion (yellow line). By contrast, the corresponding numbers are about 90% and 86% for full-siblings. Figure 4, similar to Figure 2, shows the years spent with siblings in different residency patterns but shows full- and half-siblings and includes only the population who have either a full- or half-sibling. Ten percent of all children with a half- or full-sibling have coresided 10 or more years with a half-sibling, but 90% have coresided 10 or more years with a full-sibling. In summary, although a substantive share of all siblings are half-siblings, growing up together with a half-sibling is a minority experience. Some previous work presents half-sibling incidence separately for first and later-born children (Thomson 2014), while some data sources only identify maternal half-siblingship. To facilitate comparison with such material, Figure A-2 and Figure A-3 in the Appendix show data across these dimensions.

Figure 3: Years with full- and half-siblings, 1994 birth cohort excluding singletons (N = 110,535)



Source: STAR register data. Lines show the proportion of the cohort, at a given age, that has had a living full- or half-sibling who is no older than 18 for k number of years.

Figure 4: Years registered at the same dwelling as full- and half-siblings, 1994 birth cohort excluding singletons (N = 110,535)



Source: STAR register data. Lines show the proportion of the cohort, at a given age, with a given full- or half-sibling coresidence status (siblings no older than 18). Blue lines = The anchor child's sibling is registered at the dwelling of the shared biological parent but not with the anchor child. Green lines = The anchor child's sibling is registered at the same dwelling as the anchor (the two are assumed to coreside). Solid lines = 2 years or more. Dotted lines = 8 years or more. For parsimony, the two-year and eight-year thresholds were chosen to represent a relatively short and a relatively lengthy spell.

4.3 Siblingship composition of children with low and high levels of exposure to half-siblings

Figures 3 and 4 show that half-siblings had a larger spread in years of potential exposure. Do sibling constellation and parental reproductive behavior differ for those with high and low exposure to half-siblings? Table 2 presents descriptive statistics for those with eight years or more of coresidence with a half-sibling by age 18, compared to all others with a half-sibling. As expected, the high exposure group presents a shorter average-age interval and the majority have maternal half-siblings. In the low-exposure group about half have a paternal half-sibling and about 37% (100% minus 63.7%) have a maternal half-sibling. About half of high-exposure children have no full-siblings, compared to 29.2% in the low exposure group. Paternal and maternal MPF with three or more partners is more common in the high exposure group. Those in the high exposure group more often have sibling sets that consist of both full-siblings, and maternal and paternal half-siblings (18.4% versus 8.1%).

Table 2: Sibling composition and parental fertility among children who have markedly low and high exposure to half-siblings, children with half-siblings by age 18

	Eight or more years coresidence	Other
Half-sibling spacing		
Mean	6	11
Median	6.0	11.0
Q1, Q3	4.0, 8.0	7.0, 14.0
Full-siblings		
None	5,292 (48.0%)	6,026 (29.2%)
One	4,377 (39.7%)	9,622 (46.7%)
Two	973 (8.8%)	3,427 (16.6%)
Three or more	387 (3.5%)	1,530 (7.4%)
Maternal half-siblings		
None	568 (5.2%)	13,134 (63.7%)
One	6,022 (54.6%)	4,540 (22.0%)
Two	3,151 (28.6%)	2,100 (10.2%)
Three or more	1,288 (11.7%)	831 (4.0%)
Paternal half-siblings		
None	5,574 (50.5%)	4,432 (21.5%)
One	2,382 (21.6%)	8,682 (42.1%)
Two	2,042 (18.5%)	5,129 (24.9%)
Three or more	1,031 (9.3%)	2,362 (11.5%)

Table 2: (Continued)

	Eight or more years coresidence	Other
Maternal childbearing partners		
One	568 (5.2%)	13,134 (63.7%)
Two	8,993 (81.5%)	6,660 (32.3%)
Three or more	1,468 (13.3%)	811 (3.9%)
Paternal childbearing partners		
One	5,574 (50.5%)	4,432 (21.5%)
Two	4,513 (40.9%)	14,036 (68.1%)
Three or more	942 (8.5%)	2,137 (10.4%)
Half-sibling antecedence		
Maternal only	5,574 (50.5%)	4,432 (21.5%)
Paternal only	568 (5.2%)	13,134 (63.7%)
Both	4,887 (44.3%)	3,039 (14.7%)
Sibling-set composition		
Maternal half	2,275 (20.6%)	1,365 (6.6%)
Paternal half	162 (1.5%)	3,285 (15.9%)
Mat. and Pat. half	2,855 (25.9%)	1,376 (6.7%)
Full and Mat. half	3,299 (29.9%)	3,067 (14.9%)
Full and Pat. half	406 (3.7%)	9,849 (47.8%)
Full and Mat and Pat. Half	2,032 (18.4%)	1,663 (8.1%)
Sibling position relative to half-sibling(s)		
Older	4,440 (40.3%)	8,170 (39.7%)
Younger	4,648 (42.1%)	10,960 (53.2%)
Older and Younger	1,941 (17.6%)	14,752 (7.1%)

