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Original Research Article

Are we are equipped to handle an epidemic of chronic kidney diseases?

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ABSTRACT

Background: The utilization pattern under Tamil Nadu state health insurance program, namely The Chief Minister's Comprehensive Health Insurance Scheme (CMCHISTN) reveals that chronic kidney disease (CKD) is one of the high expenditure elements and this study explores need and availability of facilities to handle the CKD in the state. The objectives of the study were to estimate the requirement of renal replacement therapy (RRT) including haemodialysis and renal transplant surgery in the population; to compute the available facility and measure the shortfall if any, so as to create an evidence-based comprehensive strategy to handle CKD in Tamil Nadu.
Methods: Based on the existing data, the estimated prevalence of CKD is calculated and it is matched with a utilization of services under CMCHISTN so as to arrive the requirements and gaps in RRT.
Results: The existing system is able to cover only around 3% of the estimated population needing RRT and projected shortfall is around 68% in HD machines.
Conclusions: The government needs to create RRT facility in the public sector covering both MHD and RT along with the suitable preventive strategy to reduce the risk factors and promote an early screening of diabetes and hypertension.

Keywords: Hemodialysis, Chronic kidney diseases, Chief Minister's comprehensive health insurance scheme

INTRODUCTION

Chronic kidney disease (CKD) is a worldwide public health problem with increasing incidence and prevalence leading to patients with kidney failure requiring replacement therapy, with poor outcomes and high cost.[2] Further, it is essential to understand that, CKD was the cause of 956,000 deaths globally in 2013, up from 409,000 deaths in 1990 and also age-adjusted death rate due to CKD raise from 11.6 in 1990 to 15.8 in 2013 per lakh population.[3] The U.S. Centre for Disease Control and Prevention states that CKD affected an estimated 16.8% of U.S. adults aged 20 years and older in the period from 1999 to 2004.[4] UK estimates suggested that in 2007 8.8% of the population of Great Britain and Northern Ireland had symptomatic CKD.[5]

The rising incidence of chronic kidney disease is likely to impact both healthcare and the economy in future years in India. The overall prevalence of CKD in the SEEK-India study was 17.2% with a prevalence of CKD in stages 1, 2, 3, 4 and 5 was 7%, 4.3%, 4.3%, 0.8% and 0.8%, respectively.[6] Stage 5 CKD is often called end-stage kidney disease, end-stage renal disease, or end-stage kidney failure, and is largely synonymous with the now out-dated terms chronic renal failure or chronic kidney failure; and usually means the patient requires renal replacement therapy (RRT) which may involve a form of dialysis, but also constitutes kidney transplant.

The government of Tamil Nadu, in order to achieve the objective of providing Universal Health Care to the people of Tamil Nadu, issued orders for implementation of health insurance scheme, called Chief Minister's

Comprehensive Health Insurance Scheme (CMCHISTN).[1] The scheme came into effect from 11.1.2012 and covers around 15.6 million families for 1016 procedures covering all the specialities. Though CMCHISTN is not covering the entire state population, it covers roughly about 80% of the families, providing treatment both at government and private health facilities. The scheme provides treatment for most of the secondary and tertiary care problems including CKD with haemodialysis and renal transplant surgery.

CMCHISTN covers majority of population in the state and we can safely conclude that CMCHISTN in a way represents the health utilization pattern in the state. Based on the utilization pattern under CMCHSITN, we are trying to estimate the requirement of renal replacement therapy (RRT) including haemodialysis and renal transplant surgery and also the available facilities in the state.

METHODS

The entire analysis and study was done using the secondary data available from the CMCHISTN claims covering the entire state for the period of 5 years from January 2012-17. The data represent the beneficiaries across all the districts of the state as beneficiaries are allowed to take treatment from any part of the state without any geographical restriction. As per claims data around Rs 213 crores are spent on MHD for the past 5 years and around 4300 patients are treated per year. Based on the existing CKD prevalence rates we estimated the number of persons expected to suffer from CKD and required number of Haemodialysis machines/renal transplants to be done. By analysing the movement of patients from district of origin to another district for treatment we are trying to estimate the district wise requirement of facilities to manage the CKD.

