Research Article

Burden of Disease: Heart Failure in an Emerging Country

Clímaco Pérez Molina[1,2,3*], Carlos Castañeda Orjuela[4], Pedro Valbuena Hernandez[5], Rafael I Perez Arias[6], María A Perez Arias[7], Ana María Arias Copete[8]

[1]Department of Cardiology, Clinic of the Universidad de la Sabana, Bogotá, Colombia; [2]Department of Cardiology, Electrophysiology Service, Clínica Colombia de Sanitas, Bogotá, Colombia; [3]Department of Cardiology, Avidanti Clinic, Ibagué, Colombia; [4]Department of Cardiology, National Health Observatory, Bogotá, Colombia; [5]Department of Cardiology, Center for Economic Research Universidad del Bosque, Bogotá, Colombia; [6]Department of Cardiology, Medical student del Rosario University, Bogotá, Colombia; [7]Department of Cardiology, Medical student de la Sabana University, Bogotá, Colombia; [8]Department of Cardiology, Nogales Clinic, Bogotá, Colombia

ABSTRACT

Heart Failure (HF) harbors a multiplicity of causes in its development and progression. Therapeutic interventions for its treatment are high-cost technologies, drugs, and procedures. With this study, we want to comprehensively evaluate the cost-effectiveness of therapeutic interventions used in the management of functional class II-IV HF. For this, a systematic review of economic evaluations of the cost-effectiveness and cost-utility type was carried out, for each of the therapeutic interventions for HF and risk of sudden death, during the period 2015-2022. The articles were searched in several databases, in English and Spanish. The data extraction was done through the Patient/Population, Intervention, Comparison and Outcomes (PICO) framework. The results were expressed in the incremental cost-effectiveness ratio. As a result, 162 clinical trials were obtained. It is concluded that the Cardioverter defibrillator in primary prevention, the resynchronisation therapy, the heart transplant, the optimal pharmacological treatment, the mitral valve surgery, the Intravenous therapy, the follow-up strategies, tele-rehabilitation, follow-up with laboratory and device such as the CardioMems they are cost-effective. While the resynchronisation therapy defibrillator, cardiac assist devices and catheter ablation for atrial fibrillation show limitations in their cost-effectiveness.

Keywords: Heart failure; Therapeutic interventions; Cost-effectiveness analysis; Incremental cost-effectiveness ratio

INTRODUCTION

Heart failure (HF) is an important and growing medical problem with significant economic impacts for the health system, with high prevalence rates (around 2%) and incidence worldwide [1,2]. HF especially affects patients 65 years of age or older, accounting for 80% of hospitalizations and 90% of related deaths [3]. Being able to reach in countries like the United States, in people older than 75 years, up to 10% [4,5]. This increase in prevalence is related to the aging of the population (secondary to a longer life expectancy and a decrease in the birth rate in industrialized countries) and to the comorbidities that this brings, such as the increase in cases of high blood pressure, diabetes, etc. [6,7].

This increase in the prevalence in older adults, for the period 2000-2020, has constituted an enormous economic burden for the health systems of all countries, with an estimated global annual expenditure of US$ 108 billion, with $65 billion attributed to direct costs and $43 billion to indirect costs [8,9]. Especially for industrialized countries, for example, in Europe and the USA between 1% and 2% of the annual health budget is spent on HF [10]. The USA and Europe contribute with 28.4% and 6.83%, respectively, of the total world expenditure for this cause [9].

At the same time, HF has been defined as a pathophysiological state in which an abnormality in the function of the heart is responsible for its inability to pump blood at an adequate rate to meet the needs of the metabolizing tissues [11,12]. Currently, the diagnosis of HF is made based on the triad: clinical signs and symptoms, BNP levels, and echocardiographic findings [13]. Although advances in medical therapy, device assistance, and surgery have significantly improved HF outcomes, the implications remain dramatic. In a UK cohort study, age-adjusted all-cause mortality rates for the first year of diagnosis were estimated to be 23.0 (95% CI: 22.0-24.1) per

100 person-years between 2012-2015 [2,14].

