Document heading doi: 10.21276/apjhs.2018.5.3.30 **Original Article**

Prevalence of cognitive impairment in urban elderly population and its association with their physical activity

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ABSTRACT

Background: Cognitive deterioration is a part of normal physiological aging, but not everyone goes through a cognitive impairment. Cognitive impairment (CI) ranges from mild cognitive impairment (MCI) to dementia and Alzheimer's disease (AD), where mild cognitive impairment is a risk factor for dementia and is a transition between normal cognition and dementia. Therefore diagnosis of cognitive impairment at the early stage and early intervention is very crucial in order to delay dementia. Few studies shown that the delay can be achieved by a tailored exercise program and physical activity. **Aim of the study:** To determine the prevalence of cognitive impairment and to evaluate its association with their physical activity level in the elderly population of urban Bangalore. **Methodology:** Cross-sectional study with sample size 175 older adults with 60 years and above. MoCA and PASE was administered and data was collected. **Data analysis:** Demographic data was summarized as the percentage for categorical variables and as median and IQ range for ordinal and non-normal continuous variables. Prevalence was described in percentage. Association between cognitive impairment and physical activity was assessed using Chi Square Test. **Result**: Data was analysed and found that prevalence of cognitive impairment in the elderly population of urban Bangalore was 58.9%. A significant association was found between cognitive impairment and physical activity (P=<0.01 with 95% CI).**Conclusion**: There is a high prevalence of cognitive impairment in the elderly population of urban Bangalore and it is strongly associated with the level of their physical activity.

Keywords: Prevalence, Cognitive impairment, Physical activity, MoCA, PASE.

Introduction

Aging is a "persistent decline in the age-specific fitness components of an organism due to internal physiological degeneration". [1] It is a normal physiological phenomenon which encompasses degradation of adaptability and reserve capacities of almost every system of the body. Degradation in cardiovascular, respiratory, endocrine, renal, visual, auditory, orthopaedic, dental, electrolyte and cognition is the part of normal aging. Reduced immunity and functioning of body organs make them vulnerable to different diseases. In India, the size of the elderly population has risen from 77 million in 2001 census to 104 million in 2011 census.[2]

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Cognitive deterioration is a part of normal physiological aging that leads to reduced vigilance, learning, problem-solving, memory, and intelligence, which further increases the dependency of elderly people. There is an early decline in processing speed with aging, which is found to be associated with degeneration of white matter integrity. The deficit in working memory that requires maintaining and manipulating information, is sometimes associated with reduced task-related activation of the frontal cortical region. With aging, they become distracted with irrelevant information, which is found to be due to reduced inhibition. Brain imaging has shown faster changes in brain volume in older people at the rate of 0.35% per year, compared to 0.12% per year in young adults. After aging there is also the reduction in cerebral metabolism for oxygen, glucose and blood flow. All these anatomical and physiological changes are found to be associated with the cognitive decline in elderly.[3]Cognitive impairment (CI) ranges from mild

