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RISK ASSESSMENT OF AUTISM SPECTRUM DISORDER USING M-CHAT-R/F SCREENING TOOL AMONG TODDLERS ATTENDING PRIMARY HEALTH CARE IN JEDDAH, SAUDI ARABIA, 2018-2019: A ONE YEAR CROSS-SECTIONAL STUDY

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Abstract:

*Background and Aims: T*here have been a movement of global increase in the occurrence of ASD. Early detection of ASD could lead to the best long-term prognosis of autism while late diagnosis is linked with bigger stress to guardians caused delayed intervention, which is critical to a child with ASD. In the Kingdom of Saudi Arabia, there is no standard screening tool being followed to detect autism cases as early as possible in primary health care. This study intends to explore the risk assessment and determinants of ASD among toddler children who are attending primary health care centers in Jeddah, Saudi Arabia.*

Materials and Methods: A cross sectional study was conducted to children ages 12-36 months attending at the PHC Centers affiliated to Ministry of Health in Jeddah City from 2018-2019. Characteristics of the child, socio-demographics and behavioral variables of both parents, and pregnancy and delivery related factors to ASD were identified using a defined and tested M-CHAT-R/F questionnaire. Chi-square test was used to check the relationship of the categorized variables with the significance threshold set at 5%.

Results: Out of 900 respondents, a total of 891 qualified in the criteria. The study population has mean of current age of 23.7±5.6 months, mean age at which the child first word was 10.8±4.2 months, mean birth weight was 2.8±0.7. Females represent 52.5%, 69% were Saudi, 96% were full term baby, and 38% ranked as third or more birth order. Socio-demographic and behavioral characteristics of the parents has mean age of mothers and fathers were 30.7±6 and 35.4±7 years respectively, University level of education represents the highest percentage for both mothers (43.2%) and fathers (42.2%), however almost 80% of mothers were not working in the past 12 months. Before pregnancy, non-smoker mother were 95% and 59% of the fathers. The Arabic version of M-CHAT-R/F identified 762 (86.5%) of children were having a low risk of ASD, 102 (11.6%) were having a moderate risk, and the rest 17 (1.9%) (95% CI 1.02 to 2.84) were having a high risk. Chi-square test revealed three variables such as mother's smoking during pregnancy (p-value 0.01), mother smoking before pregnancy (p-value 0.042) and moral support during pregnancy (p-value 0.004) can predict ASD.

Conclusion: Toddlers (12-36 months) attending primary health care in Jeddah, Saudi Arabia from 2018-2019 has 86.5% that fall under the low risk category, 11.6% have moderate risk and 1.9% (95% CI; 1.02 to 2.84) of the children having high risk of ASD. Mother's smoking before pregnancy and during pregnancy), and moral support during pregnancy were the identified significant predictors of ASD.

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INTRODUCTION:

APA (American Psychiatry Association) defines ASD (autism spectrum disorder) as a biologically based neurodevelopmental disorder characterized by impairments in two major domains: 1) deficits in social communication and social interaction and 2) restricted repetitive patterns of behavior, interests, and activities (1). At a global scale, the WHO (World Health Organization) reported an estimate predominance of ASD as 1 in every 160 children (2). The Autism and Developmental Disabilities Monitoring (ADDM) Network of the CDC (Center for Disease Control and Prevention) however, reported differently a commonness of ASD as 1 in 59 children (3). Nonetheless, both WHO and CDC ADDM Network estimated that ASD is more common in male than female with 4:1 ratio (2, 3).

There have been several studies conducted to determine the factors that have association to ASD. Birth complications with trauma or hypoxia or ischemia have shown strong risk factors associated for ASD (4). Further pregnancy influences such as maternal diabetes, maternal obesity, and C/S on the other hand have shown a weak relation with ASD (4, 5). Review studies on nutrition have also indicated that paucity in vitamin D appeared to be common in children with ASD (4, 6). Furthermore, there is enough evidence for the relation between inorganic mercury and lead to ASD (4, 7). Aside from this, review studies pertaining to psychosocial risk aspects for ASD showed maternal immigration as an issue having a link with ASD. Environmental factors on the other hand, such as maternal smoking, vaccination, and thimerosal exposure were found unrelated to risk of ASD (4, 8)

Rationale
To realize the highest rate of sensitivity and specificity in the screening of ASD among children in low risk and high population, several screening tools were validated and modified (4). Early detection of ASD could lead to the best long-term

prognosis of autism (9). It could also improve day-to-day living abilities and social manners and quality of life for children with ASD (9). Late diagnosis however is linked with bigger stress among parents (10) and postponements of timely intervention, which is of dire importance to positive results overtime of youngsters with ASD.

