

Mortality rates and hospital discharges in Chronic Kidney Disease and Chronic Kidney Disease of non-traditional causes, Costa Rica

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Abbreviations: CKD, chronic kidney disease; CKDnT, chronic kidney disease of nontraditional causes; CRF, chronic renal failure; usRF, unspecified renal failure; HRD, hypertensive renal disease; HCRD, Hypertensive cardiorenal disease; YPLL, years of potential life lost; ICD9, International Classification of Diseases, ninth version; ICD10, International Classification of Diseases, tenth edition; NISC, National Institute of Statistics and Censuses; CDSS, Costa Rican Department of Social Security; SD, standard deviation.

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Abstract

Aim: To characterize the evolution of Chronic Renal Failure compatible with Chronic Kidney Disease of nontraditional causes from 1990 to 2013 in Costa Rica, according to primary diagnosis of death and diagnosis at hospital discharge found in open source data bases.

Methods: A descriptive longitudinal study based on information from national data bases of deaths and hospital discharges with a primary diagnosis of chronic renal failure, unspecified renal failure, hypertensive renal disease, hypertensive cardio-renal disease from 1990 to 2013.

Results: There were 8382 deaths in Costa Rica between 1990 and 2013 in the studied categories. Crude death and standardized mortality rates did not show a significant increase: 8.93/100 000 inhabitants to 11.48/100 000 inhabitants. The specific rates by age and sex showed an increase after 50 years old. Guanacaste, showed high cumulative mortality rates compared with national and the rates of other provinces; as well as significant crude and standardized mortality rates in certain periods (20.3/100 000 inhabitants to 38.23/100 000 inhabitants between 1990 and 2011). Specific rates for age and sex increased after 30 years of age. Hospital discharges showed similar trends for national and Guanacaste.

Conclusions: Primary diagnoses of deaths and hospital discharges in the categories of the study could be compatible with Chronic Kidney Disease of non-traditional causes. Descriptive epidemiology has allowed for identification of risk geographical areas and some sociodemographic characteristics. It is urgent to develop a specific surveillance system.

Keywords: Chronic Kidney Disease, descriptive epidemiology, registry, Costa Rica.

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Chronic kidney disease (CKD) is recognized as a public health problem worldwide.¹ It is diagnosed when there is evidence of kidney damage for more than three months, and it is divided into five stages, depending on the volume of the glomerular filtration.² The CKD is a relatively common condition (1 in 10 people suffer from it), generally it is asymptomatic and often its progress to terminal renal failure is unnoticed, so it is vital its prevention and early detection.²

Recent worldwide epidemiological studies have identified variables that are predictive of CKD, known as trigger factors, and factors that increase the risk of disease progression, known as perpetuating factors.^{3,4} Diabetes mellitus and cardiovascular diseases stand out as the main trigger factors and perpetrators of the CKD, in both developed and underdeveloped countries.

It is estimated that about 70% of the cases of terminal renal disease, are due to the diseases previously mentioned. The aging of the population, genetic factors, ethnicity, gender, socio-economic factors, low birth weight, child malnutrition and exposure to nephrotoxins, among others, are mentioned as potential triggers or multipliers.^{2,5-10}

In some countries and regions such as Egypt, India, Pakistan, Sri Lanka, Thailand, Vietnam, Tunisia, Nigeria, the Balkans, Brazil, Canada and Mesoamerica,¹⁰⁻¹⁴ there has been an increase in the incidence and prevalence of renal disease unrelated with diabetes mellitus or cardiovascular diseases. Given their geographical distribution, no association with traditional causal factors and higher prevalence in certain occupational groups, this type of chronic renal failure is known as chronic kidney disease of non-traditional causes (CKDnT).^{11,15}

On a mesoamerican level, during the last two decades it has been reported a significant increase of CKD not related to traditional causal factors. This condition is referred to by many researchers as Mesoamerican nephropathy,¹⁶ chronic kidney disease of unknown causes,¹⁷ chronic kidney disease in farming communities in Central America (52. °Directing Council, 65. °Regional Committee Session, Pan American Health Organization / World Health Organization, Washington DC, USA, from September 30 to October 4, 2013), or chronic kidney disease of non-traditional causes in agricultural communities in Central America.

