

# **Indian Scale for Assessment of Autism (ISAA)**

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**The Ministry of Social Justice and Empowerment, Government of India constituted an Expert Committee to develop an Indian tool for assessment of persons with autism for issuance of disability certificate.**

# Multi-Centric Research Project

## Objective

The main objective was to develop a simple tool for assessment of autism for issuance of disability certificate, so that persons with autism can avail benefits and concessions given by the Government.

# METHODOLOGY

The tool was developed in the following three stages.

Stage I - Test construction

Stage II - Selection of field centers  
Training to research staff

Stage III - Standardization of the tool

# Test Construction

## Item Pool

An item pool consisting of 437 test items was developed based on items suggested by professionals and literature.

## Item Selection

Out of 437 , 70 items were short listed after validating by expert opinion from 30 professionals.

Expert committee further scrutinized and selected 57 items.

## Item Analysis

A pilot study was conducted of 57 items on a sample of 52 (Autistic-32,MR-20)

Based on the results 40 items were selected.

# **Indian Scale for Assessment of Autism (ISAA)**

**The ISAA is a rating scale comprising of 40 test items grouped under 6 domains.**

- 1. Social Relationships and Reciprocity**
- 2. Emotional Responsiveness**
- 3. Speech, Language and Communication**
- 4. Behaviour Patterns**
- 5. Sensory Aspects**
- 6. Cognitive Component**

# Indian Scale for Assessment of Autism

Items		Rarely Upto 20% Score 1	Sometimes 21 – 40 % Score 2	Frequently 41 – 60% Score 3	Mostly 61- 80 % Score 4	Always 81-100% Score 5
<b>I. SOCIAL RELATIONSHIP AND RECIPROCITY</b>						
1	Has poor eye contact					
2	Lacks social smile					
3	Remains aloof					
4	Does not reach out to others					
5	Unable to relate to people					
6	Unable to respond to social/ environmental cues					
7	Engages in solitary and repetitive play activities					
8	Unable to take turns in social interaction					
9	Does not maintain peer relationships					

## II. EMOTIONAL RESPONSIVENESS

10	Shows inappropriate emotional response					
11	Shows exaggerated emotions					
12	Engages in self-stimulating emotions					
13	Lacks fear of danger					
14	Excited or agitated for no apparent reason					

## III. SPEECH-LANGUAGE AND COMMUNICATION

15	Acquired speech and lost it					
16	Has difficulty in using non-verbal language or gestures to communicate					
17	Engages in stereotyped and repetitive use of language					
18	Engages in echolalic speech					
19	Produces infantile squeals/ unusual noises					
20	Unable to initiate or sustain conversation with others					



21	Uses jargon or meaningless words					
22	Uses pronoun reversals					
23	Unable to grasp pragmatics of communication (real meaning)					

#### IV. BEHAVIOUR PATTERNS

24	Engages in stereotyped and repetitive motor mannerisms					
25	Shows attachment to inanimate objects					
26	Shows hyperactivity/ restlessness					
27	Exhibits aggressive behavior					
28	Throws temper tantrums					
29	Engages in self-injurious behavior					
30	Insists on sameness					

## V. SENSORY ASPECTS

31	Unusually sensitive to sensory stimuli					
32	Stares into space for long periods of time					
33	Has difficulty in tracking objects					
34	Has unusual vision					
35	Insensitive to pain					
36	Responds to objects/people unusually by smelling, touching or tasting					

## VI. COGNITIVE COMPONENT

37	Inconsistent attention and concentration					
38	Shows delay in responding					
39	Has unusual memory of some kind					
40	Has 'savant' ability					

# Test Administration

- Standard Testing conditions
  - Method of assessment
    - Observation
    - Informant interview
    - Testing
  - Standard Test material / Kit
  - Testing time : 30 minutes

# Standardization of the Tool

The tool was field tested in the following ten centers representing different states of India so that the tool can be used across the country.

1. Composite Regional Center, Srinagar, J&K
2. RMLH, New Delhi
3. PGIMER, Chandigarh
4. Deepshikha, Ranchi, Bihar
5. Umeed, CDC, Mumbai
6. Composite Regional Center, Guwahati, Assam
7. Pradip, Center for Autism, Kolkata
8. NIMHANS, Bangalore
9. Vijay Human Services, Chennai
10. NIMH, Secunderabad

# Training Programmes

- Training programmes were organized for training of Research Staff to carry out field testing in different centers.
- Hands-on-experience of assessment using ISAA was imparted by case demonstrations and discussions.
- CD was developed on ISAA testing and given to research personnel for reference.

