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EVALUATION OF "TRACT AND ACT", A NOVEL ONLINE DEVELOPMENTAL SCREENING TOOL

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ABSTRACT
Track and Act is an online developmental screening tool, developed at our center, and accessible to any person with a basic knowledge of using computers/ smartphone. In this study, we evaluated the ability of a novel web-based developmental screening tool to detect developmental delays in young children. For this study, 125 children (4–30 months old) visiting our center, presenting with developmental concerns and born at term gestation with no antenatal or post-natal complications were included. Children born at pre-term gestation or with physical deformities/syndromes were excluded in this study. The online screening tool was used for assessing the 4 domains of development – language and communication, movement and physical, cognitive, and socio-emotional, through a series of "Yes/No" questions. Children enrolled in the study then underwent a formal developmental assessment using the Developmental Assessment Scales for Indian Infants (DASII). Track and Act showed good acceptable sensitivity and specificity for a screening tool in the different developmental domains. The Positive Predictive Values were high indicating that significant development delay was not missed. The tool had good accuracy in identifying high-risk children especially in the domains of language and socio-emotional development when compared with DASII. Based on our results, Tract and Act is a useful, sensitive, easy-to-use screening tool not only for tracking developmental milestones but also for identifying developmental delays such as autism spectrum disorders, and could be beneficial to parents and pediatricians.

KEYWORDS: Child development, Developmental disorders, Diagnosis, Online systems, Autism spectrum disorders.

INTRODUCTION
The early years of life are very important in influencing a range of subsequent health and social outcomes. During the early years of development, our brain has the most ability to form new connections and reorganize itself and this process is known as neuroplasticity.[1] The early environment of children has vital impact on the way their brains develop. The more stimulating the early environment, the more positive connections are formed in the brain and children thrive better in terms of physical, emotional and social development, with an optimal ability to express themselves and acquire knowledge. The availability of early childhood development programs and services to support child development during the early years are crucial components of an overall strategy for a successful childhood. Early childhood development services may address one or more of the key developmental domains, i.e., language/cognitive, social/emotional, adaptive and physical development.[2] These developmental domains can be inferred through a child's performance on a number of observed variables (test items) rather than being directly measured.[3]

A significant amount of morbidity can be reduced if developmental concerns are detected and intervened early. Studies have shown that developmental trajectories can be changed with early interventions. More than 50% of children with all disabilities are not identified before school entry, which precludes their participation in early intervention programs. Although there are many screening tests that can greatly improve detection rates, these have not been popular in primary care due to issues such as test length and difficulty in managing the behavior of the children.[4]

'Track and Act' is a newly developed screening tool by child development specialists for screening of developmental milestones across 4 main domains of development – language and communication, movement and physical, cognitive, and socio-emotional, through a series of "Yes/No" questions corresponding to the child's age.

The aim of this study was to evaluate the ability of this online tool to screen for developmental delay symptoms in a population of children who have developmental concerns. The results of the screening were compared to those from a widely used formal developmental assessment (Developmental Assessment Scales for Indian Infants (DASII))[5] to determine the diagnostic accuracy of the outcome. This study is the first step towards validating Track and Act as a developmental screening tool.

METHODS

The study was conducted at our center, the Centre for Child Development and Disabilities, Bengaluru, India, for a period of one year (May 2016 - April 2017). This is a referral center for the evaluation and management of differently abled children. Children were enrolled based on the eligibility criteria for this study in accordance with the STARD guidelines,[6] that is, children who visited the center with concerns in their development between the ages of 4 months to 30 months and born at term gestation with no antenatal or post-natal complications. All children born at preterm gestation (<37 weeks of gestation) or having physical deformities or syndrome were excluded from the study. Informed consent was obtained from parents/guardians before the assessments.

The online screening tool "Track and Act" (TA) (available through the website (https//www.totsguide.com/track-act and also as an App for Android phones) assesses four main domains of development – language and communication, movement and physical, cognitive, and socio-emotional. It is primarily aimed to provide a serial monitoring of a child's development from 4 months to 5 years of age. The tool is criterion referenced and items have been designed based on widely used screening tools. TA is also available in 3 different Indian languages (Hindi, Kannada, Tamil) for increased accessibility to population where English is not well-understood. In this pilot study, the results obtained from TA were compared to the developmental assessment done formally by a professional using DASII within 2 weeks of screening with TA, and the sensitivity and specificity of the screening tool was obtained.

The TA questionnaire contains items regarding common things observed by caregivers/parents about their children. In this study, parents could answer the entire questionnaire within 10 minutes. Each question has a score pattern that is pre-coded based on its importance for that particular age and the answers were automatically scored by the software. Scores generated in each domain of development were taken for the study. Scoring patterns used in the study were as follows: All scores were out of 100 in TA. Scores from 61–100 were considered as indicating normal development. Scores from 41–60 were considered as indicating concern in development. Scores between 0–40 were considered as indicating below average development. Similarly in DASII - Developmental Quotient (DQ) of >85 was considered as Normal, 70–85 indicated concerns in development, and <70 indicated Delayed development. Cluster percentiles of <25th centile indicated significant concern and >25th centile were considered as normal development.