The disease is concentrated in areas of the Pacific coast, from southern Mexico to Panama.¹⁷ However, it is mentioned that only in countries such as El Salvador, Nicaragua and Costa Rica, it has been scientifically documented.¹⁹ The affected population corresponds mostly to men, in a proportion of 4: 1.¹⁷ However, cases have been reported in women, to a lesser extent than men, but CKDnT prevalence is higher than the CKD presented and observed in international studies.^{20, 21} The cases on average in males, are reported between the third and fourth decades of life, however, in the female gender cases differ from the pattern of age.²²

In the Mesoamerican region, agricultural workers cultivating sugar cane seem to be the group most at risk,²³ but also miners, fishermen and workers involved in the shipbuilding industry were reported.¹⁶

Even though no published study has shown causality, there are hypotheses about the possible etiology of CKDnT, discussed in the workshop on the subject organized in Costa Rica in December 2012, and the Technical Group for the Clinical Definition of the Confirmed Case of CKDnT, Latin American Society of Nephrology and Hypertension,

in 2013, referred to as environmental toxic factors: a. strenuous work in extreme conditions of heat and humidity associated with chronic dehydration,²⁴⁻²⁷ b. Auto-administration of potentially nephrotoxic drugs (herbal medicine, non-steroidal anti-inflammatory drugs, aminoglycoside antibiotics),^{17,27} c. Food, environmental or water contamination by heavy metals (arsenic, cadmium, aluminum, lead),^{13,28} d. Renal toxicity related to environmental pollution and labor agrochemicals fertilizers, pesticides and herbicides,^{29,30} among others.

Regionally, there is no consensus on a definition of suspected or confirmed clinical case of CKDnT, so the diagnosis is made by exclusion.¹⁸

Since 2005, the Republic of El Salvador leads the specific research activities for the CKD, as reflected in the numerous studies on the subject and strengthening surveillance systems with daily data collection of hospitalization for chronic renal failure (CRF) from the National Morbid-Mortality Health System, more vital statistics, monthly pooled data collection procedures such as dialysis and hemodialysis in the Production Services System, and recently with individual mandatory reporting of CRF in the epidemiological Morbid-Mortality Surveillance System.

In Costa Rica there are few publications on epidemiological data of CKD. Although it is recorded in the vital statistics of mortality and hospital discharge, the pathology is not among the diseases of mandatory reporting of an individual or group, which does not create integrated epidemiological information periodically. However, according to the data of the Latin American Society of Nephrology and Hypertension, which is part of Costa Rica, in 2010, the overall national prevalence rate for CKD with renal replacement therapy, was 338.8 patients per million inhabitants, but no incidence rates are reported.³¹

Data published by the Ministry of Health of Costa Rica, at a workshop about CKDnT, report that between 2005 and 2010 in the province of Guanacaste rates of hospital discharges that were presented by CKD were high (112.9 cases per 100 000 inhabitants), predominantly between the ages of 20-29 years in males, compared with the rest of the country.¹⁶

To date, no national epidemiological studies that describe the true extent of CKD nor classifications of CKD compatible with CKDnT. Therefore, the objective of this research work is to characterize, according to the primary diagnosis of death and primary diagnosis of hospital discharge, from databases that are freely available, the existence of an increase in the CKD compatible with CKDnT, during the period of 1990- 2013, Costa Rica.

Methods

The present study is descriptive longitudinal and includes deaths and discharges with a primary diagnosis of chronic renal failure (CRF), unspecified renal failure (UsRF), hypertensive renal disease (HRD) or Hypertensive cardiorenal disease (HCRD), corresponding to the following codes CRF, 585 International Classification of Diseases, ninth version (ICD-9), N180-N189 International Classification of Diseases, tenth edition (ICD 10); UsRF, 586 (ICD9), N19.0 (ICD-10); HRD, 403.0- 403.9 (ICD9), I120-I129 (ICD10); HCRD, 404.0-404.9 (ICD9), I130-I139 (ICD-10), with which mortality trends and discharges were analyzed from 1990 to 2013, registered in public databases.

Population

Costa Rican residents, of all ages, of both sexes, who died or were discharged with a primary diagnosis of CRF, UsRF, HRD or HCRD in the period 1990-2013, registered in the vital statistics and national hospital discharges.