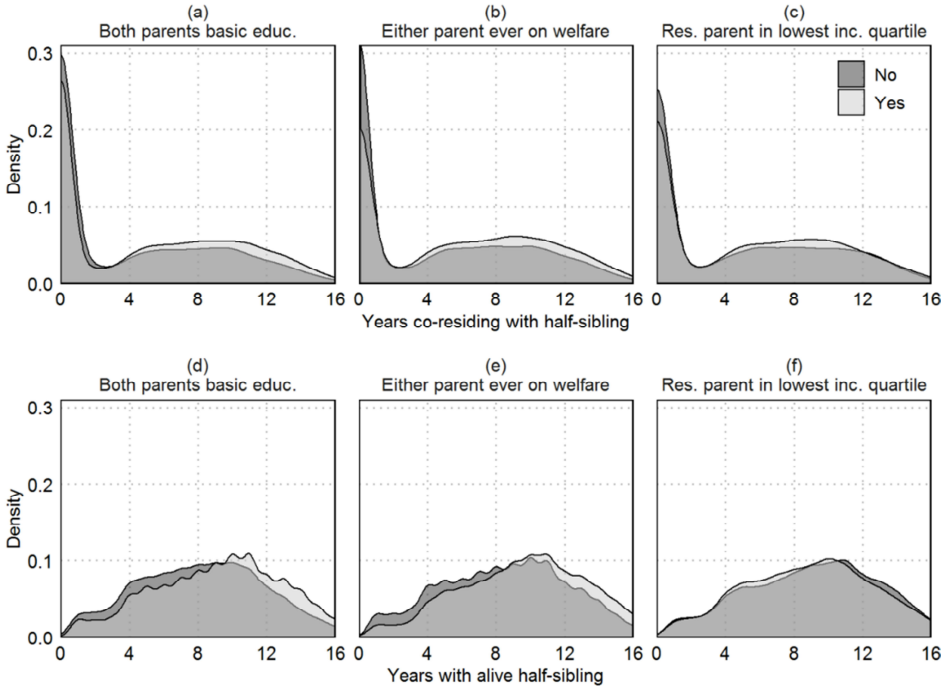
4.4 Social origin of children with low and high levels of exposure to half-siblings

Figures 5a to 5f present an overview of the extent to which parents' social vulnerability differs among children with different levels of lifetime exposure to their half-sibling. We focus on three dichotomous measures that measure different facets of parents' social vulnerability: Both parents having no higher than basic education or not (a,d); either parent ever on welfare or not (b,e); and residing parent in lowest income quartile or not. Plots a, b, and c in Figure 5 show kernel density estimates of years coresiding with half-siblings, by social vulnerability status. Plots d, e, and f in Figure 5 show kernel density estimates of years with living half-siblings, by social vulnerability status.

Children's number of years of coresidency with a half-sibling is weakly positively related to having both a mother and a father without tertiary education (a). It is also weakly positively related to having parents who have ever been welfare recipients (b),

but not to having a residential parent in the lowest income quartile (c). Children's number of years with a living half-sibling is weakly positively related to parental low education (d) and welfare recipiency (e). No substantive patterns are evident regarding having a residential parent in the lowest income quartile (f). Overall, among those who have a half-sibling by age 18, there are no substantial group differences in parental social vulnerability between children with high and low exposure to their half-sibling.

Figure 5: Half-sibling birth spacing and half-sibling coresidency by parental vulnerability, kernel density estimates, children with half-siblings by age 18



Source: STAR register data.

