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Title: Use of M-CHAT for a multinational screening of young children with autism in the Arab countries

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Use of M-CHAT for a multinational screening of young children with autism in the Arab countries

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Abstract

10 There has been a decline in the mortality rate among infants and children under five years of age in the last decade in many developing countries. This has led to a shift in focus to look beyond survival to the prevention or reduction of impairment and promotion of children’s health. With the apparent rise in the prevalence of autism spectrum disorders (ASD) in the Arab countries the development of an Arabic tool for early diagnosis and intervention was sought as part of an effort to better understand the prevalence of this disorder. The Modified Checklist for Autism in Toddlers (M-CHAT) was chosen. The study was conducted in nine Arabic speaking countries. The final analysis included 228 children (122 screened positive for ASD). The sensitivity (0.86), the specificity (0.80) and positive predictive value (0.88) were very similar to Robins et al. study (2001). Maternal health problems during pregnancy and labour were found to be more significant for ASD mothers than their control. In addition, child health problems were more evident among ASD subjects as reported by their parents with significant differences from controls. The limitation of the study is that the sample size is not large enough to generalize the results to all countries of the region. The strength of the study is that it is the first known study where Arab countries undertook a collaborative mental health study using the same tool for screening for a specific disorder.

Introduction

3 In many developing countries there has been a decline in the mortality rate among infants and children under five years of age in the last decade (UNICEF, 2000). This has led to a shift in focus to look beyond survival to the prevention or reduction of impairment and promotion of children’s health and development in the early years of life (Ansari, Akhdar, & Moutaery, 1999). Autism, one of the pervasive developmental disorders, anecdotally has appeared to increase in incidence and prevalence. It represents a complex lifelong developmental disability that typically appears during the first three years of life, although the diagnosis is not frequently made until later in a child’s life, especially when it is mild or even moderate in severity. The failure or tardiness in making the diagnosis in many Arab countries has led to excess impairment and burden to affected children and their families. Thus, the authors sought to modify and validate a tool that would aid in diagnosis and the objective determination of incidence and prevalence.

Pervasive developmental disorders (PDDs), of which childhood autism is the prototypical disorder,

are specific developmental disorders in which there are qualitative impairments in social interaction and communication combined with a restricted repertoire of interests, activities, and behaviours, with onset in early childhood (APA, 1994; WHO, 1993). Autism affects the normal development of the brain in various areas of functioning. The recent apparent increase in the diagnosis of autism globally has led to an accepted current prevalence rate of 3-6/1000, two thirds of whom are in the categories of pervasive developmental disorder – not otherwise specified (PDD-NOS) or Asperger’s syndrome (Chakrabarti & Fombonne, 2005; Volkmar, Lord, Bailey, Schultz, & Klin, 2004). Symptoms of autism vary significantly in severity, but there are several core features for this illness, including gross and sustained impairment in reciprocal social interactions, impaired verbal and nonverbal communication, and restricted or repetitive patterns of behaviour. (DiLavore & Rutter, 1995; Lord, 1991; Lord & Corsello, 2005; Lord & Luyster, 2005; Lord et al., 2000).

Parents of children with autism also frequently report concerns over delayed speech, and restlessness and hyperactivity. However, they were also

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commonly reported by the parents of children with developmental delay without autism, and thus do not act as specific indicators for autism (Charman, 2000). There is the possibility that early diagnosis followed by appropriately targeted intervention may improve outcome, especially in management of behaviour, functional skills and communication problems.

The Checklist for Autism in Toddlers (CHAT) (Aylward, 1997) is a screening instrument that identifies children aged 18 months and older who are at risk for autism. This age was chosen as an appropriate screen 'window' because joint attention and pretend play typically emerge at this time in normal development (Baron-Cohen, Allen, & Gillberg, 1992). The CHAT assesses simple pretend play and joint attentional behaviours, pointing for interest (in combination with eye contact) and following gaze, by parental report and health practitioner observation through direct testing.

