

ORIGINAL ARTICLE - PUBLIC HEALTH

URINE DIPSTICK TESTING (UDT) AT COMMUNITY LEVELS - AN INITIATIVE BY THE GOVERNMENT OF TAMILNADU FOR EARLY DETECTION OF CHRONIC KIDNEY DISEASES - AN OVERVIEW

Pravin Thiagarajan ⁽¹⁾, Abishek Jeevagan ⁽¹⁾, Vidhya Viswanathan ⁽¹⁾, Krishnaraj K ⁽¹⁾, Selvavinayagam TS ⁽¹⁾

(1) Directorate of Public Health & Preventive Medicine, Chennai

Abstract

INTRODUCTION : Chronic kidney disease is the fifth leading cause of mortality in Tamil Nadu. As diabetes and hypertension rates increase, the burden of chronic kidney disease is expected to grow, impacting both health and the economy. In developing countries with limited dialysis and transplant facilities, early detection of chronic kidney disease can significantly reduce the risk of progression to end-stage renal disease and improve overall population health. The Government of Tamil Nadu has launched the 'Urine dipstick testing Program' for early detection of chronic kidney disease at all Primary Health Centers (PHC) and Health Sub-Centers (HSC) for the target patients.

OBJECTIVE : To understand the health profile of the beneficiaries under the Urine Dipstick testing program and their status of co-morbid conditions based on State data from July 2023 to May 2024.

METHODS : A descriptive study was done based on the secondary data analysis of the beneficiaries of the Urine Dipstick Testing (UDT) Programme for the period from July 2023 to May 2024 across all districts of Tamil Nadu.

RESULTS : A total of 57,23,188 beneficiaries have been screened under this program, of which 13,082 tested positive in the Urine dipstick testing. Among these, 6312 (48.3%) were found to be hypertensive, 4272 (32.7% were diabetics) and 2498 (19%) had both hypertension and diabetes. On referral, 946 persons (7.2%) were confirmed to have Chronic Kidney Disease (CKD) in various stages.

CONCLUSION : The Urine Dipstick testing program provides a crucial opportunity for individuals from high-risk populations, particularly those with hypertension and diabetes, to undergo thorough screenings for the early detection of kidney diseases.

KEYWORDS : Chronic Kidney Diseases, eGFR, Urine Dipstick Testing

INTRODUCTION

Chronic kidney disease (CKD) is a major public health concern worldwide. It is a slow progressive, and irreversible disease associated with a decline in the estimated Glomerular Filtration Rate (eGFR) (less than 60 mL/min/1.73 m²) for at least 3 months. There is a paucity of data on the prevalence of CKD in India, but the reported prevalence ranges from <1% to 17%.¹ Furthermore, with the increasing incidence of diabetes among younger Indians, the prevalence of CKD is expected to rise further as diabetes accounts for 40%–60% of cases of end-stage renal disease (ESRD).¹

Chronic kidney disease is the fifth leading cause of mortality in Tamil Nadu. This means that Tamil Nadu needs special attention compared to most other states. A recent step survey conducted by the Institute of Nephrology and Institute of Community Medicine, Madras Medical College, estimated chronic kidney disease to be prevalent in 8.4% of the adult population of Tamil Nadu, and 0.3% will require dialysis immediately. With diabetes and hypertension increasing in the population, the burden of chronic kidney disease will only increase. This will impact not only the health of the

people but also the economy.²

The basis for implementing urgent action on chronic kidney disease is improved patient outcomes through the identification of high-risk groups, resulting in targeted therapy implementation which subsequently would reduce the incidence of adverse and costly effects such as progression to end-stage renal disease, cardiovascular events, and mortality.^{2,3}

Early detection of chronic kidney disease has a notable impact in developing countries where both dialysis and transplant facilities are severely limited; as such it is hoped to have an especially noticeable effect on curtailing progression to end-stage renal disease, with a general increase in overall population health due to the decreased development of comorbidities.³



Please Scan this QR Code to

View this Article Online

Article ID: 2024:04:02:12

Corresponding Author: Pravin Thiagarajan

e-mail : docpravins@gmail.com

The Government of Tamil Nadu launched Urine dipstick testing for early detection of Chronic Kidney disease for NCD patients at the community level (Primary Health Centre/ Health Subcentre) on 10.07.2023, and all NCD patients who have hypertension and diabetes above 30 years are screened for Chronic Kidney Disease on priority basis. This study aims to understand the health profile of the beneficiaries under the Urine Dipstick testing program and their status of co-morbid conditions based on State data collected in the last ten months since the program's launch.

