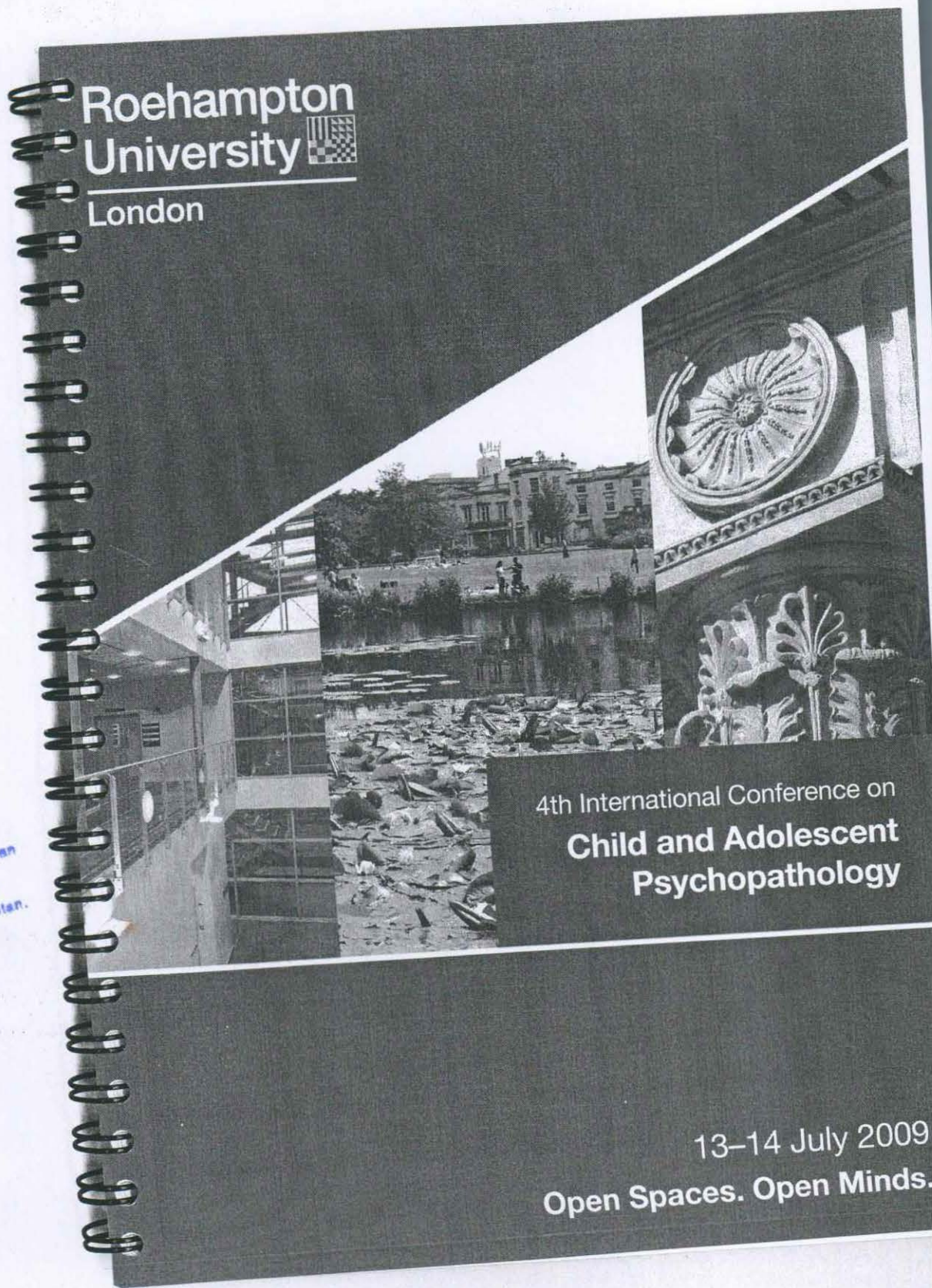


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Impaired Working Memory in Children with Attention Deficit Hyperactivity Disorder and Their Siblings

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Objective: To assess and compare working memory of children with Attention Deficit Hyperactivity Disorder (ADHD), their sibling and those children with other chronic medical illness.

Method: By using a cross-sectional design, 57 subjects were recruited through universal sampling from Hospital Universiti Sains Malaysia.

a) ADHD group (n= 21),
b) siblings of ADHD children group (n=15), and
c) non-ADHD children with chronic medical condition as the control group (n = 21). All subjects were aged between 6 and 15 years, and ADHD was diagnosed according to DSM-IV-TR. Those with other psychiatric co-morbidity or Intelligence Quotient (IQ) less than 70 were excluded. Three tests from the Working Memory Test Battery for Children were used for assessment. Digit Recall was used for assessment of the phonological loop component, Maze Memory test for the visuospatial sketch pad component and Backward Digit Recall for the central executive component.

