Research article

Characteristics of need and availability of renal replacement therapy for patients with chronic kidney disease in Azerbaijan

Babayev Fariz Hanifa[1], Karataev Madamin Musaevich[2], Tugolbai Tagaev[2], Yethindra Vityala[3]

[1]Director of the Republican Clinical Urological Hospital named after Academician M. D. Javad-Zadeh, Baku, Azerbaijan
[2]Department of Public Health and Health Care, I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan
[3]Department of Pathology, International Higher School of Medicine, International University of Kyrgyzstan, Bishkek, Kyrgyzstan

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Corresponding author: **Yethindra Vityala.** email: yethindravityala10@gmail.com

ABSTRACT

Introduction and Aim: In recent years, there has been an increase in the number of patients with renal pathology in most of the cases without severe symptoms and with significant changes in kidney function, when there is a need for renal replacement therapy (RRT). The objective is to analyze the need and availability of renal replacement therapy in patients with chronic kidney disease.

Materials and Methods: Statistical data from the State Statistical Committee of the Republic of Azerbaijan, and Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh were used. The dialysis centers and the average load per center in Azerbaijan for the period from 2014-2019 are analyzed.

Results: The provision of dialysis machines in Azerbaijan is 7.1%, in economic regions it is on average 7.7%. The highest provision is in the Nakhichevan (10.9%), Ganja-Gazakh (10.1%), and Apsheron (8.9%) economic regions. In the Republican Clinical Urological Hospital named after Academician M. Javad-zade, the need for hemodialysis centers exceeds by 31.6%.

Conclusion: With an increase in the number of dialysis machines, there is an increase in the average load per dialysis center. In the economic regions of the republic, the actual number of hemodialysis machines the need meets the standard (>50%).

Keywords: Chronic kidney disease; renal replacement therapy; dialysis; dialysis centers; dialysis machines.

INTRODUCTION

In recent years, there has been an increase in the number of patients with renal pathology in most of the cases without severe symptoms and with significant changes in kidney function, when there is a need for permanent renal replacement therapy (RRT; 1-6). By 2040, chronic kidney disease (CKD) will be the fifth leading cause of shortened life expectancy worldwide (7). Moreover, CKD is a major contributor to catastrophic healthcare costs. In high-income countries, dialysis and transplant costs account for up to 3% of the annual healthcare budget (8, 9). In this study, we determined the availability of dialysis machines, the need for dialysis centers, and the actual number of needs by economic regions of Azerbaijan for 2019. The objective of this study is to analyze the need and availability of RRT in patients with CKD.

MATERIALS AND METHODS

Statistical data from the State Statistical Committee of the Republic of Azerbaijan (10), and the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh were used. The dialysis centers and the average load per center in Azerbaijan for the period from 2014-2019 are analyzed. The availability of dialysis machines, the need for dialysis centers, and the actual number of the need for the economic regions of Azerbaijan for 2019 were determined.

The need of patients with CKD in dialysis centers is calculated according to the formula (11).

$$P = \frac{(\mathrm{K} + \mathrm{LO}) \times 3 \times 52}{800}$$

where in the economic regions of Azerbaijan;
P = need for dialysis centers,
K = number of patients with CKD,
LO = number of patients on the waiting list,
3 = optimal multiplicity of hemodialysis procedures per 1 patient per week,
52 = number of weeks per year,
800 = close to the maximum limit of the rate of use of 1 artificial kidney device per year in units of hemodialysis procedures (12).

The obtained data are presented as the mean ± standard deviation. The calculation of the intensive and extensive indicator, the visibility indicator, and the average value was carried out. For categorical variables correlation analysis between the compared indicators was determined by calculating the Pearson's linear correlation coefficient (rxy), the coefficient of determination (R, %).

RESULTS

We have analyzed the number of hemodialysis sessions per day and the average load per dialysis center in Azerbaijan as a whole and the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh based on 6 sessions per day on one device for the period from 2014- 2019 (Table 1).

Table 1: Dialysis centers and average load per center in Azerbaijan for the period from 2014–2019

	Name	**Years**					
		2014	**2015**	**2016**	**2017**	**2018**	**2019**
Azerbaijan							
1	Number of dialysis machines	445	516	604	682	693	716
2	Number of dialysis sessions per day at 6 sessions per day on one machine	2670	3090	3624	4092	4158	4296
3	Number of dialysis sessions per day at 6 sessions per machine per year	971880	1124760	1319136	1489488	1513512	1563744
4	Number of sessions per year	352416	371664	421436	497304	512671	534878
5	Specific weight of sessions	36.2	33.0	31.9	33.4	33.8	34.2
6	Average load per dialysis site at 6 sessions per day per apparatus (number of actual patients per 6 sessions)	417.3	495.5	558.3	635.6	654.5	684.3
Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh							
1	Number of dialysis machines	10					
2	Number of dialysis sessions per day at 6 sessions per day on one machine	60					
3	Number of dialysis sessions per day at 6 sessions per machine per year	21840					
4	Number of sessions per year	4981	5047	5649	6033	6673	6712
5	Specific weight of sessions	22.8	23.0	25.8	27.6	30.5	30.7
6	Average load per dialysis site at 6 sessions per day per apparatus (number of actual patients per 6 sessions)	5.8	6.1	6.3	6.6	6.8	6.5

In the republic, the proportion of hemodialysis sessions performed from possible ones (at the rate of 6 sessions on one device per day) was 36.2% in 2014 (352416), 33.0% in 2015 (371664), 31.9% in 2016 (421436), 33.4% in 2017 (497304), 33.8% in 2018 (512671), and 34.2% in 2019 (534878).