Table 1: Chief Minister's comprehensive health insurance scheme, procedures wise approval amount from 11.01.2012 to 15.01.2017.

S No	Procedure/package name	Amount in Rs/- only
1	TN0002: PTCA with drug eluting stent	2,17,53,97,366
2	TN0702: Maintenance haemodialysis for CRF	2,13,03,97,077
3	TN0371: Total knee replacement	1,73,51,01,350
4	TN0020: Coronary bypass surgery	1,71,86,61,437
5	TN0026: Mitral valve replacement (with valve)	96,25,54,175
6	TN0806: URSL	77,92,14,900
7	TN0372: Total hip replacement	73,15,02,250
8	TN0565: Hearing aid	70,31,91,000
9	TN0266: Radical treatment with photons	62,23,65,221
10	TN0386: Preterm baby/clinical sepsis/ hyperbilirubinemia (non-ventilated)	48,79,05,902

Table 2: Proportion of coverage among estimated CKD stage 5 population for hemodialysis under CMCHISTN.

S No	District name	Beneficiaries enrolled	Total no. of Patients treated so far	Estimated no. of patients treated per year	Expected population of CKD in stage 5 (0.8%)	Proportion of expected population in CKD stage 5 getting treated in %
1	Ariyalur	1,80,593	289	58	1445	4
2	Chennai	6,57,127	1995	399	5257	8
3	Coimbatore	7,03,092	883	177	5625	3
4	Cuddalore	6,05,651	835	167	4845	3
5	Dharmapuri	3,93,575	375	75	3149	2
6	Dindigul	4,73,825	548	110	3791	3
7	Erode	6,22,773	895	179	4982	4
8	Kancheepuram	7,91,711	1397	279	6334	4
9	Kanyakumari	4,45,001	960	192	3560	5
10	Karur	2,97,760	357	71	2382	3
11	Krishnagiri	4,45,558	300	60	3564	2
12	Madurai	6,47,735	1197	239	5182	5
13	Nagapattinam	3,48,336	132	26	2787	1
14	Namakkal	4,07,305	612	122	3258	4
15	Perambalur	1,44,851	321	64	1159	6
16	Pudukottai	4,15,949	309	62	3328	2
17	Ramanathapuram	2,99,580	463	93	2397	4

S No	District name	Beneficiaries enrolled	Total no. of patients treated so far	Estimated no. of patients treated per year	Expected population of CKD in stage 5 (0.8%)	Proportion of expected population in CKD stage 5 getting treated in %
18	Salem	8,25,621	1125	225	6605	3
19	Sivagangai	3,03,995	513	103	2432	4
20	Thanjavur	5,54,343	248	50	4435	1
21	The nilgiris	1,63,592	65	13	1309	1
22	Theni	2,96,375	418	84	2371	4
23	Tiruchirapalli	5,70,309	588	118	4562	3
24	Tirunelveli	6,03,389	888	178	4827	4
25	Tiruppur	5,35,695	379	76	4286	2
26	Tiruvallur	7,50,668	737	147	6005	2
27	Tiruvannamalai	5,26,539	805	161	4212	4
28	Tiruvarur	3,18,334	147	29	2547	1
29	Tuticorin	3,10,108	570	114	2481	5
30	Vellore	8,17,439	996	199	6540	3
31	Villupuram	8,10,323	1119	224	6483	3
32	Virudhunagar	3,96,173	1045	209	3169	7
Total		1,56,63,325	21511	4302	125307	3

Table 3: Projected requirements of hemodialysis (HD) machines based on the estimated CKD stage 5 populations.

