Anais da Faculdade de Medicina de Olinda
Annals of Olinda Medical School

afmo.emnuvens.com.br ISSN: 2674-8487 Original Article

Potential years of life lost due to diseases of the circulatory system in a capital of Brazilian Northeast

Anos potenciais de vida perdidos por doenças do aparelho circulatório em uma capital do Nordeste brasileiro

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Abstract

Aim: To estimate the potential years of life lost (PYLL) due to diseases of the circulatory system (DCS) in residents of Recife (Pernambuco). **Methods:** This descriptive study used a quantitative approach to analyze deaths from DCS among individuals aged 1 to 74 residing in Recife during 2017. Data were obtained from the Mortality Information System, and the PYLL and their rate (PYLLR) were calculated. **Results:** Deaths from DCS were concentrated in the oldest age groups: 60 to 69 (36.7% of men and 42.6% of women) and 50 to 59 (27.4% of men and 19.2% of women). Most deaths occurred among individuals of brown ethnicity (61.0%) with one to three years of education (26.0%), in hospitals (64.0%), and were attributed to ischemic heart disease (54.7%). The overall mortality rate was about twofold higher in men. In addition, the PYLLR was significantly higher in men than in women (16.27 years per 1,000 inhabitants vs. 7.37 years per 1,000 inhabitants, respectively). The age group between 60 to 64 years had the highest PYLLR (53.20 years per 1,000 inhabitants), followed by 65 to 69 (52.60 years per 1,000 inhabitants). Ischemic heart disease was the DCS with the highest PYLL, totaling 9,853 years: 6,701 lost in men (PYLLR = 9.24 years per 1,000 inhabitants) and 3,152 in women (PYLLR = 3.78 years per 1,000 inhabitants). Men were about twofold more likely to die

How to cite: Mendonça **CNG**, Oliveira **CM**, Mendonça **MFS**.
Potential years of life lost due to diseases of the circulatory system in a capital of Brazilian Northeast
An Fac Med Olinda 2024; 1(11):1 doi: https://doi.org/10.56102/afmo.2024.317

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Funding: None.
Ethics approval: CAAE nº 10394919.6.0000.5569.
Received: 11/13/2023
Approved: 03/05/2024

than women. **Conclusion:** PYLL was more pronounced in men; they were more likely to die from DCS than women.

Keywords: Chronic disease; Diseases of the circulatory system; Mortality; Potential years of life lost.

Resumo

Objetivo: Estimar os anos potenciais de vida perdidos por doenças do aparelho circulatório (DAC) de residentes no Recife, Pernambuco. **Métodos:** Estudo descritivo com abordagem quantitativa dos óbitos por DAC de residentes no Recife de 1 a 74 anos de idade, ocorridos em 2017.Os dados foram obtidos do Sistema de Informações sobre Mortalidade. Calcularam-se os anos potenciais de vida perdidos (APVP) e sua taxa. **Resultados:** No ano estudado, ocorreram 12.038 óbitos de residentes no Recife; destes, 1.363 (20,2%) foram por doença arterial coronariana. No sexo masculino, a taxa de APVP foi de 16,27 anos/1.000 habitantes. A faixa etária entre 60 e 64 anos apresentou maior taxa de APVP (53,20 anos/1.000 habitantes). O tipo de DAC que apresentou maiores APVP (9.853 anos) foram as doenças isquêmicas do coração em ambos os sexos, com 6.701 anos perdidos nos homens (taxa de APVP = 9,24 anos/1.000 habitantes) e 3.152 anos nas mulheres (taxa de APVP = 3,78 anos/1.000 habitantes). Em todos os tipos de DAC, os homens apresentaram aproximadamente duas vezes mais chances de morrer comparado às mulheres (RC = 1,8). **Conclusão:** Os APVP e as taxas de APVP são indicadores pouco utilizados para análise do padrão de mortalidade. Contudo, as informações apresentadas desses indicadores poderão servir para nortear ações que visam a promoção da saúde e a prevenção das DAC.

Palavras-chave: Anos potenciais de vida perdidos; Doença crônica; Doenças do aparelho circulatório; Mortalidade.