In a study by Baron-Cohen et al. (1992), the CHAT correctly predicted the four undetected cases of autism at 18 months of age from among 41 siblings of children already diagnosed with autism and therefore at higher risk of developing autism. To test the effectiveness of the CHAT in a large general population, health visitors, general practitioners, and community medical officers in the south Thames region of the UK used the questionnaire (Baird et al., 2000; Baron-Cohen et al., 1996). Of the total population of 40,818 infants eligible for screening, 16,235 (39.8%) were screened using the CHAT, mean age 18.7 months (SD 1.1). The modified (M-CHAT) (American) version of CHAT translated into Spanish, proved to have a good specificity (95%), sensitivity (97%), and a moderate positive predictive value (36%) (Baron-Cohen et al., 1996). It was initially hoped that the CHAT, with its high specificity and positive predictive value, could be adopted as a universal screen. Recent data on the CHAT, however, indicated that, while it can aid primary health-care physicians in identifying children at risk, it is not sufficiently sensitive to stand alone as a screening tool (Baird et al., 2000).

With the apparent rise in the prevalence of ASD and the growing need to screen large populations of children, the members of the Eastern Mediterranean Association of Child and Adolescent Psychiatry and Allied Professions (EMACAPAP) developed a study using the M-CHAT to screen children for autism in the Arab world. Early diagnosis and intervention is a significant challenge in virtually all communities, however this is particularly problematic in countries with a limited number of trained child mental health professionals. The EMACAPAP members were motivated to develop a tool in the Arabic language to assess ASD in the Arab world (23 countries), to portray some socio-demographic

data related to ASD in this region, and to create clinical opportunities for obtaining additional information about children with ASD and their families.

With respect to the diversity of populations included in the present study (9 countries) from the Gulf region (Kuwait, Oman, Qatar and Saudi Arabia), eastern Mediterranean region (Jordan, Lebanon, Syria), Egypt and Tunisia, the authors also present a comprehensive, descriptive profile of the demographic, social, and medical characteristics of the studied children and their families. Although these countries share the same language and religion, they have a diversity of cultural, ethnic, political and social structure.

Aim

To determine the feasibility of using a screening tool for an early onset developmental disorder using the M-CHAT in countries with limited assessment and mental health resources.

Objectives

1. To show the feasibility of using a simple tool to assess autism in countries with a limited number of trained mental health professionals;
2. To unify an Arabic tool to assess autism spectrum disorders among Arabic countries (23 countries);
3. To portray some socio-demographic data on ASD in the countries represented in the Arab world;
4. To create clinical opportunities for gathering additional clinical information about children, parents and their families.

Methods

Instrument preparation

The use of a simple, easily applicable tool that does not rely on the physician's observation of the child, but on parents' report of current skills and behaviours was a main target for the tool selection. The M-CHAT screening tool to identify children at risk for social-communication disorders (Robins, Fein, Barton, & Green, 2001) was selected. It is a 23-item yes/no parent report checklist developed to screen children ages 18 to 36 months old. Permission was obtained to use and translate the M-CHAT. Members of EMACAPAP from Egypt, Iraq, Saudi Arabia and Tunisia translated the tool into Arabic, being sensitive to the fact that classical Arabic may not be clearly understood by the mothers who were going to fill the sheet, since there are a number of Arabic dialects. To solve this problem and to make

sure that the Arabic instrument would be readily understandable in all countries, the translators added the specific dialect of some words to the classical Arabic to clarify the meaning of a number of items of the questionnaire. Back-translation to English and a comparison with the original English version performed by other fluent bilingual members of EMACAPAP verified the reliability of the translation.

The study was approved by the nine EMACAPAP member countries to use the M-CHAT. Eight of them screened children in two settings: child development centres and general paediatric settings with the goal of obtaining an average of 10 developmentally impaired and 10 typically developing children to determine the feasibility of using the M-CHAT. M-CHAT scoring cut-offs were established. A child failed the checklist when two or more of the critical items were failed or when any three items failed. Parental consent was obtained before interviews.

Study design

This is a descriptive, cross sectional study, conducted between September 2006 and March 2007. The subjects were recruited from nine Arabic countries; Egypt, Kuwait, Jordan, Lebanon, Oman, Qatar, Saudi Arabia, Syria and Tunisia. A total number of 228 children were included in this study. The number of boys ($n=185$) exceeds that of girls ($n=43$) by more than four times. The number of children recruited from different countries ranged from 8 to 82 with age range 18 to 124 months. The developmentally impaired children were diagnosed according to the Diagnostic and Statistical Manual (APA, 1994). Of the 228 children screened (developmentally impaired) using the M-CHAT, 122 screened positive for the presence of an autism spectrum disorder (ASD). The control group was selected from typically developed children matched by age and sex.