# Research Design

The project included three study groups.

Group I: Autism

Group II: MR & others

Group III: Normal

# Proposed Sample

- A total sample of 120 was to be collected from each of the 10 field centers. The age range of the subjects was between 3 to 20 years.

1	Autism group	40
2	MR and ADHD group	40
3	Normal group	40
Total		120

# Data collection

Data was collected by trained investigators on a total of 1247 study subjects in ten field centers across the country.

Table- 1 Total Sample Collected from Study Centres

1	Autism group	436
2	MR and ADHD group	411
3	Normal group	400
	Total	1247



# Tools Used

Childhood Autism Rating Scale (CARS) was used for establishing criterion validity of the present tool, Indian Scale for Assessment of Autism (ISAA).

Indian Scale for Assessment of Autism (ISAA)

CARS and ISAA were administered on the total sample (N=1123).

# Data Validation

- Data scrutiny was carried out to obtain valid data for analysis.
- Data was checked for any outliers and wrong entries.
- After cleaning of the data, 124 subjects were dropped from the total data because of incompleteness, mismatching or any other such errors.

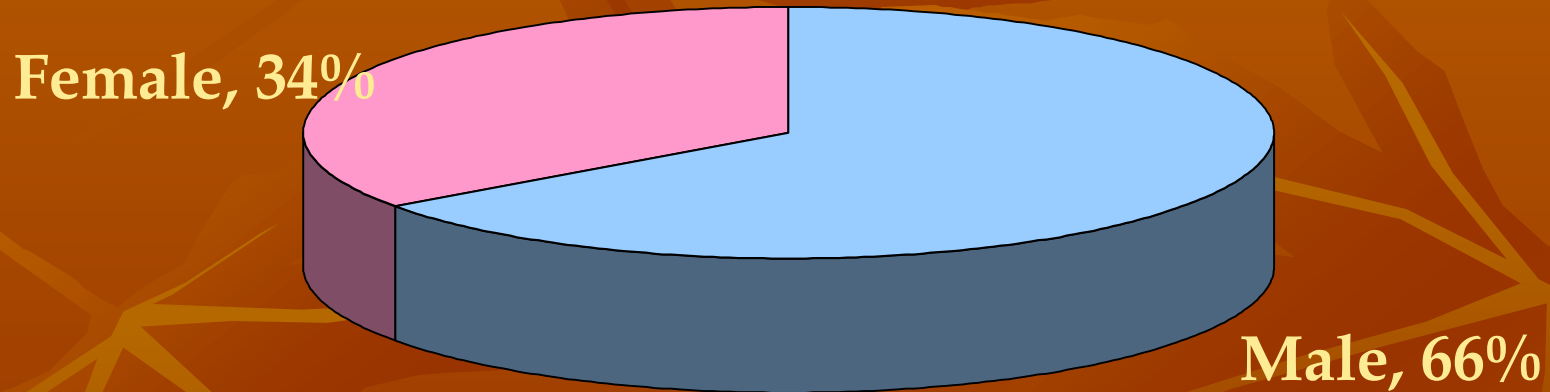
# Results & Discussion

## Analysis of Demographic Variables

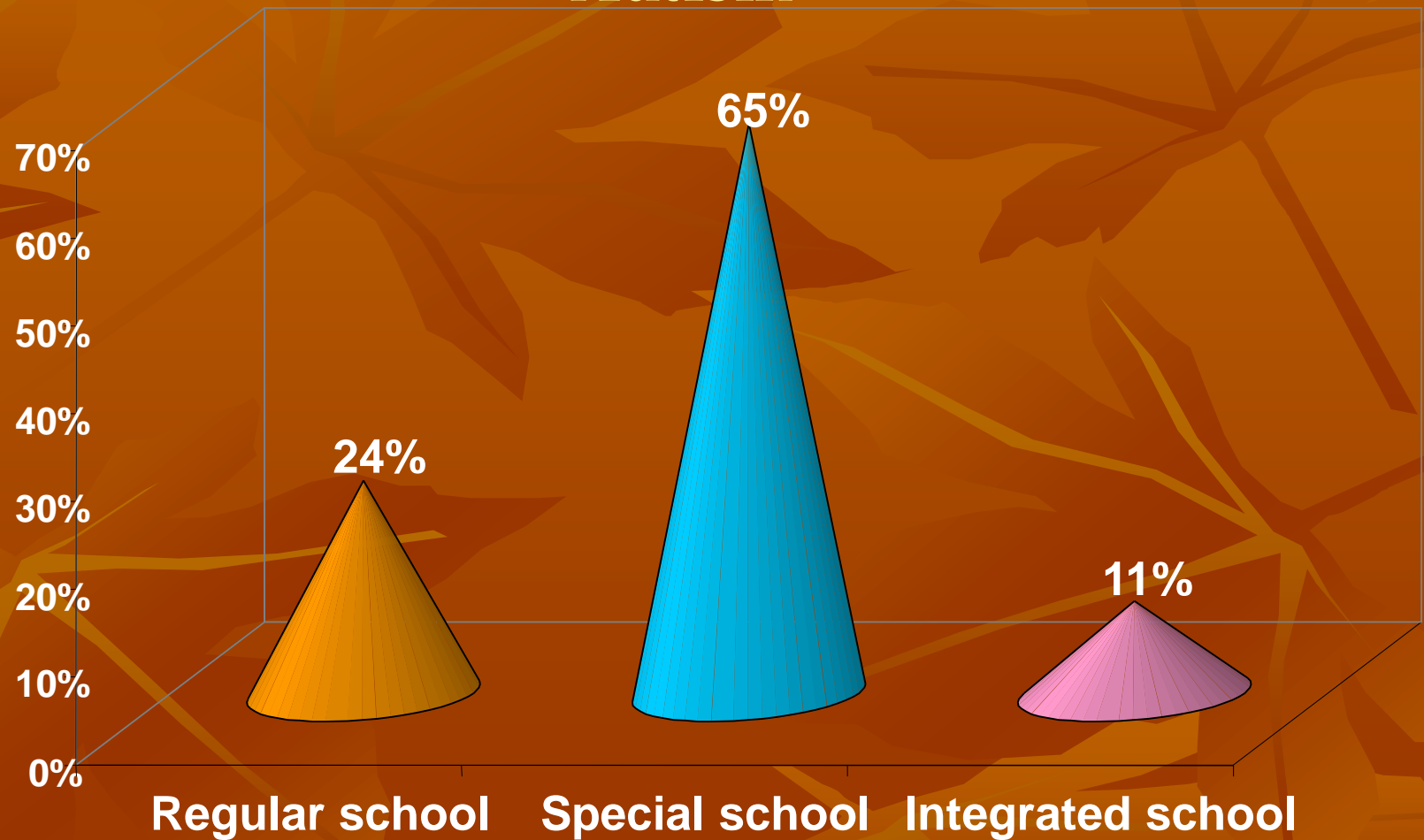
**Table -2      Sample Characteristics**

Group	Autism N=401		MR N=322		Normal N=400		Total N=1123	
Variable	N	%	N	%	N	%	N	%
Age ( Years)								
Range	3-19		3-22		3-19		3-22	
Mean	9.35		9.82		9.27		9.45	
SD	4.09		4.31		3.97		4.11	
Gender								
Male	292	72.8	198	61.5	249	62.3	739	65.8
Female	109	27.2	124	38.5	151	37.8	384	34.2