On the other hand, decompensation and rehospitalizations of this disease can occur, up to 66% of cases, in the first year of diagnosis and up to 40% from the second year onwards [15]. Given its syndromic characteristics and the fact that it is not a definitive cause, but a potential cause of death, it has become difficult to conduct adequate studies of the burden of disease. The mortality rate of patients with HF is high, as shown in the Meta-Analysis Global Group in Chronic (MAGGIC) meta-analysis that included individual data from 39,372 patients with 40.2% deceased during a median follow-up of 2.5 years, a recently published study showed that readmission rates at 30 days for HF are higher than for pneumonia or acute myocardial disease, infarction [9,16]. A first approach in this sense in Latin America was the systematic review and meta-analysis of Ciapponi, et al., conducted between January 1994 and June 2014, in 143 retrieved references. Most of the baseline studies were conducted in South America (92%), in Brazil (64%). The mean age was 60 ± 9 years and the mean ejection fraction was 36 ± 9%. The incidence of 199/100,000 person-years; prevalence, 1% (95% Confidence Interval (95% CI), 0.1-2.7%); rehospitalization rates, 33%, 28%, 31%, and 35% at 3, 6, 12, and 24-60 months of follow-up, respectively; and median hospital stay, 7.0 days. The one-year mortality rate was 24.5% (95% CI, 19.4-30.0%). In-hospital mortality was 11.7% (95% CI, 10.4-13.0%), and the latter was increased in patients with reduced ejection fraction, ischemic heart disease, and Chagas disease.

For all of the above, it is the responsibility of public policy managers in public health to produce research that moves the frontier of knowledge, to generate solutions or policies that help mitigate the health and economic burden generated by HF. Based on this, the objective of this study is to calculate, based on the available information, the estimate of the global burden of disease due to HF in Colombia.

MATERIALS AND METHODS

In order to have a synthetic indicator that allows decision-making and the orientation of investment in health, the Global Burden of Disease (GBD) was calculated for HF. This was clinically diagnosed using structured criteria such as the Framingham Criteria and those of the European Society of Cardiology [13,14,16]. For this, it was necessary to calculate frequency measures such as incidence, prevalence, and mortality and, on the other hand, the assessment of their fatal consequences (loss of years of life). An analytical model was then elaborated from the data obtained from the different sources, to determine the prevalence and incidence, the SISPRO records in Colombia (Comprehensive Social Protection Information System) were explored, based on the related codes in the International Statistical Classification of Diseases and Related Problems with health, version 10 (ICD-10), for HF and its causes (Table 1) [17,18].

Table 1: ICD-10 code of main causes of HF.

| ICD-10 code	Causes of HF
I110	Hypertensive heart disease with heart failure (congestive)
I130	Hypertensive cardio renal disease with heart failure (congestive)
I132	Hypertensive cardio renal disease with heart failure (congestive) and renal failure
I420	Dilated cardiomyopathy
I426	Alcoholic cardiomyopathy
I427	Cardiomyopathy due to drugs and other external agents
I428	Another cardiomyopathy
I429	Cardiomyopathy, unspecified
I430	Cardiomyopathy in infectious and parasitic diseases classified elsewhere
I431	Cardiomyopathy in metabolic diseases
I432	Cardiomyopathy in nutritional diseases
I438	Cardiomyopathy in other diseases classified elsewhere
I500	Congestive heart failure
I501	Left ventricular failure
I509	Heart failure, unspecified
I515	Myocardial degeneration
I517	Cardiomegaly
I110	Hypertensive heart disease with heart failure (congestive)
I130	Hypertensive cardiorenal disease with heart failure (congestive)
I132	Hypertensive cardiorenal disease with heart failure (congestive) and renal failure