Statistical analyses

SPSS software (SPSS, Inc, Chicago, IL) was used for analysis. The Chi-square (χ^2) tests were used. The sensitivity, specificity, and PPV of M-CHAT were calculated.

Results

Subjects

The final analysis included 228 children and is shown in Table I.

- Group 1 – Cases (autism spectrum disorder – ASD) with already manifest developmental problems: 122 children screened positive for the

Table I. Distribution of countries in the study by number of toddlers involved in the study.

Countries	Cases (ASD)	Control (normal development)	Total
Egypt	41	41	82
Kuwait	10	10	20
Jordan	4	4	8
Oman	10	10	20
Qatar	10	10	20
Saudi Arabia	10	10	20
Syria	13	0	13
Tunisia	14	11	25
Lebanon	10	10	20
Total	122	106	228

Table II. Distribution of the 23 M-CHAT items according to sensitivity, specificity and predictive value.

	7+	8+	9+
Sensitivity	95.1 89.2–98.0	91 84.1–95.2	86.9 79.3–92.1
Specificity	75.5 66.0–83.1	84 75.3–90.1	88.7 82.6–94.4
Positive predictive value	81.7 74.1–87.5	86.7 79.3–91.8	89.8 82.6–94.4
Negative predictive value	93 84.8–97.1	89 80.9–94.1	85.5 72.2–91.2

presence of an autism spectrum disorder (84% boys and 16% girls), with a mean age of 43.1 ± 21.4 months (range: 18 to 124 months).

- Group 2 – Control (non-autism) consisted of 106 children with typical development matched for age and sex provided from eight out of the nine countries involved in the study.

Sensitivity and specificity

To assess the degree of sensitivity, specificity and predictive value for M-CHAT as an assessment tool among Arab countries from the 23 M-CHAT items, see Table II.

The critical six items of M-CHAT are:

- Item (2) Does your child show an interest in other children?
- Item (7) Does your child use his/her forefinger to express interest in something?
- Item (9) Does your child try to bring things to show you something?
- Item (13) Does your child imitate (such as imitating your face expressing gladness or sadness)?
- Item (14) Does your child respond (looking around) when you call him/her by name?

- Item (15) When you point to a toy in the room, does your child look at it?

The most sensitive and specific critical M-CHAT items among Arab countries were item (2) followed by (7) and (15), and the least sensitive and specific were items (13) and (9).

Item (2) showed sensitivity (96.9), specificity (74.8), PVP (77.0) and PVN (96.5).

The least item, (9), showed sensitivity (76.8), specificity (48.0), PVP (35.2) and PVN (84.9).

Personal and medical history

More boys were represented among the cases of ASD 84.4% (n = 103) than the control 74.4% (n = 82) yet the difference was not statistically significant ($\chi^2 = 1.85$; p is greater than 0.05). ASD boys (84.4%) were represented more than girls (15.6%).

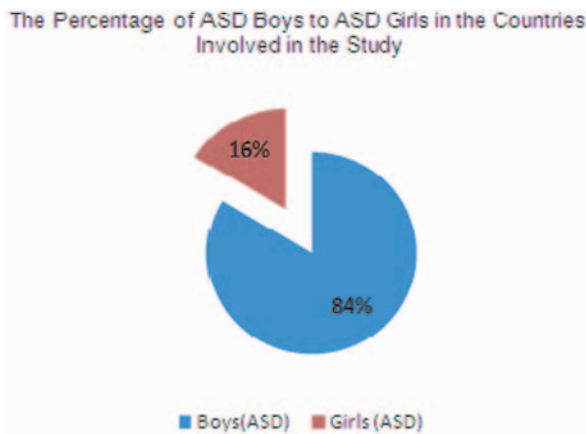


Figure 1. The percentage of ASD boys to girls in the countries involved in the study.

The ASD children in the present study had a higher average number of siblings compared to the control group (normally developed) 2.18 ± 1.74 compared to 1.65 ± 1.29 . The difference was statistically significant (Z of Mann-Whitney = 2.46, p is less than 0.05). As regards the birth order there was no significant difference (Z of Mann-Whitney = 0.516, p is greater than 0.05). Although positive consanguinity was more among parents of ASD than the controls 25.4% (n = 31) compared to 18.9% (n = 20) respectively, but the differences were statistically insignificant ($\chi^2 = 1.39$ p is greater than 0.05).

