Incidence and risk factors of diabetes mellitus in the Chinese population: a dynamic cohort study

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ABSTRACT

Objective Diabetes mellitus is a common condition often associated with an ageing population. However, only few longitudinal studies in China have investigated the incidence of diabetes and identified its risk factors. Therefore, this study aimed to investigate the incidence and risk factors of diabetes in Chinese people aged ≥45 years using the harmonised China Health and Retirement Longitudinal Study (CHARLS) data.

Design A dynamic cohort study.

Setting The harmonised CHARLS 2011–2018.

Participants 19 988 adults aged ≥45 years.

Primary outcome measure Incident diabetes from 2011 to 2018.

Results The harmonised CHARLS is a representative longitudinal survey of people aged ≥45 years. Using data extracted from the harmonised CHARLS, we calculated the incidence of diabetes and used a competing risk model to determine risk factors of diabetes. In 2011–2013, 2013–2015, 2015–2018, the crude incidence of diabetes among middle-aged and older people in China was 1403.21 (1227.09 to 1604.19), 1673.22 (1485.73 to 1883.92) and 3919.83 (3646.01 to 4213.30) per 100 000 person-years, respectively, with a significant increasing trend. There were no geographical variations in the incidence of diabetes. Age, obesity and alcohol consumption were associated with an increased risk of incident diabetes.

Conclusion The incidence of diabetes increased annually, without any geographical differences. Age, obesity and alcohol consumption were found to be risk factors for incident diabetes.

INTRODUCTION

According to the results of China’s seventh national census in 2021, people aged ≥60 years accounted for 18.7% of the total population, indicating that China had become an ageing society according to the United Nations’ definition. Rapid ageing has resulted in an increased burden on healthcare, owing to age-related diseases. Diabetes mellitus is a common condition associated with ageing. It is predicted that the incidence of diabetes will continue to increase over the next 20 years, with the majority of patients aged between 45 and 64 years. The number of older people with diabetes worldwide was estimated to be 356 million and was expected to rise to 762 million by 2045.

In a previous study that used cross-sectional data collected from 31 provinces in mainland China, the prevalence of diabetes was 10.6%, 14.9%, and 16.5% in the 50–59, 60–69, and ≥75 years age groups, respectively, which was significantly higher than that in the <50 years age group.

Although the increasing prevalence of diabetes provides critical information for public health practice and disease control programmes, the incidence measure is unable to accurately depict the epidemiological transition as an increasing prevalence could be attributed to individuals with diabetes living longer. Prior evidence has shown that the incidence of diabetes could decrease, despite the prevalence rising or remaining stable. However, to the best of our knowledge, no such data are available for the middle-aged and older Chinese population.

To understand how the risk of diabetes in a population changes over time, the incidence
of diabetes should be determined. Annual incidence is a measure of the incidence of new cases of diabetes and reflects the risk of diabetes in the general population more directly than the prevalence of diabetes.

Additionally, owing to the extended life expectancy, rapid urbanisation, environmental conditions, lifestyle patterns, inequities in socioeconomic development and distribution of healthcare resources in different geographical regions,23 24 the incidence of diabetes may vary greatly. Existing studies provide insufficient information on regional variations in the incidence of diabetes.

This lack of information can hamper effective planning and implementation of healthcare strategies and the effective use of healthcare resources. To address this important gap in the literature, we conducted a cohort study using the harmonised China Health and Retirement Longitudinal Study (CHARLS) data to investigate the incidence of diabetes and risk factors of diabetes in Chinese people aged ≥45 years.

METHODS

Data sources

In this study, we derived data from the harmonised CHARLS25 a nationwide longitudinal household interview survey conducted every 2 years among adults aged ≥45 years in China. A detailed description of the methodology has been published elsewhere.26 The harmonised CHARLS used a multistage probability sampling approach to select a nationally representative sample. Specifically, the first stage is random sampling using the probability-proportional-to-size method, including all county levels in China except Tibet, with the final sample comprising 150 counties. The sample was stratified by region and within the region by urban or rural setting. In the second stage, administrative villages were randomly selected as primary sampling units (PSUs) in rural and urban settings. Three PSUs were selected from each county. In the third phase, 24 households were randomly selected based on the geographical locations and lists of each PSU. In the fourth and final stage, randomly selected residents aged ≥45 years from a family were interviewed with their spouses.

