Characteristics of Patients Initializing Peritoneal Dialysis Treatment From 2007 to 2014
Analysis From Henan Peritoneal Dialysis Registry data

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Introduction. This study aimed to assess the number and profiles of patients initializing peritoneal dialysis form the Henan Peritoneal Dialysis Registry, a provincial database in central China.
Materials and Methods. All patients aged 18 years and greater, initializing peritoneal dialysis within the province during 2007 to 2014 were included. Demographic characteristics were collected and clinical parameters included the type of renal diagnosis (primary glomerular, secondary glomerular, and others) and recorded major comorbidities in the neural, cardiovascular, respiratory, gastrointestinal, and endocrine systems. Laboratory measurements at treatment including blood urea nitrogen and creatinine were also determined. Differences, as a temporal trend over the period, were analyzed using a nonparametric test for trend across ordered groups.
Results. A total of 2540 patients were included. The number of patients increased rapidly by 8-fold from 2007 (n = 70) to 2014 (n = 592). Overall, 40% were 55 years and older, and 60% were females. Forty-five percent of the patients were diagnosed with primary glomerular disease; 40%, secondary glomerular disease; and 15%, other kidney diseases. Half of the patients had comorbid conditions in cardiovascular system, followed by conditions in of the endocrine (15%) and neural (5%) systems. Over the study period, trends were in favor of more proportions of younger patients, female patients, and patients with secondary glomerular disease.
Conclusions. Peritoneal dialysis care increased rapidly in central region of China, with more younger and female patients over the study period.

INTRODUCTION

The Chronic kidney disease has become an important public health issue worldwide and the mortality in patients with end-stage renal disease (ESRD) is more than 10-fold greater than general population worldwide, and even worse in the developing countries.[1]

The national survey in China estimated that about 120 million Chinese adults aged more than 18 years had chronic kidney disease, and at some time point of their life, the dialysis might be needed.[2] In China, the population size of patients receiving dialysis increased rapidly over the past 2 decades;, only 41 755 patients were receiving dialysis by 1999, as compared with 102 863 patients by 2008, and 258 000 patients by 2012.[3,4] Although the patients

receiving hemodialysis incorporates the majority of patients receiving dialysis care, in recent years, peritoneal dialysis (PD) utilization increased even faster, as estimated more than 40 000 patients by 2012.[3] However, more PD facilities and trained nephrologists were located in the coastal regions and the capital of China, and provided PD care mainly to urban population.[5] In the central China, where the majority of its population remained in rural area, the number and profile of patients receiving peritoneal care have not been well known.

The new rural cooperative medical insurance scheme in China was introduced in 2003 and started to sufficiently cover rural population in Henan province since 2008,[6] which facilitated PD as an affordable treatment option for rural patients. Henan is the third largest province in China regarding to the size of population (94 million people; female, 49.5%; China Census 2010),[7] with 60% of its population living in rural area, a representative region for the central China. The objective of the current study was to assess the number and profile of the whole provincially corded patients initializing PD care in Henan from 2007 to 2014.

MATERIALS AND METHODS
Data Source

The Henan Peritoneal Dialysis Registry (HPDR) is operated under the auspices of the Department of Nephrology, the First Affiliated Hospital of Zhengzhou University and provides independent audit and analysis of renal care in Henan, China. Information was prospectively collected electronically from all renal units across Henan province. Data received at HPDR are subjected to algorithm which identifies suspicious values. If suspicious data is caught further verification will be carried out manually by contacting the relevant renal unit, and any correction will be made wherever necessary. The registration officially launched in 2007 and in this analysis all patients aged more than 18 years and initializing PD within the province between 2007 and 2014 were included. The data for hemodialysis was not included in the current study.