INTRODUCTION

Diseases of the circulatory system (DCS) are a leading cause of death among the Brazilian population, with 267,635 deaths in 1990 (29.3% of total deaths) and 424,058 deaths in 2015 (31.2% of total deaths)[1,2]. Among DCS, the most prevalent are ischemic heart disease (IHD) and cerebrovascular disease (CVD)[3].

CVD is highly neglected in Brazil and presents high incidence and mortality rates, leading to a slower epidemiologic transition compared with regions with similar socioeconomic development levels. Systemic arterial hypertension is the main risk factor for CVD, while IHD is primarily influenced by dyslipidemia, hypertension, smoking, and diabetes[4,5].

In Brazil, the risk of death from CVD and IHD varies according to sex and region. For men, the risk is similar for both diseases. On the other hand, women present more risk of death from CVD, and their IHD mortality is higher in more developed regions. In addition, the IHD mortality has increased in the Northeast and North regions while remaining unchanged in the Midwest[6].

DCS significantly impairs the quality of life and daily and work activities, and causes economic strain on families and the healthcare system, resulting in impoverishment and social harm[8]. Furthermore, studies show that DCS has elevated the number of premature deaths (30 to 69 years), contributing to a rise in years of life lost[7,8].

The potential years of life lost (PYLL) is a social and economic indicator used to analyze mortality in developed and developing countries. PYLL defines and classifies the causes and risk factors of premature death, measuring their social impact and highlighting the magnitude, vulnerability, and significance of causes of death[8].

PYLL has a greater impact on the death of younger individuals as it assumes a potential lifespan for everyone. When premature death occurs during high-productivity years, the individual does not contribute intellectually and economically to society during potential years of life, which is calculated as the difference between an established upper age limit and the age at death[9].

Calculating PYLL due to DCS is important for cardiovascular health surveillance as it helps monitor modifiable risk factors and gather healthcare service indicators[10]. Moreover, research in this area is limited and may influence preventive measures from healthcare services, particularly in Northeast Brazilian cities. Hence, this study aimed to estimate the PYLL due to DCS in residents of Recife, Pernambuco.

METHODS

This descriptive study was performed using a quantitative approach in Recife, the capital of Pernambuco. The city has an area of 218.5 km^2 and a population of 1,633,697. The primary healthcare network includes 134 Family Health Strategy units with 276 Family Health teams and 56 Community Health Agents Strategy teams; 20 Expanded Family Health Centers; 6 Integrative Practices Centers; 12 polyclinics; and 41 City Gym Centers to promote health through physical activity, leisure, and healthy eating habits[11].

The study analyzed deaths due to DCS among Recife residents aged from 1 to 74 years in 2017. Deaths of infants under one year old were excluded because infant mortality was not the focus. Additionally, deaths of individuals over 74 years old were excluded due to the upper limit of life expectancy used in the calculation method. Causes of death were classified using the 10th Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) for DCS (I00-I99), focusing on hypertension (I10-I15), ischemic heart diseases (I20-I25), and cerebrovascular diseases (I60-I69).

Data were obtained from the Mortality Information System at the Health Secretariat of Recife. All DCS deaths were analyzed based on variables extracted from the death certificate: sex, age group, ethnicity, education, marital status, location of death, and main DCS group. Descriptive analysis and statistical calculations used an estimation dataset from the Health Secretariat of

Recife for 2017, based on the 2010 population census data of the Brazilian Institute of Geography and Statistics (IBGE).

Absolute and relative frequencies, mortality rate, PYLL and PYLL rate (PYLLR), odds ratio, and p-value were calculated to characterize deaths. Statistical analysis was performed on EpiInfo (version 7.2.3.1). The odds ratio was estimated for sex differences, and the Pearson Chi-square test was used to measure trends among age groups. The Executive Secretariat of Health Surveillance provided a calculation matrix for PYLL estimation.

In this matrix, the number of deaths in each age group was multiplied by the mean of years remaining to the upper age limit of 74 years, calculated using the median age of each group. The ratio of PYLLR between men and women was determined by dividing the higher rate by the lower rate in each sex. PYLL for a specific cause of death was calculated using an adaptation of Romeder and McWhinnie's method[12]: PYLL = ∑aidi, where:

ai = years left to reach the age of 74 at death;

di = the number of deaths between ages i and i+1 years.