Table III portrays the significant differences between the ASD cases and their control (normally developed) according to maternal and child health.

- Maternal health problems during pregnancy and labour were more significant for ASD mothers than the controls.
- Child health problems were more evident among ASD children as reported by their parents with a significant difference from the controls, mainly due to mental retardation and behavioural problems.
- Parents of ASD children reported the presence of mental health problems among relatives of ASD children more than relatives of the control group.

Profile of ASD cases

ASD cases in the pilot study (n = 122) in the nine countries, were divided into four sub-groups according to geographical and specific cultural factors. The four sub-groups are:

- Gulf area: Kuwait, Qatar, Oman and Saudi Arabia
- East Mediterranean: Jordan, Lebanon and Syria

Table III. The Significant differences between ASD cases and their control according to Maternal and Child mental health problems.

Variable	ASD (n = 128)		Control (n = 106)		Test of significance	
	(n = 128)	%	(n = 106)	%		
I-Maternal health problems						
Problem during pregnancy	51	41.8	9	8.5	$\chi^2 = 32.4$	$P < 0.01$
Problem during labour	34	27.9	13	12.3	$\chi^2 = 8.4^*$	$P < 0.05$
II-Childhood health problems						
Delayed develop.	63	51.7	3	2.8	$X^2 = 65.8^{**}$	$P < 0.01$
Mental subnormal	30	25	1	1.6	$\chi^2 = 15.8^{**}$	$P < 0.01$
Other behavioural problems	18	15	1	1.6	$\chi^2 = 7.8^{**}$	$P < 0.01$
III-Mental health problems among relatives						
Similar symptoms	16	13.1	0	0	$\chi^2 = 8.9^{**}$	$P < 0.01$
Behavioural problems	14	11.5	1	1.5	$\chi^2 = 5.7^*$	$P < 0.05$
Language & learning problems	40	32.8	0	0	$\chi^2 = 25.9^{**}$	$P < 0.01$
Mental retardation	22	18	1	1.5	$\chi^2 = 10.8$	$P < 0.01$
Psychiatric illnesses	12	9.8	0	0	FET*	$P < 0.01$

*Significant; **highly significant (and also where used in the following text).

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- Egypt
- Tunisia representing the Magrébin part of the Arab countries

Concerning the parents' age in ASD cases included in the study, mothers' and fathers' ages at the birth of their studied child in the different countries were significantly higher than controls. Most of the ASD

parents' ages ranged between 31 and 40 years with a significant difference (MCE** p is less than 0.01) for mothers and (MCE* p is less than 0.05) for fathers respectively (Table IV).

The Omani maternal age for ASD children was the highest compared to their controls group. The paternal age for ASD toddlers in Kuwait is the

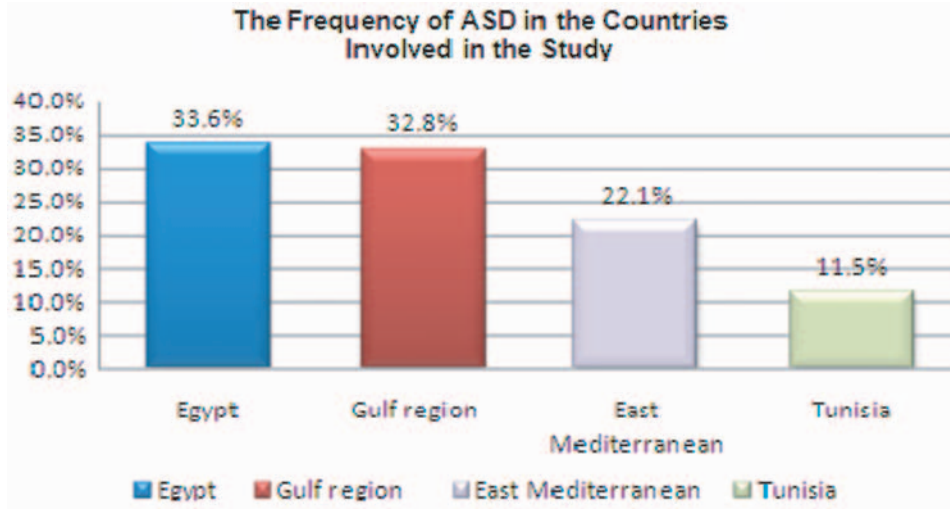


Figure 2. This shows the frequency of ASD (among developmentally at risk children) cases in the countries involved in the study.

