

## Prevalence of dementia in an urban population in Kerala, India

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**Background** Dementia is emerging as an important health problem of elderly people in India.

**Aims** To investigate the prevalence, psychosocial correlates and risk factors of various dementing disorders in an urban population in Kerala, southern India.

**Method** A door-to-door survey was conducted in the city of Kochi (Cochin) to identify residents aged  $\geq 65$  years using cluster sampling. Of 1934 people screened with a vernacular adaptation of the Mini-Mental State Examination, all those scoring at or below the cut-off of 23 were evaluated further and those with confirmed cognitive and functional impairment were assigned diagnoses according to DSM-IV criteria. Identified cases were categorised by ICD-10 criteria. Ten per cent of those screened as negative were evaluated at each stage.

**Results** Prevalence of dementia was 33.6 per 1000 (95% CI 27.3–40.7). Alzheimer's disease was the most common type (54%) followed by vascular dementia (39%), and 7% of cases were due to causes such as infection, tumour and trauma. Family history of dementia was a risk factor for Alzheimer's disease and history of hypertension was a risk factor for vascular dementia.

**Conclusions** Dementia is an important health problem of the elderly population. Identification of risk factors points towards the possibility of prevention.

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Dementia is emerging as an important health problem in Kerala, the southernmost state of India. The number of elderly people in Kerala increased from 0.9 million (5.3%) in 1961 to 2.5 million (8.3%) in 1991 and 3 million (9.5%) in 2001. Two epidemiological studies of dementia conducted in residents aged 60 years and over, one in the city of Chennai (Madras) and another in a rural block of southern India, obtained prevalence rates of 27 per 1000 and 36 per 1000 respectively (Rajkumar & Kumar, 1996; Rajkumar *et al*, 1997). A study conducted in a rural community in Kerala yielded a prevalence of 34 per 1000 in people aged 60 years and above (Shaji *et al*, 1996). Chandra *et al* (1998) reported a prevalence rate of 8.4 per 1000 in a population aged 55 years and above and an overall prevalence rate of 13.6 per 1000 in a population aged 65 years and above from a rural community in northern India. Vas *et al* (2001) reported an overall prevalence of 18 per 1000 for those aged 65 years and above in an urban population in Mumbai (Bombay). Our study aimed at investigating the prevalence of various dementing disorders, psychosocial correlates of the morbidity and the risk factors associated with the illness.

### METHOD

The community chosen for the study was the Ernakulam constituency for the legislative assembly, which is a part of the city of Kochi (Cochin). The population aged 18 years and above was 183 977 according to the electoral list.

The list of voters and the area map constituted the sampling frame. The Ernakulam constituency is divided into 178 parts, each of which has a population of 800–1000. For operational purposes, each part was designated as a cluster, and a cluster sampling technique was used. Thirty of 178 parts were randomly selected and in

each a door-to-door survey was conducted to identify residents aged 65 years and above. The community survey was conducted by a group of six psychiatric social workers who were trained by a psychiatrist (S.S.). They explained the purpose and procedures of the study to the family members and obtained their informed consent.

### Assessment tools

The following measures were used.

#### Mini-Mental State Examination

The Mini-Mental State Examination (MMSE; Folstein *et al*, 1975) was used as a screening test for cognitive impairment. Three primary translators (two psychiatrists and a clinical psychologist), well versed in English and Malayalam, translated the original version into Malayalam independently. They then met to compare the versions item by item and agree upon a final version. This version was used to test a sample of 20 literate and 20 illiterate people from different socio-economic strata. These people were asked whether the items were clear and simple, and some minor changes were made in the translation in response to their feedback. Two bilingual experts then back-translated the vernacular version into English to establish linguistic equivalence. The primary translators and the back translators met and discussed the questionnaire item by item to ensure the translations approximated as closely as possible. The correlations between English and vernacular scores were found to be high. The interrater reliability coefficient was found to be 0.9. Sensitivity and specificity for various MMSE scores were checked against the diagnosis of dementia according to DSM-III-R criteria (American Psychiatric Association, 1987). A cut-off score of 23 was selected with a sensitivity of 88% and specificity of 82% (Shaji *et al*, 1996).

#### CAMDEX Section B

Section B of the Cambridge Mental Disorders of the Elderly Examination (CAMDEX; Roth *et al*, 1986) was used for cognitive examination. The test was translated into the vernacular and items were modified and selected after field trial, to harmonise with the sociocultural situation. The interrater reliability coefficient was found to be 0.8. Separate cut-off scores were selected for different educational

levels: a cut-off of 72 was selected for people who were literate, with a sensitivity of 94% and specificity of 90%, and a score of 52 was selected for those who were illiterate, with a sensitivity of 98% and specificity of 88% (Shaji *et al*, 1996).

