

# Second-child Policy and Incidence of Infant Eye Diseases in China

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## Research

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# Abstract

## Purpose

To explore the influence of parental factors associated with the second-child policy on the incidence of ophthalmic diseases in infants.

## Methods

Data were collected on children (aged < 3 years) admitted to Qingdao Eye Hospital, China, from January 2017 to December 2019, and patients with a family history of eye illnesses were excluded. We recorded the age, sex, diagnosis, mother's history, age of the mother at birth, and parents' education and the same values for all siblings.

## Results

A total of 383 children (aged < 3 years) were admitted to the Qingdao Eye Hospital. There were also 159 siblings for a total of 541 children from 383 families. There were 229 single-child families and 154 multiple-child families. Among all the children involved in the study, the prevalence of ophthalmic diseases was 62.2% in the oldest child, 90.8% in the second, and 100% in the third. Among all 154 multiple-child families, the prevalence of ophthalmic diseases was 6.5% in the oldest child, 90.8% in the second child, and 100% in the third child. Parent's age at the time of the child's birth was not found to be related to whether the child had an eye disease for any of the children in this study. But the parents' highest level of educational level was associated with a lower chance of any eye disease.

## Conclusion

Parity affects the prevalence of ocular disease in children. Strengthening fertility education and raising maternity security may help reduce the prevalence of eye diseases in children.

## Introduction

In October 2015, China ended its more than 30-year one-child policy and fully liberalized its second-child policy. According to data from the National Bureau of Statistics, in 2017, the number of second children reached 8.83 million, an increase of 1.62 million from 2016; the proportion of second children in the total birth population reached 51.2%, an increase of 11% percentage points over 2016. The proportion of elderly parturient women has also increased year by year. Generally, there is a greater possibility of intrauterine growth retardation and premature birth in older women, which has a huge impact on infant health.

The Qingdao Eye Hospital, a large tertiary ophthalmology center in northern China, treats most of the eye patients in the area. Since 2016, the proportion of second children among infants with eye diseases, such as limbal dermoid, congenital cataract and glaucoma, has increased significantly. To this end, we have conducted a detailed study on the history of maternal births in infants and young children with eye diseases, in order to have a deeper understanding of the etiology of infants and young children with eye diseases.

## Methods

Data were collected on children (aged < 3 years) admitted to Qingdao Eye Hospital, China, from January 2017 to December 2019, and patients with a family history of eye illnesses were excluded. We recorded the age, sex, diagnosis, mother's history, age of the mother at birth, and parents' education and the same values for all siblings. We classified parental education level as follows: primary school = 1, junior high school = 2, secondary school = 3, high school = 4, college = 5, university = 6, master = 7, doctorate = 8. Ethics approval for this study was obtained from the Ethics Committee of Qingdao Eye Hospital.

Statistical analysis was performed using SPSS (version 22.0, IBM SPSS Inc., Chicago, IL, USA). All data were expressed by means  $\pm$  standard deviation (SD). Normal data distribution was tested using the 1-sample Kolmogorov-Smirnov test. In independent sample test, the one-way analysis of variance (ANOVA) was used for equal variances; the Mann-Whitney U test or the Kruskal-Wallis test was used for unequal variances. Frequency analyses were performed using the Fisher's exact chi-square test. Binary regression analysis was used to show whether various factors were related to children suffering from eye diseases. Two sided P values less than 0.05 were considered statistically significant.

## Results

From January 2017 to December 2019, a total of 383 children (age < 3 years) were admitted to the Qingdao Eye Hospital (1 person had normal high intraocular pressure and was included in the normal child group), and family history of eye diseases was excluded from the study. Together with these children, we evaluated 159 siblings for a total of 541 children from 383 separate families. Among them, there were 229 single-child families and 154 multiple-child families (about 1.5:1).

