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Original Article

Burden of disease attributed to acute respiratory infections in South America

Gabriela Bittencourt Gonzalez Mosegui[1], Fernando Antoñanzas Villar[2], Cid Manso de Mello Vianna[3]

[1] *Health and Society Department, Fluminense Federal University, Niterói, Rio de Janeiro, Brazil*
[2] *Economics and Business Department, University of La Rioja, Logroño, La Rioja, Spain*
[3] *Department of Policy, Planning and Administration in Health, Rio de Janeiro State University, Rio de Janeiro, Rio de Janeiro, Brazil*

Abstract

Introduction: Respiratory diseases (RD) are an important public health problem. Their burden has not been comprehensively evaluated in South America (SA). This study describes the burden of acute respiratory infections (ARIs) in SA in 2019.
Methodology: This is an exploratory, population-based study with a quantitative approach to incidence, mortality, and Disability-adjusted life years (DALYs) by standardized age group among the 12 countries. Measurements were captured through the Institute for Health Metrics and Evaluation (IHME) website. It used the Burden Study Global Disease, Injury and Risk Factors (GBD) 2019 assessment. Correlation analyses were performed.
Results: The age-standardized incidence rate per 100,000 people for lower respiratory infections (LRIs) is lowest in Chile (3,902) and highest in Peru (9,997). For upper respiratory infections (URIs), Bolivia (225,826) had the lowest rates, while Brazil (316,667) and Colombia (306,302) had the highest. Standardized mortality rates for LRI were lowest in Colombia (15.10) and highest in Bolivia (80.53). Bolivia had the highest standardized DALY rate (2,083), while Uruguay had the lowest (468). Upper ARI had lower incidence rates than lower ARI. The lowest DALY rates were in Suriname (82) and the highest were in Brazil (111). There is a correlation between sociodemographic and economic health indicators and the standardized rates of incidence and DALY in the upper ARIs.
Conclusions: The present paper provides comprehensive ARI burden estimates for the region. The substantial incidence and considerable mortality and DALYs are noteworthy and lead to reflections on preventive measures such as rational use of antibiotics and deeper epidemiological investigations.

Key words: Cost of illness; acute respiratory tract infections; epidemiology; incidence; disability-adjusted life years.

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Introduction

Acute and chronic RD affect thousands of people annually [1,2]. These people are mainly children under 5 years of age, the elderly, and adults with comorbidities [3–6]. In 2019, the incidence of lower acute respiratory infections (ARIs) almost reached 500 million, while that of the upper tract exceeded 17 billion new cases globally [7]. These conditions are among the most frequent in primary care consultations, relating to the prescription of antibiotics, which are often inappropriate, and in hospitalizations [3,8–12]. Further understanding of these conditions and prevention measures and treatment protocols [1,9,13] will improve the clinical and health management capabilities of health systems and individuals [14–16].

Bacterial pneumonia, sinusitis, and pharyngitis are diseases that are increasingly difficult to treat due to the spread of drug resistance; and the worsening of these diseases can have health, economic and social implications and consequences [12,17,18]. These diseases are a growing global problem and have variable prevalence in different countries [1,19,20]. In Latin America and the Caribbean (LAC), control through prescription use and surveillance measures have been implemented but not to the same extent as in Europe and the United States [12,17,21]. However, there is little information about the impact and use of community, outpatient, and hospital resources [18,22,23]. According to Klein *et al.* [20], global antibiotic consumption increased by 65% between 2000 and 2015 from 21.1 billion to 34.8 billion defined daily doses, mainly driven by increased consumption in low- and middle-income countries, such as those in LAC [18].

If the use of antibiotics has not yet been well characterized in a region [17,18,20,24], there is a need to build databases and finance local studies and education and engage in monitoring activities. The same is true about the health burden of ARIs since reliable population estimates about their prevalence, incidence, mortality, and prognosis are lacking [5,8,9,25,26]. Some studies summarize results from countries, regions [14,27] or even municipalities in a partial way, where secondary data on hospitalizations are used [18,28–31] or where information is obtained from a single health unit [10], making it impossible to have a comprehensive view of countries as a whole.

