

# Systematic review of the prevalence and incidence of Parkinson's disease in the People's Republic of China

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**Background:** Parkinson's disease (PD) is a common neurodegenerative disease, and obtaining accurate epidemiological data for this disease is very important for policy-making in public health. The purpose of this study was to determine the prevalence and incidence of PD in the People's Republic of China and explore possible future research directions.

**Methods:** We systematically retrieved studies of the prevalence and incidence of PD in the People's Republic of China, Taiwan, and Hong Kong, and standardized the data according to the world's population in 2000.

**Results:** Fifteen eligible studies were retrieved. Most were cross-sectional studies, and two thirds of the research was from the People's Republic of China. The prevalence of PD was reported in all the studies, but only two studies reported incidence data. The prevalence of PD in the People's Republic of China ranged from 16 to 440.3/100,000, and the annual incidence ranged from 1.5 to 8.7/100,000.

**Conclusion:** The prevalence of PD in the People's Republic of China has been widely investigated in the studies published to date. However, due to methodological heterogeneity, the data reported by the different studies are not comparable. There is still a lack of information on the incidence of PD in the People's Republic of China. Therefore, future research is required to answer this question.

**Keywords:** Parkinson's disease, prevalence, incidence, People's Republic of China

## Introduction

The People's Republic of China has the largest population in the world, and accounts for one fifth of the total world population. With the rapid development of its economy and society, the standard of living and health care have greatly improved in the People's Republic of China. Meantime, the age structure of the People's Republic of China's population has also changed significantly. According to data from the sixth national census in 2011, the proportion of people aged older than 60 years accounted for 13.26% of the total population of the People's Republic of China, which was increased by 2.93% in comparison with the data from 2000.<sup>1</sup> With this aging population, geriatric diseases are becoming more and more common. Parkinson's disease (PD) is the second most common neurodegenerative disease. In addition to movement disorders, non-motor symptoms, including dementia, depression, visual hallucinations, and autonomic dysfunction, can also occur in patients with PD. All these symptoms decrease quality of life for PD patients, and increase the burden on their families and caregivers. In the past few decades, epidemiological studies have been carried out in many countries to clarify the characteristics of PD at the population

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level, and found that age, genetic, and environmental factors play a key role in the pathogenesis of PD. Concerning the differences in genetic background and environmental exposure in Chinese and other populations, the epidemiological characteristics of PD in the People’s Republic of China may differ from those in other countries. Although investigation of the epidemiology of PD in the People’s Republic of China is relatively late, some well-designed studies have been reported in recent years.

In this paper, we systematically summarize the prevalence and incidence data for PD in the People’s Republic of China and development trends based on the current studies, and explore the problems and future directions for research on the epidemiology of PD in the People’s Republic of China.

### Materials and methods

We systematically searched the Chinese electronic databases, including CNKI, Wanfang, and CQVIP, and the English electronic databases, including PubMed and Embase, for Chinese epidemiological studies on PD published until September 2014. The search terms used were ‘Parkinson’s disease’, ‘epidemiology’, ‘prevalence’, ‘incidence’, ‘China’, ‘Hong Kong’, and ‘Taiwan’. No language restriction was used. We only included studies from the People’s Republic of if they included at least 3,000 participants. Considering the smaller populations in Hong Kong and Taiwan, there were no limitations on sample size. In addition, the included studies had to include clear diagnostic criteria for PD. To eliminate the possibility that differences in prevalence and incidence rates across regions could have been due to differences in their age structure, we used the World Health Organization World Standard Population 2000 as the standard. All crude age-specific rates were applied to this standard population for comparison.

### Results

The initial search of the databases yielded 945 results. After screening topics and abstracts, 37 relevant abstracts were tagged and saved for more thorough perusal. Ultimately, 15 studies met our inclusion criteria. Information on the included studies is provided in Table 1. The time span of these studies is from 1985 to 2010. Ten studies were from the the People’s Republic of China, two were from Hong Kong, and three were from Taiwan. All the studies reported the prevalence of PD, but only two studies reported incidence data.<sup>2,3</sup> Fourteen studies were cross-sectional in nature and only one study from Ilan in Taiwan had a cohort

**Table 1** Summary of studies on the prevalence of Parkinson’s disease in the People’s Republic of China (PRC)

Author/ year	Region	Research method	Design	Case-finding strategy	Diagnostic criteria	Age	Number of participants	PD case
Li et al <sup>6</sup> 1985	Six cities in PRC	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and brief examination if positive, examined by neurologist	Resting tremor and rigidity and/or hypokinesia and exclusion of other cause	0+	63,195	28
Shi et al <sup>7</sup> 1987	Hongkou Shanghai	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and brief examination if positive, examined by neurologist		0+	751,563	137
Ho et al <sup>4</sup> 1989	Hong Kong	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and neurological examination	≥3 of 5 cardinal signs, or ≥2 cardinal signs if there is ≥2 additional conditions	60+	561	19
Wang et al <sup>2</sup> 1991	29 provinces in PRC	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and neurological examination	Schoenberg’s criteria	0+	3,869,162	566
Wang et al <sup>20</sup> 1996	Kinmen Taiwan	Cross-section	Door-to-door survey	Single-phase door-to-door survey by neurologist	≥2 of 4 cardinal signs if not receiving antiparkinsonian drugs; or, ≥1 of 4 cardinal signs if improved by medications	50+	4,158	23