Measurements

Sex and age (grouped into 5 categories of < 35, 35 to 44, 45 to 54, 55 to 64, and ≥ 65 years old)

and body mass index (BMI, kg/m^2) at the first time of PD treatment were collected as demographic characteristics. Clinical parameters included type of diagnosed kidney disease (ie, primary glomerular disease, secondary glomerular disease, other kidney diseases) and recorded major comorbid conditions in neural, cardiovascular, respiratory, gastrointestinal, and endocrine systems. Laboratory measurements were those collected during the episode of PD treatment at clinics using standard methods. Blood urea nitrogen (mmol/L) and creatinine (μmol/L) were included.

Ethics and Consent

Ethics approval was granted by the Clinical Research Ethics Committee of the First Affiliated Hospital of Zhengzhou University. Written informed consent was obtained from all participants at registration.

Statistical Analysis

The demographic, clinical, and laboratory characteristics of the patients initializing PD were described as a whole and by each calendar year using standard descriptive statistics. Difference as a temporal trend over the study period (2007 to 2014) was analyzed by a nonparametric test for trend across ordered groups, an extension of the Wilcoxon rank-sum test.[8] There was missing data on measurements of BMI, blood urea nitrogen, and creatinine. The demographics (age and sex) in patients with complete and incomplete data were compared using the Chi-squared test. The statistical significant level was set at a *P* value less than .05, two tailed. All statistical analyses were carried out using the Stata (version 14.0, StataCorp LP, College Station, TX, USA). Graphics were produced using the Microsoft Excel 2010.

RESULTS

In total, 2540 patients were recorded. The number of patients initializing PD increased rapidly from 2007 to 2012 (an approximate 8-fold increase), and then remained approximately stable during the recent years (Table 1). Collected demographic, clinical, and laboratory parameters in all patients between 2007 and 2014 are summarized in Table 2. Approximately 40% of the patients were 55 years old and over, and 60% were females. Forty-five percent of the patients were diagnosed with primary

Table 1. Number of Patients Initializing Peritoneal Dialysis by Calendar Year

Study Year	Number of Patients
2007	70
2008	84
2009	150
2010	146
2011	353
2012	549
2013	596
2014	592

Table 2. Characteristics of All Patients Initialising Peritoneal Dialysis*

Characteristic	Value
Demographic	
Number of patients	2540
Age, y	
< 35	371 (14.6)
35 to 44	518 (20.4)
45 to 54	641 (25.2)
55 to 64	567 (22.3)
≥ 65	443 (17.4)
Females	1491 (58.7)
Body mass index, kg/m^2	23.0 (21.0 to 25.0)[†]
Clinical	
Diagnosis	
Primary glomerular disease	1132 (44.6)
Secondary glomerular disease	1013 (39.9)
Other renal disease	395 (15.5)
Comorbidity in neural system	130 (5.1)
Comorbidity in cardiovascular system	1260 (49.6)
Comorbidity in respiratory system	61 (2.4)
Comorbidity in gastrointestinal system	100 (3.9)
Comorbidity in endocrine system	391 (15.4)
Laboratory	
Median blood urea nitrogen, mmol/L	21.9 (17.7 to 26.5)[†]
Median serum creatinine, μmol/L	871.0 (668.1 to 1085.0)[†]

*Values are frequencies (percentage) or median (interquartile range).
[†]Body mass index on 1447 patients (57.0%); blood urea nitrogen on 1440 patients (55.1%); and serum creatinine on 1402 patients (55.2%).

glomerular disease; 40%, secondary glomerular disease; and the remaining 15%, as other kidney diseases. Half of the patients had comorbid conditions related to the cardiovascular system, followed by comorbidities in the endocrine (15%) and neural (5%) systems.

By calendar year, more proportion of the patients aged less than 35 years old (from 5.7% in 2007 to 16.7% in 2014) and less proportion aged 65 years and greater (from 28.5% in 2007 to 16.2% in 2014) were observed, showing a decreasing trend in patients' age over the study period (*P* = .004; Figure 1). In 2007, 45.7% of the patients were females, while this increased to 62.2% in 2014 (*P* = .001; Figure 1). No difference was observed in BMI (Figure 1).

