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Children from nuclear families with bad parental relationship could develop tic symptoms

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Abstract

Background: Studies have reported the impact of chronic childhood and adolescent tic disorder (TD) on families. However, few researches focused on the relationship between family environment and diagnosis of TD. We aim to assess the influence of couple relationship and family structure on the onset of TD.

Methods: A total of 660 parents of patients with TD (aged 6–12 years) and 641 parents of controls completed questionnaires. Couple relationship and family structure were selected by regression of binary logistic analysis as the risk factors. Couple relationship was divided into the harmonious, common, hostile, and divorced. Family structure included unconventional family, nuclear family, and unite family. Multivariate correspondence analysis was designed to explore relationships among categorical variables of couple relationship and family structure.

Results: There were significant associations between TD and couple relationship (Exp B = 1.310, p = .006, 95% CI = 1.080–1.590), family structure (Exp B = 0.668, p = .001, 95% CI = 0.526 ~ 0.847), gender (Exp B = 0.194, p < .001, 95% CI = 0.149–0.254), respectively. Obviously contradicted and common couple relationships were risk factors for TD compared with the harmonious and divorced. Children form unconventional family or nuclear family were prone to develop TD. Interestingly, divorced parents had the same protective effect as harmonious parents. The OR value could increase with the number and level of those risk factors.

Conclusions: In conclusion, children from nuclear families with bad parental relationship could be more likely to develop tic symptoms. The family intervention of children with TD should focus on family structure and parental relationship.

KEYWORDS
couple relationship, family structure, gender, tic disorder

1 | INTRODUCTION

Tic disorder (TD) is a childhood onset neuropsychiatric disorder characterized by motor or vocal tics (American Psychiatric Association, 2013; Hallett, 2015). A meta-analysis

of the worldwide prevalence of TDs indicated that transient tic disorder (TTD) was the most common, with a prevalence of 2.99%. The prevalence of Tourette syndrome (TS) and chronic tic disorder (CTD) was 0.77% and 1.61% (Knight et al., 2012), respectively. The prevalence of TD was 6.1% in China with 1.7% TTD, 1.2% CTD and 0.3% TS

(Yang, Zhang, Zhu, Zhu, & Guo, 2016). TDs can have a profoundly emotional and social impact on children and families, which can in turn have a reciprocal impact on tics (Evans, Wittkowski, Butler, Hedderly, & Bunton, 2016). TD children may experience subjective discomfort (pain or injury), sustained social problems (social isolation or bullying), and emotional problems (reactive depressive symptom; Roessner et al., 2011). Augustine et al. (2017) thought TD could influence on individuals, families, and communities (Dutta & Cavanna, 2013; Evans, Wittkowski, Butler, Hedderly, & Bunton, 2015; Kadam & Chuan, 2016). The health-related quality of life, anxiety, and depression of TS adolescents and their parents were shown to be affected by TS (Dutta & Cavanna, 2013; Evans et al., 2015; Jalenques et al., 2017; Kadam & Chuan, 2016). Goussé et al. (2016) had found that most parents of TD children had a high level of anxiety-depression. A Canadian population-based study concluded that individuals with TS experienced a higher frequency of anxiety and mood disorders, and required more assistance with activities of daily living than the general population (Yang et al., 2017).

Unfortunately, there is no cure for TD now, and we need to explore effective treatments to diminish the severity and frequency of TD (Cath et al., 2011). Besides pharmacological help (Schlander, Schwarz, Rothenberger, & Roessner, 2011), certain intervention or support is required to manage tics and impaired social, emotional, and behavioral functioning. Complex neurobiological and genetic mechanisms, prenatal and perinatal infections, as well as environmental factors are thought to interact with each other in the development of TD (Tagwerker & Walitza, 2016). The severity of TS and co-occurring conditions were proved to be associated with school challenges and educational service needs (Claussen, Bitsko, Holbrook, Bloomfield, & Giordano, 2018). There were many studies interested in the impact of family on chronic childhood and adolescent TD, while few studies have focused on the relationship between family environment and diagnosis of TD (Hong et al., 2013). In this study, we are looking forward to finding family risk factors related to TD by the epidemiological study and providing potential intervention suggestions.

2 | MATERIALS AND METHODS

2.1 | Study design and participants

The case group included 660 families with tic children (from outpatient), who diagnosed with *Diagnostic and Statistical Manual of Mental Disorder*s (version 5.0) by Pediatrics of Traditional Chinese Medicine (TCM), Xinhua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine from 1 January 2008 to 30 March 2014. The ages

What this paper adds

- Unconventional and nuclear family were risk factors for children to develop tic disorder (TD).
- Unharmonious couple relationship was risk for children to develop TD.
- Divorce could be protective for children compared with those unharmonious couples.
- The superimposition of risk factors can increase the probability of TD.
- The family intervention of children with TD should focus on family structure and parental relationship.

of participants ranged from 6 to 12 years without family history of TD, epilepsy and other neurological or mental illness. The TD patients in our research do not have other co-occurring conditions like ADHD, OCD, impulsive and self-injurious behavior. They were excluded by specialists in Pediatric Tic Disorder Specialist Clinic. All specialists in the clinic have a background in neuropsychiatry. Of the 660 patients in the case group, 434 had TTD, 117 had chronic motor or vocal TD, and 109 had TS. They were classified into three types according to severity: 245 mild patients with YGTSS $\leq$ 24 points, 370 moderate patients with YGTSS about 25–50 points and 45 severe patients with YGTSS about 51–100 points.

