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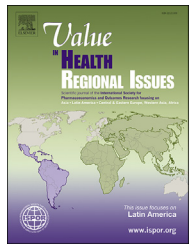

Burden of Disease Attributable to Obesity and Overweight in Colombia

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ABSTRACT

Objectives: To estimate the burden of disease attributable to obesity and overweight conditions using disability-adjusted life-years (DALYs) in Colombia. **Methods:** The burden of disease was estimated following an adapted methodology published by the World Health Organization. A selection of diseases was performed in which overweight and obesity are risk factors. DALYs were calculated by obtaining the proportion of cases and deaths of every disease that can be attributable to obesity and overweight conditions. The economic impact of obesity was calculated by multiplying the cost of care per patient for each comorbidity by the number of cases attributable exclusively to obesity. **Results:** A total of 997 371 DALYs were estimated, 45% of which corresponded to men; 81% of DALYs corresponded to years lived with disability. Conditions with greater attributable DALYs are, in order, hypertension (31.6% of the total DALYs), type 2 diabetes mellitus (28.0%), cardiac ischemic disease (14.6%), and lower back pain (11.2%). An estimation of 20.5 DALYs per 1000 inhabitants was made. The economic impact of care for comorbidities associated with obesity could amount to $2158 million. **Conclusions:** Obesity and overweight conditions are related to higher mortality and disability than previously estimated; effective interventions aimed at prevention and treatment will have a high impact on quality of life.

Keywords: burden of disease, Colombia, disability-adjusted life-years (DALYs), obesity, overweight, risk factors

Introduction

Overweight and obesity are nutrition-related problems that have become increasingly common over the past years, mainly because of the economic and nutritional changes associated with city life, affecting both developed and developing countries.[1] Obesity and overweight conditions affect the adult population mostly; nevertheless, because of the reduction of physical activity, it is also a problem in children.[2]

Weight, height, abdominal creases, and abdominal circumference are reference measures for nutritional state assessments.[1] Nevertheless, the World Health Organization (WHO) has established a classification system based on body mass index (BMI), which considers only weight and height. In this system, BMI less than 18.5 kg/m^2 is considered underweight, from 18.5 to 24.9 kg/m^2 is normal weight, and overweight occurs after 25 kg/m^2 and obesity after 30 kg/m^2. At the same time, obesity is classified as type I, II, and III, corresponding to BMI values of 30.0 to 34.9, 35 to 39, and 40 kg/m^2 or more, respectively.[1]

In Colombia, according to the results of the 2010 National Survey of Nutritional Status, the prevalence of overweight and obesity in adults aged between 18 and 64 years was 51.1%, of which 34.6% corresponded to overweight and 16.5% to obesity.[1] According to the Nutritional Health National Survey carried out in Colombia in 2015, the prevalence of obesity and overweight has increased by 5.2% percentual points in adults aged 18 to 64 years with regard to 2010.[3] The most recent survey results showed that obesity continues to be a more frequent condition in women (22.4%) than in men (14.4%).[3]

The economic impact of obesity is mainly related to the increase in health expenditure and the loss of productivity among individuals. Studies conducted in the United States have found that the per capita costs of overweight and obese people are 9.9% and 42.7% higher than for individuals with normal weight, respectively,[4] which has alarmed decision makers and those responsible for the implementation of public policies.[5] In the United States, it is estimated that between 1998 and 2006, expenditure related to the management of obesity increased by

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Table 1 – Selected diseases associated with obesity and overweight.