Sources

SISPRO (Integrated Social Protection Information System) is a health information center that, since 2013, has been registering hospital morbidity events and medications in Colombia. It is made up of databases and information systems. Sector information on supply and demand for health services, quality of services, insurance, financing, social promotion. For its part, the GBD 2020, conducted by the Institute of Health Metrics and Evaluation (IHME), is the most complete and systematic effort to date, to estimate the burden of diseases, injuries, and risk factors worldwide [19,20]. To assess mortality, the vital statistics records of the National Administrative Department of Statistics of Colombia (DANE) were consulted, for the codes related to mortality for HF and its causes, from the ICD-10, (data corrected by age groups and sex, according to the magnitude of the estimated underreporting and the misclassification of the basic cause of death) [17,18,21,22]. The population estimates of the last census in Colombia in 2018 and intercensal projections and the GBD 2020 were also considered [19-22]. Finally, specific contributions from the scientific literature on the subject under study, at a regional and global level, were also used. Incidences were expressed as incidence density using the number of cases/100,000 person-years (Figures 1 and 2) [23].
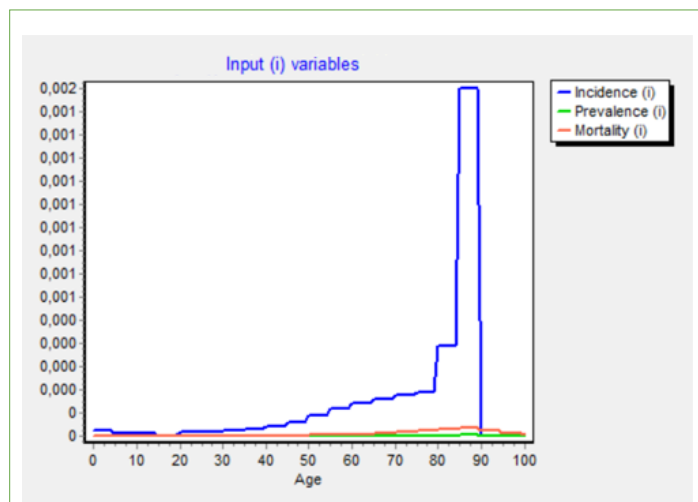
Figure 1: Result of HF data modeling at the population level by DISMOD. **Note:** (———) Incidence (i), (———) Prevalence (i), (———) Mortality (i).
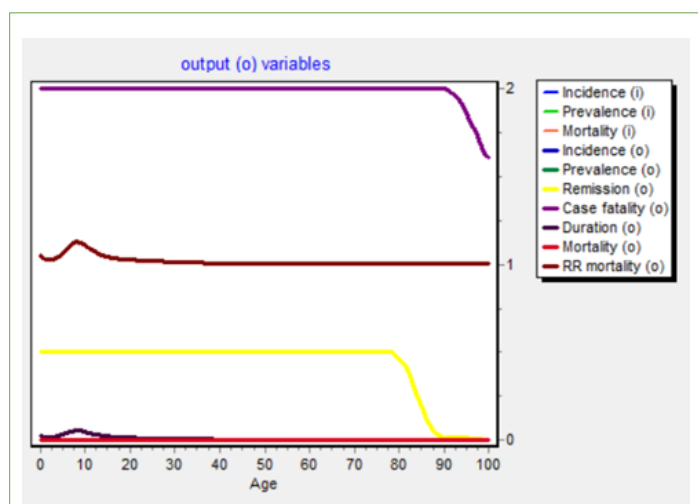
Figure 2: Result of HF data modeling at the population level by DISMOD. **Note:** (———) Incidence (i), (———) Prevalence (i), (———) Mortality (i), (———) Incidence (o), (———) Prevalence (o), (———) Remission (o), (———) Case fatality (o), (———) Duration (o), (———) Mortality (o), (———) RR mortality (o).

Process

The annual risk of death from HF was calculated as the ratio between the number of deaths for each cause taken from DANE, for the period 2015-2021, and the number of inhabitants for Colombia according to the 2018 population census [21]. Case fatality was calculated as the ratio between the specific number of deaths from HF and the total number of morbid cases discharged from hospital in Colombia for the study period. The annual risk of suffering a fatal HF event was calculated as the ratio between the risk of having a fatal HF event and its lethality. The number of non-fatal events due to HF was calculated as the difference between registered fatal events and the estimated total number of events (fatal and non-fatal). From the data obtained from these sources, the necessary epidemiological indicators were identified: Incidence, prevalence, case fatality rate, general mortality rates, severity, and disability, for HF and its risk of sudden death. To reconcile the origin of the data obtained from the sources, and in order to validate the internal consistency, the statistical program Dismod II© developed by the WHO was used; tool that allowed modeling HF data at the

population level [24]. The use of this software is common in burden of disease studies. Finally, in the objective of quantifying the loss of health, which occurs as a consequence of premature cardiovascular deaths. The degree of disability and Disability-Adjusted Life Years (DALYs) were measured [25,26].

