Health Leadership and Quality of Life. 2025; 4:140
doi: 10.56294/hl2025140

ORIGINAL

Characteristics of mortality with chronic kidney disease in Cuba. Trend and forecast. 2011-2020

Características de la mortalidad con Enfermedad Renal Crónica en Cuba. Tendencia y pronóstico. 2011-2020

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Cite as: Marín Prada M del C, Rodriguez CA, Capote Pereira L, Davalos Iglesias JM, Garcia Villar Y, Carnet Beira G, et al. Characteristics of mortality with Chronic Kidney Disease in Cuba. Trend and forecast. 2011-2020. Health Leadership and Quality of Life. 2025; 4:140. https://doi.org/10.56294/hl2025140

Submitted: 29-04-2024 **Revised:** 17-07-2024 **Accepted:** 01-10-2024 **Published:** 01-01-2025

Editor: PhD. Prof. Neela Satheesh

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ABSTRACT

Mortality due to Chronic Kidney Disease (CKD) has shown a significant increase globally and in Cuba over the past decade. This study analyzes the characteristics of mortality due to CKD in Cuba between 2011 and 2020, aiming to illustrate and determine the trend and prognosis. A longitudinal descriptive study was conducted, using data from 35 031 deaths registered by the Ministry of Public Health of Cuba. The variables analyzed include the year of death, age, sex, province of residence, and cause of death, using the International Classification of Diseases. Mortality rates were calculated and age-adjusted using standard statistical methods and the SPSS version 20.0 program. During the study period, mortality with CKD in Cuba increased from 2 764 cases in 2011 to 4 325 in 2020, an increase of 56,47 %. Age-adjusted mortality rates showed a higher increase in men (39,83 %) than in women (20,71 %). The average age at death was 70,38 years. Potential years of life lost (PYLL) amounted to 263 090,5, with the most affected age groups being 50-59 years. The provinces with the highest age-adjusted mortality rates were Cienfuegos and Sancti Spíritus. Renal diseases represent a growing cause of mortality in Cuba, aligning with trends observed in the Americas region. The implementation of CKD prevention and control programs in primary health care is crucial to mitigate this trend.

Keywords: Mortality; Arterial Hypertension; Diabetes Mellitus; Chronic Kidney Disease; Cuba; Trend and Prognosis.

RESUMEN

La mortalidad con enfermedad renal crónica (ERC) ha mostrado un aumento significativo a nivel global y en Cuba durante la última década. Este estudio analiza las características de la mortalidad con ERC en Cuba entre 2011 y 2020, con el objetivo de caracterizar la mortalidad y determinar la tendencia y pronóstico 2011-2020. Se realizó un estudio descriptivo longitudinal, utilizando datos de 35 031 defunciones registradas en el Ministerio de Salud Pública de Cuba. Las variables analizadas incluyen año de fallecimiento, edad, sexo, provincia de residencia y causa de muerte, empleando la Clasificación Internacional de Enfermedades. Las tasas de mortalidad fueron calculadas y ajustadas por edad, utilizando métodos estadísticos estándar y el

programa SPSS versión 20.0. Durante el período de estudio, la mortalidad con ERC en Cuba aumentó de 2 764 casos en 2011 a 4 325 en 2020, un incremento del 56,47 %. Las tasas de mortalidad ajustadas mostraron un aumento mayor en hombres (39,83 %) que en mujeres (20,71 %). La edad media de fallecimiento fue de 70,38 años. Los años de vida potencialmente perdidos (AVPP) ascendieron a 263 090,5, siendo más afectados los grupos de edad de 50-59 años. Las provincias con mayores tasas de mortalidad ajustada fueron Cienfuegos y Sancti Spíritus. Las enfermedades renales representan una creciente causa de mortalidad en Cuba, alineándose con tendencias observadas en la región de las Américas. La implementación de programas de prevención y control de ERC en la atención primaria de salud es crucial para mitigar esta tendencia.

Palabras clave: Mortalidad; Hipertensión Arterial; Diabetes Mellitus; Enfermedad Renal Crónica; Cuba; Tendencia y Pronóstico.

