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THE DISEASE BURDEN ATTRIBUTABLE TO SMOKING IN THE STATE OF RIO DE JANEIRO, BRAZIL IN 2000

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INTRODUCTION: Smoking is one of the main risk factors for morbidity and mortality. An estimated 59 million (4.4%) disability-adjusted life years were lost due to smoking throughout the world in 2000.
OBJECTIVE: To estimate the disease burden attributable to smoking in the State of Rio de Janeiro, Brazil, for the year 2000.
METHODS: Based on estimates of smoking prevalence and relative death risks, the smoking-attributable fraction was calculated for each selected cause, by age and gender. The disease burden attributable to smoking was estimated by multiplying the fractions by the corresponding disability-adjusted life years.
RESULTS: In the State of Rio de Janeiro, 7% of all disability-adjusted life years were due to smoking. For individuals 30 or more years old, the fraction increased to 10.6% (13.6% in males and 7.5% in females). Chronic obstructive pulmonary disease, ischemic heart disease, cerebrovascular disease, and tracheal, bronchial, and lung cancer accounted for 32.2%, 15.7%, 13.2%, and 11.1% of the estimated total DALYs, respectively, amounting to 72.2% of the smoking-attributable disease burden.
DISCUSSION: Limitations related to parameter estimates were not unique to this study, and therefore should not compromise the comparability of our results. Outcomes were similar to those obtained in other countries, despite methodological differences.
CONCLUSION: Smoking is an important risk factor and places a significant disease burden on Rio de Janeiro, Brazil, showing a pattern similar to that observed in high income countries.

KEYWORDS: Attributable risk. Epidemiology. Tobacco. Global disease burden.

INTRODUCTION

Tobacco is the single most frequently used and widespread drug in the world and was responsible for approximately five million recorded deaths in 2000, of which 50% were in low/middle income countries.[1] It is expected that by 2020, smoking will account for ten million deaths in high income countries and seven million in low/middle income countries.[2]

The harm to human health caused by smoking is widely recongnized, and the World Health Organization considers tobacco control one of the main public health challenges worldwide.[3] There is strong evidence that smoking is a causal factor for more than 50 different diseases, notably cardiovascular and obstructive respiratory diseases and cancer.[4,5] According to these studies, 45% of coronary deaths (Acute Myocardial Infarction), 85% of deaths from chronic obstructive pulmonary disease (COPD), 25% of deaths due to cerebrovascular disease (stroke), and 30% of cancer-related deaths can be attributed to smoking. According to projections by Mathers & Loncar (2006)[6], smoking-attributable deaths in high-income countries will decrease by 9% between 2002 and 2030, while they are expected to double from 3.4 to 6.8 million in low and middle income countries. In 2015, total smoking-attributable deaths are expected to surpass HIV/AIDS-related deaths by 50%. Estimates for 2015 also indicate that smoking will account for approximately 10% of all deaths in the world.

Smoking is also directly linked to extraordinary social,

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economic, and environmental costs. In high income countries, treatment for diseases related to smoking is estimated to represent 6 to 15% of total health expenditures[7]. As for environmental damage, in addition to the harm directly linked to tobacco smoke itself, the use of pesticides and fertilizers in tobacco farming causes pollution, as does the deforestation required for curing tobacco leaves.

Smoking is one of the main risk factors in surveys on the burden of disease. It is believed that in 2000, smoking was responsible for approximately five million deaths (8.8%) and 59 million (4.1%) Disability-Adjusted Life Years (DALYs) in the world.[8] This indicator extends the concept of potential years of life lost due to premature death and includes equivalent years of health life lost due to health problems or disability. The number of DALYs is calculated as the sum of the two quantities: years of life lost due to premature death (YLL – years of life lost) and years of life lost due to disability (YLD – years lived with disability).

