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Birth order and alcohol-related mortality by ethnic origin and national context: Within-family comparisons for Finland and Sweden

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ABSTRACT

Background: Previous studies have found that birth order is an important predictor of later life health, including hospitalisation for alcohol use. We examine the relationship between birth order and alcohol-related mortality in two national contexts, within native families who differ on ethnic origin.

Methods: We study the association between birth order and alcohol-related mortality after age 17, using Finnish register data for cohorts born 1953−1999 and Swedish register data for cohorts born 1940−1999. We apply Cox proportional hazard models and use sibling fixed effects that eliminate confounding by factors shared by siblings. We separate full-sibling groups by ethnic origin, which for Finland means mother's and father's Finnish or Swedish ethnolinguistic affiliation. For Sweden, we distinguish native-born according to whether one or both parents were born in Sweden or Finland.

Results: We find a positive correlation between birth order and alcohol-related mortality, but only for ethnic Finns in Finland and primarily men. Within these sibling groups, second-borns have an alcohol-related mortality risk that is 9% higher than that of first-borns, third-borns 19 % higher, fourth-borns 22 % higher, and fifth- or higher-borns 47 % higher. No such birth order associations can be found for any of the other ethnic groups analysed in Finland or Sweden.

Conclusions: Our findings suggest that cultural-related behaviours typical for ethnic groups, and the national context in which they are studied, are relevant for whether any association between birth order and alcohol-related mortality can be observed. Differences in the social interplay within the family may be an important factor.

1. Introduction

Studies on the interrelation between birth order and health have found that later-born siblings generally perform worse than earlier-born siblings with regard to various health outcomes, such as depression, mental distress, psychiatric deviation, anxiety, self-esteem, physical fitness, and mortality (Modin, 2002; Mittendorfer-Rutz et al., 2004; Riordan et al., 2011; Barclay and Myrskylä, 2014). Similar to studies on intelligence, cognitive and non-cognitive skills, and educational attainment (Blake, 1989; Black et al., 2005; Bjerkedal et al., 2007; Kristensen and Bjerkedal, 2007), a number of potential explanations to the birth order pattern have been suggested. Researchers have argued that siblings are part of a dynamically changing environment that may become less cognitively stimulating when the family grows in size, parental resources may decrease, the likelihood of communicable diseases may increase, and there may be biological depletion of mothers with additional births (Zajonc, 1976; Blake, 1981; Strachan, 1989; Hertwig et al., 2002; Riordan et al., 2006; Batty et al., 2007). Another set of explanations relate to the social environment within the family. Offspring may occupy different niches in order to avoid inter-sibling competition, and there could be within-family bullying at the expense of later-born siblings (Zweigenhaft and Von Ammon, 2000; Tucker et al., 2013). A particularly influential theory has emphasized how the within-family dynamics create more rebellious later-born children (Sulloway, 1996), which may be expressed through higher risk taking and alchohol consumption, as well as premature mortality in general.

Recent studies have found that higher birth order relates to higher mortality from external causes, primarily suicides, but also accidents and events of an undetermined event (Bjørngaard et al., 2013;Rostila et al., 2014; Barclay and Kolk, 2015; Saarela et al., 2016). A fundamental contribution of these analyses is the use of the sibling fixed effects approach. It means that within-family variation only, and not

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between-family variation, is analysed. This minimises residual confounding from unmeasured time-invariant factors that are shared amongst siblings, such as common genetic factors, parenting style, socioeconomic environment at childhood, parental health behaviours, and parental patterns of drug abuse. Using sibling fixed effects, this paper is the first to study if alcohol-related mortality is associated with birth order.

Alcohol-related deaths have been estimated to account for three million deaths, or more than five per cent of all deaths, worldwide every year. Over 200 health conditions are linked to harmful use of alcohol, and about five per cent of the global burden of disease and injury is attributable to alcohol (WHO, 2018). For people aged 15–49 years, alcohol use is the leading cause of death (GBD 2016 Alcohol Collaborators, 2018). A factor that has received relatively little attention in the literature on alcohol abuse is birth order. It may play an important role, considering the relevance of peers and age at initiation for later alcohol abuse problems. Sibling influence can be considered highly important for the uptake and continuation of alcohol consumption. Younger siblings may be introduced by older siblings to developmentally inappropriate alcohol behaviours at a younger age than otherwise would have been the case, with direct and indirect influences on health and mortality (Elliott, 1992; Harakeha et al., 2007). Access to alcohol may therefore be facilitated, and the exposure is likely to be higher for siblings with higher birth order than for those with lower. Risk taking of later-born siblings may be particularly salient in teenage years (Sulloway, 1996), when there is a link between non-conformance with parental attitudes and alcohol consumption, and thus contribute to the association between birth order and alcohol-related mortality also in the longer term.

