

Original article

Thai parental perception of the etiology of autism spectrum disorders with an emphasis on genetics

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Background: More than 90% of cases of autism spectrum disorders (ASDs) are idiopathic and are multi-factorial inheritant in etiology. Although parental perceptions of ASDs etiologies including genetics have been investigated well in western countries, there is no study regarding Asian parental perspectives on the genetic etiology of ASDs.

Objectives: Examine what Thai parents perceived to be the etiology of ASDs with particular focus on the role of genetics, and analyze the correlation between demographics of parents and the perception of genetics as an etiology of ASDs.

Methods: Children diagnosed with an ASD at Ramathibodi Hospital were recruited, and 328 questionnaires were mailed to their parents between February 1 and March 31, 2008. Based on 252 answers received, the perception of genetics as an etiology of ASDs was evaluated using univariate and multivariate analysis.

Results: Among 252 parents, 44.0% cited genetics, 52% cited other prenatal and perinatal factors such as stress and chemical exposure during pregnancy, 33% cited postnatal factors such as child rearing, child's viewing of television, and playing computer game as etiologies of ASDs. Parents' education, positive family history of ASDs, and positive family history of speech delay were all significantly associated with the perception of genetics as an etiology of ASDs.

Conclusions: Less than half of Thai parents cited genetics as an etiology of ASDs. This finding alerts medical professionals to spend more time and effort to educate and counsel parents.

Keywords: Autism spectrum disorders, etiology, genetics, multi-factorial, parental perception, Thai

Autism spectrum disorders (ASDs) are neuro-developmental disorders. These are characterized by three core impairments, social interaction, communication, and restricted repetitive and stereotyped patterns of behavior. ASDs comprise autistic disorder, Asperger syndrome, and pervasive developmental disorder [1-3].

The exact etiological factors predisposing a child to ASDs are not understood fully. Only 10% of cases

can be pinpointed with the clear genetic etiology such as syndromes, chromosomal abnormalities, and single gene disorders [4-6]. Important syndromes with an autism component include tuberous sclerosis and fragile X syndrome. Chromosomal disorders such as duplication of chromosomal region 15q and single gene disorders such as phosphatase and tensin homolog (PTEN) gene and Methyl-CPG-Binding Protein 2 (MECP2) mutation are also associated with ASDs [4, 7, 8]. Once these genetic conditions are excluded, an individual with autism is considered to have idiopathic autism, which contributes to the majority of cases.

Recent studies support that idiopathic ASDs are multi-factorial inheritor in etiology with a variety of

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genetics and/or environmental factors [4, 9, 10]. The recurrence rate in sibling of affected children is between two and eight per hundred [4, 5, 10]. This is much higher than the prevalence rate in general population [11-13] but much lower than in single-gene diseases [5]. Twin studies revealed that idiopathic ASDs are heritable, since the concordance is much higher in monozygotic twins than dizygotic pairs (60-92% vs. 0-10%) [5, 14, 15]. Moreover, data from whole-genome screens in multiplex families also suggested interactions of at least 10 genes is the causation of autism [5].

The expression of the autism gene(s) may be influenced by environmental factors as well [9]. Theories purporting environmental etiologies have been raised including prenatal and perinatal factors [16-19]. Nevertheless, no single finding factor among these studies was consistently associated with ASDs. Furthermore, postnatal factors such as childhood vaccinations were also considered as an etiology [20]. However, in the case of the MMR vaccine, it has finally been excluded as a likely etiology [9, 21-23].

Since the etiology of autism is complex with genetics, medical professionals have to educate parents of what the current findings of the causes are. Prior to beginning an educational effort, we should assess parents' perceptions of the etiology of ASD, especially in genetic issue to educate them effectively.

Many researchers have investigated the beliefs/perceptions of parents regarding the possible etiologies of ASDs including genetics. These studies showed that 26-91% of parents perceived genetics as an etiology [24-29]. Besides genetics, they also reported parents' perception of other causes such as pregnancy and delivery problems, environmental exposure, childhood illnesses, and vaccinations [24-29]. However, all of these studies were conducted in western countries. Based on socio-cultural difference, Asian parents probably had some different perceptions from that of western parents. In this study, we examined what Thai parents perceived to be the etiology of ASDs with particular focus on the role of genetics, and analyzed the correlation between demographics of parents and the perception of genetics as an etiology of ASDs.

