

Incidences of type 1 diabetes in children in the Beijing area in the period of 1988-1996 and 1997-2000

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Background: This study was undertaken to acquire the incidences of type 1 diabetes among children in the Beijing area in the period of 1997-2000 and to compare these data with those in the period of 1988-1996.

Methods: According to the WHO capture-recapture protocol, we collected data from children under 15 years who had been diagnosed as having type 1 diabetes in the Beijing area in the period of 1997 and 2000. The incidence of the disease was calculated from the demographic data and the age-adjusted incidence from the data from the Chinese population of 2000. Confidence intervals of 95% were established with the Poisson distribution, and statistical significance of differences was tested with the chi-square test.

Results: In the period of 1997-2000, the incidence of type 1 diabetes ranged from 0.759 cases per 100 000 to 1.215 cases per 100 000 with an average annual incidence of 1.014/100 000 (95% confidence interval 0.98/100 000 to 1.16/100 000). No significant difference was found in the incidence in this period as compared with the period of 1988-1996, nor in age adjusted incidence (age-adjusted incidence 0.83/100 000 for 1988-1996 vs 0.86/100 000 for 1997-2000). The incidence of the disease was significantly higher in 10- to 14-year-old children than in younger groups ($P = 0.002$). No gender-specific differences were found.

Conclusions: The study did not reveal any statistical difference when comparing the two periods of

1988-1996 and 1997-2000 in the age-adjusted incidence of type 1 diabetes in children in the Beijing area. The results were not consistent with those reported from other countries. Although the economic and social conditions in Beijing changed considerably in the periods of our study, we did not find their influence on the incidence of type 1 diabetes in the pediatric population. Immigration of people from other parts of China to the Beijing area was an intervening factor in this study.

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Key words: diabetes mellitus; insulin-dependent; incidence; Beijing; child

Introduction

The WHO diabetes mondiale project group (DIAMOND)^[1-4] has been conducting surveys on diabetes incidence in China for many years and has reported the results.^[5-9] We have continued with this work using the same standardized methods under the guidance of the WHO and the Chinese Coordination Centre. The epidemiological data on type 1 diabetes incidence were collected from children under 15 years from 1997 to 2000, and were compared with those from 1988 to 1996.^[2] The aim of this study was to find changes in the diabetes incidence in the past several years, to analyze the causes of such changes, and to provide a basis for future research.

Methods

General information and statistics

The Beijing municipal area is located geographically at an altitude of 39.6 °N to 41.4 °N and at a longitude of 115.4 °E to 117.5 °E, covering a total area of 17 800

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square kilometres. Mountain ranges occupy about 60% of the north-western part of the area. Annual average temperature is 13.1°C; there are about 2536.7 hours of sunshine and 476.5 mm rainfall per year. The municipal area consists of 4 municipal districts, 6 central suburban areas and 8 peripheral suburban areas.^[10,11] The year 2000 Chinese population census^[11] reported a total population of 13 569 000 million in the municipal area. Children under 15 years accounted for 13.6% of the total population. There were 443 000 children between 0 and 4 years, 525 000 children between 5 and 9 years, and 876 000 children between 10 and 14 years of age. Among the 1 844 000 children under 15 years, 959 000 were male and 885 000 were female. All annual figures were calculated on the basis of annual data from representative population samples collected and provided by the Beijing Municipal Bureau of Statistics.

Subjects

According to the inclusion criteria employed by the WHO DIAMOND project,^[1-4] this study compared patients with type 1 diabetes under 15 years diagnosed during the period of 1997 and 2000. The diagnosis was confirmed by physicians and all patients were on insulin therapy. Those patients were either Beijing residents or temporary residents living in Beijing for at least one year. The patients were divided into 3 age groups according to the WHO DIAMOND standard:^[1] children less than 5 years, 5 years to less than 10 years, and 10 years to less than 15 years.

Statistical methods

The methods used in this study were as same as those of the 1988-1996 survey, including the capture-recapture method.^[1-4] The first data source included the records at the Beijing Municipal Bureau of Public Health, including outpatients and inpatients treated at all 78 hospitals at or above township level. The second data source was a questionnaire survey conducted among health care professionals working at more than 1000 municipal nurseries and primary or middle schools about the number of newly diagnosed type 1 diabetes cases.

