



Firstborn children's sex specific emotions and behaviors during mothers' second pregnancy after implementation of the universal two-child policy in China

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Abstract

The present cross-sectional study aimed to identify sex-specific characteristics and other factors for firstborn children's emotions and behaviors during their mothers' second pregnancy after the implementation of the two-child policy in China. Firstborn children aged 1.5–5 years old and their pregnant mothers were enrolled from two hospitals from March to September 2019 in our city. Mothers completed a self-designed questionnaire and Child Behavior Checklist during their routine prenatal examinations. Linear regression was used to explore potential factors influencing firstborn children's behaviors and emotions towards their mother's second pregnancy. A total of 880 firstborn children were included. There was no significant difference in internalizing/externalizing problem scores and prevalence between male and female firstborn children during their mothers' second pregnancy. Children's easy temperament, good parental relationship, and father's authoritative and indulgent parenting styles were potential positive factors for both male and female firstborn children. Harmonious family environment, children's age, father's accompaniment, and being informed by parents of the arrival of a sibling were only related to firstborn girls experiencing fewer emotional and behavioral problems. Mother's education and seeking for firstborn children's opinion about the new sibling were only related to firstborn boys experiencing fewer emotional and behavioral problems. There was no sex differences in internalizing/externalizing problems in firstborn children during their mother's second pregnancy. Children's temperament, family environment and fathers' parenting styles were consistent influencing factors for both firstborn girls' and boys' emotions and behaviors.

Keywords Firstborn children · Emotions · Behaviors · The two-child policy

Introduction

In 1979, China implemented the well-known “one child policy,” allowing only one child per couple, which eased population pressure and improved the economic well-being of the country. However, the policy led to an accelerated aging population, skewed gender ratios, and a declining working-age population that threatened economic growth and the well-being of the population (Zeng & Hesketh, 2016). In response, in October 2015, the Chinese government announced the universal two-child policy (Zeng & Hesketh, 2016). Since then, several families have taken advantage of this policy shift, with 1.64 million “second-child births” in 2017 alone (Yang, 2020). Though the economic and social impact of this policy shift is regularly evaluated, there has been little study on the behavioral impact this change has had on the family unit; though some empirical evidence has reported

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an increasing number of negative reports from firstborn children regarding the implementation of this law (Qian et al., 2019).

It is expected that a family's structure would change following the arrival of a younger sibling, where the firstborn child's role of only-child is transformed into one of older brother or sister, i.e., "transition to siblinghood" (TTS), which may start from the mother's pregnancy until the younger sibling is at least 1–1.5 years old (Yang et al., 2021). Firstborn children, especially preschool-aged children, will go through a longer period of TTS (Gottlieb & Mendelson, 1990). During TTS, firstborn children can show both positive and negative reactions towards a baby sibling, such as improved language abilities (Stewart et al., 1987) and self-care abilities (Gullicks & Crase, 2010), increased anxiety (Harris et al., 1989), feelings of being upset (Feiring et al., 1983), aggression (Kojima et al., 2007), showing clinging behavior (Harris et al., 1989), and experiencing sleep disturbances (Harris et al., 1989). Though these changes were mainly observed after the birth of the sibling, there remains no clear consensus on the firstborn child's emotional and behavioral response during their mother's pregnancy. Furthermore, a child's feelings about a new sibling before their birth may predict their reactions after the birth and the quality of the sibling relationship (Chen et al., 2018).

There is also evidence to suggest that these emotional and behavioral changes occur only in a subset of firstborn children. Studies revealed that firstborn boys and girls have different emotional and behavioral vulnerabilities when facing the arrival of a baby sibling. Dunn et al., found firstborn boys had more problems with withdrawal than girls (Dunn et al., 1981), while Baydar et al., found girls had more anxious-depressed symptoms than boys (Baydar, et al., 1997). Girls also sought more assistance from mothers, yet boys cried more than girls (Feiring et al., 1983). Our previous study has shown however, that gender of the firstborn child is not a potential factor of their internalizing and externalizing problems (Yang, 2020). Given the large discrepancies in gender difference across studies and the lack of unified and standardized measures of emotional and behavioral assessment, it is difficult to ascertain the impact that a mother's pregnancy may have on firstborn girls and boys. Additionally, family type, socioeconomic status, parenting style, and the timing of the baby sibling (Chen et al., 2016; Volling, 2012; Chen et al., 2018) may also impact children's emotions and behaviors. Therefore, it is worth identifying and understanding firstborn children's emotional and behavioral responses to their upcoming baby sibling with a standardized measurement. Thus, a cross-sectional study was conducted to examine the sex-specific emotional and behavioral characteristics of pre-school aged, firstborn children during their mother's second pregnancy, and the potential factors that might predict sex-specific differences in China.