cognitive impairment (MCI) to dementia and Alzheimer's disease (AD). Dementia is characterized by progressive deterioration of intellect, activities of daily living (ADL), memory and behaviour. It is one of the major causes of disability in late life. 3.7 million Indians over 60 years were reported to have dementia in the year 2010. According to 2010 estimation, the worldwide economic cost of dementia was US$ 604 billion. [4] According to World Health Organization (WHO), dementia is going to be epidemic in elderly people, demanding prevention, early detection, and treatment of the same.MCI is a syndrome with a cognitive decline more than what is expected for an individual's age and education level, without interfering with his/ her ADL. [5] Therefore MCI is a risk factor for dementia and is a transition between normal cognition and dementia. Ganguli (2004) reported that around 50% of MCI can progress to dementia, whereas up to 22% of patients with MCI provided with early intervention can be restored to normal cognitive function. [6] Therefore diagnosis of cognitive impairment at the mild level and early physical therapy intervention in the form of aerobic exercise, resistance training, circuit training, and aquatic therapy is very crucial in order to delay dementia. [7]Commonly used screening tests for cognitive function in the clinical setup is MMSE, which is a reliable, valid and easily administered tool. Since MMSE is not sensitive to the mild form of cognitive impairment Nasreddine (2005) developed MOCA a tool which is sensitive to mild cognitive impairment. Montreal cognitive assessment (MoCA) is a quick screening tool, which has a sensitivity of 90% to detect MCI and 100% to detect AD. It is shown to be tremendously better than mini-mental state examination (MMSE), a commonly used clinical tool to assess cognition with 18% sensitivity to detect MCI and 78% to detect AD. [8]Among all risk factors of dementia like age, sex, genetics; physical activity is a modifiable risk factor. Physical activity (PA) is defined as any bodily movement produced by skeletal muscles that result in energy expenditure. [9] Physical activity could be in the form of occupation, household, leisure time, transportation, or sports. Exercise is also one of the components of physical activity which is more structured, planned and repetitive, which is aimed to maintain or improve the physical fitness. Therefore indirectly physical activity is also positively associated with physical fitness. Indian elderly were found to be reasonably active but few barriers to physical activity in Indian elderly were identified as lack of knowledge, guidelines, recommendation, motivation, health issues and family support that have made them reluctant to activities of daily life. [10] Instruments that are commonly used to measure PA focus more on young adults, considering which; Washburn(1992) developed physical activity scale for elderly (PASE).[11] This questionnaire focused on physical activities performed by elderly in a week period and included questions on leisure, household, and work-related activities. They found that it could be easily administered and established a good test-retest reliability of 0.75(95% CI) and good construct validity. It was found to be positively associated with grip strength, static balance and leg strength of older people. A meta-analysis done on cognition and physical activity found an association between cognitive decline and physical activity. [12] Zheng (2016) found that the effect of aerobic exercise on MCI significantly improved global cognitive function in elderly with MCI. [7].A prevalence study done by Sengupta 2014 found 8.8% prevalence of CI in Ludhiana, Punjab using MMSE, the area covered was a small part of India and the tool used to diagnose cognitive impairment is not sensitive to detect CI in a mild state. Therefore it is indispensable to identify cognitive impairment in other communities of India, using a tool like MoCA which is more sensitive to detect a mild form of CI, so that early physical therapy intervention can be delivered to delay dementia. [13]

Also, the western countries have shown the association between physical activity and cognition, but there is a scarcity of scientific evidence regarding the prevalence of CI in Indian elderly and its association with the level of their Physical Activity. Access to this information is of huge public health importance given the rising number of the elderly and increasing prevalence of dementia in India, which is a social and economic burden to the family and the country. This can be delayed by detecting and intervening in the early stage of Cognitive impairment by prescribing tailored exercise. There exists a huge geographical, racial and cultural difference in western and Indian population which has a strong influence on cognition (Lacritz, Wiener and Cullum 2011).[14] Hence this study aims to determine, what is the prevalence of cognitive impairment and its association with their physical activity level in urban elderly?

Materials and Methods

Objectives of the study

- To determine the association between CI and physical activity.
- To determine the prevalence of cognitive impairment in urban elderly.

Study Design: Cross-sectional study,

Source of data collection: Communities centres in Bangalore city, Parks, Outpatient of tertiary Hospitals. Bangalore, India

Sample Size: 175

Based on 10% prevalence of cognitive impairment (Sengupta et al 2004) and margin of error of 5%, alpha of 95%, sample size comes to 138. Adding 20% nonrespondent rate, the sample size was rounded off to 175.

Inclusion Criteria**:**

- Age more than 60 years
- Indian
- Non institutionalized community dweller
- No neurological deficit
- No chronic co-morbidities
- Elderly who can read and write in English.

Exclusion Criteria:

- Institutionalized
- Presence of any diagnosed neurological deficit
- Incapable of reading and writing in English

Materials Required:

- PASE questionnaire and MoCA scale
- Stationary items: pen, pencil, eraser, stapler.

Study participants:

House visit: 67 houses were visited out of those 61 houses had 114 numbers of elderly, 101 fulfilled the inclusion criteria and 96 elderly agreed to participate in the study.

Tertiary Hospitals : Also 98 people working staff and individuals visiting tertiary hospital were screened, out of those 69 people met the inclusion criteria and 65 agreed to participate.

Park: 72 people coming to park were approached for the study out of that 59 met the inclusion criteria and 14 agreed to participate.

