Burden of Obesity: 10-Year Review of the Literature on Costs in Nine Countries

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Introduction

Obesity has a substantial economic impact because of its high prevalence and association with multiple chronic diseases, including type 2 diabetes, cardiovascular disease, dyslipidemia, hypertension, sleep apnea[1-4] and cancers of the breast, endometrium, colon, esophagus, and kidney[5], as well as nonalcoholic fatty liver disease.[6] The negative impact of obesity on health is reflected in substantially increased health care resource utilization and costs. This literature review was undertaken to determine the costs associated with obesity both at the aggregate level for each country considered and the per capita level, where available. Also of interest was the impact of increasing degrees of obesity on costs. This literature review includes data from nine countries: Australia, Canada, France, Germany, Italy, Spain, Sweden, the United Kingdom (UK), and the Unites States (US).

Methods

We searched articles indexed in MEDLINE and published in English, French, German, Italian, Spanish, and Swedish between 1997 and June 2007 to identify data on costs associated with obesity. The Medical Subject Heading (MeSH) terms "obesity" and "obesity, morbid" were combined with those for "costs and cost analysis," "economics, pharmaceutical," "economics, medical," "economics, hospital," and "work disability." The MEDLINE search returned 201 results, and 79 articles were selected for full-text review. EMBASE, International Pharmaceutical Abstracts (IPA), and Current Contents Connect (CCC) databases also were searched with similar keywords and limits; 16 additional unique articles were located, and 6 were chosen for full-text review. In addition, supplemental searches of data published on the Internet by the World Health Organization (WHO) and governmental agencies were conducted, and seven sources were selected for further consideration. For all search results, costs related to behavioral or lifestyle interventions for obesity were excluded. Of the 92 cost-related full-text documents reviewed, 34 studies or reports presented national or regional data in one or more countries of interest, and information from these sources is presented here.

The cost data are summarized and grouped by study methodology. To aid in cross-country comparability, costs are standardized to year 2007 US dollars using purchasing power parity (PPP) exchange rates. PPP rates are currency conversion rates that eliminate the relative price differences among countries for goods or services that are equivalent in satisfaction or utility. Converting all health care costs to a uniform, price-adjusted currency allows comparison of the volume of health care purchased in the different countries (without adjusting for population size differences among the countries). Each country's reported cost was converted to 2007 US dollars by first inflating the reported cost in its original currency to 2007 values using the Consumer Price Index (CPI). The 2007 value was then divided by the 2007 PPP rate for that country to derive the value in 2007 US dollars.

Results

Definition of Obesity

An international panel of experts convened by WHO concluded that body mass index (BMI) (BMI = kg/m^2) is the most useful population measure of obesity.[7] A BMI ≥ 30 kg/m^2 is the most widely accepted criteria defining obesity in the prevalence studies reviewed, and that is the obesity definition for the studies presented unless otherwise noted.

Aggregate National Direct Costs

Among the 29 studies identified describing direct costs, 15 sources present estimates of the total national direct cost of obesity for populations in Australia, Canada, France, Germany, Spain, Sweden, the UK, and the US, with data collection ranging from 1992 to 2005 (Table 1). National cost estimates are those calculated from the point of view of national health services or those based on an extrapolation of costs to a nation's obese population. Ten of the 15 studies report the proportion of national health care expenditures attributable to obesity, ranging from 5.3% to 7.0% for the US and from 0.7% to 2.6% for the other countries.

Of the 15 studies providing an estimate of the national direct costs of obesity, 9 studies calculated the cost of obesity-related diseases using an etiologic fraction approach.[8-16] Obesity increases the relative risk of certain diseases (e.g., type 2 diabetes, cardiovascular disease, hypertension). The etiologic fraction is the portion of cases of a specific disease that is directly attributable to obesity. Summing the obesity-attributable costs of all diseases associated with obesity gives the overall cost of obesity. The number of disease states considered in these studies varied from 4 to 15; conservative estimates use fewer disease states. The obesity-related diseases most frequently included in the etiologic fraction studies include type 2 diabetes, cardiovascular disease (including coronary artery disease and stroke), hypercholesterolemia, hypertension, and certain cancers (including postmenopausal breast cancer, endometrial cancer, and colon cancer).

Five of the 15 studies providing an estimate of national direct costs used costs incurred by obese individuals based on national health care provider data[17] or extrapolated from or modeled on nationally representative sample data.[18-21] One of the 15 studies was based on a systematic literature review.[22]