Analysis phase

Years of Life Lost (YLL) due to premature death were calculated by multiplying the number of deaths at each age by life expectancy in years. It was used for the study as standard life expectancy at age 80 years for men and 82.5 years for women, from international life tables [26]. For Years of Life Lost Due to Disability (YLD), the severity or weight of disability, which is calculated for each disabling sequela (assessed between 0 without disability, and 1 death, for cardiovascular disease and HF, divided according to severity into four levels: controlled, medically managed, mild, moderate, and severe HF [27]. Each severity level of HF was assigned a disability weight, which represents the magnitude of health loss associated with the severity level [27]. The descriptions and weights of disability for different levels of severity of HF, multiplied by the duration and number of incident cases of each disease In the end, the sum of PYLL and PYLL determines the DALYs or in English Disability Adjusted Life Years (DALY), particular variant of Quality Adjusted Life Years (QALYs) Unlike QALYs, DALYs are measured by means of scales, which give a severity score between 0 to 1, where 0 represents perfect health and 1 death. it means a year of v lost healthy life. The DALY scale deducts 3% from the value of each year of future life (Rodríguez-García) [26]. These values were validated, with those obtained from the global study of CGE of the WHO [19,20].

Epidemiological simulation model

Then, a matrix-type simulation model was developed, with a kernel programmed in Microsoft Excel® in which the data was stored, and the central estimation calculations were performed in a deterministic manner. Only data from all persons aged 0 to 100 years were used in the model. For the analysis, the STATA version 14.0 software was used.

RESULTS

Regarding the prevalence of HF, in Colombia in the period from 2013 to 2021, there were 2,892,700 (2,863,967.8-2,921,432.2) events for outpatient consultations, procedures, emergencies (86.1%) and hospitalization (13.9%), (Table 2). Bearing in mind that approximately 53% of these are re-consultations and readmissions (1,533,131) and the deaths for this period, according to the DANE registry, there are 162,881 deaths: for an estimated 1,196,688 (1,183,184-1,210,192) cases. For a current population of 51,807,375 inhabitants, which allows calculating a prevalence of 2.31% (2.28-2.33), and for those over 60 years of age, on an estimated 659,371 patients (12.3%), in a population according to the 2018 Census of 6,372,307 inhabitants, 10.35% (10.24-10.37). For its part, the incidence density for the 2013-2021 period was 298.8 cases/100,000 person-years (Supplementary Figure 1). With a cumulative incidence for the 2015-2021 period of 18.26 cases/10,000 people. Observing an increase in prevalence, over the decades, reaching in those over 60 years, up to 6 times the value for the general population, explained by the fact that at older ages, the presence of this disease is more frequent.

Table 2: SISPRO reported events for CI 2013-2015.

Year	Detail	cases	Standard deviation	CI 95% Min	CI 95% Max
2013	Cons, proceed and urg	919570	89920.71	889344,858	949795,142
2013	Hospital	116793	16989.31	111082,367	122503,633
2014	Cons, proceed and urg	527591	102390,951	493174,222	562007,778
2014	Hospital	128734	18634.72	122470,291	134997,709
2015	Cons, proceed and urg	119,852	14187.55	115083,123	124620,877
2015	Hospital	17049	2631,247572	16164,556	17933,444
2016	Cons, proceed and urg	105652	12812.33	101345,379	109958,621
2016	Hospital	10771	1695.871	10200.97	11341.03
2017	Cons, proceed and urg	143868	2520,385182	138186,817	149549,183
2017	Hospital	16080	2520,385182	15232.82	16927,1797
2018	Cons, proceed and urg	184420	21448,39154	177210.5	191629.5
2018	Hospital	25003	3951.532	23674,7673	26331,2327
2019	Cons, proceed and urg	251245	28511,12955	241661,524	260828,476
2019	Hospital	35797	5437,51406	33969.28	37624.72
2020	Cons, proceed and urg	196618	22528,60651	189045,436	204190,564
2020	Hospital	25005	3835.368	23715.81	26294,1862
2021	Cons, proceed and urg	62443	7934.003	59776.14	65109.86
2021	Hospital	6209	994.7519	5,874,633	6,543,367
	Overall, events	2892700	28732,20023	2863968	2921432

Note: (Hosp) Hospitalization, (Cons) Consultations, (Proced) Procedures, (Urg) Emergencies.