Most previous research on the relationship between birth order and alcohol use has been limited by using non-representative samples and does not adequately account for potential confounding factors (Blane and Barry, 1973; Ernst and Angst, 1983). One exception is a study on birth order and hospitalization for alcohol use based on Swedish population register data (Barclay et al., 2016). It found that later-born siblings are hospitalized at a notably higher rate than first-borns, and that there is a monotonic increase in the hazard of hospitalization with higher birth order. Whether the pattern observed in that study carries over to alcohol-related mortality, which is a much more severe indicator of excessive alcohol use, is not known, and is in the focus of this paper.

We improve on previous research also by conducting similar analyses across two national contexts, Finland and Sweden, and for native groups that differ by ethnic origin. Ethnic origin relates to cultural norms and behaviours, which may affect alcohol use and vary by context, meaning that the birth order pattern for alcohol-related mortality may differ across ethnic groups and countries (Ahern et al., 2008). It is likely more emphasised in contexts and families where alcohol intoxication, drunkenness, hangovers, and alcohol-induced pass-outs are more of a norm.

The multigenerational population registers of Finland and Sweden provide novel opportunities to study how alcohol-related mortality relates to birth order, and to do so for people who differ by ethnic background. Both countries have substantial populations of ethnic Swedish and ethnic Finnish origin, who differ in alcohol-related mortality. Swedish speakers in Finland account for five per cent of the total population. Finns constitute the third largest foreign-born group in Sweden, or seven per cent of all foreign-born individuals, where a large share have raised families in Sweden. Until 2017, they constituted the largest group. Both these minority groups have managed to keep their cultural roots and identities in spite of a substantial degree of intermarriage. Swedish speakers in Finland have a very long history, while many ethnic Finns in Sweden are more recent migrants, primarily arriving during the country's economic expansion in the 1960s and 1970s (Leiniö, 1984; McRae, 1997). In each national context, people in the minority group have formed a permanent and stable community.

In ages 18–50 years, the ethnolinguistic group of Finnish speakers in Finland have approximately three times higher rates of alcohol-related mortality than the native group of Swedish speakers in the country (Blomgren et al., 2004; Saarela and Finnäs, 2016). The Finnish speakers report also more frequent drunkenness, suffer more frequent hangovers and have alcohol-induced pass-outs significantly more often than Swedish speakers (Simpura, 1990; Paljärvi et al., 2009). Similar differences exist between ethnic Finns and ethnic Swedes in Sweden (Ågren and Romelsjü, 1992; Hjern and Allebeck, 2004; Westman et al., 2015; Östergren et al., 2020). Socio-economic, demographic and area-level variables explain only a small part of the differentials in alcohol-related mortality between ethnic Finns and ethnic Swedes. One may therefore assume that they relate to group-specific cultural norms that affect alcohol use, and to variation in social networks and family bonds that protect from unhealthy drinking behaviours (Saarela et al., 2016; Saarela and Rostila, 2019; Saarela and Kolk, 2020). Although an examination of within-family variation in alcohol-related mortality cannot fully address those claims, it will help to cast light on this issue and may provide some indirect empirical support.

In an international perspective, both Sweden and Finland have strict alcohol policies, with only slight differentials. Both societies are described as 'dry' drinking cultures, though with more sporadic and heavy drinking oriented towards intoxication (Bruun and Rosenqvist, 1985; Karlsson et al., 2012). Alcohol and booze have been perceived as particularly rooted in the Finnish self-perception, although in an international perspective, Sweden and Finland are quite similar in this respect (Peltonen, 2000). In the working-age population, the alcohol-related mortality rate is more than twice higher in Finland as compared to Sweden, and roughly four times higher in men than in women in each country (Saarela and Kolk, 2020). Many of the underlying factors are nevertheless similar in both countries, and particularly the educational gradient in alcohol-related mortality (Martikainen et al., 2013, 2014; Mackenbach et al., 2015; Nordahl et al., 2014; Östergren et al., 2018).