Table IVA. Distribution of maternal age at time of birth of their ASD child in the different groups of Arab countries.

Maternal age in years		region				Total
		Egypt	Gulf region	East Mediterranean	Tunisia	
15-20	Count	0	1	0	0	1
	% within region	0%	2.5%	0%	0%	0.8%
21-30	Count	26	8	10	7	51
	% within region	63.4%	20.0%	37.0%	50.0%	41.8%
31-40	Count	14	30	16	6	66
	% within region	34.1%	75.0%	59.3%	42.9%	54.1%
40+	Count	1	1	1	1	4
	% within region	2.4%	2.5%	3.7%	7.1%	3.3%
Total	Count	41	40	27	14	122
	% within region	100.0%	100.0%	100.0%	100.0%	100.0%

Table IVB. Distribution of paternal age at time of birth of their ASD child in the different groups of Arab Countries.

Paternal age in years		region				Total
		Egypt	Gulf region	EastMed.	Tunisia	
21-30	Count	9	5	3	0	17
	% within region	22.0%	12.5%	11.1%	0%	13.9%
31-40	Count	27	16	17	9	69
	% within region	65.9%	40.0%	63.0%	64.3%	56.6%
40+	Count	5	19	7	5	36
	% within region	12.2%	47.5%	25.9%	35.7%	29.5%
Total	Count	41	40	27	14	122
	% within region	100.0%	100.0%	100.0%	100.0%	100.0%

Table V. Level of ASD mother's education in the Arab region.

Maternal education	region				Total
	Egypt	Gulf region	East Med.	Tunisia	
Uneducated count	5	2	5	0	12
%within region	12.20%	5.00%	18.50%	0.00%	9.80%
Senior education count	16	14	17	7	54
%within region	39.00%	35.00%	63.11%	50.00%	44.30%
High education count	20	24	5	7	56
%within region	48.80%	60.00%	18.50%	50.00%	45.90%
Total count	41	40	27	14	122
%within region	100.00%	100.00%	100.00%	100.00%	100.00%

highest compared to their controls (77.8% versus 22.2%) MCE* p is less than 0.025.

315 Mothers' education of the studied children and their controls did not show significant differences ($\chi^2 = 2.6$; p is greater than 0.05). The distribution of the level of education of ASD mothers in the Arab countries shows that the more educated mothers can detect ASD earlier in general and particularly in the Gulf Area, followed by Tunisia and Egypt with significant differences (MCE* p is less than 0.05) Table V.

325 *The relation of maternal health and development to ASD*

The maternal health problems during pregnancy and their relation to the development of ASD in the countries of the region are presented in Figures 3A and 3B. There is a high association between problems during pregnancy and labour of ASD mothers compared to their control with significant differences ($\chi^2 = 32.4^{**}$ p is less than 0.01) and ($\chi^2 = 8.4^*$ p is less than 0.05).

335 Figure 3B shows the distribution of ASD toddlers as regards maternal health problems during pregnancy and labour. The percentage of these problems was very evident among Tunisian mothers followed by mothers from East Mediterranean group (Jordan, Lebanon and Syria). In Egypt, maternal health problem during pregnancy had a more significant association with the development of ASD than labour problems. Kuwaiti and Tunisian mothers of ASD toddlers involved in the study reported having problems during pregnancy. MCE p is equal to 0.025 and p is equal to 0.002 respectively.

Egyptian mothers of ASD children reported having problems during pregnancy 94.7% of the time compared to 5.3% for the control group ($\chi^2 = 19.7$; p is equal to 0.000).