S No	District name	Beneficiaries enrolled	Total of HD machines available under CMCHSITN	Expected CKD population in stage 5(0.8%)	Estimated number of HD Machines needed	Projected shortage of HD machines
1	Ariyalur	1,80,593	8	1445	72	89
2	Chennai	6,57,127	168	5257	263	36
3	Coimbatore	7,03,092	283	5625	281	-1
4	Cuddalore	6,05,651	103	4845	242	57
5	Dharmapuri	3,93,575	17	3149	157	89
6	Dindigul	4,73,825	20	3791	190	89
7	Erode	6,22,773	106	4982	249	57
8	Kancheepuram	7,91,711	134	6334	317	58
9	Kanyakumari	4,45,001	85	3560	178	52
10	Karur	2,97,760	21	2382	119	82
11	Krishnagiri	4,45,558	47	3564	178	74
12	Madurai	6,47,735	119	5182	259	54
13	Nagapattinam	3,48,336	2	2787	139	99
14	Namakkal	4,07,305	28	3258	163	83
15	Perambalur	1,44,851	12	1159	58	79
16	Pudukottai	4,15,949	20	3328	166	88
17	Ramanathapuram	2,99,580	4	2397	120	97
18	Salem	8,25,621	12	6605	330	96
19	Sivagangai	3,03,995	203	2432	122	-67
20	Thanjavur	5,54,343	26	4435	222	88
21	The nilgiris	1,63,592	28	1309	65	57
22	Theni	2,96,375	25	2371	119	79
23	Tiruchirapalli	5,70,309	69	4562	228	70
24	Tirunelveli	6,03,389	30	4827	241	88
25	Tiruppur	5,35,695	4	4286	214	98
26	Tiruvallur	7,50,668	47	6005	300	84
27	Tiruvannamalai	5,26,539	50	4212	211	76
28	Tiruvarur	3,18,334	62	2547	127	51
29	Tuticorin	3,10,108	25	2481	124	80

S No	District name	Beneficiaries enrolled	Total of HD machines available under CMCHSITN	Expected CKD population in stage 5(0.8%)	Estimated number of HD Machines needed	Projected shortage of HD machines
30	Vellore	8,17,439	195	6540	327	40
31	Villupuram	8,10,323	29	6483	324	91
32	Virudhunagar	3,96,173	42	3169	158	73
Total		1,56,63,325	2,024	125307	6265	68

Table 4: Migration of benefiaries for haemodialysis under CMCHISTN.

S No	Patient native district	Total no. of patients treated so far under CMCHISTN	Treated in home district hospitals		Treated in other district hospitals	
			Number of beneficiaries	%	Number of beneficiaries	%
1	The Nilgiris	65	0	0	65	100
2	Pudukottai	309	29	9	280	91
3	Nagapattinam	132	23	17	109	83
4	Tiruvarur	147	32	22	115	78
5	Villupuram	1119	338	30	781	70
6	Tiruvallur	737	225	31	512	69
7	Cuddalore	835	267	32	568	68
8	Tuticorin	570	191	34	379	66
9	Dharmapuri	375	163	43	212	57
10	Dindigul	548	241	44	307	56
11	Ariyalur	289	148	51	141	49
12	Tiruppur	379	197	52	182	48
13	Namakkal	612	322	53	290	47
14	Thanjavur	248	131	53	117	47
15	Sivagangai	513	277	54	236	46
16	Tiruvannamalai	805	437	54	368	46
17	Ramanathapuram	463	263	57	200	43
18	Perambalur	321	198	62	123	38
19	Krishnagiri	300	186	62	114	38
20	Chennai	1995	1298	65	697	35
21	Virudhunagar	1045	745	71	300	29
22	Karur	357	256	72	101	28
23	Vellore	996	748	75	248	25
24	Tirunelveli	888	684	77	204	23
25	Tiruchirapalli	588	478	81	110	19
26	Theni	418	345	83	73	17
27	Coimbatore	883	740	84	143	16
28	Kancheepuram	1397	1177	84	220	16
29	Erode	895	761	85	134	15
30	Salem	1125	964	86	161	14
31	Kanyakumari	960	896	93	64	7
32	Madurai	1197	1126	94	71	6
	Grand total	21511	13886	65	7625	35

To start with procedure wise analysis of CMCHISTN performance was done at the end of 5th year of implementation from the claims data available from January 2012-17. The details of top 10 procedures based on utilization, where the maximum claim was paid listed in Table 1.