Chen et al <sup>3</sup> 2001	Ilan, Taiwan	Survey follow-up study	Door-to-door survey with follow-up at 7 years	2-phase door-to-door survey: questionnaire and examination by neurologists	≥2 cardinal signs and exclusion of other causes	40+	10,058	37
Qiao et al <sup>21</sup> 2001	Xian	Cross-section	Door-to-door survey with reexamination 6–12 months later	2-phase door-to-door survey: questionnaire and examination by neurologist	≥2 cardinal signs and exclusion of other causes	55+	4,850	38
Zhou et al <sup>22</sup> 2001	Shanghai	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and neurological examination	≥2 cardinal signs and exclusion of other causes	55+	16,030	235
Zhang et al <sup>23</sup> 2003	Beijing	Cross-section	Door-to-door survey with reexamination 2–54 months later	2-phase door-to-door survey: questionnaire and neurological examination	≥3 cardinal signs, or ≥2 cardinal signs if there is ≥1 additional condition: asymmetry, one sign was either resting tremor or bradykinesia, or no levodopa unresponsiveness	55+	5,743	64
Woo et al <sup>5</sup> 2004	Hong Kong	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and examination by geriatrician	≥2 cardinal signs (resting tremor, bradykinesia, or rigidity) and exclusion of other causes	55+	415	2
Zhang et al <sup>9</sup> 2005	Beijing, Xian, Shanghai	Cross-section	Door-to-door survey with reexamination in 2 months	2-phase door-to-door survey: questionnaire and neurological examination	≥3 cardinal signs, or ≥2 cardinal signs if there is ≥1 additional condition: asymmetry, one sign was either resting tremor or bradykinesia, or no levodopa unresponsiveness	55+	29,454	277
Zhang et al <sup>24</sup> 2005	Linxian	Cross-section	Screening of survivors of cohort study	2-phase: screening with interview and brief neurological examination; then full neurological examination	UKPDS Brain Bank Criteria	50+	16,488	86
Chen et al <sup>25</sup> 2009	Keelung Taiwan	Cross-section	Screening of populations of a KCIS study	2-phase: screening with interview and brief neurological examination; then re-valued by the senior neurologist	UKPDS Brain Bank Criteria	40+	11,322	80
Wang et al <sup>8</sup> 2010	Beijing	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and examination by neurologist	UKPDS Brain Bank Criteria	60+	3,473	70
Liu et al <sup>26</sup> 2010	Kashi Xinjiang	Cross-section	Door-to-door survey	2-phase door-to-door survey: questionnaire and examination by neurologist	UKPDS Brain Bank Criteria	55+	6,229	57

**Notes:** Schoenberg's criteria: (a) insidiously progressive rest tremor, rigidity, hypokinesia + no definite cause + middle age, (b) diagnosis by neurologist or senior doctor, and (c) exclusion of secondary causes.

**Abbreviations:** KCIS, Keelung Community - Based Integrated Screening; UKPDS, United Kingdom Parkinson's Disease Society.

design.<sup>3</sup> Concerning sample size, only two studies from Hong Kong contained fewer than 3,000 participants.<sup>4,5</sup> The door-to-door survey method was used in 13 studies. Three studies focused on the total population,<sup>2,6,7</sup> while the remaining 12 studies were conducted only in the elderly population. The investigations covered most regions in the People's Republic of China. Most were conducted in the general population, with only one study of Chinese veterans.<sup>8</sup> With regard to diagnostic criteria, at least two of four positive core PD symptoms was applied in most studies, with the exclusion of atypical Parkinsonism. The UK Parkinson's Disease Society criteria have been used more widely in recent years.

Epidemiological research on PD started in the People's Republic of China in the 1980s, and peaked during 1995–2005 with several large-scale, high-quality studies. Thereafter, there was a decline in this field of research. The surveyed regions were mainly in mainland China, which accounts for two thirds of the available data. Further, the most developed regions on the eastern coast have been well investigated, with fewer studies carried out in western China. The reported crude prevalence of PD ranged from 18/100,000 to 2,010/100,000, with significant heterogeneity between the different investigations. After standardization, the adjusted PD prevalence ranged from 16.7/100,000 to 440.3/100,000, still with significant heterogeneity (Table 2). The minimum and maximum values were found in the very early studies, from the People's Republic of China and Hong Kong, respectively. From 1995, the standardized prevalence was 79.5/100,000 to 193.3/100,000. With regard to the incidence of PD, a study from the People's Republic of China in 1991 reported a figure of 1.5/100,000;<sup>2</sup> the adjusted incidence was 1.5/100,000, which was significantly lower than the incidence in Western countries. In 2001, a study from Taiwan reported a PD incidence of 10.4/100,000,<sup>3</sup> and the adjusted incidence was 8.7/100,000, which was significantly higher than that in the People's Republic of China and comparable with Western countries. There have been no further reports on the incidence of PD in the People's Republic of China.