#### CAMDEX Section H

Section H of the CAMDEX (Roth *et al*, 1986) is a structured interview in which information about an individual's history and functional abilities is obtained from a relative or caregiver. This interview elicits details of personal and social functioning as well as the individual and family histories.

#### Socio-economic Status Scale – Urban

The Socio-economic Status Scale – Urban (Kuppuswamy, 1976) was used to categorise the population into different socio-economic groups.

#### Study design

The study was conducted in three phases. During phase I, all identified people aged 65 years and above were screened with the vernacular adaptation of MMSE. The screening was done by trained psychiatric social workers. In phase II, those who scored 23 or below on the MMSE had a detailed neuropsychological evaluation with CAMDEX Section B to confirm the impairment in cognitive function. For each individual a caregiver or relative was interviewed with CAMDEX Section H to confirm the history of deterioration in social and occupational functioning or activities of daily living. This was done by a clinical psychologist. In phase III, a psychiatrist visited the homes of participants whose impairments were confirmed by the CAMDEX Sections B and H for diagnostic evaluation according to DSM-IV criteria (American Psychiatric Association, 1994). Ten per cent of the negatively screened population were randomly selected and evaluated at each stage. Evaluation in phase III included a detailed medical history, physical and neurological examination. Necessary investigations were done to rule out conditions such as hypothyroidism, HIV infection, brain tumours and vitamin B<sub>12</sub> deficiency. Cases of dementia were categorised according to ICD-10 criteria (World Health Organization, 1992). Although DSM-IV is more specific in the definition of domains of impairment required for the

diagnosis of dementia, ICD-10 criteria offer clear guidelines for categorising the cases.

Age- and gender-specific prevalence rates of dementia, Alzheimer's disease and vascular dementia were calculated. The Alzheimer's disease group and the vascular dementia group were compared with control groups matched for age, gender and education and with one another on various socio-demographic and clinical parameters. Assessment of risk factors was based on the structured interview in CAMDEX Section H. Caregivers were asked whether the individual had a known history of high blood pressure, diabetes mellitus, cardiac disease, cancer, Parkinson's disease, Down's syndrome, head injury, fits or any psychiatric disorder. The 'caseness' of alcoholism was assessed with questions about alcohol consumption and problems related to the individual's drinking habits.

The control groups were selected by group matching of the cases with respect to age, gender and level of education. For this purpose the entire population was stratified according to these categories and the required number of controls were selected from each group at random.

The group comparisons were made using the chi-squared test. Fisher's exact test was used to find out the statistical significance whenever the expected frequency was less than 5. Odds ratios were used to find out the relative risk of various risk factors pertaining to dementia and 95% confidence intervals were determined using the approximation of the Woolf formula.

## RESULTS

The survey identified 2031 elderly people aged 65 years and above. Of these, 1934 people were screened with the vernacular adaptation of MMSE. The socio-demographic characteristics of the sample are given in Table 1. The 97 people who were not tested with the MMSE during this phase comprised 24 people who refused to consent, 17 who had severe visual or hearing impairment, 23 who were very ill or had severe physical disability, 3 who were uncooperative owing to chronic functional psychiatric illness and 30 who could not be traced.

Of the 1934 people screened with MMSE, 327 scored at or below the cut-off score of 23. The clinical psychologist

**Table 1** Socio-demographic characteristics of the sample (n=1934)

Characteristic	n (%)
<b>Gender</b>	
Male	874 (45.2)
Female	1060 (54.8)
<b>Education</b>	
Illiterate	216 (11.2)
Primary	851 (44.0)
Secondary	540 (27.9)
Higher secondary	135 (6.9)
Graduation	110 (5.7)
Postgraduates and professionals	82 (4.3)
<b>Religion</b>	
Hindu	924 (47.8)
Christian	874 (45.2)
Muslim	136 (7.0)
<b>Socio-economic status</b>	
Upper class	119 (6.2)
Upper middle class	294 (15.2)
Middle class	536 (27.8)
Lower middle class	585 (30.2)
Lower class	400 (20.7)
<b>Marital status</b>	
Married	1150 (59.5)
Unmarried	67 (3.5)
Widow	627 (32.4)
Widower	85 (4.4)
Divorced/separated	5 (0.3)
<b>Current living status</b>	
Living with spouse and children	775 (40.0)
Living with children	867 (44.8)
Living with spouse	141 (7.3)
Living with other relatives	91 (4.7)
Living alone	60 (3.1)

approached these 327 people for neuropsychological evaluation with CAMDEX Section B. Twenty-seven of them could not be tested: 7 people refused to consent, 5 had died, 8 were bedridden owing to physical illness and 7 could not be traced. Historical evaluation of these cases by the clinical psychologist indicated that no one in this group had a history suggestive of dementia. Caregivers of the 223 people with cognitive impairment confirmed by CAMDEX Section B assessment were interviewed using CAMDEX Section H, leading to identification of impairment in social and personal functioning in addition to cognitive impairment, 55 of whom were diagnosed as having dementia based on DSM-IV criteria. Among the negatively

screened cases, 161 people out of 1607 with an MMSE score above the cut-off of 23 were evaluated with CAMDEX Section B, and one case of dementia was identified; in the subsequent phase of negative screening no case could be detected.

