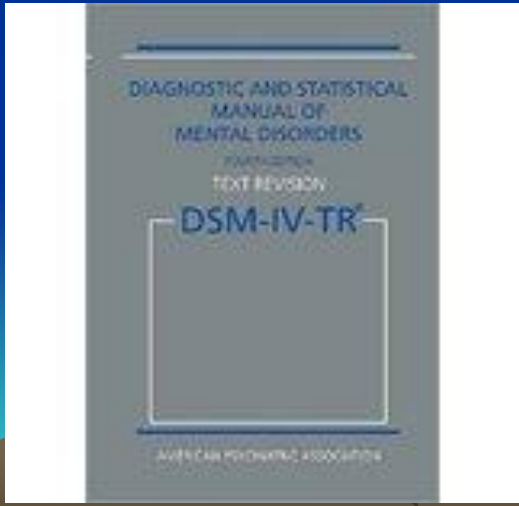
A Pair-Matched Case Control Study of Family-Environmental Factors Associated with ADHD in Chinese Children

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Attention Deficit Hyperactivity Disorder (ADHD)





A persistent pattern of inattention and/or hyperactivity impulsivity that interferes with functioning or development.

Six or more symptoms present

- before age of 7 (DSM-IV, 2000)
- before age of 12 (DSM-5, 2013)

persist at least 6 months

significant impairment in 2 settings

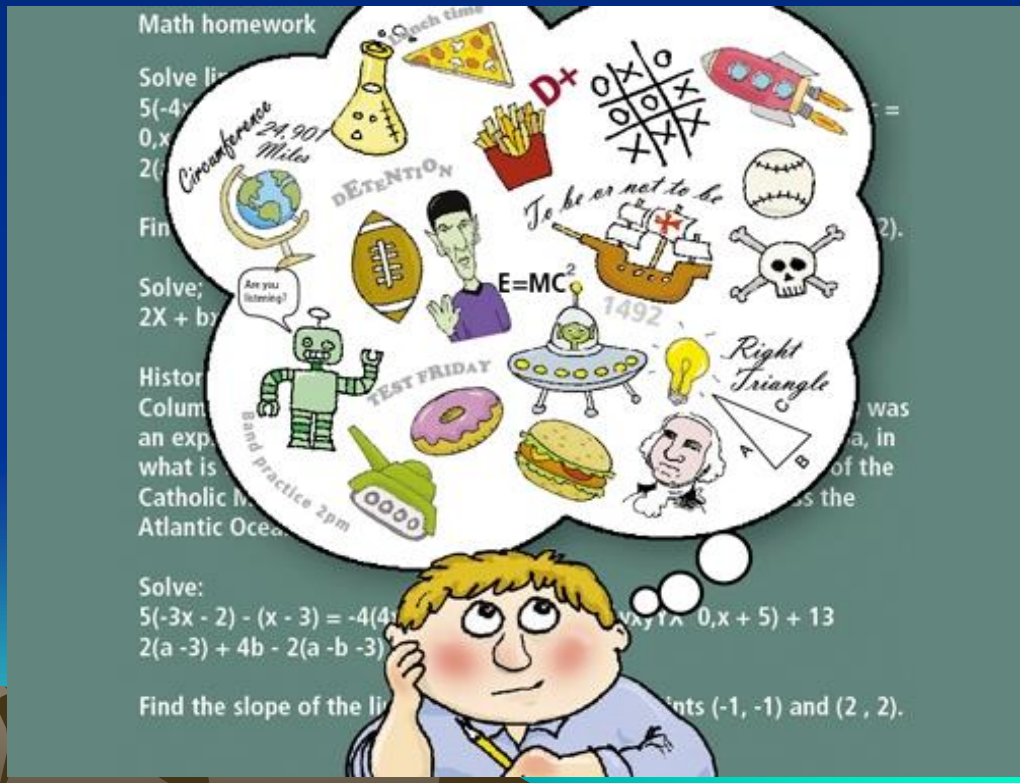
not occur during schizophrenia or another mental disorder

