Prevalence of Parkinson’s disease in Sydney


Objective – To examine the prevalence of Parkinson’s disease (PD) in Bankstown, Sydney, using the same methodology as a previous study in Randwick, Sydney, Australia (1998–1999). Participants and methods – Twenty census districts (CDs) for the Bankstown local government area were randomly selected. Research personnel door-knocked every household within the CDs to locate people aged ≥55 years. A structured questionnaire (containing four screening questions for PD) was administered to those agreeing to participate. Screened positive participants were invited to come for a clinical examination. This is a continuation of the previous study and data have been combined. Results – Combining data for Bankstown and Randwick gave 1028 participants; crude prevalence, 780 per 100,000 (CI: 546–1077). In Bankstown, there were 501 participants aged ≥55 years (response rate 70%); 135 were screened positive with 101 (74.8%) agreeing to a clinical examination. The prevalence of PD in the Bankstown community was 3.4% (17 of 501) (95% CI: 1.98–5.43) for those aged ≥55 years; crude prevalence 776 per 100,000 (CI: 452–1241). Conclusion – The combined results of two Sydney studies appear to indicate that Sydney has one of the highest prevalence estimates of PD in developed countries.

Parkinson’s disease (PD) is the second most common neurodegenerative disorder. Its prevalence rises sharply after the sixth decade. Parkinsonism is also common in the elderly. The study by Bennet et al., found 15% of people aged 65–74, 30% of those aged 75–84 and 50% of those aged 85 and over had one or more parkinsonian signs (1). With an ageing population in developed countries, PD and parkinsonism will become more prevalent and important.

An Australian epidemiological study published in 1966 (2) reported that the PD prevalence in Australia was 66 per 100,000, which was much lower than other developed countries (with the exception of Japan). The prevalence of PD in the United States of America, Europe and South America has been consistently reported between 150 and 300 per 100,000 (3). Since the survey in 1966, the Australian population has aged significantly and the life expectancy at birth (both sexes combined) is now 79.2 years compared with 70.9 years in 1965 (4).

A pilot study in Randwick municipality of Sydney, Australia, from 1998 to 1999 revealed that PD prevalence is substantially higher now than that reported in 1966 (5). The estimated prevalence of PD (including newly diagnosed cases) in the Randwick community was 775 per 100,000. If newly diagnosed cases were excluded, the prevalence would still have been as high as 449 per 100,000. In contrast to the 1966 study (2), which used a general practitioner (GP) questionnaire, the Randwick survey used a two-step method with a screening phase followed by an examination phase. This difference in study methodology may provide an explanation for the lower prevalence found in 1966 in that milder cases may not have presented to GPs in the earlier study, thus underestimating the true prevalence of PD.

The sample in Randwick was randomly chosen and although 2820 households were door-knocked, the eligible number (aged ≥55 years) involved in the pilot study was small (n = 527). Hence it was decided to repeat the study in another local government area (LGA) of Sydney using the same methodology. The new study was performed in Bankstown LGA.
Although incidence is considered a better indicator of disease occurrence, it can be difficult to determine incidence in chronic diseases such as PD and therefore prevalence was used in this study.

Methods

Bankstown municipality is an area of 76.8 km square, has a population of 165,073 (2001 census) and is located in the south-western part of Sydney (Fig. 1). Of the total population in Bankstown LGA, 23.7% are aged 55 and above (compared with 22.5% average of the state of New South Wales) (6).

The sampling methods for this community survey were identical to those used in the Randwick study and have been previously reported (5). Two attempts at door knocking were made and if there was no response, a letter was dropped asking household members to contact the investigators. Failure to respond or rejection of the survey was considered as non-participation.

Screening

The research personnel, who consisted of one research assistant and a volunteer doctor, were given uniform training sessions by the chief investigator to perform the survey. This included training in completion of a standardized questionnaire for the purpose of screening for PD. The screening questionnaire had been previously validated and had a sensitivity of 90% for identifying parkinsonism in a community setting (7).

People aged 55 and above who agreed to participate were interviewed by the two trained research personnel. People who had resided in the census district for <3 months, and those who could not speak English, were excluded.