PYLLR was calculated using the formula PYLLR = ∑aidi x 1,000/N, where N is the number of people aged from 1 to 74 years.

RESULTS

In 2017, 12,038 residents of Recife died, of which 6,747 (56.1%) were aged from 1 to 74 years. Among these, 1,363 (20.2%) deaths were due to DCS. These deaths were concentrated in the 60 to 64 and 65 to 69 age groups (306 [36.7%] for men and 226 [42.6%] for women), followed by the 50 to 54 and 55 to 59 age groups (228 [27.3%] for men and 102 [19.2%] for women). Brown ethnicity and low education level (1 to 3 years) were predominant for both sexes (Table 1).

Table 1. Characterization of deaths from diseases of the circulatory system (DCS) in men and women by demographic variables, location of death, and type of DCS. Recife, Pernambuco, Brazil, 2017

Variables	Men		Women		Total	
	n	%	n	%	nº	%
Age group (years)*						
10 to 14	1	0.1	1	0.2	2	0.1
15 to 19	-	-	1	0.2	1	0.1
20 to 24	1	0.1	1	0.2	2	0.1
25 to 29	5	0.6	2	0.4	7	0.5
30 to 34	6	0.7	5	0.9	11	0.8
35 to 39	19	2.3	5	0.9	24	1.8
40 to 44	23	2.8	12	2.3	35	2.6
45 to 49	68	8.2	26	4.9	94	6.9

50 to 54	101	12.1	42	7.9	143	10.5
55 to 59	127	15.2	60	11.3	187	13.7
60 to 64	147	17.6	99	18.7	246	18.0
65 to 69	159	19.1	127	24.0	286	21.0
70 to 74	176	21.1	149	28.1	325	23.8
Ethnicity*						
White	258	31.0	163	30.8	421	30.9
Black	59	7.1	36	6.8	95	7.0
Brown	513	61.6	328	61.9	841	61.7
Indigenous	1	0.1	1	0.2	2	0.1
Not reported	2	0.2	2	0.4	4	0.3
Years of education						
None	66	7.9	77	14.5	143	10.5
1 to 3	217	26.1	141	26.6	358	26.3
4 to 7	185	22.2	114	21.5	299	21.9
8 to 11	208	25.0	102	19.2	310	22.7
12 or more	74	8.9	42	7.9	116	8.5
Not reported	83	10.0	54	10.2	137	10.1
Marital status						
Single	329	39.5	241	45.5	570	41.8
Married	349	41.9	132	24.9	481	35.3
Widowed	58	7.0	101	19.1	159	11.7
Divorced	65	7.8	37	7.0	102	7.5
Never married	20	2.4	6	1.1	26	1.9
Not reported	12	1.4	13	2.5	25	1.8
Location of death						
Hospital	533	64.0	376	70.9	909	66.7
Other healthcare facility estabelecimentos de saúde	81	9.7	40	7.5	121	8.9
At home	178	21.4	103	19.4	281	20.6
On the street	21	2.5	6	1.1	27	2.0
Other	20	2.4	5	0.9	25	1.8
Main DCS groups						
Ischemic heart diseases	456	54.7	286	54.0	742	54.4
Cerebrovascular diseases	294	35.3	178	33.6	472	34.6
Hypertensive diseases	83	10.0	66	12.5	149	10.9

* No deaths occurred in the 1 to 9 age range or among individuals of Asian ethnicity.

Most deaths for both sexes occurred in hospitals (66.7%), followed by at home (20.6%), and in other healthcare facilities (8.9%). Among the main DCS groups, most deaths were due to IHD (54.4%), followed by CVD (34.6%) and hypertensive diseases (10.9%) (Table 1).

The mortality rate was 85.8 deaths per 100,000 inhabitants, twofold higher in men than in

women (p = 0.00). The highest rate was in the 70 to 74 age group (929.1 per 100,000 inhabitants; Table 2). PYLLR due to DCS was 11.51 years per 1,000 inhabitants.

The PYLLR was higher in men than in women (16.27 years per 1,000 inhabitants vs. 7.37 years per 1,000 inhabitants, respectively). The highest PYLLR was in the 60 to 64 age group (53.20 years per 1,000 inhabitants), followed by the 65 to 69 age group (52.60 years per 1,000 inhabitants) (Table 2). Men had about two times more chances of dying than women (OR 1.8; p = 0.00) (Table 2).

