RESEARCH PAPER

A Community Based Cross Sectional Study to Evaluate the Association of Age and Gender with Cognitive Impairment among the elderly population aged 60-65 years attending Ashok Nagar Urban Health Centre, Belagavi

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Introduction

The process by which information and understanding are acquired through thought, experience, and the senses is known as cognition. It incorporates several facets of advanced cognitive processes and abilities, including language, attention, memory, knowledge, planning, decision-making, reasoning, judgment, perception, understanding, and visuospatial function, among others.[1] According to current statistics, 7%-8% of India's population are over 60 years of age.[2] The fundamental cognitive domains stand for the mental skills necessary for day-to-day functioning. The ability to focus, maintain effort, and change emphasis when necessary is made possible by attention and concentration. Effective information storing, retrieval, and use are made possible by memory, which comprises working, long-term, and short-term memory. Higher order abilities like organizing, planning, problem solving, and decision making are all part of executive functions. Visuospatial ability aids in activities requiring visual perception and constructional abilities as well as spatial orientation. Being aware of the time, location, and people around oneself guarantees self-awareness. And last, processing speed is a measure of how fast and effectively information is received and processed. These domains interact to create the basis of cognition and are essential for preserving flexibility and freedom in daily living.[3]

The functional impairment of one or more cognitive areas resulting from a variety of situations is referred to as "cognitive impairment." [4] In 1988, Reisberg and associates coined the term "mild cognitive impairment" (MCI) to describe a condition that falls between normal cognition and dementia and has the potential to develop into full-blown dementia.[5]

There may be limited awareness in the community regarding cognitive health, leading to delayed recognition of symptoms. A study can inform educational campaigns to raise awareness about cognitive health and promote proactive healthcare-seeking behavior. Cognitive impairment can significantly impact an individual's quality of life and independence. The study can provide insights into the challenges faced by those with cognitive impairment and guide the development of support services to enhance their quality of life. Identification of modifiable risk factors for cognitive impairment allows for the development of preventive measures. The study can contribute to the identification of lifestyle and environmental factors that, when addressed, may reduce the risk of cognitive impairment. Cognitive impairment can have significant public health implications, affecting individuals, families, and communities. By studying cognitive impairment, you can contribute to developing effective public health strategies and interventions tailored to the specific needs of the people of Belgaum since there is a lack of comprehensive local data on cognitive health. Conducting a study will help fill this gap and provide a better understanding of the prevalence, risk factors, and patterns of cognitive impairment in this region. Belgaum has unique demographic, cultural, and environmental factors that could influence cognitive health. A study can identify these factors and contribute to developing region-specific guidelines and recommendations for cognitive health promotion. A study on cognitive impairment in Belgaum is important to identify the existing gaps in knowledge, the specific needs of the local population, and potential health concerns to contribute to the broader field of health research.

A popular cognitive screening tool in clinical and research contexts is the Mini Mental Status Examination (MMSE).[6] In various Asian countries a MMSE cut-off of 23 has been demonstrated to detect patients with Cognitive Impairment, particularly those with risk of dementia[7] Education has an impact on MMSE scores, and it has been suggested that adjusting for educational attainment might maximize MMSE performance in identifying cognitive impairment.[8] A number of psychological and socioeconomic variables may influence the actual prevalence rates of cognitive impairment. Cognitive impairment is linked in community samples to low levels of education,

socioeconomic status, depression, and chronic disease.[9]As people age, the frequency of MCI dramatically rises.[10] A study conducted in Taiwan revealed a higher rate of prevalence among females as compared to males.[11] In clinical settings, the PGI-BBD is a comprehensive series of five tests designed to measure cognitive dysfunction, impairment, decline, or deficiencies. This evaluation may aid in the judiciary's decision-making on the degree of drop in compensation grant as well as in the development of rehabilitation methods. This battery includes five tests:

PGI Memory: Assesses the temporal lobes (right for non-verbal memory, left for verbal memory). Bhatia's and VAIS: Evaluates overall cognitive ability and frontal lobe executive function. Nahor-Benson and Bender Gestalt: Assesses the parieto-occipital areas, emphasizing motor organization (sensory-to-CNS-to-execution), spatial connections, and visual perception.[12]

The study hypothesizes that cognitive impairment represents a significant public health burden among adults aged 60-65 years attending as Urban Health Centre in Belagavi and that its prevalence is significantly associated with advancing age and Gender as it was a gap which required it to be tested through our study. The Urban Health Centre in Belagavi does not have community-based prevalence statistics on cognitive impairment in older patients. Additionally, little research has been done on the relationship between sociodemographic factors and cognitive impairment in young adults (60–65 years old).