INTRODUCTION

Measuring how many people die each year helps determine the effectiveness of our health systems and direct resources to where they are most needed. For example, mortality data can help guide activities and resource allocation across sectors, such as the health sector. Systematic collection and analysis of high-quality data on deaths and causes of death, as well as data on disability, disaggregated by age, sex, and geographic location, is essential for improving health and reducing deaths and disability worldwide.[1]

Mortality records show that kidney disease has increased from the 13th leading cause of death in the world to the 10th. Mortality has increased from 813,000 people in 2000 to 1,3 million in 2019. In high-income countries, kidney disease is the eighth leading cause of death, ahead of hypertensive heart disease and Diabetes mellitus (DM).[2] The global burden of Chronic Kidney Disease (CKD) is steadily increasing and is projected to become the 5th most common cause of years of life lost worldwide by 2040.[3] CKD generates numerous healthcare costs, and it is difficult to estimate these costs in the early stages, as the vast majority of studies are referenced to subjects on replacement therapy or transplantation. Furthermore, this disease has a great impact on individuals, their families, and society and is associated with high cardiovascular morbidity and mortality.[4] Renal diseases (RD) are among the leading causes of mortality and disease burden in the Region of the Americas in 2019.[5] They were responsible for 254 028 total deaths, 131 008 deaths in men, and 123 020 deaths in women. The age-adjusted mortality rate was estimated at 15,6 deaths per 100,000 population in 2019, which varied substantially between countries, from 73,9 deaths/100 000 population in Nicaragua to 5,0 deaths per 100 000 population in Canada.[6] In Cuba, the main causes of death are due to non-communicable diseases, for example, heart disease, malignant neoplasms, and cerebrovascular disease, among others, such as DM. CKD is related to the diseases above.[1] One of the closest relationships is with Diabetes mellitus; in many cases, there is no time to define whether it is a cause or a consequence of CKD, and the patient dies before reaching renal function replacement therapy (RRT). In 2011, CKD was ranked 16th among the 35 leading causes of death and had an adjusted rate of 3,3 per 1 000 inhabitants; by the end of 2020, it was already in 13th place, with an increase in its rate to 5,9 per 1 000 inhabitants.[7] Studies conducted in Cuba show increases in the number of deaths with chronic kidney disease in recent years, mainly in the groups aged 60 years and older and in the 40-65 years age group (in the working age).[8,9,10,11] Moreover, there is no predilection for regions of the country.[10]

Our study aims to characterize mortality in patients with chronic kidney disease in Cuba in the period 2011-2020 and to determine the trend and prognosis. Studying the trend and prognosis of diseases and their mortality helps improve health programs and create new indicators. For the above described, the study is carried out to characterize the mortality in patients with chronic kidney disease in Cuba from 2011-2020 and determine the trend and prognosis.

METHOD

A longitudinal descriptive study was carried out. The universe was constituted by the 35 031 Cuban deceased in the period 2011-2020, in which CKD was considered one of the causes of death in the medical death certificate.

The information was obtained from the mortality database of the National Directorate of Medical and Statistical Records of the Ministry of Public Health of the Republic of Cuba. The following variables were recorded: year of death, age, sex, province of residence, and cause of death (basic, contributory, or direct).

To define the causes of death, we used the Tenth International Classification of Diseases.[9] To calculate the rates, we used the population from the statistical health yearbooks for the years 2011-2020 [4], and to standardize the rates, we used the type population used by the directorate of medical records of the Ministry of Public Health, Population type, census of Cuba in 1981, with adjustment by direct method.

The data were processed automated using the SPSS program version 20.0. Absolute frequencies and percentages were calculated, and crude and specific mortality rates by age group, sex, and province were calculated, expressed, and multiplied by 100 000 to facilitate their interpretation.

https://doi.org/10.56294/hl2025140

The mortality data for the period undergoing trend analysis for the average and relative change between the extreme years was also calculated. The upper limit age was 78 years, the life expectancy at birth for Cuba in 2020 was approximated for practical reasons, and the rate of years of life potentially lost was calculated by the formula:

$$T_{AVPP} = \frac{\sum_{xn}(w - \overline{x})_{xn} * D}{Total\ de\ poblaci\acute{o}n\ a\ riesgo}$$

Where: xn = age limit of the interval

x= average age of the interval

W = edad límite superior establecida (78 años)

D = number of deaths at the ages of the interval

The Scientific Council and the Institute of Nephrology Ethics Committee approved this research. Confidentiality of information was guaranteed in the study. The results were presented in tables and graphs.

RESULTS AND DISCUSSION

In the period 2011-2020, there were a total of 35 031 deaths with CKD in Cuba. There was an increase in the number of deaths from 2 764 in 2011 to 4 325 in 2020, with a 56,47 % increase (figure 1). In the period 2016 to 2018, there were two slight decreases in 2016 (3 444) concerning the year 2015 (3 498) and (3 819) in 2018 concerning 2017 (3 878).