During the calculation of six sessions on one device, the average load per dialysis center from the number of sessions per year was 417.3 sessions in 2014, 495.5 sessions in 2015, 558.3 sessions in 2016, 635.6 sessions in 2017, 654.5 sessions in 2018, and 684.3 sessions in 2019.

A direct strong correlation was revealed between the number of devices and the average load per dialysis center (rxy=+0.8). The greater the number of dialysis machines, the greater the average load per dialysis center. The share of influence was 68.9% (R is the coefficient of determination).

Thus, with an increase in the number of dialysis machines, there is an increase in the average load per dialysis place. In 2019, the average load increased by 164.0% compared to 2014 in terms of visibility. At the same time, the proportion of sessions conducted from the number of possible ones is on average a third (M=33.7%).

In the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh, during the calculation of six sessions per day on one device from 2014–2019, the number of possible hemodialysis sessions per day was 60, and per year was 21,840. The proportion of hemodialysis sessions from the number of possible (at the rate of 6 sessions on one device per day) was 22.8% in 2014 (4981), 23.0% in 2015 (5047), 25.8% in 2016 (5649), 27.6% in 2017 (6033), 30.5% in 2018 (6673), and 30.7% 2019 (6712).

During the calculation of six sessions on one device, the average load per dialysis center out of the number of sessions per year was 5.8 sessions in 2014, 6.1 sessions in 2015, 6.3 sessions in 2016, 6.6 sessions in 2017, 6.8 sessions in 2018, 6.5 sessions in 2019. A direct average correlation was found between the number of devices and the average load per dialysis center (rxy=+0.5). With a stable number of dialysis machines, the average load per dialysis place increases slightly. The share of influence was 25.0% (R is the coefficient of determination).

Thus, with a stable number of dialysis machines, there is an increase in the average load per dialysis center. In 2019, the average load increased by 112.0% compared to 2014 in terms of visibility. At the same time, the proportion of sessions conducted from the number of possible ones is on average 26.7%.

The availability of dialysis machines, the need for dialysis centers, and the actual number of the need for the economic regions of Azerbaijan for 2019 were determined (Table 2). In general, there are 716 dialysis centers in the republic for 4106 patients with CKD (40.8 ±0.6). The availability of dialysis machines in the republic amounted to 7.1 per 100,000 population. The need for dialysis centers, calculated according to the formula proposed by Apolihin *et al.*,(11), amounted to 800.5 per year, which corresponds to the established regulatory load (800 dialysis per year when working in one shift).

Table 2: Provision of dialysis machines, the need for dialysis centers and the actual number of dialysis centers from the demand in the economic regions of Azerbaijan for 2019

	Economic regions of Azerbaijan	Number population	Number of dialysis centers	Patients with CKD (abs. number)	CKD incidence (P±m)	Security dialysis machines (per 100.000 population)	Need for dialysis centers	Actual number of dialysis centers from requirements (%)
1	Azerbaijan	10067108	716	4106	40.8 ± 0.6	7.1	800.5	89.4
2	Absheron, including Baku	2862336	256	2126	74.2 ± 1.6	8.9	414.5	61.7
3	Ganja-Gazakh	1293712	131	481	37.2 ± 2.8	10.1	93.8	139.6
4	Shaki-Zagatala	622100	42	185	29.7 ± 2.1	6.7	36.0	116.6
5	Lankaran	941320	38	178	18.9 ± 1.4	4.0	34.7	109.5
6	Guba-Khachmaz	550912	36	143	25.9 ± 2.1	6.3	27.9	129.0
7	Shirvan-Aran	2354200	162	881	6.9 ± 0.5	6.9	171.8	94.3
8	Nakhchivan	465612	51	112	24.0 ± 2.2	10.9	21.8	233.9

P±m - intensive indicator and error of representativeness, CKD - chronic kidney disease

The actual number of the need for hemodialysis centers was 89.4%. In the Absheron economic region, including Baku, there is the most number of patients (2126) with CKD (74.2±1.6) and dialysis centers (256). At the same time, the provision is at the level of 8.9 per 100,000 population, the need for dialysis centers is 414.5, and the actual need for hemodialysis centers was 61.7%.

In the Ganja-Gazakh economic region, 131 dialysis centers account for 481 patients with CKD (37.2±2.8). The availability of dialysis machines is 10.1 per 100,000 population with a need of 93.8 and an actual number of 139.6%, which is 39.6% more than the need.