Description	*ICD-10* code	Risk group
Cardiac ischemic disease	I20-25	≥20 y
Hypertension	I10-I15	≥20 y
Type 2 diabetes mellitus	E11	≥20 y
Dyslipidemias	E78	≥10 y
Osteoarthritis	M15-M19	≥30 y
Endometrial cancer	C54-C55	≥30 y
Colorectal cancer	C18-C21	≥30 y
Breast cancer	C50	≥30 y
Sleep apnea	G47.3	≥30 y
Lower back pain	M54.5	≥20 y
Infertility	N46 y N97	Women: 15-49 y Men: ≥ 15 y
Gallstones	K80	≥30 y
Gastroesophageal reflux disease	K21	≥30 y
Fatty liver	K76	≥30 y
Depression	F32-F33	≥10 y

ICD-10 indicates *International Classification of Diseases, Tenth Revision.*

46% in hospitalization services, 27% in outpatient services, and 80% in medications.[6]

The increase in the prevalence of the disease presents a problem for health service providers because obesity is a risk factor for a range of morbidities, most of which are related to significant endocrine and metabolic disorders.[4] According to the Global Burden of Disease (GBD) study, a high BMI is linked to 5.47% of total disability-adjusted life-years (DALYs).[7] Estimating the burden of disease allows the measurement of the impact of conditions on a population using a comparable magnitude: DALY.[8,9] The goal of this study was to assess the burden of disease attributable to overweight and obesity in Colombia.

Methods

The methodology proposed by WHO was followed for the estimation of the burden of disease associated with overweight and obesity.[10] The activities developed are detailed herein.

Selection of diseases in which overweight and obesity are risk factors: Outcomes associated with a high BMI were documented according to Lozano et al[11] and considered in the assessment of disease burden of risk factors. After the suggestion of a thematic expert, other outcomes were included that have been associated with excess weight and have an impact on local clinical practice such as dyslipidemia, gastroesophageal reflux, and fatty liver. In addition, risk by age groups was defined for each of the conditions associated with obesity; these are presented in Table 1.

Population-attributable fraction: This is the proportion of cases that can be attributed to a certain exposure. The comparative risk methodology proposed by Kelly et al[12] was adopted to determine the population-attributable fraction (PAF) for each selected disease. In this approach, the distribution of the population exposed to the risk factor is compared with a hypothetical exposure distribution that corresponds to the minimal theoretical risk of exposure. The equation used to calculate the PAF is as follows:

$$\mathrm{PAF} = \frac{\sum_{i=1}^{n} P_i(\mathrm{RR_i} - 1) - \sum_{i=1}^{n} P'_i(\mathrm{RR_i} - 1)}{\sum_{i=1}^{n} P_i(\mathrm{RR_i} - 1)},$$

where n is the number of exposure categories, P_i the population proportion on the ith exposure category, P'_i the population proportion on the ith exposure category in the hypothetical distribution, and RR_i: the relative risk associated with the ith exposure category.

A BMI of 21 ± 1 kg/m^2 was considered the minimum theoretical risk.[13] The relative risks (RRs), sex-stratified, to cardiac ischemic disease, type 2 diabetes mellitus, osteoarthritis, and endometrial, breast, and colorectal cancer were obtained from the systematic review of James et al[13] that evaluated the association between the 1-unit increase in the BMI increase and the events of interest. For the other conditions, a literature review was carried out in PubMed and Up-To-Date in which the risk of comorbidity due to a 1-unit increase in the BMI was reported. In this review, preference was given to recent studies in which the risk was stratified by sex and age. Table 2 presents the results of the literature review regarding hypertension, dyslipidemia, sleep apnea, lower back pain, infertility, gallstones, gastroesophageal reflux disease, fatty liver, and depression.

When odds ratio was reported as a risk measure, the methods proposed by the Cochrane Collaboration were used to convert to RR.[14] If the measure of risk associated with the 1-unit increase in the BMI was not reported by age groups, the same risk was assumed for all. This assumption was applied for osteoarthritis, endometrial cancer, breast cancer, colorectal cancer, sleep apnea, low back pain, infertility, gastroesophageal reflux disease, fatty liver, and depression.

Population: The population projection for 2016 estimated by the *Departamento Administrativo Nacional de Estadísticas* (DANE) was considered for this study. The results are presented for the entire Colombian population in 5-year periods and the following age groups: younger than 5, 5 to 14, 15 to 49, 50 to 60, and older than 70 years.