Result: ADHD children and their siblings showed similar impairment and both differed from the control group on the Maze Memory test. ADHD children also showed impairment in Digit Recall test, however the sibling group did not differ from the control group on this test. The score of Backward Digit Recall did not show any significant difference between the 3 groups.

Conclusion: Impairment of the visuospatial sketch pad component of working memory seems to cluster in ADHD children and their siblings. Thus, impairment of visuospatial sketch pad component may point towards an endophenotype of ADHD.

Wee

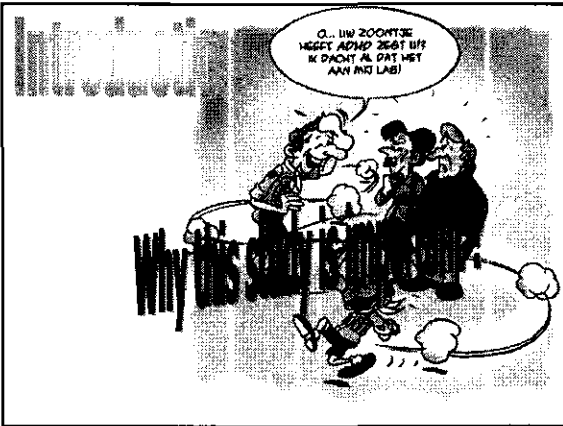
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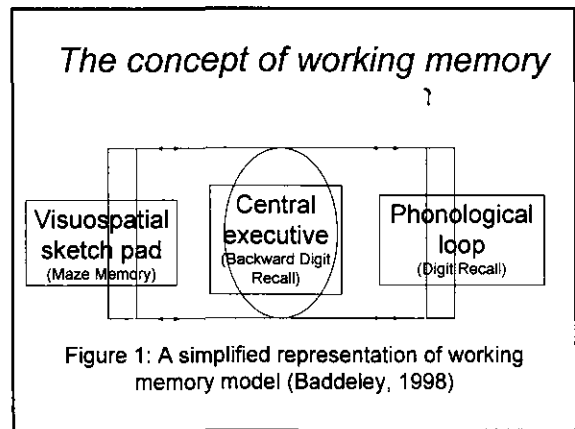
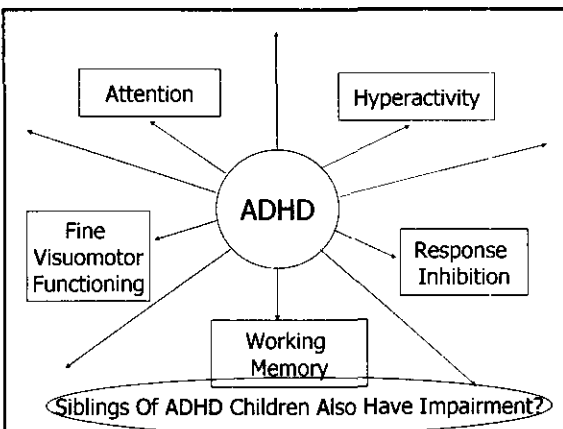
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- The Universiti Sains Malaysia Ethics Committee approved this study.
- This research was supported by Universiti Sains Malaysia Short Term Research Grant.



APA 2000: 3-7% school age children

1. ADHD
Very
Common



Study Objective

Hypothesis

Objective

1. To assess and compare working memory of ADHD children, their sibling and control group.
2. To determine the familial clustering of working memory impairment in ADHD.
3. To look for any association between working memory scores and sociodemographic variables.

Hypothesis

1. Working memory of ADHD children and their siblings are poorer compare to control group.
2. There is no different in working memory performance of ADHD children and their siblings.
3. There is no relationship between working memory scores and sociodemographic variables.

Methodology

Methodology

- Study design
 - Cross-sectional study.
- Sampling method
 - Universal sampling method.
- Study Subjects
 - Patients attending Child & Adolescent Psychiatric Clinic, HUSM; their siblings and patients from Paediatric Clinic, HUSM.



-Diagnosis follow DSM-IV-TR criteria (By child & adolescent psychiatrist)
-No co-morbid psychiatry, medical or surgical illness

-Closes age to the ADHD siblings.
-No psychiatric, medical or surgical illness

- No 1st degree relative of ADHD
- Stable chronic medical illness (heterogenous) except neurological disorder.
- No psychiatric disorder.
- Matched age & sex with ADHD children.