Of the 223 people with cognitive impairment, 127 had no impairment in social or occupational functioning. This group comprised 31 men and 96 women (mean age 74.5 years, s.d.=7.2; mean MMSE score 21, s.d.=0.2); 60 were illiterate and 33 had only primary education.

Forty-one people had cognitive impairment along with impairment in social and occupational functioning but did not meet the criteria for a diagnosis of dementia. In this group there were 13 men and 28 women (mean age 78.3 years, s.d.=4.8; mean MMSE score 17, s.d.=5.24); 20 were illiterate, and 32 belonged to lower-class or lower middle-class households. Most of the people of this group had multiple disabilities due to sensory impairments, physical diseases and psychiatric disorders; 19 people had visual impairment, 8 had hearing problems and 5 had both. The reported physical diseases included hypertension (41.5%), diabetes mellitus (36%), cardiac disease (24%), arthritis (19.5%), stroke (14.6%) and other diseases such as bronchial asthma, tuberculosis and malignancy. Seven people had psychiatric disorders: 5 had depressive disorder, 1 had bipolar mood disorder and 1 had schizophrenia; 5 had age-related cognitive decline.

One case of dementia was detected while evaluating the 10% of the negatively screened population, so we might have missed 10 cases of dementia in the group of people who scored above the cut-off on the MMSE; 65 cases of dementia could have been detected in 1934 elderly people aged 65 years and above, yielding a prevalence rate of 33.6 per 1000 (95% CI 27.3–40.7).

Categorisation of the 56 cases of dementia by ICD-10 diagnostic criteria showed that 30 (54%) were due to Alzheimer's disease, 22 (39%) were due to vascular dementia and 4 (7%) were due to other causes (1 case of tuberculous infection, 1 case of head trauma and 2 cases of cerebral tumours). Age- and gender-specific prevalence rates of dementia are given in Table 2.

Alzheimer's disease was found to have a prevalence rate of 15.5 per 1000 (95% CI 9.6–20). This form of dementia was found in 13 men and 17 women (ratio 1:1.3).

**Table 2** Age and gender-specific prevalence of dementia

Age group (years)	Gender			Cases of dementia			Prevalence (per 1000)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>			
65–69	334	426	760	4	1	5	11.9	2.3	6.6
70–74	285	302	587	7	5	12	24.6	16.6	20.4
75–79	164	181	345	9	9	18	54.9	49.7	52.2
80–84	64	104	168	7	5	12	109.4	48.1	71.4
85–89	23	36	59	3	4	7	130.4	111.1	118.6
90+	4	11	15	0	2	2	0	181.8	133.3
Total	874	1060	1934	30	26	56	34.3	24.5	28.9

The mean age of onset of illness was 74.5 years (s.d.=9) and mean duration of illness was 4.07 years (s.d.=3) according to clinical evaluation done by the psychiatrist. The medical history revealed that 21 out of 31 persons were receiving medical treatment.

The prevalence of vascular dementia was 11.4 per 1000 (95% CI 6.7–16.1). Of the 22 persons in the vascular dementia group, 6 were women and 16 were men (1:2.7). There was a male preponderance of vascular dementia ( $\chi^2=4.45$ ,  $P<0.05$ ). The mean age of onset of illness was 70 years (s.d.=7.5) and the mean duration of illness was 4.3 years (s.d.=4); 21 out of 22 persons were receiving medical treatment.

Comparison of the Alzheimer's disease group ( $n=30$ ) with a control group matched for age, gender and education ( $n=30$ ) revealed that a family history of dementia was a significant risk factor for developing Alzheimer's disease (OR 12.43, 95% CI 1.46–105.6). Comparison of the vascular dementia group ( $n=22$ ) with a control group ( $n=22$ ) revealed that people with a history of hypertension had an increased risk of developing vascular dementia (OR 11.8, 95% CI 2.48–49.5).

## DISCUSSION

### Prevalence of dementia

The prevalence rate of 33.6 per 1000 in our study is well within the range of prevalence rates reported from other studies conducted in India (Rajkumar & Kumar, 1996; Shaji *et al*, 1996; Chandra *et al*, 1998; Vas *et al*, 2001). Prince (2000) reviewed seven published prevalence surveys from the developing world and reported that the prevalence of dementia ranged from 13 per 1000 to 53 per 1000 for all those aged 60

years and over, and from 17 per 1000 to 52 per 1000 for all those aged 65 years and over (Li *et al*, 1989; Zhang *et al*, 1990; Phanthumchinda *et al*, 1991; Hendrie *et al*, 1995; Rajkumar & Kumar, 1996; Shaji *et al*, 1996; Chandra *et al*, 1998). In general, estimated rates for the Asian nations have been lower than rates for the USA and Europe (White, 1992).