This gap restricts evidence-based health-care planning, including appropriate resource allocation, preventive strategies, and early intervention programs tailored to this population.

Materials and Methods-

This Community Based Cross Sectional study was carried out between April 2024 to June 2025 in which 930 participants were screened amongst which 621 elderly participants aged between 60-65 years belonging to either gender were enrolled in this study after consenting. With a precision of 15% and a 95% confidence level, the sample size was determined using a reported prevalence of cognitive impairment of 8.4% among urban seniors in Belagavi. This prevalence estimate was derived from an earlier MMSE-based community-based study conducted in an urban aged population in Belagavi.[13]

Inclusion Criteria- Elderly individuals aged 60–65 years who provided written informed consent and had MMSE scores between 18 and 25 were included in the study. Scores <18 were suggestive of dementia, while scores >25 were considered within the normal range.

Exclusion Criteria- Participants with alcohol dependence, a history of transient ischemic attack or stroke, other neurological conditions such as brain injury due to trauma or tumor, and those receiving antipsychotic medications were excluded from the study.

Ethical approval for the study was obtained from the Institutional Ethics Committee, Jawaharlal Nehru Medical College (MDC/JNMC/IEC/150), dated 18 March 2024.

Statistical Analysis-

The Statistical Package for the Social Sciences (SPSS), version 31, was used for data analysis. For continuous variables, descriptive statistics were displayed as mean ± standard deviation; for categorical variables, they were shown as frequencies and percentages. The mean MMSE scores of each group were compared using one-way analysis of variance (ANOVA). The association between MMSE scores and continuous factors was evaluated using correlation analysis. A p-value of less than 0.05 was regarded as statistically significant.

Screening Tool- The MMSE screening tool, which consists of 11 questions with a maximum score of 30 points and takes 5 to 6 minutes to administer, was used to screen 930 participants attending OPD at Urban Health Centre. It evaluates cognitive functions such as orientation, memory, attention, language, and visual spatial skills in order to identify cognitive impairment.[14] 621 of them had MMSE scores between 18 and 25, making them eligible for enrolment after giving their consent. Using a systematic performance analysis, the researcher gathered and documented the sociodemographic data of the study participants. All eligible participants were then given the PGI-BBD instrument, and their answers were entered in an individual response sheet. To start with PGI memory scale, which had 10 subtests participant had to answer orally to the questions asked to them. KOH blocks and Pass-A-Long test had a set of cubes which was to be solved in the given time limit. Verbal Adult Intelligence Scale (VAIS) consists of 4 subtests i.e. information, Digit span, Arithmetic and comprehension which is obtained by the participants orally. Nahor-Benson test consists of 8 cards, out of these cards, 5 cards have designs and 3 cards contain the instructions which was to be followed by the participant. Visual-Motor Gestalt Test consists of 9 figures, the participant is given the response sheet and he/she has to draw the figures as per given in the card. This process took between 45 and 60 minutes for each participant.

Results-

Figure No. 1: Age-wise Distribution of the Study Participants.

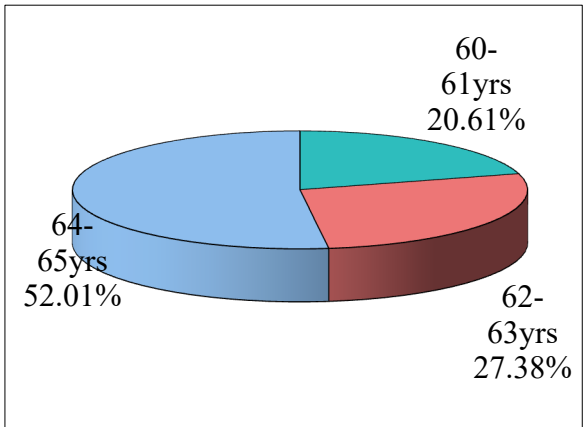

Figure No. 2: Gender-wise Distribution of the Study Participants.