Methods

This study was approved by the Ethics Committee, Ramathibodi Hospital, Mahidol University. This study was conducted between February 1 and March 31,

2008. Participants consisted of parents with at least a child diagnosed with an ASD without known etiology recruited from the Child Development Clinic and the Child and Adolescent Psychiatric Clinic at Ramathibodi Hospital. Three hundred twenty eight families were contacted by mail for an invitation to participate in this study. One set of questionnaire was mailed out to each family. The families were asked to return them back within two weeks. Two hundred and fifty two questionnaires were completed and posted back during the study period.

The questionnaire consisted of demographics and parents' perception of the etiology of ASDs. The parents were asked about demographic data through a series of fill-in-the-blank and multiple choice questions. They were asked to indicate their perceptions about the etiology of ASDs using a checklist (more than one response possible) of commonly reported factors in previous studies [24, 26-28]. A space was also provided for parents to indicate their perceptions that were not noted in the checklist.

Statistical analysis

Descriptive analysis was performed to describe parents' demographics and perception of the etiologies of ASDs. Univariate analysis, Pearson's Chi-square test or Fisher's exact test, were used to find the correlation between parents' demographics and the perception of genetics as an etiology of ASDs. We performed a multivariate analysis with binary logistic regression to determine independent demographics associated with this perception.

Results

Of the 252 parents, 79% were mothers, 95% were at least 30 years old, 52% graduated with a bachelor degree or higher, and 44% earned a monthly household income of over 30,000 Thai Baht. The mean age of their affected child was 8.51 years ($SD = 3.69$), and most were male (88%). One-fifth of these families had one or more other family members with ASDs and one-third had family history of speech delay.

For the etiology of ASDs, more than one choice was allowed. However, 50% of parents provided only one answer while the rest provided a combination of responses. All of the parents' responses were grouped and summarized in **Fig. 1**. Details of each group were described below.

Genetics

Fig. 1 shows that genetics were perceived to be an etiology of ASDs by 44% of the parents. Of these parents, most of them (81%) indicated that their understanding of the role of genetics in ASDs to be a person with autistic genes may or may not exhibit an ASD, and the presentation of ASDs depends on a combination of genetic and environmental factors. Interestingly, 6% of parents indicated that a person with autistic genes always exhibit clinical presentation. The remaining (13%) answered that they were not sure how genetics play a role in ASDs.

Prenatal and perinatal factors

As shown in **Fig. 1**, 52% of parents perceived prenatal and perinatal factors to be etiologies of ASDs, including stress during pregnancy, chemical exposure, diet, infection during pregnancy, and complications during birth.

Postnatal factors

In **Fig. 1**, 33% of parents perceived postnatal factors to be etiologies of ASDs, including child rearing,

child's viewing of television and playing computer games, childhood vaccinations. In addition, a majority of parents who cited child rearing as an etiology of ASDs shared the same views. They provided their written comments that "inadequate interaction between children and caregivers" or "not enough interaction between children and people outside the household" were child-rearing patterns that caused ASDs.

Unknown etiology

Although many parents believed there was an underlying etiology of ASDs, 23% of parents perceived that there was still unknown etiology of ASDs.

Table 1 and **2** show the results of univariate analysis and logistic regression analysis, respectively. Based on these analyses, parents' education, positive family history of ASDs, and positive family history of speech delay were all significantly associated with the perception of genetics as an etiology of ASDs. Other demographics such as parents' gender, age, and household income were not found to be associated factors.