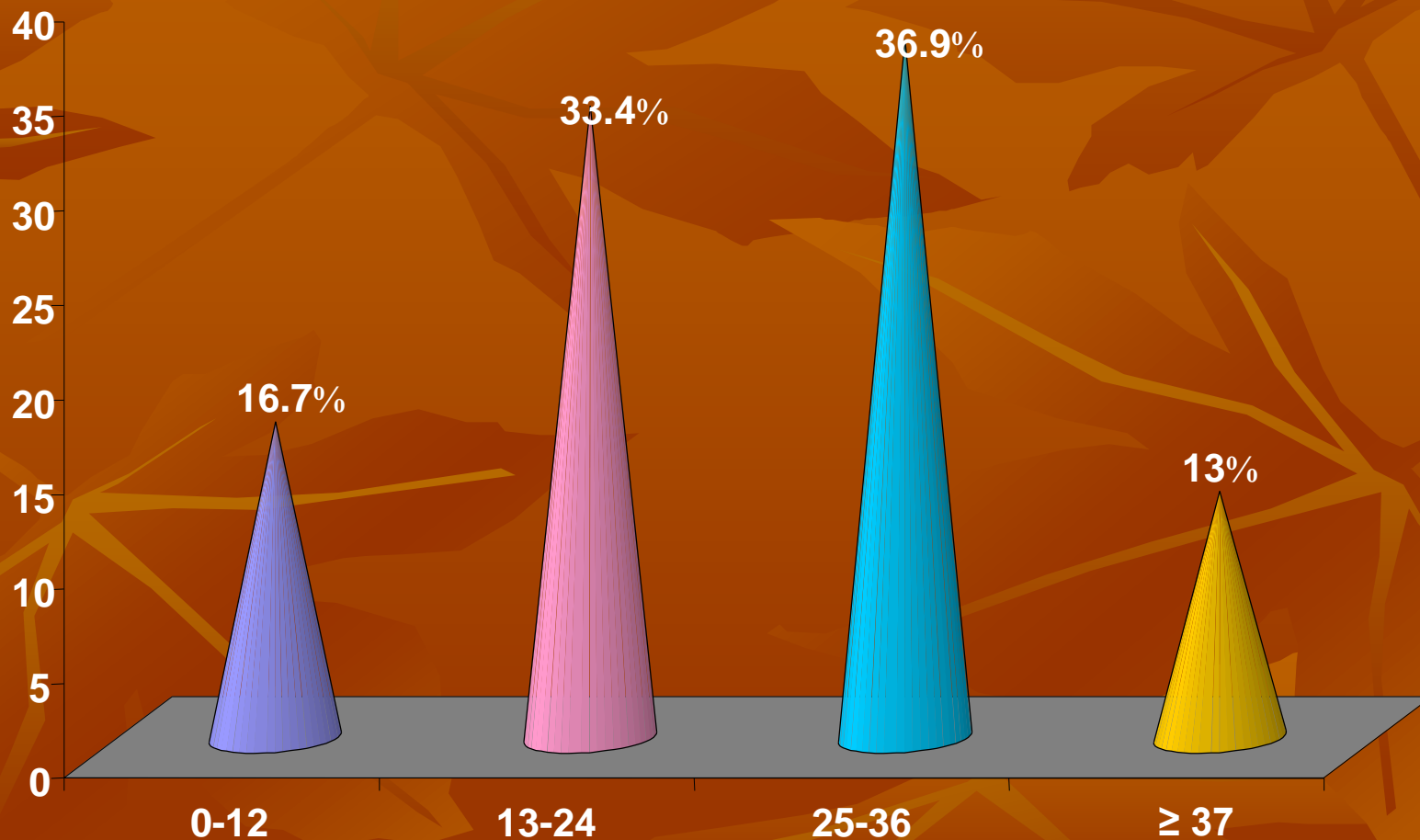
**Figure 1 Gender Distribution of Study Sample**



**Figure 2    Type of Schooling of Children with Autism**



**Figure 3 Age of Onset (months) among Children with Autism**



# Results of ISAA

- Item total correlations were computed to obtain validity of each item in the scale.
- Results show that all the items of ISAA were found to be highly significant at 0.001 level, except, one item viz. 'savant ability' which was significant at 0.05 level.
- Hence the present results indicate that all the 40 items are valid and hence may be retained in ISAA tool.

## ■ Item Total Correlations

Item No.	Correlation Value	Significance level
A1	.561(***)	.000
A2	.629(***)	.000
A3	.656(***)	.000
A4	.710(***)	.000
A5	.702(***)	.000
A6	.668(***)	.000
A7	.597(***)	.000
A8	.629(***)	.000
A9	.531(***)	.000
A10	.613(***)	.000
A11	.595(***)	.000
A12	.597(***)	.000
A13	.626(***)	.000
A14	.648(***)	.000
A15	.455(***)	.000
A16	.582(***)	.000
A17	.497(***)	.000
A18	.318(***)	.000
A19	.493(***)	.000
A20	.488(***)	.000