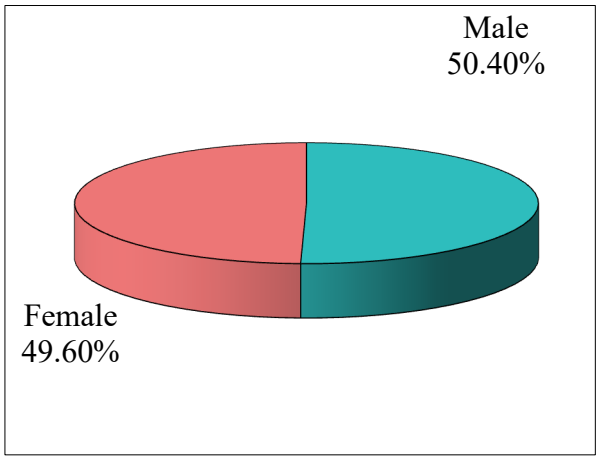

Figure No. 3: Education-wise Distribution of the Study Participants.

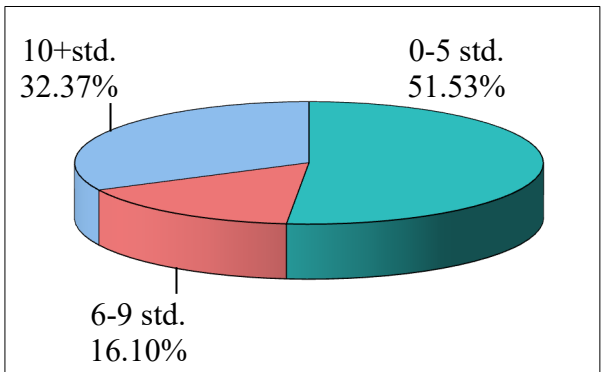

Table No. 1: Multiple Logistic Regression analysis of Cognitive Impairment with individual sub-variables of socio-demographic profile.

Factors	Estimate	S.E.	OR	95% C.I. OR		p-value
				Lower	Upper	
Age groups						
60-61yrs (n=128)	Ref.					
62-63yrs (n=170)	0.53	0.27	1.70	1.01	2.87	0.0470*
64-65yrs (n=323)	0.37	0.23	1.44	0.91	2.27	0.1180
Gender						
Male (n=313)						
Female (n=308)	1.22	0.39	3.38	1.58	7.23	0.0020*
Education						
0-5 std. (n=320)	-1.71	0.25	0.18	0.11	0.30	0.0001*
6-9 std. (n=100)	-0.43	0.34	0.65	0.33	1.27	0.2090
10+std. (n=201)	Ref.					
BMI						
Under weight (n=84)	Ref.					
Normal (n=321)	0.11	0.28	1.12	0.64	1.95	0.6960
Over weight (n=173)	0.29	0.33	1.33	0.71	2.52	0.3760
Obese (n=43)	0.14	0.46	1.15	0.47	2.81	0.7610
Habits (E.g. Smoking, Alcohol and tobacco products.)						
Yes (n=311)	1.76	0.35	5.81	2.91	11.57	0.0001*
No (n=307)	Ref.					
Exercise						
Yes (n=17)	-0.86	0.59	0.42	0.13	1.35	0.1450
No (n=604)	Ref.					

*p<0.05- statistically significant. (SE- Standard error, OR- Odds Ratio, C.I- Confidence Interval)

Table no 1 shows-With 60-61 years serving as reference category, participants with age group of 62-63 years showed higher odds of Cognitive Impairment than the other two categories, indicating that individuals in this age group are 1.7 times more likely to have Cognitive Impairment than those in 60-61 years age group with a significant p-value of 0.0470. For 64-65 years age group, the odds of Cognitive Impairment was 1.44 times higher when compared to the reference category. However this association was not statistically significant.

Using males as the reference group, females were found to have higher Odds ratio and this association was statistically significant suggesting that there is a strong gender related difference in the Cognitive status.

In educational status category, study participants with 10^{th} standard and more of schooling were taken as reference category. It was observed that study participants with 0-5^{th} standard of schooling exhibited significantly lower Odds of Cognitive Impairment (0.18) when compared with those having 6^{th} – 9^{th} standard of education (0.65). This association was found to be highly statistical significant with p-value of 0.0001. Education showed a protective effect against Cognitive Impairment

that is higher education was associated with reduced Odds of Cognitive Impairment.