The extent to which cultural norms affect alcohol use and, thus, alcohol-related mortality, may vary by social context. For instance, in immigrant parents, cultural-related drinking behaviours and family values may assimilate toward the norms of a new context and cease to affect intrafamily behaviours of the offspring (Kulis et al., 2012). If not, and the social environment within the family is obsolete, within-family behaviours may be abiding and become even more pronounced within another environment (Caetano and Clark, 1999). We study persons with similar origin in terms of Finnish, Swedish, or mixed Finnish-Swedish background, but in two national contexts that have many similarities in terms of institutional policies, but not necessarily in terms of the social interplay within families.

Thus, there have been many studies on alcohol-related mortality in both Finland and Sweden, but none have examined birth order effects within families. We use population register data from two generations of the population in Finland and in Sweden to examine sibling groups who are the offspring of majority-culture parents and sibling groups with minority-culture or mixed cultural background. Based on this setting, the study seeks to answer whether alcohol-related mortality relates to a person's birth order, and whether any such interrelation is dependent on ethnic origin and national context. We expect that, if there is a relation between birth order and alcohol-related mortality, it should be most pronounced for Finnish speakers with ethnic Finnish background in Finland.

2. Methods

2.1. Data

We use Finnish register data that cover the period 1971−2017, and Swedish register data that cover the period 1971−2016. Persons in these multigenerational population registers can be linked to the mother and the father, which means that we can construct sibling groups.

All study persons in Finland are native and registered as a Finnish speaker or a Swedish speaker. The same restrictions apply to both the parents. Due to substantial differences in group size, we study people with Finnish ethnic background (*Finnish*) separately from those with Swedish or mixed ethnic background (*Swedish or Mixed*) in Finland. The first group consists of Finnish-registered persons with a Finnish-registered mother and a Finnish-registered father. The second group consists of all other combinations of Swedish- or Finnish-registered persons with Swedish- or Finnish-registered parents. Foreign-born immigrants with foreign-born parents are consequently excluded. This is not a critical issue with regard to data size or inference, because immigration and intermarriage across other ethnic lines in Finland have until recently been rare.

The data on Sweden are restricted to persons born in Sweden, whose mother and father were born in Sweden or Finland. In Sweden, we separate persons with both parents born in Sweden (*Swedish*) from those with one or both parents born in Finland (*Finnish or Mixed*).

For both countries, we lack sufficient statistical power to split the data by different combinations of parental ethnicity and sex.

With the data from Finland, we study full-sibling groups in which all siblings were born 1953−1999, to ensure that both parents can be identified (Karhunen and Uusitalo, 2017), and that all persons were at least 17 years old when they entered the study window. A similar setup is used for Sweden, i.e., full-sibling groups in which all siblings were born 1953−1999, but we can extend also with cohorts born 1940−1952. Birth order refers to the full-sibling group, as we perform within-family analyses by ethnic origin.

Alcohol-related mortality is assessed with the ICD-8 codes 291, 303, 571, 5728X, E851, E860, N979, and N980 for deaths in 1971–1986, with the ICD-9 codes 291, 303, 3050, 3317, 34570, 3457A, 3457X, 3575, 3594, 4255, 980, and E849 for deaths in 1987–1995, and with the ICD-10 codes E244, F10, G312, G405, G621, G721, I426, K292, K70, K860, O354, X45, T51, Y90, Y91, Z502, Z714, and Z721 for deaths in 1996–2017. Medical conditions fully attributable to alcohol are

Table 1
Descriptive statistics of the study populations.

