

Economic Burden of Childhood Overweight and Obesity: A Systematic Review and Meta-Analysis

^aJiying Ling, PhD, MS, RN, FAAN; Sisi Chen, PhD, PAPHS; Nagwan R. Zahry, PhD; & Tsui-Sui Annie Kao, PhD, FNP-BC, FAANP

^a1355 Bogue St., C241, East Lansing, Michigan, US 48824; Phone: 517-353-8591; Email: lingjiyi@msu.edu

Supplemental Table 1 Summary Table (N=48)

Author, Year	Country	Data (year), Time Frame	Child Characteristics	Child Groups	Costs Included Items	Main Results on Healthcare Costs
Au et al., 2012	Australia	Longitudinal Study of Australian Children (LSAC; 2004, 2006, 2008) Over 5 years	N=4335 Age: 4-5 years 51.75% male	Non-overweight (3445) vs. overweight (890)	Non-hospital medical care and prescribed medication costs	Overall healthcare cost difference: AUD\$121.35±32.41, 12.92%±3.59% Medical care cost difference: \$86.57±31.27, 10%±3.69% Medication cost difference: \$34.78±8.81, 58.84%±15.47% (In AUD \$, value of 2008)
Batscheider et al., 2014	Germany	GINIplus (1995-1998) and LISApplus (1997-1999), 10-yr follow-up Annual	N=3635 Age: M=10.1 years 51.3% male	Normal BMI-z growth class 1 (1556) vs. rapid BMI-z growth class 2 (2022) vs. persistent rapid BMI-z growth class 3 (57)	Physician visits, (physical) therapies, number of hospital and inpatient rehabilitation days	Overall direct medical costs: class 1: €362 (95% CI: 314-420, SD=1067); class 2: 363 (95% CI: 316-417, SD=1159); class 3: 722 (95% CI: 420-1070, SD=1252) (In Euros €, values of 2007)
Bettenhausen et al., 2015	United States	Pediatric Health Information System (PHIS) administrative Database (October 2011-September 2012) Per hospitalization	N=518 hospitalized asthma patients Age: median=8 (IQR=6-11) 59.7% male; 11.4% Hispanic; 23.9% White; 56.9% Black	Healthy weight (310) vs. overweight (88) vs. obesity (102)	Adjusted billed charges; length of stay	Adjusted bills charges: healthy weight: median \$6876 (IQR5237–9390) [7167.7±3076.3]; overweight: 7056 (5409–9061) [7175.3±2705.2]; obesity: 7198 (5331–9306) [7278.3±2944.4] Length of stay (hour): healthy weight: 26 (18–41) [28.67±17.78]; overweight: 26 (19.25–40) [28.42±15.37]; obesity: 31 (19–42) [30.67±17.04] (In US \$, values of 2012)
Biener et al., 2020	United States	Medical Expenditure Panel Survey (2001-2015) Annual	N=40,613 Age: 11-17 years 50.2% male	Healthy weight vs. obesity	Total medical expenditures including costs on inpatient care, outpatient visits, prescription drugs, and expenditures by payer type	Annual medical costs per person: \$1035.89±3884.77 vs. 1943.27±3884.77 Total direct costs for 11-17 years-old from 2011-2015: averaged \$7.71 billion per year, \$9.85 billion in 2015, up from \$5.41 billion in 2001 (In US \$, values of 2015)
Black et al., 2018	Australia	Longitudinal Study of Australian Children (2004-2012)	N=10804 Age: 6-13 years	Healthy weight vs. overweight	Non-hospital total Medicare costs	Total annual Medicare costs per child: healthy weight: AUD\$237.8±4.43SE; overweight: \$267.1±9.37SE; obesity: \$298.7±20.37SE

