International Journal of Speech and Audiology

E-ISSN: 2710-3854
P-ISSN: 2710-3846
Impact Factor (RJIF): 6.4
IJSA 2025; 6(2): 92-97

Journal's Website
Received: 20-05-2025
Accepted: 25-06-2025

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Establishing norms for test for everyday attention (TEA) among native Malayalam speakers

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DOI: https://www.doi.org/10.22271/27103846.2025.v6.i2b.88

Abstract
Purpose: Attention is the ability to concentrate or maintain focus on a task. The aim is of our study is to determine the effect of aging on everyday attention for native Malayalam speakers in the age ranges 18-34 years (Group I) and 35-49 years (Group II).
Methodology: The study compared Test for Everyday Attention subsystems between two age groups (18-34 and 35-49 years) sing 100 cognitively healthy participants. Each was tested individually in a quiet, distraction-free room. Subtests included map search, elevator counting (with/without distraction), visual and auditory elevators (with reversal), telephone search (single/dual task), and the lottery task. Responses were recorded and scored after test completion.
Results: The study showed that younger adults (18-34 years) performed better than older adults (35-49 years) on tasks like Map Search, Elevator Counting with Distraction, Telephonic Speech while Counting, and Lottery Score. It highlights that the impact of aging on attention varies, influenced by task length, difficulty, and delivery. The TEA Test remains a valuable tool for assessing different aspects of attention across age groups and neurodevelopmental conditions.
Conclusion: Attention is affected inconsistently by aging—some aspects remain intact while most decline. The TEA test evaluates various attention components like switching, sustained, and selective attention. To assess this effectively in native Malayalam speakers, a norm was established.

Keywords: TEA test, Selective attention, Sustained attention, Divided attention, Switching

Introduction
Attention is commonly defined as an individual's ability to concentrate or sustain focus on a task. The concept of attention refers to a person's information processing capacity [1]. Selective/focused, sustained, changing, divided, and attentional capacity are some examples of types of attention [7]. Investigations on neuro imaging have revealed that attention is carried out by a unique "network of anatomical locations. [2, 3]. A three-system approach on attention was created with regard to these focused parts of the brain and includes the phrases orienting, alerting, and target detection [2, 3]. Both overt visual orienting and the initial covert movement of attention to a location are referred to as orienting [2, 3] When processing priority information, the ability to prepare and sustain attentiveness [2, 3] is referred to as alerting. In target detection, the attention system moves from a generalized alert state to a more highly engaged state when locating a visual target [2, 3] Instead of being a single process, attention is a cognitive function that results from a number of components processes [14]. Indeed, numerous accepted theories of attention support the segmentation of the attentional system into a number of related but distinct processes, including selective or focused attention, sustained attention, divided attention, and shifting of attention in both adults and children [1]

Types of attention
Sustained attention
The ability to maintain the focus of attention on a task over time is known as sustained attention, and it is a fundamental component of normal cognitive capacities [12]. The activation prefrontal areas and parietal regions, located primarily but not exclusively in the right hemisphere, are prominently involved in the mediation of sustained attention [8]

Selective attention

The most fundamental function of attention is filtering or selection. An individual must filter away unnecessary information from their environment and choose to concentrate on information that is goal relevant in order for behaviour to be effectively goal-directed [13]. The simultaneous availability and temporal synchronization of the same information across two or more sensory systems is referred to as intersensory redundancy. The Intersensory redundancy provided by bimodal stimulation is crucial for organizing early selective attention, which in turn helps to shape early perception, learning, and memory.

Divided attention

The capacity to process more than one piece of information at once is known as divided attention. Divided attention can also be explained as a condition of paying attention to more than one stimulus or to a stimulus presented in more than one modality.

Attention and language comprehension

Attentional mechanisms influence how linguistic and non-linguistic information are processed together. For individuals to perceive and understand communication, they need to pay attention and retain information. There is a potential that the listener will overlook important details because of factors like emotions, underlying meanings, context, and other things that might cause communication to break down. The cognitive function that is needed under these circumstances is attention. The selection of information that is pertinent to the context depends heavily on attention. For longer stretches of time, listening and paying attention to speech requires a type of attention called sustained attention. In circumstances like dichotic listening conditions, divided attention is another type of attention that is used. Maintaining attention is crucial for both verbal and cognitive processing [4].