(MINI Kid Screen- for screening of psychiatric disorder)

Inclusion Criteria

- Aged between 6 to 15 years.
- The child must be able to communicate in English, Mandarin or Malay language.
- IQ \geq 70 (Seguin Form Board Test)

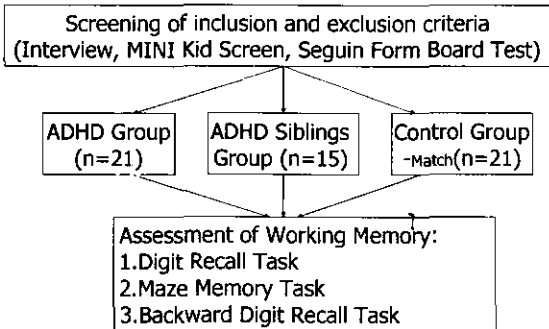
Exclusion Criteria

- History of severe head injury or any head trauma which cause lost of constiousness.
- Hearing impairment.
- Parent or guardian refused to give informed consent.

Instruments used

- Sociodemographic questionnaire.
- M.I.N.I. Kid Screen.
- Seguin Form Board Test.
- Working Memory Test Battery for Children (WMTB-C)
 - Digit recall (phonological loop).
 - Backward digit recall (central executive).
 - Maze memory test (visuospatial sketch pad).

Study Flow Chart



Results

Table 4: Sociodemographic summary of the ADHD children (n=21), Siblings of ADHD children (n=15) and Control group (n=21) with or without chronic medical illness (n=21)

	ADHD children (n=21)	ADHD Siblings Group (n=15)	Control group (n=21)
Gender: Male	19 (90.5%)	9 (60.0%)	19 (90.5%)
Female	2 (9.5%)	6 (40.0%)	2 (9.5%)
Age (years): Median, Range	8.5, 6.3-11.8	9.5, 6.4-14.1	8.9, 6.7-11.9
Ethnic Group: Malay	20 (95.2%)	15 (100%)	21 (100%)
Chinese	1 (4.8%)	0	0
Others	0	0	0
Father Education Level:			
Not schooling	0	0	0
Primary	2 (9.5%)	1 (6.7%)	2 (9.5%)
Secondary	12 (57.2%)	9 (60.0%)	13 (61.9%)
Tertiary	7 (33.3%)	5 (33.3%)	6 (28.6%)
Mother Education:			
Not schooling	0	0	0
Primary	2 (9.5%)	1 (6.7%)	2 (9.5%)
Secondary	12 (57.2%)	9 (60.0%)	13 (61.9%)
Tertiary	7 (33.3%)	5 (33.3%)	6 (28.6%)
IQ: Median	103	100	125

$\chi^2=7.096; p=0.029$

Kruskal-Wallis Test $p=0.041$

Mann-Whitney Test ADHD & Control $p=0.017$

Table 8: Working memory performance of subject's groups

Test Score	Subject's Group	Median	Kruskal-Wallis Test	
			Chi-Square	P Value
Digit Recall Standard Score (Phonological)	ADHD	75.00	15.61	<0.001
	ADHD Siblings	85.00		
	Control	85.00		
Maze Memory Standard Score (Visuospatial)	ADHD	81.00	9.81	0.007
	ADHD Siblings	87.00		
	Control	100.00		
Backward Digit Recall Standard Score (Central Executive)	ADHD	72.00	3.34	0.188
	ADHD Siblings	82.00		
	Control	78.00		

Table 9: Comparison of Digit Recall Standard Score and Maze Memory Standard Score among the study groups

Test Score	Subject's Group (I)	Subject's Group (J)	Mann-Whitney Test	
			Z Score	Asymp. Sig. (2 tailed)
Digit Recall Standard Score	ADHD	ADHD Siblings	-3.19	0.001
	ADHD	Control	-3.50	<0.001
	ADHD Siblings	Control	-0.34	0.734
Maze Memory Standard Score	ADHD	ADHD Siblings	-1.01	0.310
	ADHD	Control	-2.92	0.003
	ADHD Siblings	Control	-2.12	0.034

Association of demographic variables with the working memory scores

- In the Spearman correlation analysis IQ score only showed significant association with Backward Digit Recall Standard Score in ADHD group (correlation coefficient= 0.497, p=0.022) and control group (correlation coefficient= 0.541, p=0.011).
- Other demographic variables did not show any association with the working memory scores.

Discussion

- ADHD group showed impairment in Visuospatial sketch pad component and phonological loop component of working memory. (Similar with previous study Karatekin and Asarnow, 1998).

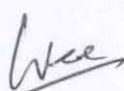
- Siblings group showed impairment in Visuospatial Sketch pad component of working memory. (Similar with previous study Rommelse et al, 2008)

- ADHD group and siblings group showed similar impairment in Visuospatial sketch pad component.
- From the result of this study, we can suggest that impairment of visuospatial sketch pad component of working memory are clustered in ADHD family.

- ### Limitation
- Small sample sizes.
 - Control group of chronic medical condition.
 - Did not investigate the effect of ADHD medication.
 - Did not sub-classified the ADHD types.
 - WMTB-C
 - Only used 3 out of the 9 subtests.
 - Only involve 1 siblings.

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 - Madam Maria Socorro Pieter (Psychologist)
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