In the Kingdom of Saudi Arabia, there is no standard screening tool being followed to detect autism cases as early as possible in primary health care. Almost no research on autism has been conducted in Saudi Arabia except that of Al-Zahrani in 2013 which involved school aged (7-12 years old) children. Up to our knowledge, no research has been carried out about screening of ASD on toddlers (12-36 months) in the country.

Aim of the study

The following study intends to explore explore Risk Assessment of ASD among toddler children who are attending primary health care centers.

Specific objectives
1. To stratify the study sample into low, moderate and high risk groups by using M-CHAT-R/F Screening among children attending primary health care centers.
2. To estimate the prevalence of toddlers at high risk of developing Autism.
3. To identify the factors associated with high risk of Autism.

LITERATURE REVIEW:
The Autism Spectrum Disorder
Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders characterized by persistent deficiency in social communication and interaction and limited and repetitive patterns of behavior, interests, or activities (1). Recently, there have been a movement of global upsurge in the occurrence of ASD and this could be attributed to

several reasons. The WHO summarized factors that have influenced such trend. Upgraded consciousness, development of analytical criteria, superior diagnostic tools, improved reporting and modifications in diagnostic performances (development of progressive screening, augmented identification and analytical substitution) were among these factors identified (2).

Detection of Autism Spectrum Disorder

It has been previously reported that prompt identification and intervention proved to be advantageous to both child with ASD and the concerned parents or family members (4, 9, 10). In 2006, the American Academy of Pediatrics offered a recommendation for a standardized screening tool for autism spectrum disorders at the 18- and 24-month well child pediatric visit (11). Having an appropriate screening or diagnostics tools that can detect ASD in children is thus necessary. In seek for a better screening or diagnostic tools for ASD fitted to respective characteristics or culture of the study population, several studies have been conducted utilizing modified screening tools.

In 2004, a group of Chinese researcher conducted a cross-sectional study on Chinese children aged 18 to 24 months using the CHAT-23 screening tool to differentiate children with autism (12). The CHAT-23 consisted of 2 parts namely, part A which is the parental questionnaire from M-CHAT and part B which is the observation part from the original CHAT. Part A had the utmost sensitivity but inferior specificity, while use of part B had the utmost specificity but inferior sensitivity. Based on this particular study it was recommended to use part A to identify the possible positive cases then advance to part B with assistance from qualified heath care workers (12).

In addition to this, the researchers have presented how to differentiate a child with autism. The child who is failing 2 of 7 key discerning questions or 6 of 23 questions in the parental questionnaire should be suspected of having autism. Further suggestions for observation by trained assessors should be adopted as part of the screening procedure. Failing 2 of 4 items in part B of the CHAT-23 suggests autism (12).

In 2008, a researcher from Georgia State University performed a study about ASD screening in primary care setting. This study used the Modified Checklist for Autism in Toddlers (M–CHAT) and the M–CHAT Follow-Up. The authors have presented M–CHAT as a standardized screening tool to promote Level 1 ASD test, and can be applied with least intervention on the general practitioner in primary care setting. Though not assumed to identify non-ASD delays, the M–CHAT can be practiced in combination with a universal screening tool to amplify early discovery of ASD. Moreover, the level 2 supplemental interview can be applied by a general practitioner throughout the well-child visit, so as to discover chance for ASD and deserves immediate medical recommendation (13). This research establishes the benefit of Level 1 screening for ASD using the M–CHAT in the primary care setting.

M–CHAT screen in the absence of the follow-up interview is not advanced in the primary care setting at this time. Interview should be combined into the well-child visit. The interview has been premeditated for use by professionals and paraprofessionals with least exposure with ASD, and can ordinarily be done in 5–15 minutes. Use of the interview produces the PPV to .57, which is a reasonable level (13).

In 2011, another study was carried out in USA to assess numerous initial screening tools applied in primary care setting and suggested endorsements in combining autism-specific screening into primary care practice. The authors have found that most primary care physicians have used level one screening tool to identify children who have high inclination to ASD in low risk population because application of this is fast and simple and can be interpreted easily (14). Children identified with ASD from level one screening are suggested to undergo the level two screening tools in order to determine the specific disorder. However, level two screening are unusually practiced for screening in a primary care setting because it is time consuming to manage and interpret (13, 14).