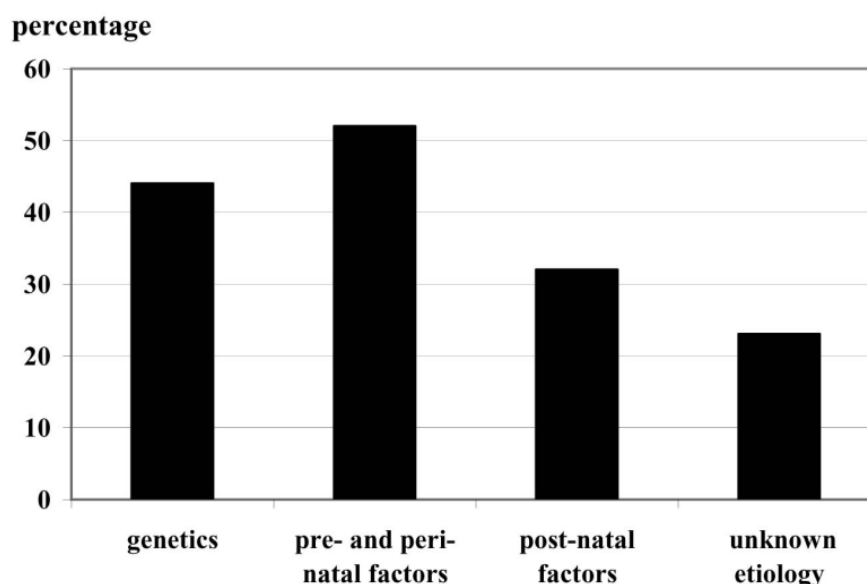


Fig. 1 Parental perceptions of ASDs etiologies (n=252). Note that the sum of total percentages is more than 100 because many parents endorsed multiple etiologies.

Table 1. Univariate association between parents' demographics and the perception of genetics as an etiology of ASDs.

Variables	Perceived genetics as an etiology of ASDs		P-value	Odds ratio (95% CI)
	Yes (n=111)	No (n=141)		
Parents' gender				
Male	21	33	0.39	0.76 (0.41-1.14)
Female	90	108		1.00
Parents' age (year)				
> 39	60	83	0.82	0.87 (0.25-2.98)
30-39	46	52	0.93	1.06 (0.30-3.71)
20-29	5	6		1.00
Parents' education				
Bachelor's degree or higher	64	68	0.01*	2.53 (1.23-5.22)
High school	34	38	0.03*	2.41 (1.10-5.30)
Junior high school or lower	13	35		1.00
Household income (Baht/month)				
≥ 30,000	53	58	0.27	1.33 (0.81-2.20)
< 30,000	57	83		1.00
Affected children's gender				
Male	95	127	0.28	0.66 (0.31-1.41)
Female	16	14		1.00
Affected children's age (year)				
> 15	8	5	0.34	0.56 (0.17-1.87)
10-15	26	38	0.46	1.30 (0.65-2.59)
6-10	45	62	0.52	1.22 (0.66-2.26)
0-5	32	36		1.00
Positive family history of ASDs				
Yes	41	9	0.00*	8.59 (3.95-18.69)
No	70	132		1.00
Positive family history of speech delay				
Yes	57	33	0.00*	3.46 (2.02-5.92)
No	54	108		1.00

Note: Average household income/month in Bangkok was 33,088 Baht, 33 Baht = 1 US \$ (December 26, 2009).

Table 2. Logistic regression analysis to determine independent factors associated with parents' perception of genetics as an etiology of ASDs.

Variables	Perception of genetics as an etiology of ASDs	
	P-value	Adjusted odds ratio (95% CI)
Parents' highest level of education		
Bachelor's degree or higher	0.04*	2.22 (1.01-4.91)
High school	0.08	2.19 (0.92-5.18)
Junior high school or lower	0.12	
Positive family history of ASDs	0.00*	6.09 (2.67-13.89)
Positive family history of speech delay	0.03*	2.00 (1.09-3.69)

Discussion

In the present study, less than half of the parents perceived that genetics was an etiology of ASDs. This number was less than the finding in most recent

studies (73-91%) [26-29]. However, 81% of parents perceived that genetics was an etiology and understood the role of genetics in ASDs with multi-factorial inheritance. Current scientific theory described the

concept of multi-factorial inheritance diseases as diseases caused by simultaneous action of multiple genetics and/or environmental factors [30]. This may imply that once parents had the perception of genetic etiology of ASDs, they had a tendency to understand the underlying multi-factorial inheritance.