	Finland, born 1953−1999, period 1971−2017, from age 17		Sweden, born 1953−1999, period 1971−2016, from age 17		Sweden, born 1940−1999, period 1971−2016 from age 17−30		Sweden, born 1940−1999, period 1987−2016 from age 17−30	
	Finnish	Swedish or mixed	Swedish	Finnish or mixed	Swedish	Finnish or mixed	Swedish	Finnish or mixed
Birth order (%)								
1st	41.8	44.1	38.7	37.7	38.5	38.2	38.6	37.8
2nd	36.8	38.8	39.4	38.5	38.7	37.6	39.2	38.3
3rd	13.9	12.6	14.8	15.2	14.8	15.1	14.8	15.1
4th	4.6	3.1	4.5	5.1	4.9	5.3	4.6	5.2
5th or higher	2.9	1.4	2.7	3.4	3.1	3.8	2.8	3.6
Year of birth (%)								
1940−1946					18.9	4.2	11.3	2.2
1947−1952					17.7	8.1	13.7	5.5
1953−1959	19.0	17.8	27.8	20.2	17.6	17.7	16.5	14.5
1960−1969	36.4	35.3	33.9	38.4	21.5	33.7	25.4	34.8
1970−1999	44.6	46.9	38.4	41.4	24.3	36.3	33.1	43.0
Sex (%)								
Man	51.0	51.9	51.4	51.3	51.3	51.3	51.3	51.3
Woman	49.0	48.1	48.6	48.7	48.8	48.7	48.7	48.7
Mother's age at birth (%)								
-20 years	9.4	7.4	8.5	10.2	7.8	9.7	7.9	9.8
21−25 years	35.6	33.1	30.9	34.5	29.1	33.7	29.9	33.8
26−30 years	32.2	35.1	33.0	30.9	32.1	31.0	32.8	31.2
31−35 years	16.1	17.5	18.4	16.5	19.7	17.0	19.2	17.0
36+ years	6.7	6.9	9.2	7.9	11.2	8.5	10.2	8.2
Educational attainment (%)								
Primary level	8.2	9.3	11.1	12.0	17.2	13.0	14.4	12.2
Secondary level	48.9	44.3	48.5	52.9	46.9	52.3	47.4	52.5
Tertiary level	42.9	46.3	40.4	35.0	36.0	34.6	38.2	35.3
Number of deaths								
Alcohol as main cause	7761	278	2357	214	7512	287		
Other main cause	51,879	2944	64,162	3862	133,961	4761		
Alcohol as main or contributing cause							16,610	730
Other main or contributing cause							126,109	4465
Number of sibling groups	782,974	65,802	1,484,850	73,899	1,800,547	76,660	1,796,721	76,461
Number of siblings	2,020,518	163,118	3,255,152	164,137	4,219,290	176,067	4,171,845	174,418
Number of person years	46,707,988	3,440,325	75,278,194	3,782,099	118,637,392	4,310,452	87,326,716	3,640,284

The data consist of full-sibling groups with at least two siblings, in which all siblings are born 1953−1999, or 1940−1999, and for whom both parents can be identified. Each index person is observed from age 17, or from age 18–30 if born before 1953, until death, first emigration, or end of the observation period.
For Finland, the index persons and their parents are either Finnish-registered or Swedish-registered. For Sweden, index persons are born in Sweden, while their parents are born in Sweden or Finland.
Number of deaths, sibling groups, siblings, and person years refer to the complete cohorts as decribed above. Numbers used in the analyses of within-family variation are provided at the bottom of the results tables.
The variable distributions are per person years and refer to the complete cohorts as described above.
Alcohol-related mortality refers to the ICD-8 codes 291, 303, 571, 5728X, E851, E860, N979, and N980 for deaths in 1971–1986, to the ICD-9 codes 291, 303, 3050, 3317, 34570, 3457A, 3457X, 3575, 3594, 4255, 980, and E849 for deaths in 1987–1995, and to the ICD-10 codes E244, F10, G312, G405, G621, G721, I426, K292, K70, K860, O354, X45, T51, Y90, Y91, Z502, Z714, and Z721 for deaths in.1996–2017.

consequently covered.

For the entire period 1971−2017 in Finland and 1971−2016 in Sweden we can separate alcohol as the main cause of death. For the period 1987−2016 in Sweden, it is possible to conduct also analyses with alcohol as the main or contributing cause. We consequently have one data setup for Finland, i.e., for cohorts born 1953−1999, period 1971−2017, and follow-up from age 17, and three data setups for Sweden; (a) cohorts born 1953−1999, period 1971−2016, and follow-up from age 17, (b) cohorts born 1940−1999, period 1971−2016, and follow-up from age 17−30, and (c) cohorts born 1940−1999, period 1987−2016, and follow-up from age 17−30. For the sake of comparison and completeness, we perform parallel analyses for mortality from any other main (or contributing) cause.