In the harmonised CHARLS, the baseline survey was conducted in 2011 and 17 708 respondents were interviewed. Data on demographic information and health and socioeconomic status were collected using structured questionnaires.

The respondents were followed up via face-to-face interviews every 2 years. This study is an analysis of the harmonised CHARLS data. The harmonised CHARLS data are stored in the National School of Development, Peking University, Beijing, China. Data can be found at http://charls.pku.edu.cn/pages/data/111/zh-cn.html.

Study population and outcome measurement

This was a dynamic cohort study because not all individuals entered the cohort at the same time. To assess the long-term trends of the incidence of diabetes, we excluded individuals with diabetes and those who were lost to follow-up after the first investigation. Figure 1 shows the respondents who were asked whether they had ever been diagnosed with diabetes or high blood sugar by a doctor and whether they were taking any medication for diabetes, including insulin injections, modern Western medicine or traditional Chinese medicine.
Exposures
The primary exposure variable in this study was the time of entering the cohort. We grouped individuals entering the cohort into the following sets: (a) 2011–2013; (b) 2013–2015 and (c) 2015–2018. In this case, two dummy variables were included in the model, with individuals from 2011 to 2013 included in the reference group.

Geographical areas are defined according to the annual statistical bulletin of the National Bureau of Statistics of China. Specifically, we grouped individuals from (a) Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong and Guangdong provinces as Eastern China; (b) Henan, Hubei, Hunan, Anhui, Jiangxi and Shanxi provinces as Central China; (c) Liaoning, Jilin and Heilongjiang provinces as Northeastern China; and (d) Sichuan, Shaanxi, Chongqing, Yunnan, Guangxi, Neimenggu, Guizhou, Xinjiang, Gansu, Ningxia and Qinghai provinces as Western China.

Outcomes
We identified diabetes as the primary outcome. We used self-reported diabetes based on the question ‘Has a doctor told you that you have diabetes or high blood sugar?’ If individuals reported a history of diabetes, they were further asked if they were taking any medication for diabetes, including insulin injections, modern Western medicine, traditional Chinese medicine or any other treatments, to reduce recall bias and under-reporting.

Covariates
To account for variations in baseline characteristics, we adjusted for several confounding factors that may influence the development of diabetes. The data we studied included demographic information (sex, age, marital status, urban or rural living, and residential region), socio-economic characteristics (education and employment) and health behaviour (body mass index (BMI)). Smoking behaviour was assessed based on the question ‘Have you ever chewed tobacco, smoked a pipe, smoked self-rolled cigarettes or smoked cigarettes/cigars?’. Those who answered ‘No’ were defined as never smoked, and if the answer was ‘Yes’, then the respondent would be asked ‘In 1 day, about how many cigarettes do/did you consume?’, according to the number of cigarettes consumed per day was defined as ‘<20/day’ and ‘≥20/day’. Drinking was assessed based on the question ‘Did you drink any alcoholic beverages, such as beer, wine or liquor in the past year? How often?’. Those who answered ‘None of these’ were defined as None, and if the answer was ‘Yes’, then the respondent would be asked ‘How often did you drink liquor/beer/wine or rice wine, including white liquor, whisky and others per month in the last year?’ According to the number of alcohol units consumed, the respondent was defined as ‘Less than once per day’, ‘Once per day’, ‘Twice per day’ and ‘More than twice per day’. Incomes have been reported several times related to metabolic alterations; however, due to the large number of missing values (nearly one-third) in the CHARLS data, which may affect results, we have added the results of this analysis in online supplemental table 1 for readers’ reference. All information was collected from the individuals’ reports.

Statistical analysis
We calculated the crude incidence of diabetes as follows:

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\text{Incidence} = \frac{\text{Number of individuals with newly diagnosed diabetes}}{\text{Total person–years at risk}}
\]

The ‘person-years at risk’ is defined as the period from the first diabetes-free year to the subsequent year of diabetes diagnosis. To further assess long-term trends in the incidence of diabetes, we used a competing risk model that included all the covariates to control for baseline changes. In terms of sensitivity analysis, we employed logistic regression analysis based on short panel data and obtained similar results (online supplemental table 2).

Data analyses were performed using Stata V.16.0 (StataCorp, Texas, USA).

Patient and public involvement
Patients and the public were not involved in the research.