From the above details, it is clear that non-communicable diseases topping our claims and cost of treating chronic kidney disease (CKD) are the second most common expenditure next to cardiovascular diseases (CVD). Further financial and human suffering due to CKD is not a one-time problem but continues one with increasing trend and needs immediate attention of policy makers for

intervention. We further analysed CMCHISTN data on the basis of the epidemiology of CKD covering, incidence, risk factors, the requirement of renal replacement therapy (RRT), and availability of facility etc. so as to create an evidence to plan for a comprehensive strategy to handle CKD in Tamil Nadu.

Table 5: Estimated need for renal transplant (RT) surgery based on the CMCHISTN utilization report.

S No	District	Total no. of patients treated so far	Estimated no of patients treated per year	Number of RT done under CMCHISTN	Number of RT centers	Estimated persons in need of RT
1	Ariyalur	289	58	8		50
2	Chennai	1995	399	85	12	314
3	Coimbatore	883	177	126	5	51
4	Cuddalore	835	167	20		147
5	Dharmapuri	375	75	30		45
6	Dindigul	548	110	27		83
7	Erode	895	179	54	1	125
8	Kancheepuram	1397	279	44		235
9	Kanyakumari	960	192	9		183
10	Karur	357	71	25		46
11	Krishnagiri	300	60	13		47
12	Madurai	1197	239	16	3	223
13	Nagapattinam	132	26	17		9
14	Namakkal	612	122	29		93
15	Perambalur	321	64	7		57
16	Pudukottai	309	62	23		39
17	Ramanathapuram	463	93	8		85
18	Salem	1125	225	47	2	178
19	Sivagangai	513	103	8		95
20	Thanjavur	248	50	40	1	10
21	The nilgiris	65	13	27		-14
22	Theni	418	84	10		74
23	Tiruchirapalli	588	118	42	2	76
24	Tirunelveli	888	178	26	2	152
25	Tiruppur	379	76	67		9
26	Tiruvallur	737	147	70		77
27	Tiruvannamalai	805	161	27		134
28	Tiruvarur	147	29	29		0
29	Tuticorin	570	114	20		94
30	Vellore	996	199	26		173
31	Villupuram	1119	224	39		185
32	Virudhunagar	1045	209	7		202
Total		21511	4302	1026	28	3276

An average patient on maintenance haemodialysis needs around 3 times dialysis in a week for at least 4 hours each time with blood flows of 300 ml/min and dialysate flows of 500 ml/min. The cost of maintenance haemodialysis (MHD) under CMCHISTN is Rs. 8000 (120 USD) per 8-10 cycles including the cost of erythropoietin. The cost in private market is 3-5 times more than this rate. The cost of renal transplant under CMCHISTN is Rs. 400,000 (6200 USD) including one-year follow-up medicines. Again in private market, it cost around 2-3 times of this rate. Considering the cost, convenience and longevity of the person, the renal transplant will be an advantage compared to maintenance haemodialysis (MHD), only issues are the availability of the suitable donor for the kidney.

The details of RRT undertaken under CMCHISTN is analysed district-wise with enrolled population, the extent of the problem, number of persons benefited under MHD and RT, equipment's availability and shortfall etc. in detail so as to understand the gaps and arrive the strategy to handle CKD epidemic.

Since this study involves only secondary data analysis and not directly linked to the identity or intervention of the patients, the ethical clearance is not applicable.