To overcome the problems associated with the design of traditional indicators, the World Health Organization (WHO) and the World Bank (WB) proposed a global effort that was not restricted to the creation of composite indicators, such as disability-adjusted life years (DALYs), but which aimed to represent the total burden of health loss of populations due to different diseases by adding unhealthy years of life and those lost due to premature death and disease [32,33]. This effort was materialized in the Global Burden of Disease (GBD) study and in the systematization of secondary data for epidemiological analysis to quantify and compare, across countries and regions, health losses resulting from diseases in different metrics [34,35]. These disease burden analyses help in the construction of indicators capable of supporting the planning, organization, implementation, and monitoring of health actions [32] for diseases such as ARI, which, besides their impact on public health, generate direct and indirect economic costs for individuals and society.

Given that evidence on the health burden of these diseases and that the resources consumed in LAC, and particularly in South America (SA) are scarce and data sources are dispersed and often unreliable, there is a need for a more organized approach to the region to systematize and summarize current knowledge and guide future research to provide better information on the use of resources, including antibiotics, to health system managers [27,36]. This exploratory population-based study using a quantitative approach sought to estimate the annual epidemiological and health burden of acute respiratory diseases in SA, using GBD Study data from 2019.

Methods

Information sources

In the absence of previous studies and reliable data sources for the measures surveyed in the chosen countries, the data, measures, and metrics offered by the Institute for Health Metrics and Evaluation (IHME) were used [4,5,7,25,28,29,36,37]. IHME [7] is an independent global health research centre at the University of Washington. From its website can be accessed the Global Health Data Exchange (GHDx) [38], a catalogue of surveys, censuses, vital statistics, and other health-related data. This tool synthesizes numerous data entry sources used to estimate mortality, causes of death and illness, and risk factors from the GBD or GBD Study 2019 [39]. Measures were taken according to country (location) and cause—lower and upper respiratory infections (codes A.2.2 and A.2.3, respectively) [7,38]. Age groups were categorized and standardized. The variables analysed are presented in two metrics: absolute numbers and rates (new cases per 100,000 inhabitants) [7,33,40,41].

Information on income, population, human development index (HDI), and health expenditures was obtained from the WB database [42] and is shown in Table 1.

Burden of Disease Analysis

This analysis of the health burden of ARIs in SA focused on data on deaths, incidence, and losses to society, reflected in DALYs. The DALY of an illness

Table 1. Demographic and economic–sanitary indicators of SA countries, 2019.

Country	Population, total	GDP (x 100,000 USD)	GDP per capita, PPP (current international $)	HDI	Current health expenditure (% of GDP)	Current health expenditure per capita (current US$)	Domestic general government health expenditure (% of GDP)	Domestic general government health expenditure per capita (current US$)	Current health expenditure per capita, PPP (current international $) -	Domestic general government health expenditure per capita, PPP (current international $)	Domestic private health expenditure (% of current health expenditure)	Domestic private health expenditure per capita (current US$) -	Domestic private health expenditure per capita, PPP (current international $)
Argentina	44,938,712	452,818	22.999	0.845	9.5	946	5.93	590	2,199	1.371	37	354	822
Bolivia	11,513,102	40,895	9.093	0.718	6.9	246	4.93	175	631	449	28	68	174
Brazil	211,049,519	1,873,288	15.388	0.765	9.6	853	3.91	348	1,498	610	59	504	885
Chile	18,952,035	278,584	25.395	0.851	9.33	1,376	4.75	701	2,424	1,234	49	675	1,190
Colombia	50,339,443	323,109	15.688	0.767	7.71	495	5.54	356	1,204	866	28	139	339
Ecuador	17,373,657	108,108	11.851	0.759	7.82	487	4.83	301	935	577	38	185	356
Guyana	782,775	5,173	13.635	0.682	4.93	326	2.93	194	674	400	38	123	255
Paraguay	7,044,639	37,925	13.149	0.728	7.17	388	3.3	179	950	437	54	210	513
Peru	32,510,462	228,325	13.397	0.777	5.22	370	3.28	233	712	448	37	137	263
Suriname	581,363	4,221	19.841	0.738	9.74	619	7.01	446	1,680	1,210	27	170	460
Uruguay	3,461,731	61,231	24.006	0.817	9.35	1,661	6.23	1,106	2,310	1,538	33	555	771
Venezuela, RB	28,515,829	NAD	NAD	0.711	5.37	339	2.47	156	385	177	54	183	207

