

# Prevalence of Parkinson's disease and other types of Parkinsonism in Al Kharga district, Egypt

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**Abstract:** Parkinson's disease (PD) is a common neurodegenerative disorder in older people. The prevalence of PD varies among ethnic and geographic groups around the world. In this study, we aimed to estimate the prevalence of PD and other types of Parkinsonism in persons aged  $\geq 40$  years in the Al Kharga district of Egypt. The study was conducted on the total population of Al Kharga district (62,583 persons) between 2005 and 2009 and involved three neurology specialists and 15 female social workers undertaking a door-to-door survey. Suspected cases of Parkinsonism were subjected to meticulous clinical and neurological examination by three neurology staff members from Assiut University hospital who carried out their examinations separately. Of the total population surveyed, 15,482 persons were aged  $\geq 40$  years and 49 of these were identified as having Parkinsonism (prevalence: 316.50 per 100,000 people [95% confidence interval {CI} 240.21–404.98]). Of the 49, 33 fulfilled the diagnostic criteria for PD, giving a prevalence rate of 213.15/100,000 (95% CI 150.51–285.80) while 14 fulfilled those for vascular Parkinsonism, with a prevalence rate of 90.43/100,000 (95% CI 49.60–137.78). Postencephalitic and unspecified Parkinsonism each had a prevalence rate of 6.46/100,000. The prevalence of Parkinsonism was found to increase steadily with age, and the prevalence of all types of Parkinsonism was statistically higher in rural compared with urban communities, with no significant difference between men and women.

**Keywords:** epidemiology, door-to-door survey, PD, postencephalitic Parkinsonism

## Introduction

Parkinson's disease (PD) is the second most common neurodegenerative disorder after Alzheimer's disease.<sup>1</sup> Worldwide, published door-to-door survey reports of PD prevalence have estimated wide-ranging prevalence from 57 to 230 per 100,000 people.<sup>2</sup>

Data on prevalence and incidence of PD are of particular interest for several reasons. First, epidemiological studies can provide insight into suspected risk factors, protective factors, and primary causes of disease, and may be used to investigate the natural history of PD. Moreover, by providing critical information on the burden of a particular disease to the population, epidemiological data can inform public health planning.<sup>3</sup> In particular, study of the frequency of PD is of great importance because an increased frequency of PD could indicate a common underlying cause, prompting genetic studies or investigation for possible environmental causes.

Perhaps the best epidemiological approach to determine the prevalence of PD is door-to-door survey performed directly by neurologists. Using this approach, we studied the epidemiology of Parkinsonism and PD among individuals aged  $\geq 40$  years living in the Al Kharga district of Egypt.

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## Methods

### Study region

The New Valley Governorate is one of the biggest governorates in Egypt. It lies in the Egyptian Western Desert, 625 km from Cairo. Al Kharga is the capital of the governorate, and it is located 232 km southwest of Assiut. It is the biggest and oldest oasis of the New Valley. It has different geographical, social, economic, and cultural characteristics in comparison to the Nile Valley, which is a long way away. In addition, it is an area of poorly utilized resources that is far away from medical services. Most of the people of Al Kharga work in simple industries and agriculture using underground water supplies.

### Study design

This study was part of a door-to-door survey of major neurological disorders that was conducted in the Al Kharga district, New Valley, Egypt from June 1, 2005 to May 31, 2009.<sup>4</sup> Persons who had been living in the Al Kharga district for at least 6 months at the time of the study were eligible for inclusion in the project.

The total population (62,583) was screened by door-to-door survey by three neurology specialists using a standardized Arabic questionnaire specially designed for the study.<sup>4</sup> Fifteen female social workers accompanied the specialists during house visits to collect demographic data. Of the total population, 15,482 persons aged  $\geq 40$  years with suspected cases of Parkinsonism were subjected to meticulous clinical and neurological examination by three neurology staff members, who undertook their examinations separately at Assiut University Hospital, Assiut, Egypt. Laboratory and radiological investigations were also carried out in the hospital to verify diagnosis according to suspected etiology.