5. Discussion

Family reconstitution and MPF has increased during recent decades (Thomson 2014). Therefore, half- and step-sibling relationships will increasingly be a common feature of modern kinship relationships. It is often assumed that repeated and close interaction during childhood and adolescence is essential for the formation of siblingship-like relationship (Rossi and Rossi 1990). It is not known what amount of social interaction between half-siblings is needed to generate close affinity. However, we have argued that it is informative to at least know what proportion of the population has a half-sibling for a lengthy time during childhood and adolescence. It is likewise informative to estimate the proportion that grow up with a half-sibling in the same household.

The present study analyzes the population variance in how many years individuals have a half-sibling and how many years individuals reside with half-siblings from ages 0 to 18. For a full birth cohort, we identify close to all older and younger half-siblings from the mother's and father's side as they accumulate over 18 years. We have almost no missing data on paternal fertility, we have no attrition except for out-migration, and we cover biological kin independent of recall bias or measurement errors stemming from respondents or survey design.

We find that 26% of the full birth cohort has a half-sibling by age 18. By contrast, only 8% of the birth cohort have coresided up to 8 years with a non-adult half-sibling. One important point that follows from these basic descriptions is that even though half-siblings are a large share of all siblings that one will ever have, full-siblings will make up the vast majority of the siblingship-like relationships because so many half-siblings are unable to interact during childhood or adolescence due to birth spacing and/or because they do not coreside. Children with a lot of exposure to their half-siblings tend either to have no full-siblings or to simultaneously have maternal half-siblings, paternal half-siblings, and full-siblings. The results strongly suggest that the degree of interaction with half-siblings varies substantially within the group that ever has a half-sibling. We conclude that cross-sectional adult half-sibling prevalence is not an optimal measure for estimating how many people have a siblingship-like relationship with their half-sibling (Wolfe et al. 1996). Our findings are informative for research on differences in the qualitative nature of full- and half-sibling relationships. Evolutionary explanations of why half-siblings are less likely to be close confidantes focus on the fitness advantages of investing in more closely related kin. Sociological explanations include the argument that step- and half-sibling relationships are incomplete institutions that cannot provide the default toolkit or social cohesion that produces close affinity among full-siblings. Both frameworks seek to explain variation among full- and half-sibling pairs that actually interact and thus have the opportunity to form a relationship of a given kind. We have suggested that a more useful denominator is all half-siblings,

not only those nominated by respondents or counted within a household at a given point in time. We suggest that research on full- and half-sibling affinity should pay attention to half-siblings' exposure to each other (Tanskanen and Danielsbacka 2019).

Even at similar levels of incidence of multi-partner fertility, exposure to half-siblings from the perspective of the child will differ substantially. This is contingent on the birth spacing of half-siblings, the composition of male to female MPF, and factors that influence coresidence patterns, such as shared post-separation custody and alternating residence. Analyzing country differences in the proximate determinants of half-sibling interaction would be an interesting avenue for future research.

We also analyze whether children of different social origin who have at least one half-sibling have different lengths of exposure to their half-siblings. We found no substantive variation in this respect. Previous research has been fairly conclusive in finding that half-siblingship and other complex family relations are overrepresented among low SES and vulnerable populations (Monte 2018; Thomson et al. 2014). Our findings corroborate these stylized facts by showing that, providing that one has a half-sibling by age 18, the number of years exposed to a half-sibling is not contingent on SES.

The present study has important limitations. Due to data restrictions, this study does not analyze stepchildren, and so it does not give a complete picture of the development of children's relationships in complex family forms. We have focused on accurately covering all full- and half-sibling relations, but our data are less accurate in covering their movements in and out of households. Administrative registers give a precise image of living siblings at different ages. Approximating residency based on being registered at a given dwelling should be considered a rough measure: Individuals may reside in a place other than where they are registered. Despite this fact, the possibility of mapping out even a relative measure of residency for every half-sibling over 18 years is a worthwhile exercise. Accurately describing half-sibling and other family relations is an ongoing challenge for family demography. This study contributes to that project by employing administrative data to offer a description of half-siblingship across the life course that would be hard to obtain using available survey material.