Sources

Public databases of mortality, from the records of death certificates that make up the Costa Rican vital statistics, provided by the National Institute of Statistics and Census (NISC).

Databases of public hospital discharges, from institutional statistics of the Costa Rican Social Security Department (CDSS), supplied by the CDSS.

Population data was obtained from the national projections published on the website of Central American Population Center, in January 2001.

Variables

Sociodemographic variables: contained in the databases: sex, age, place of residence, discharge centers, and year.

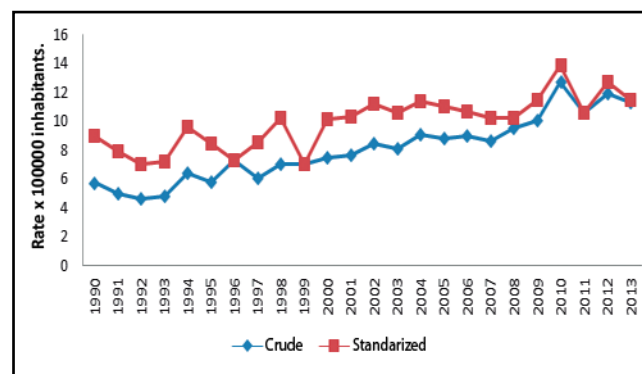


Figure 1. Crude mortality rate and adjusted by CKD in the categories studied, Costa Rica, 1990-2013
Source: Prepared with data obtained from databases of open access: NISC

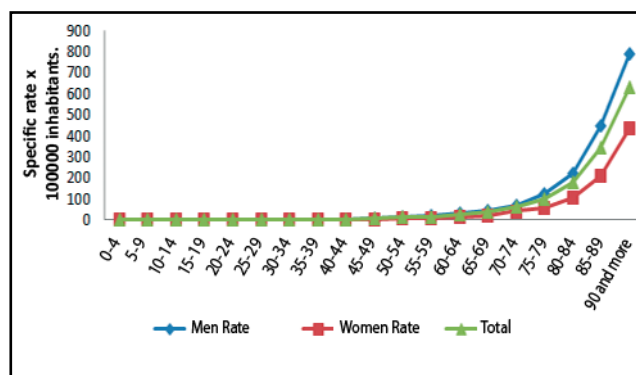


Figure 2. Characterization of mortality due to CKD, according to categories under study, by five-year age groups and sex, Costa Rica, 1990-2013. Source: Prepared with data obtained from databases of open access: NISC

Years of potential life lost (YPLL): the years lost is estimated as the difference between the potential limit for life, minus the age of death of each death. The study was considered as end of life limit 85 years, and all deaths between 0-84 years were included. Total YPLL and gender were calculated, table model (Coale and Demeny: Norte) for the years: 1990, 1997 to 2013, nationwide and for the province of Guanacaste.

Diagnostic groups: the international classification version 9 (ICD-9), for the period 1990-1996 and for the period 1997-2013, the International Classification of Diseases version 10 (ICD-10) was used. To compare both periods groups were certified as follows: CRF 585 (ICD9) and N180-N189 (ICD10), UsRF 586 (ICD9) and N19.0 (ICD-10), HRD 403-403.9 (ICD9) and I120-I129 (ICD10), HCRD 404.0-404.9 (ICD9) and I130-I139 (ICD10).

Analysis Plan

An exploratory analysis of the databases of deaths and discharges were conducted, which allowed to describe percentages, absolute and relative frequencies. Rates overall, specific, standardized mortality was calculated by the indirect method (using as standard population the

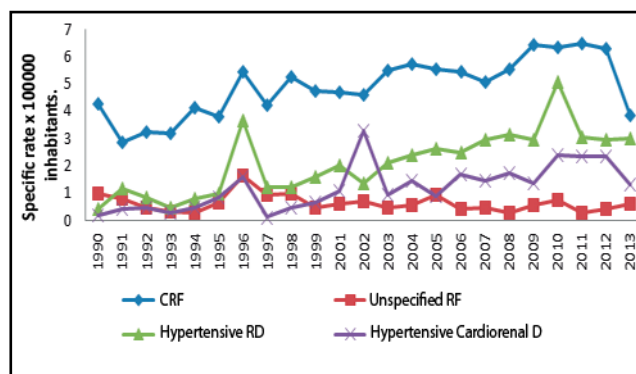


Figure 3. Behavior in mortality CKD, according to categories in the study, classification ICD 9- 10 Costa Rica from 1990 to 2013
Source: Prepared with data obtained from databases of open access: NISC

average population of the World Health Organization from 2000 to 2025). For the calculation of the rates the NISC population estimates were used to, based on the 2001 census.