Source: Word Bank Data, 2022 [42]. NAD: No available data or injury is a measure that represents the 'burden' of a disease, expressed as the number of years lost due to ill health, disability, or early death. This measure derives from the sum of years of life lost (YLL) or due to mortality in the population (YLL is estimated as the product of the number of deaths and the residual life expectancy at the age of death) plus the years of life with disability or years lost due disability (YLD) for incident cases of the illness or injury (following an incidence perspective, YLDs are estimated as a product of the number of incident cases multiplied by the duration of illness symptoms in years and the weight of disability attributed to illness) [43].

These measures were obtained from the IHME [7] by year, country (location), and cause for all age groups (standardized per 100,000 population) [7,33,40,41]. All results were derived from 1,000 samples extracted from the posterior distribution of each step in the estimation process [40]. Results were reported for the rates of mortality, incidence, YLL, YLD, and DALY and standardized by age [29,44].

Sociodemographic and economic–sanitary indicators

Countries were categorized by income, population, HDI, and health expenditures, namely current health expenditures, current health expenditures per capita, general household health expenditures, government (% gross domestic product, GDP), general household health expenditures, government per capita (US$ 2019), current health expenditure per capita, purchasing power parity (PPP) (US$ 2019 international), general government household health expenditure per capita, PPP (US$ 2019 international), private household health expenditure (% current health expenditure), private household health expenditure per capita (US$ 2019), private household health expenditure per capita and PPP (international US$ 2019) [42].

Table 2. Distribution of the components of lower and upper respiratory infections: YLL, YLD, DALY, deaths, incidence, all ages, SA, 2019.

Countries	YLL (n)	YLD (n)	DALY (n)	Deaths (n)	Incidence (n)
Argentina					
Lower	598,557	3,305	601,861	36,264	2,532,306
Upper	167	42,482	42,649	3.6	123,876,512
Bolivia					
Lower	240,378	1,162	241,541	6,570	886,692
Upper	1,269	9,633	10,903	18	28,047,440
Brazil					
Lower	1,970,627	24,163	1,994,790	88,641	18,933,430
Upper	5,205	225,730	230,935	106	661,219,006
Chile					
Lower	66,847	954	67,800	4,703	739,963
Upper	116	16,788	16,904	3	49,088,752
Colombia					
Lower	222,133	3,425	225,558	7,899	2,674,383
Upper	962	49,014	49,976	19	142,898,067
Ecuador					
Lower	148,929	1,577	150,505	5,436	1,240,809
Upper	729	15,169	15,898	12	44,116,107
Guyana					
Lower	8,047	50	8,097	262	38,515
Upper	20	615	635	0.3	1,799,599
Paraguay					
Lower	38,531	482	39,013	1,474	377,395
Upper	5081	7,244	7,295	0.8	21,083,384
Peru					
Lower	388,576	4,223	392,799	18,179	3,273,290
Upper	789	31,848	32,637	13	92,755,188
Suriname					
Lower	4,245	37	4,282	163	29,208
Upper	5	458	463	0.1	1,339,048
Uruguay					
Lower	22,528	205	22,734	1,595	160,540
Upper	19	3,127	3,146	0.6	9,146,233
Venezuela					
Lower	163,016	2,196	165,212	5,555	1,693,460
Upper	115	22,567	22,682	3	65,709,924
South America					
Lower	3,872,414	41,779	3,914,193	176,740	27,073,065
Upper	9,447	424,675	434,122	181	1,051,045,502

Source: Own authorship; GHDx [7] data, accessed in 21/05/2022.

Data analysis and ethical issues

After downloading, the data were adjusted in dynamic tables in Microsoft Excel® 2013. The rate calculations were carried out, as well as correlation analyses between the rates collected for the different countries and the demographic, economic, and health variables were performed [42]. This study used secondary data from a public domain database without nominal identification, and it respects the ethical principles present in the resolution of the National Health Council No. 466, of December 12, 2012 [45].