Pitch accent stimulates a part of the general attention network that is responsive to the semantic and pragmatic aspects of language, and there are overlaps between the language task and the spatial attention test suggesting a very strong connection between attention and language comprehension [9]. The TEA Test, is a remarkable concept that evaluates attention and all of its elements.

Test of Everyday Attention (TEA) is to assess the performance of patients with specific attentional impairments in the domain of attention is the first of its kind, that offers norm-referenced results for evaluations that are sensitive to selective, sustained attention, and attentional switching, respectively [9, 10]. A test of divided attention is also part of the test battery. Using visual and auditory tasks, the TEA uses eight subtests to evaluate a person's pattern of strengths and weaknesses across the three attentional categories. Participants must be adults within the age range of 18 to 80 years old[15]and the test duration takes 45 to 60 minutes.

Need for the study

Attention and concentration problems are commonly reported following many types of brain damage and diseases. Attentional issues are anticipated in both right hemisphere stroke [16] and closed head injury [17]. According to WHO, India has a stroke incidence rate of about 130 per 100,000 people annually. It is obvious that objective measurements of attentional performance are required for evaluating attentional disparities and directing intervention. Hence, a range of diverse activities are needed to appropriately measure each attention system separately[5]. The TEA test is the only one that assesses different attentional domains; therefore, this study attempted to establish normative data in young adults who speak Malayalam as their first language in order to carry out treatment procedures effectively.

Aim of the study

To develop normative of Test for Everyday Attention (TEA) for native Malayalam speakers in the age ranges 18-34 years and 35-49 years.

Objectives

- To develop normative of Test for Everyday Attention for native Malayalam speakers in the age ranges 18-34 years and 35-49 years.
- To compare the subsystems of Test for Everyday Attention across two age groups (18-34 years and 35-49 years).

Materials and Methods

Participants

A total of 100 participants with normal cognitive abilities were taken for the study. 50 adults from the age range of 18-34 years and 50 adults from the age range of 35-49 years were selected.

Inclusion criteria

- Minimum qualification of 10th standard education
- Malayalam and English bilinguals with intact/corrected visual and auditory senses and a fair degree of psycho-motor facility was included.

Exclusion criteria

The participants whose qualification below 10th standard were excluded.

Administration of the test

Prior to the administration of the test, informed consent was obtained from the participants and the participants were given proper instruction regarding the purpose of the study.

Procedure

The TEA test was administered by the tester on each participant in a quiet room free from disturbance. Their responses were noted and scored towards the end of the test. The testing was done from subtest 1 - subtest 8 in the following order

- **Map search:** Subjects had to search for symbols on a coloured map. The scoring was the number out of 80 found in 2 minutes.
- **Elevator counting:** Subjects were asked to pretend they are in an elevator whose door indicator is not functioning. They, therefore, had to determine which 'door' they have arrived at by counting a series of tape-presented tones.
- **Elevator counting with distraction:** Subjects had to count the low tones in the pretend elevator while ignoring the high tones.
- **Visual elevator:** Here, subjects had to count up and down as they follow a series of visually presented 'doors' in the elevator.

- **Auditory elevator with reversal:** This is similar to the visual elevator subtest, but with a tape presentation that plays at a set speed. In this subtest, high pitch tones were interpreted as upward arrows from the previous subtest, signifying that the elevator was moving upward, and low pitch tones as downward arrows from the previous subtest, signifying that the elevator was moving downwards. When each string of tones ended, the respondents had to accurately identify the floor they were on.
- **Telephone search:** Subjects had to look for key symbols while searching entries in a simulated classified telephone directory.
- **Telephone search dual task:** Subject had to search in the directory while simultaneously counting strings of tones presented by a tape recorder.
- **Lottery task:** Listening to, attending to, and identifying numbers during a broadcast of lottery numbers.

Scoring

Scoring was done by calculating the individual score of each subtest and then calculating the percentile score.