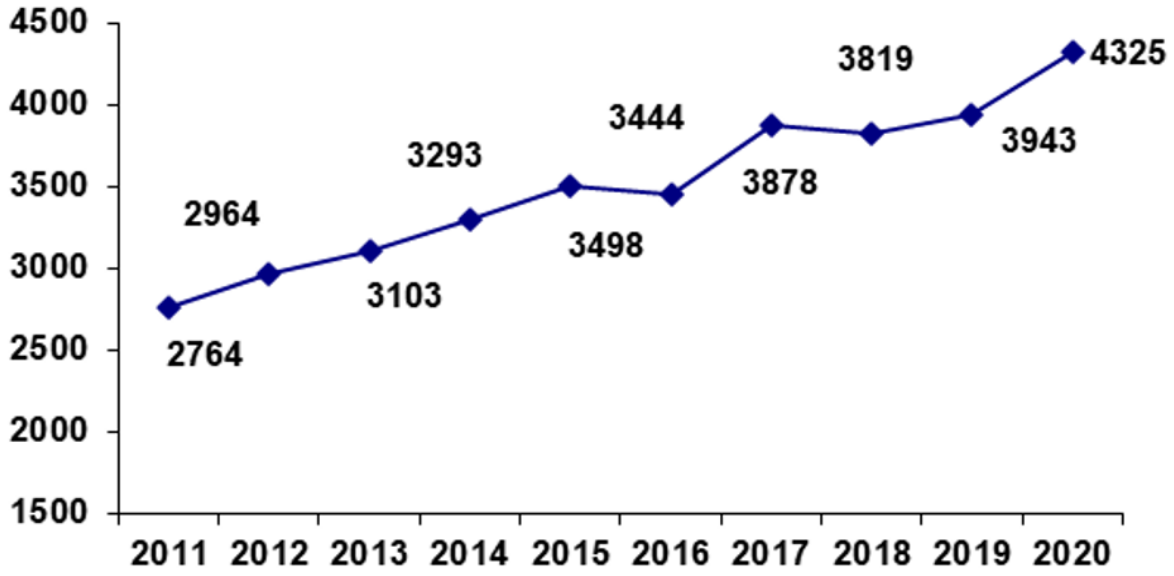

Figure 1. Deaths with chronic kidney disease. Cuba, 2011-2020

The sex-adjusted mortality rate showed an increase of 39,83 % in the male sex, higher than the female (20,71 %). The highest percentage increase in the adjusted mortality rate in the male sex occurred in 2020 compared to 2019, with 12,39 %. The female sex from 2016 to 2017 was 11 % (figure 2). The male-female ratio is 1,11:1. The difference in adjusted rates between men and women is 5,51 %.

The mean age was 70,38 years, with a standard deviation of 15,48 years and a median of 73 years. The years of life potentially lost (YLLL) in the period was 263 090,5, with a rate of 133,8 inhabitants. The age group 50-59 (94191,5) was the one that lost the most years of life.

The mortality rate increased in most age groups, except in the 1-4 years group, where it decreased by 27,75 %. The age groups with the highest rates are 70-79 and 60-69. However, the highest percentage increases were observed in the age groups 85 years and older (54,91 %), 80-84 years (54,35 %), 40-49 years (49,30 %), and 50-59 years (34,44 %). The percentage of increase in the group younger than one year is astonishing, at 70,12 %; a more specific study is needed to investigate its causes. The above information is important because it adds to the problems that exist in the country's population dynamics, where the low birth rate affects the generational replacement of the country. Also, mortality presents an increase in the working age, this being the economically active age of the population, and another important factor is that the population of Cuba is one of the oldest in Latin America (table 1).

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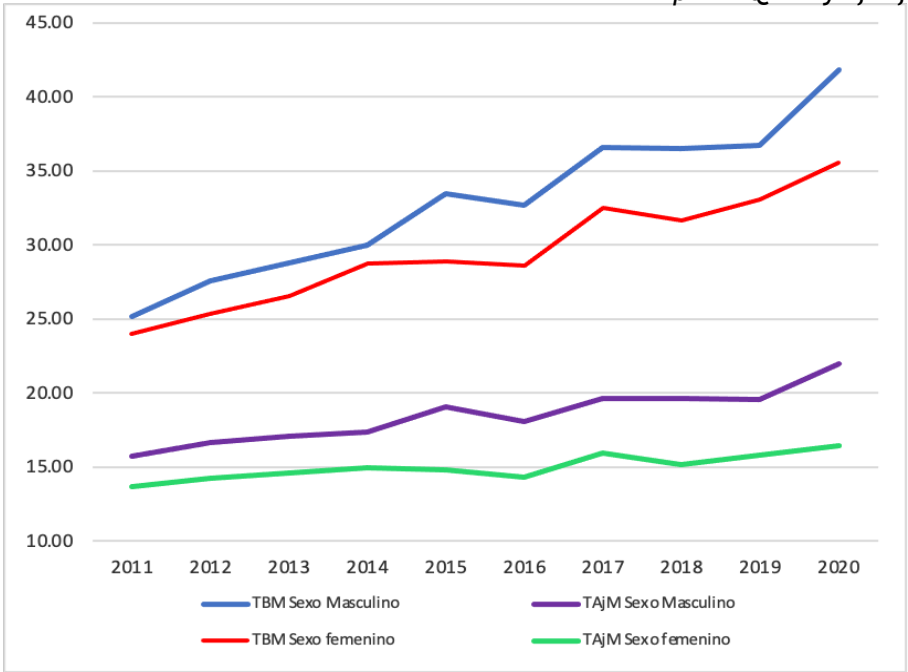


