Stockholm Research Reports in Demography | no 2020:30

Oh half brother, where art thou?

The boundaries for full- and half sibling interaction

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ISSN 2002-617X | Department of Sociology

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Oh half brother, where art though?

The boundaries for full- and half sibling interaction

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Abstract

Background: Previous research indicates that both full and half siblingships have the potential to develop into enduring social relationships, providing that the siblings have the opportunity to interact with one another during childhood and adolescence.

Objective: This study estimates: (1) how much time half and full siblings

may be exposed to each other during childhood and adolescence; (2) how half sibling exposure is conditional on birth spacing and residency; and (3) the extent to which parents' social vulnerability is associated with different levels of lifetime exposure to half siblings.

Method: This study uses Swedish register data to calculate exposure to half siblings based on birth spacing and registered residency for all full and half siblings to the 1994 birth cohort.

Results: A substantive share of half siblings are less exposed each other due to lengthy birth spacing and residency patterns. By age 18, 26% of the birth cohort have had a half sibling also no older than 18 for at least one year. By age 18, 13% of the birth cohort have had a half sibling no older than 18 for up to 10 years. By age 18, 8% of the birth cohort was registered in the same dwelling as another half sibling for eight years or more. Parents' social vulnerability does not predict exposure to half siblings among the population who 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 half siblings are unable to interact during childhood or adolescence due to extensive age differences and/or because they do not co-reside.

Contribution: This study quantifies the boundaries for exposure to full and half siblings across childhood and adolescence. It highlights the benefits of including a population perspective and a child's perspective to full and half sibling social relationships.

Keywords: Half siblings, Family complexity, Multi partner fertility, Siblingship, Birth spacing

Stockholm Research Reports in Demography 2020:30

ISSN 2002-617X

1. Introduction

Siblingship is among the strongest and most enduring types of social relationships (Rossi & Rossi 1990). Siblings influence each other during childhood and provide support to 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 decreases and the proportion linked via only one parent increases. This has spurred research to examine the extent to which half siblings are likely to form siblingship relationships similar to those of full siblings (Tanskanen & 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 compared to full siblings (Ahrons 2007; Anderson 1999; Danielsbacka et al. 2015; Danielsbacka & Tanskanen 2015; Ganong & Coleman 1988; Kersting & Feldhaus 2016; Steinbach & Hank 2018; Tanskanen et al. 2017; Tanskanen & Danielsbacka 2014; Tanskanen & 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 co-residence 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 co-residency 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 co-residence of full- and half siblings affect how many years a given child is exposed to his/her 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 corroborates the theoretical models used to explain qualitative differences between full and half siblingship with a demographic approach. 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 not to vary across human populations. Institutional contexts regarding half siblings can be similar across large socio-cultural entities. For this reason, these theories will not be directly applicable (i.e. without added supportive hypothesis) to explain differences in half siblingship closeness between populations (Thomson et al. 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 to half siblings across the life-course is fairly limited. By age 18, 26% of the 1994 birth cohort had a half sibling who is also no older than 18; 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 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 lions-share of the siblingship-like relationships as 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 siblings 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 provide a useful complement to survey sources (e.g. Huinink et al. 2011; Kalmijn et al. 2018) for the study of half siblingship.

2. Theory & 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). A human capacity for altruistic and reciprocal behavior was adaptive only as long as it was directed at close kin, who could pass on the genotype to the next generation (Kaplan, Gurven and Hooper 2009). Patterns supportive of inclusive fitness theory 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 biological full siblings, suggesting that advanced cooperation and interaction and biological relatedness is fundamentally correlated (Chapais 2009). Closeness and resource investments are often found to be lower among non-biological family compared to biological family (e.g. van Houdt, Kalmijn, and Ivanova 2018) Accordingly, half sibling relationships should be characterized by less affection compared to full-sibling relationships, since the former dyad shares a quarter of its genetic material and the latter around half (Tanskanen & 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 guidance from 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 & Coleman 1988). Step and half siblings are often depicted in terms of negative or stigmatizing stereotypes (Hadfield & Nixon 2013). Moreover, institutions such as schools, healthcare, marital law, and custodianship law are aligned to cater to marital couples and nuclear families and create problems for other forms of household structures and perpetuate their status as secondary (Mason, M. A., Fine, & Carnochan 2004). Countries such as Sweden, where the present study takes place, employ individualized taxation and transfers to custodians tied to individuals rather than family unit (Thévenon & Neyer 2014). Such policies have been suggested to be more ready to accommodate reconstituted households (Nieuwenhuis & Maldonado 2018). Yet, in Sweden, marital status and biological ties are decisive importance for legal custodianship (Björnberg 2001), marital and non-marital unions are regulated by separate bodies of family and property law (Wells & Bergnehr 2014). Qualitative research indicate that half siblingships are persieved as undefined and indefinate relationships without

established rights and responsibilities attached to then (Bäck-Wiklund & Johansson 2012).

Family systems theory emphasizes that supportive and functioning family environment lay the grounds for enduring close relationships (Poortman & Voorpostel 2009). Families with half siblings, in Scandinavia and elsewhere, tend to be more unstable (Lappegård & Thomson 2018). Socio-economic position is positively associated with union stability (Jalovaara & Andersson 2018), the prevalence of re-constituted families is larger in low SES groups and vulnerable groups compared to high SES groups and affluent groups (Turunen 2011). Children growing up with half siblings (Turunen 2014) or ever separated families (Jonsson & Gähler 1997) tend to have lower educational attainment. In all, institutional and family systems perspectives predict a hampered development of reciprocity and trust 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. Whether due to extensive spacing or lack of day-to-day contacts 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 relationships. Interaction is essential to kin selection theory. The identification of genetic closeness occurs either through repeated interaction in general or by identifying alters who interact frequently with known biological kin, i.e. persons whom one's mother/father treats as close kin (Lieberman et al. 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 determining exposure among 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 sibling. 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 & 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 needed for creating siblingship like-relationship, and they may be variable between populations.