### Rural v. urban prevalence

The prevalence rate obtained from this urban study was lower than that found in an earlier rural study in which the prevalence of dementia in people aged 65 years and above was 44 per 1000 (Shaji *et al*, 1996). Comparison of the prevalence rates of dementia in these rural and urban populations indicates that there is little variation in the prevalence of Alzheimer's disease (15.5 per 1000 in the urban population and 17 per 1000 in the rural population), but that the higher prevalence of vascular dementia contributes to the greater total prevalence in the rural community.

Rajkumar & Kumar (1996) reported a higher prevalence of dementia in the rural community than in urban settings. Shibayama *et al* (1986) also found higher prevalence rates of dementia in rural areas of Japan compared with urban areas. Differences in lifestyle, health awareness and healthcare delivery systems may be the factors contributing to this difference. Moreover, people in urban areas are better educated and more in touch with current events, and so perform better on cognitive testing.

### Dementia subtypes

In rural Kerala vascular dementia constituted 58% of the total dementia cases (Shaji

*et al*, 1996). In studies conducted in rural and urban communities in Tamil Nadu, a neighbouring state to Kerala, vascular dementia constituted 27% and 26% respectively of the total dementia cases (Rajkumar & Kumar, 1996). It has been observed that there is a regional variation in the relative proportion of Alzheimer's disease and vascular dementia. The relative proportion of Alzheimer's disease in the Indian studies ranged from 41% to 65% and the proportion of vascular dementia ranged from 22% to 58% (Rajkumar & Kumar, 1996; Shaji *et al*, 1996; Vas *et al*, 2001).

### Risk factors

One of the consistent findings across studies is that the prevalence of dementia increases proportionately with age. Our study confirmed this finding. We also found that people with Alzheimer's disease more often had an increased family history of dementia. Increased risk of dementia among first- and second-degree relatives has already been reported (Heston *et al*, 1981; Whalley *et al*, 1982; Heyman *et al*, 1984). Identification of hypertension as a risk factor for vascular dementia indicates the need for changes in lifestyle and better monitoring of blood pressure.

### Methodological issues

In our study 127 people had cognitive impairment without any impairment in social and occupational functioning; the mean MMSE score of this group was 21. Of these 127 people, 100 had MMSE scores ranging between 20 and 23. A borderline score on the MMSE may not indicate true organic impairment, but may be due to other factors (such as motivational and emotional factors, depression, sensory impairments, motor slowness and general physical frailty) that affect the test performance.

Although 96 people had confirmed cognitive impairment along with functional impairment, only 55 people satisfied the DSM-IV criteria for dementia. The 41 people who did not meet these criteria need special mention. They had neither a clinical history nor signs and symptoms suggestive of dementia. Normality, cognitive impairment and dementia are part of a spectrum; there is no fixed point at which normality stops and dementia supervenes. It was apparent that there was an accumulation of factors in this group that adversely affected cognitive functioning. The possibility of

### CLINICAL IMPLICATIONS

- The prevalence rate of dementia in people aged 65 years and above in this urban community was 33.6 per 1000.
- Alzheimer's disease was the most common cause of dementia, followed by vascular dementia.
- Identification of risk factors such as hypertension points towards some possible methods of intervention to reduce the total prevalence of dementing disorders in this community.

### LIMITATIONS

- During the second phase, 8% of participants could not be evaluated.
- Assessment of risk factors was based on the retrospective account of caregivers.
- The problem of diagnostic misclassification between Alzheimer's disease and vascular dementia cannot be ruled out.

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missing some cases of dementia in this group cannot be fully ruled out, so the reported prevalence may be a slight underestimation. It is possible that some people in this group might develop clinical dementia subsequently.

The study investigated a population of comparatively high literacy (89%), which facilitated age ascertainment and cognitive testing. Analysis of the results did not reveal any relationship between literacy and diagnosis of dementia. Selection of 65 years as the lower age limit made the study design more efficient.

The problem of diagnostic misclassification between Alzheimer's disease and vascular disease is one of the problems of dementia research. Compared with DSM-IV, the ICD-10 criteria offer more promise of specificity of diagnosis, but no comparative study of diagnostic accuracy is available (Cummings & Khachaturian, 1999). Although diagnostic accuracy has not been adequately assessed for cases categorised during the course of a community survey, it would probably be lower than that for referred cases. The assessment of risk factors was based on the interview with a

caregiver, and this is one of the limitations of the study.

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