		12 months after height/weight measurement		Healthy weight vs. obesity		Pharmaceutical costs: healthy weight: \$19.64±2.105SE; overweight: \$30.76±7.406SE; obesity: \$39±16.203SE Total annual medical costs: \$43 million (In AUD \$, values in 2015)
Booth et al., 2009	Australia	Random sample Feb-May 2004 Annual	N=496 Age: 15-19 years, M=15.3 58.5% male	Healthy weight vs. overweight/obesity	Full-service charges and Medicare expenditures for specialist medical and dietary consultations, pathology tests and radiological investigations	Overweight/obesity vs. healthy weight: 48% increase
Breitfelder et al., 2011	Germany	German Infant Nutritional Intervention study (GINI-plus, September 1995 to July 1998); Influence of life-style factors on the development of the immune system and allergies in East and West Germany study (LISA-plus, November 1997 to January 1999) Last 12 months	N=3508 for direct medical costs N=2667 for indirect costs caused by parental work absence Age: M=10.2 years 51.3% male	Healthy weight (3930) vs. overweight (302) Healthy weight vs. obesity (96)	Direct medical costs (physician visits, physical therapies, hospital stays, inpatient rehabilitation) Indirect costs (parental work absence)	Total direct medical costs: healthy weight: €402±3022.54 (95% CI: 321-510); overweight: €468±1436.36 (95% CI: 317-641); obesity: €680±1329.72 (95% CI: 443-975) Total indirect costs due to parental work absence: healthy weight: €100 (95%CI: 90-110); overweight: €85 (95%CI: 58-117); obesity: €118 (95%CI: 59-187) (In Euros €, values of 2007)
Buescher et al., 2008	United States	North Carolina public health records linked to 2004 North Carolina Medicaid enrollment records Annual	N=3528 Age: 12-18 years, 47.7% male; 43.3% White; 52.4% Black	Healthy weight (1841) vs. at risk for overweight (619) vs. overweight (1019)	Average total Medicaid expenditure per child that includes hospital costs, physician costs, and prescription drug costs	Average Medicaid expenditures per child: healthy weight: \$3604; at risk for overweight: \$4791 (p=.08); overweight: \$4491 (p=.13) Average prescription drug expenditures per child: healthy weight: \$340; at risk for overweight: \$426 (p=.10); overweight: \$483 (p=.01) (In US \$, values in 2004)
Clifford et al., 2015	Australian	Waves 1–4 of the Longitudinal Study of Australian Children	Baby cohort: N=5107 0–1-year-old; 4606 (90%, 0-1 yr-old), 4386 (86%, 2-3 yr-old)	Healthy weight vs. overweight vs. obesity	Non-hospital healthcare (Medicare) costs that include healthcare services/attendances	Total healthcare costs per child [baby cohort]: healthy weight: AUD\$1006±1208, 557±904, 563±823 (n=2835); overweight: 995±2838, 607±1356, 641±2025 (n=728); obesity: 918±3382, 652±3616; 750±3607 (n=244)

		Over 2 years	and 4242 (82%, 4-5 yr-old) Age: M=0.7 51.6% male Kindergarten cohort: N=4983 4-5 year-old 4464 (90%, 4-5 yr-old), 4331 (87%, 6-7 yr-old) and 4164 (84%, 8-9 yr-old) Age: M=4.8 51.6% male		and prescription medications	Total healthcare costs per child [kindergarten cohort]: healthy weight: 470±670, 424±637, 459±751 (n=2778); overweight: 516±1205, 478±1464, 524±1815 (n=706); obesity: 576±3080, 549±4583; 541±3005 (n=283) (In AUD \$, values in 2011)
Estabrooks et al, 2007	United States	Kaiser Permanente Colorado child members with BMI measurements (KPCA, 2000-2004) Annual	N=11,636 members (8455 healthy weight, 1641 overweight, and 1540 obese) Age: 3-17 years 52.3% male M=10.14	Healthy weight (8455) vs. overweight (3181)	Direct and indirect costs for primary care sick visits and mental health visits	Additional annual costs for overweight vs. healthy weight: \$42.148/child±340.01 (95% CI: 20.992, 63.140) for primary sick visits and \$31.866/child±497.72 (95% CI: 5.424, 67.122) for mental health visits Annual costs for healthy weight (median): \$164/child for primary sick visits and \$339/child for mental health visits (In US \$, values in 2004)
Finkelstein et al, 2008	United States	Medical Expenditure Panel Survey (MEPS, 2001-2003) Annual	N=20,231 Age: 8-19 years	Healthy weight (11350) vs. overweight (2832) vs. obesity (2812)	Annual per-child medical costs	Additional annual costs for overweight vs. healthy weight per child: \$180±89.29 (95% CI: \$30-\$380) Additional annual costs for obese vs. healthy weight: \$220±107.14 (95% CI: \$30-\$450) (In US \$, values of 2006)
Hampl et al, 2007	United States	Sample of patients who had at least 1 well childcare visit at the primary care center (2002-2003) Annual	N=8,404 Age: 5-18 years 49.2% male; 61.2% Black; 11.9% Hispanic	Healthy weight (5063) vs. overweight (1493) vs. diagnosed obesity (793) vs. undiagnosed obesity (1055)	Health care charges: primary care visits; emergency department, inpatient, outpatient primary care, same day surgery, and observation unit stays; and laboratory use on the basis of blood tests ordered	Mean health care charges: healthy weight: \$445±450; overweight: \$473±461; diagnosed obesity: \$617±533; undiagnosed obesity: \$481±439 (In US \$, values in 2003)
Hayes et al, 2016	Australia	Healthy Beginnings Trial (HBT); Medicare	N=350 Age: 2-5 years 52% male	Healthy weight (215) vs.	Healthcare costs: hospital, nonhospital, emergency, and	Healthcare costs per child: healthy weight: AUD\$838.67±847.67; overweight: \$869.67±1028.33; obesity: \$1374.67±\$1539.33

