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# PREVALENCE of DIABETIC NEPHROPATHY in LANKARAN-ASTARA ECONOMIC REGION

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**ABSTRACT**

Diabetic nephropathy (DN) is an important cause of end-stage renal disease and is recognized as a public health problem worldwide. However, there have been no nationwide surveys of DN prevalence in China. This study is aimed at estimating the pooled prevalence of DN among patients with type 2 diabetes in China. Published studies on the prevalence of DN among patients with type 2 diabetes published from January 1980 to October 2019 were systematically reviewed using PubMed, Embase, Google Scholar, Chinese Wanfang databases, and Chinese National Knowledge Infrastructure. The pooled prevalence of DN was estimated with the random effects model using R software. Prevalence estimates were also stratified by study design, methodological approach, and study population characteristics. Thirty studies with a total of 79,364 participants were included in our study. The overall pooled prevalence of DN was 21.8% [95% confidence interval (CI): 18.5-25.4%]. Subgroup analysis found that the prevalence of DN varied significantly according to different DM and DN diagnostic criteria (P < 0:05); the pooling estimate was the highest in the west region of 41.3%, followed by that in the east region of China with 22.3%, northeast region with 20.7%, and central region with 15.6% (P < 0:05), and was higher in the maledominated studies 27.7%, compared with the female-dominated studies 17.6% (P < 0:05). The prevalence of DN is high in Chinese patients with type 2 diabetes and shows geographic and gender variation. These data indicate that national strategies aimed at primary and secondary prevention of DN and screening programs for DN are urgently needed to reduce the risk and burden of DN in China.



## 1. Introduction

Diabetes mellitus (DM) is a worldwide public health challenge. WHO estimated that there were around 422 million people living with diabetes and that there was a rising trend in the number of people living with DM [1]. Among these people, type 2 diabetes (T2DM) accounts for over 90% of all persons with diabetes [2]. Diabetic nephropathy (DN) is frequently associated with T2DM and the leading cause of chronic kidney disease and end-stage renal disease [3]. Importantly, with the increasing incidence of T2DM, the frequency

of DN has also increased [4]. Examining the prevalence and influencing factors of DN in patients with T2DM is, therefore, an important first step in understanding the disease burden and developing additional research priorities as well. In China, with the rapid economic growth and urbanization, lifestyle changed significantly. At the same time, the prevalence of T2DM has been increasing dramatically. IDF Diabetes Atlas estimated that in 2017, the prevalence of diabetes was 10.9%, and it estimated that there were 114 million people living with diabetes and 61 million people with undiagnosed diabetes [5]. Besides, the national survey in China also showed that a large proportion of diabetes was undiagnosed and that patients with newly diagnosed diabetes accounted for 60% of the total diabetic population [6]. Consequently, it is striking that DN among those with T2DM has become one of the most important public health crises in China, and there is an urgent need to assess the epidemiological characteristics and risk factors of DN in T2DM in China to implement effective interventions. Although the DN epidemic in China is striking [5], the prevalence and risk factors of DN among Chinese patients with T2DM have not been systematically studied nationwide, and the variation of DN prevalence in T2DM in China also has not yet been reported, which limits the ability to realize its severity and characteristics. Therefore, we conducted a meta-analysis of studies on DN to determine the national prevalence of DN and its variation in patients with T2DM in China.

## 2. Materials and Methods

### *2.1 Literature Search*

This meta-analysis was conducted according to the PRISMA guideline. The PubMed, Embase, Google Scholar, Chinese Wanfang databases, and Chinese National Knowledge Infrastructure (CNKI) were searched. We used the following search terms: (“nephropathy” OR “kidney diseases”) AND (“diabetes mellitus” OR “diabetes” OR “mellitus”) AND (“epidemiology” OR “prevalence”). We searched for studies published from January 1980 to October 2019 to identify relevant articles. The literature was limited to those published in Chinese and English as both reviewers are fluent in these languages.