Furthermore, the investigators have pinpointed four important characteristics along which screening test could be preferred. Firstly, sensitivity must be almost high to make sure that children with the disorder will be identified. Second is specificity, must be comparatively high to identify those children who do not have the disorder. The third criterion is positive predictive value (PPV) and lastly, the negative predictive value (NPV) (14). Therefore a screening tool that meet the criteria can be established. In this study also the authors recommended to submit or apply the screening tool as the child would have their immunizations accompanied with their parents (14). In the same year also, another researchers have provided recommendation that children should undergo the two screenings whenever they attend for 18 and 24 month vaccination because when screening is done together with or as a chunk of routinely pediatric care, children from culturally and ethnologically diverse backgrounds took part more equally and frequently (15).

In 2012, a group of researchers conducted a study to evaluate the adaption of Modified Checklist for Autism in Toddlers (M-CHAT) as a screening method based on culture and setting in Turkey. The study showed that the predictive positive value (PPV) of the M-CHAT escalates when the questionnaire was filled-up by the health-care staff with the parents. Additionally, the researchers have concluded that M-CHAT is a beneficial tool in Turkey for screening children for pervasive developmental disorder in primary care after the age of 18 months when it is modified based on culture and setting (16).

In 2014, another study was carried out to confirm the efficacy of M-CHAT in metropolitan Atlanta and Connecticut to screen toddler aged 18- and 24-months. In this particular study, the researchers have used a Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F) where wordings from the original M-CHAT have been simplified and then a follow up screening was done to youngsters who sustained screen positive. The researchers described that children with total score was >3 and >2 after follow-up had a 47.5% risk identified with autism spectrum disorder 94.6% risk of any developmental deferment. Using children detected 2 years younger than the national median age of diagnosis; the present corroboration study specifies that the M-CHAT-R/F advances the aptitude to detect autism spectrum disorders amongst toddlers screened during well-child care appointments. Furthermore, the researchers have reported that the M-CHAT-R distinguishes autism at high risk compared with the M-CHAT. It can likewise detect the number of children requiring the follow-up (17).

In 2016, a study in Albania was performed to screen 2,594 toddlers for autism using M-CHAT-R-A (Modified Checklist for Autism in Toddlers Revised-Albanian) screener that were accomplished by mothers. In this study, out of 2,594 children screened only 253 (9.75%) screened positive on the MCHAT-R-A. Follow up interviews were used utilizing the M-CHAT-R/F-A for those of the screened positive toddlers wherein 127 (50.2%) identified with ASD. The remaining 126 were did not follow up because of parent refusal to communicate. A total of 26 of the 127 toddlers who received the follow-up interview (21%) persisted to screen positive on the follow-up (MCHAT-R/F-A), making them eligible for a free developmental/diagnostic assessment. This study concluded that strong performance is exhibited using the M-CHAT-R to diagnose ASD in toddlers who received follow up after screening positive during community visits (18).

METHODOLOGY:
Study design and study location
The study design is descriptive cross sectional which was conducted at the Primary Health Care Centers (PHCC) affiliated to Ministry of Health in Jeddah City. Jeddah city is located in Makkah province in western area of Saudi Arabia on coast of Red Sea. It is the second largest city in Saudi Arabia after the capital Riyadh. The total number of PHC Centers affiliated to Ministry of Health in Jeddah is 47 centers. They are distributed over five sectors according to hospitals distribution: King Abdullah Medical Complex (11 PHCC), East of Jeddah Hospital (10 PHCC), AL-Thaghar Hospital (6 PHCC), King Fahad General Hospital (13 PHCC) and King Abdul-Aziz Hospital (7 PHCC).

Study population

The target population is toddlers aged 16-36 months who attended primary health care in Jeddah, Saudi Arabia.

Sample size

The formula $P = 1 - (1-\pi)^n$ was used to calculate the sample size for rare events.

The critical event limit r =1 (the most commonly used value), the expected incidence of ASD (λ event rate) is 0.0033 (0.33%) or less, and the power of the study was 95%, the calculated sample size was 900 subjects.

Sampling technique
Multistage sample technique
Stage one selection of PHC centers
Two health center was selected from each sector using simple random sample.
Stage two selection of toddlers
All toddlers aged (16-36) who were attended to the selected PHC were included in the study.