Note: Rate per 100 000 population. Age-adjusted rate. Direct method adjustment. Sample population: the census of Cuba, 1981.

Figure 2. Crude and sex-adjusted mortality in deceased patients with chronic kidney disease. Cuba, 2011-2020

Table 1. Specific mortality rates with Chronic Kidney Disease by age group, Cuba 2011-2020

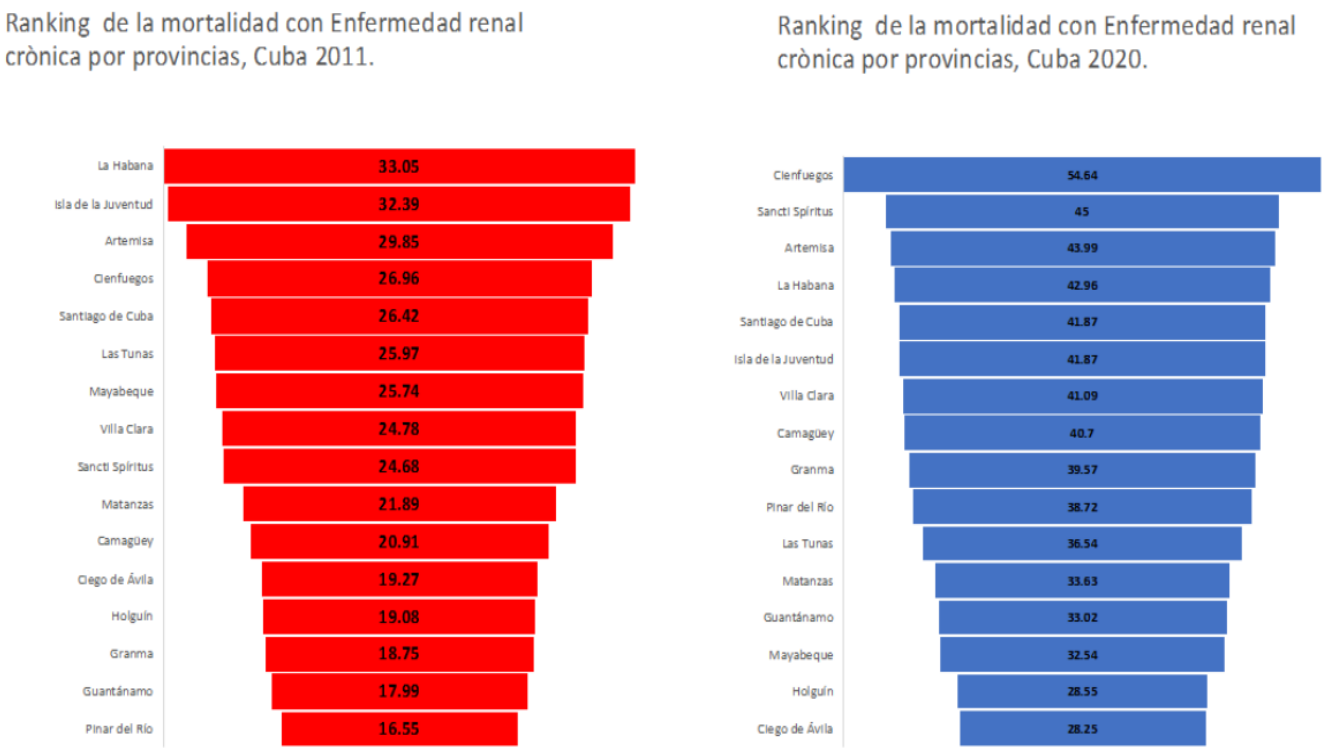
Age groups	Year-specific rates									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
< 1 año	3,85	1,6	1,52	6,55	4,86	2,49	6,93	5,21	3,56	6,55
4-ene	2,09	2,86	1,8	1,58	2,19	2,61	3,66	2,9	1,9	1,51
9-may	0,79	0,82	0,34	0,35	1,03	1,01	0,66	0,48	0,8	0,97
14-oct	0,57	0,72	0,28	0,29	0,3	0,47	0,17	0,86	0,52	0,7
15-19	1,1	0,43	0,85	0,71	0,71	0,42	0,43	1,01	0,74	1,38
20-39	2,76	2,87	3,24	2,72	2,86	3,14	2,96	3	2,79	3,61
40-49	9,37	10,24	10,95	9,87	10,91	10,09	10,69	10,84	11,59	13,99
50-59	23,67	27,47	26,16	24,33	25,01	24,42	26,74	29,07	30,91	32,06
60-69	60	60,76	60,98	60,08	66,83	60,66	67,83	63,91	69,41	73,27
70-79	122,65	125,68	129,03	142,3	138,28	127,64	145,47	139,69	140,63	146,49
80-84	176,62	196,41	219,18	235,74	226,87	238,8	263,82	242,5	240,81	272,62
85 and more	250,6	279,5	303,05	332,51	369,79	379,84	397,5	378,04	357,67	388,21