Clinical examination

Requests were made for all those who screened positive to the questionnaire to be examined by a neurologist or a geriatrician. A structured clinical workup consisting of the motor examination of the Unified PD Rating Scale (UPDRS) (8), a neurologic examination and review of history and medications was used to establish the diagnosis of parkinsonism and the classification of it. The diagnosis for PD or possible PD was based on the criteria provided by de Rijk et al., (9) namely, at least two of the following: resting tremor, bradykinesia or rigidity, in the absence of other apparent causes of parkinsonism. The stages of the PD were further classified according to Hoehn and Yahr (10). A positive response to levodopa treatment was not required for a new diagnosis as the inclusion as a criterion would underestimate the prevalence. Most new cases have mild symptoms not requiring treatment.

Participants who were screened positive were either invited to come to the hospital for examination or were alternatively visited in their homes. All participants were assessed by at least one specialist (either a neurologist or geriatrician). A new diagnosis of parkinsonism required the independent opinion of two specialists while a minimum of one specialist opinion was required if the patient had been diagnosed previously by a neurologist. In situations where there was uncertainty about the diagnosis a third opinion was sought from another specialist.

This study was approved by the Human Research Ethics Committee of the South Western Sydney Area Health Service prior to commencement. All participants gave informed, written consent.

Statistical methods

Data were entered into a Microsoft Access database and analysed using SPSS (Statistical Package for the Social Sciences, Version 11.5).

The point prevalence estimate was defined as the ratio of the number of disease onsets that occurred on or prior to the day when the residents were surveyed in the screening stage. The age-specific prevalence figures were estimated as the number of cases per 100,000 on the prevalence day of the
1 August, 2002, for those who were 55 years of age or over. The overall crude prevalence for the total population was also estimated on the assumption that no persons aged <55 years have PD. Calculations of age-specific prevalence estimates were performed according to the method of Li and Schoenberg, 1985 (11). Confidence intervals were calculated based on the Poisson distribution (12).

Results

The survey was carried out between August 2002 and July 2003. A total of 4080 households were letter dropped; 1238 households did not participate (i.e. refused or were unable to be contacted); 307 households could not speak English. The participation rate was 70%.

Sample size and characteristics of participants

There were 501 people aged 55 or above who participated in the study. Overall, the mean age was 70.9 years (SD 8.2) with a range of 55–100 years. Mean age for males was 71.3 years (SD 7.9) and for females was 70.5 years (SD 8.4); 44.7% of participants were male (224 of 501); 71.7% of participants were born in Australia. The male to female ratio was 0.82:1.

Participants who screened positive

Of the 501 participants, 135 were screened positive (that is, answered ‘yes’ to two of four screening questions for parkinsonism, or answered ‘yes’ only to the question which asked ‘Have you noticed a tremor of your hands, arms, legs or head?’ (see appendix). Further details of the screening tool can be referred to in a previous publication (7).

Clinical examination for parkinsonism

Of the 135 screen positive participants, 101 (74.8%) were examined; 34 refused or were unavailable for examination. Of those who screened positive, 10 had been previously diagnosed with PD by a neurologist. Following the clinical examination, a further seven participants were newly diagnosed as having PD. Therefore, the prevalence of PD in the Bankstown community was 3.4% (17 of 501) (95% CI: 1.98–5.43). The prevalence did not include one participant who had been previously diagnosed by a neurologist and was on medication for PD but declined to attend a clinical examination. Had this person been examined and confirmed as having PD, the prevalence in the Bankstown community would have increased to 3.6% (95% CI: 2.13–5.68).

According to the Hoehn and Yahr classification, (10) there were 17.6% of PD patients in stage 0.5 (three of 17), 17.6% in stage 1 (three of 17), 29.4% in stage 2 (five of 17), 29.4% in stage 3 (five of 17), 0% in stage 4, and 5.9% in stage 5 (one of 17). For the seven newly diagnosed PD patients, 42.9% (three of seven) were in stage 0.5, 42.9% (three of seven) were in stage 2 and 14.3% (one of seven) were in stage 3. The UPDRS motor examination scores (8) for these new PD patients ranged from nine to 25 (out of a possible maximum score of 108) (mean 20.6, SD 11.2, median 21). Other subtypes of parkinsonism (n = 7) included 71.4% (five of seven) of vascular aetiology, 14.3% (one of seven) of unknown aetiology and 14.3% (one of seven) possible PD. There were 45 participants with a clinical diagnosis of essential tremor (ET), defined as a bilateral, largely symmetric postural or kinetic tremor that was visible and persistent, involving the hands and forearms (and in which, other known causes of an enhanced physiological tremor were excluded) (13); four had ET and PD and three had ET and Parkinsonism. These participants have been included in both categories.