Descriptive statistics of the study populations are found in Table 1. There are in total 8039 alcohol-related deaths in the data from Finland, and 2,571, 7,799, and 17,340 in the three different setups of the Swedish data. The alcohol-related mortality rate is higher in the Finnish group than in the Swedish or Mixed group in Finland (deaths per 1000 person years are 0.166 vs. 0.081), and lower in the Swedish group as compared with the Finnish or Mixed group in Sweden (0.031 vs. 0.057, 0.063 vs. 0.067, and 0.190 vs. 0.201).

2.2. Ethical approval

The data from Finland are used with Statistics Finland's permission TK-52−694-18 and those from Sweden with the Stockholm Ethical Review Board's permission 2017/1623−31/5.

2.3. Statistical analyses

To analyse the association between birth order and alcohol-related mortality we apply Cox proportional hazards models with sibling fixed effects. The failure event is death from an alcohol-related cause. We run parallel models in which death from any other cause is the failure event. The baseline hazard for mortality is time since age 17 (or 18–30 if born before 1953). Right-censoring occurs at first emigration or at the end of the observation period. The sibling fixed effects approach is based upon a within-family comparison. By comparing siblings in the same family we consequently adjust for all time invariant observed and unobserved factors that are shared by the siblings within a family. The approach can be considered superior to the regular Cox proportional hazard model because of its ability to minimise confounding from unobserved or unmeasured variables. The analyses are based upon stratified Cox regressions where siblings share the same baseline hazard. The sibling group variable is the shared mother plus father id (i.e., full-siblings). A requirement for the analyses is that sibling groups must have variance in the outcome, meaning that there must be at least two siblings in the group, and at least one must have died from an alcohol-related cause, or from any other cause in the parallel models. The analyses were performed using SPSS 26 and Stata 14.

Separate analyses are conducted for sibling groups with Finnish and Swedish or Mixed origin in Finland, and for sibling groups with Swedish and Finnish or Mixed origin in Sweden. We adjust for each sibling's (index person's) birth year, sex, the mother's age when giving birth, and educational level. All variables are categorised. Birth year is used to adjust for cohort trends in alcohol use. Sex accounts for differences in alcohol use between men and women. Mother's age at child birth captures potential changes in parental consumption of alcohol with age. Father's age at child birth was excluded due to low explanatory power. Education, measured as the highest level attained, is included to proxy health-related behaviour. There is no need to adjust for factors like parental education or parental socio-economic status because the sibling comparison removes the confounding effect of factors shared by the siblings.

We also conduct analyses where education is removed from all models, to evaluate how important this variable is for the overall pattern observed, and models in which we interact birth order with sex, to see if any birth order association is similar for men and women.

3. Results

Table 2 summarises the results from the fully adjusted family fixed effects models that examine the relationship between birth order and alcohol-related mortality as the main cause, on the one hand, and birth order and mortality from any other cause, on the other hand. The first four columns refer to Finland and separate Finnish sibling groups from those with Swedish or Mixed background. The four latter columns are for Sweden and separate Swedish sibling groups from those with Finnish or Mixed background. The cohorts analysed are the same in both countries, or those born 1953−1999, and the follow-up is from age 17. For ethnic Finns in Finland, there is a clear birth order pattern for alcohol-related mortality. Within these sibling groups, second-borns have an alcohol-related mortality risk that is 9% higher than that of first-borns (95 % CI: 1.01−1.18), third-borns 19 % higher (95 % CI: 1.05−1.35), fourth-borns 22 % higher (95 % CI: 1.02−1.48), and fifth- or higher-borns 47 % higher (95 % CI: 1.15−1.87). No such birth order associations can be found for any of the other ethnic groups studied in Finland or Sweden. For ethnic Swedes in Sweden, the alcohol-related mortality risk rather decreases with birth order. For mortality from any other main cause than alcohol, there is no evident birth order pattern in any ethnic category. For ethnic Swedes in Sweden, mortality from any other cause increases slightly with birth order. This is consistent with previous results from Sweden (Barclay and Kolk, 2015), which have found a positive correlation between birth order and all-cause mortality.