In addition, according to the same survey, 66% of DALYs due to tracheal, bronchial, and lung cancer, 38% due to chronic respiratory disease, and 12% due to vascular disease were attributable to smoking. Thus, while in high income countries 12% of all DALYs were related to smoking in 2000, in low/middle income countries with low versus high mortality rates, the proportions were approximately 4% and 2%, respectively.[1] However, given the expected increase in mortality and sequelae due to smoking in low/middle income countries, added to the fact that treatment and control of respiratory abnormalities related to smoking is difficult and frequently ineffective,[9] this scenario will most likely worsen considerably.

As a major public health issue, the understanding of the disease burden attributable to smoking is crucially important for the development and deployment of tobacco control initiatives, so as to create permanent public policies that are consistent with health promotion. The disease burden attributable to smoking for the State of Rio de Janeiro was estimated based on information from the Global Burden of Disease Survey undertaken in Brazil in 1998 and the National Cancer Institute's prevalence data on current and former smokers for the State capitals of Brazil (2002-2003). Rio de Janeiro has the second largest state economy in Brazil and a population of 14 million. It also has the highest proportion of elderly people (11.5% of the population 60 years and older) and is undergoing an advanced demographic transition. It is thus a very appropriate population for this type of survey.

MATERIAL AND METHODS

Based on a literature review, a list of the main diseases associated with smoking was prepared, with the corresponding International Classification of Diseases Tenth Revision (ICD 10) codes.[10] Therefore, diseases such as malignant neoplasm of the lip, oral cavity and pharynx (C00-C14), esophagus (C15), stomach (C16), pancreas (C25), larynx (C32), trachea, bronchi and lung (C33-C34), cervix uteri (C53), bladder (C67), kidneys and other urinary organs (C-4-C66 and C68), and leukemia (C91-C95) were included in the present survey. As for cardiovascular diseases, the list included ischemic heart diseases (I20-I25), cerebrovascular diseases (I60-I69), atherosclerosis (I70), aortic aneurysm and dissection (I71), other heart diseases (I30-I51), and other arterial diseases (I72-I78). As for respiratory diseases, the list included pneumonia and influenza (J10-J18), bronchitis and emphysema (J40-J43), and chronic obstructive pulmonary disease (J44). Lastly, perinatal conditions were included in the survey, such as short gestation and low birth weight, (P07), newborn respiratory distress syndrome (P22), and other respiratory conditions originating during the perinatal period (P23-P28).

During the Brazilian Burden of Disease Study in 1998, estimates were calculated on a national level and for Brazilian Major Regions. Therefore, in order to obtain the indicators for the State of Rio de Janeiro for the year 2000, the following methodology was applied. First, years of life lost due to premature mortality (YLL) according to gender and age were calculated based on the Mortality Information System. To avoid sudden fluctuations, YLL for 2000 was estimated by the yearly mean number of deaths from 1998 to 2002 by year. Morbidity estimates, measured by years lived with disability (YLD) for the year 2000, used the same morbidity/mortality ratio (YLL/YLD) that was used by the Global Burden of Disease Survey for Brazil[11] for the Southeast Region for 1998. It was assumed that Rio de Janeiro has a morbidity pattern similar to that of the Southeast region as a whole, and that the ratio did not change from 1998 to 2000. However, some smoking-attributable diseases were not included in Brazil's Global Burden of Disease Survey. Therefore, the YLL/YLD ratio could not be calculated for 1998 using the GBD-Brasil-1998[11] outcomes.