### Diagnostic criteria

Parkinsonism and PD were diagnosed according to Morgante et al<sup>5</sup> and Gelb et al,<sup>6</sup> respectively. Vascular, postencephalitic,

and other types of Parkinsonism were defined according to Seijo-Martinez et al.<sup>7</sup> The severity of PD was classified using the Hoehn and Yahr (HY) scale.<sup>8</sup> PD cases were assessed using the Unified Parkinson's Disease Rating Scale (UPDRS), version 3.0.<sup>9</sup>

### Statistical analysis

SPSS (v 12.0.1; IBM Corporation, Armonk, NY, USA) and EpiCalc 2000 (Brixton Health; software available from: <http://www.brixtonhealth.com/epicalc.html>) were used for data analysis. The chi-square test, independent-samples *t*-test, or one-way analysis of variance following by the post-hoc test (least significant difference) was used to analyze differences in proportions between groups, as appropriate. The 95% confidence interval for the prevalence was calculated using Microsoft® Excel 2007 (Microsoft Corporation, Redmond, WA, USA). A *P*-value of 0.05 was considered to indicate statistical significance.

### Results

The overall study population consisted of 15,482 subjects (53.7% male and 46.3% female) aged  $\geq 40$  years. Of these, 49 persons were found to be suffering from Parkinsonism, which had a crude prevalence 316.50/100,000 (95% CI 240.2–404.9). The determined age- and sex-specific prevalence of Parkinsonism revealed that prevalence increases with age, but no significant difference in prevalence according to sex was found (Table 1). The prevalence of different types of Parkinsonism according to location of residence (urban or rural community) in those aged  $\geq 40$  years is presented in Table 2. The age- and sex-adjusted prevalence of PD and other types of Parkinsonism is shown in Table 3. Table 4 summarizes studies of the prevalence of Parkinsonism and PD undertaken in various locations worldwide.

The UPDRS scores (total, motor, and activities of daily living) are shown in Table 5, along with a summary of the other clinical characteristic data of all 33 PD cases.

**Table 1** Prevalence of Parkinsonism per 100,000 people in Al Kharga district, Egypt, according to age and sex

| Age, years | Total                |                    |                      | Male                 |                    |                    | Female               |                    |                  |
|------------|----------------------|--------------------|----------------------|----------------------|--------------------|--------------------|----------------------|--------------------|------------------|
|            | Cases, n/ population | PR/10 <sup>5</sup> | 95% CI               | Cases, n/ population | PR/10 <sup>5</sup> | 95% CI             | Cases, n/ population | PR/10 <sup>5</sup> | CI 95%           |
| 40≤50      | 1/7,309              | 13.68              | 9.43 to 40.50        | 0/3,864              | 0.00               | 0.0                | 1/3,445              | 29.03              | –20.0 to 85.9    |
| 50≤60      | 5/4,236              | 118.04             | 28.90 to 221.40      | 1/2,242              | 44.60              | –30.7 to 132.0     | 4/1,994              | 200.60             | 31.3 to 396.9    |
| 60≤70      | 13/2,354             | 522.25             | 294.10 to 851.60     | 8/1,269              | 630.42             | 254.9 to 1,065.8   | 5/1,085              | 460.83             | 113.3 to 863.8   |
| 70≤80      | 15/1,161             | 1,291.99           | 731.90 to 1,941.60   | 11/693               | 1,587.30           | 784.9 to 2,517.9   | 4/468                | 854.70             | 135.6 to 1,688.7 |
| 80+        | 15/422               | 3,554.50           | 2,031.30 to 5,321.10 | 10/252               | 3,968.25           | 1,890.0 to 6,378.5 | 5/170                | 2,941.18           | 751.2 to 5,481.0 |
| Total      | 49/15,482            | 316.50             | 240.2 to 404.90      | 30/8,320             | 360.58             | 249.5 to 489.4     | 19/7,162             | 265.29             | 162.6 to 384.4   |

**Abbreviations:** CI, confidence interval; PR, prevalence rate.

**Table 2** Prevalence of different Parkinsonism types according to location of residence (urban or rural community) per 100,000 people in Al Kharga district, Egypt

| Parkinsonism type   | Total    |      |        |                  | Urban (n=11,307) |                    | Rural (n=4,175) |                    |
|---------------------|----------|------|--------|------------------|------------------|--------------------|-----------------|--------------------|
|                     | Cases, n | %    | PR     | 95% CI           | Cases, n         | PR/10 <sup>5</sup> | Cases, n        | PR/10 <sup>5</sup> |
| Parkinson's disease | 33       | 67.3 | 213.15 | 150.51 to 285.80 | 14               | 123.82             | 19              | 455.06             |
| Vascular            | 14       | 28.6 | 90.43  | 49.60 to 137.78  | 7                | 61.91              | 7               | 167.66             |
| Postencephalitic    | 1        | 2.00 | 6.46   | -4.46 to 11.12   | 0                | 0.00               | 1               | 23.95              |
| Unspecified         | 1        | 2.00 | 6.46   | -4.46 to 11.12   | 0                | 0.00               | 1               | 23.95              |
| Total               | 49       | 100  | 316.50 | 240.21 to 404.98 | 21               | 185.73             | 28              | 670.66             |