		Benefits Scheme (MBS); Pharmaceutical Benefits Scheme (PBS); New South Wales (NSW) Admitted Patient Data Collection and NSW Emergency Department Data Collection Annual		overweight (103) vs. obesity (31)	medicine use	Healthcare costs of children with obesity were 1.62 (95% CI: 1.12-2.36) times that of children with a healthy weight Medicine costs per child: healthy weight: \$30±45.33; overweight: \$27.67±40; obesity: \$46.33±44.67 (In AUD \$, values in 2014)
Janicke et al, 2009	United States	State of Florida Agency for Health Care Administration Medicaid database, (2001-2005) Over 4 years	N=13,688 Age: 5-18 years, M=10.5±3.0 48% male; 25.4% Black; 33.8% Hispanic; 28.7% White	Obesity/morbidly obesity (2354) vs. non-obesity (11334)	Total medical expenditures of nonpsychiatric health services: outpatient visits, emergency department visits, pharmacy claims, inpatient length of stay	Total expenditures for obesity/morbidity obesity: B=0.059 (95% CI: 0.003-0.114) Outpatient expenditures for obesity/morbidity obesity: B=0.235 (95% CI: 0.153-0.318) Inpatient expenditures: B=-0.002 (95% CI: -0.148-0.144) Pharmacy expenditures: B=-0.171 (95% CI: -0.274-0.068) (In US \$, values of 2005)
Janicke et al, 2010	United States	Medicaid claims data (before March-December 2007) Annual	N=200 Age: 7-15 years, M=11.24±0.17 52.5% male; 65% Black; 6% Hispanic; 25% White	Healthy weight (87) vs. overweight (68) vs. obesity (45)	Outpatient and medical/physician expenditures, pharmacy expenditures, and acute care expenditures	Mean outpatient and medical/physician expenditures: healthy weight: \$1170±1137.94; overweight: \$1069±1162.72; obesity: \$1647±1724.01 Mean acute care expenditures: healthy weight: \$126±121.26; overweight: \$122±115.45; obesity: \$200±194.54 Mean pharmacy expenditures: healthy weight: \$1212±2639.65; overweight: \$904±1591.52; obesity: \$1047±2374.70 (In US \$, values of 2007)
Janssen et al, 2009	Canada	Canadian Community Health Survey Data Set (CCHS, 2000-2001); Ontario Health Insurance Plan (OHIP, 2002-2003) Over 2 years	N=2440 Age: 12-17 years 50.9% male	Healthy weight (1945) vs. overweight/obesity (495)	Direct physician costs	Mean physician costs per year: healthy weight: \$233±787.54 (95% CI: 194-264); overweight/obesity: \$233±442.70 (95% CI: 196-274) (In Euros \$, values of 2002-2003)

Jerrell et al, 2009	United States	Claims data for South Carolina's Medicaid Program (January 1995-December 2004) Annual	N=6438 Age: 0-17 years, M=10.94 46% male; 74% Black	Healthy weight (552) vs. obesity (2943)	Total costs of outpatient visits, emergency visits, inpatient days, and pharmacy claims	Total Medicaid health care costs: healthy weight: \$1524.2; obesity: \$2859.6 (In US \$, values of 2004)
Johnson et al., 2006	United States	Medical Expenditure Panel Survey (MEPS, 1998) Annual	N=4898 Age: 4-17 years M=10.58 51.1% male; 16.3% Black; 13.3%	Non-overweight (2620) vs. overweight/obesity (2278)	Health expenditures on prescription drug, in-patient and office visits	Medical expenditures per child: non-overweight: \$494.558±2096; overweight/obesity: 488.827±1976 (In US \$, values of 1998)
Kirk et al, 2012	Canada	Children's Lifestyle and School Performance Study (CLASS 2003); Administrative health datasets: Medical Services Insurance Database and Canadian Institute for Health Information Discharge Abstract Database Ontario Case Costing Initiative (2001-2006) Over 6 years	N=3361 Age: 10-11 years 48% male	Healthy weight (2252) vs. overweight (773) vs. obesity (336)	Health care utilization on infectious diseases, internalizing disorders, conduct disorder, other mental disorders, asthma, other respiratory disorders, injury, obesity, miscellaneous obesity-related disorders, otitis media, and chronic adenoid/ tonsil disorder	Physician costs for the selected conditions per person per visit: healthy weight: \$358.3; overweight: \$353.6; obesity: \$423.4 Physician costs for obesity per person per visit: healthy weight: 0; overweight: \$2.9; obesity: \$13.6 (In US \$, values of 2006)
Kompaniyets et al, 2020	United States	NIS (National Inpatient Sample Database; 2006-2016) Per hospitalization	N=~4.1 million Age: 2-19 years	Healthy weight vs. primary diagnosis obesity vs. secondary diagnosis obesity	Hospitalization length of stay, charges, and costs	Obesity as a primary diagnosis vs. healthy weight (mean per hospitalization): 1.8-day lower length of stay (healthy mean 3.8 days); \$20879 higher charges (healthy mean 29333); \$6049 higher costs (healthy mean 9192) Obesity as a secondary diagnosis vs. healthy weight (mean per hospitalization): 0.8-day higher length of stay; \$3453 higher charge; \$1359 higher costs (In US \$, values in 2016)
Kuhle et al, 2011	Canada	Children's Lifestyle and School	N=3,399 Age: 10-11 years 48% male	Healthy weight (2277) vs.	Total healthcare costs (physician and hospital costs), and	Total health care costs (2003-2006, median [25th, 75th percentile]): healthy weight: CDN\$275 (128, 598), 333.67±348.15;