Thus, preliminary analyses were performed and certain decisions were made: (1) cancers of the larynx and kidney were estimated according to the YLL/YLD ratio for the cancer residual group; (2) cardiovascular diseases like atherosclerosis, aortic aneurism, and other arterial diseases were calculated according to the cardiovascular residual group YLL/YLD ratio; (3) disease causes classified as "other heart diseases" were estimated according to the weighted mean between inflammatory diseases (I-0-I33, I38, I40-I42) and the cardiovascular residual group,

with weights of 2/3 and 1/3, respectively; (4) bronchitis/emphysema (J40-43) and COPD (J44) were calculated according to the YLL/YLD ratio of codes J40-J42 and J44 in combination; (5) for pneumonias and influenza (J10-18), the ratio observed for acute respiratory diseases was applied (I.B.01), including codes J10-J18 and J20-J22; (6) low birth weight was estimated according to the ratio in the group of diseases under codes P05-P07; and (7) for newborn respiratory distress syndrome and other conditions originating in the perinatal period (P23-P28), the ratio for group I.D.02 was applied, including "asphyxia and birth trauma" (P03; P10-15, and P20-29).

Two parameters are needed to estimate the population-attributable fraction: smoking prevalence (risk factor) and smoking-attributable relative mortality risk. The data on prevalence of current and former smokers by age bracket and gender used in this study was obtained from the National Self-Reported Disease Survey of the National Cancer Institute (INCa, 2002-2003)[7], which aims to estimate the prevalence of exposure behaviors and risk factors to non-communicable diseases. These studies included the prevalence of exposure behaviors in the Municipality of Rio de Janeiro, i.e., 19.8% of men and 15.9% of women.

The relative mortality risks for the selected diseases in this study were based on the "Cancer Prevention Study II" (CPS II).[5] The CPSII is a nationwide prospective mortality study of nearly 1.2 million US adults, aged 30 years or older, that began in 1982. These relative risk estimates are shown in Figure 1 and are widely used to calculate the smoking-attributable fraction in different countries.[12-20]

The disease burden attributable to smoking was calculated based on the *population-attributable fraction* (PAF), defined as the proportion of a given disease or sequelae attributable to a certain risk factor. In this case, the smoking prevalence by gender and age was used, as well as the relative mortality risk attributable to each smoking-attributable disease.

The *population-attributable fraction* is estimated as:

$$FPA = \frac{\sum_{i=0}^{k} p_i (RR_i - 1)}{1 + \sum_{i=0}^{k} p_i (RR_i - 1)} = 1 - \frac{1}{\sum_{i=0}^{k} p_i (RR_i)}$$

Where: p_i is the prevalence of the i-th category of the risk exposure factor and RR_i is its respective risk relative to the reference exposure category.

Multiplying the population attributable fraction by DALYs gives us the number of disability-adjusted years of life lost for each smoking-attributable disease.[6]

Disease Category	CPSII (1982-1988)			
	Males		Females	
	Smokers	Former smokers	Smokers	Former smokers
Neoplasms*				
Lip, oral cavity and pharynx	10.9	3.4	5.1	2.3
Esophagus	6.8	4.5	7.8	2.8
Stomach	2	1.5	1.4	1.3
Pancreas	2.3	1.2	2.3	1.6
Larynx	14.6	6.3	13	5.2
Trachea, lungs, and bronchi	23.3	8.7	12.7	4.5
Cervix uteri	_	_	1.6	1.1
Bladder	3.3	2.1	2.2	1.9
Kidneys, urinary tract	2.7	1.7	1.3	1.1
Acute myeloid leukemia	1.9	1.3	1.1	1.4
Cardiovascular Diseases*				
Ischemic heart disease				
35-64 years	2.8	1.6	3.1	1.3
≥ 65 years	1.5	1.2	1.6	1.2
Other heart conditions	1.8	1.2	1.5	1.1
Cerebrovascular disease				
35-64 years	3.3	1	4	1.3
≥ 65 years	1.6	1	1.5	1
Atherosclerosis	2.4	1.3	1.8	1
Aortic aneurism	6.2	31	7.1	2.1
Other arterial diseases	2.1	1	2.2	1.1
Respiratory diseases *				
Pneumonia, influenza	1.8	1.4	2.2	1.1
Bronchitis, emphysema	17.1	15.6	12	11.8
Chronic obstructive pulmonary disease	10.6	6.8	13.1	6.8
Perinatal conditions*				
Short gestation/low birth weight	-	-	1.8	-
Respiratory stress syndrome	-	-	1.3	-
Other conditions arising in the perinatal period	-	-	1.4	-

* ≥ 35 years of age; Source: USDHHS[5].