Methods

Participants

The present study collected responses from pregnant mothers recruited through two Obstetrics Departments from March to September 2019. One is the Women' and Children's Hospital with the largest number of prenatal outpatients, and the other is located in a less-developed area of our city, to ensure enrollment of participants with varying socioeconomic backgrounds. Mothers were included given the following criteria: (1) mother at least 14 weeks pregnant with her second child; (2) her firstborn child was between one and a half to five years old; (3) her firstborn child had not experienced a parental divorce; (4) neither the firstborn child nor the mother was diagnosed with a mental or physical illness. The city of enrollment is located in one of the six provinces that implemented the one-child policy in both urban and rural areas in the 1970s. In 2017, 10,100 s-child births were registered than the number of one-child following the implementation of the two-child policy in 2016 (Yang, 2020).

Eight hundred and eighty pregnant mothers (M age = 30.45, SD age = 3.01) and their 483 (54.89%) firstborn girls and 397 (45.11%) firstborn boys were included, more than 77% of the mothers were in the third trimester. These firstborn children were ages ranged from 1.5 to 5 years old (M age = 3.58, SD age = 1.25) with more than two thirds of them in the age bracket 2–4 years (70.60%). In terms of socioeconomic status, the majority of the mothers earned undergraduate degrees (74.66%) and nearly two thirds of them reported low or moderate financial pressure (68.86%). Additionally, over 90% of firstborn children were raised in harmonious families.

Measures

The self-designed questionnaire The first section of the questionnaire is comprised of introductory language, including the purpose of the study, to facilitate communication between study investigators and participants. The second section was designed to collect basic demographic information about the study participants including gender, age, family structure (nuclear family and extended family), family annual income (categories were based on the average income of residents in the China Statistical Yearbook 2019), self-awareness of family financial pressure (low, moderate, and high) and parental education. The third section focused primarily on the potential influencing factors of children's emotions and behaviors which were reported most frequently by other studies, such as children's temperament (three categories according to Thomas and Chess's theory:

easy, difficult, and slow-to-warm-up), family relationship (five categories of parental relationships and the relationship between parents and children, namely very good, good, general, bad, and very bad), family atmosphere (five categories: very harmonious, harmonious, general, disharmonious, and very disharmonious), parenting styles (four categories according to Baumrind's parenting typology: authoritative, authoritarian, indulgent, and neglectful), parental accompaniment (parents' daily time spent playing or staying with their firstborn child), the way and the time the firstborn child knew about their younger sibling (Chen et al., 2016; Volling, 2012; Chen et al., 2018; Baumrind, 1967; Thomas et al., 1982). The questionnaire was developed by our research team with consultation to experienced professors in the field of Child Psychology and finalized after two rounds of piloting and revisions.

Child behavioral checklist for ages 1.5–5 (CBCL/1.5–5) The CBCL/1.5–5, a widely used, standardized tool, was used to assess the firstborn child's emotional and behavioral characteristics over the preceding two months (Achenbach & Rescorla, 2000). Mothers scored the 99 items as not true, somewhat or sometimes true, or very true or often true. This checklist has been translated into different languages for intercultural comparison such as Spanish, French (Rescorla, 2005; Achenbach & Rescorla, 2000), with the Chinese language version showing good generalizability in China (Ivanova et al., 2010; Liu et al., 2011; Wu et al., 2012). In the current study, the *Cronbach's alpha* for the internalizing/externalizing problems scores with the Chinese language CBCL/1.5–5 were 0.88 and 0.90, respectively, and the *Spearman correlation coefficients* for the internalizing/externalizing problems scores with the Chinese language CBCL/1.5–5 were 0.75 and 0.98, respectively.

The CBCL/1.5–5 identified seven emotional and behavioral syndromes (emotionally reactive, anxious/depressed, somatic complaints, withdrawn, sleep problems, attention problems, and aggressive behavior) and two broadband emotional and behavioral problems (internalizing problems and externalizing problems). Internalizing problems refer to inwardly focused negative behaviors such as anxiety, depression, and somatic symptoms, while externalizing problems refer to outwardly focused negative behaviors such as hyperactivity, aggression, and disruptive conduct (Tien et al., 2020). In the CBCL/1.5–5, internalizing problems consist of emotionally reactive, anxious/depressed, somatic complaints and withdrawn, with a total of 36 items, and externalizing problems entail attention problems and aggressive behavior, with a total of 24 items. Scales for internalizing problems and externalizing problems were chosen to capture the firstborn child's emotions and behaviors in the present study, which encompassed more numerous and diverse problems than a syndromic scale (Rescorla, 2005),

and internalizing and externalizing behaviors are well established and widely used behavioral classifications within the field of child and adolescent psychology (Tien et al., 2020). A child's internalizing/externalizing problems score was obtained by summing the ratings for the items that comprised the problem, higher scores indicate more problems. If their score was ≥ 90 th percentile of the total score, then they were considered to have internalizing or externalizing problems.