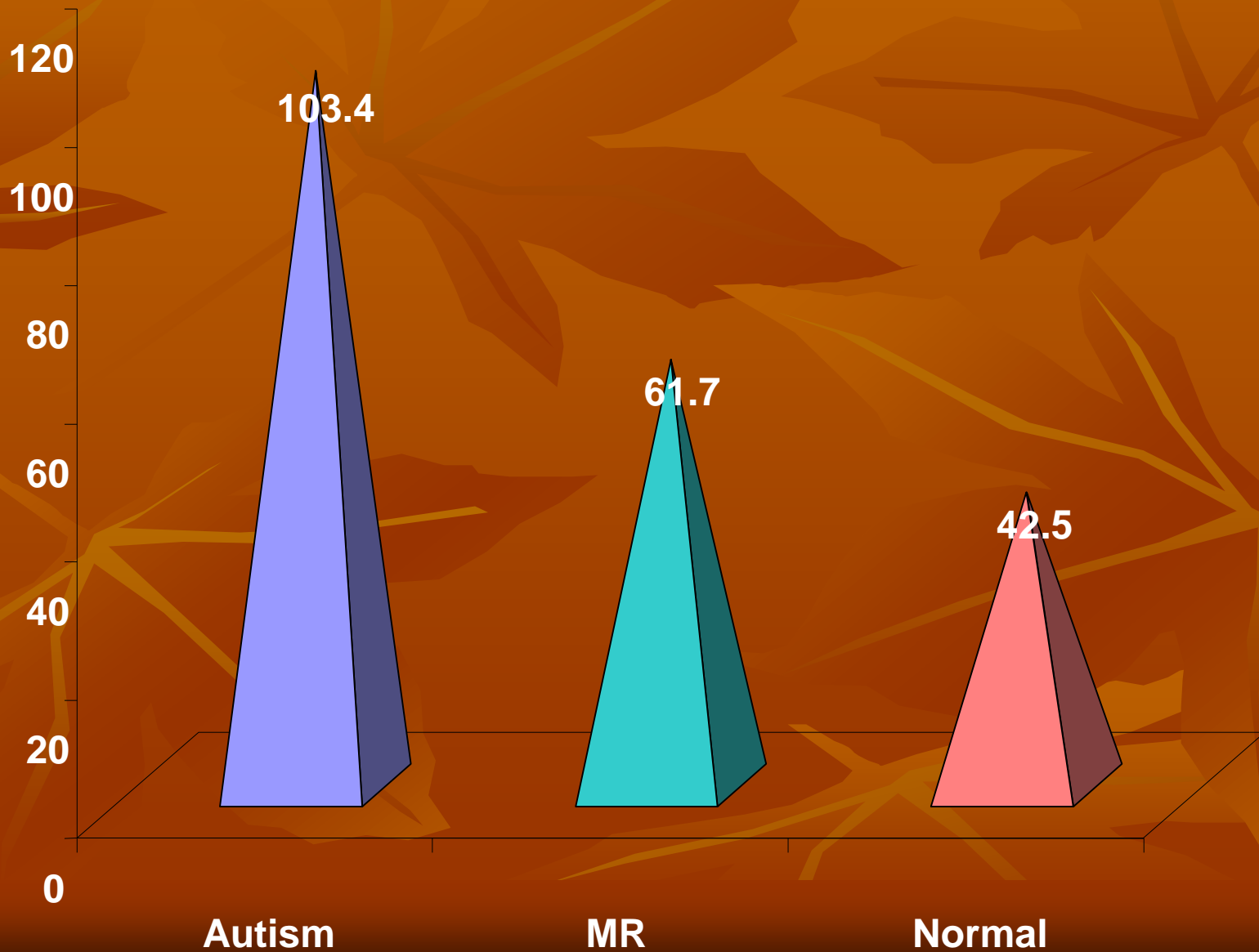
## ■ Item Total Correlations

Item No.	Correlation Value	Significance level
A21	.458(***)	.000
A22	.289(***)	.000
A23	.288(***)	.000
A24	.517(***)	.000
A25	.594(***)	.000
A26	.565(***)	.000
A27	.526(***)	.000
A28	.518(***)	.000
A29	.534(***)	.000
A30	.451(***)	.000
A31	.500(***)	.000
A32	.585(***)	.000
A33	.554(***)	.000
A34	.539(***)	.000
A35	.559(***)	.000
A36	.486(***)	.000
A37	.558(***)	.000
A38	.544(***)	.000
A39	.186(***)	.000
A40	.101(*)	.039

# Validity

- Results of Mean values, SDs and ANOVA between the 3 study groups viz. Autism, MR & others and Normal group reveal that the Mean scores of the autism group (103.40) were found to be significantly higher than those of MR and others group (61.67) and normal group (42.46).
- The mean differences were statistically significant ( $p < 0.001$ ). This signifies that ISAA clearly differentiates between autistic and non-autistic persons.

**Figure 4 Mean Scores of ISAA among Study Groups**



# Discriminant Validity

To determine the discriminant validity of ISAA between Autism and MR & others group, 't' test was computed to obtain the mean difference between the criterion and control group. The value of 't' test was 26.03 which was highly significant ( $p < 0.001$ ).

The results suggest that ISAA clearly discriminates between autistic and MR and normal children. These findings are further confirmed using CARS.

