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ECONOMIC BURDEN OF DISEASES CAUSED BY OVERWEIGHT AND OBESITY IN MEXICO

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INTRODUCTION

Overweight and obesity have a high impact on public health, including its association with chronic diseases like type 2 diabetes mellitus (T2DM) [1], cardiovascular diseases (CVD) [2], and cancer [3]. This problem is particularly severe in Mexico, straining public health and the economy [4]. The research aims to quantify the economic burden of diseases related to excess weight in Mexico, emphasizing the importance of adequate health strategies to address this issue's health and financial aspects.

METHODS

This study focuses on the economic burden of diseases linked to overweight and obesity, utilizing secondary sources like scientific articles and guidelines. It did not involve individual patient data; hence, we required no ethics approval. The methodology includes population-based data analysis, starting with determining the proportion of overweight individuals using the 2022 National Health and Nutrition Survey [4]. We then conducted a literature review to identify diseases causally related to overweight and obesity. We used cohort studies to ensure causality, comparing individuals with average weight to those with overweight or obesity.

We calculated the attributable risk proportion (ARP), also known as attributable fractions exposed (AFE) or etiological fraction (EF), which indicates the proportion of risk directly linked to a particular exposure, such as overweight or obesity. It emphasizes that not all individuals with these conditions develop diseases solely due to weight. AFE estimates how many individuals among the exposed set the condition due to this exposure. The calculation involves knowing the disease incidence among exposed and unexposed individuals, using the formula PAF = (RR - 1) / RR. We estimated the annual new and prevalent cases in Mexico associated with diseases caused by overweight and obesity. It assumes similar distributions of overweight and obesity among affected and unaffected populations despite potentially higher prevalence in certain conditions like T2DM or CVD. Despite the lack of BMI-adjusted prevalence data, the approach aims to maintain standardized estimates and avoid overestimating disease burden. We adjusted the number of annual new cases and prevalent diseases caused by overweight and obesity in individuals with excess weight who became ill due to their weight status, using the estimated PAF for each condition of interest.

We researched healthcare cost analysis studies in Mexico up to 2013, ensuring alignment with current medical practices. Most studies focused on the public sector and adjusted costs to present value using the annual inflation rate up to 2023. Costs were initially calculated in Mexican Pesos (MXN) and converted to US Dollars (USD) at an exchange rate of MXN 17 per USD 1.

RESULTS

The ENSANUT 2022 provided estimates of the prevalence of overweight, obesity, excess weight, and abdominal fat accumulation (defined as a waist circumference greater than 80 cm in women and 90 cm in men) based on data collected from 8,563 participants. We identified 27 diseases linked to overweight and obesity. Table 1 presents data on the yearly new cases and prevalent cases in Mexico for each condition in the general population, adjusted by sex and age when necessary. Additionally, it includes information on the Population Attributable Fraction (PAF) of overweight and obesity for each of the 27 medical conditions, indicating the proportion of patients with overweight or obesity who develop these conditions due to their excess weight.

We estimated the number of new annual and prevalent cases of 27 medical conditions associated with excess weight in Mexico. We utilized the prevalence of overweight and obesity in Mexico as a baseline, along with data on new annual cases, prevalent cases, and the AFE for each condition. This estimation focuses on individuals with excess weight who develop these diseases due to overweight and obesity. Table 2 displays direct healthcare costs for managing diseases resulting from excess weight and obesity. Costs vary based on whether it's the first year of treatment or subsequent periods, with some conditions having consistent costs throughout or one-time expenses, like gallstones.

In Mexico, we estimated the annual healthcare cost of individuals affected by weight-related diseases. We included the yearly quantity of new and existing cases of overweight and obesity-related diseases, along with data from Table 2, which lists the direct healthcare costs associated with each new and existing case of these diseases. This calculation aims to gauge the economic burden of overweight and obesity in Mexico regarding direct healthcare costs, as presented in Table 3.

Table 1. Annual new cases, prevalent cases in Mexico, and the attributable fraction of overweight and obesity for suffering from each of the 27 diseases in which overweight and obesity are a risk factor.

