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Accuracy of Ages and Stages Questionnaire as a Broad Screening Tool for Autism: Pakistani Population Perspective

Zainab Zahid and Nazia Mumtaz

Riphah International University

Ghulam Saqulain

Riphah International Hospital

Autism Spectrum Disorder (ASD) is disorder of behavior which occurs in early life and affects social communication. ASD has a high local prevalence, economic burden, compromised quality of life, and need of population screening by an easy-to-use screening tool and its sensitivity assessment. Current study was conceived to evaluate the accuracy of Ages and Stages Questionnaire-3 (ASQ-3; Squires et al., 2009) as a broadband screening tool to gauge at risk individuals for autism in Pakistan. This cross-sectional comparative study was done at Riphah College of Rehabilitation and Allied Health Sciences Lahore, Pakistan over a period of 6 months from July to December 2021. A sample of 154 children with autism aged 24 and 30 months of both genders were included. Children with any comorbid conditions and developmental speech and language disorders, Cerebral Palsy, Downs Syndrome, or any other conditions were excluded from the study. Basic demographic sheet, ASQ-3, and Modified Checklist for Autism in Toddlers Revised (MCHAT-R; Robins et al., 2009) were utilized for data collection and the analysis was done utilizing SPSS Version 21. Analysis revealed that ASQ-3 has a sensitivity of 73.70%, specificity of 83.30%, positive predictive value of 83.50%, negative predictive value of 49.20% and an accuracy rate of 75.97%. A significant positive correlation was present between MCHAT-R and ASQ both at 30 months of age and 24 months. Findings showed that ASQ-3 can be used confidently as a broad-based screener for ASD, and hence help in early identification and management of ASD cases by clinicians and researchers.

Zainab Zahid and Nazia Mumtaz, Department of Speech Language Pathology, Riphah International University, Lahore, Pakistan.

Ghulam Saqulain, Riphah International Hospital, Islamabad, Pakistan.

Correspondence concerning this article should be addressed to Ghulam Saqulain, Riphah International Hospital, Islamabad, Pakistan.

Email: ghulam_saqulain@yahoo.com

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Autism Spectrum Disorder (ASD) is a behavioral disorder occurring early in life and characterized by deficiency in social communication as well as stereotypic, rigid or repetitive sensorimotor behavior (Lord et al., 2018), including deficiency in social and emotional reciprocity, nonverbal communication, relationship development, and maintenance; repetitive and restrictive behavior including stereotype motor manners, speech and objects; non flexible rather fixed routines or behavior patterns; being occupied with certain interests; atypical sensitivity or interest; etc. (Weitlauf et al., 2014). Hence, screening of kids 18-21 Month of age will help rapid diagnosis (Zwaigenbaum et al., 2015).

Prevalence of ASD varies considerably across the globe with overall estimates ranging from 0.19 to 11.6 per 100 population with a much higher prevalence range of 1.6 to 18.9 in Asia noted in a review by Chiarotti and Venerosi (2020), with an ASD population of 350,000 children in Pakistan (Furrukh & Anjum, 2020). Hence as regards the prevalence, effect on family, morbidity, economic burden, and outcome, ASD is considered among the most devastating developmental childhood disorders which affect development of appropriate age relationship with parents as well as siblings and other significant members (DiCicco-Bloom et al., 2005).

In Pakistan with misconceptions about features of autism, ASD has not come under the limelight of policy makers (Imran & Azeem, 2014). Hence diagnosis and intervention of developmental issues like ASD could be challenging with barriers in screening and referral of children with developmental disorders, so much so that only 20% get a chance of intervention before 3 years of age, with recommendation of standardized screening at 9, 18, 24, and 30 months or as soon as suspected (Vitrikas et al., 2017). Early intervention may be responsible for improving intelligence quotient (IQ), academic endeavors, better employment status, and decreased tendency for being involved in crimes (Mackrides & Ryherd, 2011).

A consideration of the research was: Should the general surveillance of child's development include ASD screening? A review by Zwaigenbaum et al. (2015) posited that screening for ASD at 18 to 24 months age is supportive in early detection and is also in compliance to the recommendations of American Academy of Pediatrics. While keeping in view the screening proprieties, a screening test could be sensitive and/or specific with a screener that correctly identifies at high-risk population and is a sensitive test for screening of ASD and a child who is missed being identified by screener is false negative. On the

other hand, a test which correctly identifies a child who does not have ASD is termed as the specificity of the screening test measure, so if this screened positive it will be a false positive (Zwaigenbaum et al., 2015).