Pregnant mothers were invited to complete the questionnaire and CBCL about the emotions and behaviors of their firstborn child when they attended a prenatal examination. In order to ensure the quality of the study and the reliability of the data, the following three quality control measures were used. First, before the formal study began, the investigators had been uniformly trained to ensure that they had a good understanding of the project background, research methods, and content. Second, the survey was piloted twice in the target hospitals to familiarize the investigators with the survey procedures and survey environment in order to reduce bias and resolve issues during the study. Third, questionnaires filled out by mothers were checked to ensure validity and avoid omissions. This study was approved by the Medical Ethics Review Committee of our institution (5 September 2018). The flowchart of the study is shown in Fig. 1.

Data analysis

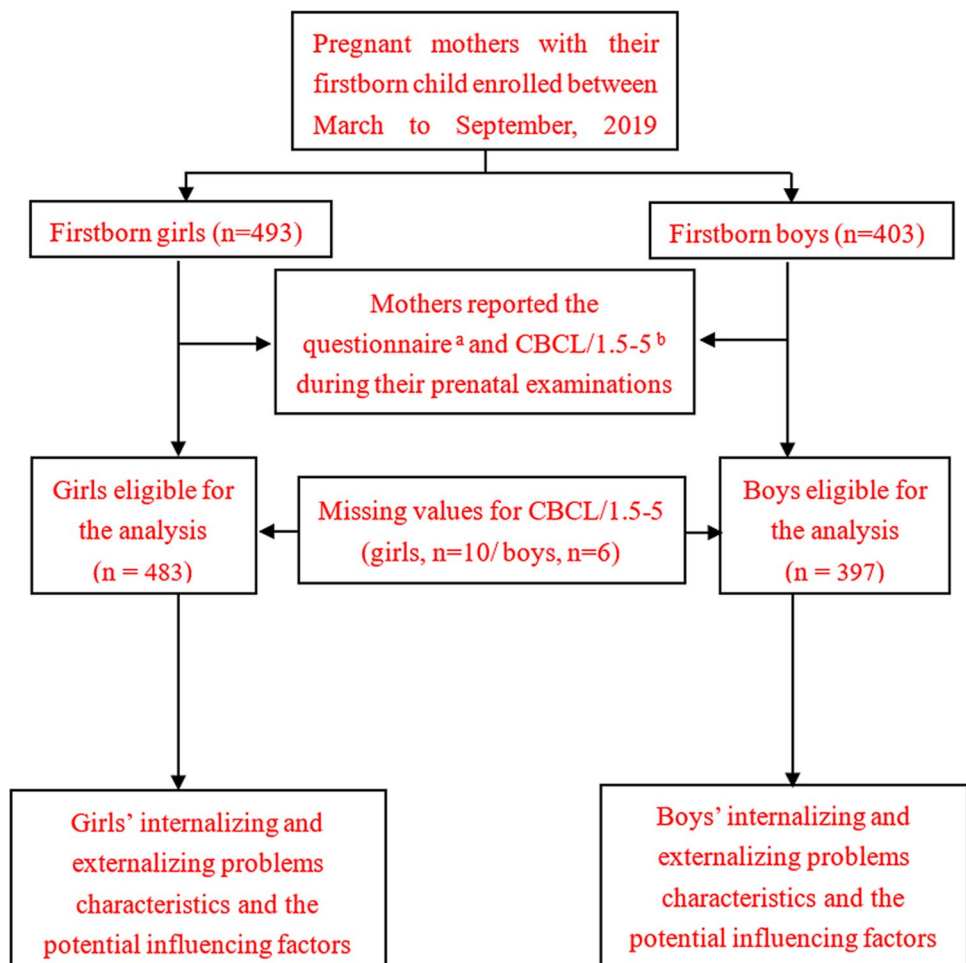
SPSS (version 21.0 for Windows, Chicago, IL) was used for data analysis. Percentages and means (standard deviation, SD) were used to describe participants' characteristics. *Cronbach's alpha* coefficient (*Cronbach's alpha*) and *Spearman correlation coefficient* were used to examine the internal consistency and structural correlation for the CBCL/1.5–5 in the study, respectively to ensure authenticity and reliability of results. Rank sum and chi-square tests were conducted to analyze the sex differences in scores and prevalence of children's internalizing/externalizing problems. Lastly, simple linear regression and multiple linear regression were used to identify the factors related to a firstborn child's internalizing/externalizing problems. Factors that were significantly related to the problem scores ($p < 0.05$) were included in the multivariable model to determine whether they had an independent effect. A p -value of < 0.05 was considered statistically significant in all analyses.