Disease	Sex	Age	Annual new cases	Prevalent cases	Ref.	AFE	Ref.
Esophageal cancer	Male/Fem	N.A.	1,290	1,341	[5]	32.4 %	[22-24]
Colon and rectal cancer	Male	N.A.	7,936	19,596	[5]	15.0 %	[25-27]
Colon and rectal cancer	Female	N.A.	6,965	17,877	[5]	5.57 %	[25-27]
Gallbladder and bile duct cancer	Male	N.A.	332	413	[5]	18.7 %	[28]
Gallbladder and bile duct cancer	Female	N.A.	585	1,121	[5]	25.6 %	[28]
Pancreatic cancer	Male/Fem	N.A.	4,985	4,014	[5]	9.09 %	[29]
Premenopausal breast cancer	Female	< 50 years	11,369	31,273	[5]	13.0 %	[30-32]
Postmenopausal breast cancer	Female	≥ 50 years	5,883	68,015	[5]	25.8 %	[30-32]
Uterine cancer	Female	N.A.	5,508	16,679	[5]	38.0 %	[22-24]
Ovarian cancer	Female	N.A.	4,963	13,529	[5]	5.66 %	[33-35]
Kidney cancer	Male/Fem	N.A.	5,925	15,635	[5]	23.1 %	[22-24]
Thyroid cancer	Male	N.A.	2,085	6,472	[5]	13.3 %	[36,37]
Thyroid cancer	Female	N.A.	9,142	30,622	[5]	12.0 %	[36,37]
Leukemias	Male	N.A.	3,723	11,338	[5]	7.92 %	[38]
Leukemias	Female	N.A.	3,232	9,950	[5]	11.6 %	[38]
Endometrial cancer	Female	N.A.	9,439	25,026	[5]	50.0 %	[22,39,40]
Hepatocellular carcinoma	Male/Fem	N.A.	7,536	8,007	[5]	23.1 %	[41,42]
Meningioma	Male/Fem	N.A.	3,189	8,806	[5]	23.5 %	[43-45]
Prostate cancer	Male	N.A.	26,742	90,670	[5]	9.09 %	[46]
Stroke	Male	N.A.	48,398	507,672	[6,7]	30.1 %	[47]
Stroke	Female	N.A.	59,321	762,079	[6,7]	30.1 %	[47]
Ischemic Heart Disease	Male	N.A.	150,874	1’362,214	[7-10]	28.1 %	[48]
Ischemic Heart Disease	Female	N.A.	114,126	1’003,187	[7-10]	28.1 %	[48]
High blood pressure	Male	N.A.	370,562	5’928,998	[10,11]	50.9 %	[49]
High blood pressure	Female	N.A.	484,913	7’758,610	[10,11]	50.9 %	[49]
Type 2 diabetes mellitus	Male	N.A.	308,074	6’529,910	[7,12,13]	43.7 %	[50]
Type 2 diabetes mellitus	Female	N.A.	312,120	8’663,781	[7,12,13]	43.7 %	[50]
Chronic Kidney Disease (CKD)	Male	N.A.	121,370	3’899,029	[7]	38.2 %	[51-53]
Chronic Kidney Disease (CKD)	Female	N.A.	166,658	4’880,188	[7]	38.2 %	[51-53]
CKD / Renal Replacement Therapy	Male	N.A.	21,318	89,153	[14,15]	38.2 %	[51-53]
CKD / Renal Replacement Therapy	Female	N.A.	22,823	93,189	[14,15]	38.2 %	[51-53]
Kidney transplant	Male	N.A.	1,872	33,004	[15]	38.2 %	[51-53]
Kidney transplant	Female	N.A.	1,058	51,280	[15]	38.2 %	[51-53]
Heart failure	Male	N.A.	120,915	659,537	[16]	47.4 %	[54]
Heart failure	Female	N.A.	130,099	709,629	[16]	52.9 %	[54]
Low back pain	Male/Fem	N.A.	-	17’634,264	[17,18]	8.80 %	[55-57]
Obstructive Sleep Apnea	Male	30-49 years	41,818	794,546	[19,20]	81.2 %	[29,58]
Obstructive Sleep Apnea	Male	≥ 50 years	56,011	1’064,211	[19,20]	72.5 %	[29,58]
Obstructive Sleep Apnea	Female	30-49 years	13,401	254,616	[19,20]	83.3 %	[29,58]
Obstructive Sleep Apnea	Female	≥ 50 years	33,074	628,414	[19,20]	76.9 %	[29,58]
Dementia	Male/Fem	N.A.	-	749,619	[21]	11.8 %	[59-61]
Cholelithiasis	Male	N.A.	415,403	N.A.	[7]	38.7 %	[62]
Cholelithiasis	Female	N.A.	1’226,064	N.A.	[7]	38.7 %	[62]

DISCUSSION

We examined the economic burden of diseases linked to overweight and obesity in Mexico, revealing alarming findings regarding public health. It emphasizes the urgent need to address this growing crisis and its economic impacts. The direct healthcare costs associated with these diseases are substantial, reaching nearly 14 billion dollars in 2023 with an annual increase of 2 billion US dollars, indicating an unsustainable trend. Cardio-renal-metabolic diseases contribute significantly to this economic burden. Comparative studies from other countries highlight similar trends globally. AFE offers a precise risk estimation, but the financial impacts remain considerable. The study underscores the need for preventive and management measures, including gender-specific interventions, to address this issue comprehensively. It advocates for promoting healthy habits, nutritional education, physical activity, and access to quality healthcare. Addressing these challenges is crucial not only for public health but also for the country's economic stability.