The percentage of patients diagnosed with different kidney diseases, stratified by calendar year is shown in Figure 2. Except for the data in 2007, during the earlier years (2008 to 2011), there was a higher proportion of patients with a primary glomerular disease compared to the proportion with a secondary glomerular disease. However, the difference became smaller as the time went ahead. In the recent years (2012 to 2014), primary and secondary glomerular diseases contributed approximately equally (each about 40%) to the patient population. During all the study years, testing for trend suggested an increased contribution from secondary glomerular disease (*P* < .001). The record of major comorbid conditions stratified by calendar year is presented in Figure 3.

The assessment of levels of blood urea nitrogen and creatinine demonstrated no significant difference over the study period (Figure 4). The age and sex in the patients with complete and incomplete data were shown in Table 3. No significant difference was found in the demographics between the two groups.

DISCUSSION

To our knowledge, this is the first study that investigated the number and profile of patients initializing PD care in a central region of China where rural residents contribute to the majority of population and during the years when the new rural cooperative medical insurance scheme was introduced.

The results show that patients initializing PD increased rapidly from 2007 to 2014, according to the provincial registration database of Henan. Higher proportion of younger and female patients was observed in the recent years, compared to that in the earlier period. Secondary glomerular disease was shown to become a more important disease for which patients initializing PD treatment over the study period in contrast with primary glomerular disease, despite of the rapidly increasing number of PD care for both diseases. However, the reason behind such changes remains to be investigated. Some laboratory markers measuring kidney

Figure 1. Patient demographics (age, sex, and body mass index) by calendar year (2007 to 2014).
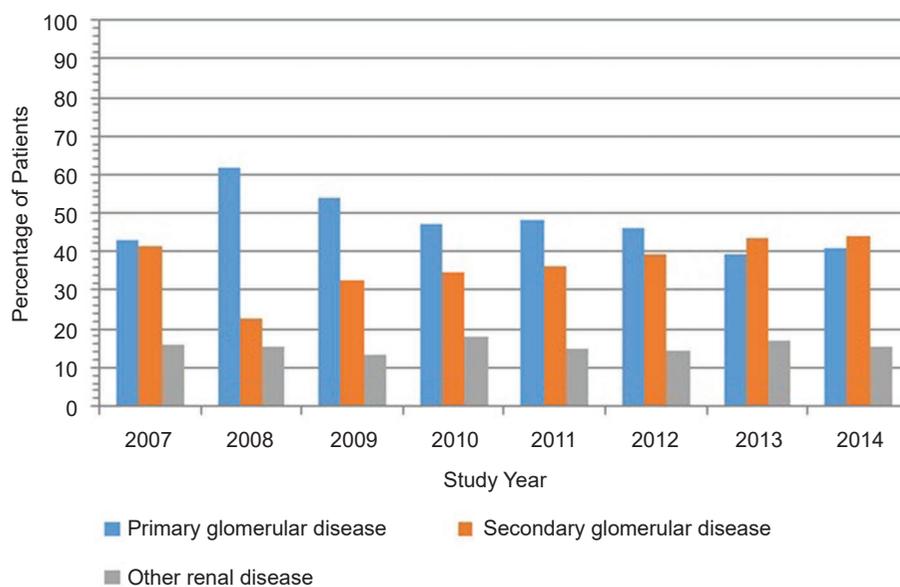
Figure 2. Percentage of patients diagnosed with primary glomerular, secondary glomerular, and other renal diseases by calendar year (2007 to 2014).
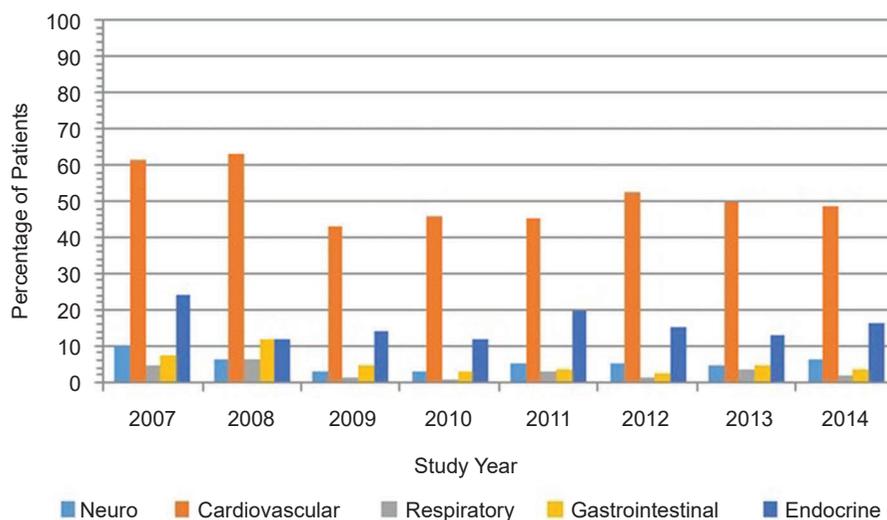
Figure 3. Percentage of patients identified with comorbid conditions in major systems by calendar year (2007 to 2014).

