# Prevalence of Chronic Kidney Disease (Spatial Inquiry of 2016-2017) in Polonnaruwa District, Sri Lanka

## M. Riswan

*Ph.D. Research Scholar (Commonwealth), Department of Sociology, University of Kerala, India & Senior Lecturer, Department of Sociology, South Eastern University of Sri Lanka, Sri Lanka*
 *https://orcid.org/0000-0002-8490-7886*

**Abstract**

*The CKD as a serious public health hazard in Sri Lanka, which is the cause of poverty and underdevelopment among affected families in various parts of the country. CKD has become a new challenge for the health sector and driven people to the loss of livelihood, productivity, and increase the cost of treatment. This paper emphasized the prevalence of CKD and unequal frequencies of the disease in different health regions (MOHs) in Polonnaruwa district, Sri Lanka. Based on primary and secondary data analysis, the results of the findings were produced in a descriptive way in which tables, maps, and charts were also administered. The study mainly used ArcGIS (ArcMap 10.3) software to identify the different distribution of CKD unequally in different health regions (seven MOH divisions) in the district. The study found that the endemic of CKD and affected patients, HD patients, and death rate also occurred unequally in each MOH division in different means. The distribution of CKD occurred due to the geographical setting, social, economic patterns of the people in the study area.*

*Nevertheless, this study only focused on understanding the different prevalence of CKD in each MOH division in a particular district. However, the study needs to be extended further to identify the factors and impacts due to this chronic health issue in the district and country as a whole. The study suggested that CKD has become a major obstacle to the ongoing development activities in the district; thus, the government needs to identify disseminate methods to prevent CKD from this study area, as well as from Sri Lanka.*

**Keywords: CKD, Spatial Analysis, Prevalence Ratio, MOH areas and Dry zone**

## Introduction

Chronic Kidney Disease (CKD) is a worldwide threat to public health, and it is a key determinant of poor health outcomes for major Non-communicable diseases (Norberto Perico and Giuseppe Remuzzi, 2012). The new form of Chronic Kidney Disease (CKD) pervading the dry zone of Sri Lanka constitutes a humanitarian tragedy with vast implications for the society, economy, and the environment. First detected in the early 1990s in the Anuradhapura and the Polonnaruwa Districts in the dry zone agricultural region in North Central Province (NCP), the disease is now spreading to neighboring districts in the North-Western, Eastern, and Uva as well as the Central and Northern Provinces (Banrarage, A., 2013).

Around 70,000 people in many districts of Sri Lanka affected by chronic kidney disease. They are mostly in the rural areas of the country. If there are 70,000 CKD affected patients, altogether around 350,000 people (members of the families of the CKD patients) are affected socially and economically. The patients in the final stages of CKD have to go for dialysis every 10-12 days, and they have to meet travel expenses and also the cost of the chemicals required for dialysis. Most of the patients are farmers, and they have lost the last cropping seasons. Both parents of some families affected by CKD have died, and the children of such families are in a desperate situation.

They are in dire need of financial assistance. There is a Task Force appointed by former President. The Director of this Task Force is working part-time, and very little action appears to have been taken to prevent the occurrence of this disease indicated by the rise in CKD affected patients during the last few years (Weeraratna, C.S., in. The Island, May, 2016). According to the following map, it can be found that the registered CKD patient who are under higher risk conditions in 10 districts, including 60 Divisional Secretariats in Sri Lanka, up to the year 2014.

**Map 1: High-risk areas and distribution pattern of CKD/CKDu in Sri Lanka**
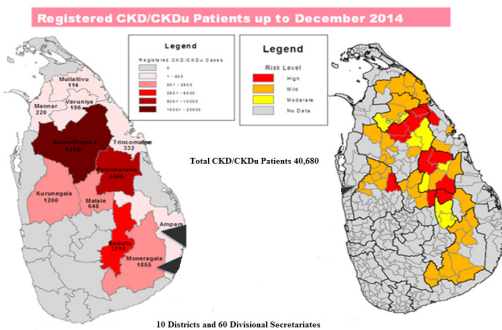


**Source:** Regional Directory Health Services (RDHS), Polonnaruwa, 2017.

Out of 10 districts, there are two districts, namely, Anuradhapura and Polonnaruwa have been identified as the more vulnerable zone for an epidemic of CKD in the North Central Province (NCP) in the country. Meantime, an amount of 5,306 patients were reported particularly affected by the Chronic Kidney Disease (CKD) in numerous villages under Medirigiriya, Dimbulagala, Thamankduwa, Elahera, Hingurakgoda, Lankapura and Welikanda Medical Officer(s) of Health (MOH) areas in Polonnaruwa district (Report of RDHS Office, Polonnaruwa, 2017). However, it is expected that water scarcity may be one of the key factors for increasing socio-economic and health problems or chronic diseases among rural communities. In this backdrop, this research aims to analyze the unequal distribution of CKD in the study community significantly by using spatial analysis.