Excluding educational level from these models does not change the conclusions to any considerable extent (Table S1 in the Supplementary materials). In the context of ethnic Finns in Finland, the estimates for second-borns, third-borns, fourth-borns, and fifth- or higher-borns are only slightly higher than in the fully adjusted models, or 1.12 (95 % CI: 1.04–1.21), 1.22 (95 % CI: 1.08–1.38), 1.26 (95 % CI: 1.05–1.51), and 1.49 (95 % CI: 1.17–1.89). Thus, differences in educational level between siblings contribute only modestly to the association between birth order and alcohol-related mortality. Similar conclusions apply to those with Swedish background in Sweden; excluding education gives a slightly less attenuated pattern for how birth order relates positively to mortality from any other cause than alcohol. The negative association between birth order and alcohol-related mortality for these sibling groups, on the other hand, is slightly less emphasised when education is excluded.

Table 3 summarises the results based on the two additional setups of the Swedish data, which extend to cohorts born 1940−1999. The first four columns refer to main cause mortality in 1971−2016, while the latter four columns refer to mortality from main or contributing cause in 1987−2016. The number of alcohol-related deaths is much higher with these setups as compared with the first one in Table 2, and particularly so for ethnic Swedes, but not any single estimate for alcohol-mortality is statistically significant at the 5% level. Thus, in Sweden, there are no significant associations between birth order and alcohol-related mortality in any of the ethnic groups studied. Estimates for associations between birth order and mortality from any other cause than alcohol have no sizeable effects or they are statistically not significant. In corresponding models where education is excluded, there are not either any sizeable or significant birth order associations (Table S2 in the Supplementary materials). The only exception is alcohol-mortality as the main or contributing cause, for which there is a slight level difference between first-borns and others in ethnic Swedes. Thus, in this context, sibling differences in educational attainment contribute modestly to the sibling differences in mortality.

Models that interact birth order with sex show that the associations between birth order and alcohol-related mortality for ethnic Finns in Finland apply primarily to men (Table S3 and Table S4 in the

Table 2
Hazard ratios (with 95 % confidence intervals) for within-family birth-order effects on alcohol-related mortality and mortality from any other main cause, by ethnic background in Finland and cohorts born 1953-1999.

	Finland 1971–2017								Sweden 1971–2016							
	Finnish				Swedish or Mixed				Swedish				Finnish or Mixed			
	Alcohol-related		Other cause		Alcohol-related		Other cause		Alcohol-related		Other cause		Alcohol-related		Other cause	
Birth order																
First	1		1		1		1		1		1		1		1	
Second	1.09	(1.01–1.18)	0.99	(0.96–1.02)	0.81	(0.50–1.32)	1.07	(0.95–1.22)	0.86	(0.72–1.02)	1.01	(0.98–1.05)	1.07	(0.59–1.97)	1.00	(0.88–1.14)
Third	1.19	(1.05–1.35)	0.98	(0.94–1.03)	0.44	(0.19–1.06)	1.01	(0.81–1.26)	0.72	(0.53–0.98)	1.08	(1.02–1.14)	1.20	(0.47–3.10)	0.94	(0.76–1.17)
Fourth	1.22	(1.02–1.48)	0.96	(0.90–1.03)	0.50	(0.13–1.94)	1.08	(0.77–1.52)	0.60	(0.39–0.94)	1.07	(0.99–1.17)	0.77	(0.19–3.16)	0.96	(0.70–1.32)
Fifth or higher	1.47	(1.15–1.87)	1.04	(0.95–1.14)	1.14	(0.18–7.04)	0.77	(0.45–1.32)	0.43	(0.22–0.82)	1.17	(1.03–1.32)	1.48	(0.20–10.7)	0.95	(0.61–1.46)
# deaths	7761		51,879		278		2944		2357		64,162		214		3862	
# sibling groups	7554		48,296		271		2834		2337		61,838		210		3693	
# siblings	23,704		148,830		725		7863		5605		151,341		594		9610	
# person years	760,428		4,210,177		21,522		208,262		182,621		4,389,180		18,276		261,625	

Each person is observed from age 17.
Control variables are sex, educational level, year of birth, and mother's age at birth.