ADHD - 3 subtypes:

1. Inattentive type
2. Hyperactive-impulsive type
3. Combined type







From ADHD Kid to Olympic Gold Medalist

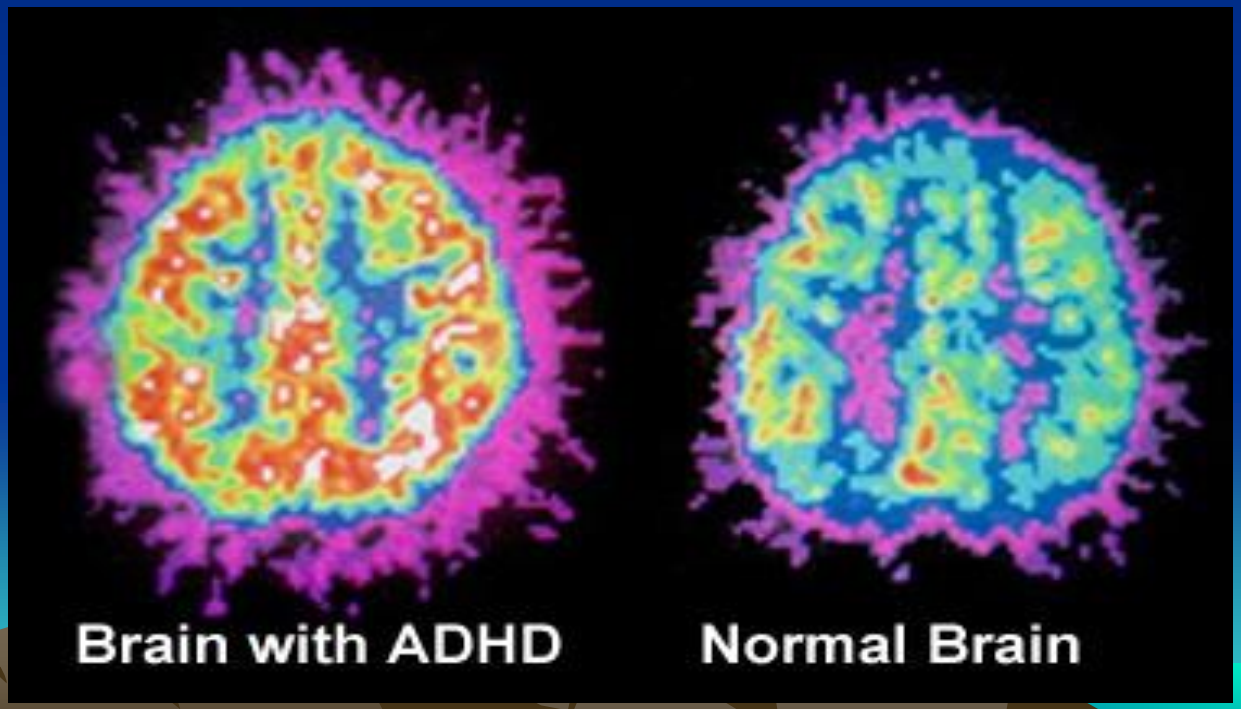
Michael Phelps

- 31 years old American swimmer
- Diagnosed with ADHD at age 9
- Finished his career with 23 gold medals and 28 overall



Causes of ADHD

- ADHD is caused by developmental differences in the brain that affect the areas controlling attention, concentration, impulsivity, activity levels and memory.
- ADHD persists into adulthood in about 30–50% of cases.