		Performance Study (CLASS, 2003), linked to administrative health datasets (2003-2006) Over 3 years		overweight (782) vs. obesity (340)	lifetime (birth to age 14) physician costs	overweight: 298 (136, 600), 344.67±343.70; obesity: 356 (140, 721), 405.67±430.37 Lifetime physician costs (1992-2006): healthy weight: 2147 (1428, 3297); overweight: 2309 (1463, 3315); obesity: 2504 (1694, 3725) (In CDN \$, values of 2006)
Kuhle et al, 2012	Canada	Children's Lifestyle and School Performance Study (CLASS; 2003); Administrative health data sets (2003-2006) Per physician visit	N=3,399 Age: 10-13 years, M=11.1±0.4 48.1% male	Healthy weight (2264) vs. overweight (788) vs. obesity (347)	Physician visits and costs	Per capita physician visit costs (mean): healthy weight: CDN\$24; overweight: \$32; obesity: \$47 (In CDN \$, values of 2006)
Lightwood et al, 2009	United States	National Health and Nutrition Examination Survey (1971-1974, 1976-1980, 1988-1994, 1999-2000); Medical Expenditure Panel Survey (MEPS) Annual	N=162,000 adult population from 2020-2050 Age: 12-19 years; 35-64 years (2020-2050)	Healthy weight vs. obesity	Direct medical costs and indirect costs resulting from loss of productivity stemming from morbidity and premature mortality	Excess annual direct medical costs: \$130 million in 2020 to \$10 billion in 2050 Annual indirect costs of lost productivity: \$942 million in 2020 to \$36 billion in 2050 (In US \$, values of 2007)
Monheit et al, 2009	United States	Medical Expenditure Panel Survey (MEPS-HC; 2001-2003); National Health and Nutrition Examination Survey (NHANES) Annual	N=6,738 Age: 12-19 years, female M=15.39±2.24, male M=15.37±2.26 51.4% male; 14.6% Hispanic; 13.3% Black	Healthy weight (5781) vs. overweight (957) (separated by gender)	Health expenditures excluding specific health conditions that are associated with overweight	Annual health expenditure differences: females: \$790±315; males: no difference Mental health expenditure differences: females: \$208±91; males: no difference (In US \$, values of 2003)
Nafiu et al., 2008	United States	Electronic anesthesia record and the charges from billing data from a large tertiary institution	N=1643 children under Adenotonsillectomy Age: 3-18 years M=7.2±3.8	Healthy weight (1306) vs. overweight (215) vs. obesity (122)	Mean total hospital charges forwarded to the insurance payer, length of stay	Mean hospital charges per child: healthy weight: \$4023.9±2494.8; overweight: 4468.8±3400.9; obesity: 5031.9±2559.4 Length of stay (day): healthy weight: 0.25±0.64; overweight: 0.39±0.75; obesity: 0.63±0.83