**Abbreviations:** CI, confidence interval; no, number; PR, prevalence rate.

**Table 3** Age- and sex-adjusted prevalence of different Parkinsonism types per 100,000 people in Al Kharga District, Egypt

| Sex    | Age, years | Population | Parkinsonism type   |          |          |          |                  |       |             |        |
|--------|------------|------------|---------------------|----------|----------|----------|------------------|-------|-------------|--------|
|        |            |            | Parkinson's disease |          | Vascular |          | Postencephalitic |       | Unspecified |        |
|        |            |            | Cases, n            | PR       | Cases, n | PR       | Cases, n         | PR    | Cases, n    | PR     |
| Male   | 40≤50      | 3,864      | 0                   | 0.00     | 0        | 0        | 0                | 0.00  | 0           | 0.00   |
|        | 50≤60      | 2,242      | 0                   | 0.00     | 1        | 44.60    | 0                | 0.00  | 0           | 0.00   |
|        | 60≤70      | 1,269      | 6                   | 472.80   | 2        | 157.60   | 0                | 0.00  | 0           | 0.00   |
|        | 70≤80      | 693        | 9                   | 1,298.70 | 2        | 288.60   | 0                | 0.00  | 0           | 0.00   |
|        | 80+        | 252        | 5                   | 1,984.13 | 4        | 1,587.30 | 0                | 0.00  | 1           | 396.83 |
|        | Total      | 8,320      | 20                  | 240.38   | 9        | 108.17   | 0                | 0.00  | 1           | 12.02  |
| Female | 40≤50      | 3,445      | 1                   | 29.03    | 0        | 0        | 0                | 0.00  | 0           | 0.00   |
|        | 50≤60      | 1,994      | 2                   | 100.30   | 1        | 50.15    | 1                | 50.15 | 0           | 0.00   |
|        | 60≤70      | 1,085      | 4                   | 368.66   | 1        | 92.17    | 0                | 0.00  | 0           | 0.00   |
|        | 70≤80      | 468        | 3                   | 641.03   | 1        | 213.68   | 0                | 0.00  | 0           | 0.00   |
|        | 80+        | 170        | 3                   | 1,764.71 | 2        | 1,176.47 | 0                | 0.00  | 0           | 0.00   |
|        | Total      | 7,162      | 13                  | 181.51   | 5        | 69.81    | 1                | 13.96 | 0           | 0.00   |

**Abbreviations:** CI, confidence interval; PR, prevalence rate.

**Table 4** Worldwide prevalence studies of different Parkinsonism types

| Region        | Study                                | Study design                          | Study period | Cases, n/<br>Population | Ages, years | Crude overall Parkinsonism prevalence per 100,000 people | Crude overall PD prevalence per 100,000 people |
|---------------|--------------------------------------|---------------------------------------|--------------|-------------------------|-------------|----------------------------------------------------------|------------------------------------------------|
| Egypt         | El Tallawy et al <sup>4</sup>        | Door-to-door                          | 2005–2009    | 49/15,482               | ≥40         | 316.50                                                   | 213.15                                         |
| Sicily, Italy | Morgante et al <sup>10</sup>         | Different medical information sources | 2001         | 21/6,494                | ≥40         | 323.40                                                   | 215.60                                         |
| Spain         | Seijo-Martinez et al <sup>7</sup>    | Door-to-door                          | 2004         | 41/753                  | ≥65         | 5,440.00                                                 | 1,990.00                                       |
| UK            | Schrag et al <sup>22</sup>           | Cross-sectional                       | 2000         | 156/121,608             | ≥20         | –                                                        | 128.00                                         |
| Tanzania      | Dotchin et al <sup>23</sup>          | Door-to-door                          |              | 33/161,071              | ≥20         | –                                                        | 20.00                                          |
| Brazil        | Barbosa et al <sup>24</sup>          | Community-based surveys               |              | 86/1,186                | ≥64         | 7,200.00                                                 | 3,300.00                                       |
| Argentina     | Bauso et al <sup>25</sup>            | Hospital based                        | 2003–2008    |                         | ≥40         | –                                                        | 394.00                                         |
| Tunisia       | Attia Romdhane et al <sup>12</sup>   | Door-to-door                          |              | 34,874                  | ≥40         | –                                                        | 216.00                                         |
| Libya         | Ashok et al <sup>14</sup>            | Door-to-door                          |              |                         | All ages    | –                                                        | 31.40                                          |
| Nigeria       | Osuntokun et al <sup>26</sup>        | Door-to-door                          | 1987         | 20,000                  | All ages    | –                                                        | 10.00                                          |
| Saudi Arabia  | al Rajeh et al <sup>13</sup>         | Door-to-door                          |              | 22,630                  | All ages    | –                                                        | 27.00                                          |
| India         | Gourie-Devi et al <sup>27</sup>      | Population-based survey               | 1993–1995    | 34/102,557              | All ages    | –                                                        | 33.00                                          |
| Nebraska, USA | Strickland and Bertoni <sup>28</sup> | Passive surveillance of PD registry   | 1997–2000    | 5,179 cases             | All ages    | –                                                        | 329.30                                         |
| Albania       | Kruja et al <sup>29</sup>            | Door-to-door                          |              |                         | All ages    | 800.00                                                   | –                                              |