The incidence of ophthalmic diseases was here found to vary with parity. The prevalence of ophthalmic diseases was 62.2% (239/384) in the oldest child, 90.8% (139/153) in the second child, and 100% (4/4) in the third.

The mother's age at childbirth for the affected children was  $27.1 \pm 5.3$  years, and the mother's age at childbirth was  $26.7 \pm 3.7$  years for unaffected children ( $p = 0.322$ ). The father's age at childbirth was  $28.3 \pm 5.6$  years for unaffected children and  $27.8 \pm 4.0$  years for affected children ( $p = 0.251$ ).

The mother's average highest level of education was  $3.9 \pm 1.3$  among affected children and  $4.3 \pm 1.6$  for unaffected children ( $p = 0.008$ ). The father's highest level of education was  $4.1 \pm 1.3$  for affected children

and  $4.4 \pm 1.5$  for unaffected children ( $p = 0.023$ ). Whether the child was born prematurely was also found to differ statistically significantly between the affected and unaffected children ( $p = 0.031$ ). The child's sex, birth weight, caesarian vs vaginal delivery, and whether the mother was sick or took medicine during pregnancy showed no statistically significant difference between the affected and unaffected children ( $p > 0.05$ ).

Table 1  
Characteristics of the Study Population

		Number	Average	Standard deviation	95% CI	Min	Max
Birth weight	Unaffected	159	3.4	0.4	3.3–3.4	2.5	4.5
	Affected	382	3.4	0.5	3.3–3.4	1	4.5
	Total	541	3.4	0.5	3.3–3.4	1	4.5
mother's age at childbirth	Unaffected	159	26.7	3.7	26.1–27.2	20	45
	Affected	382	27.1	5.3	26.6–27.6	20	48
	Total	541	27.0	4.9	26.6–27.4	20	48
mother's highest level of education	Unaffected	159	4.3	1.6	4.0–4.5	2	8
	Affected	382	3.9	1.3	3.8–4.0	2	8
	Total	541	4.0	1.4	3.9–4.1	2	8
father's age at childbirth	Unaffected	159	27.8	4.0	27.1–28.4	20	46
	Affected	382	28.3	5.6	27.8–28.9	20	50
	Total	541	28.2	5.2	27.7–28.6	20	50
father's highest level of education	Unaffected	159	4.4	1.5	4.2–4.6	2	7
	Affected	382	4.1	1.3	4.0–4.2	2	7
	Total	541	4.2	1.3	4.1–4.3	2	7

Binary regression analysis showed parity to be related to whether the child had eye disease (OR = 7.392 [4.030–13.559],  $p < 0.001$ ). The same was true for both the mother's (OR = 0.807 [0.658–0.990],  $p = 0.008$ ) and father's highest level of education (OR = 0.935 [0.756–1.156],  $p = 0.023$ ). Preterm birth ( $p = 0.999$ ) and whether the mother was sick or took medication during pregnancy was found not to be related to whether the child had ophthalmic diseases ( $p = 0.13$ ).

Table 2  
Characteristics of the Multi-child families

		Number	Average	Standard deviation	95% CI	Min	Max
Birth weight	Unaffected	159	3.4	0.4	3.3–3.4	2.5	4.5
	Affected	153	3.4	0.5	3.4–3.5	1.5	4.5
	Total	312	3.4	0.4	3.4–3.4	1.5	4.5
mother's age at childbirth	Unaffected	159	26.7	3.7	26.1–27.2	20	45
	Affected	153	32.0	4.6	31.2–32.7	20	48
	Total	312	29.3	4.9	28.7–29.8	20	48
father's age at childbirth	Unaffected	159	27.8	4.0	27.1–28.4	20	46
	Affected	153	33.3	5.0	32.5–34.1	22	50
	Total	312	30.5	5.3	29.9–31.1	20	50

In multi-child families, the prevalence of ophthalmic diseases was 6.5% in the first child (10/155), 90.8% in the second child (139/153), and 100% in the third child (4/4).