Other prenatal, perinatal, and postnatal factors have less evidence to support their causality as etiologies of ASDs [9]. Despite less supportive evidence, parents in this and previous studies still cited these prenatal, perinatal, and postnatal factors as contributing factors of ASDs [24-26, 28].

Regarding prenatal and perinatal factors, stress, chemical exposure, diet, infection during pregnancy, and complications during birth were cited as etiologies of ASDs. Although concerns have been raised about the effects of toxic chemical exposure on brain development in ASDs, it remains unclear whether any specific exposures have substantive impact on ASDs [31]. As far as rubella infection during pregnancy is concerned to be an etiology in the minority of cases [9], a portion of Thai parents believed that nonspecific types of infection during pregnancy might significantly affect their child's condition. In relation to birth complications, several studies suggested that there was a higher rate of birth complication in children later diagnosed with ASDs than in general population [17-19]. However, some recent studies hypothesized that the increased prevalence of obstetric complications among these children was most likely due to the underlying genetic factors or an interaction of genetics and the environment [17, 32]. While western parents believed childhood diet to be an etiology of ASDs, Thai parents cited diet during pregnancy as an etiology. Even though some dietary treatment such as casein- and gluten-free diet led to improvement in some children with ASDs, the evidence of dietary as an etiology or treatment in ASDs is still inconclusive at this time [33, 34]. Interestingly, stress during pregnancy was concerned by the majority of Thai parents who cited prenatal and perinatal factors as the etiologies, but it was neither supported by any current scientific researches nor concerned by parents in western societies.

Differences in perceptions between Thai and western parents continued into postnatal factors. Parents in this study frequently cited child rearing, viewing of television, and playing computer games as postnatal etiologies. However, these have never been reported previously. Many parents in this study still

perceived that child rearing was an etiology of this condition. We raised concern that this perception might lead to parents' guilt and cause adverse effects on the parent-child relationship. Surprisingly, vaccinations, which once were strongly believed as possible causes of ASDs [24, 26, 27], only 4% of parents in this study cited vaccinations as the contributing cause. The less concern among Thai parents might be explained because they possessed information that MMR vaccine had already been excluded as a likely etiology [9, 21, 23], or they were less aware about the adverse effects of vaccines. In fact, it had not been widely publicized in Thailand that the MMR vaccine probably caused ASDs.

For factors associated with the perception of genetics as an etiology of ASDs, parents' education, positive family history of ASDs, and positive family history of speech delay were significantly associated factors. This association might be due to parents with higher educational levels that enables to access and understand information from scientific researches. The role of genetics as an etiology for ASDs was more pronounced when parents perceived ASDs as "running in the family". Furthermore, since family history of speech delay was closely related to family history of ASDs as one part of the presentation of ASDs, all three of these associations greatly affected parental perception of the genetic etiology. However, family history of ASDs had the most significant association for their understanding. When a child is diagnosed with an ASD, parents with low educational level and no family history of both ASDs and speech delay probably need more clarification to understand the genetic etiology of ASDs.

There were two limitations for our study. First, all of the children with ASDs were from only one hospital. Thus, this population may not accurately represent the entire population of ASDs cases. Second, a majority of parents who responded the questionnaire were mothers. Thus, most of the perceptions represent maternal perspectives, which may have overshadowed paternal perspectives. However, statistical analysis proved no difference in perceptions between fathers and mothers in all etiologies reported in this study.

Conclusion

Most parents in this study cited one or more etiologies to explain an ASD in their child but less than half, mentioned genetics as an etiology. Our findings offer medical professionals a raised awareness of what

Thai parents perceived to be the etiology of ASDs. It also alert medical professionals to spend more time and effort to educate and counsel parents, especially those parents with relatively low educational background, without family history of ASDs, or conditions associated with ASDs such as speech delay.

Acknowledgements

We thank Drs. Pim Suwannarat, Jariya Chuthapisith, and Mahipathorn Chinnapha for their editing this manuscript, Drs. Duangrudee Wattanasirichaigoon and Chusak Okascharoen for their valuable discussion, and Ms. Umaporn Udomsubpayakul for her advice of statistical analysis. The authors have no conflict of interest to report.

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