Results

Geographic location and study population

SA is a continent that comprises the southern portion of America and is also considered a subcontinent of the American continent. Its expanse is 17,819,100 km² and is home to 6% of the world's population. It has 12 countries and a diversity of languages, populations, life expectancies, infant mortality rates, and several other economic, social, demographic, and health indicators [42].

Estimation of disease burden

The epidemiological and health burden of acute RD in SA was highlighted using data collected in GHDx [7] and is presented in Tables 2 and 3.

In the year 2019, before the COVID-19 pandemic, in SA, there were approximately 1.05 billion new cases of upper respiratory infections (URIs) and 27 million cases of lower respiratory infections (LRIs); and these cases represented 9.2 and 8.4% of global cases, respectively. The more than 176,000 reported deaths had significant differences in distribution between countries and accounted for 7.7% of global fatalities from LRI and nearly 4% from URI. Compared to LAC, SA is of considerable importance, representing 65.6% of the incidence (27,073,064) and 92.4% (176,739) of LRI-associated deaths and 66% (1,051,045,501) of new cases and 48.1% (181) of relative deaths due to URI.

Table 3. Distribution of age-standardized rates: YLL, YLD, DALY, mortality, and incidence for lower and upper respiratory infections in SA, 2019.

Countries	Age-standardized YLL rate per 100,000 people	Age-standardized YLD rate per 100,000 people	Age-standardized DALY rate per 100,000 people	Age-standardized mortality rate per 100,000 people	Age-standardized incidence rate per 100,000 people
Argentina					
Lower	1,160	7	1,167	66	5,205
Upper	0.4	97	98	0.01	283,245
Bolivia					
Lower	2,072	11	2,083	81	8,680
Upper	9	77	86	0.2	225,827
Brazil					
Lower	954	11	965	41	8,517
Upper	3	108	111	0.05	316,668
Chile					
Lower	312	5	317	20	3,903
Upper	0.7	98	99	0.02	285,301
Colombia					
Lower	487	7	494	15	5,408
Upper	2	105	108	0.04	306,303
Ecuador					
Lower	952	10	962	42	7,960
Upper	4	85	90	0.08	248,587
Guyana					
Lower	1,245	8	1,252	51	5,958
Upper	3	79	82	0.05	232,042
Paraguay					
Lower	651	8	658	27	6.112
Upper	0.8	103	104	0.01	301,574
Peru					
Lower	1,199	13	1,212	55	9,997
Upper	2.5	94	96	0.04	273,571
Suriname					
Lower	807	7	814	31	5,152
Upper	1	81	82	0.02	236,597
Uruguay					
Lower	463	5	468	25	4,028
Upper	0.6	98	98	0.01	283,518
Venezuela					
Lower	623	8	631	21	6,133
Upper	0.5	82	82	0.01	238,200

Own authorship. GHDx [7] data. Accessed in 21/05/2022.

New cases as well as deaths measured by disease burden deserve to be analysed with caution given the existing population differences (Table 2).

YLL in the subcontinent were 3,872,413 due to LRI and 9,446 related to URI—an equivalent of 5.2 and 4.1% of YLL worldwide due to these diseases. However, the burden on LAC is greater, corresponding to 77% and 46% of YLL on this continent (due to LRI and URI, respectively). The sum of YLDs for the 12 SA countries was 41,779 and 424,675 due to LRI and URI, respectively. The LAC region accounted for 8.1 and 8.9 percent of global YLDs for these diseases, respectively; and comparing the values of SA and LAC, countries in the region were responsible for about 78% of the continent's YLDs for both types of infections.

Globally, the LAC region accounted for 5.2% and 8.9% of DALYs lost due to LRI and URI, respectively. SA represents around 77% of this burden for LAC for both types of infections. The total DALYs for SA were 3,914,193 (LRI) and 434,122 (URI).