Procedure of Data Collection: After obtaining ethical clearance from the Ethical Committee, house to house survey was done in 6 communities of North Urban Bangalore city. City parks around this areas and tertiary hospital . Individuals with 60 years of age in the house were identified and screened for the inclusion and exclusion criteria. Purpose, objective and the benefit of the study were explained. Written Consent was taken from the individual who fulfilled the inclusion criteria after which MOCA was administered and PASE questionnaire was given to each of them. The participant was given the freedom to withdraw anytime during the study without any explanation.

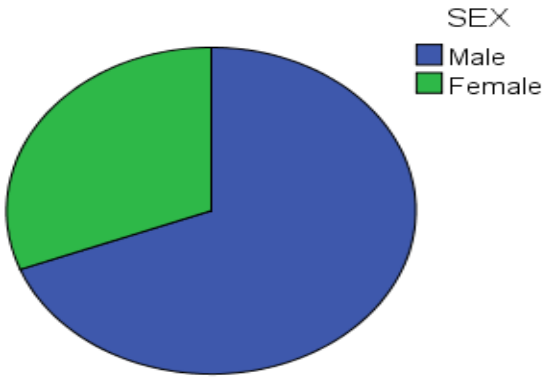
Data analysis: The collected data were entered into Microsoft Excel and the statistical analysis was performed using the Statistical Package for Social Science (SPSS version 20.0 software). Demographic data was summarized as the percentage for categorical variables and as median and IQ range for ordinal and non-normal continuous variables. Prevalence was described in percentage. Association between cognitive impairment and physical activity was assessed using Chi Square Test.

Results

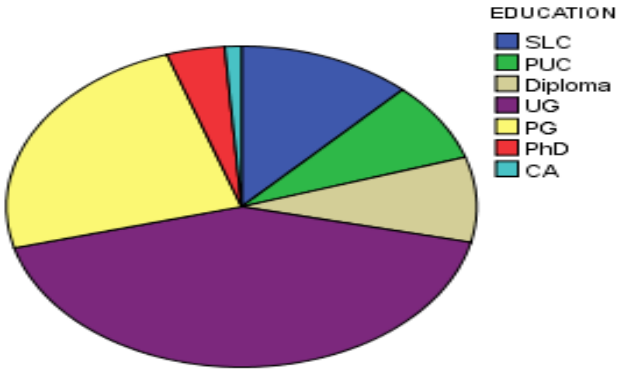
A total of 175 elderly subjects were recruited in the study, in order to assess their cognitive function and physical activity and to determine the prevalence of cognitive impairment and find its association with physical activity.Demographic data of the subjects (age, gender, education) are shown in the table below (Table 1).

Table 1: Demographic details (Gender, Education, and Age) of the subjects

VARIABLE	FREQUENCY	PERCENTAGE
Gender (N=175)		
Male	121	69.1
Female	54	30.9
Education (N =175)		
Secondary Leaving Certificate	21	12.0
Pre University College	14	8.0
DIPLOMA	15	8.6
UG	74	42.3
PG	42	24.0
PhD	7	4.0
Chattered Accountant	2	1.1
Age		
60-65	58	33.1
66-70	30	17.1
71-75	39	22.3
76-80	42	24.0
More than 81	6	3.4



Graph 1: pie chart of gender distribution



Graph 2: pie chart of education distribution

The above table shows the description (frequency and percentage) of the subjects in terms of their age, gender and education. There were 121 (69.1 percent) males and 54 (30.9 percent) females, where 33.1 percent were in the age group of 60 to 65; 17.1 percent in the age group of 66 to 70; 22.3 percent in the age group of 71 to 75, 24.0 percent in the age group of 76 to 80 and 3.4 percent in the age group of more than 81. Among them 12 percent were qualified till SLC, 8 percent till PUC, 8.6 percent had the diploma, 42.3 percent were undergraduates, 24 percent were post graduates, 4 percent were Ph.D.'s and 1.1 percent were Chartered accountants.

Table 2: Result of test of normality using Shapiro-Wilks Test for the variables (Age, MOCA score, and PASE score)

Variable	Significance on SHAPIRO WILKS Test
Age	0.00
MOCA Score	0.02
PASE Score	0.477

The above table shows the result of Shapiro-Wilks test of Normality of the variables (age, MOCA score, and PASE score) showing the significance level of 0.00 and 0.02 for age and MOCA score, that shows that the data is not normally distributed and; significance level of 0.477 showing the normally distributed data of PASE score.