Results and Discussion

The result obtained was subjected to statistical analysis. The first objective of the present study was to develop normative of Test for Everyday Attention for native Malayalam speakers in the age ranges 18-34 years and 35-49 years. Mean, standard deviation, minimum and maximum, median and cut off values were calculated for 8 subtests in both age groups. The table below shows the cut off values for all of the subtests in both age groups of 18-34 years and 35-49 years. The second objective was to compare the subsystems of Test for Everyday Attention across two age groups (18-34 years and 35-49 years). The Mann-Whitney U test was used to compare the mean ranks between the groups and indicated how the groups differed. The results are given below;

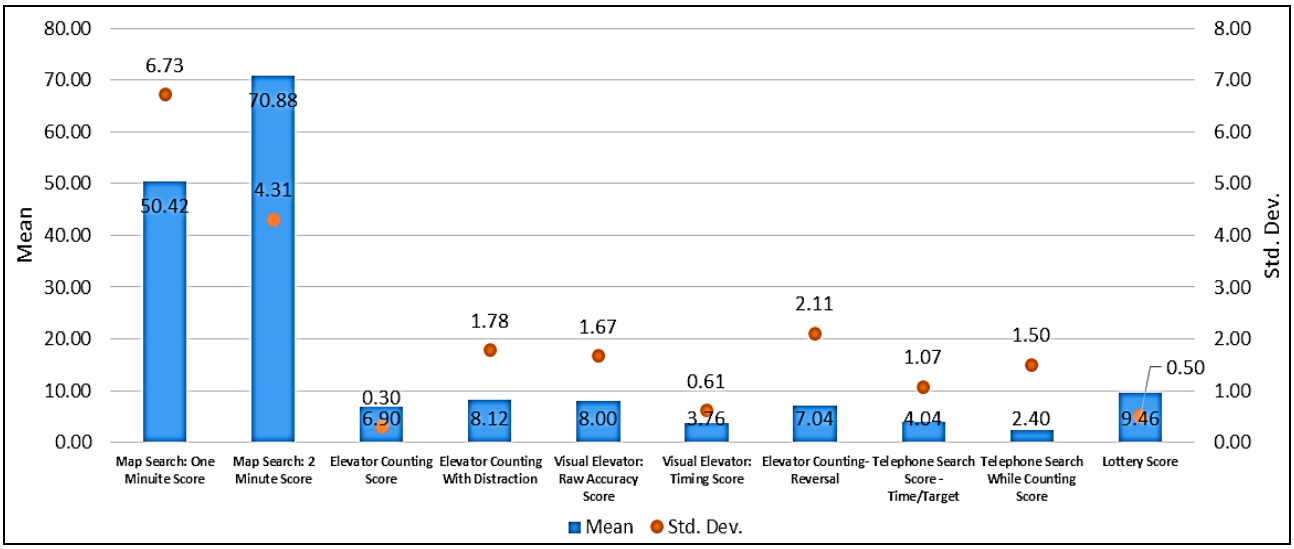

Fig 1: Mean Plot of All Subtests 18-34 years

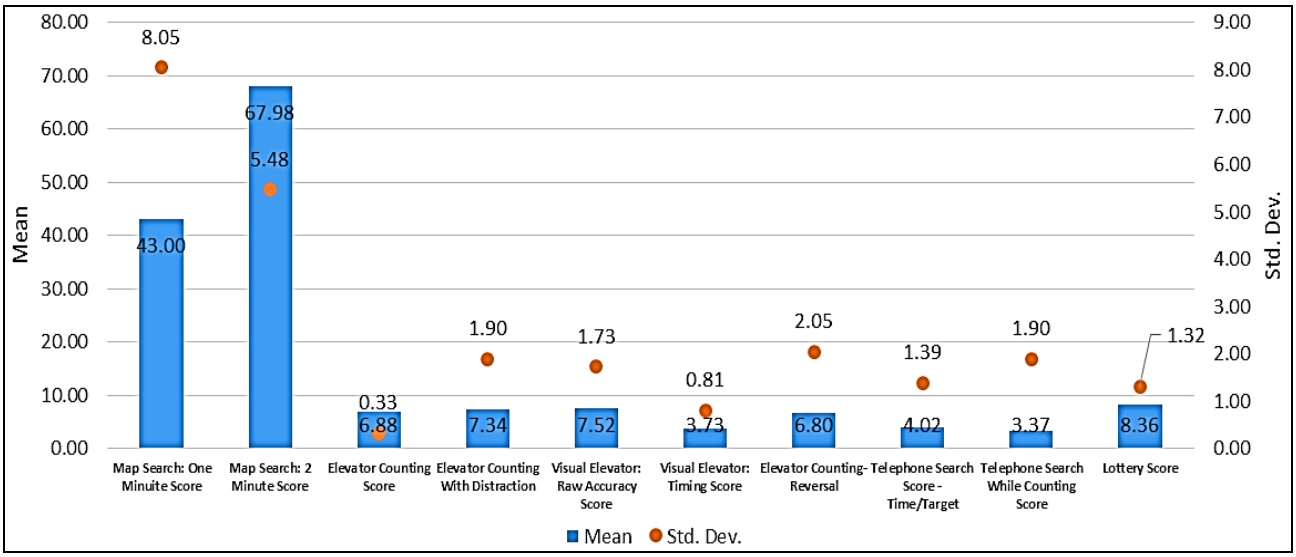

Fig 2: Mean Plot of All Subtests 35-49 years

Table 1: Descriptive statistics of normative data for Subtest I

Age ranges	18-34 years		35-49 years	
Statistic	Map Search: One Minute Score	Map Search: 2 Minute Score	Map Search: One Minute Score	Map Search: 2 Minute Score
Mean	50.42	70.88	43.00	67.98
Std. Dev.	6.73	4.31	8.05	5.48
Min	32.00	57.00	29.00	58.00
Max	64.00	77.00	57.00	77.00
Median	51.00	71.00	40.50	68.00
Cut-off value (+/- 2SD)	36.96-63.88	62.26-79.5	26.9-59.1	57.02-78.94

Table 2: Descriptive statistics of Normative data for Subtest 2

Age ranges	18-34 years (Elevator Counting Score)	35-49 years (Elevator Counting Score)
Mean	6.90	6.88
Std. Dev.	0.30	0.33
Min	6.00	6.00
Max	7.00	7.00
Median	7.00	7.00
Cut-off value (+/- 2SD)	6.3 - 7.5	6.22 - 7.54