The age-standardized incidence rate per 100,000 people for LRIs is lowest in Chile (3,902) and Uruguay (4,028) and highest in Peru (9,997), Bolivia (8,679), and Brazil (8,517). For URIs, Bolivia (225,826) and Guyana (232,042) had the lowest rates, while Brazil (316,667) and Colombia (306,302) had the highest. Standardized mortality rates for LRI were lowest in Colombia (15.10) and Uruguay (25.16) and highest in Bolivia (80.53) and Argentina (65.74). URI had much lower mortality rates than LRI. The lowest mortality rates were in Argentina, Paraguay, and Uruguay (0.01) and the highest in Bolivia (0.16) and Ecuador (0.08), as indicated by GHDx and IHME [7].

It was observed that age-standardized YLL rates per 100,000 related to LRI were low in Chile (313) and Uruguay (463). Bolivia had an almost 7 times higher rate (2,072) of YLL than Chile (312). Guyana also had a high rate (1,245). The values for URI were much lower. Argentina and Venezuela had rates of 0.42 and 0.45, respectively, while Bolivia and Ecuador had higher values of 8.9 and 4.3, respectively.

YLD rates differed between countries. For LRI, the highest rates were found in Peru (13) and Bolivia (11). These rates are more than double those found in Chile (5.2) and Uruguay (5.4). URI had higher rates in Brazil (108) and Colombia (105), while Bolivia (77) and Guyana (79) had the lowest rates.

For LRI, the lowest age-standardized DALY rates per 100,000 were those of Chile and Uruguay (317 and 468, respectively). Values up to 6.5 times higher and almost 4 times higher can be found in Bolivia (2,083) and Guyana (1,252), respectively. URI had the lowest standardized DALY rates in Suriname (82) and Venezuela (82), while the highest could be found in Brazil (111) and Colombia (108).

The result of the mortality, incidence, and DALY rates along with the demographic, social, and economic health indicators collected can be seen in Table 4.

LRIs have a small positive correlation with incidence rate and GDP, but the correlation is higher between GDP per capita and HDI. URI shows moderate positive correlations for DALY and incidence rates and the demographic, social, and economic–sanitary variables analysed (Table 4).

Discussion

In the SA subcontinent, the epidemiological burden of ARI in 2019 reached 1.3 billion new cases and 168,904 deaths according to GHDx [7]. URIs and LRIs behave differently. The former had a high incidence (1,051,045,501 new cases) and low mortality (181 deaths), while the latter had high mortality (176,740 deaths) and a lower incidence (27,073,065 new cases).

As for incident cases of URI, the subcontinent had 66% of LAC cases, data that corroborate findings from other studies [4,14]. Jin *et al.* [14] described the global and regional burden of URI from 1990 to 2019, analysing incidence, mortality, and DALYs in different age groups and sexes in 204 countries and territories in 21 geographic regions between 1990 and 2019 using GBD 2019. The authors used WB income classification in the analysis to identify countries and regions. Global

Table 4. Correlation between socioeconomic, demographic and socio-sanitary variables, South America, 2019.

Epidemiological measures and burden of disease	Current health expenditure (% of GDP)	Current health expenditure per capita (current US$)	Domestic general government health expenditure (% of GDP)	Domestic general government health expenditure per capita (current US$)	Current health expenditure per capita, PPP (current international $) -	Domestic general government health expenditure per capita, PPP (current international $)	Domestic private health expenditure (% of current health expenditure)	Domestic private health expenditure per capita (current US$)	Domestic private health expenditure per capita, PPP (current international $)	GDP (x 100,000 US$)	GDP per capita, PPP (current international $)	HDI
Lower												
DALY rate	-0.328	-0.526	-0.103	-0.469	-0.459	-0.384	-0.335	-0.536	-0.482	-0.0419	0.636	0.385
Mortality rate	-0.185	-0.322	-0.021	-0.279	-0.230	-0.182	-0.298	-0.342	-0.259	-0.003	0.435	0.116
Incidence rate	-0.444	-0.607	-0.433	-0.638	-0.649	-0.672	0.063	-0.474	-0.488	0.290	0.786	0.367
Upper												
DALY rate	0.412	0.362	0.058	0.247	0.381	0.223	0.344	0.478	0.536	0.637	0.171	0.499
Mortality rate	-0.223	-0.446	-0.031	-0.415	-0.456	-0.407	-0.341	-0.428	-0.440	-0.019	0.730	0.377
Incidence rate	0.436	0.433	0.058	0.317	0.455	0.294	0.401	0.541	0.600	0.589	0.316	0.541