RESULTS
Study population
In the harmonised CHARLS, the baseline population comprised 17 708 individuals, including 664 patients with diabetes and 2007 who were lost to follow-up. In 2011–2013, 15 037 individuals were examined, including 211 individuals with newly diagnosed diabetes and 412 who died. In 2013, 3084 new individuals were added (figure 1).

Table 1 shows an increase in the incidence of diabetes, ranging from 1403.21, 1673.22, and 3919.83 per 100 000 person-years between 2011–2013, 2013–2015, and 2015–2018, respectively. In general, most individuals lived in Western China and in rural areas, were women, married, employed, non-smoking, non-alcohol consuming and had less than lower secondary education.

Crude and age-standardised incidence of diabetes
Table 2 shows the crude and age-standardised incidence of diabetes across the study period. The age-standardised incidence of diabetes increased significantly, from 1343.64/100 000 person-years in 2011–2013 (95% CI 1041.56 to 1740.70) to 3919.83/100 000 person-years in 2015–2018 (95% CI 3646.01 to 4213.30). There was also an increase in this incidence among men (2011–2013: 1071.86/100 000 person-years, 95% CI 711.81 to 1641.31; 2015–2018: 3696.41/100 000 person-years, 95% CI 3318.29 to 4115.78) and women (2011–2013: 1708.36/100 000 person-years, 95% CI 1071.86/100 000 person-years, 95% CI 711.81 to 1641.31; 2015–2018: 3696.41/100 000 person-years, 95% CI 3318.29 to 4115.78).

Competing risk regression analysis
In the model analysis, 13 647 individuals without missing data were included. Among the confirmed cases, the duration from the absence to onset of diabetes ranged from 2 to 5 years. Table 3 shows the results of the competing risk regression analysis.
Table 1  Baseline characteristics

|                    | 2011          | 2011–2013     | 2013–2015     | 2015–2018     |
|--------------------|---------------|---------------|---------------|---------------|
|                    | N  | %   | N  | %   | N  | %   | N  | %   |
| Death              | 412 | 2.74 | 499 | 3.12 | 803 | 4.46 |
| Region within China|                |               |               |               |
| Northeastern       | 1240 | 7.28  | 1076 | 7.16  | 1144 | 7.14  | 1202 | 6.67  |
| Eastern            | 5379 | 31.56 | 4711 | 31.33 | 5030 | 31.40 | 5568 | 30.91 |
| Central            | 4824 | 28.30 | 4268 | 28.38 | 4509 | 28.15 | 5203 | 28.89 |
| Western            | 5601 | 32.86 | 4982 | 33.13 | 5334 | 33.30 | 6038 | 33.52 |
| Rural or urban living|            |               |               |               |
| Urban              | 6774 | 39.74 | 5431 | 37.14 | 5656 | 36.45 | 6760 | 37.53 |
| Rural              | 10270 | 60.26 | 9194 | 62.86 | 9862 | 63.55 | 11251 | 62.47 |
| Sex                |                |               |               |               |
| Men                | 8172 | 47.95 | 7179 | 47.74 | 7657 | 47.81 | 8630 | 47.92 |
| Women              | 8870 | 52.05 | 7858 | 52.26 | 8360 | 52.19 | 9379 | 52.08 |
| Age (years)        |                |               |               |               |
| <50                | 3989 | 23.64 | 2123 | 14.58 | 1827 | 11.80 | 2143 | 12.48 |
| 50–60              | 5955 | 35.28 | 5287 | 36.32 | 5349 | 34.55 | 5604 | 32.63 |
| 60–70              | 4360 | 25.83 | 4447 | 30.55 | 5187 | 33.50 | 5618 | 32.71 |
| ≥70                | 2573 | 15.25 | 2701 | 18.55 | 3120 | 20.15 | 3808 | 22.17 |
| Marital status     |                |               |               |               |
| Married or partnered| 14854 | 87.21 | 12640 | 86.44 | 13320 | 85.84 | 14677 | 85.29 |
| Other              | 2178 | 12.79 | 1983 | 13.56 | 2198 | 14.16 | 2531 | 14.71 |
| Education          |                |               |               |               |
| Less than lower secondary| 14996 | 88.06 | 13389 | 89.05 | 14292 | 89.23 | 15966 | 88.66 |
| Upper secondary and vocational training| 1708 | 10.03 | 1418 | 9.43 | 1487 | 9.28 | 1728 | 9.60 |
| Tertiary           | 325 | 1.91 | 228 | 1.52 | 238 | 1.49 | 314 | 1.74 |
| Employed           |                |               |               |               |
| No                 | 6003 | 36.15 | 5024 | 34.86 | 5516 | 35.81 | 5970 | 34.79 |
| Yes                | 10604 | 63.85 | 9388 | 65.14 | 9887 | 64.19 | 11188 | 65.21 |
| BMI (kg/m²)        |                |               |               |               |
| <18.5              | 938 | 7.15 | 661 | 6.25 | 798 | 6.41 | 867 | 6.07 |
| 18.5–23.9          | 5597 | 42.67 | 4147 | 39.22 | 4814 | 38.64 | 5468 | 38.26 |
| 24–24.9            | 2651 | 20.21 | 2179 | 20.61 | 2612 | 20.96 | 3004 | 21.02 |
| ≥25                | 3930 | 29.96 | 3586 | 33.92 | 4235 | 33.99 | 4952 | 34.65 |
| Smoking            |                |               |               |               |
| Never              | 11526 | 76.56 | 9246 | 85.08 | 11134 | 72.63 | 12533 | 76.70 |
| <20                | 1391 | 9.24 | 775 | 7.13 | 1894 | 12.36 | 1598 | 9.78 |
| ≥20                | 2138 | 14.20 | 846 | 7.79 | 2301 | 15.01 | 2210 | 13.52 |
| Alcohol consumption|                |               |               |               |
| None               | 11275 | 71.73 | 9580 | 66.25 | 10100 | 65.54 | 11379 | 66.28 |
| Less than once per day| 2739 | 17.43 | 2730 | 18.88 | 3200 | 20.76 | 3553 | 20.70 |
| Once per day       | 933 | 5.94 | 1181 | 8.17 | 1163 | 7.55 | 1343 | 7.82 |
| Twice per day      | 582 | 3.70 | 686 | 4.74 | 673 | 4.37 | 659 | 3.84 |
| More than twice per day| 189 | 1.20 | 284 | 1.96 | 275 | 1.78 | 234 | 1.36 |