Mortality: Mortality data were obtained from a DANE vital statistics database. An underreporting adjustment was performed for each age group as reported in the 2010 Disease Burden Study for Colombia[15] and another adjustment factor of 1.04 because there are deaths that are grouped in a nonspecific category. For more details on the factor by underreporting considered for each age group, see Appendix Table 1 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2019.02.001.

Risk-factor–attributable mortality (AM): The deaths related with obesity for each disease were calculated with the mortality information of every age group and disease (M_{ij}) and the PAF for every age group and disease (PAF_{Mij}) by using the following formula:

$$\mathrm{AM_{ij}} = \mathrm{PAF_{Mij}} \times \mathrm{M_{ij}}.$$

Years of life lost due to premature death: Years of life lost due to weight-related conditions (YLL_A) were calculated using risk-factor AM and reference values of years of life lost by age group (YLL_j) obtained from WHO standard life tables.[16] The following equation was used:

$$\mathrm{YLL_{A_{ij}}} = \mathrm{AM_{ij}} \times \mathrm{YLL_j}.$$

Risk factor–attributable cases: Prevalence data of cardiac ischemic disease, hypertension, type 2 diabetes mellitus, and endometrial, colorectal, and breast cancer were obtained for each age group from the results of a burden of chronic noncommunicable diseases study carried out in Colombia.[17] Data for the other diseases (dyslipidemia, sleep apnea, lower back pain, infertility, gallstones, gastroesophageal reflux disease, fatty liver, and depression) were extracted from the individual records of health services provision (Registros Individuales de Prestación de Servicios de Salud [RIPS]) database. RIPS is part of the integrated information system of the Colombian Ministry of Health and Social Protection, established in 2000 through Resolution No. 3374.[18] The database centralizes information about health services currently provided to the population in all the regimes defined by

Table 2 – Risk of development of selected diseases by 1-unit (1 kg/m²) increase in BMI.