incident cases reached 17.2 billion in 2019. Sociodemographic index (SDI) regions had the highest age-standardized incidence rates from 1990 to 2019 and the highest incidence rates across all age groups in 2019 but had a downward trend in age-standardized incidence rates. On the other hand, medium SDI regions, such as SA, had an increasing trend. The United States of America and Brazil had the highest age-standardized incidence rates per 100,00 people (331,560 and 316,667, respectively) [14]. LRI was investigated by Troeger *et al.* [6], who analysed cases, deaths, and related DALYs in all age groups in 195 countries using GBD 2015. The values found for LAC were very close to those estimated in our study. In children, contrasts observed in morbidity and mortality could be associated with differences in nutritional status and characteristics of care given to ill children. Parents' disease perception, level of concern about the decision to seek assistance, the way care is sought, and its quality has a great influence on the course and outcome of the disease. Other risk factors such as living in crowded conditions, and lack of immunization deserve to be mentioned.

SA accounts for 48% of deaths associated with URIs and 92% of deaths associated with LRIs in LAC. The age-standardized mortality rates presented in our study are similar to those of other studies [6,14]. The highest rates were found in regions of medium SDI, as reported by Jin *et al.* [14]. A close look at LRIs, including pneumonia, reveals that they are among the leading causes of death worldwide among adults over 50 years of age [8,26]; in 31 Latin American countries, they were the third most frequent cause of death in adults between 2001 and 2003 [28]. Chicaiza-Ayala *et al.* [29], when describing the burden of ARIs in Ecuador between 2011 and 2015, reported 14.84 million cases and 17,757 deaths (0.12%), which were calculated using a different methodology from the one used in this study. Existing data on URI are always underestimated, both in adults and children, because of nonspecific clinical presentation and a perceived lack of need for medical attention.

A systematic review that aimed to assess the incidence, aetiology, and use of resources for influenza in LAC found that information on incidence was reported by only 4 of the 46 countries in the group and the annual rate of ‘influenza-like’ diseases was 36,080 per 100,000 person-years [5]. Influenza-related specific mortality data, often unavailable, was higher in extreme age groups (under one year and over 65) [5].

A consideration of the breakdown of hospitalizations, deaths, expenditure, and length of stay related to ARIs in Brazil, which has an open database], can help in gaining an understanding of the severity of the condition under study. According to DATASUS [46] of the Brazilian Ministry of Health, in 2021, the list of morbidities associated with IDC-10, which is a chapter dealing with RD (J00 to J06, J09-J11, J12-J18, J20-21, J30-J39), were responsible for 742,882 hospitalizations, where 346,700 (46.7%) were diagnosed as pneumonia and 150,713 (20.3%) as other RD. These hospitalizations were concentrated in the extreme age groups—under one year (80,664 –10.9%) and 1–4 years (106,370 – 14.3%) and 80 years or more (100,095 – 13.5%). The total number of hospital deaths related to these diseases in 2021 was 87,269, increasing with increasing age, except for children under 1 year of age. The average cost of hospitalization was R$1,545.25 or US$ 300.1 (as of 05/10/2022) [47], and the average stay was 6 days; both attributes varied between the age groups and diseases that make up this list. Healthcare providers or systems should promote immunization against influenza and pneumonia and implement prevention practices to avoid the spread of infections.

An analysis of total DALYs for RD points to a worrying scenario. LRIs caused almost 4 million DALYs, where the component of YLL (3,872,414) bore the greatest weight in this indicator in the countries analysed. In LAC, DALYs are nearly three times higher than for high-income North America (1,339,934) and account for 77% of the burden of disease [7]. A rough estimate found 2.74 million deaths and 103 million DALYs worldwide, with LAC countries totaling 4.7 million DALYs (with a downward trend) and SA countries, presented in isolation in the study, accounting for 73.2% of this burden with 3.4 million DALYs due to LRIs in all age groups [6]. Brazil had the highest DALYs and Suriname the lowest, reinforcing the findings of our study. According to GBD 2019 [41], 6 infectious diseases, including LRIs, were among the top 10 causes of DALYs in children under 10 years of age in 2019.