BMI, body mass index; N, number.
Table 2  Crude and age-standardised incidence of diabetes over time

| Incidence  | 2011–2013 | 2013–2015 | 2015–2018 |
|-----------|-----------|-----------|-----------|
| Total Case| 211 (15 037) | 268 (16 017) | 706 (18 011) |
| Crude incidence (95% CI) | 1403.21 (1227.09 to 1604.19) | 1673.22 (1485.73 to 1883.92) | 3919.83 (3646.01 to 4213.30) |
| Age-standardised incidence (95% CI)* | 1343.64 (1041.56 to 1740.70) | 1573.32 (1252.85 to 1983.99) | 3919.83 (3646.01 to 4213.30) |
| Men Case | 80 (7179) | 114 (7657) | 319 (8630) |
| Crude incidence (95% CI) | 1114.36 (895.93 to 1385.30) | 1488.83 (138.40 to 1240.54) | 3696.41 (3318.29 to 4115.78) |
| Age-standardised incidence (95% CI)* | 1071.86 (711.81 to 1641.31) | 1441.65 (1026.82 to 2055.74) | 3696.41 (3318.29 to 4115.78) |
| Women Case | 131 (7858) | 154 (8360) | 387 (9379) |
| Crude incidence (95% CI) | 1667.09 (1406.39 to 1975.15) | 1842.11 (147.07 to 1574.92) | 4126.24 (3741.95 to 4548.13) |
| Age-standardised incidence (95% CI)* | 1708.36 (1238.82 to 2368.87) | 1819.03 (1343.23 to 2475.76) | 4126.24 (3741.95 to 4548.13) |

*Age-standardised incidence was calculated using the study sample from 2015 to 2018 as the standard population.

risk model analysis, considering the changes in the baseline characteristics. First, as the model results suggest, the increasing trend in the incidence of diabetes was robust. Specifically, individuals entering the cohort in 2013–2015 (sub-HR (SHR)=4.80, 95% CI 3.64 to 6.39) and in 2015–2018 (SHR=9.49, 95% CI 6.27 to 10.34) were at a higher risk of diabetes than those entering in 2011–2013. While there were no urban–rural or regional differences in the incidence of diabetes, there was an increased risk of diabetes with age, a BMI of ≥25 kg/m² and alcohol consumption.