Results

Characteristics of participants

A total of 880 pregnant mothers and their firstborn children (483 firstborn girls, 397 firstborn boys) aged one and a half

Fig. 1 Flowchart of the present study. ^a The self-designed questionnaire, including 1) introduction about the purpose of the study; 2) basic demographic information; and 3) the potential influencing factors of children's emotions and behaviors. ^b The Child Behavior Checklist for 1.5 to 5 years old (CBCL/1.5–5) was used to assess the firstborn child's emotional and behavioral characteristics over the preceding two months. The checklist contains 99 items and identifies two broadband emotional and behavioral problems, namely internalizing problems and externalizing problems



to five years were included. The demographic characteristics of the firstborn child and their family characteristics are presented in Table 1. The average gestational age of the mother's second pregnancy was 31.68 weeks. Mother's accompaniment ($Z = -0.77$, $p = 0.56$) and father's accompaniment ($Z = -0.17$, $p = 0.87$) with the firstborn children decreased since the pregnancy, but the difference was not statistically significant.

Firstborn child's internalizing and externalizing problems

As seen in Table 2, the mean scores of the firstborn child's internalizing and externalizing problems were 7.21 and 8.64, respectively, with slightly more than 10% of firstborn children have internalizing or externalizing problems scores. Firstborn girls demonstrated higher scores on internalizing problems compared to firstborn boys (7.47 vs 6.89, $p = 0.22$), and firstborn boys had higher scores on externalizing problems (8.78 vs 8.53, $p = 0.63$). In addition, firstborn boys had a higher prevalence rate of internalizing problems (11.34% vs 11.18%, $p = 0.94$) and externalizing problems (10.58% vs

10.35%, $p = 0.91$) above the clinical cutoff compared to girls. However, these tendencies were not significantly different.

Factors related to the firstborn child's internalizing/externalizing problems

Tables 3 summarizes the factors related to the firstborn child's internalizing or externalizing problems. For firstborn girls, good parental relationship ($p < 0.01$), harmonious family environment ($p = 0.02$), and easy temperament ($p < 0.001$) were significantly associated with lower internalizing problems scores. Additionally, father's accompaniment after pregnancy ($p < 0.01$), firstborn girls' age ($p < 0.01$), good parental relationship ($p = 0.02$), father's authoritative ($p < 0.01$) and indulgent ($p = 0.05$) parenting styles, child's easy temperament ($p = 0.01$), and being informed by parents about the younger sibling ($p = 0.05$) were found to significantly lower externalizing problems scores among girls.

Firstborn boys whose mother's had more education ($p = 0.03$), better parental relationship ($p = 0.01$), father's authoritative ($p = 0.01$) and indulgent ($p = 0.03$) parenting styles, and easy temperament ($p < 0.001$) had significantly lower internalizing

Table 1 Demographic characteristics of 880 family members enrolled in this study

Characteristics	Girls (<i>n</i> = 483)		Boys (<i>n</i> = 397)		Total (<i>N</i> = 880)		Missing values (<i>n</i>)
	Mean	SD	Mean	SD	Mean	SD	
Children's age (years)	3.56	1.22	3.6	1.28	3.58	1.25	6
Mother's age (years)	30.5	3.01	30.38	3.03	30.45	3.01	7
Gestation							3
Second trimester	110	22.82%	89	22.53%	199	22.69%	
Third trimester	372	77.18%	306	77.47%	678	77.31%	
Family structure ^a							6
Nuclear family	75	15.69%	62	15.66%	137	15.68%	
Extended family	403	84.31%	334	84.34%	737	84.32%	
Children's temperament ^b							6
Easy	450	93.75%	369	93.65%	819	93.71%	
Difficult	23	4.79%	10	2.54%	33	3.78%	
Slow-to-warm-up	7	1.46%	15	3.81%	22	2.52%	
Family annual income, CNY							36
< 120000	153	32.69%	121	32.18%	274	32.46%	
120001–240000	192	41.03%	139	36.97%	331	39.22%	
240001–360000	69	14.74%	69	18.35%	138	16.35%	
> 360000	54	11.54%	47	12.50%	101	11.97%	
Family financial stress							0
Low	80	16.56%	70	17.63%	150	17.05%	
Moderate	254	52.59%	202	50.88%	456	51.82%	
High	149	30.85%	125	31.49%	274	31.14%	
Father's education							1
Primary/secondary school	24	4.97%	15	3.79%	39	4.44%	
High school	46	9.52%	53	13.38%	99	11.26%	
Undergraduate degree	352	72.88%	275	69.44%	627	71.33%	
Masters/Doctorate	61	12.63%	53	13.38%	114	12.97%	
Mother's education							0
Primary/secondary school	15	3.11%	11	2.77%	26	2.95%	
High school	55	11.39%	51	12.85%	106	12.05%	
Undergraduate degree	364	75.36%	293	73.80%	657	74.66%	
Masters/Doctorate	49	10.14%	42	10.58%	91	10.34%	
Parental relationship ^c							0
Very good	271	56.11%	228	57.43%	499	56.70%	
Good	178	36.85%	140	35.26%	318	36.14%	
General	34	7.04%	29	7.30%	63	7.16%	
Mother-child relationship ^c							0
Very good	404	83.64%	328	82.62%	732	83.18%	
Good	79	16.36%	69	17.38%	148	16.82%	
General	0	0%	0	0%	0	0%	
Father-child relationship ^c							0
Very good	327	67.70%	257	64.74%	584	66.36%	
Good	130	26.92%	109	27.46%	239	27.16%	
General	26	5.38%	31	7.81%	57	6.48%	
Family atmosphere ^c							2
Very harmonious	158	32.85%	125	31.49%	283	32.23%	
Harmonious	286	59.46%	241	60.71%	527	60.02%	
General	37	7.69%	31	7.81%	68	7.74%	
Father's parenting style ^d							5
Authoritative	314	65.42%	270	68.35%	584	66.74%	