2.3 Measures of Half Sibling Exposure

Half siblingship is the product of MPF and is, therefore, from the parents' perspective, preceded by separation or 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 US, 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 percent of all children reside with a half sibling (Kennedy & 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 US and 16 % in Norway (Thomson et al. 2014), 12 % percent in West Germany, 23 % in East Germany and 14 % in Finland (Kreyenfeld & Jalovaara 2018). Between 17 and 23 % have a paternal or maternal half sibling in the US (Dorius 2011; Guzzo & Furstenberg 2007; Monte 2018). Register data support similar incidence rates for paternal half siblings in Norway (Lappegård & Rønsen 2013; Lappegård & Thomson 2018).

Across countries, measures of cumulative experiences of divorce and stepfamily formation reveal high levels of family complexity (Andersson 2002). We know of two studies that have analyzed the development of half siblingship across the life course. Using a sample of unmarried mothers who were in receipt of welfare, Cancain and colleges (2011) showed an accumulation of half siblingship to 60 % from birth to age 10. Moreover, they found that MPF in one parent was positively correlated with MPF in the other. In a sample of adults, Tanskanen and Danielsbacka (2019) found that 40 % of respondents with half siblings reported never having resided with these.

This paucity in research may largely be due to the high demands of data necessary to measure half siblingship across the life course. The plastic nature of complex families and reliance on modules constructed to focus on household members make it difficult to capture the full set of half siblings over the course. Half sibling incidence inferred from a parental perspective data (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 NLSY (Bloome 2017) and multi-actor prospective panel designs such PAIRFAM (Huinink et al. 2011) and OKiN (Kalmijn et al. 2018) may overcome many of these problems (Tanskanen & 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 & Le Bourdais 1999; Müller & Castiglioni 2015; Wolfe et al. 1996). In consideration to the many obstacles in assessing 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 & Meyer, 2006; Jonsson & Gähler 1997). It is not known whether parental vulnerability among MPF men and women are uncorrelated to factors that influence lifetime exposure to half siblings, such as gender of the MPF parent, birth spacing and co-residency patterns. For example, the prevalence of MPF is relatively high among men with high income (Lappegård & Rønsen 2013); age at first birth is predictive of a more stable financial situation above and beyond family structure and later age at first birth shorten the spacing between children born to different parents (Holland & 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 is a relevant aspect of a demographic phenomenon (McLanahan & Percheski 2008). Therefore, we provide a brief description of differences between children from vulnerable and non-vulnerable families in years with siblings and years co-residing 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. Supplementary figure 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 may be exposed to each other during childhood and adolescence. We count the years individuals have an alive 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 had had an alive 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 et al. 2011, Figure 1). At every age, we calculate the proportion of the anchor cohort who had had an alive half sibling for k number of years (A_k in Table 1).

We use information on registered residence to estimate of sibling co-residency status. Residential administers 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 its maternal half sibling is also registered with this mother, then the half sibling pair are assumed to co-reside (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 co-reside. 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 its (non-shared) mother, but lower chance of contact compared to if index and half sibling where co-residing.

Table 1. Half sibling exposure

Measure	*Half sibling status*
A_k	Half sibling alive & 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 co-resides with anchor)

$_k$ = Years of exposure.

In the second part of our analysis, we describe parent's fertility regimes and the sibling-composition for children who have much 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) having co-resided eight years or more with a half sibling, contrasted against all other. We measure the birth spacing between the anchor child and the closest half sibling. We measure the incidence of half siblingship on the maternal or paternal side or both sides. We also measure the number of maternal/paternal childbearing partners, the number of full and maternal/paternal half siblings and the anchor child's sibling position (younger, older or both), and full- and half sibling composition.

