Cross-National Comparisons of the Occurrence of Alzheimer's and Vascular Dementias

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Summary. The relative occurrence of Alzheimer's and vascular dementias is examined in various countries using data of four types: incidence, prevalence, clinic and neuropathological studies. There is clear evidence that Alzheimer's dementia is more common than vascular dementia in Great Britain and North America and, to a lesser extent, in Scandinavia. The evidence from other countries with predominantly Caucasian populations is more limited, but also supports a predominance of Alzheimer's dementia. By contrast, the evidence from Japan generally shows that vascular dementia is more common. The more limited evidence available from China also supports a preponderance of vascular dementia. There is a need for studies directly comparing the occurrence of Alzheimer's dementia in Caucasian and Oriental populations.

Key words: Dementia – Alzheimer's disease – Vascular dementia – Prevalence studies – Incidence studies

Introduction

If it could be established that there are differences between countries in the occurrence of Alzheimer's or vascular dementias, this would be an important clue to the aetiology of these disorders. However, making comparisons across countries is not a simple matter. If separate studies are carried out in different countries, any difference in prevalence or incidence rates is more likely to be due to differences in the methodologies of the studies than to true national differences in disease occurrence. For example, in their meta-analysis of dementia prevalence studies, Jorm et al. (1987) found that methodological differences between studies had an important influence on the prevalence rates found. In particular, studies produce higher or lower rates depending on where the cutoff is placed for defining a person as demented rather than normal. This is because there is no qualitative boundary for separating dementia from normal ageing. To make meaningful comparisons of prevalence and incidence rates across countries, identical methodologies need to be used at the various sites. Unfortunately, with

the exception of the US/UK Cross-national Project (Gurland et al. 1983), studies based on identical methodologies in different countries do not exist.

While direct comparisons of prevalence and incidence rates across studies are not meaningful, there is an alternative way of making cross-national comparisons. This involves comparing the relative prevalence or incidence of dementing disorders, rather than the absolute rates. Within a single study, the same methodology is being used to estimate the occurrence of both dementias. If the rate for one dementing disorder is divided by the rate for the other, it does not matter that the absolute rates are affected by the cutoff for defining cases. Such an approach ignores the overall rates for dementia and simply examines how the dementia cases are subdivided into different disorders. Even making comparisons of relative rates across studies does, however, have its problems. Alzheimer's and vascular dementias are themselves not clearly defined categories, particularly in the very elderly, who may suffer from both disorders to some degree. Depending on the diagnostic procedure used, studies may vary in whether they assign certain cases to the Alzheimer's, vascular or mixed categories. While acknowledging that this problem exists, the present paper attempts to discover whether there are cross-national differences in the relative occurrence of the two major dementing disorders.

In making cross-national comparisons of the relative occurrence of Alzheimer's and vascular dementias, there are various kinds of studies that can be examined. Four are examined here: incidence, prevalence, clinic and neuropathological studies. Incidence studies are, in principle, the most relevant for studying cross-national differences. They are based on either total populations of defined areas or representative samples of larger populations, and estimate the rate of new onsets of dementing diseases. Unfortunately, because of the time and cost involved in carrying out incidence studies, they are few in number. Furthermore, the diagnostic procedures involved in incidence studies are often rudimentary. Even with the facilities of specialist clinics, there is error involved in the clinical diagnosis of dementing diseases. In a general population survey, the extent of investigation which can be carried out is generally more limited than in a specialist clinic, making diagnostic error more likely.

Prevalence studies are much more numerous than incidence studies. They share with incidence studies the advantage of representativeness and the disadvantage of more rudimentary diagnostic procedures. However, they are theoretically less interesting than incidence studies, because prevalence is a function of duration of survival as well as of incidence. Thus, any differences found in the relative prevalence of Alzheimer's and vascular dementias may be due to either differences in relative incidence or differences in relative survival.

Clinic studies are those which report the diagnostic-breakdown of patients assessed at specialist dementia clinics. They typically involve more rigorous diagnostic procedures than incidence or prevalence studies, but suffer from a lack of representativeness of the patients seen. Only a subset of cases in a community will ever be seen at such clinics and the selection mechanisms involved are unknown.

The final kind of study involves the neuropathological examination of series of dementia cases at autopsy. Such studies estimate the relative prevalence of dementing disorders at the point of death. Because autopsy confirmation is considered necessary for the definitive diagnosis of Alzheimer's and vascular dementias, these studies have the greatest diagnostic validity. However, they also involve the least representative sampling, because only a subset of patients receiving specialist diagnostic services during life will come to autopsy. Again, the selection mechanisms involved are unknown.