Age (y)	Men	Women	Source	Comment
Coronary heart disease				
30-44	HR: 1.12 (1.05-1.19)		James et al[13]	In the case of ischemic cardiac events, the literature reports the association between the reduction in the BMI and the occurrence of these events, so for the estimation of the effect of the increase in the BMI by 1 unit, the inverse of the reported value was taken
45-59	HR: 1.10 (1.08-1.14)			
60-69	HR: 1.05 (1.03-1.08)			
70-79	HR: 1.04 (1.02-1.06)			
≥80	HR: 1.03 (1.00-1.05)			
Type 2 diabetes				
30-44	RR: 1.36	RR: 1.47	James et al[13]	The estimates were derived from the age- and sex-specific associations of type 2 diabetes with BMI from the Japanese National Survey
45-59	RR: 1.24	RR: 1.34		
60-69	RR: 1.18	RR: 1.21		
70-79	RR: 1.27	RR: 1.20		
≥80	RR: 1.27	RR: 1.20		
Osteoarthritis				
All ages	RR: 1.04	RR: 1.04	James et al[13]	Information was extracted from Must et al[33]
Endometrial cancer				
–		RR: 1.10 (1.07-1.14)	James et al[13]	Describes the increase in incidence rates per unit increase in BMI irrespective of age
Breast cancer				
		RR: 1.03 (1.02-1.04)	James et al[13]	Describes the increase in incidence rates per unit increase in BMI irrespective of age
Colorectal cancer				
	RR: 1.03 (1.01-1.05)		James et al[13]	Describes the increase in incidence rates per unit increase in BMI irrespective of age
Hypertension				
–	RR: 1.21 (1.09-1.35)		Gelber et al[34]	Men with BMI increase of >5%-10% had an RR of 1.21 (95% CI 1.09-1.35) and men with BMI increase of >10% had an RR of 1.72 (95% CI 1.48-1.99), compared with men whose BMIs remain at baseline values
25	HR: 1.12 (1.08-1.17)		Shihab et al[35]	Considering BMI as a time-dependent variable, every unit increment increased the likelihood to develop hypertension (HR = 1.06; 95% CI 1.04-1.08)
45	HR: 1.12 (1.08-1.15)			
65	HR: 1.08 (1.02-1.14)			
Dyslipidemia				
27-34		RR: 1.03 (0.68-1.58)	Schmiegelow et al[36]	Risk attributable to minor changes in BMI (1-2 kg/m²)
4-21	OR: 1.62 (1.02-2.57)		Nielsen et al[37]	Patients recruited for the study were obese
Sleep apnea				
30-60	OR: 1.14 (1.10-1.19)		Lee et al[38]	BMI impact on sleep apnea is less significant from 60 y
Lower back pain				
–	OR: 1.18 (0.96-1.44)		Frilander et al[39]	Reported for an increase of 3 kg/m² in BMI
–	OR: 1.016 (1.013-1.200)	OR: 1.018 (1.013-1.023)	Hershkovich et al[40]	Logistic regression was used to correlate low back pain and weight changes; carried out on adolescent population. Reported for an increase of 1 kg/m² in BMI
Infertility				
–		HR: 0.96 (0.91-0.99)	van der Steeg et al[41]	Reduction in pregnancy frequency
Gallstones				
60	HR: 1.08 (1.02-1.14)	HR: 1.08 (1.06-1.11)	Rooney Banim[42]	
Gastroesophageal reflux disease				
30-55		OR: 1.30 (1.25-1.34)	Jacobson et al[43]	Reported for an increase of 0.5-1 unit in BMI
Fatty liver				
42.9 ± 14.8	HR: 1.16 (1.16-1.17)		Loomis et al[44]	Estimates based on data extracted from clinical reports
Depression				
13-19	OR: 1.19 (0.94-1.52)	OR: 1.24 (1.02-1.51)	Bjørngaard et al[45]	

BMI indicates body mass index; HR, hazard ratio; OR, odds ratio; RR, relative risk.

Law 100.[19] RIPS allows you to search the total number of people served by a specific *International Classification of Diseases, Tenth Revision* (*ICD-10*) code, and also allows searching by a period, sex, or age, among other characteristics.[20]

Demographic information obtained from DANE was used as the denominator in the calculation of disease prevalence.[21] The data obtained from RIPS were also subject to adjustment because of underreporting according to the *Observatorio Nacional de Salud* in which it estimated an underrecording of approximately 50%,[17,22] so the corresponding correction factor was applied. To consult the total number of cases considered for each pathology and the respective source, see Supplemental Materials found at https://doi.org/10.1016/j.vhri.2019.02.001. The attributable cases (ACs) were calculated by using prevalence (*P*) or incidence (*I*) and PAF by applying the following equation:

$$AC_{ij} = PAF \times \left(\frac{P}{I}\right)_{ij}.$$

For diseases with 2 or more sequelae, a literature review was conducted to obtain the PAF of developing certain sequelae since the disease is present. In addition, for the sequelae with different severity states, the frequency reported in local studies was considered, including gray literature review. For more details on the distribution of cases between sequalae, see Appendix Table 2 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2019.02.001.

Years lived with disability: For this calculation, a proportion of ACs for every disease was used and weighted on the basis of the health impact of the sequelae associated with the disease (DW). The weight of each disease was obtained from the study by Murray et al.[8]

$$YLD_{A_{ij}} = AC_{ij} \times DW_{ij}.$$

Disability-adjusted life-years: DALYs were calculated using YLD_A and YLL_A data by applying the following equation:

$$DALY_{A_{ij}} = YLL_{A_{ij}} + YLD_{A_{ij}}.$$

The results were expressed in DALYs per 1000 inhabitants.