According to data from DANE, in the period 2013-2021, 162,881 people died from HF as a potential cause of death in Colombia. The final causes of death were HF (100%), Ischemic heart diseases (26.5%), Hypertensive diseases (26.2%), Chronic diseases of the lower respiratory tract (23.4%), Cardiopulmonary diseases and Pulmonary circulation diseases (19.7%), All other forms of heart diseases (2.4%) and Acute rheumatic fever and chronic rheumatic heart diseases (1.8%), (Table 3). The mortality rate Annual HF (for the 2012-2021 period) was calculated at 34.93 deaths per 100,000 inhabitants, the average HF lethality for the 2013-2021 period was 13.6%, (in men 7.17% and in women 6.43%). The annual risk of suffering an event due to fatal HF, for this same period, in Colombia, was 0.26% (annual), the number of non-fatal cases due to annual HF, for the period, was 132,965 cases/year and the number of annual non-fatal clinical events (consultation, procedure, emergency and/or hospitalization) occurring due to HF in Colombia was 318,219 events/year.

Based on morbidity data from SISPRO, mortality from DANE, and the 2018 population census, years of life lost, years lost due to disability, and DALYs were estimated for the total population with HF, for the period (2013-2021), an average value of 309,771.90 DALYs/year and 597.93 × 100,000 (266.06-604.25), (Table 4).

On the other hand, based on the statistical data of the GBD 2020 for cardiovascular diseases, the indicators of burden of disease, prevalence, incidence, mortality, years lost due to premature death, years lost due to disability and DALY for HF were estimated for the period 2016-2019. For which the records were considered, by causes, as in the study by Bragazzi et al. Ischemic heart disease (26.5%), hypertensive heart disease (26.2%), Chronic obstructive pulmonary disease (23.4%), cardiomyopathies (6.5%), mitral valve (2.7%), alcoholic cardiomyopathy (2 .4%), aortic valve (2.4%), other cardiovascular (2.4%), rheumatic disease (1.8%) and myocarditis (1.8%). Below, they are described per 100,000 (Table 5).

Table 3: Mortality of patients with HF in Colombia, 2013-2021.

Year	Detail	cases	Standard deviation	CI 95% Min	CI 95% Max
2013	Cons, proceed and urg	919570	89920.71	889344,858	949795,142
2013	Hospital	116793	16989.31	111082,367	122503,633
2014	Cons, proceed and urg	527591	102390,951	493174,222	562007,778
2014	Hospital	128734	18634.72	122470,291	134997,709
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	Overall, events	2892700	28732,20023	2863968	2921432

Note: (Hosp) Hospitalization, (Cons) Consultations, (Proced) Procedures, (Urg) Emergencies.

Table 3: Mortality of patients with HF in Colombia, 2013-2021.

Year and %	Cause	Total	%CI	Total	%CI	Total	%CI	Total
	2013		Men		Women		Indet	
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	172	3,096	61	1,098	111	1,998	0
0.262	hypertensive diseases	7,054	18,48,148	3,343	8,75,866	3,711	9,72,282	0
0.265	Ischemic heart diseases	32,351	85,73,015	17,843	47,28,395	14,508	3844.62	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	1,030	202.91	427	84,119	603	1,18,791	0
0.024	All other forms of heart disease	3,267	78,408	1,683	40,392	1,584	38,016	0
1,000	Heart failure	2,413	2413	1,197	1,197	1,216	1216	0
0.234	Chronic diseases of the lower respiratory tract	11,817	27,65,178	6,228	14,57,352	5,589	13,07,826	0
	Overall, year	58,104	1,58,83,755	30,782	83,84,222	27,322	74,99,533	
	2014							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	43	1	18	0.324	25	0.45	0
0.262	hypertensive diseases	7,826	20,50,412	3,733	9,78,046	4,093	10,72,366	0
0.265	Ischemic heart diseases	34,453	91,30,045	18,899	50,08,235	15,554	4121.81	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	1,004	1,97,788	410	80.77	594	1,17,018	0
0.024	All other forms of heart disease	3,711	89,064	1,930	46	1,781	42,744	0