**Objectives**

The key objective of this study is to understand an unequal distribution of chronic kidney disease in Polonnaruwa district in connotation with geographical features of MOH zones and the specific objective is to inspect the trend of CKD from 2016-2017 in the Polonnaruwa district.

**Methodology**

Methodology refers to the various approaches to the research process. This study employed data from both primary (interview) and secondary data (statistical report from Regional Director of Health Services Office [RDHS] and MOH offices) in assessing the unequal distribution of CKD in the Polonnaruwa district. The data collection technique covered the seven MOH areas in the study region and, village-level data also gathered to employ the different ratio of CKD impacts and find out the victimized families who have received the monthly allowances from the government due to the impacts of CKD. An in-depth discussion has been conducted with selected village people and Gramma Niladhari to understand the impacts of CKD and its prevalence mechanism. The secondary statistical data were highly administered in this study for analyzing the unequal distribution of disease. Thus, the report of RDHS and MOHs have directed from 2006 to 2017 to identify the real CKD affected information. At the initial phase, a preliminary assessment was conducted across the Polonnaruwa district, which supported the researcher to closer with the study region to specify the population, socio-economic background of respondents, household data to gather basic information relevant to the study. The collected data have been analyzed quantitatively and qualitatively on the basis of purpose of the study. In this approach, ArcGIS (ArcMap 10.3) software has used to identify the prevalence of CKD in Polonnaruwa district. The findings or results have been interpreted by using computer software in a descriptive way.

**Empirical Evidence from Previous Studies**

Weerasekara, P. (2017) carried out an empirical study of Chronic Kidney Disease in Anuradhapura District in 2017 through applying a quantitative research method. Socioeconomic factors affecting chronic kidney disease were considered as the dependent variable, and income, occupation, education, and infrastructure facilities were considered as the

independent variables of the study. The study found that male farmers who drink well water in the study area have a risk of affecting from CKD. It also pointed out that not only biological factors but the socioeconomic factors like people's life patterns are also contributed to causing CKD in the Anuradhapura district. Most of the patients have lower income and lower socioeconomic status and have studied from grade 1 to grade 5. Water sources, food patterns, and life style mainly influenced by CKD. The study concluded that enriching the knowledge of health education is important to eradicate CKD in Sri Lanka (Weerasekara, P., 2017).

Ranasinghe, H et al. (2015) 'Water Treatment, Preventive Measures and the Chronic Kidney Disease in the Farming Community in Sri Lanka,' examined the impact of water treatment and preventive measures on CKD. The results of the study revealed that both preventive measures and water treatment significantly reduce the probability of occurrence of CKD. The study pointed out that drinking treated water is truly noteworthy to consider and make more sense in preventing the possibilities of CKD. The study concluded that ensuring an adequate supply of treated water for the severely affected villages is important, and both government and non-government organizations should work conscientiously to increase the awareness of CKD and safety protections to save the people (Ranasinghe, H. et al., 2015).

The research on Reasons and Social Effects of Chronic Kidney Disease (CKD) Patients in North Central Province Sri Lanka was accompanied by Wasantha Subasinghe elaborated that CKD has emerged as a major health care problem in the North-Central of Sri Lanka during the last few decades. This research focused on the prevalence of kidney disease and identifying the responsibility of the government authorities regarding solving the problems of CKD. The research found that the CKD's spreading rate, sex ratio, geographical and environmental relations, food patterns, livelihood patterns, and water resources to view the CKD in a new dimension than the biological factors behind it. The study also recommended that changes should occur in two dimensions first is in individual-level changes like change the food culture, change the working behavior, mental relaxation, get

early treatments and the caring and second one is well-planned national level programs like awareness program on preventing and caring, the national task force for better health services, clinical treatments, drinking water supply, limitations on fertilizers and pesticide usage (Subasinghe, W., 2014).