Finally, years of potential life lost (YPLL) was estimated at national level and for the province of Guanacaste, by gender, calculated from the life expectancy for that province, according to estimates from NISC.

All analyzes were performed using the programs of Excel, SPSS version 21, and for the calculation of YPLL, Epidat version 4.1.

Results

CKD deaths in the categories under review in Costa Rica:

Between 1990 and 2013 they were recorded in Costa Rica ERC 8382 deaths in the categories being studied. For

these years, both the crude mortality rate as the standardized, did not appear to have significantly increased 8.93 / 100 000 to 11.48 / 100,000 (Figure 1 and Table 1).

The average age for deaths in males is 67.98 years (SD = 18.61), while for women it was 69.89 (SD = 19.42).

Nationwide, deaths from ERC in the categories studied seem to affect mainly groups among the middle aged and older ages of life. In Figure 2, a significant increase in men and women, from the age group of 50-54 years of age is observed. The average mortality rate ranks from 50 years of age (16.03 / 100,000 for men and 7.48 / 100,000 women); five years from 50-54 there is a progressive increase up to total adjusted rates of 631/100 000 in people 90 years and older (Figure 2). In terms of geographical distribution, it is noted that deaths from ERC in the categories under study, are concentrated in San Jose, Guanacaste and Alajuela, with 28.8%, 20.8% and 17.7% respectively, showing the province of Guanacaste with very high rates accumulated 28.53 / 100,000, compared with other provinces (Table 2).

Table 1. Characteristics of deaths and discharges for CKD in the categories under study, between 1990-2013, Costa Rica

Characteristics	Deaths (1990 a 2013)		Discharges	
	Quantity	Percentage	Quantity	Percentage
Gender				
Women	3181	38	19626	61,9
Men	5201	62	12100	38,1
Total	8382		31726	
Age groups(years old)				
0-4 years old	61	0,73	176	0,56
5-9 years old	22	0,26	307	0,97
10-14 years old	25	0,30	549	1,73
15-19 years old	59	0,70	806	2,54
20-24 years old	83	0,99	1044	3,29
25-29 years old	95	1,13	1421	4,48
30-34 years old	139	1,66	1698	5,35
35-39 years old	183	2,18	2075	6,54
40-44 years old	254	3,03	2632	8,30
45-49 years old	378	4,51	3058	9,64
50-54 years old	469	5,60	3163	9,97
55-59 years old	527	6,29	2982	9,40
60-64 years old	653	7,79	2812	8,87
65-69 years old	739	8,82	2666	8,41
70-74 years old	862	10,28	2041	6,44
75-79 years old	997	11,89	1736	5,47
80-84 years old	1028	12,26	1259	3,97
85-89 years old	963	11,49	842	2,66
90 years old and more	845	10,08	444	1,40
Total	8382	100	31711	100
Losses	0	0	15	--

Table 1b. Features of deaths and discharges by CKD in the categories studied, between 1990-2013, Costa Rica				
Characteristics	Deaths		Discharges	
	Quantity	Percentage	Quantity	Percentage
Provinces				
San José	2412	28,8	9085	28,66
Alajuela	1483	17,7	6213	19,60
Cartago	723	8,6	2411	7,61
Heredia	686	8,2	2966	9,36
Guanacaste	1744	20,8	5952	18,78
Puntarenas	695	8,3	3074	9,70
Limón	639	7,6	1863	5,88
Foreigner	0	0	133	0,42
Total	8382	100	31697	100
Losses	0	0	29	--
Distribution by CIE classification 9-10				
Chronic renal failure	4783	57,1	7312	23,05
Unspecified renal failure	558	6,7	381	1,20
Hypertensive renal disease	1933	23,1	20794	65,54
Hypertensive cardiorenal disease	1108	13,2	3239	10,21
Total	8382	100	31726	100
Hospitals				
H. México	-	-	10177	32,08
HSJD	-	-	3941	12,42
HCG	-	-	3597	11,34
H. Enrique Baltodano	-	-	2973	9,37
Others	-	-	11038	34,79
Total			31726	100
Source: Prepared with data from the databases of open access: NISC and CDSS				

Of the deaths attributable to CKD in the categories studied, 57.1% are CRF, 23.1% HRD, HCRD 13.3% to 6.7% and UsRF, this trend is evidenced by adjusted rates through the year, according to the classification ICD-9 and 10 (figure 3).