**Table-3 Mean, SDs and t Value of ISAA between Autism & MR Groups**

Domain	Group	N	Mean	SD	t- Value
Social Reciprocity	Autism	401	29.0	7.99	26.62***
	MR	322	14.7	5.95	
Emotional Responsive	Autism	401	12.8	4.46	17.72***
	MR	322	7.6	3.00	
Speech-Lang & Com	Autism	401	21.9	6.42	21.85***
	MR	322	13.0	3.81	
Behaviour Patterns	Autism	401	17.1	5.38	17.11***
	MR	322	11.2	3.36	
Sensory Aspects	Autism	401	13.4	4.82	17.75***
	MR	322	8.1	2.60	
Cognitive Component	Autism	401	9.3	2.40	13.44***
	MR	322	7.0	2.15	
ISAA Total	Autism	401	103.4	25.12	26.03***
	MR	322	61.7	15.66	
CARS Total	Autism	401	39.7	8.51	27.16***
	MR	322	23.7	7.00	

# Criterion Test Validity

- The criterion test validity of ISAA was determined by comparison of total scores obtained on the tool with those on CARS.
- Pearson Product moment correlation was computed and the resulting correlation  $r = 0.77$  ( $p < 0.001$ ) reveals that ISAA has high degree of validity as that of CARS.

## Table-4 Correlations between ISAA and CARS

	Criterion Test Validity	ISAA Total	CARS Total
ISAA Total	Pearson Correlation	1	.765(***)
	Sig. (2-tailed)		.000
	N	401	401

\*\*\* Correlation is significant at the 0.001 level (2-tailed).



# Reliability

## ■ Internal consistency Reliability

- The internal consistency reliability of ISAA tool was obtained by computing Cronbach's coefficient alpha.
- The alpha coefficient obtained was 0.97 indicating a high degree of internal consistency of the tool. CARS alpha coefficient was  $r=0.94$ .
- Hence, the present results suggest that ISAA tool has high degree of reliability



## Table-5 Cronbach's Alpha of ISAA

Group	N	Cronbach's Alpha
Autism	401	0.932***
Mental Retardation	322	0.907***
Normal	400	0.786***
ISAA -Total	1123	0.974***

\*\*\* Correlation is significant at the 0.001 level (2-tailed).

## Inter Rater Reliability

- Inter-rater reliability- Two raters independently administered and scored ISAA on 67 randomly selected children which is about 17% of the sample.

## Test-Retest Reliability

- ISAA scores on two separate test occasions were compared for 120 cases which constitute 30% of the sample.

## Table -6 Inter-rater Reliability Coefficient on ISAA

Domain	Pearson 'r'
Social Relationship and Reciprocity	0.730***
Emotional Responsiveness	0.810***
Speech - Language and Communication	0.757***
Behaviour Patterns	0.635***
Sensory Aspects	0.737***
Cognitive Component	0.625***
ISAA Total	0.834***

# Table-7 Test-Retest Reliability Coefficient on ISAA

Domain	Pearson 'r'
Social Relationship and Reciprocity	0.741***
Emotional Responsiveness	0.805***
Speech - Language and Communication	0.853***
Behaviour Patterns	0.712***
Sensory Aspects	0.606***
Cognitive Component	0.630***
ISAA Total	0.830***

\*\*\* Correlation is significant at the 0.001 level (2-tailed).

# Discriminant Function Analysis

- Discriminant function analysis was performed to determine the proportion of autistic, mentally retarded & others and normal children that could be correctly classified by ISAA.
- Thus results of discriminant analyses indicate a fairly high power of ISAA in discriminating autistic and non-autistic persons.

# Table-8 Results of Discriminant Analysis

Group		Predicted group		Total
		Autism	Normal	
Autism	N	386	15	401
Normal		0	400	400
Autism	%	96.3	3.7	100
Normal		0	100	100

**\* 98.1% of original grouped cases correctly classified.**

**Table - 9 Results of Discriminant Analysis of Autism and MR Group**

<b>Group</b>		<b>Predicted group</b>		<b>Total</b>
		<b>Autism</b>	<b>MR</b>	
<b>Autism</b>	<b>N</b>	<b>356</b>	<b>45</b>	<b>401</b>
<b>MR</b>		<b>28</b>	<b>294</b>	<b>322</b>
<b>Autism</b>	<b>%</b>	<b>88.8</b>	<b>11.2</b>	<b>100</b>
<b>MR</b>		<b>8.7</b>	<b>91.3</b>	<b>100</b>

**\* 90% of original grouped cases correctly classified.**



## Sensitivity and Specificity

According to CARS, 30 is cut off score for diagnosis of autism. Using 30 of CARS as constant, the sensitivity and specificity levels were computed with different cut off scores on ISAA starting from 45 to 80 as given in the table.