There are 42 dialysis centers for 185 patients (29.7=2.1) in the Shaki-Zagatala economic region. The availability of dialysis machines is 6.7 per 100,000 population with a need of 36.0. The actual number exceeds the need for centers by 16.6% (116.6%).

There are 38 dialysis centers in the Lankaran economic region, 178 patients with CKD (18.9±1.4), the availability of dialysis machines was 4.0 per 100,000 population, the need for dialysis centers was 34.7 and the actual number (109.5%) exceeds the need for hemodialysis centers by 9.5%.

In the Guba-Khachmaz economic region, the number of patients with CKD is 143 (25.9±2.1) with 36 dialysis centers. At the same time, the provision is at the level of 6.3 per 100,000 population, the need for dialysis centers is 27.9 and the need for hemodialysis centers is 129.0%, which exceeds the total need by 29.0%.

In the Shirvan-Aran economic region, there is a significant number of patients (881) with CKD (6,9±0,5) and dialysis centers (162). The availability of dialysis machines in this area is 6.9 per 100,000 population with a need of 171.8 and an actual number of 94.3%.

There are 51 dialysis centers in the Nakhchivan economic region, and the number of patients is 112 (24.0±2.2). There is the highest availability of dialysis machines, which amounted to 10.9 per 100,000 population with a need of 21.8. It should be noted a significant excess of the actual number from the need for centers by 133.9%.

Thus, the availability of dialysis machines in Azerbaijan is 7.1%, and in economic regions an average of 7.7%. The highest provision is in Nakhchivan (10.9%), Ganja-Gazakh (10.1%), and Absheron (8.9%) economic regions. Normally, the actual amount of demand should be more than 50%. In all economic regions, including the republic, the actual amount of demand is more than 50%. In the republic, the need for dialysis centers is 800.5 with the actual use of 89.4%. In the Absheron and Shirvan-Aran economic regions, with a need of 414.5 and 171.8, respectively, there is a shortage of the actual number of dialysis centers by 38.3% and 5.7%, respectively.

In Ganja-Gazakh, Shaki-Zagatala, Lankaran, Guba-Khachmaz, and Nakhchivan economic regions, there is an excess of the actual number of dialysis centers on 39,6%, 16,6%, 9,5%, 29,0%, and 133.9%, respectively.

The excess of the actual availability of dialysis centers in comparison with the need indicates a high availability of hemodialysis machines. At the same time, the absence of patients waiting for dialysis in the republic is of no small importance.

The analysis of the availability of dialysis machines, the need for dialysis centers, and the actual number of dialysis centers from the need in the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh for 2019 was also carried out (Table 3).

Table 3: Provision of dialysis devices, the need for dialysis centers and the actual number of dialysis centers from the need of the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh for the year 2019

	Name	**2019 year**
1	Population	2092000
2	Number of dialysis centers	10
3	Patients with CKD (absolute number)	39
4	Incidence of CKD (P±m)	1.8 ± 0.3
5	Dialysis facilities (per 100,000 population)	0.5
6	Need for dialysis centers	7
7	Actual number of dialysis places per demand (%)	131.6

P±m - intensive indicator and error of representativeness, CKD - chronic kidney disease

In this medical institution, there are 10 dialysis centers for 39 patients with CKD (1.8± 0.3) in 2019. The availability of dialysis machines was 0.5 per 100,000 population. The need for dialysis centers is 7.6, and the actual need for hemodialysis centers is 131.6%, which exceeds the total need by 31.6%. Thus, with the functioning of 10 dialysis machines, the need is 7.6, which exceeds the need by 31.6%.

DISCUSSION

The increase in the number of patients receiving hemodialysis treatment determines the need to study and availability of hemodialysis machines to plan RRT. The remaining availability of hemodialysis indicates the possibility of hemodialysis centers or departments to provide RRT, and not a true need (2). A positive trend is a decrease in the share of constituent entities of the Russian Federation with an extremely low level of RRT (2). In this study, Azerbaijan is characterized by a high supply of hemodialysis machines, the excess of the actual availability of dialysis centers compared to the need.

In general, in the republic and the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh noted an increase in the average load per dialysis place in 2019 by 164.0% and 112.0%, respectively, the average specific weight of the sessions performed from the number of possibilities is 33.7% and 26.7%, respectively. The availability of dialysis machines in Azerbaijan is 7.1%, and in the economic regions of the republic an average of 7.7%. In all economic regions, including the republic, the actual number of dialysis centers they need is >50%. In the Republican Clinical Urological Hospital named after Academician M.J. Javad-Zadeh, the provision of dialysis machines was 0.5 per 100,000 population, the need for dialysis centers is 7.6, and the actual need for hemodialysis centers is 131.6%. In order to assess the provision of patients with CKD with RRT, constant monitoring is necessary to determine the estimated need. In its turn to reduce the number of patients in need of RRT, early detection of CKD, continuity in the work of general practitioners, endocrinologists and cardiologists is necessary.

CONCLUSION

With an increase in the number of dialysis machines, there is an increase in the average load per dialysis center. In the economic regions of the republic, the actual number of hemodialysis machines the need meets the standard (>50%).

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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