		(January 2005 and June 2007)	55.3% male; 76% White; 11% Black; 5.6% Hispanic			(In US \$, values of 2007)
		Per hospitalization				
Okubo et al, 2016	United States	Kids' Inpatient Database (KID, 2012)	N=100,157 Age: 2-18 years, M=6.70±6.7 62% male; 21% Hispanic, 34.5% Black, 30% White	Non-obesity (96573) vs. obesity (3584)	Mean total charges and length of stay for inpatient services among patients with acute asthma exacerbations	Additional mean total charges for inpatient services among obese vs. nonobese children: \$3445±536.99 (95% CI: \$2471-\$4576, p<.001) Length of stay: 0.41±0.04 days (95% CI: 0.33-0.49, p<.001) (In US \$, values of 2012)
Okubo et al, 2017A	United States	Kids' Inpatient Database (KID, 2012)	N=51,918 Age: <18 years 86.9% male; 46% White; 13.5% Black; 25.9% Hispanic; 2.2% Asian; 12.4% other	Non-obesity (51918) vs. obesity (1488)	Total hospitalization costs and length of stay among patients with urinary tract infection	Hospitalization costs: non-obesity: \$6033±11980; obesity: \$7785±12763; 1.29 times greater cost (95% CI: 1.13-1.47) Total length of stay (day): non-obesity: 3.54±4.92; obesity: 4.57±6.93; 1.29 times greater cost (95% CI: 1.16-1.44) (In US \$, value of 2012)
Okubo et al, 2017B	Japan	Diagnosis Procedure Combination inpatient database (July 1, 2010 and March 31, 2015)	N=38,679 Age: 3-8 years, M=6.53±0.03 59% male	Healthy weight (28904) vs. overweight (3334) vs. obesity (3264)	Total hospitalization costs and length of stay among patients with acute asthma exacerbations	Total costs: healthy weight: 29320; overweight: 29751 (difference 431±572.19); obesity: 30121 (difference 802±602.55) Total length of stay (day): healthy weight: 5.21; overweight: 5.13 (difference -0.08±0.04); obesity: 5.30 (difference 0.09±0.03) (In Japanese yen, values of 2015)
Okubo et al, 2018A	Japan	Diagnosis Procedure Combination inpatient database (DPC; July 1, 2010 to March 31, 2015)	N=27,771 Age: 3-8 years, M=5.13±0.30 57.2% male	Healthy weight (19701) vs. overweight (2675) vs. obesity (2785)	Total hospitalization costs and total length of stay among patients with influenza-related respiratory infections	Total costs in US \$ (mean): healthy weight: \$276; overweight: \$262 (difference -13.7±5.10); obesity: \$267 (difference -8.4±5.18) Total length of stay (day): healthy weight: 4.32; overweight: 4.28 (difference -0.04±0.05); obesity: 4.32 (difference -0.01±0.05) (In US \$, 100 Japanese yen per US \$ in 2015)
Okubo et al, 2018B	Japan	Diagnosis Procedure Combination inpatient database (DPC, July 1, 2010 to March 31, 2015)	N=42,698 Age: 3-8 years, M=5.16±0.06 56.2% male	Healthy weight (35849) vs. overweight/obesity (3152)	Total hospital costs and length of stay among patients with diagnoses of bronchitis/pneumonia and RSV infection	Total costs (mean): healthy weight: 16983; overweight/obesity: 17145 (difference 162±159.95) Total length of stay (day): healthy weight: 5.84; overweight/obesity: 5.80 (difference -0.04±0.04) (In Japanese yen, values of 2015)
Okubo et al, 2018C	United States	Kids Inpatient Database (KID;	N=133,602 Age: 2-20 years, M=5.64±0.05	Non-obesity (132092) vs. obesity (1510)	Total healthcare costs and length of stay among patients with	Total healthcare costs (mean): non-obesity: \$3433; obesity: \$3653; crude difference: \$1231±112.76 (95% CI: 1016, 1458)