Economic impact of obesity: Following the Colombian healthcare system perspective, we estimated the direct medical costs associated with obesity and their complications by the methodology of the base case or case type.[23] The resulting event costs were expressed in 2016 US dollars ($1 = Col$3051 [Colombian pesos]). Resources were identified with the help of a thematic expert, in terms of medicines, procedures, and consultations associated with the treatment of each of the health conditions associated with obesity and the comorbidities previously selected for disease burden estimation. The construction of the base case considered the cost-generating events defined in the corresponding clinical practice guidelines. Price information of the medicines was obtained from the System of Prices of Medicines report (Sistema de Información de Precios de Medicamentos) accumulated till September 2016[24] and the drug price regulation newsletters published by the Ministry of Health.[25] The costs of procedures, laboratories, and consultations were obtained from the Social Security Institute 2001 tariff (Agreement 256) plus the increase suggested in the *Instituto de Evaluación Tecnológica en Salud* manual. To calculate the total cost, we multiplied the annual cost of treating each condition for cases attributable to obesity. The details of the cost-generating events identified for each condition can be found in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2019.02.001.

Results

From 59 347 deaths reported (and adjusted) by DANE, 11 565 were estimated to be attributable to obesity and overweight conditions. Table 3 presents the results. An estimation of 3 800 505 cases of complications attributable to obesity and overweight conditions was made. The most common diseases associated with obesity and overweight complications were diabetes mellitus, hypertension, back pain, and sleep apnea. Table 4 presents the results.

In Table 5, DALYs for men and women are presented for each condition; 997 371 DALYs were estimated, of which 45% corresponded to men; 81% of DALYs corresponded to YLD. Conditions with greater attributable DALYs are, in order, hypertension, type 2 diabetes mellitus, cardiac ischemic disease, and lower back pain. An estimation of 20.5 DALYs per 1000 inhabitants was made, 18.6 for men and 22.3 for women.

Under the assumption that all patients who develop a comorbidity attributable to obesity receive the treatment they require, an annual cost of $2159 million is projected. The conditions that generate the greatest impact in economic terms are hypertension, diabetes mellitus, and sleep apnea, because these are the conditions that represent the greatest number of cases

Table 3 – Deaths attributable to overweight and obesity conditions for each complication.

Cause of death	Total men	%	Total women	%	Total	%
Ischemic heart disease	4395	80.4	3792	62.16	8187	70.8
Type 2 diabetes mellitus	485	8.9	680	11.14	1164	10.1
Hypertensive diseases	460	8.4	569	9.33	1029	8.9
Breast cancer	0	0.0	561	9.19	561	4.8
Endometrial cancer	0	0.0	303	4.97	303	2.6
Gallstones	62	1.1	118	1.93	180	1.6
Colon and rectum cancer	52	0.9	57	0.93	108	0.9
Osteoarthritis	4	0.1	10	0.16	14	0.1
Sleep apnea	2	0.0	5	0.09	8	0.1
Gastroesophageal reflux disease	3	0.1	3	0.05	7	0.1
Fatty liver	1	0.0	1	0.02	2	0.0
Dyslipidemias	1	0.0	1	0.02	2	0.0
Depression	0	0.0	1	0.01	1	0.0
Back pain	0	0.0	0	0.00	0	0.0
Infertility	0	0.0	0	0.00	0	0.0
Total	5464		6101		11 565	

Table 4 – Cases attributable to overweight and obesity in men for each complication.