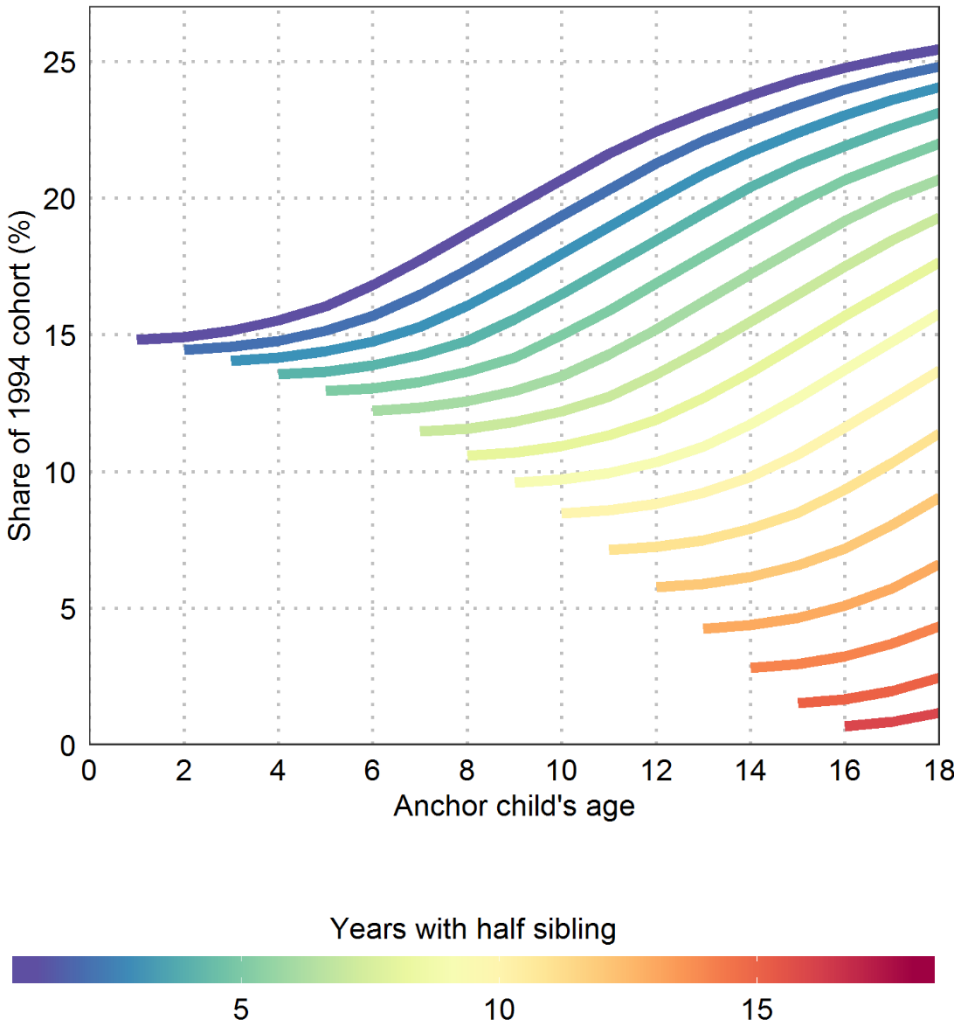
In the third part of our analysis, we analyze parental socioeconomic origin by the length of exposure to half siblings. We construct three measures of parental socioeconomic origin. We use a dummy which takes the value one if both of the anchor child's parents has no higher educational degree than what is obtained from basic mandatory school. We construct age-specific disposable income ranking, 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 one of 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 given extended enough 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 considering birth spacing? Figure 1 shows the share of the total population who has an half sibling on the y axis, 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 had an half sibling. About 26% have at least one half-sibling at age 18 (blue line). However, this proportion declines when considering how many years the half sibling set may have interacted while being under age 18. For example, one may believe that to achieve a close relationship one needs to have interacted with a half sibling for at least 10 years by 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 to a half siblings.

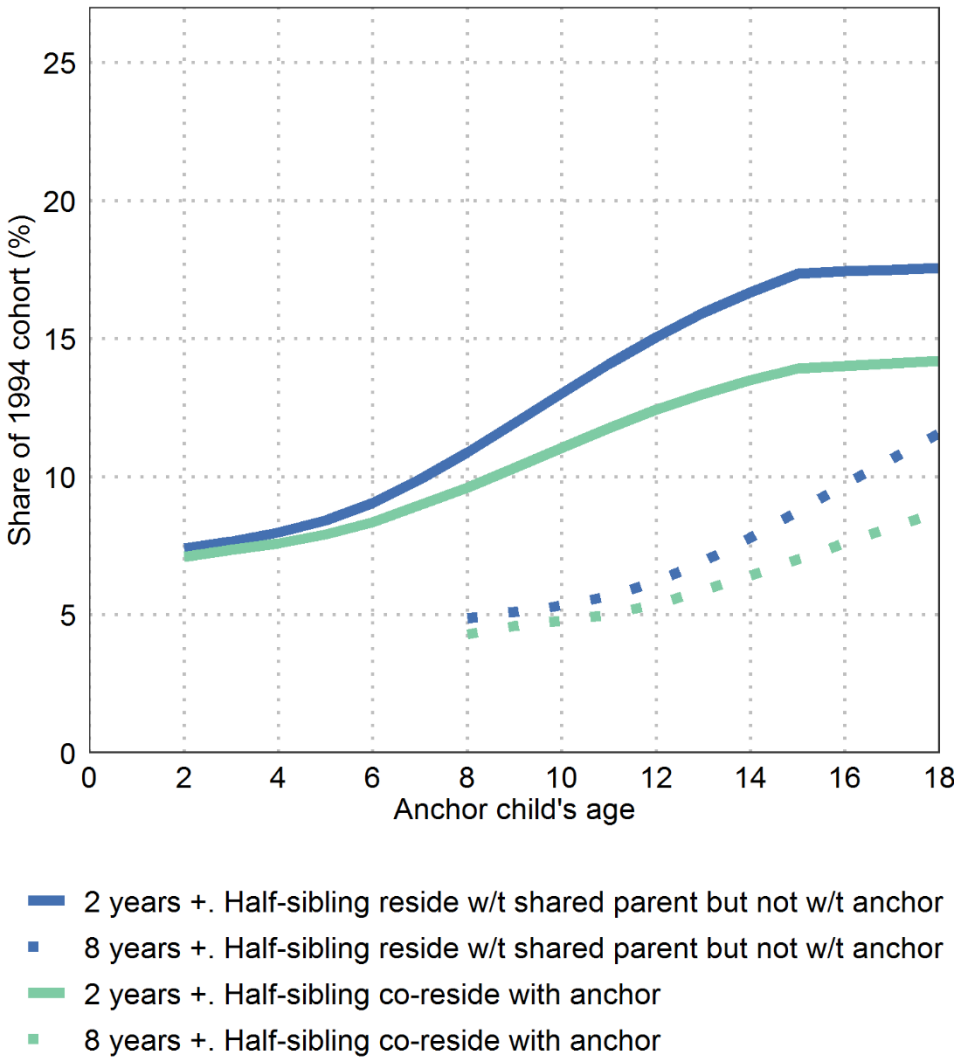
Figure 1. Years with half siblings. 1994 birth cohort.
(N = 116,843*).*