		2003, 2006, 2009, and 2012) Per hospitalization	54% male; 40.6% White; 12.1% Black; 21.5% Hispanic; 1.7% Asian; 24.2% other		pneumonia and bronchitis	Total length of stay (day): non-obesity: 2.53; obesity: 2.65; crude difference: 0.51±0.06 (95% CI: 0.39, 0.63) (In US \$, values of 2012)
Ramsey et al, 2020	United States	Pediatric admissions at Kapi'olani Medical Center for Women and Children (KMCWC; May 1, 2009- January 31, 2012) Per hospitalization	N=730 eligible Age: 2-18 years 57% male; 15% Asian, 13% Filipino; 22% Hawaiian; 9% other Pacific Islander; 11% Samoan; 12% White	Healthy weight (432) vs. overweight (90) vs. obesity (130)	Hospital costs among pediatric patients	Additional hospital costs compared to healthy weight: overweight: -0.4% (95% CI: -14-13%); obesity: 19% (95% CI: 7-31%, difference \$1015±446.68 (95% CI: \$144-1895) (In US \$, values of 2012)
Sonntag et al, 2016	Germany	German Interview and Examination Survey for Children (KiGGS); Microcensus data from German Federal Statistical Office (2009) Over lifespan	N=14,747 Age: 0-17 years	Healthy weight vs. obesity	Lifetime excess costs as difference between 1) the expected lifetime indirect costs for children with overweight/obesity and 2) the same costs for children with normal weight	Excess lifetime costs for obese vs. non-obese females: €6441 (range: 2489-12253) Excess lifetime costs for obese vs. non-obese males: €11557 (range: 4011-23660) (In Euros €, values of 2010)
Thavamani et al, 2020	United States	Healthcare Cost and utilization Project Kids Inpatient Database (HCUP-KID; 2003-2016) Per hospitalization	N=36,698 Age: 0-20 years, M=15.17±4.73 41% male; 44.2% Caucasian; 10.2% Black; 22.4% Hispanic; 23.2% other	Morbid obesity (1273) vs. without morbid obesity (35425)	Healthcare resource utilization including total hospital costs and length of stay among patients with acute pancreatitis	Total hospital costs: without morbid obesity: \$9983±21268; with morbid obesity: \$12194±19603; difference: \$1596±631.38 (95% CI: 359-2834) Total length of stay (day): without morbid obesity: 5.01±5.65; with morbid obesity: 5.54±6.07; difference: 0.41±0.19 (95% CI: 0.04-0.79) (In US \$, values of 2016)
Trasande et al, 2009A	United States	Medical Expenditure Panel Survey (MEPS; 2002-2005) Over 2 years	N=19,613 Age: 6-19 years 51.28% male; 17.93% Hispanic; 15.09% Black; 3.76% Asian; 63.20% others including whites	Healthy weight (10835) vs. overweight (4083) vs. obesity (4695)	Expenditures of outpatient visit, prescription drug, and emergency room	Additional expenditures of obesity vs. healthy weight: outpatient visits: \$194±56.63 (97.5% CI: \$116-338; 32.2% higher); prescription drugs: \$114±37.76 (97.5% CI: \$34-182; 35% higher); emergency room: \$12±7.40 (97.5% CI: \$3-32; 9.6% higher) Additional expenditures of overweight vs. healthy weight: outpatient visits: \$79±34.69 (97.5% CI: \$27-163; 13.1% higher); prescription drugs: \$64±66.33 (97.5% CI: \$11-271; 19.5%

						higher); emergency room: \$25±34.44 (97.5% CI: \$13-148; 19.9% higher) (In US \$, values in 2005)
Trasande et al, 2009B	United States	Nationwide Inpatient Sample (NIS; 1999-2005) Per hospitalization	N=3.1 million Age: 2-19 years	Healthy weight vs. secondary diagnosis of obesity	Total costs and charges of hospitalizations, length of stay	Increase in costs of hospitalizations: difference \$727±153.06 (95%CI: 468, 1068) Length of stay: difference 0.85±0.06 (95% CI: 0.74, 0.97) (In US \$, values in 2005)
Trasande et al., 2010	United States	National Health and Nutrition Examination Survey (NHANES, 2003-2006); Nationwide Inpatient Sample (NIS, 2005); Medical Expenditure Panel Survey (MEPS, 2001-2005) Annual	N=1,332,063 Age: 12 years 51.2% male	Overweight vs. obesity	Direct medical expenditures (outpatient, prescription drugs, hospitalization)	Direct medical expenditures in childhood: overweight: male \$700.5 million, female \$667.3 million; obesity: male \$717.8 million, female \$683.8 million Direct medical expenditures in adulthood attributable to childhood obesity: overweight: male \$275.1 million, female \$349.5 million; obesity: male \$1.25 billion, female \$1.60 billion Total medical expenditures in childhood and adulthood: \$6.24 billion 1% obesity reduction save \$260.4 million in direct medical expenditures: \$86 million in childhood, and \$174.4 million in adulthood Medical expenditures per child: overweight: \$363; obesity: \$356 (In US \$, values in 2005)
Turer et al, 2013	United States	Medical Expenditure Panel Survey (MEPS, 2005-2009) Annual	N=17,224 Age: 10-17 years, M=14.21±0.04 48.25% male; 14.31% Black; 17.15% Hispanic; 56.76% White; 6.94% other	Healthy weight (11540) vs. overweight (2928) vs. obesity (2756)	Annual total health care expenditures including out-of-pocket and insurance payments for office-based and ED visits, inpatient care, outpatient prescriptions, and home health care; total out-of-pocket expenditures	Mean out-of-pocket expenditures: healthy weight: \$485; overweight/obesity: \$352. Overweight: OR=1.0 (95% CI: 0.9-1.0); obesity: OR=0.99 (95% CI: 0.98-1.0) Mean total expenditures: healthy weight: \$1780; overweight: \$1920; obesity: \$1740. Overweight: OR=1.0 (95% CI: 0.9-1.0); obesity: OR=0.98 (95% CI: 0.96-1.0) (In US \$, values of 2009)
Vellinga et al., 2008	Ireland	Hospital In-Patient Enquiry (HIPE, 1997-2004)	N=680,238 in 1997 to 984,137 in 2004 Age: 6-18 years	Obesity	Average hospital cost per day (health care worker supplies, patient care supplies, diagnostic and therapeutic	Hospital costs per child per day related to obesity: €388 in 1997; €401 in 1998; €407 in 1999; €432 in 2000; €477 in 2001; €497 in 2002; €520 in 2003; €538 in 2004 (In Euros €, values of 2004)