Table 3: Median and Interquartile range of the Age, MOCA score, PASE score

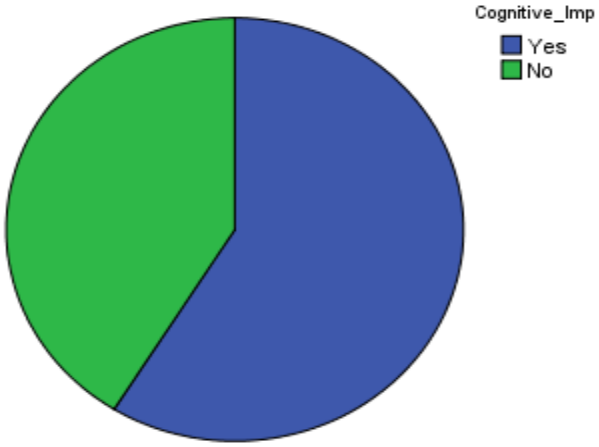
VARIABLE	MEDIAN	25TH, 75TH PERCENTILE
AGE	70	65,76
MOCA SCORE	24	22,27
PASE SCORE	100.7	76.4,129.9

The above table shows the Median and Interquartile range of the age, Montreal Cognitive Assessment (MOCA) score and Physical activity scale for elderly (PASE) score. The median and the interquartile range were used since the data weren't distributed normally. The median and the 25th, 75th percentile of Age was found to be 70 and 65, 76. The median and 25th, 75th percentile of MOCA score was found to be 24 and 22, 27. The median and 25th, 75th percentile of the PASE score was found to be 100.7 and 79.4, 129.9.

Table 4: Prevalence of Cognitive Impairment.

Cognitive impairment	frequency	Percentage
Yes	103	58.9
No	72	41.1
Total	175	100

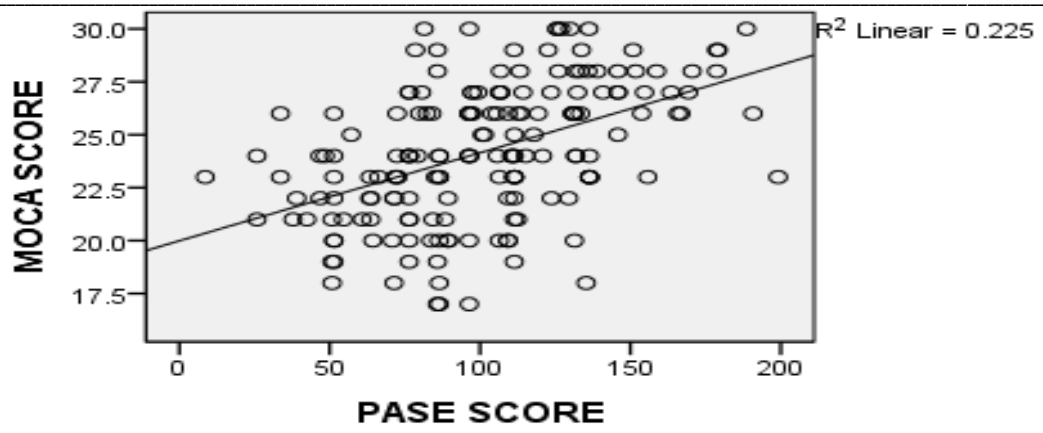
The above table shows the prevalence of cognitive impairment. Among 175 subjects of more than 60 years of age, 58.9 percent had cognitive impairment and 41.1 had normal cognition.



Graph 3: pie chart of cognitive impairment distribution

Table 5: Association between cognitive impairment and physical activity

		Cognitive Impairment				
		Yes	No	Pearson Chi-Square	P Value	Odds Ratio (95% CI)
PASE Quartiles	First Quartile	44	5	37.8	< 0.001	23.4 (7.5, 73.2)
	Fourth Quartile	12	32			
	Total	56	37			



Graph 4: scattered plot of moca and pase score

The above table shows the association between cognitive impairment and the physical activity. Here the PASE scores have been divided into four quartiles. First, second, third and fourth quartile represents the score of; less than 25, 26 to 50, 51 to 75 and more than 76 respectively. The number of subjects falling into first and fourth quartiles was taken and associated with their cognition using chi-square test. Chi-square test showed that there is a significant association between cognitive impairment and physical activity (P=<0.001). The Odds ratio of Cognitive impairment and physical activity was 23.4 (7.5, 73.2).