Figure 1 - Relative risks of the main tobacco-related diseases used in the Global Burden of Disease Survey. Rio de Janeiro State, Brazil, 2000

RESULTS

Twenty-two tobacco-related disease groups (19 adult and 3 childhood diseases) resulted in 7% of all DALYs in the State of Rio de Janeiro attributable to smoking (5% for women and 8.9% for men) (Table 1). However, focusing on smoking-attributable DALYs for individuals 30 years and older (the group in which smoking-attributable diseases have actually become evident), a higher fraction emerges: 10.6% overall (13.6% in men and 7.5% in women).

Among the group of chronic respiratory diseases, 84.4% of DALYs are related to bronchitis/emphysema and 76.3% to COPD for both sexes combined (Table 2). Considering gender differences in the above-mentioned chronic respiratory diseases, smoking-attributable bronchitis/emphysema accounted for 87.8% of DALYs in men and 77.7% in women. For COPD, the figures were 77.7% for men and 74% for women (Table 2).

For ischemic heart diseases, 32.1% of all DALYs in the 30-59 age group and 12.3% in the 60-and-over were attributable to smoking for the two sexes combined. For cerebrovascular diseases in men and women, 32.7% and 8.9% of all DALYs were smoking-attributable in the 30-59 and ≥ 60 age groups, respectively (Table 2).

Cancer of the trachea, bronchi, and lung (81.4%) and cancer of the larynx (79.5%) showed the highest smoking-attributable fractions of total DALYs for malignant neoplasms, followed by cancer of the lip, oral cavity, and pharynx (67.1%) and esophagus (65.6%) (Table 2).

Of the total DALYs due to pneumonia, 19.3% were smoking-attributable for both sexes combined (Table 2). As for the perinatal period, smoking-attributable low birth weight represented 12.5% of all DALYs for male and female neonates (Table 2).

Table 3 shows the absolute and proportional distribution of smoking-attributable DALYs, rated according to total DALYs: COPD 32.3%, ischemic heart disease 15.7%, and cerebrovascular disease 13.2%. Combined, the three diseases accounted for 61.1% of all smoking-attributable DALYs in the year 2000 in the State of Rio de Janeiro among individuals 30 years and older, considering the 22 disease groups selected for the study.

DISCUSSION

In the State do Rio de Janeiro, 7.0% of all DALYs are smoking-attributable, for all ages. However, analyzing the 30-year and over age group separately, smoking-attributable DALYs increased to 10.6% (13.6% in men and 7.5% in women). Men persistently presented a higher attributable disease burden than women, due to a higher prevalence of smoking in males.[21-26]

The results are consistent with Mathers *et al.* (1999)[27] for the Global Burden of Disease Survey conducted in Australia in 1996, where 9.7% of all DALYs were smoking-attributable (12.1% in men and 6.8% in women). The State of Rio de Janeiro shows patterns similar to those found in high income countries.

Cardiovascular diseases were ranked in a relevant position among the main diseases associated with DALYs. In the current study, of all DALYs from ischemic heart disease (IHD), the smoking-attributable faction for the 30-and-over group was 20.4%, and for strokes it was 19.4%.

Worldwide, for individuals 30 years and older, 17.0% of all DALYs due to ischemic heart disease were attributable to smoking[28]. In low/middle and high income countries, the results are 15.0% and 23.0%, respectively.[28] In Latin America and the Caribbean, 14.0% and 15.0% of DALYs caused by cerebrovascular disease and ischemic heart disease, respectively, are smoking-attributable in the same age group.[28]

Based on data from the Global Burden Disease Survey 2000 (GBD-2000), Ezzati et al. (2003)[29] showed that 12.0% of all DALYs due to ischemic heart disease and an equal proportion for strokes were attributable to smoking. In high income countries, 22.0% of such conditions are smoking-attributable, i.e., the proportions are similar to those in the current study.