Table 3
Hazard ratios (with 95 % confidence intervals) for within-family birth-order effects on alcohol-related mortality and mortality from any other cause, by period of observation and ethnic background in Sweden, cohorts born 1940-1999.

	Period 1971–2016								Period 1987–2016							
	Swedish				Finnish or Mixed				Swedish				Finnish or Mixed			
	Alcohol as main cause		Any other main cause		Alcohol as main cause		Any other main cause		Alcohol as main or contributing cause		Any other main or contributing cause		Alcohol as main or contributing cause		Any other main or contributing cause	
Birth order																
First	1		1		1		1		1		1		1		1	
Second	0.99	(0.91–1.08)	0.98	(0.96–1.00)	0.84	(0.53–1.35)	1.08	(0.97–1.20)	1.05	(0.99–1.11)	0.98	(0.98–1.00)	0.95	(0.71–1.28)	1.05	(0.95–1.17)
Third	0.98	(0.84–1.12)	1.00	(0.97–1.03)	0.75	(0.37–1.54)	1.03	(0.87–1.24)	1.04	(0.94–1.15)	0.98	(0.97–1.00)	1.16	(0.74–1.84)	1.00	(0.83–1.20)
Fourth	0.98	(0.80–1.19)	0.98	(0.94–1.02)	0.53	(0.19–1.49)	0.99	(0.77–1.28)	1.12	(0.97–1.29)	0.96	(0.93–0.98)	0.90	(0.46–1.77)	0.94	(0.72–1.22)
Fifth or higher	0.94	(0.71–1.23)	1.00	(0.94–1.06)	0.89	(0.23–3.49)	1.08	(0.77–1.51)	1.11	(0.92–1.34)	0.96	(0.93–0.99)	1.28	(0.53–3.08)	1.03	(0.73–1.46)
# deaths	7512		133,961		287		4761		16,610		126,109		730		4465	
# sibling groups	7412		124,904		281		4451		16,203		118,037		709		4198	
# siblings	21,065		351,034		883		12,726		45,179		326,904		2039		11,777	
# person years	830,216		12,833,762		29,891		391,745		1,014,307		7,375,315		46,965		265,875	

Each person is observed from age 17, or from age 18–30 if born before 1953.
Control variables are sex, educational level, year of birth, and mother's age at birth.

Supplementary materials). Second-born men have 4% higher (95 % CI: 0.95−1.14) alcohol-related mortality than first-born men, third-born men 16 % higher (95 % CI: 1.01–1.33), fourth-born men 26 % (95 % CI: 1.03–1.54) higher, and fifth- or higher-born men 45 % higher (95 % CI: 1.12–1.88). For women, the birth order pattern is not monotonous and less emphasised. In Sweden, there is a negative association between birth order and alcohol-related mortality for both men and women with Swedish background born 1953−1999, while there is a positive association between birth order and mortality from any other cause in the same birth cohorts. For the cohorts born 1940−1999 in Sweden, there is no association between birth order and alcohol-mortality or mortality from any other cause in these models. There is a slight positive correlation between birth order and mortality from alcohol as the main or contributing cause in men with Swedish background, but none of these estimates are statistically significant.

4. Discussion

Using high quality population register data from Finland and Sweden and a sibling comparison, this study has found that later-born siblings could be more likely to die from an alcohol-related cause than their first-born sibling. However, the correlation can be observed only for ethnic Finns in Finland and primarily men, and not for any of the other ethnic groups analysed in Finland or Sweden.

A number of theories have been proposed for why higher birth order should be associated with negative outcomes in adulthood, such as elevated mortality and behaviours with negative health consequences like excessive alcohol consumption. Researchers have suggested that later-born children receive less parental resources as they have to compete with a larger number of siblings, such as in the resource dilution model (Blake, 1981). The confluence hypothesis similarly suggest that later-born children will grow up in a cognitively less stimulating environment (Zajonc, 1976). Another set of explanations have focused on personality differences, suggesting that later-born are more likely to engage in risky and rebellious behaviour, where drinking may be a typical example (Sulloway, 1996; Zweigenhaft and von Ammon, 2000; Zweigenhaft, 2002; Barni et al., 2014). Older siblings may also introduce drinking and smoking to younger siblings (Blane and Berry, 1973; Elliott, 1992). However, recent research finds no association between birth order and the development of personality in terms of the Big Five personality traits (Rohrer et al., 2015).