1,000	Heart failure	2,188	2188	1,059	1,059	1,129	1129	0
0.234	Chronic diseases of the lower respiratory tract	12,693	29,70,162	6,475	1515.15	6,218	14,55,012	0
	Overall, year	61,918	1,66,26,245	32,524	86,87,845	29,394	7,938.40	
	2015							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	49	0.882	17	0.306	32	0.576	0
0.262	hypertensive diseases	8,715	2283.33	4,178	10,94,636	4,537	11,88,694	0
0.265	Ischemic heart diseases	36,197	95,92,205	19,660	5209.9	16,537	43,82,305	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	1,009	1,98,773	414	81,558	595	1,17,215	0
0.024	All other forms of heart disease	3,958	94,992	2,049	49,176	1909	45,816	0
1,000	Heart failure	2,233	2233	1,120	1120	1,113	1113	0
0.234	Chronic diseases of the lower respiratory tract	13,413	31,38,642	6,840	1600.56	6,573	15,38,082	0
	Overall, year	65,574	1,75,41,824	34,278	91,56,136	31,296	83,85,688	0
	2016							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	33	0.594	9	0.162	24	0.432	0
0.262	hypertensive diseases	8,430	2208.66	4,115	1078.13	4,315	1130.53	0
0.265	Ischemic heart diseases	37,452	9924.78	20,625	54,65,625	16,827	44,59,155	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	951	1,87,347	374	73,678	577	1,13,669	0
0.024	All other forms of heart disease	4,172	1,00,128	2,264	54,336	1908	45,792	0
1,000	Heart failure	2,095	2095	1,083	1083	1,012	1012	0
0.234	Chronic diseases of the lower respiratory tract	13,530	3166.02	6,936	16,23,024	6,594	15,42,996	0
	Overall, year	66,663	1,76,82,529	35,406	93,77,955	31,257	83,04,574	0
	2017							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	33	0.594	14	0.252	19	0.342	0
0.262	hypertensive diseases	8,841	23,16,342	4,250	1113.5	4,591	12,02,842	0
0.265	Ischemic heart diseases	38,618	10233.77	21,012	5568.18	17,606	4665.59	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	912	1,79,664	363	71,511	549	1,08,153	0
0.024	All other forms of heart disease	4,204	1,00,896	2,268	54,432	1936	46,464	0
1,000	Heart failure	2,080	2080	1,038	1038	1,042	1042	0
0.234	Chronic diseases of the lower respiratory tract	14,467	33,85,278	7,163	16,76,142	7,304	17,09,136	0
	Overall, year	69,155	1,82,96,544	36,108	95,22,017	33,047	87,74,527	0
	2018							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	31	0.558	17	0.306	14	0.252	0
0.262	hypertensive diseases	9,121	23,89,702	4,412	11,55,944	4,709	12,33,758	0
0.265	Ischemic heart diseases	40,186	10649.29	22,047	58,42,455	18,139	48,06,835	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	975	1,92,075	371	73,087	604	1,18,988	0
0.024	All other forms of heart disease	4,486	1,07,664	2,393	57,432	2,093	50,232	0

1,000	Heart failure	2,121	2121	1,047	1047	1,074	1074	0
0.234	Chronic diseases of the lower respiratory tract	13,991	32,73,894	7,026	16,44,084	6,965	1629.81	0
	Overall, year	70,911	1,87,34,183	37,313	98,20,308	33,598	89,13,875	0
	2019							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	95	1.71	52	0.936	43	0.774	0
0.262	hypertensive diseases	9,346	24,48,652	4,476	11,72,712	4,870	1275.94	0
0.265	Ischemic heart diseases	39,179	1,03,82,435	21,463	56,87,695	17,716	4694.74	0
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	1,152	2,26,944	483	95,151	669	1,31,793	0
0.024	All other forms of heart disease	4,691	1,12,584	2,514	60,336	2,177	52,248	0
1,000	Heart failure	2,220	2220	1,136	1136	1,084	1084	0
0.234	Chronic diseases of the lower respiratory tract	16,488	38,58,192	8,424	19,71,216	8,064	18,86,976	0
	Overall, year	73,171	1,92,50,517	38,548	1,01,24,046	34,623	91,26,471	0
	2020							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	57	1,026	22	0.396	35	0.63	0
0.262	hypertensive diseases	11156	29,22,872	5423	14,20,826	5733	15,02,046	0
0.265	Ischemic heart diseases	45,543	1,20,68,895	25,379	67,25,435	20163	53,43,195	1
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	1169	2,30,293	462	91,014	707	1,39,279	0
0.024	All other forms of heart disease	4415	105.96	2298	55,152	2117	50,808	0
1,000	Heart failure	2062	2062	1067	1067	995	995	0
0.234	Chronic diseases of the lower respiratory tract	12692	29,69,928	6862	16,05,708	5830	1364.22	0
	Overall, year	77,094	2,03,60,974	41,513	1,09,65,531	35,580	93,95,178	1
	2021							
0.018	Acute rheumatic fever and chronic rheumatic heart diseases	41	0.738	fifteen	0.27	26	0.468	0
0.262	hypertensive diseases	9,320	2441.84	4,439	11,63,018	4,881	12,78,822	0
0.265	Ischemic heart diseases	43,349	1,14,87,485	23,693	62,78,645	19,655	52,08,575	1
0.197	Cardiopulmonary disease and diseases of the pulmonary circulation	1,432	2,82,104	604	1,18,988	828	1,63,116	0
0.024	All other forms of heart disease	4,218	1,01,232	2,269	54,456	1949	46,776	0
1,000	Heart failure	1931	1931	991	991	940	940	0
0.234	Chronic diseases of the lower respiratory tract	9,658	22,59,972	5,135	1201.59	4,523	10,58,382	0
	Overall, year	69,949	1,85,04,371	37,146	98,07,967	32,802	86,96,139	1
	Total, period 2013-2021		16,28,80,942		8,58,46,027		7,70,34,385	