Participants without personal habits served as reference category while participants with habits (E.g. Smoking, Alcohol and tobacco products.) showed higher Odds ratio of 5.81 more than those who did not have any habits with a statistically significant p-value of 0.0470. Individuals who had habits of drinking alcohol, smoking cigarettes and chewing tobacco were almost 6 times more likely to have Cognitive Impairment than the individuals without habits.

Table No. 2: Pair-wise comparison of Age groups across PGI BBD variables using the Mann-Whitney U test.

Variables	60-61yrs(n=128) vs 62-63yrs (n=170)		60-61yrs (n=128) vs 64-65yrs (n=323)		62-63yrs (n=170) vs 64-65yrs (n=323)	
	Z-value	P-value	Z-value	P-value	Z-value	P-value
Cognitive Impairment	-2.0201	0.0434*	-1.8996	0.0575	0.4057	0.6849
Remote Memory	0.4013	0.6882	-0.4796	0.6315	-1.0140	0.3106
Recent memory	0.3877	0.6982	0.0044	0.9965	-0.4782	0.6325
Mental Balance	2.8377	0.0045	1.6728	0.0944	-1.4526	0.1463
Attention & Concentration	1.3167	0.1880	1.6516	0.0986	0.1097	0.9126
Delayed Recall	1.5835	0.1133	1.2569	0.2088	-0.6289	0.5294
Immediate Recall	1.4124	0.1578	0.9079	0.3639	-0.7719	0.4402
Verbal Retention for Similar Pairs	2.3705	0.0178*	0.9880	0.3231	-1.8015	0.0716
Verbal Retention for Dissimilar Pairs	1.6236	0.1045	1.1704	0.2419	-0.7582	0.4483
Visual Retention	1.1055	0.2690	1.6576	0.0974	0.4815	0.6301
Recognition	-1.0267	0.3046	0.4976	0.6187	1.8490	0.0645
KOH blocks	-2.2666	0.0234*	-1.9997	0.0455*	0.3758	0.7071
Pass a long	-2.2252	0.0261*	-2.0326	0.0421*	0.4739	0.6356
T.Q on Information	0.5249	0.5997	0.9784	0.3279	0.3928	0.6945
T.Q on Digit Span	1.7349	0.0828	2.1404	0.0323*	0.2917	0.7705
T.Q on Arithmetic	1.8212	0.0686	2.1520	0.0314*	0.1443	0.8852
T.Q on Comprehension	0.6403	0.5220	1.2309	0.2184	0.5328	0.5942
Nahor and Benson Test	0.4896	0.6244	1.6375	0.1015	1.2458	0.2128
Bender-Gestalt Test	-2.2585	0.0239*	-1.5510	0.1209	0.9052	0.3653

*p<0.05- Statistically significant.

Table No 2 shows-When Cognitive Impairment was compared between 2 independent age groups, i.e. 60-61 years vs 62-63 years, results showed a statistically significant value with Z values -2.0201 and p value of 0.0434 which indicates that the 62-63 years age group had higher impairment than 60-61 years age group. When 60-61 years and 64-65 years age group was compared, results showed a significant Z value of -1.8996 but however it was not statistically significant with a p value very close to 0.0575. When 62-63 years were compared to 64-65 years age group, Z-value was 0.405 with a p-value of 0.6849 which was statistically not significant. When Verbal retention for similar pairs were compared within the age group 60-61 years vs 62-63 years, Z-value of 2.3705 with a statistically significant value of 0.0178, this means younger group i.e. 60-61 years had better performance than 62-63 years group. In the rest two categories of 60-61 years vs 64-65 years & 62-63 years vs 64-65 years, there was no statistically significant Z-value of 0.9880 & -1.8015 with a p-value > 0.05. When KOH's blocks was compared between 2 independent age groups i.e. 60-61 years vs 62-63 years, 60-61 years vs 64-65 years, results showed a statistically significant value with Z values -2.266, -1.9997 and p-value of 0.0234, 0.0455 respectively. This means there was significant decline in visuo-motor ability after 60-61 years. But when 62-63 years vs 64-65 years age group was compared there was no significant decline with Z value 0.375 and p-value of 0.707. When Pass a long Test was compared between 2 independent age groups i.e. 60-61 years vs 62-63 years, 60-61 years vs 64-65 years results showed a statistically significant value with Z values -2.225, -2.0326 and p-value of 0.026, 0.042 resp. This means there was a significant decline after 60-61 years, but then when 62-63 years vs 64-65 years age group was compared there was no statistical significant results with Z-value 0.473 and p-value 0.635. When Bender-Gestalt test was compared, 60-61 years vs 62-63 years age group had a statistically significant value with Z value -2.258 & p value 0.0239. This means there is a significant decline in visuo-motor coordination after 60-61 years of age group.