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

For interaction to take place between siblings, they not only need to be alive at the same time but, most likely, also need to be physically adjacent to each other. One important factor that set the limits to this interaction is the co-residence status of half sibling pairs. Figure 2 shows the years children spent in different residence state vis-à-vis their half siblings. Blue lines indicate that the anchor child do not have a half sibling registered in the same dwelling, but that the half sibling reside with their shared parent. Green lines indicate that the anchor and half sibling are registered at the same dwelling and are assumed to co-reside. 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 co-residence (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 S3).

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

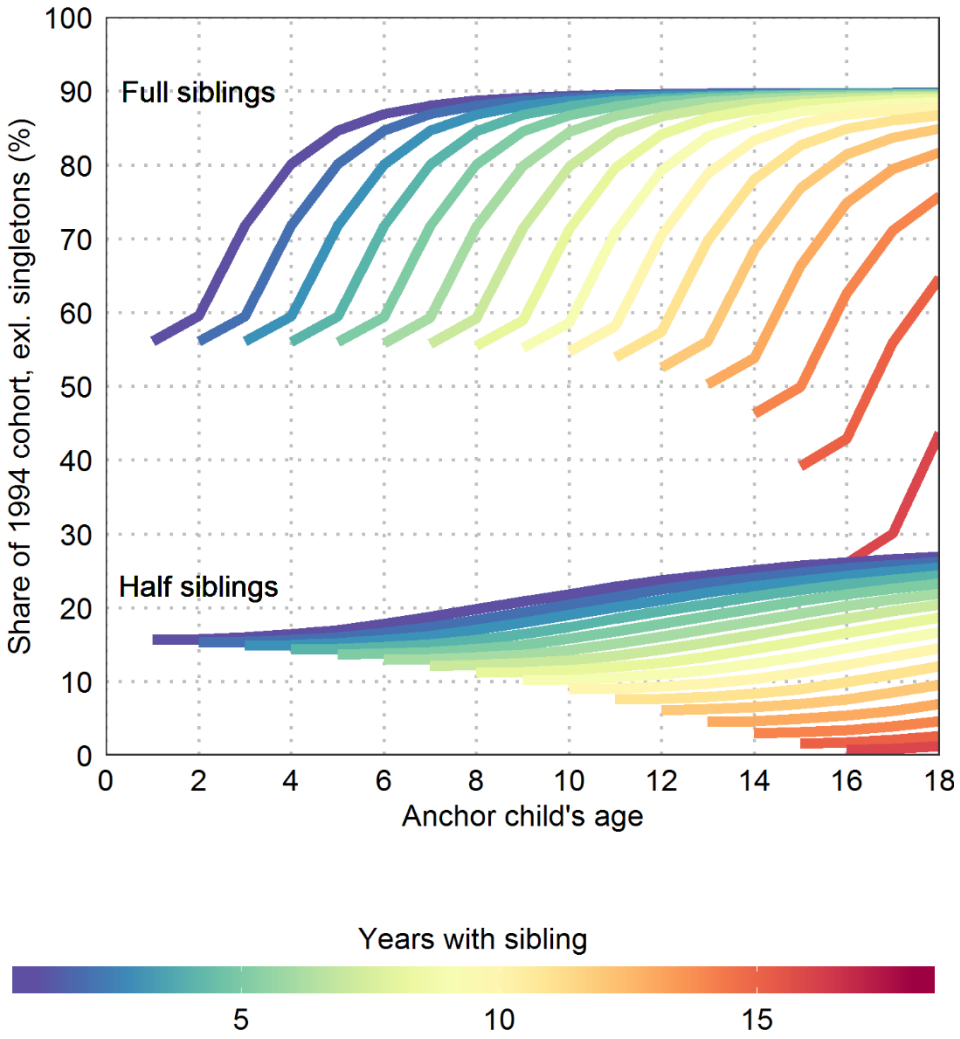


Source: STAR register data. Lines show the proportion of the cohort, at a given age, with a given half sibling co-residence status (half sibling no older than 18). Blue lines = The anchor child's half sibling is registered at a dwelling of the shared biological parent but not with the anchor child. Green lines = The anchor child's half sibling is registered at the same dwelling as 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 were chosen to represent a relatively short and a relatively lengthy spell.