					supplies and medication)	
Wang et al, 2002	United States	National Hospital Discharge Survey (NHDS, 1979-1999) Annual	N=72,826 Age: 6-17 years	Healthy weight vs. obesity	Annual hospital costs=total number of hospital stays * average hospital cost per day	Annual hospital costs associated with obesity: \$35.10 million (0.43% of total hospital costs) in 1979-1981 to \$127.44 million (1.70% of total hospital costs) in 1997-1999 (In US \$, values of 2001)
Wang et al, 2010	United States	National Medical Expenditure Panel Survey (MEPS, 2000); National Longitudinal Study of Youth (1979) Lifetime	N=8,056,855 (4.2 million males & 3.9 million females) Age: 16-17 years in 2000 51.6% male	Non-overweight vs. overweight vs. obesity	Lifetime medical costs=mean annual medical costs * life expectancy after age 40	Lifetime medical costs saved after age 40 for males as a result of 1% point prevalence reduction in adolescence: non-overweight: \$43896; overweight: \$39846; obesity: \$54203 Lifetime medical costs saved after age 40 for females as a result of 1% point prevalence reduction in adolescence: non-overweight: \$43120; overweight: \$43474; obesity: \$52646 Lifetime medical cost decrease due to a 1% reduction in overweight/obese adolescents in 2000: \$586.3 million (\$73 per capita) (In US \$, values of 2007)
Ward et al., 2021	United States	Medical Expenditure Panel Survey (MEPS, 2011-2016)	N=36,583 Age: 6-19 years, M=13.12±3.91; 51.08% male; 21.11% Hispanic, 14.23% Black	Healthy weight vs. overweight vs. obesity	Total annual medical expenditures	Annual medical expenditures per person: healthy weight: \$1873 (95% CI: 1821-1925); overweight: \$1852 (95% CI: 1794-1916); obesity: \$2183 (2013-2327) (In US \$, values of 2019)
Wenig et al, 2011	Germany	German Interview and Examination Survey for Children and Adolescents (KiGGS, May 2003-May 2006)	N=14,836 Age: 3-17 years, M=10.9±3.62 51.4% male; 17.3% migrant; 82.7% non-migrant	Healthy weight (11357) vs. overweight (1306) vs. obesity (897)	Pharmaceutical costs	Weekly mean pharmaceutical costs: healthy weight: €3.27 (95%CI: 3.03-3.54); overweight: €3.31 (95%CI: 2.75-3.95); obesity: €4.06 (95%CI: 2.98-5.60) Mean pharmaceutical costs per year: healthy weight: €170±706.84 (95%CI: 158-184); overweight: €172±571.58 (95%CI: 143-205); obesity: €211±1039.08 (95%CI: 155-291) (In Euros €, values of 2006)
Wenig et al, 2012	Germany	German Interview and Examination Survey for Children and Adolescents (KiGGS, May2003- May 2006)	N=14,836 Age: 3-17.98 years, M=10.87±4.87 51.31% male	Healthy weight (11478) vs. overweight (1321) vs. obesity (904)	Total medical costs (physician visits, physical therapy, hospitalizations)	Annual medical costs per person: healthy weight: €438±2733.05 (95%CI: 392-492); overweight: €540±2512.67 (95%CI: 417-688); obesity: €443±1265.56 (95%CI: 366-531) (In Euros €, valued in 2006)