Data collection tool
We have two tools of data collection.:
First: The Modified Checklist for Autism in Toddlers, Revised with Follow up (M-CHAT-R/F) (13, 14). This M-CHAT-R/F consists of 20 questions answered by parents

(0-2) score low risk
(3-7) score moderate risk; should be followed up. if the score equal two or more need referral for diagnosis and early intervention but if after follow up the score (0-1) no need referral.
8-20 score high risk; need immediate referral

Second: Questionnaire regarding Factors related to high risk child with ASD. The was Questionnaire validated by three consultant divided into 3 parts namely;

Part 1: Characteristics of the child.

Part 2: Socio-demographic and behavioral variables of parents.

Part 3: Factors related to pregnancy and delivery.

Data collection technique

Interview with parents was done during their waiting time in waiting area of the PHC Centers.

Variables

Dependent factors:

1- The percentage of toddlers at low, medium and high-risk strata of developing autism.

2- The prevalence of toddlers at high risk of developing autism

Independent factors:

The factors associated with toddlers at high risk of developing autism, which include: -

Child's age, gender, nationality, child birth order, age difference between child and his/her older sibling, birth weight, term of pregnancy, age of child when pronounced first word, mother's age, father's age, mother's education, father's education, professional status in last 12 months, mother and father smoking status before and during pregnancy, family history of mental illness, medications and supplements during pregnancy, maternal complication during pregnancy, moral support and depression during pregnancy and postpartum, type of delivery, child complication during delivery.

Data entry and statistical analysis

Data collected were entered and statistically analyzed using SPSS statistical software package version 22.

Ethical considerations

Prior to the conduct of the study, the researchers have obtained the following permits and approvals:

- Ethical approved was obtained from Research ethical in minstery   of health
- Permission from public health and PHCC
- Written consents was obtained from all mother of the toddlers.
- Psychiatric referral done for high risk group.

Budget

This particular study is self- funded by the author.

RESULTS:

Demographic characteristics of the study population

900 toddlers aged 16-36 months were selected in the current study. However, nine children didn't fit the criteria to be included and were omitted from the study. The mean and SD of toddlers were 23.7±5.6 months. 52.5% of them were females, 38% ranked as third or more birth order and 96% were full term babies. In terms of nationality, mostly (69%) were Saudi nationals. The mean age at which the child first word was 10.8±4.2 months. The mean birth weight was 2.8±0.7. Ten children having extreme weights, the highest and lowest extreme weights ranged from 5 to 7.5 kg and from 0.7 to 0.9 kg respectively Table 1.

Regarding the socio-demographic and behavioral characteristics of the parents (Table 2), the mean age of mothers and fathers were 30.7±6 and 35.4±7 years respectively. The University level of education represents the highest percentage for both mothers and fathers; 43.2% and 42.2% respectively. Almost 80% of mothers were not working in the past 12 months. Non-smoker parents before pregnancy was 95% of the mothers and 59% of the fathers. Slightly higher percentage was observed to non-smoker parents after pregnancy which was 96.1% of the mothers and 63.8% of the fathers. Almost all of the parents (94.4%) does not have background of mental illness in the family.

Table 1. Comparison between low\moderate autism risk group and high risk group with regards to some characteristics of the child.

Characteristics	Mean Total N (%)	High N(%)	Low\ Moderate N(%)	p-value
Age (months)	23.67(±5.678)	-	-	-
Gender -Male	414 (47.5%)	9	405	.903
-Female	457 (52.5%)	8	449	
Nationality -Saudi	595 (69%)	13	579	.748
-Non_Saudi	268 (31%)	4	264	
Child birth order -First	286 (33%)	6	280	.401
-Second	251 (29%)	2	249	
-Third or more	333 (38%)	9	324	
If not first born, age difference between child and older sibling by months: - <12 - 12-24 - 24-36 - >36	24(4%) 150(26%) 157(27.4%) 243(42.3%)	0 3 4 3	24 147 153 240	.257
Child's weight	2.78(±0.68)	-	-	-
Long of pregnancy: -Term	832 (96%)	13	819	.148
-Preterm	33 (4%)	2	31	
Child age when said first word	10.83(±4.22)	-	-	-

* significant at p-value <0.05

Table 2. Comparison between low\moderate autism risk group and high risk group with regards to some socio-demographic and behavioral variables of the parents.