DISCUSSION

By analysing individuals from the harmonised CHARLS, we found an increased incidence of diabetes across the study period. The incidence of diabetes increased even after controlling for changes in baseline characteristics. In addition, we found that individuals in Northeastern, Eastern, Central and Western China had the same risk of incident diabetes.

Instead of focusing on incidence measures, the vast majority of prior studies have focused on prevalence measures. For example, the prevalence of self-reported diabetes among the middle-aged and elderly in China was 5.61%, 7.49%, and 8.99% in 2011, 2013, and 2015, respectively, as per a previous study. While these studies, the incidence measured in our study reflects the epidemiological transition of diabetes in China more accurately. Here, the incidence was 1673.22 per 100 000 person-years in 2013–2015, which is similar to that of a previous study that used data from eight provinces and found an incidence of 1.6%.29

The trend in the incidence of diabetes in this study was similar to that found in the study by Wang et al,30 but was in contrast to that found in the study by Liu et al.31 Both our study and that by Wang et al found that the incidence of diabetes was on the rise, which was consistent with the prevalence of diabetes among adults in China between 2013 and 2018.32 In contrast, the findings of Liu et al showed a downward trend in the incidence of diabetes, which may have resulted from the different calibre of the population investigated and a cross-sectional study design of the entire population, whereas we used follow-up data on individuals aged ≥45 years.

Although there is insufficient evidence on regional differences in the incidence of diabetes, existing studies have shown that there is no significant difference in the incidence of diabetes in Eastern, Central and Western China,25 which is consistent with our findings. In contrast to the findings in a previous study,30 no urban–rural differences were observed in our study. This may be a result of the narrowing gap in lifestyle between rural and urban residents. In recent decades, with the rapid development of economy and accelerated urbanisation, the lifestyle and dietary patterns of individuals living in rural areas in China have gradually approached the lifestyle and dietary patterns of those living in urban areas.35
Table 3  Competing risk model analysis of the incidence of diabetes

|                                     | SHR   | Robust SE | z     | P value | 95% CI      |
|-------------------------------------|-------|-----------|-------|---------|-------------|
| **Timing of entering the cohort**   |       |           |       |         |             |
| 2011–2013 Reference                 |       |           |       |         |             |
| 2013–2015                           | 5.13  | 9.46      | 71.29 | <0.001  | 3.57 to 7.36|
| 2015–2018                           | 7.84  | 1.72      | 146.09| <0.001  | 5.10 to 12.00|
| **Rural or urban living**           |       |           |       |         |             |
| Urban Reference                     |       |           |       |         |             |
| Rural                               | 0.91  | 0.09      | −0.92 | 0.357   | 0.75 to 1.11|
| **Region within China**             |       |           |       |         |             |
| Northeastern Reference              |       |           |       |         |             |
| Eastern                             | 1.09  | 0.23      | 0.40  | 0.690   | 0.72 to 1.65|
| Central                             | 1.10  | 0.23      | 0.44  | 0.659   | 0.72 to 1.67|
| Western                             | 1.15  | 0.24      | 0.67  | 0.505   | 0.76 to 1.74|
| **Sex**                             |       |           |       |         |             |
| Men Reference                       |       |           |       |         |             |
| Women                               | 0.90  | 0.11      | −0.89 | 0.376   | 0.71 to 1.14|
| **Age (years)**                     |       |           |       |         |             |
| <50 Reference                       |       |           |       |         |             |
| 50–60                               | 1.48  | 0.22      | 2.65  | 0.008   | 1.11 to 1.98|
| 60–70                               | 1.91  | 0.29      | 4.29  | 0.000   | 1.42 to 2.56|
| ≥70                                 | 1.73  | 0.34      | 2.75  | 0.006   | 1.17 to 2.55|
| **Marital status**                  |       |           |       |         |             |
| Married or partnered Reference      |       |           |       |         |             |
| Other                               | 0.94  | 0.16      | −0.34 | 0.737   | 0.68 to 1.32|
| **Education**                       |       |           |       |         |             |
| Less than lower secondary Reference |       |           |       |         |             |
| Upper secondary and vocational train| 0.94  | 0.16      | −0.37 | 0.714   | 0.67 to 1.31|
| Tertiary                            | 1.47  | 0.48      | 1.18  | 0.236   | 0.78 to 2.79|
| **Employed**                        |       |           |       |         |             |
| No Reference                        |       |           |       |         |             |
| Yes                                 | 1.43  | 0.32      | 1.61  | 0.108   | 0.92 to 2.23|
| **BMI (kg/m²)**                     |       |           |       |         |             |
| 18.5–23.9 Reference                 |       |           |       |         |             |
| <18.5                               | 1.075 | 0.328     | 0.240 | 0.812   | 0.592 to 1.954|
| 24–24.9                             | 1.648 | 0.255     | 3.230 | 0.001   | 1.218 to 2.232|
| ≥25                                 | 3.625 | 0.453     | 10.310| 0.000   | 2.838 to 4.632|
| **Smoking**                         |       |           |       |         |             |
| Never Reference                     |       |           |       |         |             |
| <20                                 | 0.93  | 0.17      | −0.42 | 0.678   | 0.65 to 1.32|
| ≥20                                 | 0.95  | 0.15      | −0.33 | 0.743   | 0.70 to 1.30|
| **Alcohol consumption**             |       |           |       |         |             |
| None Reference                      |       |           |       |         |             |
| Less than once per day              | 0.68  | 0.09      | −3.05 | 0.002   | 0.53 to 0.87|
| Once per day                        | 0.63  | 0.13      | −2.19 | 0.028   | 0.42 to 0.95|
| Twice per day                       | 0.60  | 0.17      | −1.75 | 0.080   | 0.34 to 1.06|
| More than twice per day             | 0.47  | 0.27      | −1.30 | 0.195   | 0.15 to 1.47|