Table 3: Descriptive statistics of Normative data for Subtest 3

Age ranges	18-34 years (Elevator Counting with Distraction)	35-49 years (Elevator Counting with Distraction)
Mean	8.12	7.34
Std. Dev.	1.78	1.90
Min	4.00	4.00
Max	10.00	10.00
Median	8.00	8.00
Cut-off value (+/- 2SD)	4.56 - 11.68	3.54 - 11.14

Table 4: Descriptive statistics of Normative data for Subtest 4

Age range	18-34 years		35-49 years	
Statistic	(Visual Elevator: Raw Accuracy Score)	18-34 years (Visual Elevator: Timing Score)	(Visual Elevator: Raw Accuracy Score)	35-49 years (Visual Elevator: Timing Score)
Mean	8.00	3.76	7.52	3.73
Std. Dev.	1.67	0.61	1.73	0.81
Min	5.00	2.80	4.00	2.20
Max	10.00	5.20	10.00	5.80
Median	8.50	3.60	7.50	3.70
Cut-off value (+/- 2SD)	4.66 - 11.34	2.54 - 4.98	4.06 - 10.98	2.11 - 5.35

Table 5: Descriptive statistics of Normative data for Subtest 5

Statistic	18-34 years (Elevator Reversal)	35-49 years (Elevator Reversal)
Mean	7.04	6.80
Std. Dev.	2.11	2.05
Min	3.00	3.00
Max	10.00	10.00
Median	7.00	7.50
Cut-off value (+/- 2SD)	2.82 - 11.26	2.7 - 10.9

Table 6: Descriptive statistics of Normative data for Subtest 6

Age range	18-34 years	35-49 years
Statistic	(Telephone Search Score - Time/Target)	(Telephone Search Score - Time/Target)
Mean	4.04	4.02
Std. Dev.	1.07	1.39
Min	2.40	2.40
Max	6.20	7.70
Median	3.80	3.55
Cut-off value (+/- 2SD)	1.9 - 6.18	1.24 - 6.8

Table 7: Descriptive statistics of Normative data for Subtest 7

Age ranges	**18 - 34 years**	**35 - 49 years**
Statistic	Telephone Search Counting Score	Telephone Search Counting Score
Mean	2.40	3.37
Std. Dev.	1.50	1.90
Min	-0.50	-0.75
Max	5.50	6.60
Median	2.50	3.30
Cut-off value (+/- 2SD)	-0.6 - 5.4	-0.43 - 7.17