A review article on Chronic Kidney Disease (CKD) in Sri Lanka - Current Research Evidence Justification (2014) critically reviewed and attached with other relevant literature to justify the possible contributory reason(s) for CKD. This article first reviewed the literature on socio-economic, environmental, meteorological, health, and geo-environmental/chemical aspects about the CKD of unknown etiology in Sri Lanka and then studied the known etiology of CKD (key medical facts) in detail with a comprehensive list of causes. The environmental factor became the cause of CKD in previous studies at the beginning, and authors focused on heavy metals related to agricultural activities. Arsenic, cadmium, and lead were studied in detail. This review article finally justified through a literature review that CKD in North Central Province (NCP) in Sri Lanka is caused by chronic exposure and heavy metals related to agricultural activities (Gunatilake, S.K. et al. 2014).

Asoka Bandarage conducted a study on Political Economy of Epidemic Kidney Disease in Sri Lanka (2013). The study focused on the Chronic Kidney Disease (CKD), which is taking the lives of poor farming communities with the aim of broadening the discourse on the neglected political economy of CKD in Sri Lanka till now. In this respect, the study brought together the bio-medical debate on the impact of extensive and unregulated use of agrochemicals on public health and kidney disease with wider global interdisciplinary perspectives on the industrialization of agriculture and the association of food production by transnational agribusiness corporations. The study also suggested to minimize the use of chemical pesticides, increase agricultural earnings and income of farmers, and restore the enthusiasm, self-confidence, and self-respect among farmers. It concluded that the usage of environmentally sustainable and socially equitable development and organic agriculture in Sri Lanka or any country facing the same problems is the long-term solution to CKD (Bandarage, A., 2013).

The study based on Chronic Kidney Disease (CKD) risk factor identification based on secondary data analysis, which was done by Jayasinghe, YKRT. (2011) described what is CKD and its different stages, and its emerging condition in Sri Lanka in the first part of the study. In the second part of the study, Cadmium, Fluoride, Uranium, Cyanobacteria Toxins and Alcohol were identified as the major factors and Phyto-Remediate Plants, Aluminium, Utensils, Mal-Nutrition, Nitrogen and Phosphorous Selenium, Arsenic, Herbal Medicine, Food impact and Agrochemical Pesticide/ Fertilizer were identified as minor factors contributed to CKD. The study also revealed that a reduction in the quality of life and an increase in health expenditure were the impacts of CKD. Breadfruit leaf and Murunga have been found as the solution to overcome the CKD by the people (Jayasinghe, 2011).

Amara Paranagama et al. (2013) conducted a study on Water Quality Parameters about Chronic Kidney Disease in Sri Lanka. Water quality parameters of drinking water have assumed to be a cause of CKD in Sri Lanka. This research focused on re-examining diverse causative factors identified by previous researchers on CKD and analysis of water quality in samples from shallow wells supplying drinking water to CKD patients and non-patients in North Central Province in Sri Lanka. The water samples were tested, and heavy metals like Cadmium (Cd), Sodium (Na), Calcium (Ca), Fluoride (F) and Chloride (Cl) were found as causative factors for CKD and that were analyzed using Factor Analysis techniques. The results revealed that three Factors were identified in Patient samples, which were typically different from the Non-Patient samples. About Cd, none of the Anuradhapura CKD Patient samples contained Cd. The study concluded that Cd could be considered as a significant Factor by itself acting as a pollutant of drinking water sampled in Polonnaruwa (Paranagama et al. 2013).

The all empirical evidence was closely associated with CKD in various aspects; such as water scarcity, contamination of drinking water, chemical organs and water pollution and the physical or biological and the environmental factors connecting to CKD were discussed by the authors based in Polonnaruwa, Anuradhapura region and so on in Sri Lanka. The

spatial distribution of CKD in the Polonnaruwa district has been undertaken by the researcher to fulfill the research gap in the existing field.