Even though all age groups were included in the Global

Table 1 - Disability-adjusted life years (DALYs) and their smoking-attributable fraction, according to gender and estimated cause of disease, for individuals ≥ 30 years of age. Rio de Janeiro State, Brazil, 2000

Causes of disease	DALYs			Attributable fraction (%)		
	Both	Male	Female	Both	Male	Female
All causes (all ages)	3,868,987	1,984,049	1,884,939	7.0	8.9	5.0
All causes (≥ 30 years)	2,536,658	1,287,508	1,249,150	10.6	13.6	7.5
Smoking-attributable causes * (≥ 30 years)	813,052	461,944	351,108	33.2	38.0	26.8

* Attributable DALYs estimated for selected tobacco-related diseases among individuals 30 years and older: 269,600, 175,656, and 93,944 for both sexes, males, and females, respectively.

Table 2 - DALYs, smoking-attributable DALYs, and the smoking-attributable fraction, according to gender and smoking-attributable selected diseases, ≥ **30 years of age**. Rio de Janeiro State, Brazil. 2000

Causes of disease	DALYs			Attributable DALYs			Attributable fraction		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
Tobacco-related causes* (≥ 30 years)	813,052	461,944	351,108	269,600	175,656	93,944	33.2	38.0	26.8
Group I.B. Infectious Respiratory Diseases	**55,609**	**29,808**	**25,801**	**10,714**	**6,293**	**4,421**	**19.3**	**21.1**	**17.1**
Pneumonia, Influenza (J10-J18)	55,609	29,808	25,801	10,714	6,293	4,421	**19.3**	21.1	17.1
Group I.D. Conditions arising in the perinatal period	**54,957**	**30,296**	**24,661**	**3,960**	**2,350**	**1,610**	**7.2**	**7.8**	**6.5**
Low birth weight (P07)	9,850	5,038	4,812	1,232	689	543	**12.5**	13.7	11.3
Respiratory Stress Syndrome (P22)	19,503	11,110	8,393	1,005	623	382	**5.2**	5.6	4.6
Other conditions originating in the perinatal period (P23-P28)	25,604	14,149	11,455	1,723	1,038	685	**6.7**	7.3	6.0
Group II.A. Malignant neoplasms	**131,024**	**77,700**	**53,324**	**63,111**	**47,121**	**15,990**	**48.2**	**60.6**	**30.0**
Malignant neoplasm of lip, oral cavity and pharynx(C00-C14)	14,212	11,358	2,854	9,536	8,216	1,320	**67.1**	72.3	46.2
Malignant neoplasm of esophagus (C15)	10,484	8,205	2,279	6,879	5,562	1,317	**65.6**	67.8	57.8
Malignant neoplasm of stomach (C16)	23,073	14,096	8,976	4,435	3,533	901	**19.2**	25.1	10.0
Malignant neoplasm of pancreas (C25)	9,338	4,746	4,592	2,196	1,129	1,067	**23.5**	23.8	23.2
Malignant neoplasm of larynx (C32)	6,298	5,514	784	5,006	4,441	565	**79.5**	80.5	72.1
Malignant neoplasm of trachea, lungs, and bronchi (C33-C34)	36,696	24,607	12,089	29,888	21,333	8,554	**81.4**	86.7	70.8
Malignant neoplasm of cervix uteri (C53)	15,169		15,169	1,520		1,520	**10.0**		10.0
Malignant neoplasm of bladder (C67)	4,860	3,294	1,566	1,811	1,418	393	**37.3**	43.0	25.1
Malignant neoplasm of kidneys, urinary tract (C64-C66, C68)	3,315	1,980	1,335	764	684	80	**23.0**	34.5	6.0
Acute myeloid leukemia (C91-C95)	7,581	3,901	3,680	1,077	805	272	**14.2**	20.6	7.4
Group II.G. Cardiovascular Diseases	**436,765**	**240,636**	**196,130**	**87,364**	**53,593**	**33,771**	**20.0**	**22.3**	**17.2**
Ischemic heart disease (I20-I25) (30-59 yrs.)	84,714	57,447	27,267	27,193	19,658	7,535	**32.1**	34.2	27.6
Ischemic heart disease (I20-I25) (≥ 60 yrs.)	122,344	62,385	59,959	15,082	8,306	6,776	**12.3**	13.3	11.3
Other heart conditions (I29-I51)	35,524	21,477	14,047	4,996	3,771	1,225	**14.1**	17.6	8.7
Cerebrovascular disease (I60-I69) (30-59 yrs.)	80,807	43,521	37,286	26,454	13,618	12,836	**32.7**	31.3	34.4
Cerebrovascular disease (I60-I69) (≥ 60 yrs.)	102,775	49,362	53,413	9,175	5,242	3,934	**8.9**	10.6	7.4
Atherosclerosis (I70)	217	143	75	46	38	8	**21.2**	26.4	11.3
Aortic aneurysm (I71)	6,285	4,196	2,089	3,699	2,584	1,115	**58.9**	61.6	53.4
Other arterial diseases (I72-I78)	4,100	2,104	1,996	718	376	342	**17.5**	17.9	17.1
Group II.H. Chronic Respiratory Disease	**134,696**	**83,504**	**51,193**	**104,451**	**66,299**	**38,152**	**77.5**	**79.4**	**74.5**
Bronchitis, emphysema (J40-J43)	20,963	14,077	6,886	17,703	12,355	5,348	**84.4**	87.8	77.7
Chronic obstructive pulmonary disease (J44)	113,733	69,427	44,306	86,748	53,944	32,804	**76.3**	77.7	74.0