Table 1 (continued)

Characteristics	Girls (<i>n</i> = 483)		Boys (<i>n</i> = 397)		Total (<i>N</i> = 880)		Missing values (<i>n</i>)
	Mean	SD	Mean	SD	Mean	SD	
Authoritarian	55	11.46%	53	13.42%	108	12.34%	
Indulgent	90	18.75%	51	12.91%	141	16.11%	
Neglectful	21	4.38%	21	5.32%	42	4.80%	
Mother's parenting style ^d							8
Authoritative	385	80.71%	333	84.30%	718	82.34%	
Authoritarian	43	9.01%	32	8.10%	75	8.60%	
indulgent	45	9.43%	27	6.84%	72	8.26%	
Neglectful	4	0.84%	3	0.76%	7	0.80%	
Informed time							63
Preparing for pregnancy	61	13.62%	64	17.34%	125	15.30%	
Pregnant for 1–8 weeks	235	52.46%	184	49.86%	419	51.29%	
Pregnant > 8 weeks	152	33.93%	121	32.79%	273	33.41%	
Informed way							62
Parents	433	96.87%	364	98.11%	797	97.43%	
Others	14	3.13%	7	1.89%	21	2.57%	
Mother's accompaniment, hour ^e							
Before pregnancy	16.56	8.27	16.73	8.06	16.64	8.17	37
After pregnancy	16.25	8.15	16.47	8.19	16.35	8.16	38
Father's accompaniment, hour ^e							
Before pregnancy	11.08	8.48	11.60	8.50	11.31	8.49	68
After pregnancy	11.01	8.46	11.55	8.50	11.25	8.48	68

CNY: Chinese Yuan

^aFamily structure included nuclear family and extended family. Nuclear family is a family group consisting of parents and their children (one or more), and an extended family is a family consisting of parents and their children, aunts, uncles, grandparents, and cousins, all living in the same household

^bThomas and Chess's categorized children's temperament into three groups, i.e., easy, difficult, and slow-to-warm-up. (Thomas et al., 1982)

^cParental relationship, mother–child relationship, and father–child relationships in the questionnaire were defined as five categories, namely very good, good, general (the state between good and bad), bad, and very bad, and the family atmosphere was classified as very harmonious, harmonious, general (the state between harmonious and disharmonious), disharmonious, and very disharmonious. However, no respondents (0, .0%) reported of bad, very bad, disharmonious and very disharmonious, so the data are not presented in the table

^dAccording to Baumrind's parenting typology (Baumrind, 1967), authoritative parenting means parents are demanding and responsive; authoritarian parenting means parents are demanding but not responsive; indulgent parenting means parents are responsive but not demanding; and neglectful parenting means parents are not responsive and not demanding

^eMother's and father's accompaniment means parents' daily time spent playing or staying with their first-born child

problems scores. Additionally, only father's authoritative parenting styles ($p=0.01$), easy temperament ($p=0.02$), and seeking firstborn child's opinion ($p<0.01$) were related to lower externalizing problems scores. These results are found in Table 4.

Discussion

Though the economic and social impact of the shift from a one to two child policy in China has been and continues to be researched, little data exists on the feelings and

opinions of the children impacted by this changing decree. This study aims to better understand a firstborn child's emotional and behavioral reaction and potential influencing factors during their mother's pregnancy. As seen in this study, there was no significant sex difference in internalizing/externalizing problems during mother's pregnancy with a younger sibling. However, other factors could be considered when approaching this subject matter with a child.