4.2 Full- and Half siblingship Exposure Across the Life Course

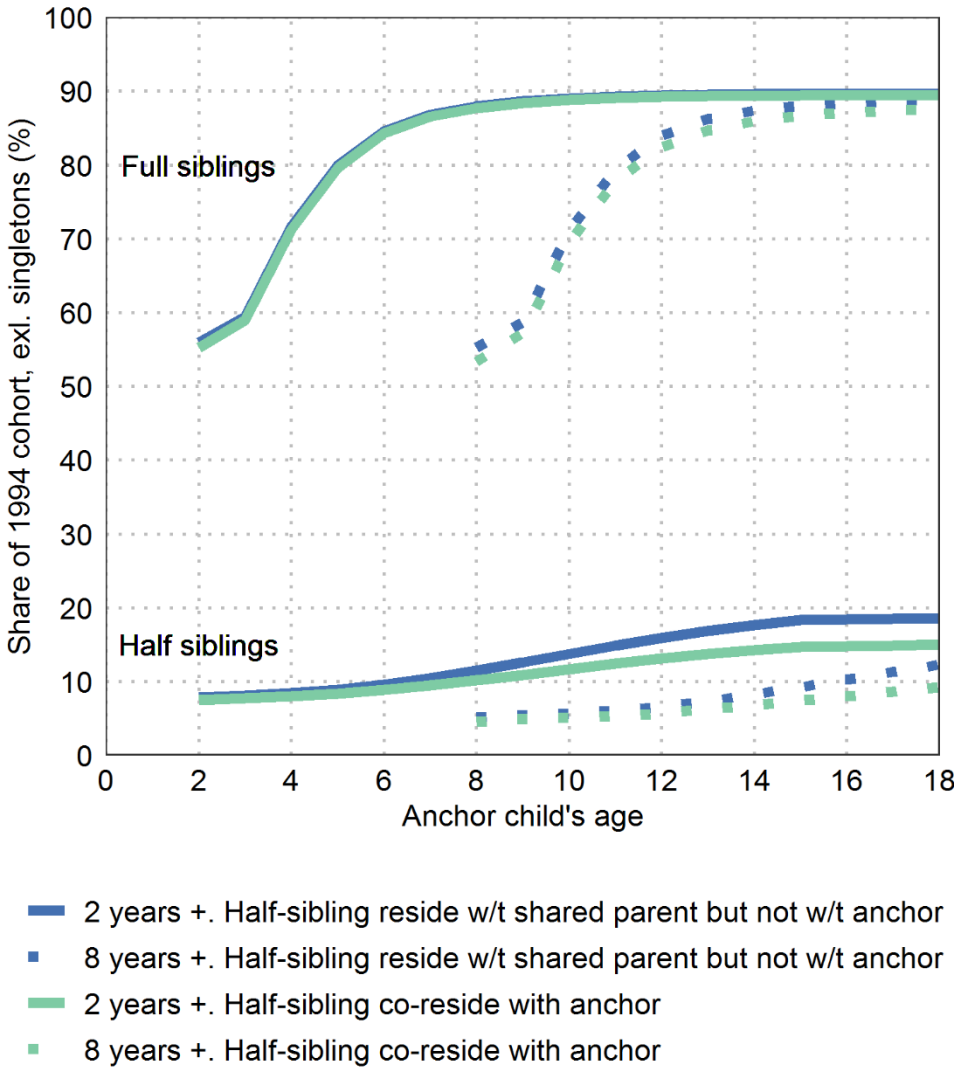
Next, we substantiate how half sibling exposure is conditional on birth spacing and residency, by comparing half and full-siblings. Full and half siblings both have the potential to produce sibling-like relationships. The amount of interaction differs between full and half sibling, however, because half siblings have wider birth spacing and different residency patterns. Figure 3, similar to figure 1, shows years spent with alive 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. 27% of this population has a half sibling at age 18 (blue line in top bundle), which go down to 15% using a 10-year criterion (yellow line). In 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 show full and half siblings and include only the population who have either a full or half sibling. 10% of all children with a half or full sibling have co-resided 10 or more years with a half sibling, but 90% have co-resided 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 S2 and figure S3 in the supplemental 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, who has had an alive 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 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 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 showed that half sibling 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 co-residence 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% (100-63.7) 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. 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 co-residence	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	5292 (48.0%)	6026 (29.2%)
One	4377 (39.7%)	9622 (46.7%)
Two	973 (8.8%)	3427 (16.6%)
Three or more	387 (3.5%)	1530 (7.4%)
Maternal half siblings		
None	568 (5.2%)	13134 (63.7%)
One	6022 (54.6%)	4540 (22.0%)
Two	3151 (28.6%)	2100 (10.2%)
Three or more	1288 (11.7%)	831 (4.0%)
Paternal half siblings		
None	5574 (50.5%)	4432 (21.5%)
One	2382 (21.6%)	8682 (42.1%)
Two	2042 (18.5%)	5129 (24.9%)
Three or more	1031 (9.3%)	2362 (11.5%)
Maternal childbearing partners		
One	568 (5.2%)	13134 (63.7%)
Two	8993 (81.5%)	6660 (32.3%)
Three or more	1468 (13.3%)	811 (3.9%)
Paternal childbearing partners		
One	5574 (50.5%)	4432 (21.5%)
Two	4513 (40.9%)	14036 (68.1%)

Table 2 cont.