Nationally, in relation to the results of YPLL by CKD in the categories under study, the information was obtained and shown in Figure 4. There is a gradual and steady increase in male, 3.00 times for the 1990 period, from 1997 to 2013, behavior that is not observed in females.

Hospital discharges in Costa Rica:

Between 1990 and 2013 31726 hospital discharges were presented with diagnoses of CKD in the categories under study (Table 1), the total of 44768 discharges for all the CKD. The percentage of discharges of CKD in the categories under study represents 70% of the discharges by CKD.

In the male, the average age is 52.61 years (SD = 23.36), while for females is 51.65 (SD = 24.96).

The provinces with the highest percentage of hospital discharges of CKD in the categories of study are: San Jose (28.66%), Alajuela (19.60%) and Guanacaste (18.78%) (Table 1).

The hospitals with the highest percentage of discharges were the Mexico Hospital (32.08%), San Juan de Dios Hospital (12.42%), Calderon Guardia Hospital (11.34%) and Enrique Baltodano Hospital (9.37%) (Table 1).

Of the expenses attributable to CKD a 23.05% belongs to CRF 65.54% HRD, 10.21% HCRD, and 1.2% to UsRF.

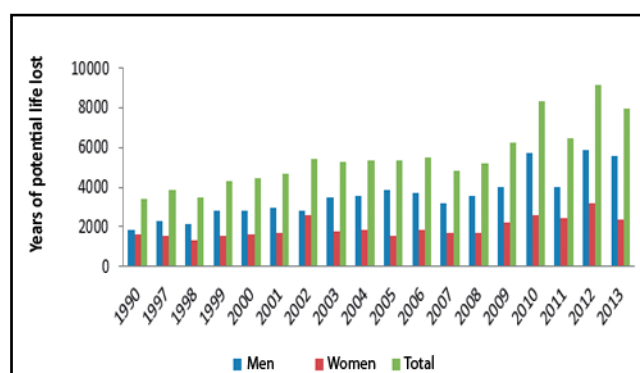


Figure 4. Trend of years of potential life lost (YPLL) by CKD, in categories of study, by sex, Costa Rica, 1990, 1997-2013

Source: Prepared with data obtained from databases of open access: NISC

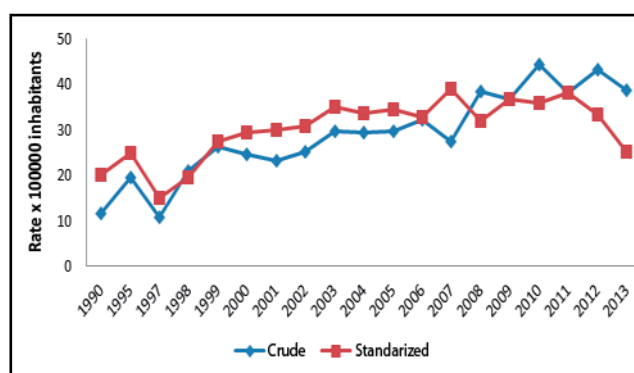


Figure 5. Crude mortality rate and standardized by CKD, in the categories of study in the province of Guanacaste, 1990, 1995, 1997 to 2013. Source: Prepared with data obtained from databases of open access: NISC

Deaths caused by CKD in the categories under study, of residents in the province of Guanacaste

Between 1990 and 2013 there were 1744 deaths by CKD registered in the categories studied. As for the behavior of mortality by provinces, Guanacaste recorded crude mortality rates and standardized by CKD, which has increased significantly from 20.3 / 100,000 inhabitants up to 38.23 / 100,000 inhabitants from 1990 to 2011, with a downward trend (figure 5).

The average age for deaths in men is 64.09 years (SD = 17.55), while for women, 70.02 (SD = 18.88).