First, the preschool aged firstborns in our study appeared to have fewer internalizing/externalizing problems than

Table 2 The scores and prevalence rates of firstborn children's internalizing/externalizing problems

	Total (<i>N</i> = 880)		Girls (<i>n</i> = 483)		Boys (<i>n</i> = 397)		<i>Z</i> / χ^2	<i>p</i> ^b
	Mean or <i>n</i>	<i>SD</i> or %	Mean or <i>n</i>	<i>SD</i> or %	Mean or <i>n</i>	<i>SD</i> or %		
Scores of internalizing problems	7.21	6.24	7.47	6.42	6.89	6.00	-1.24	.22
Scores of externalizing problems	8.64	6.61	8.53	6.53	8.78	6.71	-.48	.63
Prevalence rate of internalizing problems ^a	92	10.45%	54	11.18%	45	11.34%	.01	.94
Prevalence rate of externalizing problems	92	10.45%	50	10.35%	42	10.58%	.01	.91

^aThe clinical cutoff threshold of internalizing/externalizing problems was the 90th percentile of the total score. The clinical threshold for internalizing problems for all children, girls, and boys were 16, 16, and 15, respectively; the clinical threshold for externalizing problems was 18 in firstborn children regardless of sex

^bThe scores of boys' and girls' internalizing/externalizing problems was analyzed by rank sum test because the data was non-normally distributed. The prevalence rate of boys' and girls' internalizing/externalizing problems was analyzed by chi-square test

children in other studies. Besides the study conducted in Denmark (Steenhoff et al., 2021), we found the mean score of externalizing problems for firstborn children in this study was lower than the same-aged, firstborn children in America (Kolak & Volling, 2013). More so, firstborn children in this study showed fewer internalizing and externalizing problems scores when compared to same-aged children (either first born or non-firstborn children) in Taiwan (Wu et al., 2012), Jiangsu, China (Liu et al., 2011), United States (Wu et al., 2012), and Australia (Zubrick et al., 2007). The prevalence rate of internalizing problems in firstborn children in this study was also lower than the same-aged Dutch children (Tick et al., 2007).

Second, consistent with other studies, there seems to be no gender differences in internalizing or externalizing problems among firstborn children. Only one other study conducted in Denmark has explored gender differences in internalizing and externalizing problems in first-born children at the same age, for the same period, and with the same scales. This study had multiple outcome indicators, but maternal, paternal, and child's scores all showed slightly but non-significantly higher scores for externalizing problems in firstborn boys and slightly but non-significantly higher scores for internalizing problems in firstborn girls (Steenhoff et al., 2021). Studies have suggested that the long-term, only-child policy in China may have led to strong possessiveness and jealousy among firstborn children (Yang et al., 2021). This, coupled with the assumptions that Chinese families lack experience in coping with emotional and behavioral changes in firstborn children before the birth of a baby sibling, could lead to negative effects on firstborn children. However, our study suggests that the second pregnancy of the mother does not appear to be a stressful event for the firstborn child in China, as in Denmark.

A child's temperament also seemed to play a role when it came to internalizing or externalizing problems. Consistent with previous studies (Pitzer et al., 2009; Schipper

et al., 2004), this study showed that girls and boys with an easy temperament had significantly fewer internalizing and externalizing problem scores. Temperament is a relatively consistent and inherent characteristic in a person (Shiner, et al., 2012), and children's temperament can be classified into easy, difficult, and slow-to-warm-up (Thomas et al., 1982). Children with an easy temperament are found to be more adaptable and positive (Spruyt et al., 2008; Thomas et al., 1982). Therefore, children with an easy temperament are less vulnerable to changes in their environments and they can better adapt to the arrival of a new sibling compared to children with difficult or slow-to-warm-up temperaments.

Besides children's temperaments, good parental relationship appeared to be a protective factor for firstborn children's internalizing problems and firstborn boys' externalizing problems during their mother's pregnancy. Previous studies also demonstrated that firstborn children with destructive marital conflict and low levels of supportive coparenting were significantly positively associated with externalizing and internalizing problems (Kolak & Volling, 2013; Hosokawa & Katsura, 2019) and decreases in infants' secure attachments (Brown et al., 2010). These consistent findings can be understood by the emotional security hypothesis, which suggests that interparental conflict may endanger children's emotional security (Cummings & Davies, 1995; Cummings & Wilson, 1998). Emotional insecurity, in turn, may negatively impact children's behavior and their social interactions. Interestingly, the parent-child relationship was not related to the firstborn child's internalizing and externalizing problems in this study. Therefore, it's important to develop a supportive parental relationship following the birth of a sibling for the betterment of the firstborn child.