We handed out the questionnaires to parents of TD children by specialists and asked them to fill in it before their second visit. The control data was gotten from the questionnaire finished by parents of 641 primary school students without TD from Yangpu District at the same age. Both them were given 1 week to finish it seriously. All data were inputted by two postgraduates by excel and checked by the third party. Flow diagram of data analysis are shown in Figure 1. Investigators obtained the informed consent before enrolling participants in the study. This study was approved by the Ethics Committee of Xinhua Hospital Affiliated to Shanghai Jiaotong University School of Medicine (XHEC-D-2018-033).

2.2 | Questionnaire and setting

The questionnaire used in this research has been identified by five specialists in this field, with the reliability coefficient $r = .7523$ and internal consistency coefficient $\alpha = 0.8123$. The questionnaire includes three parts: Family Factors, Perinatal and Past History Factors, and Diet Factors. The original variables of family factors included family structure (1 = nuclear family, 2 = stem family, 3 = unite family,

4 = broken family, 5 = inter-generational family, 6 = single family), single child or not (1 = yes, 2 = no), parents' education level (1 = postgraduate, 2 = graduate, 3 = junior college, 4 = secondary professional education school, 5 = technical school, 6 = senior high school, 7 = junior high school, 8 = primary school, 9 = illiteracy), relationship of parents (1 = harmonious, 2 = common, 3 = disharmony, 4 = divorce) and home environment (1 = quiet, 2 = commonly quiet, 3 = noisy). Family structure comprised the following categories on the basis of current living arrangement: unconventional family, nuclear family, and unite family. In accordance with the education law of the PRC (Education Law of the People's Republic of China, 2015), Parents' education level was reordered as illiteracy (1), compulsory education (2 include junior high school, primary school), non-compulsory secondary education (3 include secondary professional education school,

technical school, senior high school), junior college (4), graduate (5), and postgraduate (6). A new variable was created by subtracting the value of mother's education level from the father's to describe the different of parents' education level. To ensure that the assignment was 1 and above, the result of the subtraction should pulse 4. The value less than 4 meant that fathers' education levels were lower than mothers' and more than 4 was the opposite. The extreme value represents a greatly different education levels of parents. The value assignment of variables was shown in Table 1.

2.3 | Statistical analysis

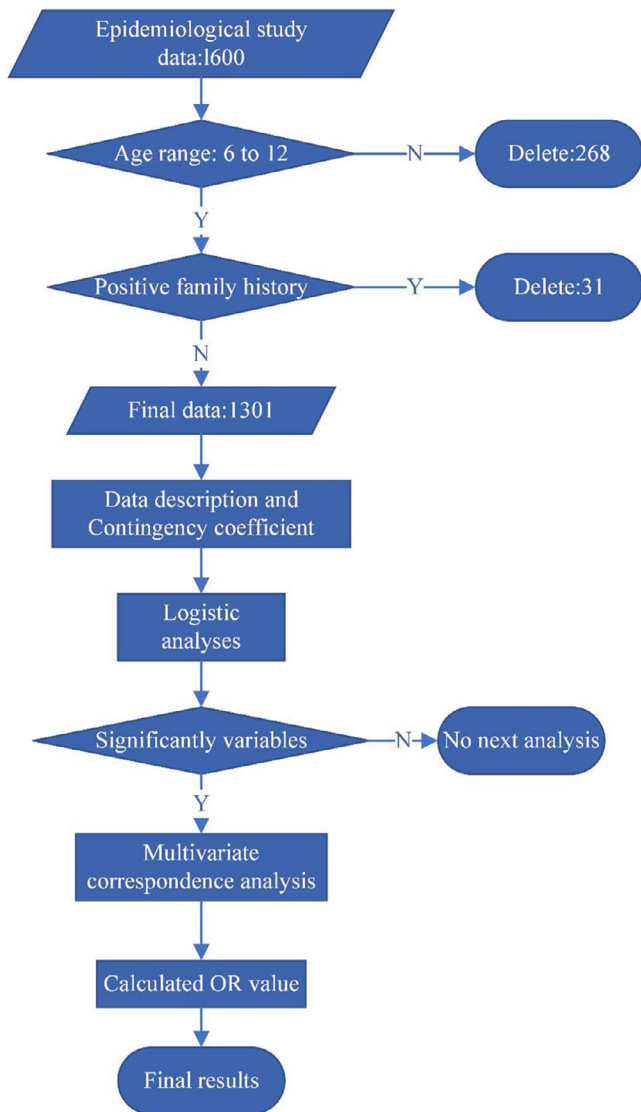The abnormal values were identified by sorting each choice and cases with missing values were deleted. Frequency of

