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## Prevalence of Parkinson's disease: a door-to-door survey in rural Bolivia

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### Abstract

A door-to-door survey was carried out in rural areas of the Cordillera Province, Bolivia, to determine the prevalence of Parkinson's diseases (PD) in a sample of 9955 subjects. We found five cases of PD on prevalence day, November 1, 1994. The crude prevalence was 50.2/100,000 (95% CI 18.5–124.5) and 286/100,000 (95% CI 28–543) in subjects aged 40 years or more. Our prevalence is close to rates found in other in developing countries.

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### 1. Introduction

Parkinson's disease (PD) occurs worldwide in all ethnic groups. There are wide variations in the reported prevalence rates for different parts of the world. Crude prevalence rates vary from 10 to 350 per 100,000 population [1]. Data available from developing countries are limited due to the difficulty in conducting neuroepidemiological surveys and, above all in rural areas, due to the lack of hospital registers, a community based door-to-door survey is often the only possible method of case ascertainment. We carried out a door-to-door survey to evaluate the prevalence of major neurological disorders (epilepsy, stroke, parkinsonism and peripheral neuropathy) in a sample from the rural areas of the Cordillera Province, Bolivia. Background and methods have been described elsewhere [2].

### 2. Materials and methods

The study was carried out in the Cordillera Province, Santa Cruz Department, in the south-eastern part of Bolivia.

The province covers 86,245 km<sup>2</sup> with a population of 88,628, of whom 55,675 live in rural areas [3]; it is administratively divided into 10 rural areas. The life expectancy at birth is 60 years [3]. Racially the population is a mixture of Mestizos, descendants of inter-marriage between Spanish colonists and the native tribes, and approximately 30% pure Guaraní Indians [2]. A cluster survey method was used with the 10 areas acting as strata. Within each stratum, communities were selected at random and each constituted one cluster. Sampling was designed to select approximately 20% of the population in each area. Urban areas, defined as a community with more than 2000 inhabitants, were excluded from the sampling frame. In total we selected 10,124 people in 55 communities. Inhabitants were eligible if they had been resident in the communities for at least 6 months preceding the prevalence day.

This was a two phase study. The screening phase was carried out by 26 Guaraní non-physician health workers; all positive subjects on screening underwent a complete neurological examination performed by neurologists [2].

We adopted the SNES screening instrument [4], a slightly modified version of the WHO protocol [5]. In the SNES study the sensitivity of the screening instrument for parkinsonisms was 100% while the specificity was 86% [6]. The screening instrument addressed parkinsonism through

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Table 1  
Age-specific prevalence of PD in population aged 40 years or above

Age	Population	Number of cases	cases/100,000	95% CI
40–49	786	1	133	0–397
50–59	497	2	371	0–892
60 +	497	2	443	0–1076
Total	1780	5	286	28–543

two specific items: one question about the presence of rigidity or slowness in movement and the other concerning the presence of tremor.

We determined the prevalence of PD as a point prevalence on the prevalence day, November 1, 1994.

PD was defined in the context of parkinsonism, and four cardinal signs were considered: resting tremor, bradykinesia, rigidity, and postural-reflex impairment. For parkinsonisms at least two of the cardinal signs had to be present.

PD was diagnosed by ruling out the subtypes of parkinsonism. A further requirement was that at least one of the cardinal signs had to be either resting tremor or bradykinesia [7].

Analysis was carried out using the Csample module of EPI-INFO 6 in order to allow for the cluster sampling. All results presented are therefore adjusted for both area stratification and clustering [8]. In addition results were age-adjusted to the World standard population to facilitate international comparison [9].

### 3. Results

The eligible population consisted of 10,124 subjects. At the end of the screening 9955 questionnaires had been completed. Out of the 9955 screened subjects, 1780 (17.9%) were aged 40 years or more (886 male and 894 female).

Of the 9955 subjects screened 1130 (11.3%) were positive as defined by the screening instrument, of whom 469 (41.5%) were aged 40 years and above. Of these 1027 were directly examined by neurologists in phase two. One hundred and three (10%) were not examined of whom 86 were not found, 10 died during the study and seven refused the neurological examination.

Table 2  
Clinical features

Patients	Sex	Age	Resting tremor	Bradykinesia	Rigidity	Impairment Postural reflex	Emi-parkinson
1	F	58	+	+	–	+	N
2	F	55	+	+	+	–	N
3	M	70	+	+	+	–	N
4	M	80	–	+	+	+	N
5	F	45	+	–	+	+	Y (Right side)

F, female; M, male; N, no; Y, yes.