Note: Rate per 100 000 population. Age-adjusted rate. Adjustment by the direct method. Sample population: the census of Cuba, 1981.

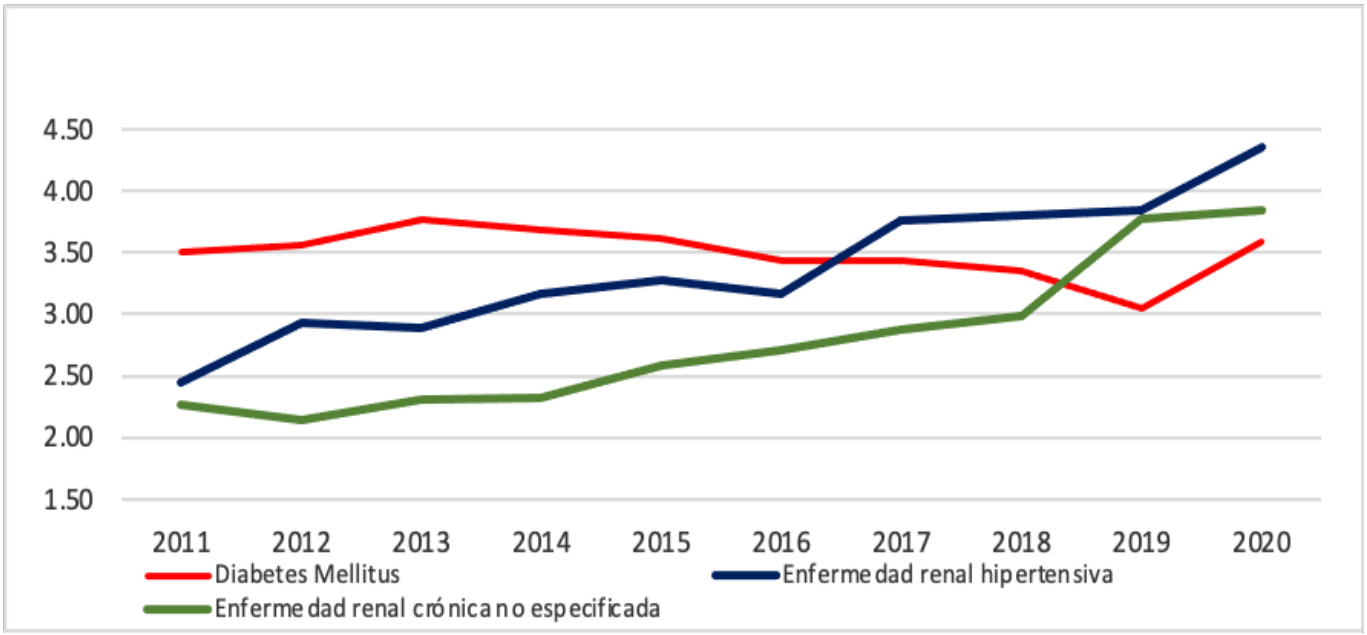
Figure 3 shows a progressive increase in age-adjusted mortality rates with CKD in all provinces, with the particularity that the scenario concerning the places they occupy in the national ranking varies in the 2011-2020 period. Havana and the special municipality Isla de la Juventud, in 2011, exhibited the highest mortality rates (first and second place). At the end of 2020, Cienfuegos and Sancti Spíritus, which 2011 ranked fourth and ninth, respectively, occupy these places. Other provinces, such as Las Tunas and Mayabeque, dropped their positions during this period, although their rates increased. In contrast, the opposite occurs with Granma, Pinar del Río, and Camagüey, which climb to higher positions than those they occupied at the beginning of the period with increased rates. Santiago de Cuba and Artemisa maintained the same position but increased their rates in 2011.