Variables	Total N (%)	High N(%)	Low\ Moderate N(%)	p-value
Socio-demographic of the Parents				
Mother's age	30.697 (5.9284)	-	-	-
Father's age	35.387 (±7.1312)	-	-	-
Mother's education level -Primary	101(11.7%)	2	99	.883
-Intermediate	91(10.5%)	3	88	
-Secondary	264(30.6%)	4	260	
-University	373(43.2%)	7	366	
-Advanced studies	35(4.1%)	1	34	
Father's education level -Primary	69(8.1%)	0	69	.146
-Intermediate	87(10.2%)	4	83	
-Secondary	298(34.8%)	5	293	
-University	362(42.2%)	7	355	
-Advanced studies	41(4.8%)	1	40	
Mother's professional status (in past 12 months) -Work	174(20.3%)	6	168	.278
-Did not work	685(79.7%)	11	674	
Behavioral Characteristics of the Parents				
Mother's smoking status <u>before</u> pregnancy				.042*

-Smoker	44(5.1%)	2	42	
-Non-smoker	815(94.9%)	14	14	
Father's smoking status <u>before</u> pregnancy				.101
-Smoker	352(41%)	7	345	
-Non-smoker	506(59%)	10	496	
Mother's smoking status <u>during</u> pregnancy				.079*
-Smoker	33(3.9%)	2	31	
-Non-smoker	823(96.1%)	15	808	
Father's smoking status <u>during</u> pregnancy				.213
smoker	309(36.2%)	5	304	
non-smoker	545(63.8%)	12	533	
If having family members diagnosed with mental illness				.790
Yes	48(5.6%)	1	47	
No	812(94.4%)	16	796	

 * significant at p-value <0.05

Risk assessment of ASD among children

According to the Arabic version of the Modified Checklist for Autism in Toddlers, Revised, with follow up (M-CHAT-R/F), majority of the children studied (86.5%) children were having a low risk of ASD while 11.6% of these children were having a moderate risk of ASD and 1.9% have high risk of ASD, as shown in Table 3 (95% CI 1.02 to 2.84). These 102 (11.6%) children needs follow-up check-up for verification. On the other hand, the 17 (1.9%) children that fall under the high risk category needs immediate referral to experts for final diagnosis.

Table 3. classification of toddlers according level of Autism Spectrum Disorder (ASD) risk in Jeddah, Saudi Arabia from 2018-2019 using the Arabic version of the Modified Checklist for Autism in Toddlers, Revised, with follow up (M-CHAT-R/F).

Risk Category	Frequency	Percent
low	762	86.5
Moderate	102	11.6
High	17	1.9
Total	881	100.0

Predictors of ASD among children

Chi-square test results showed that none of the following variables were able to predict ASD, namely, the gender, the nationality, the child birth order, the gestational age (Table 1), mother and father educational levels, mother's professional status in past 12 months, father smoking status, presence of a family members diagnosed with mental illness (Table 2), supplements and medications taken during pregnancy, type of delivery, complications during pregnancy or delivery, the moral support after delivery, and depression during pregnancy (Table 4). On another hand, three variables can predict ASD, mother's smoking during pregnancy (p-value 0.01), mother smoking before pregnancy (p-value 0.042) as shown in Table 2, and the moral support during pregnancy (p-value 0.004) which was protective against ASD as shown in Table 4. Multiple linear regression analysis showed that none of the following variables were able to predict ASD, namely, age of the child, age of the mother, and age of the father.

Table 4. Comparison between low\moderate autism risk group and high risk group with regards to some factors related to pregnancy and delivery.