Table 1. National Annual Direct Costs of Obesity

Country/ Reference	Methodology	Data Source	Proportion of National Direct Health Care Costs	Cost in Local Currency (Year Collected)	Cost Adjusted to 2007 USD[a]
Australia[8]	Etiologic fraction, 7 diseases[b]	National health services data	NR	A$873.0 million (2005)	$642.0 million
Canada[9]	Etiologic fraction, 8 diseases[b]	Governmental report data (Economic Burden of Illness in Canada)	2.2%	Can$1.6 billion (2001)	$1.5 billion
Canada[10]	Etiologic fraction, 10 diseases[b] Obese: BMI ≥ 27	National Health Expenditure Database and the Canadian Institute of Health Information	2.4%	Can$1.8 billion (1997)	$1.8 billion
France[11]	Etiologic fraction, 15 diseases[b] Obese: BMI ≥ 27	1991-1992 National Household Survey	2.0%	F5.8 billion (1992)	$8.1 billion
France[18]	Self-reported, medical chart-verified costs extrapolated to national level	1991-1992 National Household Survey subgroup of obese persons (n = 21,586)	0.7% to 1.5%	F4.2 billion to F8.7 billion (1992), based on estimation algorithm	$5.9 billion to $12.2 billion
Germany[12]	Etiologic fraction, 4 diseases[b]	German Federal Department of Health cost estimates	NR	€2.0 billion (2001)	$2.6 billion
Spain[13]	Etiologic fraction, 4 diseases[b]	Data from Spanish Society for the Study of Obesity	1.7%	€620.4 million (2002)	$951.6 million
Sweden[22]	Systematic literature review	Not specified	1.0% to 2.0%	Sk1.5 billion to 3.0 billion (2002)	$173.6 million to $347.3 million
UK[17]	Not specified	National Health Service data	2.3% to 2.6%	£991.0 million to £1.124 billion (2002)	$1.7 billion to $1.9 billion
US[19]	Econometric model	MEPS data; N = 10,128 adults BRFSS data; N = 398,446 adults Based on sampling from the 1996 and 1997 NHIS	5.7%	US$75.0 billion (2003)	$85.0 billion
US[20]	4-equation regression model	1998 MEPS 1996 and 1997 NHIS	5.3%	US$26.8 billion (1998) (based on MEPS data)	$34.1 billion
	Secondary estimate	National Health Accounts data (has nursing home expenditures)	NR	US$47.5 billion (1998)	$60.4 billion
US[21]	National cost of illness analysis	2000 MEPS; N = 16,262 adults	NR	US$38.8 billion (2000)	$46.7 billion
US[16]	Etiologic fraction, 8 diseases[b] Obese: BMI ≥ 29	1988 NHIS, N = 88,262 1994 NHIS, N = 80,261	5.7%	US$51.6 billion (1995)	$70.3 billion
US[15]	Etiologic fraction, 8 diseases[b]	Not specified	7.0%	US$70.0 billion (1995)	$87.0 billion
US[14]	Etiologic fraction, 15 diseases[b] (15 obesity-related diseases)	NHIS 1995 and NHANES III for comorbid prevalence rates	NR	US$102.2 billion (1999)	$127.5 billion

BRFSS = Behavioral Risk Factor Surveillance System; MEPS = Medical Expenditure Panel Survey; NHANES = National Health and Nutrition Examination Survey; NHIS = National Health Interview Survey; NR = not reported.

[a]Originally published costs were updated to 2007 costs using the ratio of CPIs from 2007 over the published cost year. CPIs were from the Organisation for Economic Co-operation and Development.[23] Inflated 2007 costs were converted to 2007 US dollars using the PPP (http://stats.oecd.org/wbos/default.aspx?querytype=view&queryname=221) for each country relative to the US.

[b]The population-attributable risk percent (or etiologic fraction or population-attributable fraction) of a comorbidity due to obesity was calculated from the incidence of the comorbidity in obese persons and the incidence in persons with normal BMI (< 25). The formula is P(RR-1)/[P(RR-1) + 1], where P is the probability of a person in a given population being obese, and RR is the relative risk for the comorbidity in an obese subject.

Retrospective Analyses of Direct Costs by BMI Category

Of the 29 studies describing direct costs, 8 were retrospective database analyses or medical record reviews designed to estimate the impact of BMI category on direct costs.[24-31] Only one of these studies, the Swedish study by Borg and colleagues,[24] was not based on US data; it found that 2.3% of Sweden's total hospital care costs, Sk2.155 billion per year, were excess hospitalization costs of overweight and obese individuals (97% due to obesity).

Several of these studies compare costs for normal-weight individuals with those of obese individuals and show that direct costs are significantly greater for obese patients, and higher BMI levels are associated with higher costs:

- One US study reported higher resource use with increasing BMI, specifically, increased hospital inpatient days, number of outpatient visits, outpatient pharmacy costs, and laboratory services ($P < 0.001$).[26]
- Mean annual costs of health care were 25% higher for moderately overweight individuals and 44% higher for severely overweight individuals compared to normal-weight individuals.[26]
- Another US study reported significantly more hospitalizations, outpatient visits, professional service claims, and prescription drug use for obese persons (BMI ≥ 27.9) versus nonobese persons (BMI = 18.5-24.9) ($P < 0.001$); for each unit BMI increase, costs increased 2.3% ($P < 0.001$).[27]
- Thorpe and colleagues[30] used 1987 and 2001 MEPS data and estimated that obesity accounted for 27% of the increase in health care expenditures from 1987 to 2001 in the US.