METHODS

This study involves a secondary data analysis of the Urine Dipstick Testing programme data for the period from July 2023 to May 2024 across all districts of Tamil Nadu and the study population includes all the Urine Dipstick Testing (UDT) Programme beneficiaries in Tamil Nadu in that period.

The data is compiled in an Excel version with the various details of the beneficiaries as a line list. The list contains the basic demographic details of the beneficiaries, such as age, gender, and address.

The next part contains details about the comorbid status of the beneficiaries such as Hypertension, diabetes, Both Hypertension and diabetes, smoking, and alcoholism. The final part contains the details of the referral and suspected/confirmed status at a higher health facility.

After data cleaning, analysis was done using the Statistical software SPSS version.¹⁶ All categorical variables were expressed as frequencies, percentages, and proportions. All continuous variables were expressed as mean and standard deviation. The test of significance used was the chi-square test. The test was found to be significant if p-value <0.05.

RESULTS

A total of 57,23,188 beneficiaries have been screened under this program, of which 13,082 (0.2%) tested positive in the Urine dipstick testing. Of those 13,082 tested positive and referred, 946 (7.2%) were confirmed to have Chronic Kidney Diseases (CKD).

The gender distribution of the beneficiaries under the urine dipstick testing program shows equal representation of both males and females. 6312 (48.3%) were found to be hypertensive, 4272 (32.7% were diabetics) and 2498 (19%) had both hypertension and diabetes. About 1501 (11.4%) of the study population were smokers and 1561 (11.9 %) of the study population were alcoholics. (Table 1)

Table 1: Characteristics and test results of the persons who were tested positive in the Urine Dipstick Testing Program, July 2023 to May 2024, Tamil Nadu

Characteristics		Frequency N (N= 13,082)	%
Gender	Male	6629	50.7%
	Female	6453	49.3%
Comorbidities	Hypertension	6312	48.3%
	Diabetes mellitus	4272	32.7%
	Both HTN & DM	2498	19%
	Smokers	1501	11.4%
	Alcoholics	1561	11.9%
Urine Dipstick Test Result	1+	8574	65.5%
	2+	3549	27.1%
	3+	818	6.3%
	4+	141	1.0%

The results of urine dipstick testing done for 13,082 persons who tested positive show 8574 (65.5%) to be with 1+, 3549 (27.1%) to be 2+, 818 (6.3%) to be 3+, and 141 (1.0%) were 4+.

Table 2: Chronic kidney disease diagnosed in the Urine Dipstick Testing Program, July 2023 to May 2024, Tamil Nadu

Urine Albumin	No. tested positive (N= 13,082)	No. Confirmed with CKD	% Confirmed with CKD
1+	8574	399	4.7
2+	3549	367	10.3
3+	818	152	18.6
4+	141	28	19.9
TOTAL	13,082	946	7.2

Among the total beneficiaries of the Urine Dipstick Testing Program, about 7.2% (946) of them were confirmed to have Chronic Kidney Disease (CKD) at a higher facility based on Renal function tests, Ultrasound abdomen, and eGFR.

Of 818 persons who had 3+ in the urine dipstick test, 152 (18.6%) were confirmed to have CKD while of 141 persons who had 4+ in the urine dipstick test, 28 (19.9%) were confirmed to have CKD.

The distribution of diagnosed CKD cases by HUDs are given in Table 3. Cuddalore, Villupuram, Kanniyakumari had highest number of CKD case distribution.

Table 3: Health Unit District-wise Chronic Kidney Disease diagnosed under the Urine Dipstick Testing Program, July 2023 to May 2024, Tamil Nadu

Health Unit Districts	Number of Chronic Kidney diseases diagnosed (N=946)	Percentage out of total diagnosed
Cuddalore	115	11.4%
Villupuram	83	8.3%
Kanniyakumari	67	6.7%
Ariyalur	57	5.7%
Kallakurichi	55	5.5%
Tiruppur	54	5.4%
Chennai	45	4.5%
Thiruvallur	43	4.3%
Attur	42	4.2%
Dindigul	42	4.2%
Chengalpattu	31	3.1%