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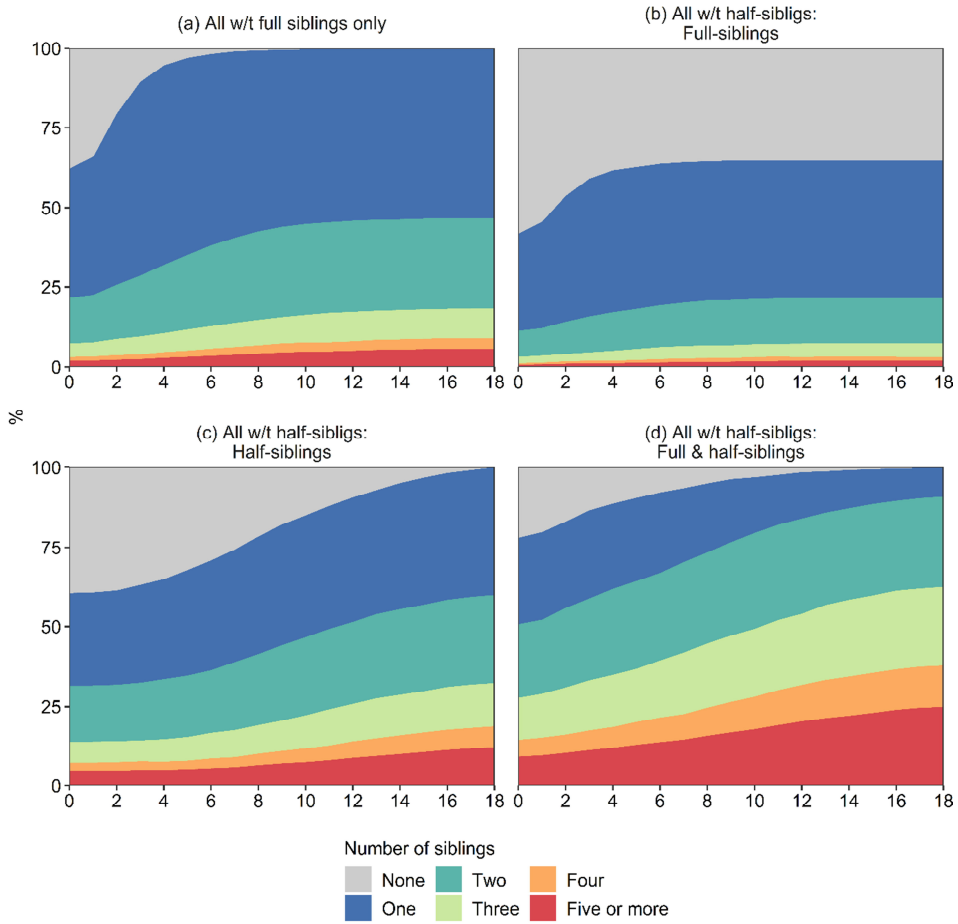
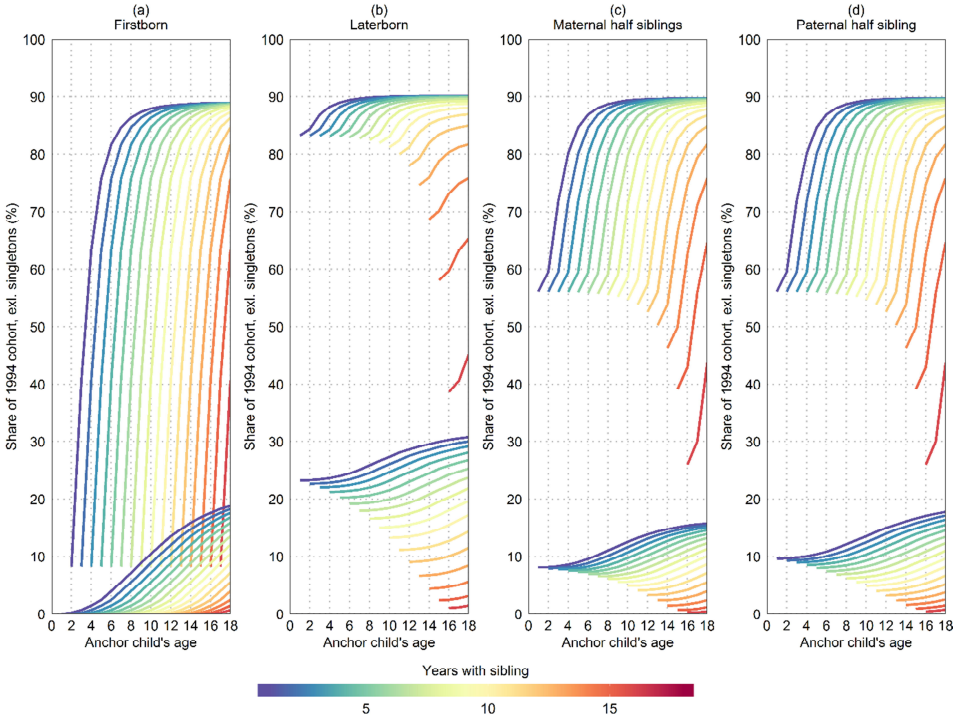
Appendix