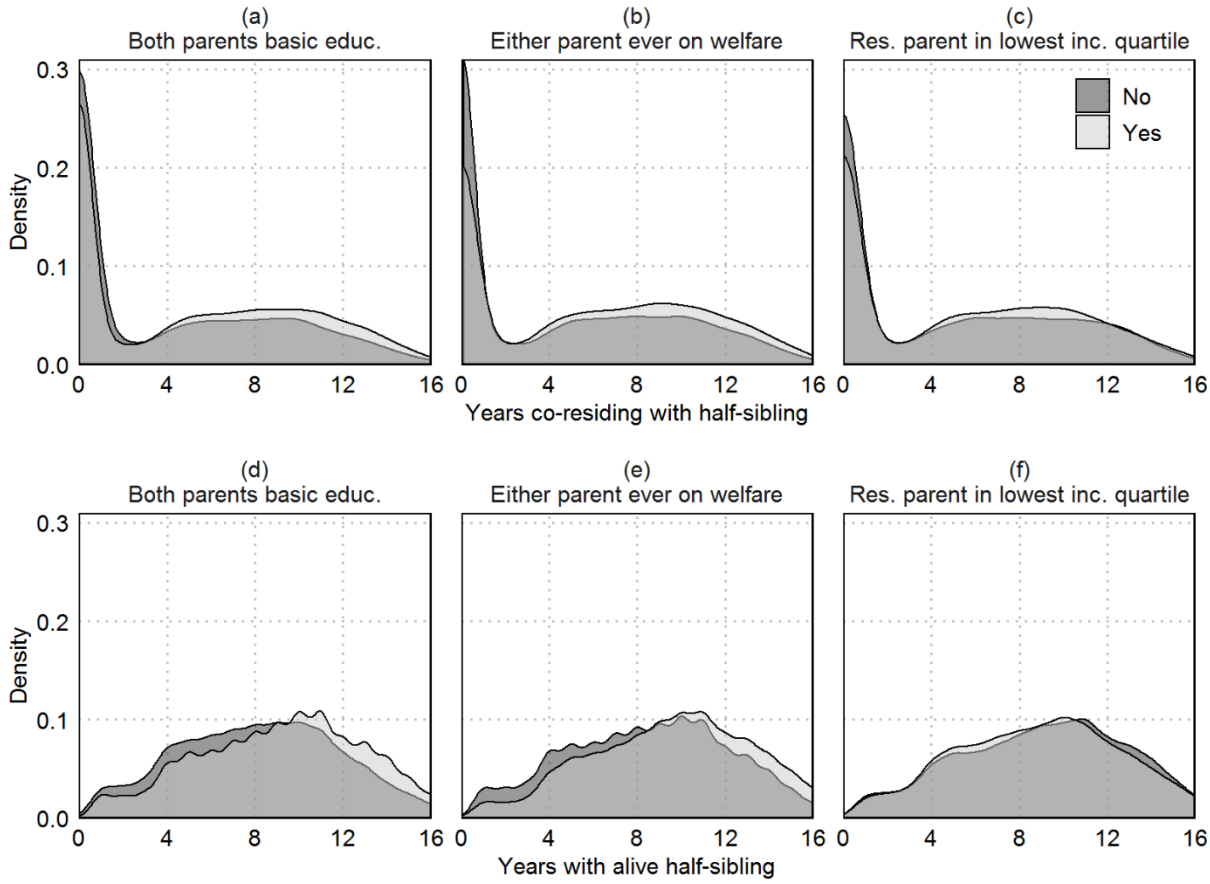
Three or more	942 (8.5%)	2137 (10.4%)
Half sibling antecedence		
Maternal only	5574 (50.5%)	4432 (21.5%)
Paternal only	568 (5.2%)	13134 (63.7%)
Both	4887 (44.3%)	3039 (14.7%)
Sibling-set composition		
Maternal half	2275 (20.6%)	1365 (6.6%)
Paternal half	162 (1.5%)	3285 (15.9%)
Mat. & Pat. half	2855 (25.9%)	1376 (6.7%)
Full & Mat. half	3299 (29.9%)	3067 (14.9%)
Full & Pat. half	406 (3.7%)	9849 (47.8%)
Full & Mat & Pat. Half	2032 (18.4%)	1663 (8.1%)
Sibling position relative to half sibling(s)		
Older	4440 (40.3%)	8170 (39.7%)
Younger	4648 (42.1%)	10960 (53.2%)
Older & Younger	1941 (17.6%)	14752 (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); residing parent in lowest income quartile or not. Plots a, b and c in Figure 5 show kernel density estimates of years co-residing with half siblings, by social vulnerability status. Plots d, e and f in Figure 5 show kernel density estimates of years with alive half siblings, by social vulnerability status.

Children's number of years of co-residency 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 numbers years with an alive 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 respect to parental social vulnerability between children with high and low exposure to their half sibling.

Figure 5. Half sibling birth spacing and half sibling co-residency by parental vulnerability. Kernel density estimates. Children with half siblings by age 18.



Source: STAR register data.

5. Discussion

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

The present study has analyzed the population variance in how many years individuals have an 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. In contrast, for example, only 8% of the birth cohort have co-resided 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 co-reside. Children with much 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 vary substantially within the group who ever have 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-line 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 confidants focus on the advantages for fitness of investing in more closely related kin. Sociological explanations include the argument that step- and half sibling relations are incomplete institutions which cannot provide the default toolkit or social cohesion that produce 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 & Danielsbacka 2019).

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

We also analyzed whether children from different social origins 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 step children, and so it does not give a complete picture of the development of children's relations 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 alive siblings at different ages. Approximating residency based on being registered at a given dwelling should be considered a rough measure. Individuals may reside in different places than those they are registered at. 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 would be hard to obtain using available survey material.

Acknowledgements

This research is funded by the Academy of Finland Grant number 321264 and the Swedish Research Council for Health, Working Life and Welfare (FORTE) Grant number 2016-07099. Thanks are due to the anonymous reviewers and to colleagues at the Swedish Institute for Social Research for helpful comments on earlier versions of the paper.