Table 4: Estimated DALYs for the population with HF in Colombia, 2013-2021.

Ages	Mortality	Healthy years	AVPD	POP YLD	Total, Morbidity	Healthy years	YLL	YLD	DALY
0-4 years	173.59	0	0.72	124	24,471	0	14236.3	47724.3	61960.61
5 -9 Years	36.91	4	1	33	9,262	4	2,849	16472.44	19321.59
10 -14 Years	58.8	9	1	53	9,400	9	4,239	16457.41	20696.56
15-19 years	151.8	2:00 p.m.	1	136	12,143	2:00 p.m.	10158.76	21788.2	31946.96
20-24 years	247.63	19	0.9	222	13,219	19	15,290	24330.88	39621.23
25-29 years	339.01	24	1	303	15,392	24	19,250	26649.67	45899.89
30-34 years	517.7	29	0.9	463	19,835	29	26719.93	30087.46	56807.39
35-39 years	800.02	34	1	716	26,460	34	37,332	36992.25	74324.04
40-44 years	1291.26	39	1	1,156	35,782	39	53,913	45164.27	99077.4
45-49 years	2248.22	44	1	2012.16	53,130	44	82709.17	65797.52	148506.7
50-54 years	4144.93	49	1	3709.71	83712.15	49	131392.5	92392.55	223785
55-59 years	6652.6	54	1	5,954	1,17,045	54	1,77,684	114588.3	292272.3
60-64 years	9734.25	59	1	8,712	1,43,315	59	211635.2	125409.5	337044.7
65-69 years	12873.53	64	1	11521.8	163970.4	64	2,16,116	129126	345241.9
70-74 years	16936.96	69	1	15,159	1,74,865	69	2,01,591	129479.8	331070.6
75-79 years	22210.19	74	0.9	19,878	1,78,027	74	156221.8	120385.9	276607.7
80-84 years	27475.19	79	1	24,590	333545.3	79	1,98,362	184754.9	383117.4
85-89 years	27370	79	1	24,496			0		0
90-94 years	19325.25	79	1	17296.1			0		0
95-99 years	8139.95	79	0.9	7285.25			0		0
100 >Years	2141.06	79	0.9	1,916			0		0
Desc Years	12.89	49	1	12			645		645.28
	162881.7				14,13,573	15,60,346	1227601		2787947

Table 5: Disease burden indicators for HF, data from the GBD 2020, period 2016-2019.

Indicator	Year	Half	CI 95% Min	CI 95% Max
Prevalence	2016-2019	1.78	1.55	2
Incidence	2016	96.66	89	101
Incidence	2017	97	89	101
Incidence	2018	99	91	108
Incidence	2019	103	94.04	112
Mortality	2019	29	22	38
Yll	2019	444	355.54	603
Yld	2019	69	44	101
DALY	2018	493	379	639
DALY	2019	512.67	400	703.68

DISCUSSION

In the present study, we have evaluated the global burden of HF from 2013 to 2021, making comparisons between different sources, by age groups and sex. The results suggest that the global burden of HF in Colombia is significantly high, the number of cases is 1 in every 50 inhabitants in general, with a growing increase in prevalence by age. Aging and population growth explain the absolute increase in the number of HF cases, the latter driven by the increase in risk factors such as hypertension, diabetes mellitus, obesity, smoking, unhealthy lifestyles, and Alzheimer's disease [29-31] (Supplementary Table 1).