function, which included blood urea nitrogen and creatinine, suggest that patients' kidney function at the baseline of receiving PD care did not differ over the study period.

Although no trend data on the prevalence of chronic kidney disease over the relevant years was reported in China, several studies in other countries showed a stable trend.[9,10] According to a population-based screening study on residents over 40 years old in Henan province in 2010, approximately 10.5% of the subjects had an indicator of kidney damage.[12] There was therefore a large size of potential patients who needed dialysis in

Henan. In the current study, an 8-fold increase in the number of patients starting PD care was seen from 2007 to 2014. The beginning point coincided with the start of sufficient coverage of medical insurance under the new rural cooperative scheme, suggesting this increasing trend may be driven by financial affordability rather than disease burden. Improved family income might also contribute to the increasing trend. However, no information was available from HPDR. It was reported that 16% of Chinese patients withdrew from dialysis due to financial stress in 1999.[3] Our study implied somehow there might be some proportion of patients
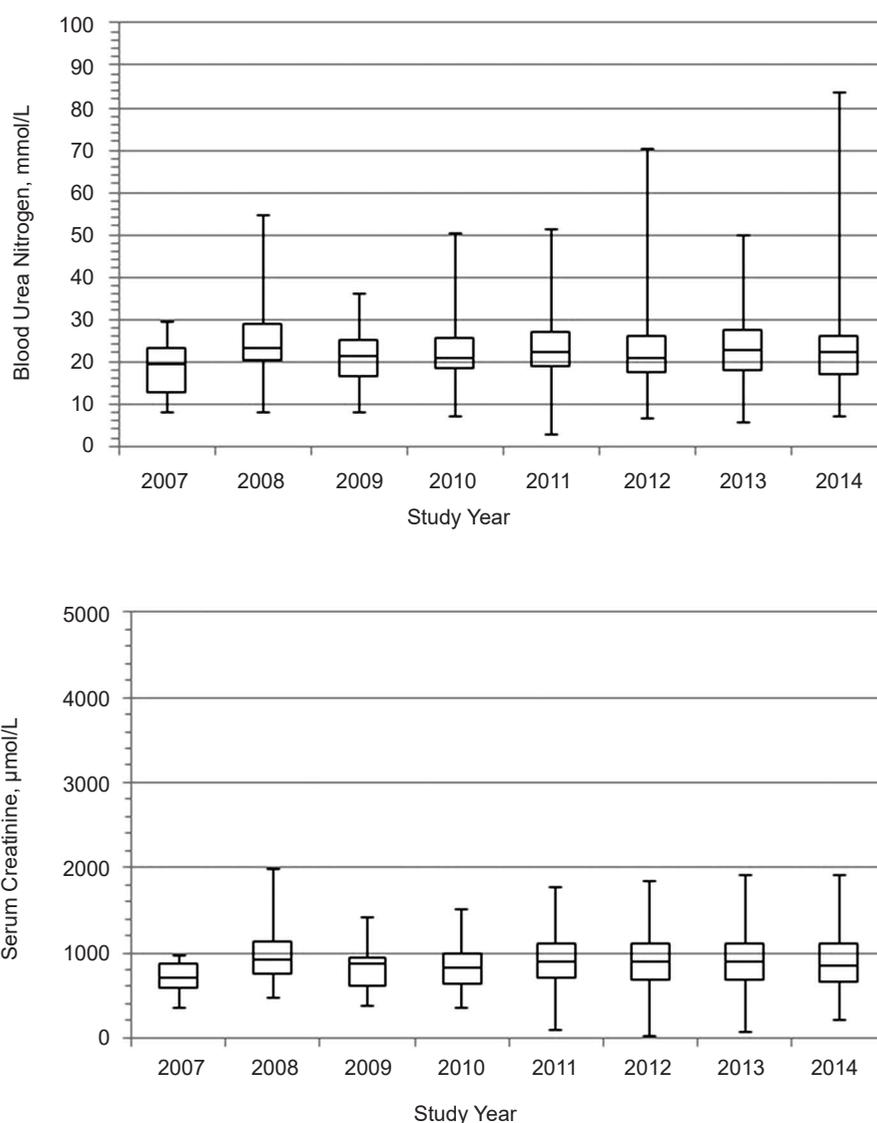
Figure 4. Laboratory measurement (blood urea nitrogen and creatinine) of patients initializing peritoneal dialysis by calendar year (2007 to 2014).