In this study, a father's authoritative parenting style was associated with fewer externalizing problem scores in firstborn girls and boys, as well as fewer internalizing problems scores in firstborn girls. Parenting styles can be categorized as authoritarian, authoritative, indulgent, and

Table 3 Factors related to internalizing and externalizing problems in firstborn girls using multiple linear regression

Variables	Girls' internalizing problems			Girls' externalizing problems		
	$\beta(95\%CI)$	<i>p</i>	VIF ^c	$\beta(95\%CI)$	<i>p</i>	VIF
Father's accompaniment after pregnancy (hours)	-.08 (-.12, .01)	.07	1.04	-.14 (-.17, -.04)	.002	1.05
Children's age (years)	- ^b	-	-	-.14 (-1.29, -.21)	.01	1.32
Parental relationship						
Very good	-.14 (-4.30, .71)	.16	5.40	-.15 (-4.67, .69)	.14	5.73
Good	-.24 (-5.63, -.86)	.01	4.62	-.23 (-5.59, -.51)	.02	4.91
General ^a						
Mother-child relationship						
Very good	-.07 (-3.04, .60)	.19	1.57	-	-	-
Good ^a						
Father-child relationship						
Very good	-.12 (-4.68, 1.26)	.26	6.68	-.20 (-5.82, .41)	.09	6.83
Good	-.08 (-3.94, 1.76)	.45	5.60	-.17 (-5.53, .64)	.12	6.14
General ^a						
Family atmosphere						
Very harmonious	-.32 (-6.86, -1.96)	.00	4.59	-.12 (-4.28, .95)	.21	4.87
Harmonious	-.20 (-4.88, -.43)	.02	4.16	-.02 (-2.57, 2.15)	.86	4.35
General ^a						
Father's parenting style						
Authoritative	-.16 (-4.91, .50)	.11	5.65	-.32 (-7.20, -1.60)	.002	5.64
Authoritarian	.04 (-2.30, 3.86)	.62	3.15	-.02 (-3.58, 2.77)	.80	3.19
Indulgent	-.05 (-3.84, 2.00)	.54	4.27	-.18 (-6.11, -.07)	.05	4.24
Neglectful ^a						
Children's temperament						
Easy	-.31 (-11.63, -4.31)	.00	3.00	-.18 (-8.27, -1.00)	.01	2.64
Difficult	-.04 (-5.62, 3.27)	.60	3.07	.04 (-3.19, 5.96)	.55	2.70
Slow-to-warm-up ^a						
Informed way						
Parents	-	-	-	-.09 (-6.84, -.06)	.05	1.06
Others ^a						
Informed time						
Pregnant for 1–8 weeks	-	-	-	.06 (-.90, 2.53)	.35	2.40
Pregnant > 8 weeks	-	-	-	.08 (-.84, 2.95)	.27	2.62
Preparing for Pregnancy ^a						
Seeking children's opinion						
Yes	-	-	-	-.01 (-1.51, 1.18)	.81	1.43
No ^a						

^aReference group^bNo data, i.e., variables weren't included in the multiple linear regression model^cVariance inflation factor

neglectful according to parental demandingness and responsiveness (Baumrind, 1967; Maccoby & Martin, 1983). An authoritative parenting style is characterized by warmth, a high level of communication with the child and high level of democratic parenting (Baumrind, 1967; Maccoby & Martin, 1983). Most children raised under an authoritative and warm parenting style are more self-reliant, with fewer emotional and behavioral problems (Pinquart, 2017; Richters, 2010).

Therefore, firstborn children with authoritative parents may be able to better cope with unexpected stress and changes in more calm and purposeful ways.

Interestingly, over 93% of the firstborn children in this study were considered to have an easy temperament by their mothers. More so, over 92% of firstborn children were raised in a harmonious family and about 80% of firstborn children grew up with a warm parenting style. Thus, these

Table 4 Factors related to internalizing and externalizing problems in firstborn boys using multiple linear regression