FIGURE 1 Flow diagram of data analysis

TABLE 1 Value assignment of variables

Factors description	Choices	Value assignment
Family structure	Unconventional family	1
	Nuclear family	2
	Unite family	3
Single child or not	Single child	1
	Not single child	2
Gender	Boys	1
	Girls	2
Parents' education level	Compulsory education	1
	Non compulsory secondary education	2
	Junior college	3
	Bachelor degree	4
	Graduate degree	5
Couple relationship	Harmonious	1
	Commonly	2
	Hostile	3
	Divorce	4
Home environment	Quiet	1
	Commonly	2
	Noisy	3
Age group	6 ~ 8	1
	9 ~ 10	2
	11 ~ 12	3
Different of parents' education level	F«M	1
	F < M	2
	F = M	3
	F > M	4
	F»M	5

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TABLE 2 Crosstab of each variable

		Group		Age group			Family structure			Gender		Home environment			The noly child or not		Couple relationship
		Control	Case	6~8 years	9~10 years	11~12	Unconventional family	Nuclear family	Unite family	Boys	Girls	Qquiet	Commonly	Noisy	Single child	Not single child	Harmonious
Group	Control	641	0	356	185	100	11	365	265	309	332	504	19	118	572	69	565
	Case	0	660	364	189	107	21	443	196	549	111	471	41	148	566	94	499
Age group	6~8 years	356	364	720	0	0	16	470	234	450	270	541	33	146	634	86	599
	9~10 years	185	189	0	374	0	12	219	143	255	119	280	20	74	324	50	299
	11~12	100	107	0	0	207	4	119	84	153	54	154	7	46	180	27	166
Family structure	Unconventional family	11	21	16	12	4	32	0	0	26	6	22	3	7	23	9	8
	Nuclear family	365	443	470	219	119	0	808	0	549	259	624	39	145	696	112	676
	Unite family	265	196	234	143	84	0	0	461	283	178	329	18	114	419	42	380
Gender	Boys	309	549	450	255	153	26	549	283	858	0	615	53	190	736	122	676
	Girls	332	111	270	119	54	6	259	178	0	443	360	7	76	402	41	388
Home environment	Quiet	504	471	541	280	154	22	624	329	615	360	975	0	0	864	111	854
	Commonly	19	41	33	20	7	3	39	18	53	7	0	60	0	47	13	34
	Noisy	118	148	146	74	46	7	145	114	190	76	0	0	266	227	39	176
Single child or not	Single child	572	566	634	324	180	23	696	419	736	402	864	47	227	1,138	0	944
	Not single child	69	94	86	50	27	9	112	42	122	41	111	13	39	0	163	120
Couple relationship	Harmonious	565	499	599	299	166	8	676	380	676	388	854	34	176	944	120	1,064
	Commonly	50	111	80	49	32	5	100	56	123	38	83	15	63	131	30	0
	Hostile	5	31	20	12	4	1	24	11	34	2	15	8	13	31	5	0
	Divorce	21	19	21	14	5	18	8	14	25	15	23	3	14	32	8	0
Fathers' educational level	Compulsory education	44	126	100	43	27	1	117	52	145	25	96	15	59	126	44	133
	Non compulsory secondary education	215	154	191	121	57	7	202	160	235	134	280	9	80	329	40	300
	Junior college	168	117	152	86	47	14	163	108	163	122	219	16	50	253	32	241
	Bachelor degree	166	218	226	101	57	8	260	116	249	135	312	17	55	351	33	312
	Graduate degree	48	45	51	23	19	2	66	25	66	27	68	3	22	79	14	78
Mothers' educational level	Compulsory education	45	137	93	57	32	0	136	46	153	29	110	15	57	124	58	136
	Non compulsory secondary education	158	187	191	98	56	11	191	143	231	114	254	19	72	307	38	278
	Junior college	221	149	200	121	49	12	201	157	219	151	281	14	75	330	40	309
	Bachelor degree	191	165	209	85	62	8	243	105	217	139	302	11	43	333	23	308
	Graduate degree	26	22	27	13	8	1	37	10	38	10	28	1	19	44	4	33
Difference in parents' educational level	F«M	32	12	29	10	5	1	38	5	23	21	36	2	6	43	1	39
	F < M	147	77	118	74	32	4	115	105	130	94	160	6	58	213	11	190
	F = M	307	370	383	180	114	18	416	243	480	197	511	27	139	578	99	547
	F > M	137	157	160	88	46	8	195	91	184	110	220	22	52	252	42	238
	F»M	18	44	30	22	10	1	44	17	41	21	48	3	11	52	10	50

each variable was used to describe the form of the data and contingency coefficient was used to estimate the extent of the relationship between two variables. Statistically significant variables were screened by logistic regression analyses. The multiple correspondence analysis (MCA) was used to describe the relationship between each choice. Finally, the proportions of the case and the control in population constructed according to MCA were calculated. All analyses were carried out using the IBM SPSS Statistics software (version 23.0). Statistical significance was determined as $p < .05$.