Alcohol use has been proposed as one mechanism behind the relationship between mortality and birth order (Barclay et al., 2016). We find only partial support for this explanation, in the form of ethnic Finnish men in Finland, while associations are ambiguous or close to zero in the other groups studied. Ethnic Finns in Finland consequently seem to be exposed to a culture and a set of circumstances that differ with regard to how alcohol is consumed. Thus, the groups analysed may be subject to cultural contexts that differ in terms of family support, bonding, and parental monitoring, which are known to be associated with lower levels of alcohol use, and in familism and the nuclear family, which generally serve as protective factors (White et al., 2006; Ramirez et al., 2012; Ewing et al., 2015). The interplay between siblings in social behaviour may be different in Finland, and for ethnic Finnish men in particular, than in Sweden (Saarela et al., 2016; Saarela and Kolk, 2020). In Sweden and amongst ethnic Swedes in Finland, other social contexts, such as peers, schools and neighbourhoods, may potentially be more important and have protective effects (Saarela and Rostila, 2019). Ethnic Swedish parents may, hypothetically, also more commonly intervene to reduce sibling rivalry, bullying, and competition. One further aspect worth stressing is that it is easier to uphold your cultural identity when your mother tongue can be used in the communication with governmental and other official authorities. That is the case for Swedish speakers in Finland, but not for Finns in Sweden. However, with the population register data used here we cannot explicitly measure cultural norms or values in an explicit manner, nor drinking, alcohol-related behaviours, or family relations.

Another explanation for the lack of a universal effect of birth order on alcohol-related mortality is that we have been concerned with (late) adulthood and medical conditions that are fully attributable to alcohol. Barclay et al. (2016) found more attenuated and non-significant birth order effects for alcohol hospitalisation at ages 20 and above, as compared with ages below 20. In this perspective, the pattern observed for alcohol hospitalisation at adulthood seems to carry over to alcohol-related mortality. Thus, birth order effects on alcohol behaviour may no longer be of major importance at advanced ages, as the influence of the family of origin tends to diminish over time (Blane and Barry, 1973; Cruz et al., 2012; Walsh et al., 2014).

This study has concerned ethnic groups which are firmly integrated and rooted, and have good access to social support and government services. This limits the generalisability to contexts in which ethnic minorities exist due to recent migration, where they may be less integrated and more affected by the migration history. On the other hand, our setting allows us to assess a more direct association with ethnic origin and cultural behaviour, not affected by socioeconomic and other disadvantages, which often is the case when ethnic groups are being compared. Another limitation of our study is that the concept of ethnicity may be considered equivocal in the sense that a study person in Sweden may affiliate with ethnic Swedes even though a parent was born in Finland, while a Swedish-registered person probably affiliate strongly with the Swedish-speaking community in Finland irrespective of having a Finnish-registered parent.

It needs to be emphasised as well that the method of sibling fixed effects implies that we have analysed families were at least one child has died, meaning that the study persons need not be representative for the population at large. Corresponding estimates from non-fixed regressions, i.e., standard between-family models generally display notably different estimates for the interrelation between birth order and alcohol-related mortality in each ethnic group (Tables S5 and S6 in the Supplementary materials). However, they are based on comparisons of siblings across families, and families differ socially and genetically, which is a notorious problem from the perspective of residual confounding.

To conclude, we demonstrate that, when using total population data of all alcohol deaths observed over 45 years and for complete birth cohorts of siblings, birth order effects on alcohol-related mortality are not universal, though more substantial effects exist in some contexts, such as for ethnic male Finns in Finland. We apply sibling comparison models, which allows us to be certain that the birth order effects observed are related to dynamics within the family of origin, and not to variation between the type of families in which the children of various birth orders have grown up.

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The funding source played no role in this research.

Contributors

Both authors conceived the study, wrote the initial draft, and approved the final version of the manuscript. JS prepared the data and run the regressions for Finland. MK prepared the data and run the regressions for Sweden.

Declaration of Competing Interest

No conflict declared.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2021.108859.

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