Table No. 3: Gender based comparison with PGI BBD variables using Mann-Whitney U test.

Variables	Male (n=313)			Female (n=308)			Z-value	P-value
	Mean	SD	Mean rank	Mean	SD	Mean rank		
Cognitive Impairment	25.31	6.63	344.34	22.65	5.69	277.12	4.6677	0.0001*
Remote Memory	5.52	0.54	320.24	5.45	0.55	301.61	1.2931	0.1960
Recent memory	4.91	0.39	313.54	4.89	0.45	308.42	0.3550	0.7226
Mental Balance	4.79	1.61	303.03	5.00	1.21	319.10	-1.1155	0.2647
Attention & Concentration	2.65	1.55	281.41	3.14	1.62	341.07	-4.1427	0.0001*
Delayed Recall	3.76	1.48	280.53	4.26	1.16	341.96	-4.2657	0.0001*
Immediate Recall	3.72	1.47	292.17	4.00	1.19	330.14	-2.6365	0.0084*
Verbal Retention for Similar Pairs	3.43	1.14	297.30	3.64	0.95	324.93	-1.9185	0.0551
Verbal Retention for Dissimilar Pairs	3.63	1.32	311.50	3.62	1.01	310.49	0.0698	0.9444
Visual Retention	4.09	1.58	290.14	4.40	2.04	332.20	-2.9203	0.0035*
Recognition	4.79	0.87	289.35	5.02	0.89	333.00	-3.0306	0.0024*
KOH blocks	83.20	13.95	365.15	76.28	15.18	255.97	7.5817	0.0001*
Pass a long	59.15	17.37	325.18	55.37	18.45	296.59	1.9849	0.0472*
T.Q on Information	76.51	15.57	286.84	80.86	15.83	335.56	-3.3831	0.0007*
T.Q on Digit Span	65.59	9.76	277.83	69.86	14.43	344.70	-4.6437	0.0001*
T.Q on Arithmetic	66.01	15.98	279.39	73.22	17.34	343.12	-4.4252	0.0001*
T.Q on Comprehension	66.84	13.02	321.26	65.92	14.40	300.57	1.4364	0.1509
Nahor and Benson Test	3.46	1.12	323.36	3.32	1.10	298.44	1.7306	0.0835
Bender-Gestalt Test	9.37	2.59	297.52	9.84	2.40	324.70	-1.8869	0.0592

*p<0.05- Statistically significant.

Table no 3 shows-When Cognitive Impairment was compared between males and female participants, the Z value was 4.667 which showed male participants showed higher Cognitive Impairment than female participants with a statistically significant p-value of 0.0001.

When Attention & concentration ability was compared b/w males & females, there was a statistically significant Z value of -4.1427 with a p value of 0.0001 which indicates female participants had better attention & concentration than the male participants.

When delayed recall and immediate recall was performed, female participants performed better than the male participants with a Z value of -4.265 and -2.636 and statistically significant p value < 0.05 respectively.

When Visual Retention and Recognition were compared between the two independent groups, there was a statistically significant Z value of -2.9203 and -3.0306 with p values 0.003 and 0.002 respectively. This means female participants performed better than the male participants.

When KOH Blocks and Pass A long Test were compared between male and female participants, results showed higher positive Z values of 7.5817 and 1.984 with statistically significant p values of 0.0001 and 0.0472 respectively, which means males significantly performed better in visuo-motor coordination and block design skills.

When T.Q. on Information, T.Q. on Digit Span and T.Q. on Arithmetic was compared between males and female participants, there was statistically significant Z values of -3.38, -4.64 and -4.42 and p values < 0.05 respectively, which means female participants performed better than male participants; but when T.Q. on Comprehension was compared, it did not show any significant values with Z value 1.436 and p value > 0.05.

Discussion-

This study was conducted to provide a better understanding of Association of Age and Gender with Cognitive Impairment in the Northern Karnataka region. A total of 930 participants were enrolled among which 621 study participants were consented and PGI-BBD was administered on to them.