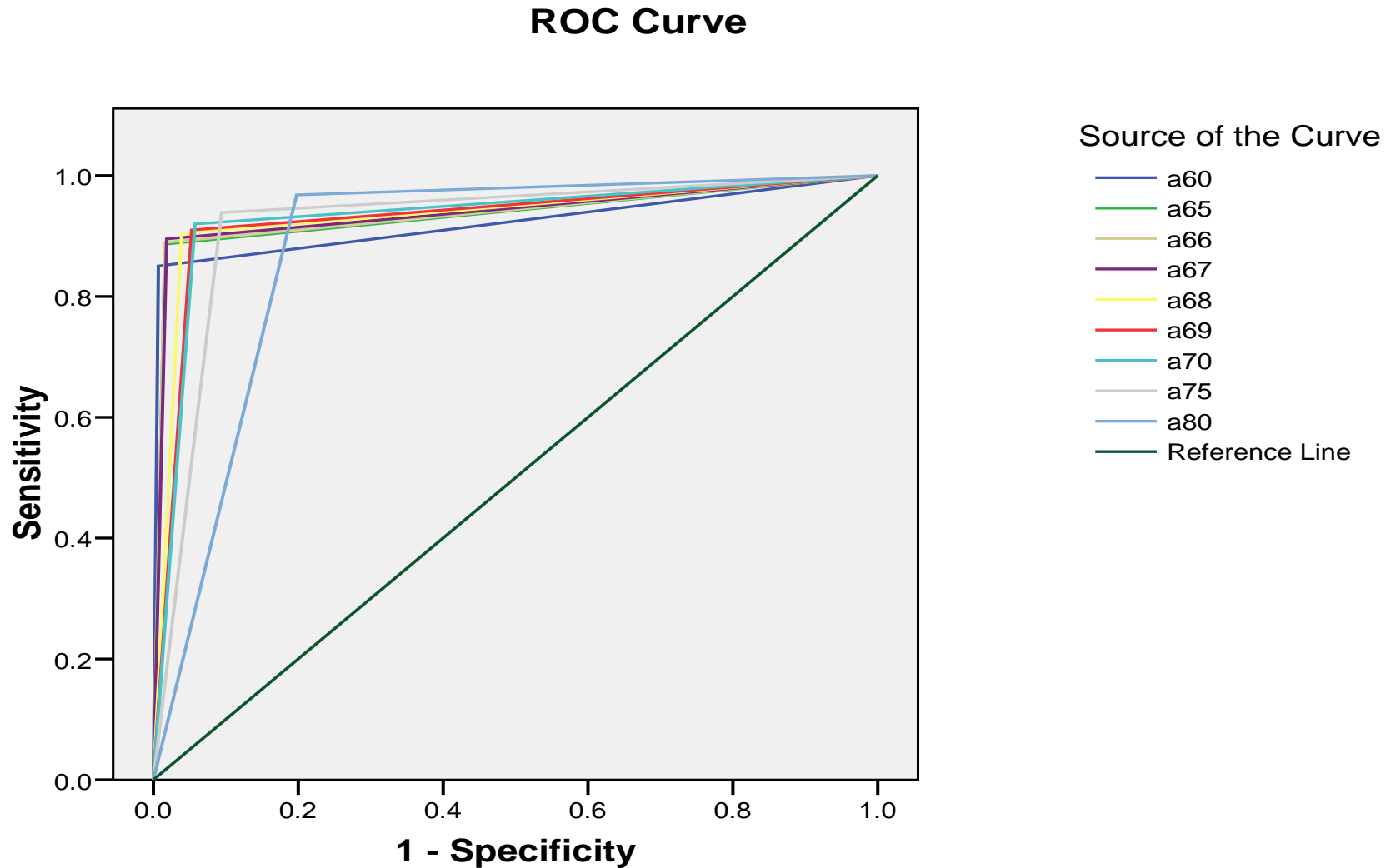


# Table-10 Sensitivity and Specificity Levels – CARS vs ISAA

Cut Off Scores		Groups					
		All 3 Study Groups (N=1123)		Autism & Normal (N=801)		Autism & MR (N=723)	
CAR S	ISAA	Sensitivi ty	Specificali ty	Sensitivi ty	Specificali ty	Sensitivity	Specificali ty
>=30	>=45	100.0	51.7	100.0	77.6	100.0	10.8
>=30	>=50	100.0	65.6	100.0	89.5	100.0	26.4
>=30	>=55	99.5	77.2	99.7	94.5	99.5	47.2
>=30	>=60	99.3	85.0	99.7	96.4	99.3	64.6
>=30	>=65	98.4	88.7	99.2	96.7	98.4	72.9
>=30	>=66	98.4	89.0	99.2	96.7	98.4	73.6
>=30	>=67	98.2	89.5	99.0	97.1	98.2	75.0
>=30	>=68	96.1	90.4	97.6	97.1	96.1	77.1
>=30	>=69	94.7	91.0	96.9	97.6	94.7	78.5
>=30	>=70	94.3	92.0	96.6	98.1	94.3	80.9
>=30	>=75	90.6	93.9	94.8	98.3	90.6	85.4
>=30	>=80	80.2	96.8	84.3	99.0	80.2	92.4

- Receiver Operating Characteristic Curve (ROC) technique was used to find out the cut off level which indicated that a score of 70 and above on ISAA can be used for diagnosis of autism.
- With 70 as the cut off score, the sensitivity was 94.3% and specificity was 92.0%. The cut off at 70 also showed high and balanced sensitivity and specificity between the autism and normal children as well as between the autism and MR & other group of children.
- ROC analysis confirmed discriminant ability of ISAA,  $AUC=0.931$  with  $SE=0.009$  at cut off 70.

# Figure-5 Area Under the Curve



Diagonal segments are produced by ties.

# Norms

- The total ISAA scores may range from 40 to 200, wherein low score of 40 represents normal limits and a high of 200 indicates severe degree of autism.
- A diagnostic categorization of ISAA has been established based on the ROC cut off score of 70. Using this cut off level, individuals falling below the score of 70 are categorized as non autistic while those with score of 70 and above are categorized as autistic.

To arrive at the taxonomy of ISAA, the scores of 376 children from autism group were analyzed. The mean score was found to be 106.09, range being 70.0 to 181.0 as given below.