350 As regards problems during labour and its relation to ASD, all Tunisian mothers of ASD toddlers reported having problems during labour (MCE p is equal to 0.013) followed by Egyptian

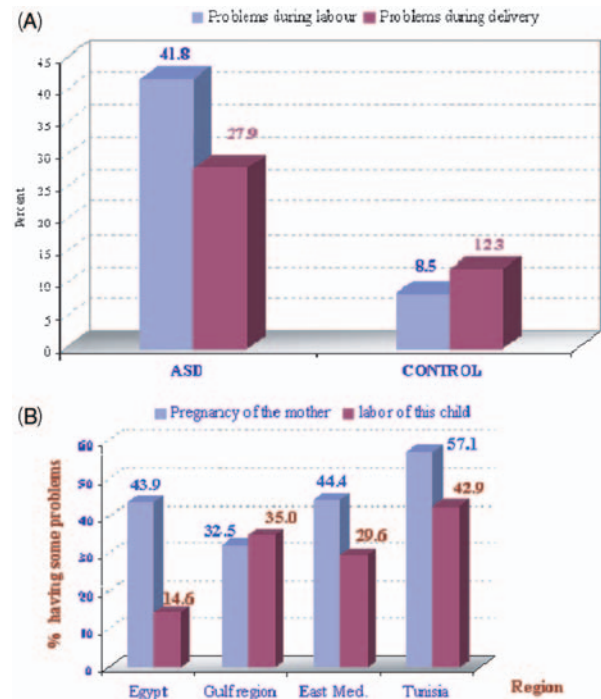


Figure 3. (A) Relation between maternal health problems and development of ASD among Arab countries (2006–2007); (B) Distribution of 122 autistic children by region according to problems during pregnancy and labour (2006–2007).

355 mothers 85.7% of ASD mothers compared to 14.3% of their control ($\chi^2 = 3.9$; p is equal to 0.048).

360 Figure 4A portrays the association of health status among ASD children in the different countries involved in the study. The figure reflects the possible association of physical illnesses such as fevers, epilepsy and infectious diseases with the development of ASD. The differences were significant for mental disability ($\chi^2 = 15.8^{**}$ p is less than 0.01); for behavioural problems ($\chi^2 = 7.8^{**}$ p is less than 0.01); history of medical illnesses ($\chi^2 = 9.7^{**}$ p is less than 0.01).

365 Figure 4B shows the distribution of ASD children in the region according to different health problems

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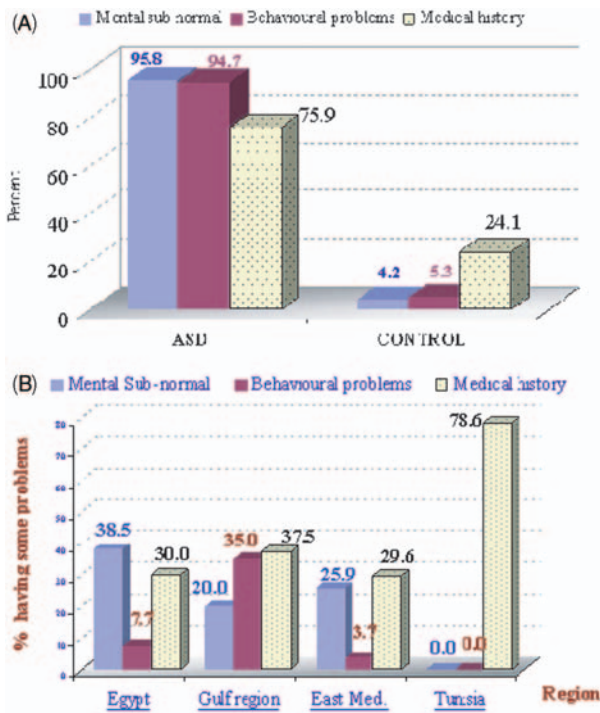


Figure 4. (A) Relation between ASD cases and their controls as regards health problems in the region (2006–2007); (B) Distribution of 122 autistic children by region according to their health problems (2006–2007).

affecting ASD cases. History of medical illnesses was high in all the countries involved in the study, followed by mental retardation, except in Tunisia. The differences are highly significant where $\chi^2 = 11.7^{**}$ p is less than 0.01.

Discussion

The purpose of this study was to validate the M-CHAT as a screening tool for children in Arab countries by assessing the degree of sensitivity, specificity and predictive value.

