



# Health Technology Assessment in India

## Department of Health Research, MoHFW



### Cost effectiveness of population-based screening for Chronic Kidney Disease among adults aged 40 years and above with Type 2 Diabetes Mellitus in Kerala and Puducherry

#### SUMMARY

*Chronic Kidney Disease (CKD) is a major public health problem with increasing incidence and prevalence, associated with a high risk of kidney failure, cardiovascular disease and premature mortality. Patients with type 2 diabetes are more than twice likely to develop CKD as compared to those with type 1 diabetes. Early detection (screening) and treatment of CKD halts the progression to end-stage renal disease (ESRD). But, currently there is no population-based screening for CKD in India. Therefore, we have undertaken a Health Technology Assessment (HTA) study to evaluate the cost-effectiveness of population-based screening for CKD in Kerala and Puducherry among the normotensive type 2 diabetic mellitus patients aged 40 years and above as compared to the current no screening scenario. We found that population-based screening using spot urine dipstick-microalbuminuria followed by albumin creatinine ratio (ACR) test and serum creatinine, was cost-effective at one time GDP per capita of India. Compared to the current scenario, implementing Scenario 1 would prevent 179 ESRD cases per lakh population over the next ten years.*

#### Introduction

CKD is a condition of structural or functional abnormalities of the kidney, with or without decreased glomerular filtration rate (GFR) for three months or longer. In India, the prevalence of CKD ranges between <1% and 17% (1). Patients with type 2 diabetes (T2DM) are more than twice likely to develop CKD as compared to those with type 1 diabetes (2). In India, CKD is the leading cause of kidney failure or end-stage renal disease (ESRD). About 2.2 Lakh people are diagnosed with ESRD every year (3) and over 90% of patients of them are unable to pay for renal replacement therapy (RRT) who eventually die due to lack of care (4).

Currently, there is no population-based screening for CKD in India. But, studies from Asian countries showed population-based screening for CKD using micro-albuminuria as cost-effective. Therefore, we evaluated the cost-effectiveness of two population-based screening scenarios for CKD in Kerala and Puducherry among the normotensive type 2 diabetic mellitus patients aged 40 years and above, as compared to the current scenario. The two scenarios considered in the study are as follows:

**Scenario 1:** Spot urine dipstick-albuminuria was done twice with the interval of three months followed by spot urine ACR test and serum creatinine.

**Scenario 2:** Spot urine ACR test and serum creatinine were done in a parallel manner.

In both scenarios, community healthcare workers (CHW) reach out to the households and measure blood pressure using digital sphygmomanometer in household members who are aged  $\geq 40$  years, followed by screening those normotensive members for type 2 diabetes using glucometer. Those normotensive T2DM patients were screened for CKD by either of the two screening scenarios.

### **Methodology**

A decision tree combined with the Markov model was developed to analyze the screening process and changes in the natural progression of CKD under two population-based screening strategies, relative to the current scenario. A mathematical cohort ( $n=1$ ) of diabetic patients was simulated over a lifetime horizon with an annual cycle. We adopted a societal perspective, taking into account direct and indirect medical expenditure along with income lost due to illness. The input parameters for the model were derived from a WHO STEPS survey, national sample survey, National Health System Cost Database for India and other relevant literature. The incremental cost-effectiveness ratio (ICER) and Net Monetary Benefit (NMB) estimates were generated for both the scenarios along with sensitivity analyses and budget impact analysis.

### **Results**

The ICER per QALY gained for the CKD screening scenario 1 and scenario 2 were ₹ 13,916 and ₹ 14,751, respectively. (Table 1) Both the ICER values were cost-effective at the threshold of the one-time per capita GDP of India. Comparatively, screening scenario 1 was more cost-effective than scenario 2. The NMB for scenario 1 and scenario 2 were ₹ 8.4 crores and ₹ 4.9 crores, respectively. The budget impact analysis showed that the current no screening scenario resulted in a societal cost of ₹ 385 crores in Puducherry and ₹ 9,303 crores in Kerala. Scenario 1 was found to be a low-cost option than the scenario 2 for both the states. If the scenario 1 is implemented, the treatment costs associated with ESRD are expected to go down by ₹ 2.15 crore over of the next ten years, with reduction in the incidence of ESRD cases by 179 per lakh population over ten years. (Table 2)

**Table 1: Base case results of CKD screening scenarios**

	<b>Non-screening</b>	<b>Screening scenario 1</b>	<b>Screening scenario 2</b>
<i>Total cost</i>	₹ 45,407	₹ 98,741	₹ 100,096
<i>Total QALY</i>	7.6	15.2	15.3
<i>Total life years</i>	10.2	19.6	19.4
<i>Incremental cost</i>		₹ 53,334	₹ 54,689
<i>Incremental QALY</i>		7.6	7.7
<i>Incremental life years</i>		9.4	9.2
<b>ICER/QALY gained</b>		<b>₹ 7,039</b>	<b>₹ 7,136</b>
<b>ICER/Life year saved</b>		<b>₹ 5,685</b>	<b>₹ 5,961</b>
<b>Discounted Estimates</b>			
<i>Total cost</i>	₹ 40,927	₹ 119,139	₹ 89,132
<i>Total QALY</i>	6.1	11.7	9.4
<i>Total life years</i>	-	-	-
<i>Incremental cost</i>		₹ 78,212	₹ 48,205
<i>Incremental QALY</i>		5.6	3.3
<i>Incremental life years</i>		-	-
<b>ICER/QALY gained</b>		<b>₹ 13,916</b>	<b>₹ 14,751</b>
<b>ICER/Life year saved</b>		<b>₹ 5,138</b>	<b>₹ 5,254</b>

**Table 2: Impact of population-based screening for CKD on the number of ESRD cases and the associated treatment cost over the ten years**

<b>Year</b>	<b>Number of ESRD cases</b>			<b>Number of cases prevented</b>		<b>Treatment cost saved (₹ in Lakhs)</b>
	<b>No screening</b>	<b>Screening scenario 1</b>	<b>Screening scenario 2</b>	<b>Scenario 1 vs 2</b>	<b>Scenario 1 vs No screening</b>	<b>Scenario 1 vs No screening</b>
1	1142	1142	1142	0	0	0
2	1083	1083	1083	0	0	0
3	897	894	894	0	3	18.2
4	658	649	648	-1	9	64.8
5	465	447	446	-2	18	121.0
6	328	303	301	-2	25	170.0
7	236	207	204	-2	30	203.8
8	175	143	141	-3	32	220.3
9	135	102	100	-3	32	221.7
10	107	76	74	-2	31	212.5

## Conclusion

The screening scenario 1 is more cost-effective than the scenario 2 for population-based screening for CKD. Given the current health spending of Kerala and Puducherry, both the screening scenarios were not financially feasible for implementation.

### Policy implications:

- If implemented, early detection of CKD through the population-based screening could reduce the incidence of ESRD cases over time.
- Population based CKD screening could reduce the expenditure incurred under the Pradhan Mantri National Dialysis Programme.

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