Table 2. Absolute distribution, mortality rate, potential years of life lost rate, odds ratio, and p-value of deaths due to diseases of the circulatory system according to sex and age group. Recife, Pernambuco, Brazil, 2017

Variables	N	MR	PYLLR	OR	p-value**
Sex					
Women	530	63.6	7.37	1	-
Men	833	114.9	16.27	1.8	0.00
Age group (years)*					
10 to 14	2	1.6	0.99	2.1	0.96
15 to 19	1	0.7	0.43	1.0	-
20 to 24	2	1.3	0.71	1.8	0.86
25 to 29	7	4.7	2.24	6.2	0.05
30 to 34	11	7.9	3.41	10.6	0.00
35 to 39	24	18.9	7.18	25.2	0.00
40 to 44	35	29.3	9.67	39.1	0.00
45 to 49	94	84.9	23.77	113.2	0.00
50 to 54	143	149.9	34.48	200.0	0.00
55 to 59	187	247.6	44.57	330.3	0.00
60 to 64	246	409.2	53.20	545.8	0.00
65 to 69	286	657.5	52.60	877.0	0.00
70 to 74	325	929.1	27.87	1239.3	0.00
Total	1363	2.542.64	11.51	116.6	0.00

MR = mortality rate; PYLLR = potential years of life lost rate; OR = odds ratio;
* No deaths occurred in the 1-9 age range; **p < 0.05 = statistically significant.

The IHD was the DCS that presented the highest PYLL (9,853 years) in both sexes: 6,701 years lost among men (PYLLR = 9.24 years per 1,000 inhabitants) and 3,152 years lost among women (PYLLR = 3.78 years per 1,000 inhabitants) (Table 3). In all types of DCS, men showed about two times more chances of dying than women (Table 3).

Table 3. Absolute distribution, mortality rate, potential years of life lost, potential years of life lost rate, odds ratio, and p-value of deaths due to diseases of the circulatory system by sex and main DCS groups. Recife, Pernambuco, Brazil, 2017.

Variables	Ischemic heart diseases	Cerebrovascular diseases	Hypertensive diseases	Total
Men				
Number	456	294	83	833
MR	62.9	40.6	11.5	114.9
PYLL	6.701	3.871	1.219	11.79
PYLLR	9.24	5.34	1.68	16.27
OR	1.8	1.9	1.4	1.8
p-value	< 0.00	< 0.00	0.02	< 0.00
Women				
Number	286	178	66	530
MR	34.3	21.3	7.9	63.6
PYLL	3.152	2.251	745	6.15
PYLLR	3.78	2.70	0.89	7.37
OR	1	1	1	1
p-value*	-	-	-	-

MR = mortality rate; PYLL = potential years of life lost; PYLLR = potential years of life lost rate; OR = odds ratio; p* < 0.05 = statistically significant.

DISCUSSION

DCS-related deaths were the leading cause of death among residents of Recife, corroborating national and global scenarios[1]. The rising incidence and prevalence of these diseases in recent years are primarily due to lifestyle changes that affect risk factors, such as sedentary behavior, poor diet, diabetes, obesity, and an aging population[13].

Considering age groups, DCS-related deaths were more common in the 60 to 69 age group for women and in the 50 to 59 group for men, indicating earlier mortality in the latter. Studies from other Brazilian states[14] have shown that sex differences in DCS mortality follow global patterns, with more developed regions having lower DCS mortality rates, starting with women.

The significant decrease in age-standardized mortality among women in the Northeast and North contrasts with the reduction between sexes in the Southeast and South regions. This disparity suggests that the Northeast and North regions still experience delayed reductions of mortality rates among men due to poor economic and social development and limited access to health services[14].

Beyond age and sex differences, DCS-related deaths were more prevalent among individuals of brown ethnicity and those with low education levels (one to three years). DCSs have

resulted in over seven million deaths annually worldwide, especially in vulnerable groups (e.g., older adults and individuals with lower income and education levels)[13]. The world population is aging; therefore, new strategies under the National Senior Policy and Active Aging Policy are needed to promote quality of life in the aging population[15].