Figure A-1: Proportion of number of full siblings, half siblings and full and half sibling among anchor children (1994 birth cohort), at age of anchor child. (a) all with full siblings only by age 18 (N = 78,901); (b–d) all with at least one half-sibling by age 18 (N = 31,634)



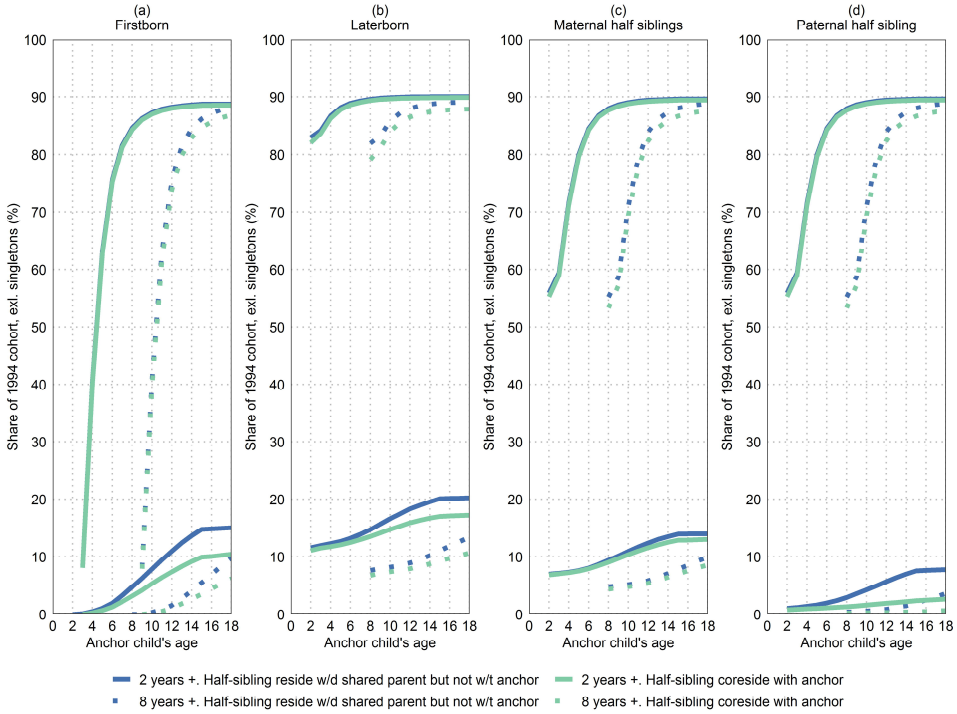
Source: STAR register data.

Figure A-2: Years of overlap with full and half sibling up to age 18: All who have ever had a half or full sibling by age 18 and who are (a) firstborn (N = 36,080); (b) later born (N = 74,455); (c) maternal half siblings (N = 17,932); (d) paternal half siblings (N = 21,628)



Source: STAR register data. Lines show the proportion of the cohort, at a given age, who has had an alive full sibling or half sibling who is no older than 18 for k number of years. Lower set of lines show half-siblings, upper set of lines show full siblings.

Figure A-3: Years of being registered at the same dwelling as full and half siblings up to age 18. All who have ever had a half or full sibling by age 18 and who are (a) firstborn (N = 36,080); (b) later born (N = 74,455); (c) maternal half siblings (N = 17,932); (d) paternal half siblings (N = 21,628)



Source: STAR register data. Lines show the proportion of the cohort, at a given age, with a given full or half sibling co-residence status (siblings no older than 18). Blue lines = The anchor child's sibling is registered at a dwelling of the shared biological parent but not with the anchor child. Green lines = The anchor child's sibling is registered at the same dwelling as anchor (the two are assumed to co-reside). Solid lines = 2 years or more. Dotted lines = 8 years or more. For parsimony, the two year and eight year thresholds where chosen to represent a relatively short and a relatively lengthy spell. Lower set of lines show half-siblings, upper set of lines show full siblings.