Poonamallee	29	2.9%
Tenkasi	27	2.7%
Nagapattinam	24	2.4%
Thoothukkudi	23	2.3%
Kovilpatti	19	1.9%
Krishnagiri	19	1.9%
Palani	18	1.8%
Tiruchirappalli	17	1.7%
Perambalur	17	1.7%
Theni	16	1.6%
Pudukkottai	15	1.5%
Karur	15	1.5%
Paramakudi	10	1.0%
The Nilgiris	10	1.0%
Virudhunagar	10	1.0%
Tirunelveli	9	0.9%
Kancheepuram	9	0.9%
Thanjavur	9	0.9%
Vellore	8	0.8%
Salem	8	0.8%
Thiruvavur	8	0.8%
Mayiladuthurai	6	0.6%
Ramanathapuram	6	0.6%
Sivaganga	6	0.6%
Aranthangi	5	0.5%
Cheygar	5	0.5%
Tiruvannamalai	5	0.5%
Tirupathur	4	0.4%
Erode	4	0.4%
Ranipet	3	0.3%
Coimbatore	2	0.2%
Madurai	2	0.2%
Sivakasi	2	0.2%
Dharmapuri	1	0.1%
Namakkal	1	0.1%

DISCUSSION

This study shows that out of a total of 13,082 people who were tested and found as a suspect using the Urine Dipstick Testing Program, 946 (7.2%) were confirmed to have Chronic Kidney Disease in various stages based on their eGFR estimation. In a large group of patients with high blood pressure, it is crucial to identify those with signs of organ damage, as they are at higher risk for heart and blood vessel-related health issues. Testing for microalbuminuria using a dipstick on a urine sample is a quick, accurate, and convenient method for patients.^{4,5,6} The prevalence of microalbuminuria among individuals with hypertension varies significantly, with estimates ranging from 6% to 40%. This variation depends on the severity and duration of hypertension in the patients.⁷ In this study, 48.3% of the total who had tested positive in urine dipstick testing had hypertension. Dipstick testing is commonly used to screen for kidney disease in people with conditions like diabetes and hypertension, which can greatly increase the risk of developing kidney issues. Both conditions have varying levels of severity, often do not present symptoms, and affect a significant portion of the adult population.⁸

One of the indicators among the WHO NCD-related tests and procedures in primary healthcare settings is the general availability of urine testing for albumin.⁹ Albuminuria, the presence of excessive amounts of the protein albumin in the urine, is an important indicator of kidney damage. It is strongly associated with a heightened risk of cardiovascular diseases, a rapid deterioration in kidney function, and an increased likelihood of overall mortality.^{10,11,12} The urine dipstick test, a method that has been in use for over 50 years, is utilised for the detection of albuminuria.¹³ The dipstick contains multiple pads with chemical reagents to assess specific urine characteristics.¹⁴ The dipstick test for urinary protein primarily detects albumin and can be utilised to semi-quantitatively assess albuminuria.¹⁵

In this study, 818 reported as 3+ in the Urine Dipstick test of which 152 (18.6%) confirmed to have CKD while 141 reported as 4+ in the Urine Dipstick test of which 28 (19.6%) confirmed to have CKD. The urine dipstick is utilized to support CKD screening programs due to its simplicity, cost-effectiveness, and ease of use.^{15,16}

The presence of albumin (and other proteins) in urine is an accepted indicator of the presence and severity of chronic kidney disease (CKD), and regular monitoring of the urine of patients in the early stages of CKD may be quite useful in detecting responses to medical/lifestyle management, as well as detecting the progression of the disease.¹⁷

This program provides a crucial opportunity for individuals from high-risk populations, particularly those with hypertension and diabetes, to undergo thorough screenings for the early detection of kidney diseases. By identifying potential issues at an early stage, individuals can access timely interventions and treatments, ultimately leading to better health outcomes.

However, it is to be noted that the persons who had 3+ and 4+ in the Urine dipstick test and not found to have CKD on further confirmatory tests should be followed up with monitoring of their co-morbid status like hypertension and diabetes ensuring its control. 4.7% of those who had 1+ in Urine dipstick are diagnosed to have CKD which has to be further studied on a case-to-case basis so as to assess any other factors including time of reporting to the referral facility and subjective errors.

Urine dipstick is a highly specific (97 – 100%) method for detecting proteinuria, however, the sensitivity of the test for detecting low-end, but clinically significant proteinuria is reported to be 32 – 46%.¹⁹ Therefore in people diagnosed with, or suspected of having diabetes, a more sensitive technique, i.e. albumin:creatinine ratio

(ACR), is recommended to quantify proteinuria.¹⁸ Recent advancement by estimating glomerular filtration rate (eGFR) may be explored considering the limitations of interpreting plasma creatinine alone, the cost and complexities of determining a gold standard GFR with either inulin or radionuclides, and the inaccuracies inherent in measuring a 24 h urine creatinine clearance.

CONCLUSION

This study aims to provide an overview of the status of Chronic Kidney Disease in Tamil Nadu following the introduction of the Urine Dipstick Testing program. Those individuals tested positive in UDT and not diagnosed with CKD are to be followed up for necessary confirmation of the disease and further studies like cohort follow-up may be attempted. In the future, a comprehensive analysis of the program's beneficiaries through a qualitative study will be done to understand the benefits and the impact of the intervention.