The yearly incidence (one per 100 000) was calculated as the number of newly diagnosed cases divided by the total population under 15 years and multiplied by 100 000. The 4-year average incidence was defined as the total number of newly diagnosed cases in the period of 1997-2000 divided by the total population of the same period, divided again by 4 and multiplied by 100 000. According to the capture-recapture method, the 95% confidence interval of the incidence was calculated with the Poisson distribution. Differences in the yearly incidence were tested statistically using the chi-square test.

With the data from the Chinese population survey of the year 2000, we adjusted the incidence for differences in the age structure of the study population.

Because of tremendous changes of living standards of people in cities and rural areas and of administrative structures of suburban areas and towns in China in the past years, we studied the Beijing municipal area as a whole and did not look for differences between geographic regions or between urban and rural areas.

Results

In the period of 1997-2000, a total of 71 newly found cases of type 1 diabetes were registered. Among these cases, 68 (M) were traced with the help of the Municipal Bureau of Public Health as the first data source, and 31 (n) were discovered from the questionnaire survey as the second data source. There was an overlap of 28 cases (m). The predicted value of new type 1 diabetes cases was calculated as $N = 75.14$; the 95% confidence interval of the total predicted value ranged from 68.79 to 81.49 cases. The rate of coincidence was 90.498% for the first data source and 41.26% for the second data source. The combined coincidence of both sources reached 94.49%, and the mutual coincidence of both sources was 45.59%. These statistical data were considered as reliable.

Climate in Beijing over the study period^[10,11]

In the period of 1997-2000, the duration of sunshine, average air temperature and average wind speed did not show any significant differences. The amount of rainfall was significantly higher in 1998 than in years before (Table 1).

Table 1. Climate of the Beijing area in the period of 1997-2000

Year	Average rainfall (mm)	Average temperature (°C)	Average sunshine (h)	Average wind speed (m/s)
1997	430.9	13.1	2596.5	2.5
1998	731.7	13.1	2420.7	2.3
1999	266.9	13.1	2594	2.6
2000	371.1	12.8	2667.2	2.5

The yearly incidence was found to fluctuate between 0.759/100 000 and 1.215/100 000 with an average rate of 1.014/100 000 (Table 2). A highly significant difference was found between the different age groups ($\chi^2 = 12.449$, $P = 0.002$). The incidence showed an increase with age (Table 3). In the 3 age groups, the incidence in the period of 1988-1996 and 1997-2000 was 0.318/100 000 and 0.350/100 000, 0.853/100 000 and 0.920/100 000, and 1.405/100 000

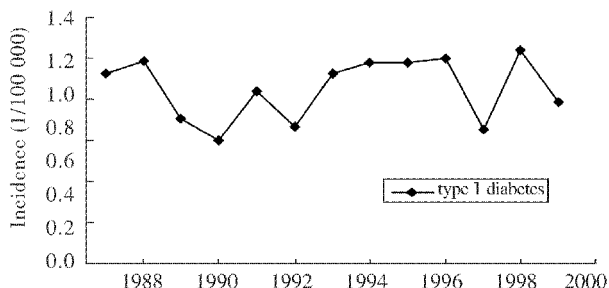


Fig. Type 1 diabetes incidence in the period of 1988-2000.

Table 2. Comparison of the yearly type 1 diabetes incidence in the Beijing area in the period of 1997-2000

Year	Total population <i>n</i>	Diabetes cases <i>n</i>	Incidence unadjusted 1/100 000	95% CI
1997	1 796 504	21	1.169	1.05 - 1.44
1998	1 712 564	13	0.759	0.62 - 1.09
1999	1 646 400	20	1.215	1.07 - 1.54
2000	1 844 000	17	0.922	0.78 - 1.26
Average	1 749 867	17.75	1.014	0.98 - 1.16

$\chi^2 = 2.331$, $P = 0.507$.