		Annual				
Wijga et al, 2018	Netherlands	Dutch Prevention and Incidence of Asthma and Mite Allergy birth cohort (PIAMA, 1996-1997) Annual	N=1,333 Age: 14-15 years	Non-overweight (1253) vs. overweight (80)	Total annual healthcare expenditures (mental healthcare, specialist/hospital care, allied healthcare, prescribed medication, dental care, general practice care)	Costs of general practice per child: non-overweight: €102±42; overweight: €110±61 Costs of dental care per child: non-overweight: €132±112; overweight: €130±102 Costs of mental healthcare per child: non-overweight: €1389±1602; overweight: €1528±1992 Costs of hospital/specialist per child: non-overweight: €448±756; overweight: €498±654 Costs for allied healthcare per child: non-overweight: €258±204; overweight: €337±292 Costs for prescribed medication per child: non-overweight: €128±436; overweight: €103±152 Total expenditures per child: non-overweight: €616±915; overweight: €837±1,213 (In Euros €, values of 2001)
Woolford et al, 2007	United States	Healthcare Cost and Utilization Project Kids' Inpatient Database (KID, 2000) Per hospitalization	N=774,274 Age: 2-18 years 53.7% male; 50.85% White; 14.37% Black; 14.31% Hispanic; 5.59% other; 14.88%	Obesity as a secondary diagnosis (8696) vs. without obesity as a secondary diagnosis (762,407)	Total charges and length of stay for each common non-pregnancy-related principal discharge diagnosis: asthma, pneumonia, affective disorders, appendicitis (All hospital fees except professional fees)	Mean charges: Asthma (n=116307): obesity vs. non-obesity (\$7766 vs. 6043, difference=1723, p=.012); Pneumonia (n=90056): obesity vs. non-obesity (\$12228 vs. 9688, difference=2540, p=.016); Affective Disorders (n=8292): obesity vs. non-obesity (\$8292 vs. 7769, difference=523, p=.001); Appendicitis (n=14134): obesity vs. non-obesity (\$14134 vs. 11049, difference=3085, p=.005) Length of stay: Asthma (n=116307): obesity vs. non-obesity (3.04 vs. 2.45, difference=0.6, p<.001); Pneumonia (n=90056): obesity vs. non-obesity (4.26 vs. 3.89, difference=0.4, p=.064); Affective Disorders (n=8292): obesity vs. non-obesity (7.72 vs. 7.11, difference=0.6, p=.001); Appendicitis (n=14134): obesity vs. non-obesity (3.33 vs. 3.16, difference=0.2, p=.187) (In US \$, values of 2000)
Woodford et al., 2009	United States	Agency for Healthcare Research and Quality	N=771,103 in 2000 and 958728 in 2003 Age: 2-18 years 53.48% male; 44.39% White; 13.46% Black; 14.38% Hispanic	Non-obesity (762,407 in 2000, 943,182 in 2003) vs. obesity (8,696 in 2000, 15,546 in 2003)	Hospital charges and length of stay	Hospital mean charges: Asthma (non-obesity: \$6884 in 2000 and 8444 in 2003; obesity: 8847 in 2000 and 10589 in 2003); Pneumonia (non-obesity: 11036 in 2000 and 13219 in 2003; obesity: 13930 in 2000 and 16609 in 2003); Affective disorder (non-obesity: 8850 in 2000

		(AHRQ) Kids Inpatient Database (KID, 2000-2003) Per hospitalization				and 10619 in 2003; obesity: 9446 in 2000 and 11942 in 2003); Appendicitis (non-obesity: 12587 in 2000 and 15586 in 2003; obesity: 16101 in 2000 and 19213 in 2003) Length of stay (day): Asthma (non-obesity: 2.45 in 2000 and 2.44 in 2003; obesity: 3.04 in 2000 and 2.88 in 2003); Pneumonia (non-obesity: 3.89 in 2000 and 3.83 in 2003; obesity: 4.26 in 2000 and 4.39 in 2003); Affective disorder (non-obesity: 7.11 in 2000 and 7.42 in 2003; obesity: 7.72 in 2000 and 8.23 in 2003); Appendicitis (non-obesity: 3.16 in 2000 and 3.08 in 2003; obesity: 3.33 in 2000 and 3.91 in 2003) (In US \$, values of 2000, 2003)
Wright et al, 2014	United States	US Medical Expenditure Panel Survey Household Component (MEPS-HC, 2006-2010) Annual	N=23,727 Age: 6-17 years	Healthy weight (15280) vs. overweight (4105) vs. obesity (4389)	Total medical expenditures (office-based, hospital inpatient, hospital outpatient, emergency room, prescription drug, dental visit, home healthcare)	Annual medical expenditure differences: children: male: overweight vs. healthy weight \$87±219.13 (95%CI: -278-581); obesity vs. healthy weight \$30±109.18 (95%CI: -157-271). Female: overweight vs. healthy weight \$90±220.92 (95%CI: -280-586); obesity vs. healthy weight \$33±110.97 (95%CI: -156-279). adolescents: male: overweight vs. healthy weight \$202±182.91 (95%CI: -122-595); obesity vs. healthy weight \$512±303.32 (95%CI: -28-1,161). Female: overweight vs. healthy weight \$215±184.18 (95%CI: -97-625); obesity vs. healthy weight \$515±301.79 (95%CI: -30-1,153). (In US \$, values in 2012)