Table 8: Descriptive statistics of Normative data for Subtest 8

Age ranges	**18 - 34 years**	**35 - 49 years**
Statistic	**Lottery Score**	**Lottery Score**
Mean	9.46	8.36
Std. Dev.	0.50	1.32
Min	9.00	5.00
Max	10.00	10.00
Median	9.00	9.00
Cut-off value (+/- 2SD)	8.46 - 10.46	5.72 - 11

1. The distribution of the Map Search: One Minute score across the age groups of 18 to 34 and 35 to 49 was significantly different, with a p value = <0. With better scores for age group of 18-34 years
2. There is a substantial difference in the distribution of Map Search: 2 Minute Score between Ages 18-34 and Ages 35-49 with a P value = 0.011. Better scores were observed for the age group 18-34 years.
3. The statistical test doesn't provide any evidence of a significant difference in the distribution of Elevator Counting Score between Age 18-34 and Age 35- 49, value-0.750.
4. With a p value of 0.038, there was a statistically significant difference in the distribution of the Elevator Counting with Distraction Score between ages 18 to 34 and ages 35 to 49. With better scores for the age group of 18-34 years.
5. The Mann-Whitney U test revealed that there is no indication of a statistically significant variation in the distribution of the Visual Elevator: Raw Accuracy Score between Ages 18-34 and Ages 35-49.
6. Between Ages 18-34 and Ages 35-49, there is no statistically significant difference in the distribution of Visual Elevator: Timing Score, according to the Mann-Whitney U test, with a p value of 0.91.
7. The Mann-Whitney U test doesn't provide any evidence of a significant difference in the distribution of Elevator Counting-Reversal Score between Age 18-34 and Age 35-49, p value=0.58.
8. With a p value = 0.419, The Mann-Whitney U test doesn't provide any evidence of a significant difference in the distribution of Telephone Search - Time/Target Score between Age 18-34 and Age 35-49.
9. With a p value of 0.012, the Mann-Whitney U test demonstrated a statistically significant difference in the Telephone Search While Counting Score distribution between the age groups of 18 to 34 and 35 to 49 with better scores for the age range 18-34 years.
10. The Mann-Whitney U test demonstrated a significant difference in the distribution of lottery score between age groups of 18 to 34 and 35 to 49, with a p value <0.001, the better scores were observed for the age range 18-34 years.

Conclusion

Attention is a state of consciousness in which a person can respond to a stimulus or stimuli. A person's ability to pay attention depends on both how many things they can concentrate on at once and for how long. The elements that affect focus and behaviour in response to stimuli are attentional processes. It basically refers to how the brain selects to interpret information associated with a stimulus. Those characteristics have an Impact on the kind of attention a person can hold for and how long. Results on how attention affects ageing as a whole are inconsistent. While some parts of our attention remain intact or are unaffected as we age, the majority of them decline. The older persons tend to exhibit a deterioration in their ability to pay attention as they get older [6]. The subtests of the Brief Neuropsychological Evaluation Instrument on young, middle aged and old adults. The results suggested a loss in attention with ageing [20]. Numerous studies have demonstrated that older adults often have poorer inhibitory processes and greater distractibility, which makes it difficult for them to concentrate on certain tasks and block out unwanted inputs. For older persons, the auditory mode is impaired but the visual mode is intact [18], The older person processes information more quickly and is less susceptible to distraction or interference from irrelevant information when the demands on the selective attention mechanism to find task-relevant information are low [19]. There is a decrease in understanding of the messages during communication when attentional components are impaired. The TEA test is employed to evaluate every aspect of attention required for the intervention of these difficulties. Test for Everyday Attention (TEA), offers norm-referenced results for evaluations that are sensitive to attentional switching, sustained attention, and selective attention, respectively. Thus, this study states the effects of ageing on attention are diverse which is supported by previous researches as well. Numerous subtests failed to find any indication of age dependence because the rate of decline in attention varied based on several factors like the length of the task, its difficulty, the delivery method, etc. The TEA test is a useful instrument for practitioners and researchers as it provides a valid assessment of several components of attention, which may be distinct across neurodevelopmental disorders.

Acknowledgements
To all our participants who have actively contributed to make this study possible.

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