The overall crude prevalence per 100,000 for Bankstown, Randwick and for the two areas combined was 776 (CI: 452–1241), 775 (CI: 467–1209) and 780 (CI: 546–1077) respectively. Table 1 shows the prevalence by age group for Bankstown, Randwick and combined.

Discussion

Using identical methodology of sampling, screening tools and diagnostic criteria, this survey of the Bankstown LGA can be considered as an extension of the Randwick pilot study (1998–1999) (5). With the exception of the chief investigator, the other specialists were new to the team. The prevalence of PD in the community of Randwick was 3.6% for the population aged ≥55 years which compares closely to the 3.4% prevalence found in Bankstown. The total number of households surveyed in the two areas was close to 7000 with a combined total of 1028 participants. The crude prevalence of the disease in the community was also similar – 776 per 100,000 (CI: 452–1242) in Bankstown and 775 per 100,000 (CI: 467–1210) in Randwick, assuming no cases of PD existed below 55 years of age.

When the Bankstown and Randwick results were combined, the crude prevalence was 780 per 100,000 (CI: 546–1077). This represents a 12-fold increase in the crude prevalence of PD compared with the study by Jenkins in 1966 (66 per 100,000...
for all age groups) (2). However, the previous study was a GP survey, which probably under-estimated the true prevalence as many PD patients with mild symptoms may not have been diagnosed using such a method. Nevertheless, even if only the well-established cases (previously diagnosed or ‘old’ cases) are included, the prevalence in the Bankstown and Randwick community groups combined would still be 445 per 100,000 (CI: 282–696) (again assuming no PD cases exist under age 55 years). When compared with the adjusted prevalence of 315 per 100,000 in the Jenkins study, this would still represent an increase of 44%. If all cases from the Randwick and Bankstown communities (new and old) are included, the increase would be 148%. A possible explanation for such an increase in prevalence may be due in part to ageing, as the life expectancy at birth in Australia has increased from 71 years in the 1960s to 79 years in 2000 (4).

However, ageing alone may not provide the sole explanation. The prevalence of PD in Sydney is also high when compared with other western industrialized nations with similar ageing phenomena and life expectancies (Australia ranks fourth in life expectancy at birth compared with other developed countries) (4). As reported by Zhang and Romans, the adjusted prevalence of PD in door-to-door knock studies in Western countries is between 150 and 300 per 100,000 (3). Results from the Europarkinson collaborative studies (1997, 2000) place the overall prevalence of PD in subjects 65 years or older as 1600 per 100,000 and 1800 per 100,000, respectively (14, 15). The age specific prevalence of PD in Australia is also higher than other Western nations and China when door-to-door knock studies are compared (Table 2) (16). Although differences in methodology make it difficult to draw absolute conclusions, it does appear within reason that the Sydney statistics are among the highest in the Western world.

There are, however, limitations to this study. A population of 1028 is moderate in size but not large and may not be representative of the Sydney population. However, we are reassured by the replication of the Randwick result in a different metropolitan region of Sydney by a different set of

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### Table 1: Crude prevalence of PD per 100,000 by age group and overall for Bankstown (2003), Randwick (1998) and combined

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Bankstown</th>
<th>Randwick</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n PD</td>
<td>Prevalence/100,000 (95% CI)</td>
<td>n PD</td>
</tr>
<tr>
<td>55–59</td>
<td>53</td>
<td>0 (0–5660)</td>
<td>69</td>
</tr>
<tr>
<td>60–69</td>
<td>167</td>
<td>1 (95–3335)</td>
<td>178</td>
</tr>
<tr>
<td>70–79</td>
<td>203</td>
<td>3 (1699–7764)</td>
<td>202</td>
</tr>
<tr>
<td>≥80</td>
<td>77</td>
<td>8 (4478–20468)</td>
<td>77</td>
</tr>
<tr>
<td>Overall‡</td>
<td>501</td>
<td>17 (452–1214)</td>
<td>527</td>
</tr>
</tbody>
</table>

† Denotes 95% Confidence intervals.
‡ Calculation based on total number of participants in each study including one person from each LGA area where age was unknown.