BMI, body mass index; SHR, sub-HR.
Here, age was significantly associated with the onset of diabetes, which is consistent with the findings of other similar studies.\(^3\)\(^4\)\(^5\) The ageing transition in China may intensify this situation.\(^6\)\(^7\) Individuals in China are experiencing extended life expectancies with relatively unhealthy ageing.

Our results showed that obesity was associated with more than three times the risk of developing diabetes, which is consistent with previous findings.\(^8\)\(^9\)\(^10\) According to a series of national surveys, the proportion of obese adults in China increased from 8.6% in 2000 to 12.2% in 2010 and to 12.9% in 2014,\(^11\) which may be contributing to the increasing incidence of diabetes.

Moreover, we found an association between alcohol consumption and the incidence of diabetes. A high alcohol intake may increase the risk of diabetes while also affecting triglyceride metabolism.\(^12\)\(^13\)\(^14\) No statistically significant association was found between smoking and diabetes incidence, which is consistent with the finding of Le Boudec \textit{et al.}\(^15\) The effect of smoking on the development of diabetes is unclear and seems to vary across the life course.

This study also has the following limitations. First, we adopted both self-reported health and objective outcomes by assessing medication use, which reduced recall bias and under-reporting. However, the Chinese Thyroid disorders, Iodine status and Diabetes Epidemiological Survey (TIDE Study) had shown that the prevalence of self-reported diabetes was 6.0%, while the prevalence of diabetes based on fasting plasma glucose \(\geq 7\) mmol/L, 2-hour plasma glucose \(\geq 11.1\) mmol/L or HbA1c (hemoglobin A1C) \(\geq 6.5\) was 12.8%.\(^16\) Given the importance of blood testing for patients with diabetes in countries conducting national public health studies, this should not be overlooked in policymaking. Second, there are many factors, such as the type of diabetes, female menopause, waist circumference, dyslipidaemia or environment, which were not fully included. We did not distinguish between type 1 and 2 diabetes, and although type 1 is most prevalent among adolescents, it still has some impact on an older population. The analysis by sex (online supplemental table 3) may represent the effects of menstruation. Even though there are still many factors that have not been analysed, we plan to gather a larger dataset, including more variables for analysis, in the future. Third, considering that the highest incidence of diabetes has been reported in those aged 35–45 years,\(^17\) the fact that we used data from individuals aged \(\geq 45\) years might undermine the representation of our findings.

The increasing incidence of diabetes emphasises the role of early prevention, education, detection and management of diabetes. Public health and lifestyle interventions targeting high-risk groups, such as older adults and drinkers, are promising tools.

**CONCLUSION**

The incidence of diabetes increased during the study period. There were no significant differences in this incidence between Northeastern, Eastern, Central and Western China. However, the risk of incident diabetes increased with age, obesity and alcohol consumption. The increasing trend in the incidence of diabetes requires more attention, with a focus on health education and promotion among individuals with the greatest risk.

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