Discussion

A general term Cognitive Impairment encompasses mild to severe cognitive impairment in the form of dementia. Many prevalence studies in India have used MMSE as an assessment tool for cognitive function, [13] that has been identified to be weakly sensitive to mild cognitive impairment. This study has used a more sensitive tool MoCA to determine the Prevalence of Cognitive Impairment.

In the current study, proposed sample was 175 older adults without any chronic systemic, neurological or psychiatric condition. Out of 175 subjects, 69.1% were male and 30.9% were female with a median age of 70 (65, 76 percentile). All subjects were educated with varied level of qualification ranging from SLC to Ph.D., accounting more of undergraduates (42.3%). Most of the subjects (33.1%) were under the age group of 60 to 65, whereas others were mostly distributed under the age group of 71 to 75 and 76 to 80, accounting 22.3% and 24% respectively.

The result of this study showed 58.9% prevalence of cognitive impairment in urban elderly of Bangalore. This result is enormously contradicting the results of previous prevalence studies done in other parts of India. A study done in Northwest part of India using Kolkata Cognitive Test battery showed 19.26% prevalence of only mild cognitive impairment .[15] Our study has used a general CI, excluding the diagnosed Dementia cases, which might have lead to the higher prevalence rate. Another study, done by Sengupta (2014) discovered 8.8% prevalence of cognitive impairment with 95% confidence interval, in a study done in Punjab using Hindi Mental State Examination in a population of 3038. Since MMSE is not sensitive to the mild form of cognitive impairment, the result seen might be a false negative, hence showing less number of cognitively impaired individuals, unlike our study which has shown a higher prevalence.

In spite of all these, study done in an urban population with most of them being highly educated, this result showing 58% prevalence of cognitive impairment sounds controversial. Further sub-analysis of the MoCA results showed, there is a significant association of cognitive impairment with increasing age (P=0.02 with 95% CI) and lesser qualification (P=<0.01 with 95 % CI). This result is corresponding with the results of many other studies. [13, 15]

Most of the participants in our study faced difficulty in the domains like visuospatial and executive, language, delayed recall and verbal fluency. Only 73 subjects (41.7%) could copy the cube correctly, 23 of them (13.1%) were able to score in the section of language (repeating the sentences) and 58.9% were able to score in the domain of verbal fluency where participants were asked to name more than 11 words starting with letter F in a minute. Participants also faced problem in immediate and delayed recall with the words Daisy and Velvet, where they reported that the words were not familiar to them. Though all the participants were capable of reading and writing English, English was

not their first language and the words and sentences used weren't familiar to them, this might have contributed to the lesser score of the participants.[16] Other missed item was the placement of clock hands where only 58.3% performed correctly. The result of our study corresponds with the result of the study done by Rossetti 2011), where 62% of the participants scored less than the cut-off score of 26 in MoCA.[17] Participants in their study also missed the items like cube drawing, sentence repetition, delayed recall, drawing clock hands, verbal fluency and abstraction items.

Nasreddine Z 2005 introduced MoCA with the aim of developing a tool to identify MCI since MMSE was not sensitive enough for MCI. They developed the tool in a small town of Canada with 277 number of elderly population and gave a cut-off score of 26 based on their population's findings. The difference in the quality of education, culture, ethnicity might have caused the variation in the cut-off score in the Indian population, hence giving rise to a false positive result with the cut-off score 26 in our study. Therefore developing a population-based MoCA norm and cut-off score in an Indian population considering their first language is essential. [17]

MoCA result might have also been affected due to the lack of an appropriate assessment setting in the study. People were approached and assessed in crowded places like the park, hospitals where the participants were not prepared for such sudden tricky questions; this might have made them conscious and thus reduced their performance.