**Abbreviation:** PD, Parkinson's disease.

**Table 5** Clinical profile data of subjects with Parkinson's disease at time of interview in Al Kharga district, Egypt

| Feature                                               | Total             |       | Male              |     | Female            |       |
|-------------------------------------------------------|-------------------|-------|-------------------|-----|-------------------|-------|
|                                                       | N                 | %     | N                 | %   | N                 | %     |
| Motor symptoms                                        |                   |       |                   |     |                   |       |
| Tremor dominant                                       | 17                | 51.50 | 9                 | 45  | 8                 | 61.5  |
| Rigidity dominant                                     | 7                 | 21.20 | 6                 | 30  | 1                 | 7.70  |
| Mixed                                                 | 9                 | 27.30 | 5                 | 25  | 4                 | 30.80 |
| Non-motor symptoms                                    |                   |       |                   |     |                   |       |
| Cognitive impairment                                  | 8                 | 24.20 | 5                 | 25  | 3                 | 23.00 |
| Psychosis                                             | 3                 | 9.00  | 2                 | 10  | 1                 | 7.70  |
| Depressed mood                                        | 15                | 45.45 | 9                 | 45  | 6                 | 46.15 |
| Sensory complaint                                     | 7                 | 21.20 | 5                 | 25  | 2                 | 15.40 |
| Mean age at onset, years (mean $\pm$ SD)              | 57.8 $\pm$ 12.6   |       | 54.36 $\pm$ 10.75 |     | 58.9 $\pm$ 11.9   |       |
| Median age at onset, years (mean $\pm$ SD)            | 58.5              |       | 55                |     | 59                |       |
| Mean age of the patients at interview (mean $\pm$ SD) | 69.40 $\pm$ 13.50 |       | 67.90 $\pm$ 13.20 |     | 70.14 $\pm$ 13.94 |       |
| Total UPDRS (mean $\pm$ SD)                           | 57.75 $\pm$ 29.20 |       | 58.30 $\pm$ 29.80 |     | 56.70 $\pm$ 29.50 |       |
| Mean of UPDRS motor score                             | 40.00 $\pm$ 15.60 |       | 41.0 $\pm$ 15.9   |     | 39.6 $\pm$ 15.9   |       |
| Mean of UPDRS, ADL                                    | 15.8 $\pm$ 12.7   |       | 16.2 $\pm$ 12.1   |     | 14.9 $\pm$ 12.6   |       |
| Family history                                        | 4.0               | 12.1  | 3.0               | 9.1 | 1.0               | 3.0   |

**Abbreviations:** ADL, activities of daily living; SD, standard deviation; UPDRS, Unified Parkinson's Disease Rating Scale, version 3.0.

The estimated disease stages (HY) of the studied PD patients in comparison with those determined in previous studies are presented in Table 6.

## Discussion

The overall prevalence of Parkinsonism in Al Kharga district was as high as 316.5/100,000. Similar results were reported by Morgante et al<sup>10</sup> in Sicily, who found that the prevalence of all types of Parkinsonism, in a population aged  $\geq 40$  years was 323.4/100,000. The overall prevalence of PD varies widely and it is the most common type of Parkinsonism in older persons.<sup>2,10,11</sup> Similarly, in the present study, PD was the most commonly reported type, with a prevalence rate of 213.15/100,000. This result is similar to that reported by Attia Romdhane et al<sup>12</sup> in Tunisia. In that research, a door-to-door study was performed of a population of 34,874 persons and prevalence was 216/100,000 in subjects aged  $\geq 40$  years. In contrast, prevalence in the present study was markedly higher than that reported in Saudi Arabia by al Rajeh et al<sup>13</sup> (27/100,000) and in Benghazi, Libya by Ashok et al<sup>14</sup> (31.4/100,000) for a

population of 518,745. The wide variability of prevalence of PD among different populations may yield important information on the contribution of genetic, epigenetic, and environmental factors to the etiology of this complex disease.<sup>15</sup> From another point of view, the variations observed might also be the consequence of differences in race; methodology; survey design; case-finding strategy; and/or, particularly, age distribution.<sup>7</sup>