REFERENCES

1. Verma VR, Kumar P, Dash U. Assessing the household economic burden of non-communicable diseases in India: evidence from repeated cross-sectional surveys. *BMC Public Health*. 2021 May 7;21(1):881.
2. Prabhakaran D, Jeemon P, Roy A. Cardiovascular diseases in India: current epidemiology and future directions. *Circulation*. 2016 Apr 19;133(16):1605-20.
3. Lashari NA, Lakho NI, Memon SA, Ahmed A, Waseem MF. Acute coronary syndrome; frequency, contributing factors and types in patients with typical chest pain. *The Professional Medical Journal*. 2017 Mar 7;24(03):409-13.
4. 13 Bennett PH, Haffner S, Kasiske BL, Keane WF, Mogensen CE, Parving HH, et al. Screening and management of microalbuminuria in patients with diabetes mellitus: recommendations to the Scientific Advisory Board of the National Kidney Foundation from an ad hoc committee of the Council on Diabetes Mellitus of the National Kidney Foundation. *Am J Kidney Dis* 1995;25:107-12.
5. 15 Ginsberg JM, Chang BS, Matarese RA, Garella S. Use of single voided urine samples to estimate quantitative proteinuria. *N Engl J Med* 1983;309:1543-6.
6. 16 Schwab SJ, Christensen RL, Dougherty K, Klahr S. Quantitation of proteinuria by the use of protein-to-creatinine ratios in single urine samples. *Arch Intern Med* 1987;147:943-4.
7. Martinez MA, Moreno A, Aguirre dC, Cabrera R, Rocha R, Torre A, et al. Frequency and determinants of microalbuminuria in mild hypertension: a primary-care-based study. *J Hypertens* 2001;19:319-26.
8. Krogsbøll LT, Jørgensen KJ, Gøtzsche PC. Screening with urinary dipsticks for reducing morbidity and mortality (Review). *Cochrane Database of Systematic Reviews* 2015, Issue 1. Art. No.: CD010007.
9. NCD-related tests and procedures in primary health care – World Health Organisation
10. Matsushita K, van der Velde M, Astor BC, et al.; Chronic Kidney Disease Prognosis Consortium. Association of estimated glomerular filtration rate and albuminuria with all-cause and cardiovascular mortality in general population cohorts: a collaborative meta-analysis. *Lancet* 2010; 375 (9731): 2073-81.
11. Van der Velde M, Matsushita K, Coresh J, et al. Lower estimated glomerular filtration rate and higher albuminuria are associated with all-cause and cardiovascular mortality. A collaborative meta-analysis of high-risk population cohorts. *Kidney Int* 2011; 79 (12): 1341-52.
12. Gansevoort RT, Matsushita K, van der Velde M, et al. Lower estimated GFR and higher albuminuria are associated with adverse kidney outcomes. A collaborative meta-analysis of general and high-risk population cohorts. *Kidney Int* 2011; 80 (1): 93-104.
13. Webster AC, Nagler EV, Morton RL, et al. Chronic kidney disease. *The Lancet* 2017; 389 (10075): 1238-52.
14. Fogazzi GB, Garigali G.. *Urinalysis* In: Feehally J, Floege J, Tonelli M, Johnson RJ, eds. *Comprehensive Clinical Nephrology*. 6th ed. China: Elsevier Inc.; 2019: 39-52.
15. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. Chapter 1: Definition and classification of CKD. *Kidney Int Suppl* (2011) 2013; 3 (1): 19-62.

16. Uchida D, Kawarazaki H, Shibagaki Y, et al. Underestimating chronic kidney disease by urine dipstick without serum creatinine as a screening tool in the general Japanese population. *Clin Exp Nephrol* 2015; 19 (3): 474–80.

17. Kavuru, V., Vu, T., Karageorge, L., Choudhury, D., Senger, R., & Robertson, J. (2019). Dipstick analysis of urine chemistry: benefits and limitations of dry chemistry-based assays. *Postgraduate Medicine*, 132(3), 225–233. <https://doi.org/10.1080/00325481.2019.1679540>

18. National Health Service (NHS). Proteinuria: detection and quantification in adults using ACR - information for GPs. NHS: UK, 2009. Available from: www.birminghamquality.org.uk/DLopen/proteinuria_GPs.pdf (Accessed Jun, 2015).

19. Kashif W, Siddiqi N, Dincer AP, et al. Proteinuria: how to evaluate an important finding. *Cleve Clin J Med*. 2003;70(6):535–7, 541–4, 546–7.