**Findings of the Study**
**Dispersal of CKD in Polonnaruwa District**

The incidence of CKD has been identified in a particular region of dry zone in Sri Lanka. In the recent past, Polonnaruwa has considered as one of the risk areas and vulnerable districts for CKD in the North-Central Province (NCP). This study has been carried out to understand the unequal distribution patterns of CKD in the study region. The CKD prevalence has mainly been analyzed based on secondary information provided by the RDHS, Polonnaruwa. The spatial analyzes were mainly done with the support of the available geo spatial package. The key analysis is presented in charts and maps. The occurrence of CKD is recorded in every part of the Polonnaruwa district. The risk areas have been identified concerning the Medical Officer of Health (MOH) divisions of Polonnaruwa. The CKD affected data has been recorded in seven MOH areas in Polonnaruwa district in 2016 and 2017, respectively, which are highly deliberates the seriousness of these diseases. Out of seven MOH areas, a higher endemic of CKD has been found in two MOH regions. The following chart 1 reflects the details of CKD affected persons in the study area in the year 2016.

**Chart 1: CKD/CKDu Patients Reports in Polonnaruwa - 2016**
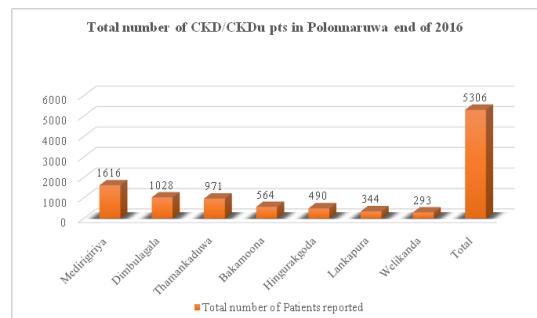


**Source:** Regional Director of Health Services (RDHS), Polonnaruwa, 2017

According to the above chart, it has noted that higher number of CKD patient (1616) has been recorded in Medirigiriya MOH area while Dimbulagala and Thamankaduwa recorded 1028pts

971pts accordingly, the lowest rate 293 pts reported in Welikanda MOH area, while Bakamoona 564pts, Hingurakgoda 490 pts, and Lankapura 344 pts stated in a different ratio. However, the prevalence of CKD/CKDu has been found as an unequal distribution across the Polonnaruwa district in NCP. The report issued by the Ministry of Health recently, the CKD is a substantial causative factor to mortality in Sri Lanka (Nagendran, T., 2016). In this background, the NCP is highly affected by CKD fatal across the country. There are two districts located in NCP, namely Anuradhapura and Polonnaruwa. Anuradhapura has been identified as a higher CKD prevalent district, and on the other hand, Polonnaruwa district has also known as an affected district by the fatal incidents due to CKD. Following chart two shows the CKD affected records in Polonnaruwa district till August 2017.

**Chart 2: CKD/CKDu Patients Recorded in Polonnaruwa – August 2017**
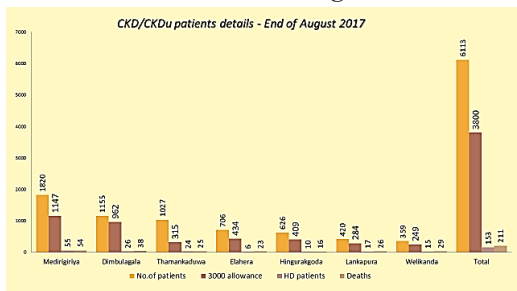


**Source:** Regional Director of Health Services (RDHS), Polonnaruwa, Aug 2017

The above chart categorized in four dimensions of data, namely, the number of patients receiving the allowance, HD patient, and Death occurred during the period above. While considering the above chart very high occurrence of CKD has been identified in Medirigiriya (1820 pts) MOH division in 2017 as it was found a higher endemic region in 2016 as well. Similarly, the low prevalence of CKD has recorded in Welikanda (359 pts) MOH division, which is the lowest vulnerable area in the Polonnaruwa district. The second and third higher numbers of CKD patients have been found in Dimbulagala (1155pts) and Thamankaduwa (1027 pts) MOH areas accordingly. The moderate numbers of CKD prevalence were screened in Elahara, Hingurkgoda, and Lankapura MOHs. The death rate also can be seen

as similar to the prevalence ratio of CKD. However, the distribution of CKD and death occurred due to CKD were accounted unequally in all MOHs in the Polonnaruwa district.

**Spatial Distribution of CKD in Polonnaruwa**

Different distribution of CKD recorded in Polonnaruwa district based on seven MOH areas. This distribution shows the unequal fraction in different zones at different levels. According to the following GIS map, it can be noticed that even though the prevalence of CKD is identified as a common health hazard in the Polonnaruwa district, the endemic and impacts of CKD have occurred variously. The application of GIS package has produced different maps to analysis the findings related with the spread of CKD. The study screened the information related to affected patients in 2016 and 2017, which highlighted the MOH areas of Madirigiriya, Thamankaduwa, Dimbulagala, Lankapura, Hingurakgoda, Welikanda, and Bakamoona accordingly.