CONCLUSION

Cardio-renal-metabolic diseases dominate the cost burden, emphasizing the need for comprehensive strategies to mitigate the economic impact of obesity. This study underscores the inextricable link between public and financial health and the unsustainable consequences of inaction.

Table 2. Healthcare costs per patient for each of the 27 diseases caused by overweight and obesity, adjusted for new and prevalent cases, Mexico, 2023.

Disease	Cost of each new case in the first year (USD)	Annual cost per prevalent case (USD)	Ref.
Esophageal cancer	$ 6,019	$ 903	[63]
Colon and rectal cancer	$ 8,987	$ 1,348	[64]
Gallbladder and bile duct cancer	$ 5,666	$ 850	[65]
Pancreatic cancer	$ 16,921	$ 2,538	[66,67]
Breast cancer	$ 17,134	$ 2,570	[68]
Uterine cancer	$ 3,751	$ 563	[69]
Ovarian cancer	$ 4,213	$ 632	[70]
Kidney cancer	$ 19,704	$ 2,956	[71]
Thyroid cancer	$ 2,632	$ 395	[72]
Leukemias	$ 16,755	$ 2,513	[73]
Endometrial cancer	$ 4,268	$ 640	[74]
Hepatocellular carcinoma	$ 4,695	$ 704	[75]
Meningioma	$ 8,162	$ 1,224	[76-78]
Prostate cancer	$ 1,031	$ 233	[79]
Stroke	$ 6,318	$ 948	[80]
Ischemic Heart Disease	$ 8,345	$ 1,252	[81,82]
High blood pressure	N.A.	$ 462	[82]
Type 2 diabetes mellitus	N.A.	$ 693	[83]
Chronic Kidney Disease (CKD)	N.A.	$ 388	[84]
CKD / Renal Replacement Therapy	N.A.	$ 21,802	[84]
Kidney transplant	$ 30,104	$ 17,912	[85]
Heart failure	$ 233	$ 35	[86]
Low back pain	N.A.	$ 1,047	[87]
Obstructive Sleep Apnea	$ 1,207	$ 181	[88]
Dementia	N.A.	$ 4,188	[21]
Cholelithiasis	$ 1,276	N.A.	[89]

Table 3. Annual healthcare costs for the total of new yearly cases and prevalent cases of each of the 27 diseases caused by overweight and obesity, Mexico, 2023.

Disease	Total cost of new cases in the first year (USD)	Total annual cost of prevalent cases (USD)	Total
Esophageal cancer	$ 1’893,796	$ 295,298	$ 2’189,093
Colon and rectal cancer	$ 10’562,069	$ 3’951,201	$ 14’513,271
Gallbladder and bile duct cancer	$ 910,151	$ 235,541	$ 1’145,692
Pancreatic cancer	$ 5’766,400	$ 696,481	$ 6’462,880
Breast cancer	$ 39’198,197	$ 45’272,405	$ 84’470,602
Uterine cancer	$ 6’030,324	$ 2’739,157	$ 8’769,481
Ovarian cancer	$ 908,980	$ 371,663	$ 1’280,643
Kidney cancer	$ 20’259,864	$ 8´019´312	$ 28’279,177
Thyroid cancer	$ 2’288,307	$ 1’111,385	$ 3’550,111
Leukemias	$ 8’446,995	$ 3’882,663	$ 12’329,658
Endometrial cancer	$ 15’468,989	$ 6’152,094	$ 21’621,083
Hepatocellular carcinoma	$ 6’139,733	$ 978,527	$ 7’118,260
Meningioma	$ 4’607,362	$ 1’908,375	$ 6’515,736
Prostate cancer	$ 12’282,116	$ 6’246,502	$ 18’528,619
Stroke	$ 154’073,641	$ 273’016,370	$ 427’090,011
Ischemic Heart Disease	$ 465’421,308	$ 613’671,430	$ 1’079,092,738
High blood pressure	$ 161’631,445	$ 2’426,104,487	$ 2’577,735,932
Type 2 diabetes mellitus	$ 141’261,545	$ 3’470,840,129	$ 3’612,101,674
Chronic Kidney Disease (CKD)	$ 32’212,081	$ 980´861,099	$ 1’013,073,180
CKD / Renal Replacement Therapy	$ 273’017’625	$ 1’141,781,802	$ 1’414,781,802
Kidney transplant	$ 25’166,591	$ 435’450,393	$ 460’616,984
Heart failure	$ 12’638,851	$ 10’342,380	$ 22’981,231
Low back pain	N.A.	$ 1’222,194,278	$ 1’222,194,278
Obstructive Sleep Apnea	$ 7’833,357	$ 992’218,206	$ 1’000,051,563
Dementia	N.A.	$ 277’699,152	$ 277’699,152
Cholelithiasis	$ 614’957,409	N.A.	$ 614’957,409
Total	**$ 2’012,977,136**	**$ 11’926,190,749**	**$ 13’939,167,885**

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