Statistical analyses

Statistical software SAS 9.2 was used for the analysis of the data. Data were analyzed using Chi-square/ Fisher Exact test to find the significance of study parameters on categorical scale between two or more groups and Non-parametric setting for Qualitative data analysis. P value of ≤ 0.01 was considered strongly significant, P value ≤ 0.05 was considered moderately significant.

RESULTS AND DISCUSSION

Identification of developmental delays by screening is the first step in the process of sensitization and working towards a child development program at an individual and community level. It is intended to identify problems at an early stage and identify individuals for whom further, in-depth assessments and activities are needed. The screening done at an individual level helps caregivers and health providers to work on customized interventions for a particular child.

One hundred and twenty five children (84 boys, 41 girls) fulfilling the eligibility criteria were enrolled in the study. The maximum number of children belonged to the 12-24 months age group (n = 60) and the most common diagnosis was Autism spectrum disorder (48%).

We found that the screening tool could identify developmental delay in 35.2% of cases and concern in development in 37.6% of the cases. The assessment done by DASII in the same group of children yielded 26.4% with delayed development and 23.2% with mild concerns in development of the Motor Quotient. The Mental Quotient of DASII revealed 61.6% of children with delayed development and 23.4% with mild concerns of mental development. Comparing the four domains of development, it was seen that for language and communication, the scores obtained by TA significantly correlated with that of DASII (P<0.001, **Table 1**).

Table 1: Correlation of Language & Communication clusters in DASII to Track & Act Score of Language / Communication.

	Language / Communication		Total	P value
	Normal	Abnormal		
Vocalization, Speech, Communication	(n = 21)	(n = 104)	(n = 125)	
Normal	14 (66.7%)	4 (3.8%)	18 (14.4%)	<0.001**
Abnormal	7 (33.3%)	100 (96.2%)	107 (85.6%)	
Vocabulary, Comprehension	(n = 19)	(n = 105)	(n = 124)	
Normal	14 (73.7%)	6 (5.7%)	20 (16.1%)	<0.001**
Abnormal	5 (26.3%)	99 (94.3%)	104 (83.9%)	

For movement and physical development domain, the significance of correlation between TA and DASII scores ranged from P<0.001 to 0.035 (**Table 2**).

Table 2: Correlation of Motor clusters in DASII to Track & Act Score of Movement / Physical

	Movement / Physical		Total (n = 125)	P value
	Normal (n =70)	Abnormal (n = 55)		
Neck Control				
Normal	70 (100%)	51 (92.7%)	121 (96.8%)	0.035*
Abnormal	0 (0%)	4 (7.3%)	4 (3.2%)	
Body Control				
Normal	59 (84.3%)	30 (54.5%)	89 (71.2%)	<0.001**
Abnormal	11 (15.7%)	25 (45.5%)	36 (28.8%)	
Locomotion – 1				
Normal	66 (94.3%)	31 (56.4%)	97 (77.6%)	<0.001**
Abnormal	4 (5.7%)	24 (43.6%)	28 (22.4%)	
Locomotion – 2	(n = 63)	(n = 45)	(n = 108)	
Normal	38 (60.3%)	12 (26.7%)	50 (46.3%)	0.001**
Abnormal	25 (39.7%)	33 (73.3%)	58 (53.7%)	
Manipulation				
Normal	62 (88.6%)	32 (58.2%)	94 (75.2%)	<0.001**
Abnormal	8 (11.4%)	23 (41.8%)	31 (24.8%)	

For the cognitive domain, except for the auditory cognizance (P = 0.255) and understanding relationships (P = 0.06), the other sub-domains showed significant correlations when compared to DASII scores (P<0.001 to 0.045) (**Table 3**).

Table 3: Correlation of Cognizance clusters in DASII to Track & Act Score of Cognitive.

