

## Education may explain link between myopia and birth order

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By Laird Harrison

Parents may increase the risk of myopia in their first-born children by devoting more attention to their education, a new study suggests.

The study in adults in the United Kingdom replicates similar findings in children. This shows that the increased risk of myopia in first-born children spans more than one generation, write Jeremy A. Guggenheim, PhD, and Cathy Williams, MBBS, PhD.

Dr. Guggenheim, of the School of Optometry & Vision Sciences, Cardiff University, Cardiff, Wales and Dr. Williams, of the UK Biobank Eye and Vision Consortium, published their findings October 8 in [JAMA Ophthalmology](#).

Myopia is increasing in prevalence in many places and contributes to blindness and visual impairment, Dr. Guggenheim and Dr. Williams write. Previous studies have found that one of the risk factors for the condition is earlier birth order.

One theory to explain this phenomenon is that parents invest less in the education of each subsequent child. Children spending more time on education might do more near work and spend less time outdoors, affecting the development of their eyes.

To test this explanation, the researchers examined an older generation than had been studied before, and adjusted for education.

They used data from the UK Biobank, which recruited 502 649 participants aged 37 to 73 years from 2006 to 2010. The participants completed a touch-key questionnaire, had a face-to-face interview with a trained nurse, and underwent physical assessment. In the later stages of recruitment, the assessments included ophthalmic evaluations.

About 23% of the participants underwent autorefractometry. The researchers excluded participants who reported a history of cataracts, cataract surgery, corneal graft surgery, laser eye surgery, or serious eye trauma. They excluded people who were not white or who were younger than 40 years or older than 69 years, because there were low numbers of these groups.

And they excluded autorefractometry readings if accompanied by a low reliability or lower reliability error message. This left 89 120 people for the analysis.

The researchers defined myopia as autorefractometry of  $-0.75$  diopters (D) or less, and high myopia as  $-6.00$  D or less. After adjusting for age and sex, the researchers found that first-born children were 12% more likely to be myopic than second-born children.

When compared to children who were fourth or later in birth order, first-born children were 38% more likely to be myopic.

But when the researchers controlled for the highest level of educational qualification attained, they found that the influence of birth order decreased significantly. In this analysis, first-born children were only 9% more likely to be myopic than second-born children, and 17% more likely to be myopic than children born fourth or later.

The researchers found a similar relationship between birth order and high-myopia.

Since highest educational qualification might not be a perfect measure of investment in education, the researchers tried adjusting for age at completion of full-time education. They got similar results.

The researchers also found a dose-response relationship between later birth order and a more positive (residual) refractive error. And adjusting for highest educational attainment reduced this relationship.

To determine whether family size was a determining factor, the researchers repeated their analysis including only families with 2 children. After adjusting for sex and age, they found that first-born children were 12% more likely to be myopic than second-born children. And after also adjusting for highest education qualification, that increased risk shrunk to 8%.

Since some first-born children are the only children of their parents, the researchers tried excluding only children from their analysis. This made very little difference in the results.

Socioeconomic status, maternal/birth-related effects, maternal age and birth weight also did not appear to have an influence in these findings, Dr. Guggenheim and Dr. Williams write.

On average, their analysis showed that first-born participants had a refractive error that was -0.25 D more negative than siblings born later.

Researchers working in East and Southeast Asia populations have found a larger effect of birth order, they report.

The large sample size, standardized methods of data collection and objective method of quantifying refractive error give weight to this study, the authors write. On the other hand, the use of self-report to exclude participants with cataracts and the wide age range of the sample increased the risk for bias.

In addition, the participants were not selected at random, and might not fully represent the UK population. And information on the amount of time the participants spent outdoors in childhood was not available.

Despite these weaknesses, the study supports the idea that education partly explains the influence of birth order on myopia, while not completely accounting for the effect, Dr. Guggenheim and Dr. Williams conclude.