**Map 2: Spatial distribution of CKD in Polonnaruwa District (2016 & 2017)**
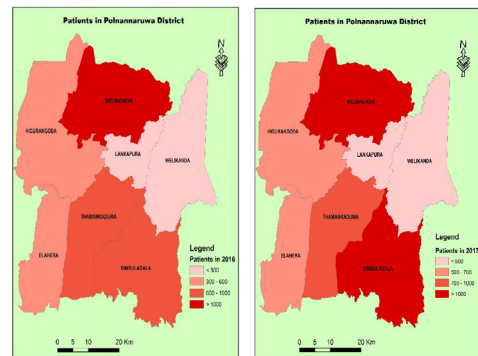


**Source:** ArcGIS (ArcMap 10.3)

The above GIS maps details the CKD affected patients and the distribution of CKD in Polonnaruwa district in the year 2016 and 2017. In both years, however, the spread of the disease has been affected by various locality on different grounds. It is found that the prevalence of CKD in 2017 slightly increased in each MOH areas compared to 2016. The Lankapura and Welikanda were seen as a low epidemic areas in 2016, which indicated <300; however, this area became CKD spread zones in 2017 in the ratio of > 500. In 2016, the Hingurakgoda and Elehara MOH

areas had stated the number of CKD patients form 300-600, and it has dramatically been increased by the distribution rate 500-700 in 2017. Further, it is observed that the 600-1000 ratio of CKD pts found in Thamankaduwa and Dhimbulagala MOH areas in the year 2016, while the range of distribution has been increased from 700-1000> in 2017 considerably. Yet, according to the data analysis, the Medirigiriya MOH area has been found as the highest record of CKD affected zone (2016: 1616 pts. and 2017: 1820 pts; 55 HD pts & 54 death) in both years 2016 and 2017.

On the other hand, the HD patient also distributed or occurred variously in seven MOH divisions. The following table 1 clearly shows the details of HD pts and KT plans in different quantities in different areas within the study community.

**Table 1: Details of HD Patients in Polonnaruwa District**

| MOH Area | No. of Pts | KT plan – cadaveric | KT plan – Live donor |
|---|---|---|---|
| Madirigiriya | 45 | 04 | 05 |
| Thamankaduwa | 17 | 01 | -- |
| Dimbulagala | 19 | -- | 02 |
| Lankapura | 15 | -- | -- |
| Hingurakgoda | 11 | 01 | 02 |
| Welikanda | 09 | -- | -- |
| Bakamoona | 06 | -- | -- |
| Other | 29 | -- | 01 |
| Total | **151** | **06** | **10** |

**Source:** RDHS Statistical Report, 2017

The highest number of HD pts (45) had been reported in the Medirigiriya MOH division, while the very lowest rate (06) recorded in the Bakamoona MOH area during the year 2017. However, the other five MOH areas have also been reported in different quantities such as Dimbulagala 19; Thamankaduwa 17; Lankapura 15; Hingurakgoda 11; and Welikanda 09 respectively. It is observed that the CKD affected ratio (including hospitalization and death) has been occurred in the Polonnaruwa district with different dimensions and unequal distribution based on the MOH divisions, as it already illustrated in the GIS map 2. At the same time, the HD pts have also found as unequal prevalent among seven MOHs in the study area.

Based on the data represents all seven MOH areas, it can be understood that the prevalence of CKD in the Polonnaruwa district has been recorded in an unequal occurrence in each MOH region in different figures. This unequal distribution occurred in the study area due to various factors. The highest affected areas located in dry zones; the affected people involving in agriculture, the usage of chemicals and fertilizers have already polluted land and water, and the underground water already has been contaminated due to agricultural practices; the lack of accessibilities for safe drinking water; the higher ratio of rural poverty; and the behavioral factors including drug and alcohol use and many other factors that contributed to driven the causes for spreading the CKD in the study area, particularly in Medirigiriya, Dhimbulagala, Thamankgaduwa, and Elehara MOH regions in Polonnaruwa district. Meantime, the Hingurakgoda, Lankapura, and Welikanda areas considered as moderate CKD prevalence regions in the locality.