	Cognitive		Total (n = 125)	P value
	Normal (n = 55)	Abnormal (n = 70)		
Visual Cognizance				
Normal	54 (98.2%)	52 (74.3%)	106 (84.8%)	<0.001**
Abnormal	1 (1.8%)	18 (25.7%)	19 (15.2%)	
Auditory Cognizance				
Normal	55 (100%)	67 (95.7%)	122 (97.6%)	0.255
Abnormal	0 (0%)	3 (4.3%)	3 (2.4%)	
Reaching, Manipulating, Exploring				
Normal	35 (63.6%)	16 (22.9%)	51 (40.8%)	<0.001**
Abnormal	20 (36.4%)	54 (77.1%)	74 (59.2%)	
Memory				
Normal	46 (83.6%)	35 (50%)	81 (64.8%)	<0.001**
Abnormal	9 (16.4%)	35 (50%)	44 (35.2%)	
Understands relationships	(n = 54)	(n = 70)	(n = 124)	
Normal	18 (33.3%)	13 (18.6%)	31 (25%)	0.060+
Abnormal	36 (66.7%)	57 (81.4%)	93 (75%)	
Differentiation by use, shape and movement	(n = 50)	(n = 68)	(n = 118)	

Normal	14 (28%)	9 (13.2%)	23 (19.5%)	0.045*
Abnormal	36 (72%)	59 (86.8%)	95 (80.5%)	
Manual Dexterity	(n = 44)	(n = 64)	(n = 108)	
Normal	26 (59.1%)	18 (28.1%)	44 (40.7%)	0.001**
Abnormal	18 (40.9%)	46 (71.9%)	64 (59.3%)	

For the socio-emotional domain, a significant correlation (P<0.001) was observed between TA and DASII scores (**Table 4**).

Table 4: Correlation of Social Interaction cluster in DASII to Track & Act Score of Socio-emotional

Social Interaction, imitative behavior	Socio-Emotional		Total
	Normal	Abnormal	
Normal	10 (33.3%)	6 (6.3%)	16 (12.8%)
Abnormal	20 (66.7%)	89 (93.7%)	109 (87.2%)
Total	30 (100%)	95 (100%)	125 (100%)

P<0.001**, Significant, Chi-Square test

The accuracy of TA when compared with the DASII in all sub-domains ranged from 62–92%, with the highest accuracy shown in the language and communication domain. Similarly, the sensitivity ranged between 57–100% and the specificity ranged from 45–78% for different sub-domains. Highest positive predictive values of >90% was observed for language and socio-emotional domains.

In India, there have been few studies determining the efficacy of international tools on Indian population.[7–9] One such study on the screening tool Ages and Stages Questionnaire® (ASQ) (modified slightly for cultural differences) in 200 Indian children compared the ASQ scores with that of the DASII and showed that ASQ has strong test characteristics for detecting developmental delay even in low resource settings. This study showed that in resource-poor settings, if parents were provided with a structured tool that is reliable, they would be able to identify developmental issues and possibly seek help earlier.[7]

The traditional screening tools available for detecting developmental disabilities are not only inconvenient and time-consuming to use, but they are dependent on reasonable cooperation of the child.[7] On the other hand, an online screening tool would help bypass many of the above-mentioned constraints. In this study, the scores from TA demonstrated a good correlation with that of DASII. Sensitivity and specificity between 70–80% is regarded acceptable for developmental screening. A low false-negative error rate (relative to a low false-positive error rate) is generally preferable, because of the more serious consequences of a high false-negative rate leading to failure to identify children with a disorder and missing opportunities for early intervention.[10] The sensitivity and specificity varied for different items in the domains due to the number of clusters in DASII. The items in the screening tool may not be as extensive as the assessment tool and this may explain the variations that are seen in the domains.

Unlike physical parameters of growth, namely weight, height and head circumference, which are serially monitored in children and plotted on graphs, health workers assess development only at one point in time. Development is a dynamic process and requires constant monitoring at intervals to identify delays. Repeated developmental screening is more valid and accurate than a single assessment. TA provides this platform to parents where they can assess their child at regular intervals and at their convenience. A trend in particular domain/ domains begins to develop on serial monitoring, suggesting to the parents that their child's development is normal or delayed. The tool also stores the data over time, which can be shared with pediatricians and healthcare workers as required.

The main limitation of the study is that it was a referral center based study. The children who came to the center were already at a higher risk than the general population to have developmental concern. However, as the first step towards validating the tool, this study aimed to determine whether TA was sensitive enough to detect a developmental delay in a population with developmental concerns. The use of this tool in the general population would be undertaken similarly in the near future, thereby reflecting the true sensitivity and specificity of this tool in the population at large. Another limitation is that the study only covered children less than 30 months although the tool can be used in children up to 5 years of age. This was to enable comparison with DASII, which is valid for children till 30 months of age. Inter-rater reliability, test-retest reliability was not studied to check if the screening tool would be affected by parental bias.

In the event of parents' inability to use the screening tool, a health worker who has a computer with Internet access can keep multiple records of several children without any paperwork. The advantage of this tool is the possibility of doing serial monitoring; however, this was not the aim of this one-time assessment study. Therefore, trends of delayed development could not be demonstrated. Longitudinal studies with greater sample

sizes in the general population will be required in the near future to get good reliability.

Based on our results, we can conclude that Track and Act online screening tool has good validity when compared to a widely used assessment tool like DASII. There is a large scope for using this tool for general screening of development in children from 4 months to 5 years after validation across different settings and population groups.

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