Studies have indicated the importance of type and number of concerns of parents in prediction of ASD especially for children of age 12 months and above. These concerns are even more valid in case of parents already having a child with ASD. The type of concerns mostly related to speech, language and communication. Hence utilizing standardized questions for screening can be very helpful for identification of children with ASD (Ben-Sasson et al., 2018).

Studies have supported the idea of specific ASD screening tools MCHAT and its revised version MCHAT-R (Robins et al., 2009) which is a 23 item Autism Specific Screener to screen the 16- to 30-month-old at risk children for Autism. Broad based screeners have also been developed like ASQ-3, which due to ease of usage, interpretation and quick to administer are favored by primary practitioners, with specific screeners used at a second stage (Hardy et al., 2015). Hence, research for investigation of the sensitivity and specificity is pertinent and required (Zirakashvili et al., 2018).

Keeping in view the high local prevalence of ASD which is also a source of economic burden, compromising quality of life of individuals with ASD and their care-givers as a result of delay in early intervention due to the necessity of screening of population using a broad based easy to use screener and need of sensitivity assessment of ASQ, the current study was conceived with the objective to evaluate the accuracy of Ages and Stages Questionnaire as a broadband screening tool to gauge at risk individuals for autism in Pakistan for early identification and intervention. This study might have implications for future research, will help bring the issue of ASD into limelight to get the attention of policy makers, help clinicians in confidently using a broad-based screener for ASD, and hence, help in early identification and management of ASD cases.

Method

Research Design

Current cross-sectional comparative study was conducted at Riphah College of Rehabilitation and Allied Health Sciences (RCR & AHS) over a period of 6 months from 1st July 2021 to 31st December 2021. A sample of 154 children with autism aged between 24 and 30 months (24 months 1 day; to 30 months 29 days) of both genders was taken using convenience sampling technique from speech language

pathologists/therapists (SLP/Ts) working at Lahore Autism Centre (LAC) a nonprofit organization, Centre for Autism Related disorder/ Disability Institute (CARD), Max Resolution Clinic and Pakistan Society for Rehabilitation of Disabled (PSRD) Lahore, Pakistan. These were children who visited institutes for evaluation. Children with any comorbid conditions and developmental speech and language disorders, cerebral palsy, Downs' syndrome, etc., were excluded from the study.

Initial sample including 163 children was calculated taking prevalence proportion of 0.12 (Chiarotti & Venerosi, 2020), confidence level of .05, absolute precision d = 0.05 and effect size 1 using formula:

$$N = \frac{z^2_{\alpha/2} * p * (1-p) * DEFF}{d^2}$$

Sample with incomplete, incorrect age specific questionnaire, lack of English language proficiency, and parents of children who had already received diagnosis of ASD prior to the study were excluded leaving behind sample of 154.

Measures

The basic demographic sheet, ASQ-3 (Squires et al., 2009), and MCAT-R (Robins et al., 2009) (Gold Standard) were used for data collection to meet the desired objectives of the study.

Ages and Stages Questionnaire-Edition 3

The ASQ-3 (Hardy et al., 2015; Squires et al., 2009) is a broad-based tool/ screener with 21 items specific to developmental age (one month to five years and six months age) to assess child in 5 different domains including fine motor, gross motor, communication, personal/social, and problem solving. Each domain has 6 questions with scoring as *Yes* = 10 points, *sometimes* = 5, and *not yet* = 0 point and on basis of total score, domains can be coded as *Fail*, *Monitor*, or *Pass*.

Modified Checklist for Autism in Toddlers-Revised

The MCHAT-R (Robins et al., 2009) is a 20-item autism specific screener with each item rated as *yes* = 0 or *no* = 1; items 2, 5, and 12 are reversed. It is designed for children of 16 to 30 months of age. MCHAT scoring determines whether follow-up is required, with score 0-2 no further follow-up is needed while in case of score 3-7 denotes that follow-up is needed being potential candidate of referral for evaluation, while eight or more failed items means follow-up should be

bypassed and referral for evaluation/ assessment and early intervention is necessary.

