

Alzheimer’s Disease - An Analytical View

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I. Introduction

Alzheimer’s disease (AD) and other forms of dementia are a growing public health problem among the elderly people in developed and developing countries, whose aging population is increasing. The aging population size is now bigger for all the countries due to sustainable development in health care system around the globe. It is estimated that by the year 2020, 70% of the world’s population aged 60 and above will be living in developing countries, more than 14% in India.^[1] The estimates of rate at which new disease develops can only be measured accurately in prospective incidence studies. The reported incidence rates for AD has been lower in Asian countries than in the industrialized world.^[2-6] Although dementia prevalence studies are available from Asian countries including India,^[7-15] there is a dearth of incidence,^[2-6] data, particularly from prospective long-term studies. We have previously reported the age-adjusted prevalence of dementia including AD to be 4.86% (AD 1.91%) in a community residing population in a southern Indian province of Kerala.^[16] The study reports the incidence rates after a 10 years follow-up of the COAT cohort.

II. Methods

The COAT study was initiated in 2001 as a longitudinal study to examine cognition in older adults in the southern Indian province of Kerala. The study first developed cognition^[17] and the activities of daily living^[18] screening and clinical evaluation instruments and derived population norms.^[19] Subsequently they undertook a prevalence survey^[16] and a follow-up incidence survey.

Figure-1 :The Prevalence of AD around the world

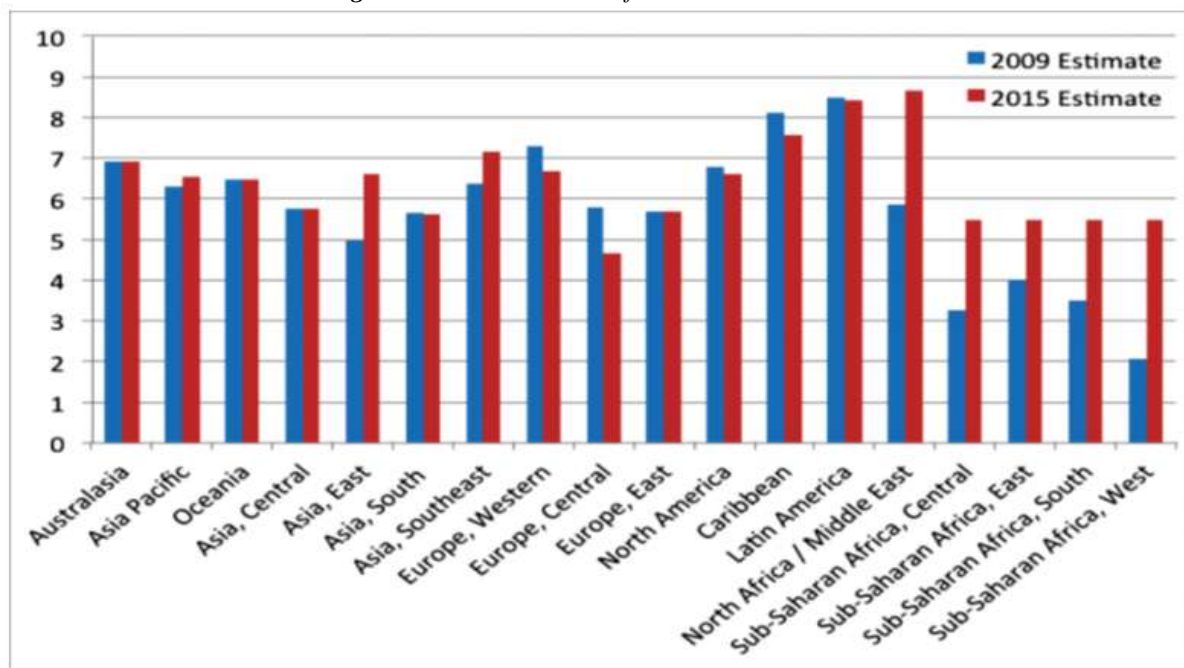


Table -1 : Showing the estimated annual numbers of incident cases of dementia, by age group and world region in 2010