Table 3. Type 1 diabetes incidence in age group and gender in the Beijing area in the period of 1997-2000

Age	Population			Diabetes cases			Unadjusted incidence		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
<5	824 746	745 220	1 569 966	2	3	5	0.242	0.403	0.3185
5- <10	1 162 664	1 065 457	2 228 121	9	12	21	0.774	1.126	0.9425
10- <14	1 640 058	1 561 323	3 201 381	18	27	45	1.1	1.729	1.406
Total	3 627 468	3 372 000	6 999 468	29	42	71	0.799	1.246	1.014

Gender totals, $\chi^2 = 3.428$, $P = 0.641$; age groups, $\chi^2 = 12.449$, $P = 0.002$.

and 1.630/100 000, respectively. No significant difference was found between the two periods of data collection ($P = 0.157$), nor was there a significant difference between boys and girls. When the age structure of the population in the year 2000 was used as a standard, the incidence of 0.99/100 000 in the period of 1988-1996 was 0.83/100 000 after age adjustment, with a correction rate of 1.108. The same adjustment corrected the incidence from 1.014/100 000 to 0.86/100 000 in the period of 1997-2000 with a correction rate of 1.07. No significant difference was found in the age-adjusted incidence between the two periods ($P = 1$). Fig. shows the type 1 diabetes incidence in a 13-year period.

Discussion

The published results demonstrate an increase of type 1 diabetes incidence from 3% to 5% per year.^[12-17] Such a trend, however, has not yet been reported in China. We analyzed the data on type 1 diabetes incidence in the Beijing municipal area in a period of 13 years in an attempt to find changes of diabetes incidence and possible causes.

Type 1 diabetes incidence is increased in winter and spring, suggesting that change of climate may have an impact on the incidence. In this study, the unadjusted yearly incidence did not show any significant difference in the period of 1997-2000, and climate exerted no effect on the incidence, either. The reported studies on type 1 diabetes incidence in Beijing, Shanghai, Guangzhou, Xinjiang and other areas did not address the issue of climate in detail.^[5-9,18,19] We suggest that

climate be considered as a possible intervening factor.

We found a significant relationship between age and diabetes incidence, i. e., the incidence was lower in younger children and higher in adolescents. This finding was similar to that reported in Beijing (1988-1996), Guangzhou and other places.^[7-9,18,19] We did not find a significant increase in diabetes incidence in the period of 1997-2000, in compared to the period of 1988-1996, even after age adjustment. This result is not consistent with that reported elsewhere.^[5-9,18-20]

In the period of 1997-2000, we found the diabetes incidence was higher in girls (1.246/100 000) than in boys (0.799/100 000), although the difference was not statistically significant. The result was somewhat different from that of the 1988-1996 survey (girls 1.370/100 000, boys 0.75/100 000) and similar to the reported result from Shanghai (1980-1991)^[7] and from other countries.^[12]

In the newly diagnosed diabetes cases, only one child belonged to the Hui ethnic minority, whereas others were of Han ethnicity. Owing to the too small number of cases, we could not analyze the influence of ethnicity on diabetes incidence. However, data from Xinjiang autonomous region, other provinces or other countries have documented such an influence.^[12,19]

In this survey, neither the yearly incidence rates nor the average incidence in the period of 1997-2000 showed a significant increase compared to the period of 1988-1996. This finding is in sharp contrast with the results reported by researchers abroad or an annual increase of type 1 diabetes incidence from 3% to 5% in some regions.^[12] The living standards and life style of residents in the Beijing area have been improved great-

ly in the past several years, but there is no evidence for the increase of diabetes incidence in children. Immigration of people from other parts of China to the Beijing area in the same period may affect the composition of our study population and the results of the survey. Therefore, long-term multi-centre investigation covering different geographic regions would help to further clarify the trends of type 1 diabetes incidence.

In this study, most cases from the second data source were included in the first data source. Collecting data from the second data source required a considerable investment in terms of time and financial resources.^[18,19] It is obvious, however, that this source helps to prevent a loss of cases and appears to be an indispensable means in future studies. We consider that the only way to further improve the accuracy of future surveys on diabetes incidence is to ensure the timely registration of new diabetes cases, to actively cooperate with the parents of diseased children, and to increase the responsibility of researchers, all which may increase the reliability of the second data source.

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Contributors: GCX, major investigator, collected statistical data and wrote the article. Others were partly involved in the study and article preparation.

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