Commonly	Hostile	Divorce	Fathers' educatioal level					Mothers' educational level					Difference in parents' educational level				
			Compulsory education	Non compulsory secondary education	Junior college	Bachelor degree	Graduate degree	Compulsory education	Non compulsory secondary education	Junior college	Bachelor degree	Graduate degree	F«M	F < M	F = M	F > M	F»M
50	5	21	44	215	168	166	48	45	158	221	191	26	32	147	307	137	18
111	31	19	126	154	117	218	45	137	187	149	165	22	12	77	370	157	44
80	20	21	100	191	152	226	51	93	191	200	209	27	29	118	383	160	30
49	12	14	43	121	86	101	23	57	98	121	85	13	10	74	180	88	22
32	4	5	27	57	47	57	19	32	56	49	62	8	5	32	114	46	10
5	1	18	1	7	14	8	2	0	11	12	8	1	1	4	18	8	1
100	24	8	117	202	163	260	66	136	191	201	243	37	38	115	416	195	44
56	11	14	52	160	108	116	25	46	143	157	105	10	5	105	243	91	17
123	34	25	145	235	163	249	66	153	231	219	217	38	23	130	480	184	41
38	2	15	25	134	122	135	27	29	114	151	139	10	21	94	197	110	21
83	15	23	96	280	219	312	68	110	254	281	302	28	36	160	511	220	48
15	8	3	15	9	16	17	3	15	19	14	11	1	2	6	27	22	3
63	13	14	59	80	50	55	22	57	72	75	43	19	6	58	139	52	11
131	31	32	126	329	253	351	79	124	307	330	333	44	43	213	578	252	52
30	5	8	44	40	32	33	14	58	38	40	23	4	1	11	99	42	10
0	0	0	133	300	241	312	78	136	278	309	308	33	39	190	547	238	50
161	0	0	30	45	25	51	10	38	43	37	32	11	1	24	89	41	6
0	36	0	6	6	7	15	2	8	8	11	7	2	2	2	18	9	5
0	0	40	1	18	12	6	3	0	16	13	9	2	2	8	23	6	1
30	6	1	170	0	0	0	0	114	51	5	0	0	5	51	114	0	0
45	6	18	0	369	0	0	0	59	189	88	32	1	33	88	189	59	0
25	7	12	0	0	285	0	0	3	62	148	66	6	6	66	148	62	3
51	15	6	0	0	0	384	0	6	36	119	204	19	0	19	204	119	42
10	2	3	0	0	0	0	93	0	7	10	54	22	0	0	22	54	17
38	8	0	114	59	3	6	0	182	0	0	0	0	0	0	114	59	9
43	8	16	51	189	62	36	7	0	345	0	0	0	0	51	189	62	43
37	11	13	5	88	148	119	10	0	0	370	0	0	5	88	148	119	10
32	7	9	0	32	66	204	54	0	0	0	356	0	32	66	204	54	0
11	2	2	0	1	6	19	22	0	0	0	0	48	7	19	22	0	0
1	2	2	5	33	6	0	0	0	0	5	32	7	44	0	0	0	0
24	2	8	51	88	66	19	0	0	51	88	66	19	0	224	0	0	0
89	18	23	114	189	148	204	22	114	189	148	204	22	0	0	677	0	0
41	9	6	0	59	62	119	54	59	62	119	54	0	0	0	0	294	0
6	5	1	0	0	3	42	17	9	43	10	0	0	0	0	0	0	62

3 | RESULTS

3.1 | The gender differences in TD

The case group with 549 males (83.18%) and 111 females (16.82%) had a male-to-female ratio of 4.94:1 (Table 1). In the control healthy group, there were 309 males (48.20%) and 332 females (51.80%) and the ratio was 0.93:1. Chi-square test was used for the evaluation of gender differences in two groups $\chi^2 = 177.14$, $p < .001$. The gender difference in the two groups was related to that in the incidence of TD (Yang et al., 2016), which was similar to that reported in the literature (Albin, 2018).