Burden of Disease Survey in Australia, these conditions only become more prevalent in individuals 30 years and older, and thus the smoking-attributable burden is more evident in this age group and above. In the present study, 15.5% of all DALYs to ischemic heart disease and 6.2% of those due to strokes were smoking-attributable.[27]

For malignant neoplasms, 48.2% of all DALYs in the 30-and-over group were smoking-attributable (60.6% in men and 30.0% in women).

Some studies worldwide have reported that 21.0% of all DALYs in the ≥ 30-year group from malignant neoplasms are smoking-attributable. In high and low/middle income countries respectively, the results are 19.0% and 29.0%[28,30]. Although the authors of those studies also worked with the 30-and-over group, the lower percentages could be explained by the fact that all types of malignant neoplasms

Table 3 - Smoking-attributable DALYs, proportional distribution, and accumulated proportional distribution according to diseases in individuals 30 years and older. Rio de Janeiro State, Brazil, 2000

Rank	Diseases	Smoking-attributable DALYs		
		number	%	% accumulated
1	Chronic obstructive pulmonary disease (J44)	86,748	32.2	32.2
2	Ischemic heart disease (I20-I25) (30-59 years)	42,275	15.7	47.9
3	Cerebrovascular disease (I60-I69) (30-59 years)	35,629	13.2	61.1
4	Malignant neoplasm of trachea, lungs, and bronchi (C33-C34)	29,888	11.1	72.2
5	Bronchitis emphysema(J40-J43)	17,703	6.6	78.7
6	Pneumonia, Influenza (J10-J18)	10,714	4.0	82.7
7	Malignant neoplasm of lip, oral cavity and pharynx(C00-C14)	9,536	3.5	86.2
8	Malignant neoplasm of esophagus (C15)	6,879	2.6	88.8
9	Malignant neoplasm of larynx (C32)	5,006	1.9	90.6
10	Other heart conditions (I29-I51)	4,996	1.9	92.5
11	Malignant neoplasm of stomach (C16)	4,435	1.6	94.1
12	Aortic aneurism (I71)	3,699	1.4	95.5
13	Malignant neoplasm of pancreas (C25)	2,196	0.8	96.3
14	Malignant neoplasm of bladder (C67)	1,811	0.7	97.0
15	Other conditions arising in the perinatal period (P23-P28)	1,723	0.6	97.6
16	Malignant neoplasm of cervix uteri (C53)	1,520	0.6	98.2
17	Low birth weight (P07)	1,232	0.5	98.7
18	Acute myeloid leukemia (C91-C95)	1,077	0.4	99.1
19	Respiratory stress syndrome (P22)	1,005	0.4	99.4
20	Malignant neoplasm of kidneys, urinary tract (C64-C66, C68)	764	0.3	99.7
21	Other arterial diseases (I72-I78)	718	0.3	100.0
22	Atherosclerosis (I70)	46	0.0	100.0
	Total for all DALYs	**269,600**	**100.0**	**100.0**

were included, while our study used only smoking related malignant neoplasms were considered, as described in the Methods section.

Meanwhile, chronic respiratory diseases showed the highest smoking-attributable fractions: 77.5% overall (79.4% in men and 74.5% in women). Within this GBD group (II.H), and in both sexes combined, bronchitis and emphysema showed a smoking-attributable fraction of 84.4%. For COPD, the figure was 76.3%. A study in the United States[18] from 1995 to 1999 estimated that 81.7% of mortality from COPD in men and 75.1% in women was smoking-attributable.

