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Intelligence test scores and birth order among young Norwegian men (conscripts) analyzed within and between families

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Abstract

The present paper reports the results of a within and between family analysis of the relation between birth order and intelligence. The material comprises more than a quarter of a million test scores for intellectual performance of Norwegian male conscripts recorded during 1984–2004. Conscripts, mostly 18–19 years of age, were born to women for whom almost complete reproductive histories were obtained. Women with single births only 1967–1998 and first birth 1967–1976 were selected for analyses. The grand mean stanine score for intellectual performance standardized for age and calendar year was 5.05 (SD = 1.80). The mean standardized score decreased with size of sibship and with higher birth orders in all sibship sizes. These patterns as well as the size of the difference between birth orders 1 and 3 were rather similar between and within families. Among 63 951 adjacent sibling pairs the mean standardized scores were 5.18 (95% confidence interval [CI]: 5.16, 5.19) for the elder and 4.93 (95% CI: 4.91, 4.94) for the younger brother. The difference in mean of standardized scores between adjacent siblings was −0.251 (95% CI: −0.270, −0.231). The difference in mean standardized scores between brothers of adjacent birth orders increased with higher maternal level of education, was highest between brothers of married women, higher with paternal income and decreased with sibship size and longer spacing between births.

Keywords: Intelligence; Birth order; Conscripts; Parental socioeconomic position; Family size

1. Introduction

Intelligence has been found to be negatively associated with birth order in numerous studies over more than a century. This documentation has mainly been based on cross-sectional datasets (i.e., between families). The most influential study may have been that of Belmont and Marolla (1973). A cross-sectional analysis of nearly 400 000 Dutch men born in 1944–1947 showed a convincing and consistent negative association between Raven test results and increasing birth orders (Belmont & Marolla, 1973). The interpretation that birth order has an influence on intelligence has been challenged, however. An alternative model known as the admixture hypothesis (Page & Grandon, 1979; Rodgers, Cleveland, van den Oord, & Rowe, 2000) proposes that the explanation rather is that parental intelligence may influence family size: Low intelligence parents tend to have more children. Consequently, a cross-sectional (between family) comparison could confound the birth

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order–intelligence association. Data on inter-generation intelligence level is usually not available, and the effectiveness of adjustment strategies (e.g., using parental education level, parental income level, other socio-economic indicators, or other family risk factors for intelligence scores that correlate with sibship sizes) is uncertain (Rodgers et al., 2000).

The logical answer to this problem in observational studies would be to analyze birth order effects among siblings within families. Comparisons between within-family and between-family analyses have been done in several studies. Three of the largest studies of this kind have used data from Birmingham, England, the Wisconsin Longitudinal Study (WLS), and the National Longitudinal Study of Youth (NLSY) (Record, McKeown, & Edwards, 1969; Retherford & Sewell, 1991; Rodgers et al., 2000).

Nearly 50 000 singleton children live-born in 1950–1954 in Birmingham were followed up with verbal tests at age 11 years (Record, McKeown, & Edwards, 1969). Test scores standardized for maternal age were reduced by 2.5–3.0 units (nearly 20% of SD) for each birth order in a cross-sectional analysis of 37 324 children of both genders. In a longitudinal (within-family) analysis of 5054 sibling pairs, the difference was considerably smaller (1.0 unit). The birth order effect was strongest between first and second born (1.5 unit) and stronger for boys (1.6 units) than girls (0.8 units).

In the WLS, participants were tested at age 16 years (Retherford & Sewell, 1991). Two samples consisting of 1015 and 507 sibling pairs between first and sixth born were examined. No consistent birth order effect was found in the sibling comparisons (Retherford & Sewell, 1991; Table 2), but a negative association was suggested in the cross-sectional analysis (Retherford & Sewell, 1991; Fig. 2a).

Rodgers and co-workers (2000) analyzed childhood test data in the NLSY. In 1311 families with 1255 sibling pairs (birth orders 1–5, of which 868 were pairs of first and second born) no sibling differences were found in a within-family analysis. A cross-sectional analysis of the same data (Rodgers et al., 2000; Table 1) shows a small but consistent negative association between birth order and test scores. Essentially the same conclusion was drawn in a recent multi-level analysis of the NLSY data: Birth order had no significant influence on children's intelligence, and the reported associations on a birth order effect were confounded by factors that vary between and not within families (Wichman, Rodgers, & MacCallum, 2006).

The question is still not settled, and the controversy has been intensely debated (Armor, 2001; Downey, 2001; Downey, Powell, Michalski and Shackelford, 2001; Rodgers, 2001; Rodgers, Cleveland, van den Oord, & Rowe, 2001; Zajonc, 2001a,b). Rodgers (2001) concluded that "[t]he existence of a birth order effect on intelligence is a phenomenon still in search of data to support its existence".

With the hope of being able to shed some light on the issue we have utilized a rather unique material from Norway which allows a between as well as a within-family comparison of the relation between birth order

Table 1
Number of single births in Norway 1967–1998 to women with first birth 1967–1976, number of sibships and males included in the study

Size of sibship	Total numbers			Included in the study[a] (% of total)			
	Sibships	Births	Males	Sibships	Percent	Males	Percent
1	36 776	36 776	18 842	15 898	43.2	15 898	84.4
2	121 210	242 420	124 172	86 742	71.6	111 185	89.5
3	67 268	201 804	104 148	54 443	80.9	87 353	83.9
4	17 748	70 992	36 796	15 194	85.6	28 171	76.6
5	3799	18 995	9784	3320	87.4	6952	71.1
6	862	5172	2719	777	90.1	1837	67.6
7	284	1988	1062	271	95.4	707	66.6
8	92	736	375	84	91.3	247	65.9
9	40	360	172	38	95.0	118	68.6
10	27	270	126	27	100.0	83	65.9
11	16	176	89	16	100.0	70	78.7
12	22	264	131	22	100.0	94	71.8
13	9	117	65	9	100.0	37	56.9
14	7	98	60	7	100.0	37	61.7
15	2	30	14	2	100.0	10	71.4
Total	248 162	580 198	298 555	176 850	71.3	252 799	84.7

[a] Sibships with at least one male with adjusted GA score at conscription are included.