### *2.2 Study Selection and Data Extraction*

Diabetes is a disease that blood glucose levels rise higher than normal and for extended periods. T2DM is the most common form of diabetes [7]. DN is a syndrome characterized by the presence of pathological levels of urinary albumin excretion, diabetic glomerular lesions, and loss of glomerular filtration rate (GFR) in diabetics [8]. In this meta-analysis, the definition and diagnostic criteria of this study were all taken from the included articles. We used the following inclusion and exclusion criteria. Studies were included in our meta-analysis if (1) included Chinese participants and (2) reported quantitative data regarding DN prevalence. Studies were excluded if (1) duplicated reports; (2) included patients with type 1 diabetes or other special populations, such as pregnant women; and (3) were studies that were qualitative or postintervention or included special professional people, such as doctors. When additional data were needed, we attempted to contact the authors to obtain relevant data. Two investigators (KY and XXZ) independently reviewed the search results and selected articles to determine eligibility and to extract study data. Disagreements of data extraction among two reviewers were reconciled by discussion. Standardized Excel spreadsheet abstraction forms were designed to capture all relevant information required for analyses, including first author, date of publication, diagnosis standard for DN, diagnosis standard for DM, study location, population source, urban/rural, age of subjects, BMI, sex, duration of DM (years), systolic pressure, diastolic pressure, number of patients with DM and DN, and quality score.

### *2.3 Quality Assessment*

Methodological quality assessments were conducted using the Strengthening the Reporting of

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Observational Studies in Epidemiology (STROBE) checklist of observational studies [9]. Two authors (KY and XXZ) evaluated each article's quality based on the checklist, and discrepancies were addressed by discussion. Each of the items was categorized as yes (1 score) or no (0 score) to denote whether the study fulfillment of corresponding criteria. If an item was not applicable for that study design, it was scored as "not applicable" (NA). The methodological quality score of studies was grouped according to the mean of the total scores into lower than 20 points or equal or higher than 20 points for quality analysis. 2.4. Statistical Analyses. The pooled prevalence of DN was calculated using the inverse variance method, as previously described. Briefly, if the tests met the hypothesis of homogeneity, fixed effects models were used; otherwise, random effects models were used [10]. Heterogeneity across the included studies was analyzed using the Q test and the I 2 index (values of 25%, 50%, and 75% are taken as low, medium, and high heterogeneity, respectively). Subgroup analyses were performed by the study year, diagnostic criteria for DN and DM, geographical areas, population source, sample size, age, BMI, sex, DM duration, study quality score, and blood pressure to explore the influence of potential heterogeneity factors on the pooling estimation. The geographic areas are divided according to the standard of the geographical division of China [11].

## 3. Results

### *3.1 Identification and Selection of Eligible Studies*

A total of 7161 citations were retrieved in the literature search. Of these, 7075 were excluded after screening titles and abstracts, and 86 were selected for further evaluation. Finally, 30 articles that provided the rates of DN in adults with T2DM were included in this review (Figure 1). A descriptive summary of the included studies is provided in Table 1. The included studies were conducted between 1991 and 2017 across 13 provinces/cities in China. All the included studies were cross-sectional studies. The sample size ranged from 46 to 31,574. Of the included studies, three were from the central region of China, nineteen from the east region, three from the northeast region, two from the west region, and two from Hong Kong. The study populations were from two different sources: five studies were community-based, whereas twenty-five were hospitalbased. The mean participant age was 59.3 years, and the mean course of DM was 7.7 years.

### *3.2 Estimated Pooled Prevalence of DN in Chinese Adults with Type 2 Diabetes*

A total of 30 studies, including 79,364 adults with T2DM, were evaluated. Substantial heterogeneity across the included studies was observed.

## 4. Discussion

To the best of our knowledge, the present study is the first meta-analysis to estimate the pooled prevalence of DN in people with T2DM in China, which included 30 studies with 79,364 patients with T2DM. The pooled prevalence of DN showed that nearly one-fifth of patients with diabetes might have nephropathy complications. The detailed estimates in this study showed that diabetes complicated with nephropathy is a serious public health challenge for the health care system and may result in a large social and economic burden in China. Our findings could help in relevant policy-making and planning and allocation of health care resources. The pooled DN prevalence in our study was in agreement with a German study (20–30%), but slightly lower than what was found in a cross-sectional population-based study among urban T2DM patients in south India (26.1%). However, the DN prevalence in our study was higher than that reported by a Saudi national diabetes registry-based study (10.8%). These phenomena may be explained by racial or ethnic differences in the prevalence of DN. In China, the pandemic of DM, predominantly T2DM, is alarming [5]. Considering the delayed diagnosis of diabetes in China, DN would be an important social and economic burden. It should be paid more attention to develop mandatory measures for early detection and

prevention. Several studies have proven that diet and exercise interventions seem to be effective methods for risk reduction for metabolic disorders. Early health screening, health education, and combination lifestyle therapies should be implemented in the high-risk population to reduce the disease burden for both individuals and society.

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