In the current study, COPD, ischemic heart disease, cerebrovascular diseases, and cancer of the trachea, bronchi, and lung were responsible for 32.2%, 15.7%, 13.2%, and 11.1% of all DALYs, respectively, in the 30-and-over group. When grouped together, these four disease groups accounted for 72.2% of the smoking-attributable disease burden among selected conditions. In the Australian study, lung cancer is the main disease, and together with COPD and ischemic heart disease it represents 72.0% of the disease burden attributable to smoking and nearly 7.0% of DALYs, for all causes of disease.[27]

For smoking-attributable diseases specific to infants (< 1 year of age), the I.D. or "perinatal conditions" group presented an attributable fraction of 7.2% for the entire set of causes of disease, and low birth weight showed the highest figure: 12.5%. However, this category represents only 0.5% of all smoking-attributable DALYs.

The current study presents some limitations that are important to discuss. The most important one relates to prevalence rates for current exposure, failing to account for the latency period between exposure to tobacco and onset of symptoms. This was not exclusive to the current study, having been identified consistently by other authors.[12-15,18,31,32]

The use of single prevalence rates, with no distinction for rural areas within the State (where higher smoking prevalence can be expected), should also be considered a limitation, resulting in more conservative figures.

As already indicated by other authors, relative risks from the CPS II, used in the current paper, are also questionable. The information found in CPS II is based on non-representative population samples, in which married, white, higher-income, and more educated individuals were over-represented, thus limiting the generalization of the results. It must be noted that these are national estimates, adjusted by age without accounting for other potential confounders like alcohol consumption, schooling, hypertension, and prevalence of diabetes mellitus.[33,34] However, in the absence of nationally representative parameters for the Brazilian population, these estimates were applied to the data in the current paper.

Lastly, the application of mortality risks to DALYs can produce misleading results, such that further investigation is needed.

The limitations mentioned here are not exclusive to the current study and should not compromise the comparability of the estimates. The paper indicates that tobacco is an important risk factor and has a great impact, representing one in every 7.3 DALYs lost by men and one in every 13.3 DALYs lost by women in the State of Rio de Janeiro. It is therefore of the utmost importance that tobacco prevention and control measures be effectively implemented as public health policies.

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