Variables	Boys' internalizing problems			Boys' externalizing problems		
	β (95%CI)	<i>p</i>	VIF ^c	β (95%CI)	<i>p</i>	VIF
Mother's accompaniment after pregnancy (hours)	-.05 (-.13, .06)	.48	1.64	-.02 (-.12, .08)	.71	1.65
Father's accompaniment after pregnancy (hours)	-.08 (-.15, .03)	.20	1.71	-.05 (-.14, .07)	.49	1.70
Mother's age (years)	- ^b	-	-	.11 (.00, .50)	.05	1.30
Family financial stress						
Moderate	.05 (-1.04, 2.33)	.45	2.04	.06 (-1.12, 2.70)	.41	2.08
High	.07 (-.97, 2.76)	.35	2.16	.03 (-1.73, 2.53)	.71	2.23
Low ^a						
Mother's education						
High school	-.25 (-9.03, -.38)	.03	5.65	-.23 (-9.93, .13)	.06	6.16
Undergraduate degree	-.31 (-8.36, -.17)	.04	9.24	-.29 (-9.24, .29)	.07	9.96
Masters/Doctorate	-.21 (-8.52, .63)	.09	6.06	-.23 (-10.13, .39)	.07	6.46
Primary/secondary school ^a						
Father's education						
High school	-.09 (-5.27, 2.13)	.40	4.30	-	-	-
Undergraduate degree	-.15 (-5.52, 1.66)	.29	7.79	-	-	-
Masters/Doctorate	-.14 (-6.52, 1.53)	.22	5.57	-	-	-
Primary/secondary school ^a						
Parental relationship						
Very good	-.32 (-6.91, -.80)	.01	6.60	.00 (-3.44, 3.44)	1.00	6.64
Good	-.27 (-6.20, -.50)	.02	5.37	.00 (-3.13, 3.24)	.97	5.31
General ^a						
Mother-child relationship						
Very good	.00 (-1.95, 2.03)	.97	1.62	-.05 (-3.12, 1.35)	.44	1.65
Good ^a						
Father-child relationship						
Very good	.01 (-2.65, 2.93)	.92	5.14	-.04 (-3.73, 2.53)	.71	5.13
Good	.00 (-2.61, 2.64)	.99	4.02	.01 (-2.80, 3.10)	.92	4.03
General ^a						
Family atmosphere						
Very harmonious	.11 (-1.57, 4.38)	.35	5.50	-.07 (-4.32, 2.34)	.56	5.48
Harmonious	.15 (-.94, 4.61)	.20	5.32	.00 (-3.16, 3.09)	.98	5.34
General ^a						
Father's parenting style						
Authoritative	-.31 (-6.78, -1.16)	.01	4.94	-.30 (-7.52, -1.19)	.01	4.97
Authoritarian	-.11 (-5.08, 1.09)	.20	3.28	-.06 (-4.74, 2.24)	.48	3.36
Indulgent	-.19 (-6.68, -.26)	.03	3.11	-.17 (-7.23, .06)	.05	3.17
Neglectful ^a						
Children's temperament						
Easy	-.23 (-8.95, -2.81)	.00	1.55	-.14 (-7.48, -.64)	.02	1.55
Difficult	-.12 (-10.51, .02)	.05	1.52	.04 (-4.19, 7.67)	.57	1.55
Slow-to-warm-up ^a						
Informed time						
Pregnant for 1–8 weeks	-	-	-	.10 (-.53, 3.14)	.16	1.91
Pregnant > 8 weeks	-	-	-	.04 (-1.56, 2.59)	.63	2.13
Preparing for Pregnancy ^a						
Seeking children's opinion						
Yes	-	-	-	-.17 (-4.03, -.95)	.002	1.25
No ^a						

^aReference group^bNo data, i.e., variables didn't be included in the multiple linear regression model^cVariance inflation factor

self-described characteristics may have contributed to the lower externalizing and internalizing problem scores.

There are several study limitations that should be noted. First, information was only collected from children's mothers, which may provide an incomplete perspective of their reactions. However, compared with the information provided by fathers and the children themselves, studies have revealed the high levels of accuracy and validity of mother-reported outcomes in a child's behaviors (Rescorla, 2005; Beyers-Carlson & Volling, 2017). Second, the study population was not a representative sample, which limits external validity. The mothers in our study were mostly in the third trimester, the firstborn children were mainly characterized as easy temperament, and tend to be raised with more educated parents, higher family income and more harmonious family. These children may show fewer emotional and behavioral problems no matter their mothers are pregnant or not. Third, this study is the baseline survey of our firstborn children's emotional and behavioral cohort study, the cross-sectional nature of the study prevents considerations about causality. Fourth, there are no information about the emotions and behaviors of the firstborn child prior to mother's pregnancy, so we cannot identify the independent effects of a mother's pregnancy on her firstborn children. Last but not least, we only focused on the characteristics and determinants of firstborn girls' or firstborn boys' emotions and behaviors, we cannot identify how gender moderates the associations between these various factors and the problem behavior. However, we believe that this is not much of a concern if one considers our study in the right perspective, namely as an exploration of the role of mothers' pregnancy in firstborn girls' and boys' emotions and behaviors in China. Then we caution the reader to consider these results with this spirit.

Conclusion

There was no significant sex difference of firstborn children's internalizing and externalizing problems during mothers' pregnancy in this study. Children's temperament was the most consistent influencing factor for firstborn children's emotions and behaviors. The establishment of harmonious and supportive interparental relationship and warm parenting styles are also important for firstborn children's emotions and behaviors.

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Authors contributions QL participated in the design of the study, interpretation of the results, and revision of the article. BY participated in the design of the study, data acquisition and analysis, and drafting of the article. LS, XH, YL, BF, YW were involved in the data acquisition and revision of the article. SR participated in the design of the study and revised the article critically. All authors read and approved the final manuscript, and there are no conflict of interest exists in the submission of this manuscript.

Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Disclosures We are grateful to the families participated in the study and the research assistants of two hospitals, and no potential conflict of interest was reported by the authors. Materials and analysis code for this study are available by emailing the corresponding author.

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