The ten leading causes of death in patients with CKD in the period were hypertensive renal disease (HKD), followed by DM, unspecified chronic kidney disease (NSKD), ischemic heart disease, malignant tumor, interstitial tubular disease, cerebrovascular disease, congenital malformations, bronchopneumonia and respiratory tract sepsis, and urological conditions, among other causes. Figure 4 shows the behavior of the three diseases with the highest rates. From 2011 to 2016, the main cause of death was DM, which moved to the third position in

2019, while HRE occupied the first place in 2016, and DM was displaced to the third place.



Note: Rate per 100 000 population. Age-adjusted rate. Direct method adjustment. Sample population: the census of Cuba, 1981.
Figure 3. National ranking by provinces according to the adjusted mortality rate with Chronic Kidney Disease. 2011-2020



Note: Rate per 100 000 population. Age-adjusted rate. Direct method adjustment. Sample population: the census of Cuba, 1981.
Figure 4. Mortality with Chronic Kidney Disease according to main causes of death. Cuba, 2011-2020

In figure 5 a, the crude and adjusted rates show a constant growth until 2015, where there is a slight decrease in 2016 and then in 2018, to continue a rise that has not stopped. The adjusted rate in 2011 was 14,59 x 100 000 inhabitants, and by the end of 2020, it increased to 18,99 x 100 000 inhabitants, for a 30,15 % increase. Figure 5b shows that the trend is upward, it fits very well to the straight line, the real or actual (red line), although it increases the same as the predicted values, it exceeds it by far, there is a large gap between those who should have died (predicted) and those who died. The same is true when looking at figure 5c and 5d. The tendency was to increase in both sexes, although the gap between the predicted and the actual is greater in men.

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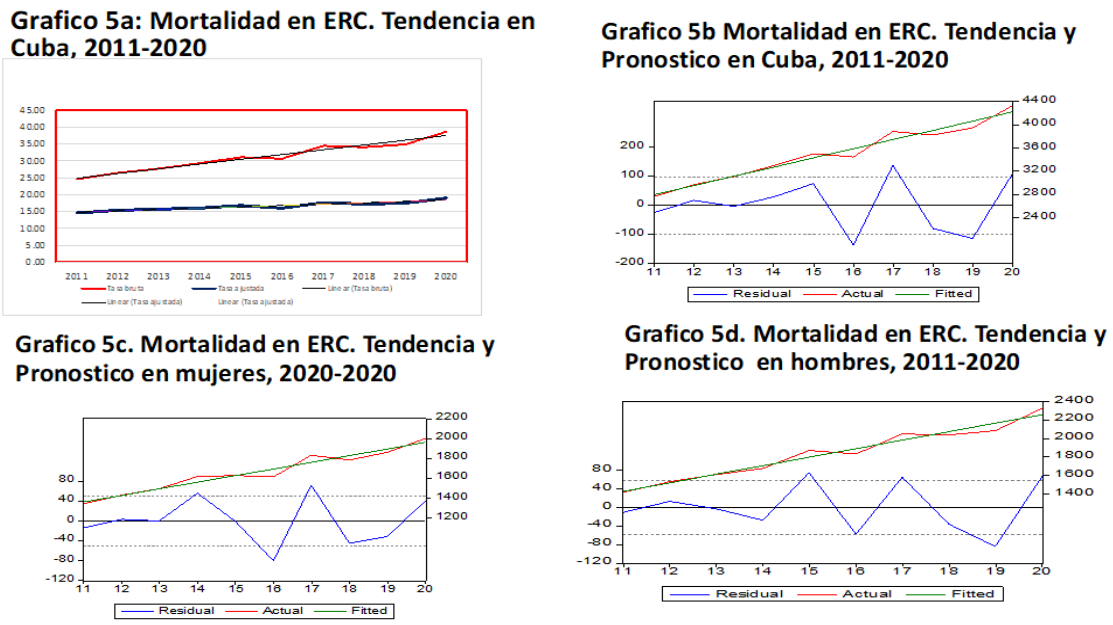

Note: Rate per 100 000 population. Age-adjusted rate. Direct method adjustment. Sample population: the census of Cuba, 1981.
Figure 5. CKD Mortality Trend and Forecast, Cuba 2011-2020

The RD in the Region of the Americas at the end of 2019 represented the eighth cause of mortality, the tenth cause of years of life lost due to premature death, and the tenth cause of disability-adjusted life years in both sexes combined, and is one of the causes with the highest growth rate in Region.[5]