Region\Age Group	60-64	65-69	70-74	75-79	80-84	85-89	90+
Australasia	5302	7963	9970	13142	15871	16734	16098
Oceania	952	1059	1140	1115	895	505	307
Asia Central	13845	11839	10615	17134	12287	7805	4243
Asia East	374859	355070	343826	362013	312414	176473	74229
Asia South	248166	238021	245465	229362	173095	98859	55871
Asia Southeast	105806	99019	100042	102452	85281	57518	36835
ASIA	788893	781223	806311	860715	775632	526580	324474
Europe Central	24550	32715	39657	61567	77122	65186	46693
Europe Eastern	41880	45376	54177	117578	97717	94641	55523
Europe Western	77053	121116	169166	266762	339361	343308	305006
EUROPE	143483	199207	263000	445907	514200	503135	407221
Caribbean	7893	8953	10857	12187	11118	8148	6846
L America An	7967	9003	10283	11202	9863	6302	2822
L America Cen	37194	40078	45438	45695	42095	29051	14507
L America Sou	12577	15517	18717	20695	20592	15549	7873
L America Tro	36707	40754	43609	47986	41267	31747	19290
AMERICAS	182939	225026	260231	296784	314187	276687	198683
Nor Africa/Mid Ea	70550	66606	67520	68282	57115	29324	12140
S-S AfricaC	8904	9352	9115	7827	5285	2430	816
S-S AfricaE	35780	38398	37179	33648	25931	13126	5103
S-S AfricaS	10863	11324	10775	10358	8161	6512	1719
S-S AfricaW	33931	35414	33779	27014	16159	6173	1492
AFRICA	160030	161095	158368	147129	112651	57563	21271
WORLD	1275345	1366550	1487911	1750534	1716669	1363965	951650

III. Statistical Methods

Incidence rates for AD were calculated by dividing the number of cases with onset of AD in each age group by the number of person-years of observation in that group. Since majority of incident cases of dementia were accounted by AD (94%), AD is reported as the primary outcome. Incidence rates were also calculated within both gender categories and four age categories (55–59, 60–74, 75–79, 80–84, and ≥ 85 years); 95% confidence intervals (CI) around these rates were available based on Poisson distributions (appropriate for rare events)^[40]. In order to be able to compare with some of the published incidence rates all available reports have been consulted. As the most data are till 2010, we have considered data for 1990, 2000, 2010 in most cases. The estimation has been made based on the derived model.

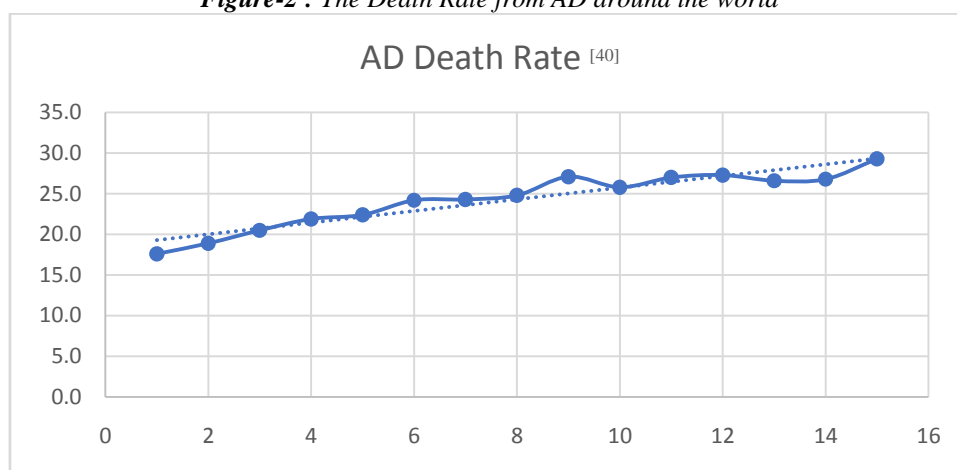
IV. Results

Table 2 : Prevalence studies of dementia from India^{[6][9][11][13]}

Region	Age	Prevalence-Dementia	AD
South India	≥ 60	3.39	1.31
North India	≥ 65	1.36	0.77
West India	≥ 65	2.44	1.50
East India	≥ 60	0.80	0.38

In India, southern part is affected and then the western in case of dementia and it is opposite in case of AD.