Deaths due to CKD in the categories studied seem to mainly affect young groups from 30-34 years, of the male gender. In Figure 6, a significant increase is observed in men from the age group of 30-34 years. The the average mortality rate is among the 30-34 age (19.80 / 100,000 for men and 1.71 / 100,000 for women); from this five-year

period there is a gradual increase up to a total adjusted rates of 191.31 / 100,000 in people between 70 and 74 years and then a decline is evident.

Of the deaths caused by CKD in the categories of study, 60.09% was CRF, a 30.10% was HRD, HCRD 7.68% and 2.12% to UCF, behavior that is evident through rates adjusted annually, according to International Classification CIE9-10 (figure 7).

Regarding the results YPLL in people living in the province of Guanacaste, information that was collected is shown in Figure 8. There is a gradual and steady increase for the male gender, of 3.15 times for the period 1990, 1997-2013 behavior that is not observed in females.

Hospital discharges of residents in the province of Guanacaste:

Between 1990 and 2013, 5952 hospital discharges for CKD were recorded, according to study categories, of people residing in the province of Guanacaste. The characteristics of the deaths and expenses are detailed in Table 3.

Table 2. Standardized Mortality from CKD in the categories studied, Costa Rica, 1990-2013

Province	Cumulative rate x 100 000
San José	7,14
Alajuela	8,52
Cartago	6,74
Heredia	7,62
Guanacaste	28,73
Puntarenas	7,97
Limón	7,54

Source: Prepared with data obtained from databases of open access: NISC and CDSS

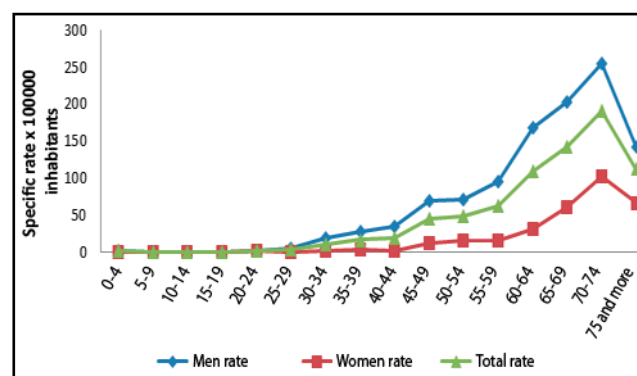


Figure 6. Characterization of mortality due to CKD in the categories of study, by five-year age groups and sex, Guanacaste, 1990, 1995, 1997 to 2013. Source: Prepared with data obtained from databases of open access: NISC

Table 3. Characteristics of Discharges and Deaths by CKD in the categories under study, between 1990-2013, Guanacaste				
	Deaths		Discharges	
Characteristics	Quantity	Percentage	Quantity	Percentage
Sex				
Women	399	22,9	1285	21,6
Men	1345	77,1	4667	78,4
Total	1744		5952	
Age groups (years old)				
0-4 years old	12	0,69	27	0,45
5-9 years old	1	0,06	33	0,55
10-14 years old	2	0,11	47	0,79
15-19 years old	4	0,23	113	1,90
20-24 years old	12	0,69	151	2,54
25-29 years old	17	0,97	259	4,35
30-34 years old	41	2,35	331	5,56
35-39 years old	58	3,33	448	7,53
40-44 years old	84	4,82	562	9,44
45-49 years old	111	6,36	712	11,96
50-54 years old	140	8,03	693	11,65
55-59 years old	121	6,94	564	9,48
60-64 years old	174	9,98	584	9,81
65-69 years old	178	10,21	541	9,09
70-74 years old	183	10,49	332	5,58
75-79 years old	171	9,81	252	4,23
80-84 years old	180	10,32	149	2,50
85-89 years old	122	7,00	105	1,76
90 years old and more.	133	7,63	48	0,81
Total	1744	100	5951	100
Losses	0	0	1	
Total	1744	100	5952	

The average age for discharges for CKD, in the categories of study in males, is 51.13 years (SD = 18.22), while for females is 53.06 (SD = 26.10).

An 23.35% corresponds to CRF, a 70.21% to HRD, a 5.56% to HCRD and 0.87%, to UCF (Table 3).