Procedure

The study was conducted following ethical approval of research from Research and Ethics Committee of Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University, Lahore, Pakistan vide Registration No. REC/RCR & AHS/21/0622 dated 14th June 2021 and consent of the parents.

For the current study, data collection communication domain of ASQ-3 was utilized for age 24 and 30 months and each was coded as *Pass* = 1, *Monitor* = 2, and *Fail* = 3 to compare the results with MCHAT-R. SLP/Ts working at the settings were utilized for data collection. They were briefed about the MCHAT-R and ASQ-3.

Through either MCHART-R or ASQ-3 if the child was screened positive were evaluated. ASQ-3 scores for the domain of communication were examined and for children screening positive on the MCHAT-R, and children assessed diagnosed as ASD, to evaluate the sensitivity of the tool ASQ-3. Screening data was composed of different settings such as clinics, centres, and institutional settings over the course of 6 months. Data were collected through the speech language therapist and pathologists. Speech language pathologists/ therapists which participated in the study explained the benefits of usage of MCHAT-R, an autism specific screener and a broadband screening tool ASQ-3. As ASQ-3 was an addition to the screening, only therapists/ pathologists who used both the tools, MCHAT-R and ASQ-3, were incorporated in the study.

Participants were excluded from the study if either form was left incomplete or if any incorrect age specific form of ASQ-3 was utilized. Participants were also left out from this research if the individual participating did not know the English language. Furthermore, if participants had any issues due to which they could not perform appropriately were also excluded from the study, as well as children who had already received the diagnosis of ASD prior to screening were excluded.

Statistical Analysis

The SPSS Version 21.0 was used for data analysis. Descriptive statistics was utilized. Sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and Accuracy of ASQ-3 were calculated. Bivariate correlation was used to see correlation between

MCHAT-R and ASQ-3 at 24- and 30-months age; a $p < .05$ was considered significant.

Results

Frequency Distribution of Sample Population

The current study with a sample of 154 comprised mostly of 136 (88.3%) males and 18(11.7%) females with 116 (75.35%) children being 30 months of age while remaining 38(24.7%) were 24 months of age.

Comparative Results (Accuracy) of ASQ-3 and MCHAT-R

The data collected was analyzed to assess the diagnostic accuracy of ASQ-3 as a broadband screening tool to gauge at risk individuals for autism compared to MCHAT-R, a gold standard tool. Analysis revealed ASQ-3 has a sensitivity of 73.70%, specificity of 83.30%, PPV of 83.50%, NPV of 49.20% and an Accuracy rate of 75.97%.

Table 1: *Results of ASQ3 and MCHAT-R Cross Tabulation (N =154)*

	Test Result		**MCHAT-R**		
			Positive	Negative	**Total**
ASQ-3	Positive	Count	87 [a] True positive	6 [b] False Positive	93
		% within ASQ	93.50% PPV	6.50%	100%
		% within MCHAT	73.70% Sensitivity	16.70% False Positive	60.40 %
	Negative	Count	31 [c] False Negative	30 [d] True Negative	61
		% within ASQ	50.80%	49.20% NPV	100%
		% within MCHAT	26.30% False Negative	83.30% Specificity	39.60 %
	Total	Count	118	36	154
		% within ASQ	76.60% (Prevalence-% of sample that passed)	23.40%	100%
		% within MCHAT	100.00%	100.00%	100%

Note. PPV = Positive Predictive Value; NPV = Negative Predictive Value.

Accuracy Rate Formula Accuracy = a + d /(a + d + b + c) x 100 = 87 + 30 (87 + 3 0 + 6 + 31) x 100 = 75.97%.

Correlation Between MCHAT and ASQ-3

Pearsons Product Moment Correlation for severity of Autism as detected by MCHAT-R and ASQ-3 at 24 months of age and 30 months of age of children reveal significant positive correlations r = .165 (p = .04) and r = .249 (p = .002), respectively.

Discussion

To improve the development of children to test the physical, cognitive, social cognitive, and communication/language milestones early detection and intervention is essentially required for which screener tools with higher sensitivity and positive predictive value are essentially needed (Salgodo-Cacho et al., 2021).