Figure-2 : The Death Rate from AD around the world



The linear model is

$$AD\text{Death Rate} = 18.551 + 0.7186(\text{Year}-1999); R^2 = 0.8978 \dots \dots \dots (1)$$

The estimated values for ADDR for the years has been calculated (Table - 2).

Table 3 : Prevalence of AD Death Rate(ADDR) in the years in the World [40]

Year	AD Death Rate	Year	AD Death Rate
2000	17.6	2011	27.3
2001	18.9	2012	26.6
2002	20.5	2013	26.8
2003	21.9	2014	29.3
2004	22.4	2015	30.0*
2005	24.2	2016	30.8*
2006	24.3	2017	31.5*
2007	24.8	2018	32.2*
2008	27.1	2019	32.9*
2009	25.8	2020	33.6*
2010	27.0		

*Estimated values using (1)

The last 15 years available data, the data upto 2020 has been modeled. It is quite good in fitting;the determinants may be considered for developing more appropriate model.

Table 4 : Relative change in the Prevalence rate of AD and Dementia in India [40]

Age Group	Relative Change in AD for 2000 to 1990	Relative Change in AD for 2010 to 2000	Relative Change in Dementia for 2000 to 1990	Relative Change in Dementia for 2010 to 2000
55 - 59	42.86	15.00	17.02	23.64
60 - 64	35.76	22.77	15.96	23.85
65 - 69	44.74	15.45	16.11	23.44
70 - 74	44.51	15.19	16.57	23.00
75 - 79	44.85	15.48	16.55	23.19
80 - 84	44.64	15.49	16.49	23.25
85 - 89	44.63	15.59	16.53	23.20
90 - 94	44.61	15.54	16.47	23.20
95 - 99	44.63	15.54	16.47	23.21

It is interesting to note that the relative change in case of prevalence of dementia and AD is nearly constant. Thus, the prevalence of dementia and AD both is exponential in India.

V. Discussion

Our results indicate high incidence of AD in this cohort of Kerala population, higher than reported previously from India though lower than developed countries. Suggestions that the incidence of AD is lower in Asia than in Europe and North America^[31] are based on very few Asian incidence studies, most of which are from eastern Asia, Japan,^[32] China,^[33] and Taiwan^[3] with reporting rates from 5.1 to 8.9 per 1000 person-years among seniors aged ≥ 65 years. Incidence of AD among seniors aged ≥ 65 years in Trivandrum, standardized against the age distribution of the year 2000 US population, was 9.19 per 1000, lower than the 17.5 per 100 found by similar methods, in the Monongahela Valley of Pennsylvania^[34] and lower than 1.15% in Shanghai^[6] and 15.7% in Anhui,^[2] in China. The incidence rates in our cohort, nevertheless, was much higher than 4.7 per 1000 found in rural Ballabgarh^[4] in India, this study was based on a limited follow-up of 1 year. The Ballabgarh cohort was largely rural illiterate older adults. In contrast, COAT cohort is largely literate, urban, and semi-urban population with better Human Development Index (HDI) of 0.64 versus 0.54 in Ballabgarh and 0.5 in India, and longer life expectancy at birth in years 74 versus 66.2 in Ballabgarh and 63.5 in India.^[20,35] Our result emphasizes that there are substantial regional differences in AD incidence within the heterogeneous population of India. The strengths of our study are long follow-up for a decade and the search for a predictive model. The incidence in India is exponential has been established. It should be a directive proposition for immediate policy framing to prevent and protect the disease.

The limitation of our study is that we could not have the data for the determinants and follow-up policy data for better planning and predictive model for policy makers. It is possible that very mild dementias were underestimated in the semi-urban localities of the survey area because the daily functional demands on older adults in these semi-rural localities are limited because of their living with and being cared for by their families.

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