The first objective of this study was to determine the association between cognitive impairment and physical activity using PASE, which is a subjective questionnaire that assesses past seven days of activity done by elderly. The median score of PASE in this study was 100.71 (76.4 to 129.9 percentile), where most of the participants scored well in the domains of walking, light house activities, job, taking care of dependent ones and gardening. Out of 175 participants, 9 subjects were involved in light sports, 4 were involved in moderate sports, 16 were involved in strenuous sports and 50 were actively exercising. These active participants were mostly involved in activities like dancing, swimming, golf, badminton, cycling and yoga and mostly were of age lesser than 70 years.

The result showed a significant association between cognitive impairment and physical activity (P=<0.01 with 95% CI), which corresponds to the result of other studies. [12]. Many studies have illustrated the physiological and structural mechanism behind this association. Summarizing the results of many studies, there are altogether five identified mechanisms of this association.

1) Neuroplasticity: Exercise-induced positive neuroplasticity might have increased the density of neuronal connection and hence the cognitive reserve.[18]

2) Increased cerebral blood flow and angiogenesis: Exercise induces increased cerebral blood flow and angiogenesis in the motor cortex, cerebellum, and hippocampus, which is assumed to be the cause of improvements seen in memory and learning. [19,20]

3) The release of Norepinephrine, Cytokines, and Neurotrophins: Release of Norepinephrine itself has been demonstrated to improve memory whereas release of Neurotrophins and cytokines are found to play role in enhancing Neuroplasticity. [21-23]

4) Increased tissue volume: Few studies have demonstrated that there is an increase in a hippocampal volume of elderly who have higher fitness level, which translates to improved memory. [24] Also, Ho 2010 demonstrated that higher physical activity and education was associated with around 2.5% greater brain tissue volume of an aging brain.[25]

5) Reduced risk of cardiovascular disease: Exercise and physical activity reduce the risk of atherosclerosis, hypertension and Diabetes Mellitus that are the risk factors for cognitive impairment, hence reducing the risk of developing cognitive impairment.[12]

These physiological and structural changes might be the reason for the significant association seen in our study as well. The active aerobic and resistance exercises were done by very fewer participants and also the intensity of subjective walking reported by the elderly is unknown. That might also be one of the contributing factors for less anatomical and physiological neural changes and hence reduced cognitive performance.

Few limitations of this study were, the subjective scale (PASE) used to assess the level of physical activity might not have given the accurate data, the use of MoCA which did not have a cut-off score based on Indian population and was in a non-local language might have given a false positive result and convenience method of sampling and data collection might have caused some bias to the overall result.

The result of this study could be interpreted in one way or the reverse. Is the reduced physical activity causing a deteriorative effect on the cognitive function or, is it the reduced cognition leading to reduced physical activity level? Therefore in order to figure out this causal relationship and to determine an accurate

prevalence of cognitive impairment in the population of urban Bangalore, a longitudinal study needs to be conducted in future using more objective assessment tool for physical activity and more reliable cognitive assessment tool validated for Indian population.

Clinical implication: There is a very high prevalence of cognitive impairment in the elderly population of urban Bangalore, which is strongly associated with their physical activity level. Therefore, every hospital and clinical setup should educate every patient and their family members regarding the importance of physical activity. Outreach programs and health camps should be organized in different areas to educate people and motivate them for physical activity and exercise. A team of physiotherapist can be involved in conducting community-based exercise programs, reaching both rural as well as urban areas.

Conclusion

The purpose of the study was to determine the prevalence of cognitive impairment in the elderly population residing in urban Bangalore and to evaluate the association between cognitive impairment and physical activity. This study shows the prevalence of cognitive impairment of 58.9% in the population of Bangalore aged >60 years. This result is very high compared to the results of other prevalence studies done in India. Out of 175 elderly participants more than half of them were not able to reach the cut-off score of 26 in MoCA. The study also shows a significant association between cognitive impairment and physical activity (P=<0.01). Elderly who were involved in a higher level of physical activity had better cognition. Hence from the study, it can be concluded that the prevalence of cognitive impairment in elderly residing in urban Bangalore is 58.9% and there is a significant association between cognitive impairment and physical activity, but the result of 58.9%prevalence should be used cautiously for the future studies.

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List of abbreviations
MoCA: Montreal Cognitive Assessment
PASE: Physical Activity Scale for Elderly
MCI: Mild Cognitive Impairment
UG: Under Graduate
PG: Post Graduate
CA: Chartered Accountant
CI: Confidence Interval
AD: Alzheimer's disease
ADL: Activities of Daily Living

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