In current study data collected from 154 participant children. The analysis revealed ASQ-3 has a sensitivity of 73.70%, specificity of 83.30%, PPV of 83.50%, and NPV of 49.20% and an accuracy rate of 75.97%. In a study by Hardy et al. (2015), it was revealed that ASQ-3 was able to detect 87% of children who were positively screened on MCHAT-R. In the current study, ASQ-3 successfully identified 56.5% cases who screened positive on MCHAT-R giving ASQ-3, a sensitivity of 73.70% in current study. A study by Sangare et al. (2009) to validate MCHAT-R and social communication questionnaire (SCQ) revealed that ASQ-3 to have sensitivity of 71%, PPV (73%), NPV (70%), and specificity of 72% compared to MCHAT-R. While in this study, the ASQ-3 when compared to MCHAT-R revealed higher sensitivity and specificity at 73.70 and 83.30%, respectively. In contrast to our study, a study by Guiberson and Rodriguez (2010), which utilized Spanish ASQ, reported low sensitivity (59%) and high specificity (92%) of Spanish ASQ. Keeping in view these facts, it can be safely assumed that M-CHAT-R plus ASQ-3 together reduce the sensitivity and NPV but increase the specificity and PPV (Sturner et al., 2019). These results favor the fact that ASQ-3 is a good general screener which can help reduce specific ASD screening and save the possible false negative cases that could have been dropped out in case of specific screening use only and hence should be explored further in larger studies in future.

Our results are quite similar to those reported by Wiggins et al. (2014). In their study, it was found that a screener tool Parents Evaluation of Developmental Status efficiently screened children with

ASD but lacked the specificity and hence over identified children with ASD and a specific ASD screener that is Modified Checklist for Autism in Toddlers was then used to pick the cases with ASD. Hence, the present study as well and study by Wiggins et al. (2014), both favor two stage screening procedures with ASQ-3/ Parents Evaluation of Developmental Status as level one screener could help reduce children requiring specific ASD assessment.

A study by Ben-Sasson et al. (2018), with a sample of children 16 to 30 months of age, revealed that there was significant and high correlation (spearman) between MCHAT-R, MCHAR-R/F, and ASQ (correlations .56 to -.65, α <.001). Similarly in the current study, Pearson's' correlation matrix for severity of autism as detected by MCHAT-R, ASQ - 3 at 24 months of age, and ASQ-3 at 30 months of age revealed a significant highly positive correlation between results of MCHAT-R and ASQ-3 at 30 months of age and at 24 months. Similarly, a study by Chong et al. (2017) revealed that ASQ-3 was sensitive to difference in age. Hence, ASQ-3 is a reliable screening tool for children requiring further in-depth assessment (Squires et al., 2009).

Limitation

This study lacks generalizability and ecological validity because children who actually visited institutes for evaluation of delays and ASD were included thus reducing the heterogeneity of the sample which complies to another study (Miller et al., 2011). The screener ASQ-3 might be more sensitive to ASD in other age groups; however, our sample did not allow this to be measured, and hence future research should examine these facts. Also, our sensitivity of ASQ-3 is an estimate studied against gold standard MCHAT-R, however, there might be missed cases which were false negative.

Conclusions

As a broad screening tool ASQ-3 has a good accuracy, sensitivity specificity, PPV, and NPV.

References

Ben-Sasson, A., Robins, D. L., & Yom-Tov, E. (2018). Risk assessment for parents who suspect their child has autism spectrum disorder: Machine learning approach. *Journal of Medical Internet Research, 20*(4), e134. https://doi.org/10.2196/jmir.9496

Chiarotti, F., & Venerosi, A. (2020). Epidemiology of autism spectrum disorders: A review of worldwide prevalence estimates since 2014. *Brain Sciences, 10*(5), 274. https://doi.org/10.3390/brainsci10050274

Chong, K. C., Zhou, V. L., Tarazona, D., Tuesta, H., Velásquez-Hurtado, J. E., Sadeghi, R., & Llanos, F. (2017). ASQ-3 scores are sensitive to small differences in age in a Peruvian infant population. *Child: Care, Health and Development*, *43*(4), 556-565. https://doi.org/10.1111/cch.12469

DiCicco-Bloom, E., Lord, C., Zwaigenbaum, L., Courchesne, E., Dager, & S. R., Schmitz, C., et al. (2005). The developmental neurobiology of autism spectrum disorder. *Journal of Neuroscience*, *26*(26), 6897-906.