Most deaths occurred in hospitals, consistent with a study conducted in Recife[16], which reported 82.2% of deaths in hospitals and 19.5% at home. The authors observed a higher risk of in-hospital death among low-income individuals, who often face barriers to early healthcare access and are hospitalized at later stages of the disease, limiting effective care[16].

Healthcare challenges in Brazil are evident, with substantial gaps in providing medium and high-complexity services. The deterioration of the Unified Health System hampers efforts to address these morbidities, which will increase with an aging population[17].

Most DCS deaths were due to IHD, followed by CVD, aligning with other Brazilian studies[3,19]. The World Health Organization estimates that cerebrovascular accidents will be the second leading cause of death worldwide by 2030[20].

The formation of atheromas and their clinical consequences (myocardial infarction and cerebrovascular accidents) is closely associated with cardiovascular risk factors, such as hypercholesterolemia, hypertriglyceridemia, low HDL-c levels, hypertension, diabetes, and obesity[21]. Primary health care is responsible for the early prevention, diagnosis, and treatment of these complications, focusing on health promotion and disease prevention based on prevalent risk factors[13].

In the present study, the mortality rate was twofold higher in men than in women, consistent with other Brazilian studies showing increased DCS mortality rates among men[22,14].

Women tend to use health services more often, allowing for early diagnosis and treatments, which may reduce mortality[17]. The concept of hegemonic masculinity in Brazilian society promotes the idea that men should demonstrate strength, and they only seek healthcare when seriously ill, impairing their health[23].

In this study, men had a PYLLR twofold higher than women, corroborating the findings of a study conducted in Ribeirão Preto, São Paulo[24]. Research in the USA showed that after acute myocardial infarction, men lose a mean of 41.8% of their years of life, whereas women lose 10.5%, suggesting that PYLL is higher among men even in developed countries[25].

PYLL highlights the decline in socioeconomic productivity, underscoring the need to implement and improve prevention policies to reduce premature DCS deaths. This indicator measures the magnitude, vulnerability, and significance of each death, providing a new criterion for setting priorities[26].

A Canadian study highlighted the importance of using PYLL to view chronic diseases comprehensively[27]. This indicator helps assess the progress of health interventions and guide cost-ef-

fective actions to reduce premature mortality. Additionally, PYLL can enhance chronic disease surveillance, aiding in monitoring and achieving public health goals[27,28].

The highest PYLL was due to IHD in both sexes, accounting for over half of deaths, followed by CVD and hypertensive diseases. A study conducted in Brazil in 1990 and 2015 found IHD as the leading cause of cardiovascular death nationwide (excluding the Amapá state), followed by CVD[14]. This data is consistent with the epidemiologic transition in Brazil[29].

Moreover, the predominance of IHD as a cause of death may suggest better control of systolic arterial hypertension, strongly associated with CVD, compared to dyslipidemia and diabetes, which are more associated with IHD[30]. In addition, the rising prevalence of diabetes in Brazil evidences the obesity epidemic, posing a challenge to sustain the reduction of cardiovascular disease mortality in the future[14].

CONCLUSIONS

Deaths from DCS were concentrated in older age groups, brown ethnicity, and lower education levels. Most deaths occurred in hospitals, and IHD was the leading cause, followed by CVD.

The overall mortality rate was about twofold higher in men, with a PYLLR of 11.51 years per 1,000 inhabitants in the municipality. Men had a higher PYLLR than women, with the former presenting a twofold chance of death compared with the latter in al DCS.

PYLL and PYLLR are underutilized indicators for analyzing mortality patterns. However, they could inform and guide actions to promote health and prevent DCS. Health managers and researchers should conduct health diagnoses that include mortality profiles and the impact of DCS-related years of life lost, as this information is crucial for health planning and care.

CONFLICT OF INTEREST

Nothing to declare.

AUTHORS CONTRIBUTIONS

CNGM: Conceptualization, data collection, formal analysis, research, methodology, writing – original draft and text review and editing; **MFSM:** formal analysis, validation, and text revision and editing; **CMO:** Conceptualization data collection, formal analysis, research, validation, methodology, supervision, writing – original draft, text review and editing. All authors approved the final version of the text to be published.

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