Factors	Total N (%)	High N(%)	Low\ Moderate n(%)	p-value
If any supplements were taking during pregnancy -Yes -No	 767(90.1%) 84(9.9%)	 14 3	 753 81	.278
If any medications were taking during pregnancy -Yes -No	 126(15.1%) 711(84.9%)	 3 13	 123 698	.448
Which medication were you taking? -Anticonvulsants -Antidepressants -Others	 6(5.2%) 1(0.9%) 108(93.9%)	 1 0 3	 5 1 105	.875
If any mother's complications during pregnancy -Yes -No	 116(13.7%) 729(86.3%)	 3 12	 113 717	.678
Mother's complications during pregnancy -GDM -Preeclampsia -Infections -Others	 72(8.2%) 25(2.8%) 3(0.3%) 22(2.5%)	 14	 741	.809
Moral support during pregnancy -Yes -No	 690(81.2%) 160(18.8%)	 13 3	 677 157	.004*
Depression during pregnancy -Yes -No	 173(20.6%) 665(79.4%)	 2 12	 171 653	.836
Type of delivery -SVD -CS -Using delivery tools	 551(64.5%) 300(35.1%) 3(0.4%)	 11 5 0	 541 295 3	.818
If any child's complications during delivery -Yes -No	 53(6.3%) 794(93.7%)	 2 13	 51 781	.206
Child's complications during delivery -Hypoxia -Trauma -Others	 30(55.6%) 4(7.4%) 17(31.5%)	 2 0 0	 28 4 17	.755
Moral support during and after delivery -Yes -No	 751(88.5%) 98(11.5%)	 13 3	 738 95	.386
Depression after pregnancy -Yes -No	 198(23.2%) 656(76.8%)	 2 14	 196 642	.560

* significant at p-value <0.05

DISCUSSION:

This undertaking was executed in order to determine the occurrence (M-CHAT-R/F) and identify the determinants of ASD among children aged 16-36 months attending primary health care centers in Jeddah.

Ideally, final diagnosis should be done for more accurate prevalence determination, but in this research, the risk of ASD was assessed by using screening tool (M-CHAT-R/F). This screening test conducted in the study have identified 86.5% of the

children fall under the low risk category, 11.6% have moderate risk and 1.9% (95% CI; 1.02 to 2.84) of the children having high risk.

In 2013, a similar study was conducted in Taif district, Saudi Arabia by Al-Zahrani and reported a prevalence rate of autism in primary school whose aged 7-12 years was 0.035%, which was much lower than our study results (19).

Another study 2010 in Oman by Al-Farsi and colleagues which used a different screening tools such as the DSM IV-TR (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision) and CARS (Childhood Autism Rating Scale) identified an overall predominance of 1.4% (95% CI; 1.2% to 1.7%) among children whose aged 0-14 years (20).

Furthermore, a recent Lebanese cross-sectional study in 2018 by Saab and colleagues which used M-CHAT screening test among children aged 16-48 months identified a national ASD prevalence of 1.48% with 95% CI (0.84% to 2.12%) (21). Several factors can be considered explaining the variation in the prevalence rates among studies, and one of those factors is due to our study involved all children whore are attending to PHCC regardless of health condition while other studies took only healthy children.

Nonetheless, our findings determined three variables that can predict ASD namely mother's smoking during pregnancy (p-value 0.01), mother smoking before pregnancy (p-value 0.042), and the moral support during pregnancy (p-value 0.004) was protective against ASD. In addition, there are some factors identified to be significantly associated to ASD in other studies that were statistically insignificant in our results. Our findings are one of the few studies that reported parental smoking is significantly associated with ASD. Contrary to this, other studies have stated that there is no conclusive evidence linking smoking and increased risk of ASD (21, 22).

To have a more concrete diagnosis of the children identified at high risk, psychiatric referral was also done for them. A follow up research will be done for the final diagnosis and prevalence of ASD.

CONCLUSION:
According to our results, 86.5% of the children fall under the low risk category, 11.6% have moderate risk and 1.9% (95% CI; 1.02 to 2.84) of the children having high risk. We also identified significant predictors of ASD such as mother's smoking during

pregnancy (p-value 0.01), mother smoking before pregnancy (p-value 0.042), and the moral support during pregnancy (p-value 0.004) which was protective against ASD.

RECOMMENDATION:

As early recognition of ASD is needed for early implementation of multidisciplinary treatment, a number of screening tests may be employed in order to assess the appropriateness of the tool on the target population in a future study. Due to the lack of standardized and validated tools in Saudi Arabia that specifically focus on the prevalence of ASD, assessment of current ASD diagnosis and launch of a national surveillance program is a significant determinant of ASD prevalence. Further researches is required to pinpoint efficient assessment approaches that preserve reasonable accuracy and quality while allowing potential ASD cases to be early diagnosed. Furthermore, a continuous health care follow-up would raise the accuracy and precision of the estimated rates of ASD among the study population. In brief, our findings can serve as a baseline for future researches that will utilize more advanced techniques for a better understanding of ASD and factors related with it.