All four kinds of study have their strengths and weaknesses. Basically, there is a trade-off between representativeness of sampling and validity of diagnosis. As well, there is the issue of measuring disease occurrence via the theoretically meaningful incidence rate or the more ambiguous prevalence rate. All but the incidence studies are potentially influenced by differences between disorders in duration of survival. The approach taken here is to use all four kinds of study, recognizing that none is perfect. If, however, consistent findings emerge from all types of study, considerable confidence can be placed in the results obtained. On the other hand, inconsistencies between the different types of study require consideration of the possible mechanisms involved.

Methods

An effort was made to locate all relevant studies using published reviews of dementia epidemiology and computer searches of the more recent literature. Studies were included if they fell into one of the four classes mentioned above and gave a diagnostic breakdown of Alzheimer's and vascular dementias. The classification of these disorders has changed somewhat over the years, so certain assumptions had to be made. It was assumed that individuals classified as having senile dementia, senile psychosis, senile brain disease, primary degenerative dementia, senile dementia of the Alzheimer type and Alzheimer's disease were suffering from the same disorder. Similarly, individuals classified as having arteriosclerotic psychosis, arteriosclerotic dementia, cerebral arteriosclerosis, multi-infarct dementia, dementia with cerebral infarcts, vascular encephalopathy and vascular dementia were regarded as having the same disorder.

The following incidence studies were used; Åkesson (1969), Bergmann et al. (1971), Kokmen et al. (1988), Li et al. (unpublished), Mölsä et al. (1982), Nilsson (1984) and Rorsman et al. (1986).

The prevalence studies used were: Åkesson (1969), Bollerup (1975), Brayne and Calloway (1989), Broe et al. (1976), Chen (1987), D'Alessandro et al. (1988), Evans et al. (1989), Folstein et al. (1985), Fukunishi et al. (1989), Gavrilova (1984), Gavrilova et al. (1987), Gurland et al. (1983), Hasegawa et al. (1983), Hasegawa et al. (1986), Ichinowatari et al. (1987), Kaneko (1975), Karasawa et al. (1982), Kay et al. (1964), Kuang and Zhao (1984), Li et al. (1989), Makiya (1978), Mölsä et al. (1982), Motohiro et al. (1985), O'Connor et al. (1989), Pinessi et al. (1984), Rocca et al. (1990), Rorsman et al. (1986), Schoenberg et al. (1985), Shibayama et al. (1986), Sternberg and Gawrilowa (1978), Sulkava et al. (1985), Zhang et al. (1990) and Zhao (1986).

The clinic studies were: Cummings and Benson (1983), Erkinjuntti et al. (1987), Freemon (1976), Garcia et al. (1981), Hutton (1981), Larson et al. (1986), Maletta et al. (1982), Marsden and Harrison (1972), Philpot and Levy (1987), Rabins (1981), Smith and Kiloh (1981), Thal et al. (1988) and Victorates et al. (1977).

The neuropathological studies were: Birkett (1972), Boller et al. (1989), De La Monte et al. (1989), Erkinjuntti et al. (1988), Gustafson and Nilsson (1982), Homer et al. (1988), Jellinger (1976), Kokmen et al. (1987), Malamud (1972), Matsushita and Ishii (1979), Mölsä et al. (1985), Moritmatsu et al. (1975), Müller and Schwartz (1978), Nishihara and Ishii (1986), Ojeda et al. (1986), Rosen et al. (1980), St. Clair and Whalley (1983), Todorov et al. (1975), Tomlinson et al. (1970), Tomonaga (1979), Ulrich et al. (1986), Wade et al. (1987) and Wilcock and Esiri (1982).