Ischemic and hypertensive heart disease and COPD are the three main causes of HF, representing in adults and globally, almost three quarters of the prevalence standardized by age. However, in children and adolescents, congenital heart disease, myocarditis, and other cardiomyopathies were the main underlying causes, although overall, the incidence of HF in these age groups is low. Despite this, complications and mortality from pediatric HF remain substantial. Children whose hospitalizations are complicated by HF have a more than 20-fold increased risk of death compared with children without HF [32] (Supplementary Table 2).

From a gender perspective, a similar prevalence rate was observed between men and women in all age groups, while women had a significantly higher number of HF cases than men in age groups ≥ 70 years, due to increased life expectancy. Regarding other risk factors, air pollution is a critical problem, related to Chronic Obstructive Pulmonary Disease (COPD) which was not evaluated in this study, but could be the subject of causal evaluation in other investigations [33-35]. The relationship with alcohol, is described, among cardiomyopathies, since alcohol causes dilatation and HF and in European countries, alcohol contributed to 10.5% of all deaths from cardiovascular diseases [36,37].

These data could be useful to visualize the impact of HF at the population level, inform and lay the foundations for the implementation of policies, to smooth out barriers to access, inequities, and inequalities, based on the local availability of medicines and medical devices, clinical practice patterns, and geographically specific public health strategies for HF management (Supplementary Table 3A).

Recognizing the disease burden of chronic diseases, as is the case of HF, is a key input to measure the impact of the disease on the population, public health intervention must be on the way to creating public policies to address this problem, close the gaps resulting from barriers, inequalities, and inequities, in the most vulnerable individuals. To achieve the ultimate goal, the equitable distribution of economic resources, allocated in the national budgets for health, in such a way that this distribution is as fair as possible (Supplementary Table 3B).

CONCLUSION

HF is a public health problem in Colombia due to its high burden of disease, which is ratified in this study, finding in its findings, 1-prevalence of 2%, 1 of every 50 inhabitants, 2-high incidence, 3-mortality, at least one third of those who die from ischemic cardiomyopathy, 4-number of years lost per year due to premature death 173,371.75 (334.65 years × 100,000 inhabitants), 5-years with annual disability of 136,400.16 years (263.28 years × 100,000 inhabitants) and 5-number of Disability Adjusted Life Years of 309,771.90 (597.93 years × 100,000 inhabitants).

This warns of the need to lay the foundations for the formulation of public policies, which lead to reducing the burden of disease, premature deaths secondary to the health impact of HF, and help health professionals and leaders of the health sector in Colombia, to design and implement promotion and prevention strategies that allow reducing the current and future burden of disease of this condition.

LIMITATIONS

Two limitations affect the present investigation. First, data comparability is, at least in part, hampered by different collection methods, sources, and reporting standards. This heterogeneity is enriching, but in the same way it detracts from the robustness of the analysis that emerges from the data, in this sense, the search for homogenization is indicated, in this context the Dismod program is a valuable tool in reconciling the origin of the data obtained from the sources.

Second, direct HF data are scarce, particularly for mortality. This can be attributed to the fact that this disease has been identified in the context of the final outcomes of cardiovascular diseases, unlike other chronic diseases, which are recognized as main or direct causes of death.

The results of this study open the panorama for carrying out economic evaluations on the direct and indirect costs of HF and its therapeutic and diagnostic interventions, as well as comparative studies on the burden of disease for different zones or regions, as well as evaluation studies and/or formulation of public policies, which allow to impact access barriers, inequalities and inequities, in the care and provision of services for the care of people suffering from this disease.

DECLARATIONS

Availability of data and materials

The datasets analyzed in this study are available for the corresponding. Institutions, Authors, upon reasonable request.

Ethical approval

This study only involved parts of databases, the necessary ethical procedures were followed, for this purpose. Ethical approval was obtained from the ethical review committee of Universidad del

Bosque, and from the respective health care institutions, for studies involving medical records.

Consent to publication

Does not apply.

Conflict of interests

None declare.

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