TABLE 3 Contingency coefficient between variables

	Group	Age group	Family structure	Gender	Home environment	The noly child or not	Couple relationship	Fathers' educational level	Mothers' educatioal level	Difference in parents' educational level
Group	—	C = 0.008 p = .956	C = 0.125 p < .001	C = 0.346 p < .001	C = 0.097 p = .002	C = 0.052 p = .058	C = 0.184 p < .001	C = 0.219 p < .001	C = 0.218 p < .001	C = 0.190 p < .001
Age group	C = 0.008 p = .956	—	C = 0.078 p = .091	C = 0.089 p = .005	C = 0.034 p = .819	C = 0.020 p = .773	C = 0.060 p = .576	C = 0.079 p = .414	C = 0.085 p = .310	C = 0.076 p = .486
Family structure	C = 0.125 p < .001	C = 0.078 p = .091	—	C = 0.083 p = .011	C = 0.089 p = .036	C = 0.101 p = .001	C = 0.444 p < .001	C = 0.155 p < .001	C = 0.175 p < .001	C = 0.148 p < .001
Gender	C = 0.346 p < .001	C = 0.089 p = .005	C = 0.083 p = .011	—	C = 0.125 p < .001	C = 0.071 p = .010	C = 0.134 p < .001	C = 0.173 p < .001	C = 0.177 p < .001	C = 0.119 p = .001
Home environment	C = 0.097 p = .002	C = 0.034 p = .819	C = 0.089 p = .036	C = 0.125 p < .001	—	C = 0.072 p = .033	C = 0.272 p < .001	C = 0.187 p < .001	C = 0.196 p < .001	C = 0.103 p = .083
Single child or not	C = 0.052 p = .058	C = 0.020 p = .773	C = 0.101 p = .001	C = 0.071 p = .010	C = 0.072 p = .033	—	C = 0.083 p = .028	C = 0.162 p < .001	C = 0.236 p < .001	C = 0.124 p < .001
Couple relationship	C = 0.184 p < .001	C = 0.060 p = .576	C = 0.444 p < .001	C = 0.134 p < .001	C = 0.272 p < .001	C = 0.083 p = .028	—	C = 0.133 p = .025	C = 0.163 p < .001	C = 0.117 p = .117
Fathers' educational level	C = 0.219 p < .001	C = 0.079 p = .414	C = 0.155 p < .001	C = 0.173 p < .001	C = 0.187 p < .001	C = 0.162 p < .001	C = 0.133 p = .025	—	C = 0.664 p < .001	C = 0.468 p < .001
Mothers' educational level	C = 0.218 p < .001	C = 0.085 p = .310	C = 0.175 p < .001	C = 0.177 p < .001	C = 0.196 p < .001	C = 0.236 p < .001	C = 0.163 p < .001	C = 0.664 p < .001	—	C = 0.406 p < .001
Difference in parents' educational level	C = 0.190 p < .001	C = 0.076 p = .486	C = 0.148 p < .001	C = 0.119 p = .001	C = 0.103 p = .083	C = 0.124 p < .001	C = 0.117 p = .117	C = 0.468 p < .001	C = 0.406 p < .001	—

3.2 | Cross frequency and contingency coefficient analysis

The relationships between TD and gender, family structure ($C = 0.125$, $p < .001$), home environment ($C = 0.097$, $p = .002$), couple relationship ($C = 0.184$, $p < .001$), fathers' educational level ($C = 0.219$, $p < .001$), and mothers' educational level ($C = 0.218$, $p < .001$) are shown in Tables 2 and 3. The relationship of TD and parents' educational level ($C = 0.190$, $p < .001$) was weak, with a modest association with gender ($C = 0.346$, $p < .001$), as mentioned above that the ratio of males to females was 4.94:1 in the case group and 0.93:1 in the control group. Family structure had a strong association with couple relationship ($C = 0.444$, $p < .001$) and harmonious couples were more inclined to build nuclear families and unite families. The level of education was an important reference at the time of mate selection, as suggested in the research that there was a high degree of correlation between parents' educational attainment ($C = 0.664$, $p < .001$). Most parents had a comparable level of education. Compared with women, men were more likely to accept female partners with lower level of education than theirs shown in cell frequency in Table 2.

3.3 | Regression of binary logistic analysis

Regression of binary logistic analyses (BLA) was used to analyze the association between 'Group' and other variables including gender and age. According to the results (Table 4; Figure 2), we found that the gender, family structure, and couple relationship could influence the onset of tic with statistically significant ($p < .01$). Boys had a higher risk of TD than girls (Exp B = 0.194, $p < .001$, 95% CI = 0.149–0.254). Compared with unite family, children living in nuclear families were more susceptible to the illness (Exp B = 0.668, $p = .001$, 95% CI = 0.526–0.847). The harmonious relationship between parents was a significant protective factor, making children away from the tic (Exp B = 1.310, $p = .006$, 95% CI = 1.080–1.590). The relationship between group, family structure, family environment, and gender was the inertia 0.752 analyzed by MCA(Figure 3).

3.4 | Analysis of a ray and its' reverse extension from the origin to the case and vertical lines from other points to the line

A ray and its' reverse extension from the origin to the case and vertical lines from other points to the line were made. The distance between the origin and the feet corresponds to relationship between the factors and the occurrence of TD. The negative sign represents the protective factor and the positive sign represents the risk factor (Figure 3; Table 5). We found that the case group was more likely to include boys who lived in the common family environment (A1), while the control group was more likely to be girls in a united family (A2). In addition, the divorce of spouses was an important factor leading to abnormal family structure (A3). The hostile relationship between parents would greatly increase the risk of children suffering from TD. All the conclusions above can be considered statistically significant because the A1, A2, and A3 regions distributed in different quadrants. The distance, common and hostile condition in couple relationship, unusual and nuclear family structure, could increase probability of TD, especially boys.

3.5 | The OR value increased with the number and level of risk factors

We selected the population that meet all protective factors from the database and remove the protections in order according to the distances in Table 5, and then increase the risk factor conditions. The proportions of the case and the control in those population constructed was calculated (Figure 4). Levels from 1 to 9 represent the increase in the number of risk factors and their levels. Level 1 present all protective factors and Level 9 present all risk factors. We compared all observations as controls with the constructed population and calculated the OR value (Table 6). As the number and level of risk factors increased, the proportion of patients with TD in the selected population and OR value gradually increases (Figure 3).