In terms of geographical distribution, it is observed that the discharges of the province of Guanacaste, come primarily from the cantons of Liberia (23.60%), Cañas (16.90%), Santa Cruz (14.10%) and Nicoya (12.3%). Hospitals with higher percentage of discharges for the Enrique Baltodano Hospital (47.3 %), Mexico Hospital (32.2%) and Hospital of the Annexation (16.7%) (Table 3).

Discussion

The results of the descriptive study suggest that primary diagnosis of death and discharge by chronic nephropathies may partially document the behavior of the CKD in the

categories of study, both nationally and in risk areas. As mentioned Meguid El Nahas and colleagues¹⁰ the number of cases reported is probably underestimated, because the early stages of the disease (stages 1-4) exceed 50 times the V stage, when deaths or most hospital discharges described are present. Thus, the data obtained represent the tip of the "iceberg" as Radhakrishnan and colleagues well described,³² in developing countries about 40% of patients with CKD do not have a medical history, and are young patients, so the progression of the disease has a very high social cost, because of the long duration of the illness.

According to the results of this research at a national level, behavior and trends of mortality by CKD in the categories studied, doesn't appear to have increased significantly. However, their behavior and mortality trend in a particular province, differs considerably from the rest of the country and shows a significant increase (especially between 1990 and 2011), suggesting the need to improve the registration process, detection and timely treatment, by the great socio-economic impact of the progression of renal disease involves.

Table 3b. Characteristics of Discharges and Deaths by CKD in the categories studied, between 1990-2013, Guanacaste				
Characteristics	Deaths		Discharges	
	Quantity	Percentage	Quantity	Percentage
Residence Canton				
Liberia	-	-	1404	23,6
Nicoya	-	-	730	12,3
Santa Cruz	-	-	842	14,1
Bagaces	-	-	533	9
Carrillo	-	-	742	12,5
Cañas	-	-	1005	16,9
Abangares	-	-	161	2,7
Tillarán	-	-	131	2,2
Nandayure	-	-	71	1,2
La Cruz	-	-	288	4,8
Hojancha	-	-	45	0,8
Total			5952	100
Distribution according to classification CIE 9-10				
Chronic renal failure	1048	60,09	1390	23,35
Kidney failure not specified	37	2,12	52	0,87
Hypertensive Renal disease	525	30,1	4179	70,21
Hypertensive heart and renal disease	134	7,68	331	5,56
Total	1744	100	5952	100
Hospitals				
H. Enrique Baltodano	-	-	2816	47,3
H. México	-	-	1917	32,2
H. La Anexión	-	-	993	16,7
Others	-	-	226	3,8
Total			5952	100
Source: Prepared with data from the databases of open access: NISC and CDSS				

As established by Rodríguez Hernández and colleagues,³³ CKD generally has a direct relationship with age, which is evident at national level, in cases of deaths and hospital discharges. However, the province of Guanacaste shows a tendency of a progressive increase in a range of early age, between 30-34 years, mainly among males (20 years before the national trend). In this regard, it is important to note that the estimated YPLL nationwide and of the province of Guanacaste, indicate a rise during the study period. YPLL are estimates which increased with increasing life expectancy and aging population.³³ However, the behavior described coincides with the study about HCRD by Rodríguez and colleagues in Mexico, because it could be explained by increased awareness in recent years, of the health personnel and of the staff designating the codes to diagnoses of deaths and of discharges.

As for the gender distribution, both nationally and in the provinces, as for the deaths there is a prevalence of males, a fact that coincides with recently published studies, both for CKD as well as CKDnT by groups led by researchers as Guillermo Garcia and colleagues, Channa Jayasumana and

colleagues, O'Donnell and colleagues.³³⁻³⁵ Although many experimental studies in mice have succeeded in showing greater susceptibility to kidney damage, which could be related with age in males, results in humans are still contradictory.³

According to the study, the geographical distribution of deaths and discharges, evidence that the CKD supports CKDnT is concentrated in two provinces: Guanacaste and Alajuela. However, Guanacaste seems to reach epidemic proportions, which is consistent with that described by Dr. Cerdas in his 2005 article.³⁶ Discharges of the hospitals reflect what was mentioned, since it is the Mexico Hospital in the spotlight that has the highest percentage of discharges for this cause.

The Guanacaste Province, located in the Chorotega region, is an area that has geographic characteristics, sociodemographic and climatic conditions, cited in the literature as factors that could explain their high vulnerability to CKDnT.