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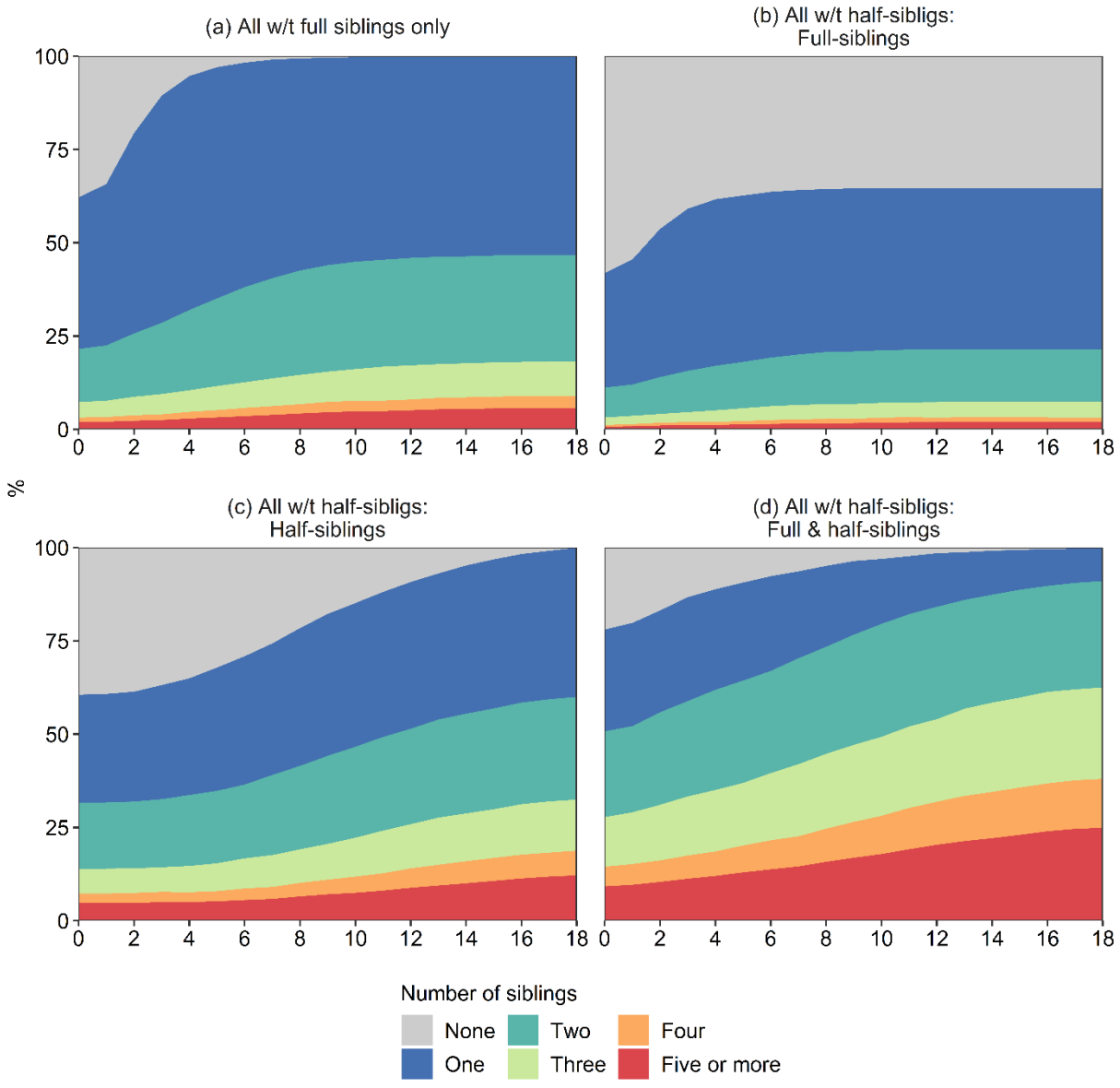
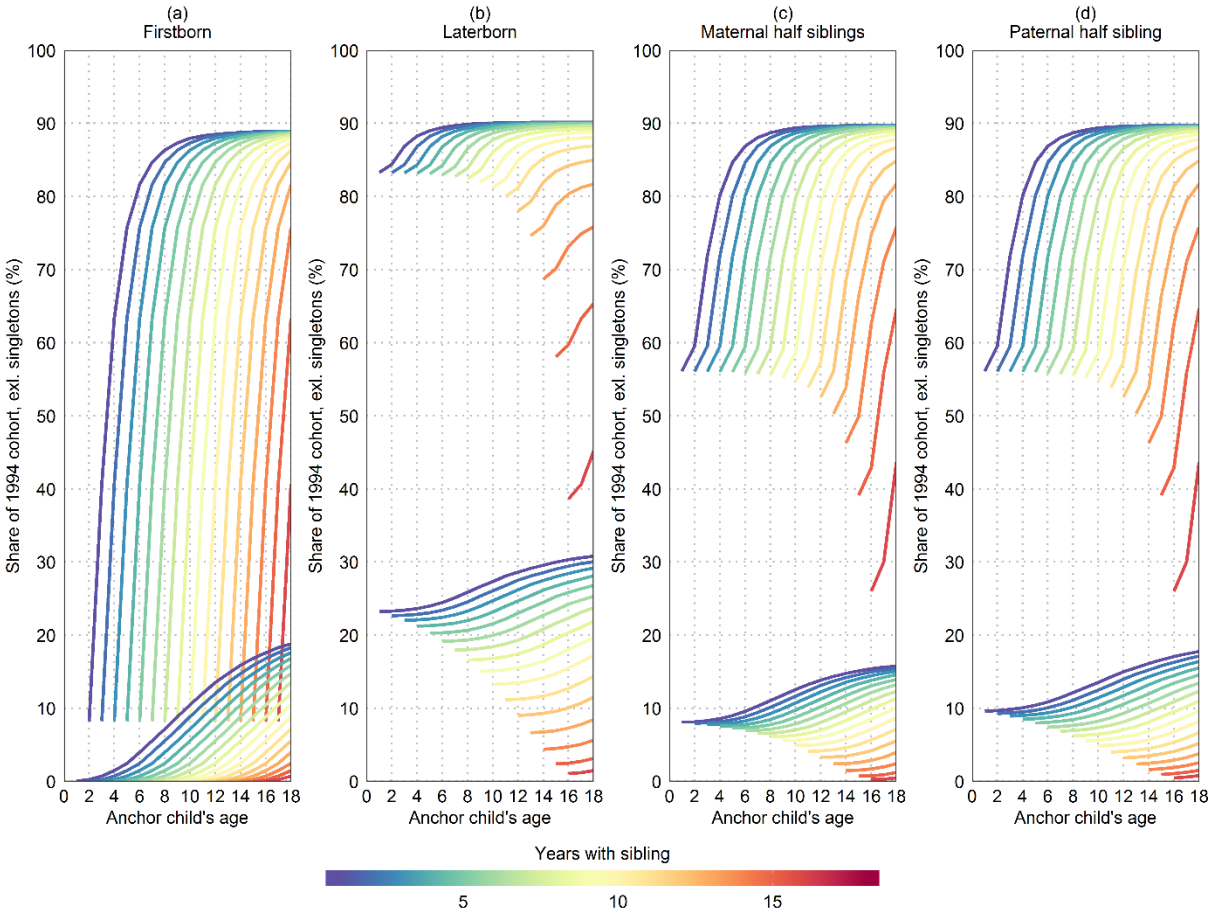
Supplementary material