The M-CHAT has a sensitivity of 0.87, specificity of 0.99, and positive predictive value of 0.80 according to Robins et al. (2001). In the present study the sensitivity was 0.86 (0.78–0.92) which is comparable to Kleinmann et al. (2007) in their latest follow-up study on the use of the M-CHAT; where the specificity was 0.80 (0.70–0.92) and positive predictive value of 0.88 (0.82–0.94) in contrast to the PPV found by Kleinmann et al. (2007). The most critical items found in our study were items (2) followed by (7). (15) And the least sensitive and specific were items (9) and (13) in contrast to Robins et al. (2001) who indicated the items with highest weights in descending order to be (7), (14), (2), (9), (15) and (13). All the six items are the best in predicting autism in toddlers.

Maternal health problems during pregnancy and labour were found to be more significant for ASD mothers than controls. This was also found in the study of Juul-Dam, (2000) who found a significantly high incidence of second or third trimester uterine bleeding and Rh incompatibility. A higher incidence of induction of labour and prolonged and precipitous labour were also found, in addition to higher rates of oxygen requirement at birth and presence of hyperbilirubinemia. Other studies also supported these findings (Gillberg & Gillberg, 1983; Deykin & MacMahon, 1980). However, the interpretation of these results is difficult, because the specific complications that carried the highest risk of autism represented various forms of pathological processes with no apparent unifying feature. This lack of specificity may indicate that various types of physical damage may underlie some features of autistic symptomatology, but that no single complication or cluster of complications is responsible for the development of autism.

Child health problems were more evident among ASD subjects as reported by their parents. There were significant differences between subjects and controls for mental retardation and behavioural problems. We also found a relationship between physical illnesses such as fever, epilepsy and infectious diseases and autism. The strongest association with a medical condition was found by Rutter (1970) with epilepsy having bimodal peaks of onset in both early childhood and adolescence. Rosen et al. (2007) found a significant increase in genitourinary infections among autistic children compared to controls; otherwise, they found no significant differences between infections in children with and without ASD in the first two years of life. Other studies also support the association of mental retardation in children with more broadly defined ASD children, their cognitive level is significantly associated with the severity of their autistic symptoms (Rapin, 1997; Volkmar et al., 2004)

Concerning the parents' age of ASD cases included in the study, mothers and fathers at the birth of their child in the different Arab countries were significantly older. Most of the ASD parents were within the age range of 31 and 40 years. Other studies also demonstrated an older age, especially of mothers (Gillberg & Gillberg, 1983; Rosen, Yoshida, & Croen, 2007; Tsai & Stewart, 1983). A five-year study conducted by Croen (2007) studying all singleton children born found that the risk for ASD increased significantly with each 10-year increase in both maternal and paternal ages. Although sex differences were not statistically significant, associations with paternal age were somewhat stronger for girls than for boys. Other studies, however, do not associate advanced maternal age with autism

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(Juil-Dam, 2001; Mason-Brothers, Ritvo, & Pingree, 1990).

The presence of mental health problems among relatives of ASD children, such as similar symptoms, behavioural problems, language and learning problems, mental retardation and psychiatric illnesses were significant in our study. Piven et al.'s study (1997) on the broader autism phenotype found significant social deficits and stereotyped behaviours among parents, grandparents, uncles, aunts and siblings of autistic children. No significant communication deficits were found. In another study by Piven et al. (1991) on psychiatric disorders among parents of autistic children, they found a high incidence of generalized anxiety disorder and major depressive disorders. However, the etiology of these disorders is not clear.

Conclusion

This study is the first known study unifying the Arab countries in the use of one tool for screening for a specific disorder. It is still a pilot study and it showed that the M-CHAT is an effective tool to use in the early screening of autism in Arab countries especially if we keep in mind that it does not require a trained person to conduct. Thus, the M-CHAT can be used on a wider basis in our countries for a multinational screening programme. It also allows us to gather additional clinical information about children, parents and their families.

Limitations of the present study are that the group, which showed positive results with the M-CHAT, was a high-risk group already suspected to have developmental delay or autistic features. In addition, the study group, though from several countries, is not large enough to generalize the results to all countries.

Acknowledgements

The authors are grateful to the IACAPAP for the continuous support through provision of sincere advice and valuable feedback. A special thanks to Professors Bennett Leventhal, Myron Belfer, Phyllis Cohen and Diana Robins for their support to the EMACAPAP group to conduct this study.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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