RESULTS

The details of RRT undertaken under CMCHISTN are given in Table 2, 3, 4 and 5 including district wise eligible population, expected problem, a number of persons benefited, equipment's available and shortfall etc.

By taking 1,56,63,325 enrolled families in the CMCHISTN as bases, estimated CKD stage 5 population requiring Haemodialysis is calculated based on the existing prevalence rates. From the actual utilization data available in CMCHISTN over a period of five years, estimated annual beneficiaries receiving haemodialysis have arrived. The proportion of the annual estimated population and actual utilization of CKD reflects that only around 3% percentage population who is availing RRT among those required as detailed in Table 2 district wise.

Projected requirements of haemodialysis (HD) machines as detailed in Table 3 is based on the estimated CKD stage 5 populations and actual availability of HD machines. All the 21,511 patients who are enrolled in the past five years to avail haemodialysis need it continuously, till either they undergo RT or die. An average every beneficiary needs 2-3 cycles per week, which comes to 8-10 cycles/month per patient. One Machine in one shift of 8 hours can handle a maximum of 3 cycles of 3-4 hours duration so as to give 90 cycles per machine in the month. So roughly one machine can maximum handle 9-10 patients in a month and 20 patients if it runs in 2 shifts per day. Based on the above understanding we need around 6255 machines for dialysis and the projected shortfall is around 68%.

It is accepted that renal transplant is the better and ultimate option for patients suffering from CKD particularly at the end stage. The renal transplant is one of the approved procedure under CMCHISTN and Table 5 estimates that around 3000 patients need renal transplant. The number of RT centres are limitation along with the availability of donor's kidney.

DISCUSSION

Even though Tamil Nadu being one of the best states with good health indicators and infrastructure, we could only reach on average of 3% coverage across the state when compared to estimate population-needing RRT. Agarwal expresses similar views, where he describes the cost of RRT, availability of RRT in India and concludes that in view of the above factors, only 3% to 5% of all patients with ESRD in India get some form of renal replacement therapy (RRT).[7]

The estimated number of beneficiaries under RRT is 4302 patients per year only, where is expected suffering population may be around 1,25,000 with around 68% shortfall of haemodialysis machine requirements. Further, is not uniform across the state and in half districts requirement for MHD is more than 80%. Another point that is clearly evident is that nearly 50% population in 1/3 of districts requiring RRT moves to other districts for the want of facility in home districts, which involves additional expenses and travel.

The requirements for the renal transplantation are high in our state through the cadaver transplant program is effectively implemented here. Our estimated renal transplant requirement of 3276 is roughly equal to the waitlist in TRANSTAN (Transplant authority of Government of Tamil Nadu).

Even this limited provision of RRT treatment by haemodialysis costs around Rs. 40 crore per annum. The out of pocket expenses may also increase in future in view of the fact that nearly 90% of the dialysis facility i.e. 1822 out of 2024 is available in the private sector only. Considering all these economic and human sufferings it is high time that we focus on prevention and early diagnosis and treatment to mitigate the CKD.

It is established that in India, diabetes and hypertension are responsible for more than 40-60% of CKD and various primary, secondary and tertiary preventive measures for prevention of chronic kidney disease is prescribed.[8-10] The lack of community-based screening programs and failure to ensure optimal control of hypertension and diabetes has led to patients being detected with CKD at an advanced stage that should be reversed.

CONCLUSION

Considering the above issues it is clear that the availability and cost of treatment are beyond the reach of many common citizens for CKD. There is huge indirect cost also in CKD management due to loss of job/working days in view of prolonged treatment. It is high time that screening for CKD is included along with other non-communicable disease screening as part of NPCDCS program.[11] This will not only identify the risk factors like hypertension and diabetes early but also ensures proper treatment so as to ensure the good control level for hypertension and diabetes. Further Government should create RRT facility in the public sector covering both MHD and RT, in view of the economic impact it creates an out of pocket expenses public are incurring in view of the limited facilities available in the government.

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