To estimate the relative occurrence of Alzheimer's and vascular dementias, the number of Alzheimer's cases was divided by the number of vascular cases. Cases of mixed dementia, if classified separately, were ignored. A ratio of this sort has an assymmetrical distribution, with higher rates of Alzheimer's dementia producing ratios from 1 up to ∞, while high rates of vascular dementia produce ratios from 1 down to 0. To overcome this asymmetry, a logarithmic transformation (to base 10) was applied. With logarithmically transformed occurrence ratios, positive values indicate a higher rate of Alzheimer's dementia, negative values a higher rate of vascular dementia, and 0 indicates equal rates.
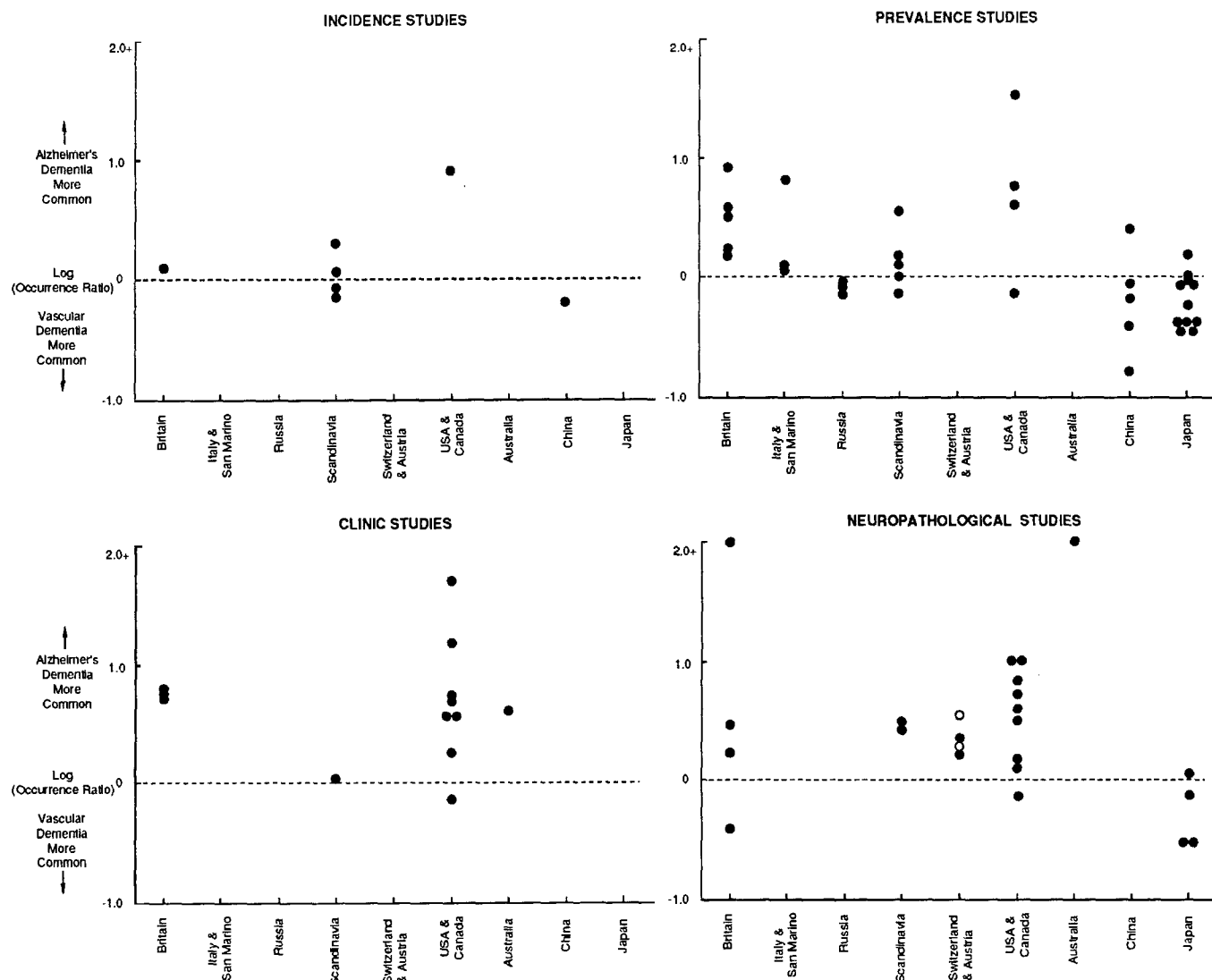
To make cross-national comparisons, studies were grouped by country. Because the number of studies from a particular country was often small, some adjacent countries with similar racial composition and culture were grouped together.

Results

Figure 1 shows the results from the four types of study. Moving from left to right along the horizontal axes of Fig. 1 are European countries, then countries with populations derived predominantly from European emigration (United States, Canada, Australia), and finally Oriental countries (China and Japan). Most studies provided a single data point in Fig. 1. However, studies reporting both prevalence and incidence data, or reporting data on two samples, have provided two data points.

The incidence studies cover only a small range of countries. Four of the seven studies come from Scandinavia, and two of these found the incidence of Alzheimer's dementia to be greater. The British and American studies both found Alzheimer's dementia to have the greater incidence. By contrast, the sole Chinese study found a greater incidence for vascular dementia.

In the prevalence studies, the evidence generally shows Alzheimer's dementia to be more prevalent in European and North American studies. The notable exceptions are the Russian studies, which have consistently reported vascular dementia to be more prevalent. The studies from the Oriental countries have also fairly consistently reported vascular dementia to be more prevalent.