### Table 2: Comparison of age specific prevalence of Parkinson’s disease in door-to-door knock studies†

<table>
<thead>
<tr>
<th>Study</th>
<th>Year of survey</th>
<th>Country</th>
<th>50–59</th>
<th>60–69</th>
<th>70–79</th>
<th>80+</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li et al. 1985 (11)</td>
<td>1983</td>
<td>China urban population</td>
<td>92</td>
<td>145</td>
<td>615‡</td>
<td>44</td>
<td>Door to door 2 stages</td>
</tr>
<tr>
<td>Wang YS et al. 1991(17)</td>
<td>1986</td>
<td>China 29 provinces</td>
<td>22.5</td>
<td>89.4</td>
<td>157.6</td>
<td>132</td>
<td>14.6</td>
</tr>
<tr>
<td>Wang SJ et al. 1994 (18)</td>
<td>1992</td>
<td>Taiwan farming population</td>
<td>780</td>
<td>1750</td>
<td>2540</td>
<td>273</td>
<td>Door to door 1 stage</td>
</tr>
<tr>
<td>Wang SJ et al. 1996 (19)</td>
<td>1993</td>
<td>Taiwan, Kinmen farming population</td>
<td>273</td>
<td>535</td>
<td>565</td>
<td>273</td>
<td>Door to door 1 stage</td>
</tr>
<tr>
<td>Chen et al. 2001 (20)</td>
<td>1993</td>
<td>Taiwan Ilan</td>
<td>122.5</td>
<td>546.7</td>
<td>819.7</td>
<td>2197.8</td>
<td>367.9</td>
</tr>
<tr>
<td>De Rijk et al. 1997 (14)</td>
<td>1990’s</td>
<td>France, Italy, Netherlands, Spain. Pooled results of five studies</td>
<td>625</td>
<td>1768</td>
<td>3498</td>
<td>–</td>
<td>Door to door</td>
</tr>
<tr>
<td>De Rijk et al. 2000 (15)</td>
<td>1990s</td>
<td>European pooled results of Sweden, France, Netherlands, Italy, Spain and Germany</td>
<td>565</td>
<td>1666</td>
<td>2813</td>
<td>–</td>
<td>Door to door</td>
</tr>
<tr>
<td>Morgante et al.1992 (21)</td>
<td>1987</td>
<td>Sicily</td>
<td>115.6</td>
<td>430.2</td>
<td>1212.5</td>
<td>236.7</td>
<td>167.4</td>
</tr>
</tbody>
</table>

† The first eight studies are from reference number 15.
‡ Aged ≥70 years.
clinicians using the same methodology. We were strict with our diagnostic criteria in both the Randwick and Bankstown studies. The requirement of at least two independent clinicians’ confirmation of PD should mean that the chance of overestimation was minimized. There is the potential for bias if there was a low prevalence of PD in the non-participants. However, the participation rates of 75% in Randwick and 70% in Bankstown are respectable and we are therefore reasonably confident of our results.

The implications of this study may be relevant to other western countries with ageing populations, and increased utilization of neurotoxic chemicals. This is because the ageing brain may be more susceptible to neurotoxins and the brain reserve progressively diminishes with each passing decade making the older individual more likely to be affected by neurotoxins. It would be of interest to compare the prevalence in the future to examine whether the disease is truly increasing in Sydney, Australia and how the prevalence in Australia, both present and in the future, compares with other nations.

Acknowledgements

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References


Appendix

Screening questions for parkinsonism

1. Do you feel you move more slowly or stiffly? Yes No
2. Do you walk with a stooped (bending forward) posture? Yes No
3. Have you noticed that you do not swing your arms when you walk as much as you used to? Yes No
4. Have you noticed a tremor of your hands, arms, legs, or head?