In multi-child families, the mother's age at childbirth was  $32.0 \pm 4.6$  years for affected children, averaged across all families and all affected children, while the mother's age at normal childbirth was  $26.7 \pm 3.7$  years ( $p < 0.001$ ). The father's age at childbirth was  $33.3 \pm 5.0$  years, while the father's age at the birth of an unaffected child was  $27.8 \pm 4.0$  years ( $p < 0.001$ ). There were statistically significant differences in whether the child was born prematurely ( $p = 0.012$ ), whether the mother was sick during pregnancy, or if she took medication ( $p = 0.027$ ) between the affected and unaffected groups.

The average age difference between the second child and the first child was  $6.1 \pm 3.7$  years (1–18 years), and the difference in birth weight was  $38 \pm 370$  g (-1700–1700 g).

## Discussion

The history of pregnancy, childbirth, and family conditions are closely related to the occurrence of childhood diseases. We here found that parity is related to whether a child develops an ophthalmic disease.

The parents' age at childbirth was found to have nothing to do with whether the child had an ophthalmic disease. However, the prevalence of ophthalmic diseases in a second child was 90%, and in third children, it was 100%, suggesting that, for the same adult individual, a greater childbearing age might not only be associated with a higher risk of disease during pregnancy and abnormal fertility, but the chance of eventually having abnormal children is also increased. Preterm birth was found to be related to whether children suffered from ophthalmic diseases, but in a large-sample study of Li HT, the increase in the number of older mothers was not found to be related to preterm birth [1]. Liu Y's research also showed the rate of preterm birth and birth weight of the second children was not affected, perhaps due to the increase in the overall quality of medical care provided in the country [2]. However, in the Liao Z' study, the cesarean section rate was higher among second-born children than among first-born, but in this study, this did not affect whether the child had an eye disease [3]. In addition, the incidence of some ophthalmic diseases such as congenital cataracts and limbal dermoid was found to be related to viral infection in early pregnancy [4–6]. Mothers may be more susceptible to the virus in early pregnancy due to age-related physical problems.

Parents' age at childbirth was here found to have nothing to do with whether the child would have an ophthalmic disease, but the level of parental education was. Better education also increases the chances of having an unaffected child. More years of education have been found to be closely associated with later marriage and older age at childbearing, but a better education background also suggests good living habits, living environment, and economic level, which related to better fertility conditions [7]. However, studies have shown that the proportion of Chinese families in Kochi who choose to have a second child is lower than the national average [8].

## Conclusions

China's second-child policy is only a few years old. Prior to this, the country used a one-child policy for more than 30 years. However, as the second-child policy continues, the age of second-time parents will gradually increase. At the same time, the incidence of eye diseases in children was also increasing. The sole research object of the present study was children in an ophthalmology hospital, which involves a high probability of non-firstborn children with eye diseases. The short time span and the limited choice of research objects are limitations of this study. However, the results to some extent suggest the importance of reproductive age and maternity security for the health of the resulting children and also remind us of our daily medical work. In China, we should strengthen the medical education of pregnant women before and during pregnancy, help them avoid illness during pregnancy, especially during early pregnancy, strengthen support during pregnancy and maternity protection, and so improve the health of their children.

# Abbreviations

Min

minimum; Max:maximum; g:gram; CI:Confidence interval; OR:oddratio;

# Declarations

## Ethical Approval and Consent to participate

Ethics approval for this study was obtained from the Ethics Committee of Qingdao Eye Hospital.

## Consent for publication

Not applicable.

## Availability of data and materials

All the data and materials generated and/or analysed during the current study are available

## Competing interests

The authors confirm that there are no conflicts of interest.

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No funding was received.

## Authors' contributions

J. Zhang conceptualized the study. W. Ma and X. Wan performed data analysis and visualization. J. Zhang wrote the manuscript. M. Jiang, Y. Ding and Y. Wang revised the manuscript. All authors read and approved the final manuscript.

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