4 | DISCUSSION

In this study, we found that gender, couple relationship, and family structure could play important roles in TD. Boys, unusual or unclear families and bad couple relationship are risks for TD. What's more, we constructed populations according to the risks and compared them with the population included all categories (all data) to calculated the OR value. With the gradual increase in risk, the OR value gradually increases, which gives us significant advice for the prevention of tics and primary care (Mills & Hedderly, 2014; Steeves et al., 2012; Verdellen, van de Griendt, Hartmann, & Murphy, 2011).

It has been reported that the range of male preponderance varies between 1.6 and 10:1 (Tanner & Goldman, 1997), and is even more pronounced in youth 5.2:1 (Freeman et al., 2000). Existing evidence demonstrates intriguing ratios of 3:1 between males and females in TD (Robertson, 2012), explaining the imbalance of gender in the study. Authors suggest that the prenatal androgen related masculinization might account for this difference (Peterson et al., 1992). The others attributed that to the increased masculine play preferences in both males and females (Alexander & Peterson, 2004). From

TABLE 4 Comparison of variables between the case and the control

Factors description		Group		wald χ^2	Exp B	p	95% CI
		Control	Case				
Gender	Boys	309	549	144.193	0.194	<.001	0.149 ~ 0.254
	Girls	332	111				
Age group	6 ~ 7	356	364	1.069	0.918	.301	0.781 ~ 1.080
	8 ~ 9	185	189				
	10 ~ 12	100	107				
Family structure	Unconventional family	11	21	11.098	0.668	.001	0.526 ~ 0.847
	Nuclear family	365	443				
	Unite family	265	196				
Home environment	Quiet	504	471	0.845	1.074	.358	0.922 ~ 1.252
	Commonly	19	41				
	Noisy	118	148				
Single child or not	Single child	572	566	0.503	0.872	.478	0.597 ~ 1.273
	Not single child	69	94				
Education level of father	Compulsory education	44	126	0.092	1.238	.761	0.312 ~ 4.921
	Non compulsory secondary education	215	154				
	Junior college	168	117				
	Bachelor degree	166	218				
	Graduate degree	48	45				
Education level of mother	Compulsory education	45	137	0.358	0.656	.549	0.165 ~ 2.608
	Non compulsory secondary education	158	187				
	Junior college	221	149				
	Bachelor degree	191	165				
	Graduate degree	26	22				
Different of parents' education level	F«M	32	12	0.033	1.141	.855	0.276 ~ 4.711
	F < M	147	77				
	F = M	307	370				
	F > M	137	157				
	F»M	18	44				
Couple relationship	Harmonious	565	499	7.478	1.310	.006	1.080 ~ 1.590
	Commonly	50	111				
	Hostile	5	31				
	Divorce	21	19				

the Figure 2, we found that gender was related to the couple relationship and family structure. Parents with girls could be more likely to construct unite families while boys' parents tend to construct the nuclear families. Another interesting finding is that boys could be related to the inharmonious couple relationship. According to the results, gender difference could impact on the family factors which can affect the development of TD.

Family-related environmental factors may play a role in the development or exacerbation of TDs (Hong et al., 2013).

Starkweather and Keith (2018) thought it might account for more variation in some children's outcomes than expected, relative to genetics. As professor Waldinger and Schulz (2016) concluded, the warmth of family environment in childhood predicts the quality of health in the long reach of nurturing family environments. Couple relationship influence not only physical health but also the mental health of children. Tai Young Park (2013) reported that marital conflict became the primary factor of the child's TD and the family therapist usually tried to solve the TD problem