Disease	Total men	%	Total women	%	Total	%
Hypertensive diseases	497 428	30.3	735 193	34.0	1 232 621	32.4
Type 2 diabetes mellitus	488 451	29.8	682 343	31.6	1 170 794	30.8
Back pain	236 620	14.4	67 315	3.1	303 935	8.0
Sleep apnea	182 438	11.1	120 781	5.6	303 220	8.0
Osteoarthritis	60 140	3.7	206 857	9.6	266 997	7.0
Depression	36 987	2.3	139 924	6.5	176 911	4.7
Gastroesophageal reflux disease	43 567	2.7	104 737	4.9	148 304	3.9
Dyslipidemias	58 449	3.6	51 778	2.4	110 227	2.9
Ischemic heart disease	25 614	1.6	20 745	1.0	46 358	1.2
Fatty liver	8036	0.5	15 109	0.7	23 145	0.6
Gallstones	1783	0.1	7310	0.3	9092	0.2
Infertility	1470	0.1	5201	0.2	6671	0.2
Breast cancer	0	0.0	1159	0.1	1159	0.0
Endometrial cancer	0	0.0	827	0.0	827	0.0
Colon and rectum cancer	195	0.0	50	0.0	245	0.0
Total	1 641 177		2 159 328		3 800 505	

attributable to obesity. Table 6 presents the economic impact of each disease.

Discussion

If we compare our results with the estimated burden of disease from the 2015 GBD study, 9.4% of total DALYs, 3% of total YLL, and 17% of YLD are attributable to obesity and overweight conditions. Other studies carried out in Latin America and the Caribbean found that about 5% of total DALYs are attributable to obesity.[26] In Mexico, 12% of the total burden of disease was attributable to dietary factors,[11] and YLL attributable to overweight and obesity were 12.1% and 20.6% of total YLL in men and women, respectively.[27] In Colombia, a disease burden of 269 DALYs per 1000 people was estimated for 2010,[15] and so if these estimates were related to the results obtained in this study, overweight and obesity would correspond to approximately 7.6% of the total disease burden. The study estimated 211 YLD and 58 YLL per 1000 people,[15] which means that obesity and overweight represent 7.9% and 6.6% of YLD and YLL, respectively. These results should be interpreted with caution because of differences in methodology and sources of information between studies.

Burden attributable to obesity and overweight conditions for each cause found in our study was compared with the estimated values of the GBD study. Our results are consistent in almost every cause; nevertheless, the main difference between studies lies in the burden for hypertension. This condition is described in GBD as a set of cardiac diseases grouping *ICD* codes I10-I13. In our study, *ICD* codes I10-I15 were considered; there was, however, no information regarding code I15 (secondary arterial hypertension) in the RIPS database. Furthermore, hypertension prevalence in Colombia reported in GBD is 1.04%,[7] which contrasts with the data found in local studies. For arterial hypertension, a variable prevalence has been reported. Cross-sectional studies show that 20% of the general population may suffer from hypertension and it may reach 50% in people older than 50 years and 65% in people older than 80 years.[28,29] In another study conducted in Bogota in people older than 60 years,

Table 5 – DALYs attributable to overweight and obesity conditions for each complication.

	YLD			DALYs			
Cause	Men	Women	Total	Men	Women	Total	%
Hypertensive diseases	121 206	179 141	300 348	127 723	187 147	314 869	31.6
Type 2 diabetes mellitus	109 219	152 573	261 792	115 841	163 091	278 931	28.0
Ischemic heart disease	9 276	7 512	16 788	81 339	64 232	145 572	14.6
Back pain	86 603	24 637	111 240	86 603	24 637	111 240	11.2
Depression	9303	36 929	46 232	9 303	36 942	46 245	4.6
Dyslipidemias	15 292	13 547	28 839	15 305	13 554	28 859	2.9
Osteoarthritis	3444	20 733	24 177	3480	20 812	24 292	2.4
Gastroesophageal reflux disease	5359	12 883	18 241	5394	12 932	18 326	1.8
Breast cancer	0	305	305	0	14 020	14 020	1.4
Endometrial cancer	0	126	126	0	6663	6663	0.7
Gallstones	219	899	1118	1074	2453	3527	0.4
Fatty liver	781	1468	2249	793	1496	2289	0.2
Colon and rectum cancer	88	22	110	897	1013	1910	0.2
Sleep apnea	253	168	421	307	279	586	0.1
Infertility	9	31	40	9	31	40	0.0
Total	*361 051*	*450 975*	*812 026*	*448 069*	*549 302*	*997 371*	
YLDs, DALYs per 1000	*15.0*	*18.3*	*16.7*	*18.6*	*22.3*	*20.5*	

DALY indicates disability-adjusted life-year; YLD, years lost to disability.