**Conclusion**

The Polonnaruwa has been identified as a vulnerable region in the country due to the prevalence of CKD. The data of CKD from 2016 to 2017 have been employed in this study to find out the results. According to the analysis, this study found that the effect of CKD has occurred in different extents in different MOH areas in the Polonnaruwa district. The distribution of CKD affected patients, the number of HD patients, and the occurrence of death were unequally scattered in each heath division in a different number. The major cause of this unequal scenario is the unhealthy environmental situation, climate change, social and economic aspects. Based on the findings, it can be revealed that the study area is located in a very dry zone where social and economic stages found in a poor condition; and due to agricultural activities the land and water have been polluted; thus people are unable to get safe and sufficient drinking water. According to these kinds of factors, the endemic of CKD experienced in each MOH division differently. Though the affected rural families have been suffering from financial challenges, including low income and poor involvement in work, thus many CKD affected

patients depend on partner's or children's income due to this severe incidence of chronic disease.

## References

Amara Paranagama, D.G. "Factors Associated with Chronic Kidney Disease of Unknown aetiology (CKDu) in North Central Province of Sri Lanka: A Comparative Analysis of Drinking Water Samples." *Applied Water Science ,* vol. 8, 2018.

Amarasiri de Silva, M.W. "Structural Violence and Chronic Kidney Disease of Unknown Etiology in Sri Lanka." *Social Science & Medicine*, vol. 178, 2017, pp. 184-195.

Banrarage, A. "Political Economy of Epidemic Kidney Disease in Sri Lanka." *SAGE Open*, vol. 3, no. 4, 2013.

Gunatilake, S.K. et al. "Chronic Kidney Disease (CKD) in Sri Lanka - Current Research Evidence Justification: A Review." *Sabaragamuwa University Journal*, vol. 13, no. 2, 2015, pp. 31-58.

Jayasekara, K.B. "Relevance of Heat Stress and Dehydration to Chronic Kidney Disease (CKDu) in Sri Lanka." *Preventive Medicine Reports*, vol. 15, 2019.

Jayasinghe, Y. "Chronic Kidney Disease." 2011, https://pdfs.semanticscholar.org/a807/e51a97e106d178a132ecf71326792fce64b2.pdf

Jayatilake, N. et al. "Chronic Kidney Disease of Uncertain Aetiology: Prevalence and Causative Factors in a Developing country." *BMC Nephrol,* vol. 14, 2013.

Nagendran, T. *A Spatial Analysis of Chronic Kidney Disease in Vavuniya*, University of Sri Jayewardenepura, 2016.

Paranagama, A. et al. "Water Quality Parameters in Relation to Chronic Kidney Disease in Sri Lanka." *Proceedings of the 2nd International Conference on Sustainable Built Environment (ICSBE 2012)*, pp. 173-183.

Perico, N. and Giuseppe Remuzzi. "Chronic Kidney Disease: A Research and Public Health Priority." *Journal of Nephrology Dialysis Transplantation*, vol. 27, no. 3, 2012, pp. 19-26.

Ranasinghe, H. et al. "Water Treatment, Preventive Measures and the Chronic Kidney Disease in the Farming Community in Sri Lanka." *The Journal of Agricultural Sciences - Sri Lanka*, vol. 10, no. 2, 2015, pp. 98-108.

*Report of Regional Director of Health Services (RDHS) Office*, Polonnaruwa, 2016 and 2017.

Subasinghe, W. "Reasons and Social Effects of Chronic Kidney Disease (CKD) Patients in North Central Province Sri Lanka (With Special Reference to Padawiya Area)." *Research Journal of Medical Sciences*, vol. 8, no. 4, 2014, pp. 121-125.

Weeraratna, C.S. "Problems in the rural sector – solutions?" *The Island,* 2016, http://www.island.lk/index.php?page_cat=article-details&page=article-details&code_title=145525

Weerasekara, P. "An Empirical Study on the Socioeconomic Factors Affecting to Chronic Kidney Disease in Anuradhapura District (With Special Reference To Kabithigollewa)." *Proceedings of 7th International Symposium SEUSL*, 2017, pp. 523-532.

**Author Details**

**M.Riswan,** *Ph. D. Research Scholar (Commonwealth), Department of Sociology, University of Kerala, India & Senior Lecturer, Department of Sociology, South Eastern University of Sri Lanka, Sri Lanka,*
**Email ID***: mriswan2008@gmail.com*