Factors associated with ADHD

- Genetic factors
- Environmental factors
- Social factors

<u>Family structure</u>

- Single child family
- Single parent/step-parent

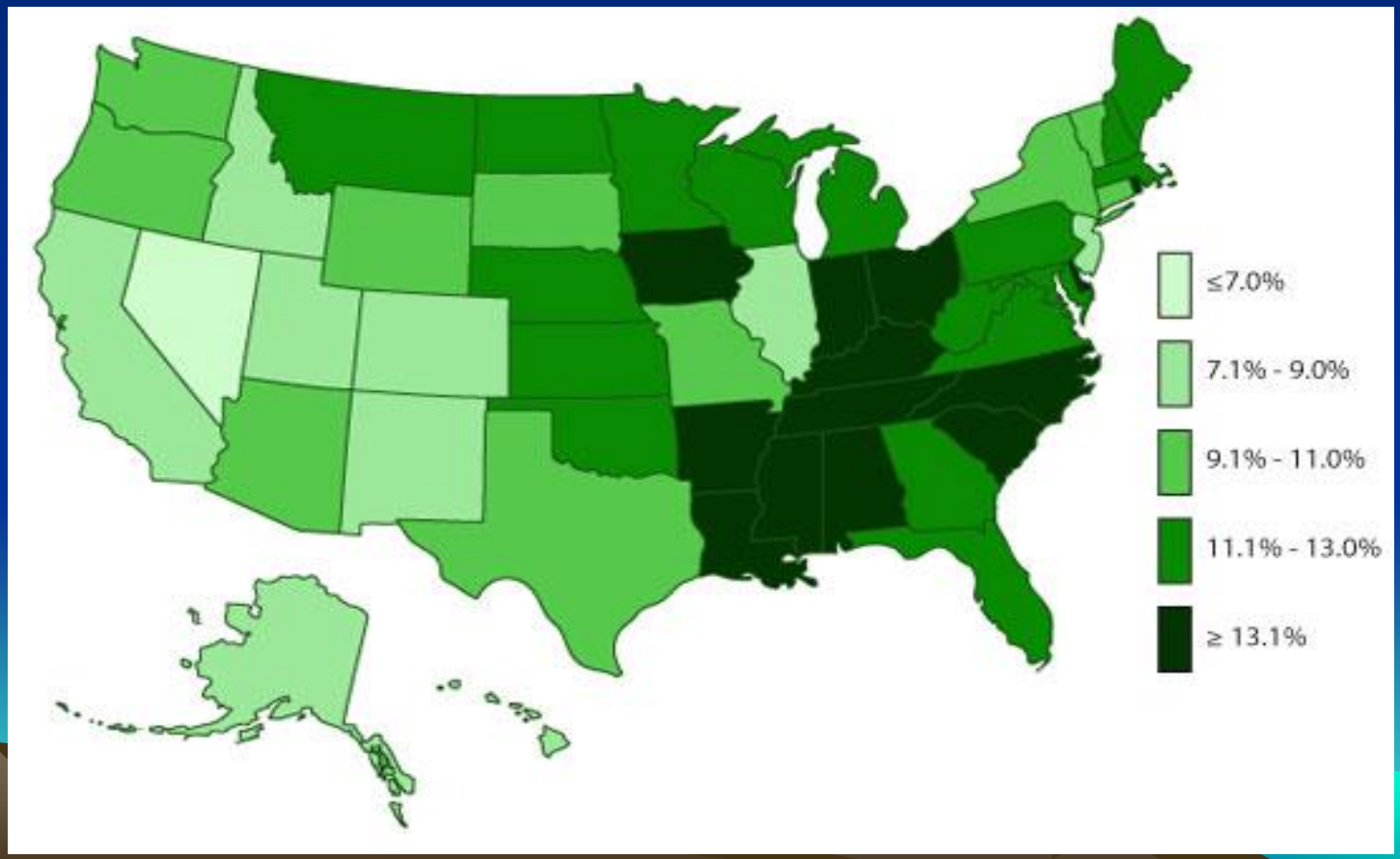
<u>Family environment</u>

- Parental relationship