Five of the eight database analyses provide per capita obesity-related costs or rate ratios by BMI category (Table 2).[25, 27, 28, 29, 31]

Table 2. Direct Costs of Obesity – Retrospective Database Analysis Studies Reporting Annual per Capita Costs by BMI Category

				Obese BMI ≥ 30		
Reference	Sample Population	Normal Weight BMI 18.5-24.9	Overweight BMI 25-29.9	Obese, Class I BMI 30-34.9	Obese, Class 2 BMI 35-39.9	Obese, Class 3 BMI ≥ 40
Finkelstein et al., 2005[25,a]	2000 and 2001 MEPS, N = 20,329 adults aged 18-64	Men: $1,351 Women: $1,956	Men: $1,520 Women: $2,451	Men: $1,743 Women: $3,027	Men: $1,920 Women: $3,505	Men: $2,942 Women: $3,315
Wang et al., 2003[31,b]	Health care plan database from a large manufacturing corporation, N = 177,971 adults aged 19 to < 75	$2,225	$2,388	$2,801	$3,182	$3,753
Wee et al., 2005[28,c]	1998 MEPS, N = 11,212 adults aged ≥ 18	$728	$744	$1,092	$1,072	$1,422
Thompson et al., 2001[29,d]	Managed care population, N = 1,286 adults aged 35-64	$1,631 (BMI = 20-24.9)	$1,794	$2,218		
Raebel et al., 2004[27,e]	Managed care population, N = 1,764 adults aged 21-84	$333.24	NR	$585.44 (BMI ≥ 27.9; mean BMI = 37.9)		

NR = not reported

[a] Annual health care expenditure for full-time employees aged 18-64 (2004 US$); versus normal-weight expenditures, differences (except overweight men) statistically significant ($P < 0.05$); [b] Annual median health care expenditure (including drug costs); difference between any two BMI category groups is statistically significant ($P < 0.01$); year value of costs not specified; [c]Unadjusted annual median health care expenditure (2003 US$); [d]Mean annual cost for all medical care (1998 US$). [e]$P < 0.001$ versus normal-weight costs.

Survey Analyses of Direct Costs by BMI Category

Of the 29 direct cost studies, 6 studies analyzed cost data collected by survey and correlated with BMI category.

Two US studies described increased total medical costs for obese persons compared with persons of normal weight:

- Andreyeva and colleagues[32] found that total medical costs increased as the degree of obesity increased, with extremely obese (BMI ≥ 40) persons having double the total medical costs of normal-weight persons.
- Sturm[33] found that obesity increases health care costs by 36% and medication costs by 77% compared with being in a normal-weight range.

Two German studies based on the same cross-sectional survey data (Cooperative Health Research in the Region of Augsburg [KORA] Survey 1999/2001) found the following:

- Average total medical costs and prescription drug costs were significantly higher for severely obese people (BMI ≥ 35) compared with normal-weight people (BMI 18.5-24.9).[34]
- Severely obese people are more likely to visit a general practitioner and have longer hospital stays than normal-weight people.[35]

An Italian study and a Swedish study focused on the effects of obesity and obesity-related disease on prescription drug costs.

- Both studies found higher prescription drug costs for obese persons than for the normal-weight reference groups.[36, 37]
- The Italian survey found that the mean number of prescriptions was significantly higher among obese individuals than normal-weight individuals.[36]
- The Swedish study found that, compared with the general population, obese persons had higher use of prescription drugs for diabetes, cardiovascular disease, and asthma, as well as nonsteroidal anti-inflammatory drugs.[37]

Indirect Costs

Absenteeism, disability, and lost productivity due to premature death were the most common measures of the indirect costs of obesity. Data on indirect costs were more limited than direct cost data; no studies involving indirect cost data collected since 1995 were found for France, Italy, or Spain. Aggregate indirect costs, with conversion to 2007 US dollars, for the other countries considered in this literature review are shown in Table 3.

Table 3. National Annual Indirect Costs of Obesity

Country	Cost in Local Currency (Year Collected)	Cost Adjusted to 2007 US$
Australia[8]	A$2.9 billion (2005)	$2.1 billion
Canada[9]	Can$2.7 billion (2001)	$2.5 billion
Germany[12]	€2.2 billion (2001)	$2.8 billion
UK[17]	£2.4 billion-£2.70 billion (2002)	$3.9 billion-$4.5 billion
US[16]	US$47.6 billion (1995)	$64.7 billion

Limitations

This review includes only country-specific economic information published in the literature and indexed in MEDLINE, EMBASE, IPA, or CCC, or available on the Internet. Native speakers conducted searches of studies or data published in French, German, Italian, Spanish, and Swedish; these non-English searches were not exhaustive but did represent information from key disease and regulatory authorities.

Conclusion

Obesity has a substantial economic impact because of its high prevalence and association with multiple chronic diseases, increased levels of disability and absenteeism, and premature mortality. The total cost of obesity and its negative health consequences has been estimated at 0.7% to 7.0% of national health expenditures worldwide. In this review of cost data from nine countries, no studies presenting direct or indirect cost estimates collected since 1995 were identified for France, Italy, or Spain. The lack of recent direct or indirect cost estimates in several countries highlights the need for further work to describe the economic burden of obesity.

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Please refer to poster handout.

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