FIGURE 2 Forest plot of logistic analyses

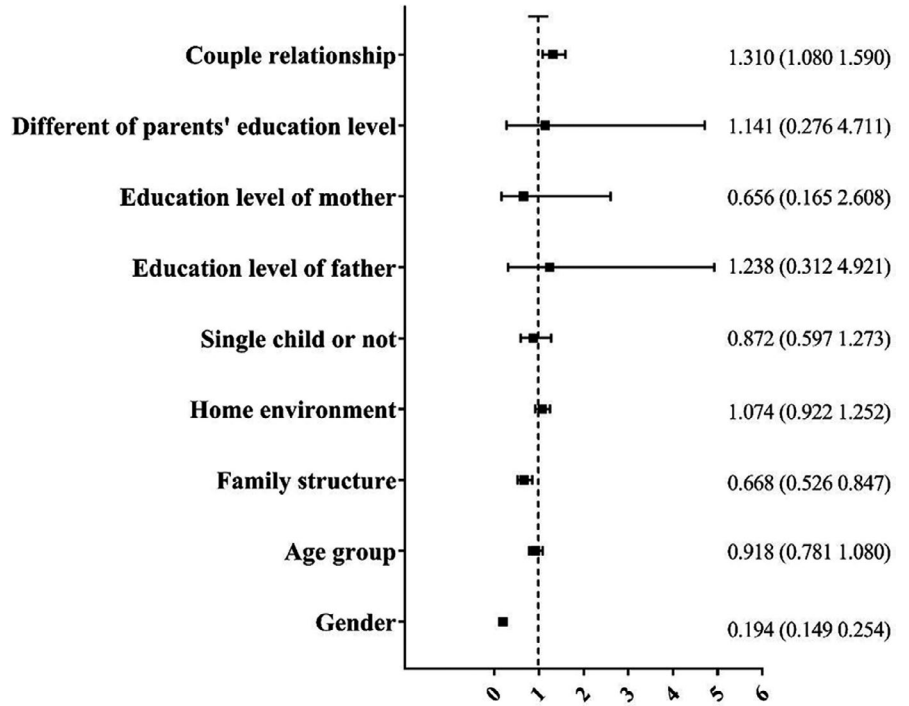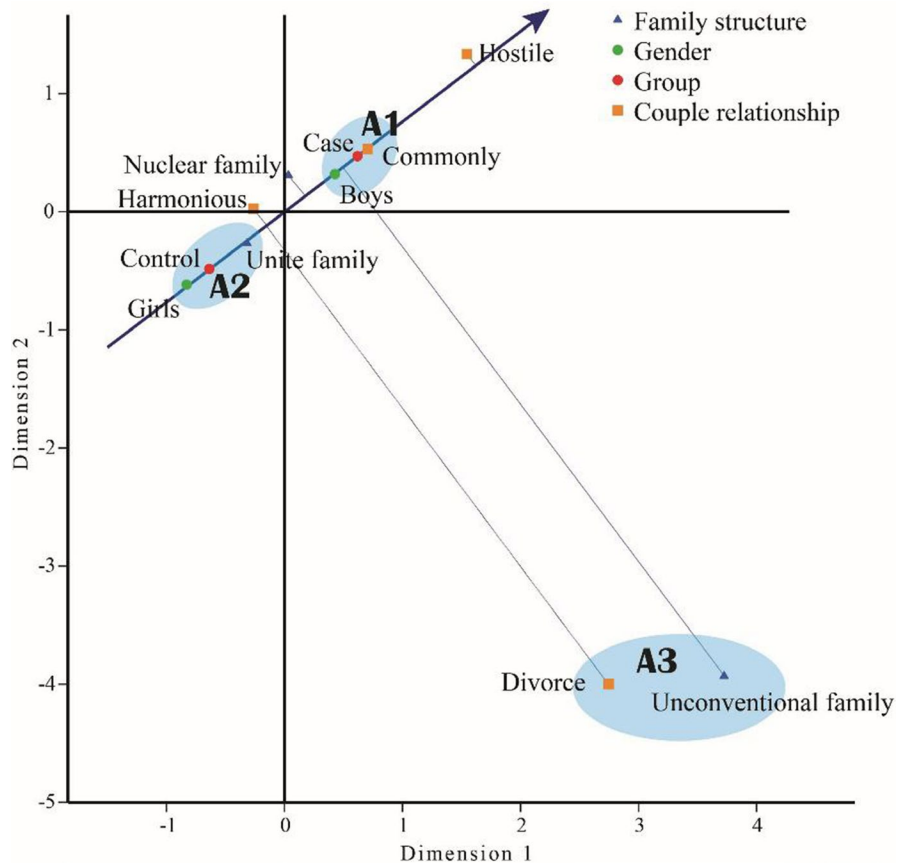|	
Couple relationship	1.310 (1.080 1.590)
Different of parents' education level	1.141 (0.276 4.711)
Education level of mother	0.656 (0.165 2.608)
Education level of father	1.238 (0.312 4.921)
Single child or not	0.872 (0.597 1.273)
Home environment	1.074 (0.922 1.252)
Family structure	0.668 (0.526 0.847)
Age group	0.918 (0.781 1.080)
Gender	0.194 (0.149 0.254)

FIGURE 3 Unite plot of category points

based on MRI's communication theory and Bowen's family systems theory. Storch et al. (2017) have studied family accommodation in children and adolescents with TD. They found that accommodation was not associated with tic severity, but was related to higher levels of anxiety, depressive symptoms, externalizing symptoms, aggression, and rule breaking behaviors (Storch et al., 2017). Other researches' results suggest that the emotional symptoms, such as anxiety