	N	Minimum	Maximum	Mean	SD
ISAA Total	376	70.0	181.0	106.09	23.5

# **Table -11 Norms of ISAA for Diagnosis of Autism**

<b>Classification</b>	<b>ISAA Scores</b>	<b>Degree of Autism</b>
<b>Below 70</b>	<b>&lt; 70</b>	<b>Normal</b>
<b>70 to Mean</b>	<b>70 to 106</b>	<b>Mild Autism</b>
<b>Mean to Mean + 2 SD</b>	<b>107 to 153</b>	<b>Moderate Autism</b>
<b>Above Mean + 2 SD</b>	<b>&gt; 153</b>	<b>Severe Autism</b>

# Percentage of Disability as per ISAA Scores

ISAA score	Percentage of Disability (%)
<70	No disability
70	40
71-88	50
89-105	60
106-123	70
124-140	80
141-158	90
>158	100



CARS                      vs                      ISAA		
Year	1971,1980,1988	2008
Place	Western, U.S.A	Indian , NIMH
Test Items	15 Items	40 Items- 6 Domains
STANDARDIZATION DATA		
Internal Consistency Reliability	0.94	0.97
Inter-Rater Reliability	0.71	0.83
Test-Retest Reliability	0.82	0.83
Criterion Validity	0.84	0.77
Discriminant Validity	-	p<0.001
Discriminant Functional Analysis	-	√
Sensitivity, Specificity	-	√
ROC Analysis	-	√



# Conclusion

- Results of the present study show that ISAA is a standardized tool with good psychometric properties.
- It is a reliable and valid tool for assessment of persons with autism.
- Results indicate high concordance between ISAA and CARS.
- Hence, ISAA can be considered as an effective tool for assessment of autism for issuance of disability certificate to persons with autism in India.

The background of the image is a solid orange-brown color, overlaid with a pattern of stylized, semi-transparent autumn leaves in various shades of brown and orange. The leaves are scattered across the frame, creating a textured, seasonal feel. In the center, the words "Thank You" are written in a large, bold, sans-serif font. Each letter is filled with a different color from a rainbow spectrum, creating a vibrant, multi-colored effect. The letters have a slight white outline and a soft drop shadow, making them stand out against the busy background.

Thank You