A similar analysis was performed for high infection rates, which amounted to approximately 450,000 DALYs, where the disability component had a heavy weight in the construction of the indicator (424,675). High-income North America had only 15% fewer DALYs, while SA represented 77% of the LAC DALYs [7]. Our findings are very similar to those of Jin *et al.* [14], who found 9.1 million DALYs for LAC, while we found 9.8 million. There are different estimates for the SA regions, given the distinction made by GHDx [7,14]. Chicaiza-Ayala *et al.* [29] had results close to ours in the analysis of only one country. Despite being carried out in a different period using a national database, an analysis of the burden of ARI done in Ecuador found, for the year 2015, a total of 124,079 DALYs related to this disease [29]. The authors cite the small marginal difference between the result obtained and the DALY indicator of GHDx.

Correlations with demographic, socioeconomic, and economic–sanitary variables indicated a certain effect on the incidence rates and URI DALYs in line with other studies [14] where regions with a low SDI had a pronounced decline in the age-standardized DALY rate. More severe fatalities were observed in regions with low SDI, while regions with high SDI had the highest age-standardized DALY rates, which can be explained by the high age-standardized incidence rates [14]. Reductions in age-standardized mortality and DALY rates in the LAC region may be associated with improvements in clinical care and an increase in medical resources on the continent. LRIs behave similarly in terms of DALY rates, and low-income countries could substantially alter the losses related to these diseases by investing in health [27,39].

This study has some limitations that deserve to be analysed with caution. The data used in the presentation of the disease burden profile came from GBDx [7,38], which is a timely alternative given the scarcity of bases and studies with adequate methodological quality in the region, in addition to GBDx's concentration on outpatient and hospital information [18,29,32,36,48]. This tool is fed by other databases and ARIs are almost always underestimated either due to their non-specific clinical presentations or due to the perception of health professionals that they are benign diseases [29].

Comparisons made with data from GHDx would not allow an analysis of SA countries as performed in this study since the classifications used by GBD are dispersed in different regions (tropical South America, Andean South America, etc.) Regions with different SDIs [6,7,14,27,38], found within the database itself, can be used for an alternative analysis.

Despite these limits, the results allow a better understanding of the ARI burden in SA. A more exhaustive and systematic epidemiological analysis study, examining the temporal trend of morbidity and mortality and the burden of these diseases in the region would be appropriate, but there are still few such studies. The gap that existed in the load of URIs and LRIs was minimized [29] because this is a set of diseases.

The incidence and substantial DALYs due to URIs in SA lead us to some reflections and considerations. Despite demographic, economic, social, and health heterogeneity, in addition to political problems that were not the object of this study; for the first time, a comprehensive estimate was made of the LRI burden in SA, contextualizing and organizing a scenario and enabling future inquiries about the challenges of prevention, treatments and epidemiological evidence in addition to improvements in other indicators.

Conclusions

This range of diseases with different morbidity and mortality patterns particularly affects areas of low development. In these areas where drug prescription, especially in primary care, seems to be excessive, reducing uncertainty and variation in its use requires additional support from health systems and the use of clinical protocols, diagnostic tests, training, availability of supplies, and education. The population can help in this issue.

Our intention in this study was to present a picture of the subject to sensitize managers on an improved understanding of these RD, which will only happen if data on morbidity and mortality, aetiology, and use of drugs are of good quality. Surveillance and care measures and actions must be taken on these diseases.

Authors' Contributions

FAV conceived and provided supervision for the study. GBGM, CMMV and FAV participated in the study design. GBGM extracted data from the information system. GBGM, FAV and CMMV analysed the statistics. GBGM wrote the initial draft. All authors reviewed and edited the draft manuscript and reviewed and approved the final version of the paper to be published.

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Corresponding author

Gabriela B. G. Mosegui, PhD (Public Health)
Departamento de Saúde e Sociedade,
Instituto de Saúde Coletiva,
Universidade Federal Fluminense.
Niterói, RJ, Brasil.
Phone:+5521999592722
Fax:+552126299053
Email:gabrielamosegui@id.uff.br

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