Cuba is not exempt from this problem, and the period analyzed shows significant increases in the age-adjusted mortality rate in patients with CKD; the standardized rate was higher than that of the region of the Americas, lower than countries such as Nicaragua and higher than Canada, these results coincide with national and international studies.[4,5, 8,9,11,12] In Ecuador, CKD is the fourth cause of general mortality and the fifth cause of premature mortality and produces 1,44 % of years lived with disability. In Spain, the disease is expected to become the second leading cause of death in the coming years, after Alzheimer's disease.[12,13,14]

Cuba has a CKD prevention and control program and a CKD case registry for primary health care (PHC).[15] In recent years, the increase in cases diagnosed in the final stages of CKD has led to an increase in hemodialysis services to 58, facilitating and bringing renal function replacement treatment to patients in all provinces and most of the country's municipalities. However, there is still a large diagnostic gap in stages 1 to 3; the number of patients in this group is unknown, showing that there are problems in the integration of the actions of the specialty with primary health care. There are problems in the dispensation of risk factors for chronic noncommunicable diseases and the timely diagnosis of CKD in primary health care. In studies carried out in some provinces, a high prevalence of hidden morbidity was found, which supports the above;[16,17,18] a large number of patients continue to be diagnosed in stages 4 and 5 in Secondary and Tertiary Care, together with the unrecorded number who die from complications once the disease is diagnosed, before reaching the renal replacement or transplant method.

On the other hand, there is a great number of deceased without a diagnosis; CKD does not appear as the basic cause of death because, in most cases, an autopsy is not performed, an important procedure for the diagnosis of the cause of death and allows the health organizers to take the necessary measures to raise the quality of the medical work; to apply the experiences obtained to decrease the indicators of morbidity and mortality in the population.[19]

The National Group of Nephrology and the Scientific Society have expressed that many factors influence the exposed results, primarily the poor integration work of several specialties, insufficient training of medical and laboratory human resources working in primary health care in topics such as the identification of primary risk factors, in those of disease progression and in laboratory techniques for the early diagnosis of CKD, HT and DM, the latter two being diseases that constitute risk factors for the development of CKD. This becomes evident when the diseases above are not well controlled, monitored, or adequately treated. In addition to the factors above, there are other factors, such as the increase in life expectancy in the country with the increase in the number of people aged 60 and over, the indiscriminate use and abuse of NSAIDs, the increase in risk factors such as obesity and sedentary lifestyle, together with problems with health education at the different levels of care, the instability of medical personnel and the poor promotion of individual self-responsibility of the population.

An important aspect of the CKD prevention program is training, an aspect that began in the specialty

through the Itinerant Nephrology Congress sponsored by the Scientific Society of Nephrology and the National Group in coordination with the National Directorate and the Provincial Health Directorates of PHC, training workshops held in the provinces of Guantánamo, Santiago de Cuba, Granma, Holguín, Las Tunas, Camagüey and Havana. This initiative began at the end of 2022, 2023 and was extended to 2024.

Sex and age are traditional risk factors for CKD mortality. The results of the study show that the increase in mortality rates has been more in men than in women and the highest mortality rates in groups older than 70 years, coinciding with international[2,5,6,8,11,12] and national[4,9,10,11] studies. However, there are countries and provinces in the country where there was a notorious increase in the rates of women. Havana and Mayabeque are examples;[11] in these places, future projects should deepen the causes. Concerning age, the results coincide with several international and national studies, which show an increase in the risk of death in all age groups, mainly in those over 70 years of age. However, the increase in the 50-60 age group has been notorious in the last ten years.[2,3,4,5,8,9,10]

Although it is known that the kidney ages and a large number of glomeruli are damaged in the elderly, an important aspect is the comorbidities that appear throughout life (diabetes and cardiovascular disease, which account for more than 40 % of cases), as well as obesity and smoking.[10,13,14] In the case of the study, the group aged 50 to 60 years should be reviewed in greater depth due to the importance of this age group for the country's socioeconomic development. CKD has multiple risk factors common to other chronic noncommunicable diseases and, in turn, can be a risk factor for other diseases. The journal Lancet reports that 1,4 million deaths are related to cardiovascular diseases, and 25,3 million cases of cardiovascular diseases are attributable to renal failure.[20] In general, 30 % of CKD cases are due to causes related to diabetes mellitus, 25 % to arterial hypertension, and 20 % to glomerulopathies.[21] It coincides that at the end of 2020, the main cause of death in the country will be cardiovascular diseases, including HTN,[7] the latter being the main cause of death in patients with CKD throughout the period and one of the risk factors for CKD. The provinces in the first places with very high mortality rates (Cienfuegos et al.) coincide with high increases in HT and DM prevalence rates.[7] Coincides with studies carried out prior to the time of this work, the province of Cienfuegos is described as an area of very high epidemiological risk of mortality with CKD and Sancti Espíritus as an area of high epidemiological risk of mortality with CKD[10,11] and both provinces present high prevalence rates of CKD in stage.[5]