In concordance with the cross-sectional study conducted in Spain from 1994 to 1995 by Errea et al,<sup>16</sup> our study indicates that PD prevalence increases with age. Seijo-Martinez et al<sup>7</sup> in Spain found that PD increases steadily as age increases up to 85 years old, then declines after that age. Similarly to Seijo-Martinez et al's study,<sup>7</sup> we found PD prevalence was higher among males than females, but the difference was not statistically significant. Some studies have reported a higher prevalence of PD in men than in women,<sup>17,18</sup> while other studies have found no such difference.<sup>9,19</sup> In addition, the clinical profile in this study suggested a more benign PD phenotype in women than men. First, women tended to be older than men at symptom onset. Second, women presented more often than

**Table 6** Frequency of Parkinson's disease according to Hoehn and Yahr (HY) stage

| Study                             | Region                                | Cases, n | HY stage distribution (%) |      |      |      |     |
|-----------------------------------|---------------------------------------|----------|---------------------------|------|------|------|-----|
|                                   |                                       |          | I                         | II   | III  | IV   | V   |
| Present study                     | Egypt                                 | 33       | 18.2                      | 39.4 | 24.2 | 15.2 | 3.0 |
| Seijo-Martinez et al <sup>7</sup> | Spain                                 | 15       | 6.7                       | 46.7 | 20   | 26.7 | 0.0 |
| Benito-León et al <sup>17</sup>   | Margaritas, Lista, and Arévalo, Spain | 81       | 11.1                      | 49.4 | 14.8 | 19.8 | 4.9 |
| Clavería et al <sup>18</sup>      | Catalejo, Spain                       | 20       | 25.0                      | 30.0 | 30.0 | 15.0 | –   |
| Chio et al <sup>30</sup>          | Cossato, Italy                        | 104      | 30.8                      | 35.6 | 14.4 | 15.4 | 3.8 |

men with a tremor-dominant form of PD, which in turn was associated with a slower disease progression. Neuroprotective effects of estrogens have been suggested as a possible explanation for a higher risk of PD in men than in women, but their role is still controversial.<sup>20</sup> Increased prevalence of Parkinsonism in rural areas compared with urban areas could be explained by environmental factors like exposure to toxins such as heavy metals, and differences in dietary habits, in addition to a greater number of consanguineous marriages occurring in rural communities than in urban.

PD progresses relentlessly and leads to severe impairment and disability. Data on the distribution of disease extent are important for health care planning. Patients in advanced stages of PD consume more health care, and are thus associated with greater health care costs, than patients in the early stages of the disease.<sup>3</sup> Rates stratified by HY stage could be found in only a few studies (Table 6); however, the distribution of PD severity in Egypt was quite similar to that indicated in most studies, in which 55% of patients were classified as HY stage I or II and less than 5% were classified as HY stage V. The higher probability of participation by patients with mild symptomatology in the population-based studies may explain the high number of cases with mild disability (HY stages I–II).<sup>21</sup>

A systematic review of the worldwide prevalence and incidence of PD by Muangpaisan et al<sup>2</sup> reported that vascular Parkinsonism was present in 6% of all Parkinsonism patients, while in this study, it was recorded in 28.6% of studied patients with a prevalence rate of 90.43/100000. In contrast, Morgante et al<sup>10</sup> found only three cases of vascular Parkinsonism out of 6,494 persons, giving a prevalence rate of 46.2/100,000 in a population aged  $\geq 40$  years. This difference may be explained by the increased possibility of vascular insults to the brain due to inadequate management of risk factors such as diabetes mellitus, hypertension, and hyperlipidemia in our population. These issues may be due to poor access to medical services in the study area, which is far away from qualified medical centers.

## Future directions

Cross-cultural variation in the prevalence of PD is potentially interesting. Environmental factors and genetic susceptibility play an important role in this variation. Therefore, this study may be helpful in aiding the description of epidemiological aspects of the disease in this area of the world. The high prevalence of PD among this studied population should encourage future genetic analysis, which will help in identification of the etiopathogenesis of the disease and in its earlier detection and prevention.

## Disclosure

The authors declare no conflicts of interest in this work.

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