Out of the 1780 subjects aged 40 years and above 156 (8.76%) were positive in the specific items for parkinsonism at the screening instrument and, in particular, 89 subjects (5%) were positive at the item concerning the presence of rigidity while 67 (3.8%) reported the presence of tremor.

After an extensive neurological evaluation five subjects (two males and three females) fulfilled the diagnostic criteria adopted. Two cases were classified as vascular parkinsonism and excluded from the analysis.

The crude prevalence of PD was 50.2/100,000 (95% CI 18.5–124.5), 97.3/100,000 age-adjusted to the world standard population, while prevalence was 286/100,000 (95% CI 28–543) in the population aged 40 years or more and 304/100,000 age-adjusted to the world standard population. Prevalence increased with age reaching 443/100,000 in the class aged 60 years or more. In the population aged 40 years and above prevalence was higher in women than in men (323 and 248/100,000, respectively). Age-specific prevalence are shown in Table 1.

None of these patients underwent a neurological examination before the survey and had not received specific treatment. Clinical features are summarized in Table 2.

### 4. Discussion

Prevalence rates of PD from developed countries are generally higher than those reported from developing ones. Door-to-door surveys carried out in industrialized countries have found crude prevalence rates that range from 131 per 100,000, Copiah County, to 350 per 100,000 reported in France [1]. Only few door-to-door neuroepidemiological surveys have been carried out in developing countries and the majority of them have been carried out in urban or mixed areas.

We carried out a door-to-door survey to determine prevalence rates of the most common neurological disorders in rural Bolivia, including PD.

Our crude prevalence of 50.2/100,000 is close to the majority of rates reported from surveys with similar study design carried out in developing countries (Igbo-Ora Nigeria 10/100,000; Chine six cities 44/100,000; 27/100,000 South Arabia; China 29 province 15/100,000) [1].

As in other surveys, age-specific prevalence increases steeply with age reaching a peak of 443/100,000 for the population aged 60 years or older [1].

We would underline that even if we studied a sample of about 10,000 inhabitants due to the structure of the study population, subjects aged 40 years and above represent only the 18% of our sample. This could explain the few number of cases identified and the wide confidence intervals; a larger sample size of the elderly population would be necessary to produce more accurate estimates. At any rate our prevalence is comparable with those reported from others developing countries and represents the only one available from rural Bolivia, and also from rural areas of South America.

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### References

- [1] Zhang ZX, Román GC. Worldwide occurrence of Parkinson's disease: an updated review. *Neuroepidemiology* 1993;12:195–208.
- [2] Nicoletti A, Reggio A, Bartoloni A, Failla G, Bartalesi F, Roselli M, Gamboa H, Salazar E, Paradisi F, Tempera G, Hall A. A neuro-epidemiological survey in rural Bolivia: background and methods. *Neuroepidemiology* 1998;17:273–80.
- [3] Bolivia, Instituto Nacional de Estadística (INE), Censo Nacional de población y vivienda, 1992. La Paz: INE; 1992.
- [4] Meneghini F, Rocca WA, Grigoletto F, Morgante L, Reggio A, Savettieri G, Di Perri R, Anderson DW. Door to door prevalence survey of neurological diseases in a Sicilian population: background and methods. *Neuroepidemiology* 1991;10:70–85.
- [5] World Health Organization Research protocol for measuring the prevalence of neurological disorders in developing countries. Neuroscience Programme. Geneva: World Health Organization; 1981.
- [6] Meneghini F, Rocca WA, Anderson DW, Grigoletto F, Morgante L, Reggio A, Savettieri G, Di Perri R. Validating screening instruments for neuroepidemiologic surveys: experience in Sicily. *J Clin Epidemiol* 1992;45(4):319–31.
- [7] Melcon MO, Anderson DW, Vergara RH, Rocca WA. Prevalence of Parkinson's disease in Junín, Buenos Aires Province, Argentina. *Mov Disord* 1997;2:197–205.
- [8] Package 'Epi Info 6', World Health Organization, Geneva, Switzerland. Centers for Disease Control & Prevention (CDC), Atlanta, USA; 1994.
- [9] Muir C, Waterhouse J, Mack T, Powell J, Whelan S, editors. Cancer incidence in five continents. Lyon: IARC (WHO); 1987.