Figure S1. Proportion of number of full siblings, half siblings and full & 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).



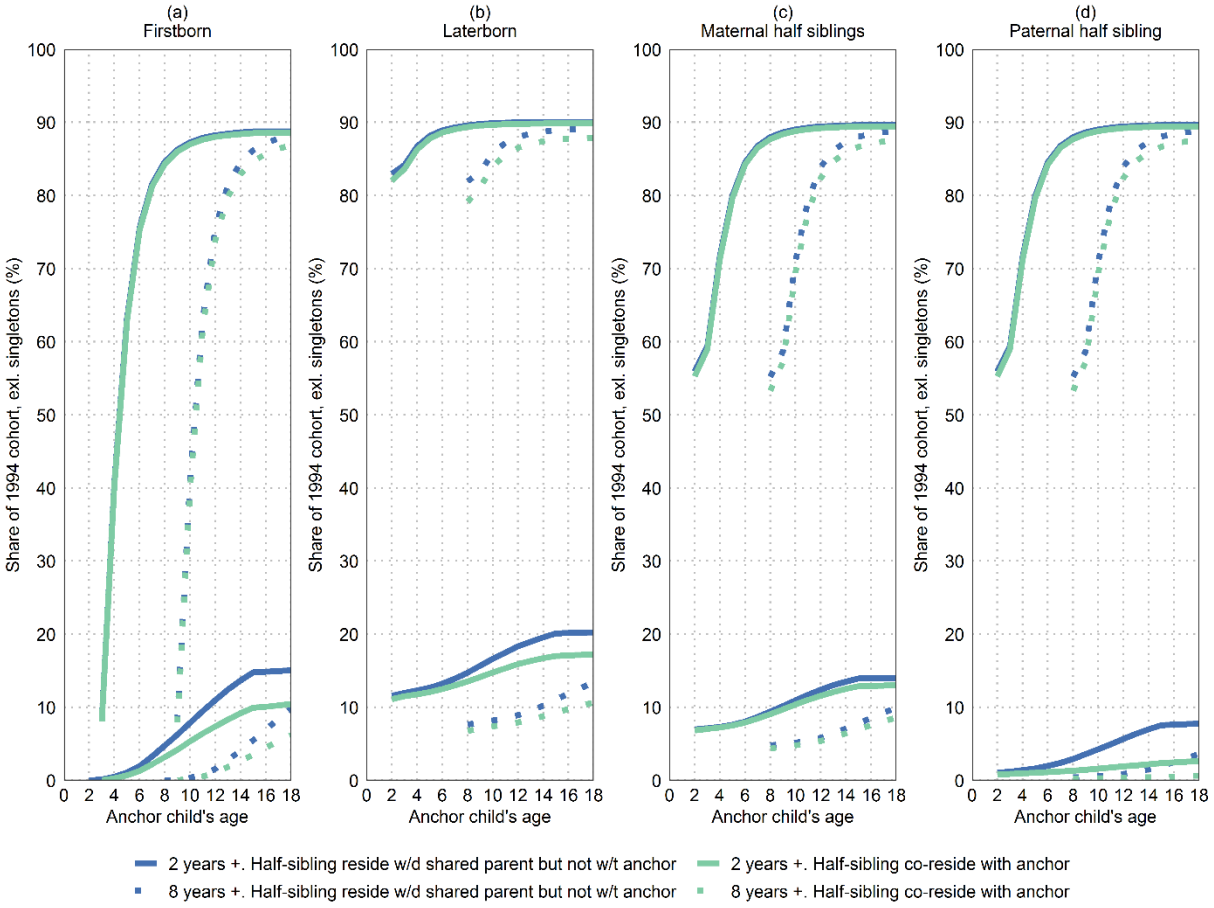
Source: STAR register data.

Figure S2. 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 S3. 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.

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