## Discussion

Studies reported before 2000 demonstrate that the prevalence and incidence of PD in the People's Republic of China were significantly lower than rates in Western countries.<sup>2,6,7</sup> Meanwhile, the PD data for Hong Kong and Taiwan were significantly higher than in the People's Republic of China,<sup>3–5</sup>

**Table 2** Reported prevalence of Parkinson's disease in the People's Republic of China (standardized to World Health Organization World Population 2000) per 100,000 population

Study	Crude prevalence rate	Standardized rate
Six cities <sup>6</sup>	44 ( $\geq 0$ year)	51.3
Li et al 1985		
Hongkou Shanghai <sup>7</sup>	18 ( $\geq 0$ year)	16.8
Shi et al 1987		
Hong Kong <sup>4</sup>	340 ( $\geq 60$ year)	440.3
Ho et al 1989		
29 Provinces <sup>2</sup>	145 ( $\geq 0$ year)	16.7
Wang et al 1991		
Kinmen Taiwan <sup>20</sup>	587 ( $\geq 50$ years)	112.2
Wang et al 1996		
Ilan, Taiwan <sup>3</sup>	368 ( $\geq 40$ years)	113.1
Chen et al 2001		
Xian <sup>21</sup>	784 ( $\geq 55$ years)	171.3
Qiao et al 2001		
Shanghai <sup>22</sup>	990 ( $\geq 55$ years)	120.6
Zhou et al 2001		
Beijing <sup>23</sup>	1,100 ( $\geq 50$ years)	109.3
Zhang et al 2003		
Hong Kong <sup>5</sup>	480 ( $\geq 55$ years)	79.5
Woo et al 2004		
Beijing, Xian, Shanghai <sup>9</sup>	1,070 ( $\geq 55$ years)	176.9
Zhang et al 2005		
Lin, Xian <sup>24</sup>	522 ( $\geq 50$ years)	112.2
Zhang et al 2005		
Keelung, Taiwan <sup>25</sup>	706 ( $\geq 40$ years)	193.3
Chen et al 2009		
Beijing <sup>8</sup>	2,010 ( $\geq 60$ years)	–
Wang et al 2010		
Kashi, Xinjiang <sup>26</sup>	927 ( $\geq 55$ years)	159.1
Liu et al 2010		

and comparable with rates in Western countries. However, one study focused on Beijing, Xi'an, and Shanghai in 2005 suggested the prevalence of PD in Chinese people over 55 years of age was 1.7%, which is also comparable with the prevalence in Western countries.<sup>9</sup> This finding indicates that the prevalence of PD in the People's Republic of China has been underestimated. It has been generally acknowledged that the prevalence of PD in Asia, Africa, and South America is significantly lower than that in Europe, which might be attributable to ethnic and regional variations. However, the results of recent epidemiological research do not support this view. For instance, the Bambui study in 2006 demonstrated that the prevalence of PD in Brazil was similar to that in Western countries.<sup>10</sup> Thus, heterogeneity in methodology is the main reason for the previous lower prevalence of PD in the People's Republic of China and Brazil, including

heterogeneity of diagnostic criteria, selection bias, and detection bias. The early studies usually had less specific diagnostic criteria in comparison with the recent studies. However, stringent standards could ensure a higher specificity but reduce the sensitivity.

The standardized prevalence of PD in the People's Republic of China was mainly in the region of 79.5/100,000 to 193.3/100,000, which is comparable with the data reported for Asian and European countries.<sup>11,12,18</sup> Most studies suggest sex differences in the prevalence of PD, with a predominance of the disease in males. The Chinese data also support this conclusion. However, some studies in Japan showed a higher prevalence of PD in females,<sup>13–16</sup> and the reasons for this observation have yet to be clarified. The prevalence of PD is generally believed to increase with advancing age, although some studies have reported a decreased prevalence of PD in the population aged over 80 years.<sup>2,3,17</sup> The reasons for this decline might involve different survival time, misdiagnosis, a small sample size, and a lower response rate in the population over 80 years. Moreover, only two studies focused on the incidence of PD in the People's Republic of China, and reported a lower incidence in the population aged over 80 years. The ratio of male and female in PD incidence was 1.1, which is also comparable with other countries.<sup>2,3,11,19</sup> However, more well-designed studies are needed for us to be able to draw robust conclusions.

Epidemiological research on PD in the People's Republic of China started later than in Western countries, and peaked during 1995–2005. Thereafter, the number of Chinese studies in this field rapidly decreased, but has similarly decreased since 2000 in USA and Europe.<sup>12</sup> This is the first systematic review summarizing epidemiological research on PD in the People's Republic of China. Its shortcomings included the small number of available studies, their questionable accuracy, rigor, and integrity, and the lack of cohort studies and studies focused on incidence. Future studies should use uniform diagnostic criteria (UKPDS) and strict methodology, with more attention on cohort studies, the incidence of PD, and special populations, eg, in veterans, to gain a better understanding of the epidemiology of PD in the People's Republic of China.

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## Disclosure

The authors report no conflicts of interest in this work.

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