- Attitude towards child



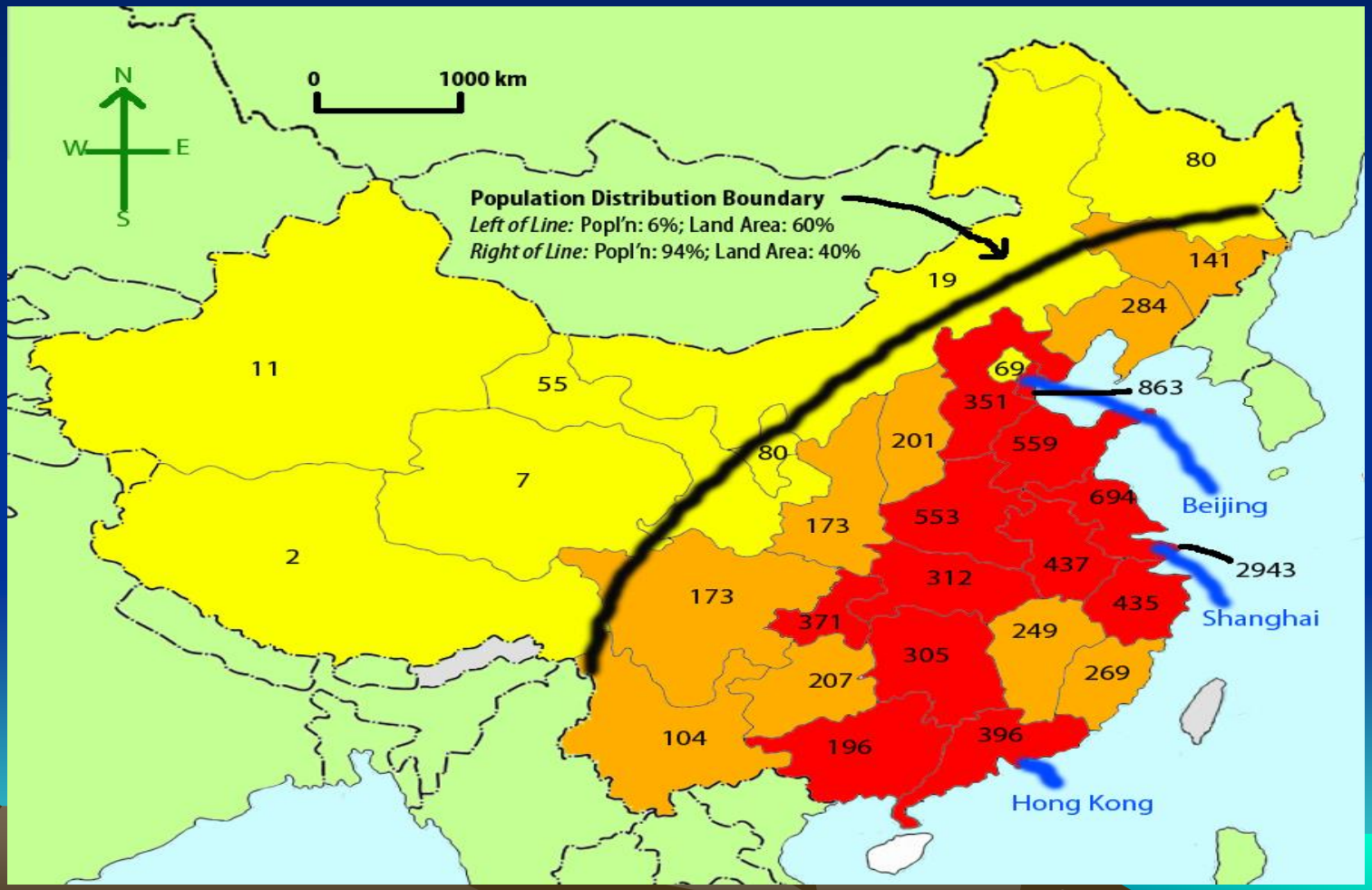
ADHD in the United States (2011)

- ~ 11% (6.4 million) of children 4-17 years of age affected.
- occurred 3 times more often in boys than in girls.
- varied by state, from 5.6% in Nevada to 18.7% in Kentucky.