Table 6 – Economic impact attributable to obesity for each complication.

Attributable comorbidity	Risk group	Cost per patient per year ($)						Total annual impact ($)		
		Adults			Children					
		Base	Minimum	Maximum	Base	Minimum	Maximum	Base	Minimum	Maximum
Hypertensive diseases	20+	490.18	437.59	640.16				604 209 830	539 381 959	789 080 045
Type 2 diabetes	20+	491.31	442.75	627.02				575 224 530	518 367 597	734 111 685
Sleep apnea	30+	1086.88	957.82	1279.93				329 563 803	290 431 247	388 100 609
Back pain	20+	604.88	483.91	743.64				178 455 601	142 764 481	219 391 743
Osteoarthritis	30+	462.05	369.64	581.03				123 365 964	98 692 771	155 132 739
Depression	10+	675.18	485.98	828.46	97.62	93.86	111.14	113 057 645	81 637 656	138 629 426
Gastroesophageal reflux disease	30+	696.75	681.63	1065.32				103 331 396	101 088 604	157 991 927
Ischemic heart disease	20+	1049.96	831.79	1710.15				48 673 929	38 560 001	79 279 476
Dyslipidemias	10+	289.14	255.20	381.86	142.03	136.57	161.70	31 598 492	27 910 172	41 682 983
Infertility in women	15+	3725.94	3074.20	4222.58				19 377 771	15 988 194	21 960 660
Fatty liver	30+	525.76	304.17	944.77				12 168 518	7 040 065	21 866 575
Breast cancer	30+	7519.95	6327.27	10 903.15				8 717 516	7 334 898	12 639 498
Gallstones	30+	456.33	408.99	563.89				4 149 160	3 718 724	5 127 076
Endometrial cancer	30+	4751.77	4143.51	5807.45				3 928 496	3 425 627	4 801 275
Colon and rectum cancer	30+	11 878.56	8402.27	16 423.38				2 905 637	2 055 296	4 017 353
Infertility in men	15+	74.26	63.57	96.85				109 173	93 457	142 379
Total								2 158 837 460	1 878 490 747	2 773 955 448

the self-reported prevalence of hypertension was 56.9% (men 55.4%; women 60.0%).[30] Nevertheless, the national risk factor study, ENFREC II[31] 1998, found that 12.3% (95% confidence interval 11.0%-13.6%) of the population reported being informed of high blood pressure. In the systematic review conducted by the *Observatorio Nacional de Salud* within the framework of the 2015 disease burden estimate, the prevalence of high blood pressure was 26% in women and 31% in men for 2014,[17] which is in contrast to the RIPS data for the same year that estimate a prevalence of 11% in women and 7% in men. Because this variable is particularly critical in estimating the burden attributable to excess weight, data from ENFREC II were considered in this study.

Because of the importance of the prevalence value for estimating the burden of disease, the lack of concrete local epidemiological data is one of the limitations of this study. The use of RR data from studies carried out in other countries as well as the problems regarding underreporting on national databases are also some of the limitations to keep in mind.

Previous studies show that the costs of obesity and the main associated comorbidities (diabetes, hypertension, and hypercholesterolemia) in Bolivia, Colombia, and Peru require financial resources of approximately 25% of the total budget allocated to public health.[32]

Nevertheless, the findings of this research show the importance of interventions to prevent and treat overweight and obesity conditions, because of the multiple health-related problems associated with these risk factors, which increase the rates of disability and mortality in the population.

Conclusions

The research results showed that overweight and obesity conditions have a high disease burden and can also have a high economic impact on the health system because they constitute a risk factor for the development of cardiovascular diseases and other complications.

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Supplemental Materials

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.vhri.2019.02.001.

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