We associated advancing age as the strongest risk factor.

The 62–63 age group in our research had a 1.70 times higher likelihood of cognitive impairment than the 60–61 age reference group (OR=1.70, p=0.047). Domains (visuo-spatial and visuo-constructive cognitive domain) like KOH's Blocks (p=0.0234) and the Pass-along exam (p=0.0261), pairwise comparisons also showed significant differences between the youngest cohort (60-61 years) and older cohorts.

In our study when Age group of study participants and Cognitive Impairment were compared, it was found out that mean Cognitive Impairment scores gradually increased with age. Age is the biggest risk factor for MCI. The apolipoprotein E (APOE) allele, male sex, and a family history of cognitive decline are additional risk factors.[15] MCI is linked to vascular risk factors include coronary artery disease, stroke, hypertension, and hyperlipidaemia. Patients with four or more comorbid illnesses, particularly two of the following: hypertension, coronary artery disease, hyperlipidaemia, and osteoarthritis, had a higher risk of MCI, according to a research on multimorbidity and MCI.[15, 16]

This is consistent with the findings of Peters et al., who found that demonstrable decreases in executive function and visuospatial ability are linked to even little increases in age during the early geriatric period.[17]

In our study it was found out that, Prevalence of Cognitive Impairment was much greater in males than the female participants. According to research done in India and other low- and middle-income nations, Males who are more exposed to vascular risk factors and who smoke and drink alcohol have been found to have worse cognitive results.[18,19]

Our research revealed a noteworthy correlation between gender and cognitive level. The risk of cognitive impairment was significantly higher in females than in males (OR=3.38, p=0.002). It's interesting to note that although men scored higher on KOH's Blocks (Mean: 83.20 vs. 76.28), women actually scored higher in areas like Attention & Concentration, Delayed Recall, and Visual Retention ($p < 0.05$), according to the Mann-Whitney U test. This paradox implies that although women may have greater rates of impairment in general screening, they may nevertheless have particular language and memory capabilities. These findings are consistent with other studies that suggested postmenopausal Estrogen deficiency may increase women's susceptibility, while educational chances frequently have a confounding effect.[20] Aβ deposition was higher in females with SMC participation than in men. Women had a higher risk of AD than males, although the underlying process is still unknown, as previously noted.[21]

A recent randomized controlled clinical trial that included eight memory training sessions for individuals with MCI was another encouraging study that suggested signs of cognitive plasticity. The patients with MCI demonstrated cognitive performance typical of people without Cognitive Impairment at the conclusion of the training sessions, which included learning mnemonic strategies based on ecological tasks, completing tasks that recruited attention and executive functions, and providing educational content on memory and aging.[22]

Conclusion- Our study assessed Cognitive Impairment and its association with demographic and life style factors. In our study Cognitive Impairment was found to be more common with advancing age and adverse life style factors. Significant differences were observed across different age groups in PGI BBD domains. The existence of substance-use behaviours and female sex were found to be significant predictors. Our study findings highlight the importance of early detection, emphasizes the necessity of early screening and health-promoting initiatives and educational interventions to reduce the burden and to maintain cognitive function and enhance quality of life in older people.

Limitations- Although the study offers insightful information, its conclusions should be viewed in light of a number of methodological issues. First and foremost, the cross-sectional design makes it more difficult to determine clear causal or temporal correlations between variables. The study's location in a single urban health centre further restricts its breadth and may make it more difficult to extrapolate the findings to other geographic or socioeconomic groups. Furthermore, the use of self-reported lifestyle characteristics raises the possibility of reporting and recollection biases, which might compromise the accuracy of the data. Lastly, the results reflect recognized risks rather than official medical diagnoses because the assessment of cognitive impairment was carried out using a screening tool rather than a thorough clinical investigation.

Recommendations- Regular cognitive screening should be used in primary-care geriatric clinics in order to identify at-risk individuals early on and maintain brain health in aging populations. Fostering cognitive resilience through adult education programs and literacy efforts that promote lifelong learning is crucial, even beyond clinical monitoring. Promoting easily accessible and reasonably priced lifestyle practices, including regular exercise, yoga, and frequent reading, which are cognitively stimulating activities that preserve brain clarity and general well-being, can support these efforts.

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