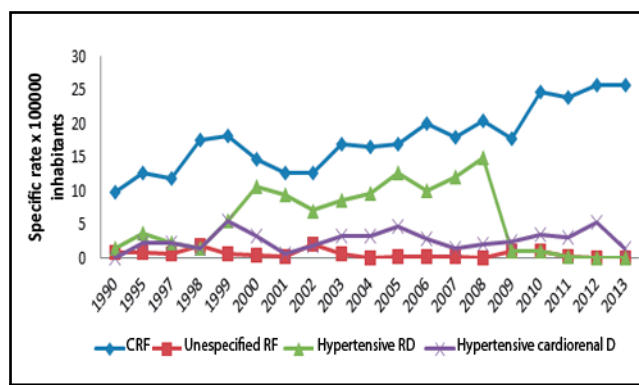


Figure 7. Behavior in mortality from CKD, in the categories of study, Classification ICD 9- 10 Guanacaste, 1990,1995, 1997-2013

Source: Prepared with data obtained from databases of open access: NISC

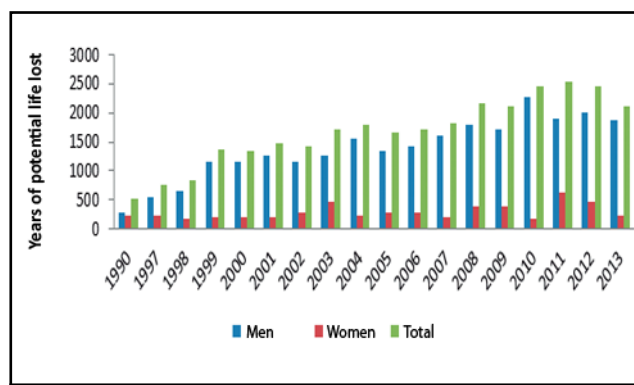


Figure 8. Trend of years of potential life lost (YPLL) due to CKD in the categories under study, by sex, in the province of Guanacaste, 1990, 1997-2013.

Source: Prepared with data obtained from databases of open access: NIS

Location: it is concentrated in the Costa Rican pacific coast, a fact that coincides with most cases reported of CKDnT in Central America.¹⁷ **Poverty:** the Report of the State of the Nation in 2012, the reference as the second poorest province in the country (severity of 8.6 to 3.3 in the Central Region), with an incidence of poverty in households, a 34.5%). **Access to health services:** according to provincial indicators published by the NISC in 2013, Guanacaste is the province with the lowest percentage of insurance (81.5%). **Climate Conditions:** Recent studies published by Dr. Crowe and colleagues, conducted in the harvest in the province of Guanacaste, mention that the temperature in the tropics could exceed the predictions of climate models, causing waves of heat for not harmful overall health, but potentially harmful in populations of workers exposed outdoors in extreme conditions,²⁷ such as workers in the harvest, which the work of Dr. Cerdas, are the people most affected by CKD supports CKDnT.³⁶

According to the data, deaths by CKDnT may be recorded at a higher rate at the national level and in Guanacaste, under coding ICD9 and ICD10 585 N18.0-N18.9. However, it should be noted that the hospital discharges seem to be registered under 403.0-403.9 ICD9 and ICD10 coding I120-I129. A possible explanation for this behavior would be the consultation for hypertensive crisis due to existing kidney damage in advanced stages of CKDnT, would not allow to exclude that coding for future analysis of the behavior of the CKD compatible with CKDnT.

In summary, in the country CKD represents a public health problem. Descriptive epidemiology presented has allowed to identify geographic areas of risk, some sociodemographic characteristics, classification and coding of diagnostic record of deaths and hospital discharges by CKD in the categories of study, which could be compatible with CKDnT. This should be encouraged to take steps in creating specific surveillance systems for CKD nationally, in order to clarify the elements of risk, its prognostic factors to

better define its clinical and epidemiological profile and give patients the best option and most importantly, prevent the pathology.

Limitations

Information bias: The study is based on public databases that appear to have significant underreporting, and therefore constitute a constraint. However, it is sought to minimize, using two databases from different sources. Hospital discharges should be interpreted with caution, since various discharges could correspond to the same person, and in the study the condition of re-entry into a medical facility for the same pathology, was not measured.

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