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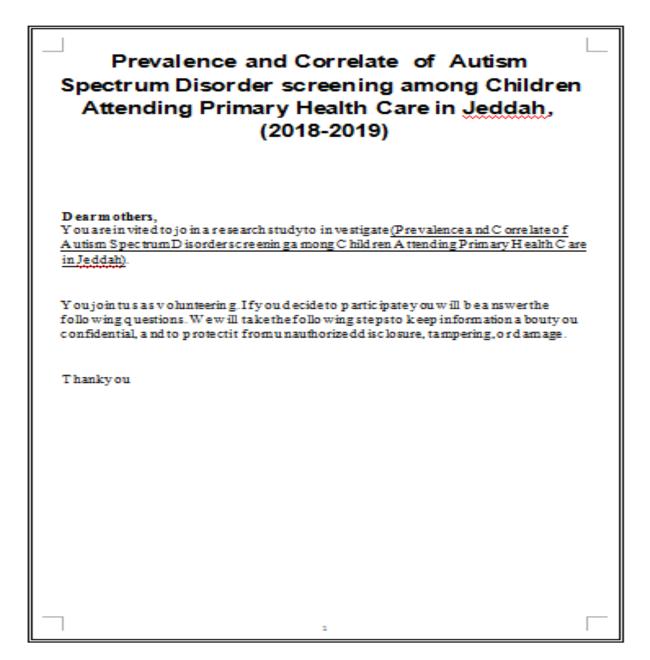
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APPENDIX A

Prevalence and Correlate of Autism Spectrum Disorder screening among Children Attending Primary Health Care in Jeddah, (2018-2019)

Dear mothers,
You are invited to join a research study to investigate (Prevalence and Correlate of Autism Spectrum Disorder screening among Children Attending Primary Health Care in Jeddah).

You joint us as volunteering. If you decide to participate you will be answer the following questions. We will take the following steps to keep information about you confidential, and to protect it from unauthorized disclosure, tampering, or damage.

Thank you

Child information:

question	Options	answer
1-What is the age of the child?		------------
2-What is the gender of the child	1- Boy 2- Girl	
3-what is the nationality of the child?	1- Saudi 2- Non Saudi	
4-What is the order of the child?	1- First 2- second 3- third or more	
If the answer (first child) transfer to question 6		
5-what is the age difference between them and last child?	1- Less than 12 month 2- From 12 to 24 month 3- From 24 to 36 month 4- More than 36 month	
6-What is the weight of the child at birth?		------------
7-was the child term or preterm ?	1- Term(9month) 2- Premature	
8-how old is the child when pronouncing the first word ?		------------

Parent information:		
9-How old is the mother?		
10-How old is the father?		
11-Education level of the mother	1. elementary 2. intermediate 3. secondary 4. university 5. postgraduate	
12-Education level of the father	1. elementary 2. intermediate 3. secondary 4. university 5. postgraduate	
13-mother professional status past 12 months	1. working 2. Not working	
14-Is the mother smoked before pregnancy?	1. yes 2. no	
15-Is the mother smoked during pregnancy?	1. Yes 2. no	
16-Is the father smoked before pregnancy?	1. Yes 2. no	
17-Is the father smoked during pregnancy?	1. Yes 2. no	
18-Did any Family members diagnosed with any mental illness?	1. yes 2. no	

Pregnancy and delivery information:

19-Did you take supplements during pregnancy?	1- yes 2- no	
If the answer(no) transfer to question 21		
20-What supplements did you eat during pregnancy?	1- Folic acid 2- calcium 3- iron 4- Omg3 5- Others(specify)…………	
21-Did you take any medication during pregnancy?	1- Yes 2- no	
If the answer(no) transfer to question 23		
22-What medications did you take during pregnancy?	1- Anticonvulsant 2- Antidepressants 3- others(specify)…………	
23-Have you had complications during pregnancy?	1- Yes 2- no	
If the answer(no) transfer to question 25		
24-What complications have you experienced during your pregnancy?	1- Gestational diabetes 2- Preeclampsia 3- Infection 4- Other (specify) …………	
25-Did you have moral support from your family during pregnancy?	1- yes 2- no	
26- Have you suffered from depression during pregnancy?	1- yes 2- no	
27-what is type of delivery?	1- Normal vaginal 2- Cesarean section	
28-Have you had complications during delivery?	1- yes 2- no	
29-if the answer yes, please choose which type of complication	1- O2 low 2- trauma 3- Other(specify)………………	
30-Did you have moral support from your family during and after delivery?	1- yes 2- no	
31-Have you suffered from postpartum depression?	1- yes 2- no	