Table 3. Age and Sex Distributions in Patients With Complete and Incomplete Data

Characteristics	Patients With Complete Data (n = 1387)	Patients With Incomplete Data (n = 1153)	P
Age, y			
< 35	219 (15.8)	152 (13.2)	
35 to 44	281 (20.3)	237 (20.6)	
45 to 54	355 (25.6)	286 (24.8)	
55 to 64	303 (21.9)	264 (22.9)	
≥ 65	229 (16.5)	214 (18.6)	> .05
Females	811 (58.5)	680 (59.0)	> .05

decided not to receive dialysis treatment due to financial burden. However, data for hemodialysis was not included in the current study.

Long-term dialysis is life-saving for patients with end stage renal disease.[12] Those residing within the east and large city centers have greater access to affordable healthcare, while those living within the remote areas tend to be less able to afford or access chronic dialysis or healthcare. Although it has been largely improved during the last decade, greater effort is required to support to deliver sustainable PD care to uremic patients living in rural China.

There were several limitations in our study. First, although the majority of population in Henan is rural residents, the actual background (ie, rural or urban) of patients in the current study was not assessed. Second, residents in Henan may receive

PD care in other provinces. However, due to the restricted term on the medical insurance scheme (ie, insurance coverage only applies to the cost spent within the province), only a very small proportion if not none is expected. Third, although the clinical measurements were validated by the algorithm, the report of comorbid condition from renal clinics was not further validated by the registration center. Fourth, it cannot be ruled out that the quality of recording in HPDR went better along with the time, so the data might be biased by this possibility. Fifth, there was missing information on clinical measurements such as BMI and urea nitrogen. As the demographical characteristics were comparable between the patients with and without complete records, the findings would less likely to be removed by missing information. Sixth, although the current study used data from a large province in China, the observation was based on the relatively small number of patients each year specifically in the earlier years.

CONCLUSIONS

Peritoneal dialysis care increased rapidly in central region of China recently, where rural residents constituted the majority of population.

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CONFLICT OF INTEREST

None declared.

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