ADHD in China - A serious public health concern

- 15 to 19 million Chinese children affected
- about 5% of all school-age children with ADHD



Study Purpose

- To explore the relationship between family-environmental factors and ADHD in Chinese children.

Hypothesis

- ADHD children would have impairments within the family unit when compared to normal controls.

Study Design

- A pair-matched case-control study.
- Same sex and age (difference between birthdays within 6 months) chosen for the ADHD and the control group.
- Approved by the institutional review boards of An Ding Hospital at Capital Medical University in Beijing, China, and Mercer University in Macon, Georgia in the United States.
- Study period from July 2009 to May 2010.

Data Collection

❖ADHD cases

- total of 161 (113 boys and 48 girls) recruited from Beijing Children and Adolescents Mental Health Center at An Ding Hospital in Beijing, China
- age range 5 -18 years
- Chinese Han nationality
- DSM-IV-TR criteria for ADHD (any subtype)

❖Normal controls

- total of 161 (113 boys and 48 girls) randomly selected from local elementary and middle/high schools at the same district in Beijing, China
- same age range and nationality as cases

Measurements (1)

❖Matched factors

- Pair-matches on age and sex for the control group and ADHD group

❖Biological factors

- Maternal age at childbirth
- Maternal stress during pregnancy
- Pregnancy-induced hypertension (PIH)

Measurements (2)

- **Family-environmental factors**
  - Maternal education
  - Paternal education
  - Single child
  - Family structure
  - Family conflicts
  - Emotional abuse

Measurements (3)

- **Lifestyle factors**
  - Domestic tobacco smoke
  - Domestic alcohol consumption
  - Physical activity
  - TV viewing
  - Internet usage
  - Accidental injury
  - Dietary supplement intake

Statistical Analyses

Step 1

- Multivariate logistic regression including all independent variables in the same model to adjust each other

Step 2

- Conditional logistic regression with backward stepwise procedures to construct a final best fit model to identify the predictors of risk for ADHD among all factors

- Statistical analyses were performed with SAS, version 9.2
- Significant at α level of 0.05 on a two-tailed test

Table 1. Demographic and Distribution of Biological Factors of ADHD: Comparisons of ADHD Cases and Non-ADHD Control subjects

Characteristic	ADHD (n=161)	Control (n=161)	P-Value	OR(95% CI)
Matched factors				
Age (years)	12.89±2.96	12.91±2.81	0.675	-
Male	113(70.19%)	113(70.19%)		
Female	48(29.81%)	48(29.81%)	-	-
Biological factors				
Maternal age at childbirth (years)				
≤ 26	98(60.87%)	101(62.73%)		
>26	63(39.13%)	60(37.27%)	0.740	1.08(0.69-1.68)
Maternal stress during pregnancy				
No	136(86.08%)	152(96.20%)		
Yes	22(13.92%)	6(3.80%)	**0.005**	**3.67(1.49-9.04)**
Pregnancy induced hypertension				
No	147(94.84%)	146(94.81%)		
Yes	8(5.16%)	8(5.19%)	1.000	1.00(0.35-2.85)

Table 2. Distribution of Family-Environmental Factors of ADHD: Comparisons of ADHD Cases and Non-ADHD Control subjects

Characteristic		ADHD (n=161)	Control (n=161)	P-Value	OR(95% CI)
Maternal education	≥ 12 years	36(22.36%)	42(26.58%)		
	9-12 years	50(31.06%)	39(24.68%)	0.184	1.50(0.81-2.76)
	≤ 9 years	75(46.58%)	77(47.83%)	0.744	1.14(0.66-1.96)
Paternal education	≥ 12 years	33(20.63%)	41(25.79%)		
	9-12 years	45(28.13%)	27(16.98%)	**0.017**	**2.07(1.07-4.01)**
	≤ 9 years	82(51.25%)	91(57.23%)	0.270	1.12(0.65-1.93)
Single child	No	22(13.66%)	66(41.77%)		
	Yes	139(86.34%)	92(58.23%)	**<.0001**	**4.00(2.27-7.04)**
Family structure	Biological parents	132(82.50%)	145(90.06%)		
	Single/step parent	28(17.50%)	16(9.94%)	0.062	1.86(0.97-3.56)
Family conflicts	No	121(76.10%)	146(91.25%)		
	Yes	38(23.90%)	14(8.75%)	**0.001**	**3.09(1.57-6.10)**
Emotional abuse	No	110(68.75%)	146(94.19%)		
	Yes	50(31.25%)	9(5.81%)	**<.0001**	**10.50(3.77-29.28)**