INCIDENCE STUDIES

PREVALENCE STUDIES

2.0+

2.0+

Alzheimer's
Dementia 1.0
More
Common

1.0

Log
(Occurrence Ratio) 0

0

Vascular
Dementia
More
Common

-1.0

-1.0

Britain · Italy & San Marino · Russia · Scandinavia · Switzerland & Austria · USA & Canada · Australia · China · Japan

CLINIC STUDIES

NEUROPATHOLOGICAL STUDIES

2.0+

2.0+

Alzheimer's
Dementia 1.0
More
Common

1.0

Log
(Occurrence Ratio) 0

0

Vascular
Dementia
More
Common

-1.0

-1.0

Britain · Italy & San Marino · Russia · Scandinavia · Switzerland & Austria · USA & Canada · Australia · China · Japan

Fig. 1. Ratio of occurrence of Alzheimer's dementia to vascular dementia (logarithmically transformed) from studies in various countries. The two *open circles* represent data from the same study but using different quantitative definitions of Alzheimer's and vascular dementias

Clinic studies also cover only a limited range of countries. However, they have fairly consistently showed a greater occurrence of Alzheimer's dementia. The sole Scandinavian study stands out as having reported an even balance between the two major dementing disorders.

The neuropathological studies mainly show a greater prevalence of Alzheimer's dementia, with the exception of those from Japan, which generally show the opposite pattern.

Discussion

The amount of evidence available from different countries varies greatly. Only Great Britain, Scandinavia and North America have data available from all four types of study. In Great Britain and North America it is clear that Alzheimer's dementia predominates over vascular dementia. In Scandinavia, the evidence is more mixed, but still favours a preponderance of Alzheimer's dementia. It may be that vascular dementia is relatively more

common in Scandinavia than in Great Britain and North America, or there could be some difference in diagnostic practice between these regions. In the rest of Europe, and in Australia, what evidence there is favours a greater occurrence of Alzheimer's dementia, with the notable exception of the three Russian prevalence studies, which reported an excess of vascular dementia. There is, however, good reason to doubt the results of the Russian prevalence studies. Shefer (1985, 1987) has carried out neuropathological examinations of series of dementia cases diagnosed by Russian psychiatrists and found that vascular dementia is considerably overdiagnosed there at the expense of Alzheimer's dementia. The Russian results may therefore be attributed to national diagnostic fashion. Consequently, it can be concluded that Alzheimer's dementia is the more common disorder in Europe and in countries with populations largely derived from European emigration.

In the Orient, however, the picture is quite different. Both the Chinese and Japanese prevalence studies have

fairly consistently reported a higher prevalence of vascular compared to Alzheimer's dementia. The sole Chinese incidence study also showed a greater incidence of vascular dementia. In the case of Japan, neuropathological studies confirm this pattern. The different occurrence ratios found in the Orient, if valid, could be due to either a greater occurrence of vascular dementia or a lesser occurrence of Alzheimer's dementia. Of course, both possibilities could be simultaneously true. The possibility that vascular dementia is more common is supported by data from a cross-national study of stroke showing that Japan has a particularly high incidence (Aho et al. 1980). If the incidence of vascular dementia is higher, then the overall incidence of dementia in Japan should be higher unless there is a reduced incidence of Alzheimer's dementia to compensate. To give a numerical illustration, if the ratio of Alzheimer's dementia to vascular dementia was 0.67 for Japan and 4.0 for North America, but there was no difference in the occurrence of Alzheimer's dementia, then the occurrence of the two disorders combined would be twice as high in Japan as in North America. If, on the other hand, Alzheimer's dementia were found to be less common in the Orient than in Caucasian populations, this would be an important aetiological clue. There is a need for studies of the occurrence of dementia and specific dementing disorders in Japan (and China) compared with Europe and North America, using as similar methodologies as possible. However, as Henderson (1990) has argued, such studies would be difficult to untertake. Possibly more feasible would be studies in single countries which have both Caucasian and Oriental ethnic groups.

More generally, it is apparent that information on the relative occurrence of dementing disorders is lacking for much of the world. There is no information available on Latin America, Africa and much of Asia, and it is quite possible that the epidemiology of dementia in these regions is different from that seen in the developed countries investigated so far. If this area were to be tackled, it would be preferable to conduct studies of incidence, because differential survival in many such countries might lead to misleadingly low prevalence estimates. Well-designed studies in contrasted populations or ethnic groups may offer an important contribution to understanding the causes of dementia.

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