Furrukh, J., & Anjum, G. (2020). Coping with autism spectrum disorder (ASD) in Pakistan: A phenomenology of mothers who have children with ASD. *Cogent Psychology*, *7*(1), 1728108.

Guiberson, M. M., & Rodriguez, B. L. (2010). Measurement properties and classification accuracy of two Spanish parent surveys of language development for preschool-age children august 2010. *American Journal of Speech-Language Pathology*, *19*(3), 225-37.

Hardy, S., Haisley, L., Manning, C., & Fein, D. (2015). Can screening with the Ages and Stages Questionnaires detect Autism? *Journal of Developmental & Behavioral Pediatrics*, *36*(7), 536-43. https://doi.org/10.1097/DBP.0000000000000201

Imran, N., & Azeem, M. W. (2014). Autism Spectrum Disorders: Perspective from Pakistan. In V. Patel, V. Preedy, & C. Martin (Eds.), *Comprehensive guide to Autism* (pp. 2483-2496). Springer, New York, NY. https://doi.org/10.1007/978-1-4614-4788-7_152

Lord, C., Elsabbagh, M., Baird, G., & Veenstra-Vanderweele, J. (2018). Autism spectrum disorder. *The Lancet*, *392*(10146), 508-520. https://doi.org/10.1016/S0140-6736(18)31129-2

Mackrides, P. S., & Ryherd, S. J. (2011). Screening for developmental delay. *American Family Physician*, *84*(5), 544-9.

Miller, J. S., Gabrielsen, T., Villalobos, M., Alleman, R., Wahmhoff, N., Carbone, P. S., & Segura, B. (2011). The each child study: Systematic screening for Autism Spectrum Disorder in a pediatric setting. *Pediatrics*, *127*(5), 866-871.

Robins, D. L., Barton, M., & Fein, D. (2009). Modified checklist for autism in toddlers, revised with follow-up. *Pediatrics*. https://drexel.edu/~/media/Files/autismInstitute/EDI/M-CHAT-R_F.ashx

Sangare, M., Toure, H. B., Toure, A., Karembe, A., Dolo, H., & Coulibaly, Y. I. et al. (2009). Validation of two parent-reported autism spectrum disorders screening tools M-CHAT-R and SCQ in Bamako, Mali. *Neurological Science*, *15*, 100188. https://doi.org/10.1016/j.ensci.2019.100188

Squires, J., Twombly, E., Bricker, D., & Potter, L. (2009). *ASQ-3 User's guide*. Baltimore, MD: Paul H. Brookes Publishing. Co. https://agesandstages.com/wp-content/uploads/2017/05/ASQ-3-TechnicalAppendix_web.pdf

Sturner, R. A., Howard, B. J., Steward, L., Attar, S. M., Bergmann, P. E., & Bet, K. (2019). *Utility of the M-CHAT-R for Identifying Autism and/or*

developmental disorder in a representative community sample at the 18-month pediatric visit. Poster presentation: Room: 710 (Palais des congres de Montreal). https://insar.confex.com/insar/2019/webprogram/Paper31341.html

Vitrikas, K., Savard, D., & Bucaj, M. (2017). Developmental delay: When and how to screen. *Am Fam Physician*, *96*(1), 36-43.

Weitlauf, A. S., McPheeters, M. L., Peters, B., Sathe, N., Travis, R., Aiello, R., ... & Warren, Z. (2014). *Therapies for children with autism spectrum disorder: Behavioral interventions update*. https://www.ncbi.nlm.nih.gov/books/NBK241433/

Wiggins, L. D., Piazza, V., & Robins, D. L. (2014). Comparison of a broad-based screen versus disorder-specific screen in detecting young children with an autism spectrum disorder. *Autism*, *18*(2), 76-84. https://doi.org/10.1177/1362361312466962

Zirakashvili, M., Gabunia, M., & Tatishvili, N. et al. (2018). Cultural adaptation and psychometric validation of the Ages and Stages Questionnaires for use in Georgia. *Journal of Child and Family Studies*, *27*, 739-749. https://doi.org/10.1007/s10826-017-0917-z

Zwaigenbaum, L., Bauman, M. L., Fein, D., Pierce, K., Buie, T., Davis, P. A., & Wagner, S. (2015). Early screening of autism spectrum disorder: Recommendations for practice and research. *Pediatrics*, *136*(1), S41-S59. https://doi.org/10.1542/peds.2014-3667D

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