| Category	Coordinate of category		Coordinate of foot point		
	Dim 1	Dim 2	Dim 1	Dim 2	Distance
Group					
Control	−0.637	−0.484	−0.637	−0.484	−0.800
Case	0.619	0.470	0.619	0.470	0.777
Family structure					
Unconventional family	3.725	−3.933	0.469	0.356	0.589
Nuclear family	0.033	0.309	0.170	0.129	0.213
Unite family	−0.316	−0.268	−0.330	−0.250	−0.414
Couple relationship					
Harmonious	−0.262	0.025	−0.154	−0.117	−0.194
Commonly	0.705	0.530	0.703	0.533	0.882
Hostile	1.545	1.336	1.624	1.232	2.038
Divorce	2.748	−4.000	−0.183	−0.139	−0.229
Gender					
Boys	0.428	0.319	0.425	0.323	0.534
Girls	−0.829	−0.617	−0.823	−0.625	−1.033
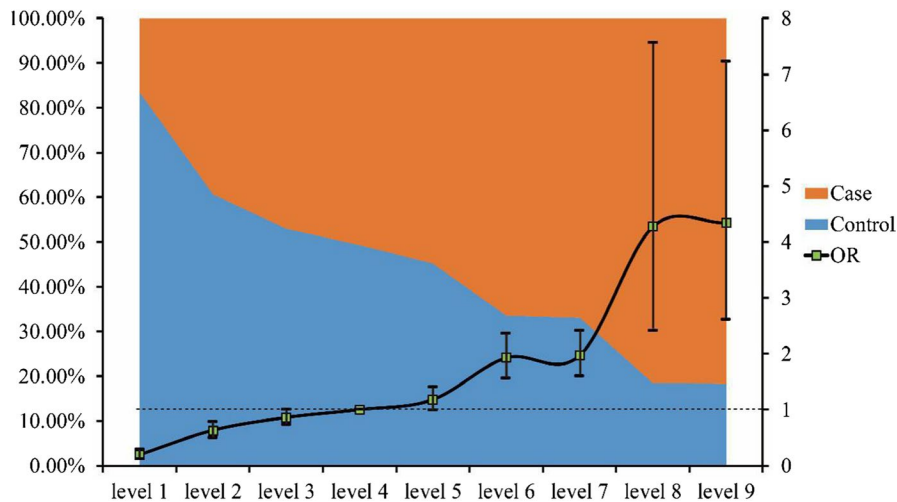
FIGURE 4 The risk of superimposed factors

(Coffey et al., 2000), are more likely to drive the TS. In this study, family structure and couple relationship were determined as important factors for TD.

Nuclear family, stem family, and unite family are common structure in China while the others considered as the unusual. On the other side, the stem and unite family could be thought as the combination of nuclear families that should be divided into the same category. Nuclear family could be dangerous for children to develop into TD. The change in family structure may impact on family members' mental health, and the internal quality of role (family function) might be the key factor (Cheng et al., 2017). The influence of family structure on children has been reported. (Troxel, Lee, Hall, & Matthews, 2014). The order of family structure related to TD was unconventional family, nuclear family, and unite family.

Mental health assessment would consider various contextual factors, from the individual to the relational and environmental. The parental couple is an important influence factor that related to child and adolescent mental health (Karamat, 2015). We found that divorced parents had the same protective effect as the harmonious while the hostile could be risk for children. Kelly (1998) thought that children living in marriages with frequent and intense conflict are significantly more likely to have substantial mental problems before parental divorce and had a bad relationship with parents (Kelly, 1998). These findings suggest that the deleterious effects of divorce have been overstated, with insufficient attention paid in the clinical and research literature of the damaging effects of highly troubled marriages on children's adjustment.

TABLE 6 Proportions of case in constructed population

Level	Family structure 1	2	3	Couple relationship 1	2	3	4	Gender 1	2	Case (%)	Control (%)	N	OR	χ^2	p
1	○	○	●	●	○	○	●	○	●	16.46	83.54	164	0.191 (0.125 ~ 0.293)	68.670	<.0001
2	○	○	●	●	○	○	●	●	●	39.34	60.66	394	0.630 (0.501 ~ 0.792)	15.717	<.0001
3	●	●	●	●	○	○	●	●	●	46.92	53.08	1,104	0.859 (0.731 ~ 1.008)	3.469	.063
4	●	●	●	●	●	●	●	●	●	50.73	49.27	1,301	—	—	—
5	○	●	○	●	●	●	●	●	●	54.83	45.17	808	1.179 (0.988 ~ 1.406)	3.353	.067
6	○	●	○	●	●	●	○	●	○	66.48	33.52	549	1.927 (1.565 ~ 2.372)	38.783	<.0001
7	●	●	○	●	●	●	○	●	○	66.96	33.04	575	1.968 (1.603 ~ 2.416)	42.550	<.0001
8	●	●	○	○	●	○	○	●	○	81.48	18.52	81	4.273 (2.414 ~ 7.564)	28.917	<.0001
9	●	●	○	○	●	●	○	●	○	81.73	18.27	104	4.345 (2.611 ~ 7.229)	37.156	<.0001

Note: Family structure: 1 = Unconventional family, 2 = Nuclear family, 3 = Unite family; Couple relationship: 1 = Harmonious, 2 = Commonly, 3 = Hostile, 4 = Divorce; Gender: 1 = Boys, 2 = Girls; ●: The category was included in the population.

Taken together, couple relationship and family structure could influence not only physical health but also the mental health of the children. Unconventional and nuclear family, as well as hostile parents were risk for children to develop TD. The superimposition of those factors can increase the risk of TD. This study suggests that parents should try to construct a harmonious couple relationship for the health of their children.

AUTHOR CONTRIBUTION
Pengcheng Zhu: Study concepts; Min Wu: Study design; Pengcheng Zhu: Definition of intellectual content; Pengcheng Zhu: Literature research; Xiaoyi Ji: Clinical studies; Xiaoyi Ji: Data acquisition; Pengcheng Zhu, Pinxian Huang: Data analysis; Pengcheng Zhu, Pinxian Huang: Statistical analysis; Pengcheng Zhu: Manuscript preparation; Xin Zhao: Manuscript editing; Min Wu: Manuscript review.

DATA AVAILABILITY STATEMENT
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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