Table 3. Distribution of Lifestyle Factors of ADHD: Comparisons of ADHD Cases and Non-ADHD Control subjects

Characteristic		ADHD (n=161)	Control (n=161)	P-Value	OR(95% CI)
Domestic tobacco smoke	No	94(58.75%)	98(61.64%)		
	Yes	66(41.25%)	61(38.36%)	0.480	1.18(0.74-1.88)
Domestic alcohol consumption	No	101(63.92%)	113(72.44%)		
	Yes	57(36.08%)	43(27.56%)	0.159	1.40(0.88-2.24)
Physical activity	> 3 days	68(43.87%)	77(56.62%)		
	≤ 3 days	87(56.13%)	59(43.38%)	**0.030**	**1.68(1.05-2.68)**
TV viewing (daily)	≤ 2 hours	142(89.97%)	126(90.00%)		
	> 2 hours	16(10.13%)	14(10.00%)	1.000	1.00(0.48-2.10)
Internet usage (daily)	≤ 2 hours	117(74.05%)	106(68.83%)		
	>2 hours	41(23.90%)	48(31.17%)	0.634	1.20(0.56-2.53)
Accidental injury	No	127(79.87%)	133(84.18%)		
	Yes	32(20.13%)	25(15.82%)	0.338	1.30(0.73-2.33)
Daily dietary supplement intake	No	117(74.05%)	106(68.83%)		
	Yes	41(25.95%)	48(31.17%)	0.319	0.77(0.45-1.32)

Table 4. Associated Factors Identified in Backward Stepwise Logistic Regression Model

Variables	Estimate	Standard Error	Wald Test	P-Value	OR (95% CI)
Single child	1.84	0.57	10.64	0.001	6.32 (2.09-19.14)
Emotional abuse	2.41	0.84	8.25	0.004	11.09 (2.15-57.29)

Results

- This study discovered that having experienced emotional abuse and being a single child were both significant factors associated with ADHD children.

- Those who were abused as children are 11 times more likely to suffer from ADHD.

Discussion

Findings consistent with the most literature

- Lack of emotional warmth towards the child
- Child maltreatment (physical/emotional)

These factors showed a trend towards an increasing risk for having a child with ADHD-related disorders.



Emotional Abuse

- Most literature found psychological mistreatment to be just as damaging as physical or sexual abuse, and child neglect.



Conditions in China

- Academic achievement is highly emphasized.
- Extremely strong competition in joint entrance examinations for junior/senior high schools and universities.
- Chinese children become little study machines.



One-child policy

- Family Planning Policy has implemented in China from 1979 to 2016.



Effects of One-child Policy

- Sex ratio imbalance
- Male: female = 117:100 (2000-2013)
- 30 million more men than women in 2020
- Old-age dependency
- “4-2-1 phenomenon”
- Little emperor syndrome
- Birth tourism





Limitations

1. Recall bias

by self-reporting of prenatal complications and exposures

2. Selection bias

by including only Chinese Han

3. Lack of a comparability

of the differences between ADHD subgroups

Conclusions

- Emotional abuse and single child status were associated with ADHD children in China.
- Appropriate parenting skills might be helpful in preventing ADHD, particularly in single child families.
- Future birth cohort studies are needed to explain the causal relationships between family-environmental factors and ADHD.

Thank you very much



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