An example of coordinated work was in Isla de la Juventud, where an epidemiological study was carried out between 2004 and 2005, and the prevalence of CKD was 9,63 in adulthood. By stages, the highest percentages of cases are attributed to stages 1 to 3b, where 9,4 % of the prevalence is found, with 6 199 patients (97,8 % of the expected cases), while patients with advanced CKD (stages 4 and 5) would be 0,18 % of the prevalence (199 patients), including those receiving renal replacement therapy by dialysis or renal transplantation.[22] It could be that this work could increase their rates, coinciding that in 2011, Isla de la Juventud had one of the highest mortality rates in the country; perhaps the chronic renal disease program has been consolidating and is the only municipality in the country that presents at the end of 2020 a 2,9 % decrease in its mortality rate with CKD. The leading causes of mortality and health loss provide fundamental information for monitoring trends in population health outcomes, recognizing the pattern of diseases and injuries that affect premature mortality and disability, identifying emerging health challenges, evaluating the effectiveness of interventions, and making public health decisions aimed at improving population health and saving lives.[4]

Kidney disease has a major effect on global health, is a direct cause of global morbidity and mortality, and is a major risk factor for cardiovascular disease. Globally, in 2017, 1,2 million people died of CKD. The overall all-age mortality rate from CKD increased 41,5 % between 1990 and 2017, although there was no significant change in the age-standardized mortality rate (2,8 %). In 2017, there were 697,5 million cases of CKD at all stages, for an overall prevalence of 9,1 % (8,5 to 9,8). The overall prevalence of CKD across all ages increased by 29,3 % since 1990, while the age-standardized prevalence remained stable (1,2 %). CKD produced 35,8 million (UI 95 % 33,7-38,0) DALYs 2017, with diabetic nephropathy accounting for almost one-third of DALYs. [20] In Cuba, with 57 nephrology, hemodialysis, and peritoneal dialysis services, the incidence of this ailment is 100 patients per one million inhabitants; the main causes of death in patients with CKD in the period are HKD, DM, and NERD, which coincides with what happens in the world closes the decade in the first place HKD. The simultaneous coexistence of factors is frequent and modulates renal damage. Non-modifiable conditions: age, gender, race, and low birth weight. Potentially modifiable comorbid alterations that can directly or indirectly induce or aggravate renal damage: hypertension, diabetes, obesity, dyslipidemia, smoking, hyperuricemia, and cardiovascular disease. CKD is thus associated with uncontrollable factors, such as gender and age, but also with habits and lifestyles and, therefore, with avoidable risk factors, such as obesity. Thus, different studies worldwide have shown that people with obesity are 83 % more likely to develop CKD. It is also estimated that 13,8 % of CKD in men and 24,9 % of CKD in women in industrialized countries may be associated with overweight or obesity. In Spain, the ENRICA report has shown a close correlation between kidney disease and cardiovascular disease and the accumulation of cardiovascular risk factors.[23,24] Of the results analyzed, the increase in mortality rates with CKD in all provinces is noteworthy; the upward trend in mortality has been described in several studies[8,9,10,11] The tendency was to increase in the last two years, and the prognosis was

fulfilled.

After the exposed analysis, it is considered that the conditions to prevent and treat in the country through health policies using the promotion of renal health, prevention, and early detection. With the scientific tools research and epidemiology of the disease, it is possible to work in the identification of the known risk factors such as age, arterial hypertension, obesity, abdominal obesity, smoking, high LDL cholesterol, low HDL cholesterol, hypertriglyceridemia, diabetes, and sedentary lifestyle. At the same time, CKD is a predictor risk factor for Cardiovascular Disease (CVD), independent of other factors such as arterial hypertension, dyslipidemia, or obesity. Once it reaches a certain stage, such as stage 3b, it triggers cardiovascular risk.[25]

CONCLUSIONS

In patients with CKD, mortality shows an upward trend; the prognosis is fulfilled; if effective interventions are not made on the risk factors for the progression of CKD, complications due to comorbidities, and the control of morbidity due to HT and DM, there will be no decrease in mortality. Mortality has shown variations by provinces, with no predilection for any region of the country; the Isle of Youth is the only one with a decreased mortality rate. DM was the main cause of death in the first seven years of the series, which HDD displaced.

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FINANCING

The authors did not receive funding for the implementation of this study.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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