# Obesity in Adults: Screening and Management

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This report summarizes estimates of health impact and cost-effectiveness that were created to assess the relative value of most of the clinical preventive services recommended by the United States Preventive Services Task Force (USPSTF) and the Advisory Committee on Immunization Practices (ACIP). This ranking of clinical prevention priorities is guided by the National Commission on Prevention Priorities (NCPP).

**A. USPSTF Recommendation**

In 2012, the U.S. Preventive Services Task Force (USPSTF) updated its 2003 recommendation of screening for and management of obesity in adults.[1,2] The Task Force found adequate evidence that intensive, multi-component behavioral interventions for obese adults can lead to weight loss and improved CVD risk factors and glucose tolerance with small risk for harms (a "B" recommendation). In contrast to the prior recommendation, the 2012 recommendation does not address adults who are overweight.

**B. Choice of Population**

Based on the Task Force recommendation, we evaluate screening for and management of obesity among adults aged 18 and older with a body mass index (BMI) of 30 $kg/m^2$ or higher.

**C. Model Type**

Analyses in this study were conducted using the HealthPartners Institute ModelHealth™: Cardiovascular disease microsimulation model. ModelHealth: CVD is an annual-cycle microsimulation model, parameterized to estimate the lifetime incidence of CVD events and associated costs in a cross-section of individuals representative of the U.S. population. Additional model details are included in the ModelHealth: CVD Technical Supplement.

Disease outcomes in ModelHealth: CVD include incidence of myocardial infarction, stroke, congestive heart failure, angina pectoris, intermittent claudication, and CVD-related death. Events are predicted by one-year risk equations estimated specifically for the model from Framingham Heart Study data [3,4]. Event risk is based on a person's age, sex, BMI, systolic blood pressure (SBP), high- and low-density lipoprotein (HDL and LDL) cholesterol, smoking status, and history of CVD.

The annual progression of BMI is derived from recall data reported in the Behavioral Risk Factor Surveillance System,[5] and the natural history of SBP and cholesterol is estimated using Framingham Heart Study data.[3,4] Tobacco initiation, cessation and relapse probabilities are derived from the National Health Interview Survey data[6] and published estimates from longitudinal studies.[7,8] Screening and treatment for hypertension and dyslipidemia in the model are consistent with national clinical guidelines,[9,10] and identification and treatment adherence patterns are consistent with the rates observed within the National Health and Nutrition Examination Survey (NHANES).[11-15] Use of antihypertensive drugs and lipid-acting agents is modeled as an exogenous treatment effect on SBP and cholesterol, respectively, and alters disease risk accordingly.

Disease costs in ModelHealth: CVD were estimated using data from the Medical Expenditure Panel Survey (MEPS).[16] First-year and ongoing costs are distinguished, and the cost of drug treatment and monitoring are accounted for separately. Pharmacy costs and clinic and lab fees associated with monitoring drug therapy are derived from nationally representative sources.[17-19]

**D. Analysis Design**

All analyses are conducted for a 4 million person birth cohort with demographic and underlying health characteristics representative of the U.S. population of age 18. Analyses compare outcomes for a simulated population with access to screening and intensive management services for obesity to the same population, all else held equal, without access to this clinical service. We assume that the screening rate for obesity is 100%; however, not all persons who are screened positive for obesity will accept enrollment in an intensive, multi-component behavioral intervention program to manage the condition. Specifically, we assume that 20% of the population will never agree to enroll in an obesity program. Among the remaining 80% of the population, we assume that the acceptance rate for an obesity program is 25%. We assume that 50% of the persons who enroll in an obesity program will complete the first year of the program; we assume the remaining persons will drop out at some point during the year (uniformly distributed), with costs and benefits proportionally realized. For maintenance, we assume that 75% of the persons who completed the full year of a program during the prior year will continue enrollment in the program the following year. If a person has maintained enrollment in a program continuously for 10 years, we assume that they will stick with the program for life. We assume that persons who have previously enrolled in a program but lapsed in maintenance may re-enroll at a referral acceptance rate of 25%.

Analyses were conducted from the societal perspective, which includes patient time costs, and in accordance with the "reference case" of the Panel on Cost Effectiveness in Health and Medicine.[20] All costs are expressed in 2012 U.S. dollars. Primary outcomes are clinically preventable burden (CPB) and the incremental cost-effectiveness (CE) ratio. CPB is given by

$$\mathrm{CBP} = \sum_{\mathrm{it}} \mathrm{QALY}_{\mathrm{it1}} - \sum_{\mathrm{it}} \mathrm{QALY}_{\mathrm{it0}}$$

where QALY represents the quality-adjusted measure for a person's life year, i is a person identifier, t denotes time, 1 represents the case with access to the specified clinical preventive service, and 0 represents the case without access to the service. Similarly, CE is given by

$$\mathrm{CE} = \frac{\sum_{\mathrm{it}} \frac{\mathrm{QALY}_{\mathrm{it1}}}{(1+\mathrm{r})^{\mathrm{t}}} - \sum_{\mathrm{it}} \frac{\mathrm{QALY}_{\mathrm{it0}}}{(1+\mathrm{r})^{\mathrm{t}}}}{\sum_{\mathrm{it}} \frac{\mathrm{Costs}_{\mathrm{it1}}}{(1+\mathrm{r})^{\mathrm{t}}} - \sum_{\mathrm{it}} \frac{\mathrm{Costs}_{\mathrm{it0}}}{(1+\mathrm{r})^{\mathrm{t}}}}$$

where *Costs* represents total intervention, treatment and management, and disease costs for a person, *r* denotes the discount rate, which is set to 3 percent. As described in further detail below, screening for and management of obesity affects BMI, diabetes incidence, LDL, and SBP. Deterministic (one-way) sensitivity analyses of key parameters were conducted by replicating simulations with all other parameters, probabilities, and population characteristics held equal.

Treatment effects

LeBlanc et al.[21] conducted the systematic evidence review for the USPSTF recommendation. Evidence was strongest for "intensive" interventions, which the Task Force defined as involving 12-26 multi-component sessions.[1] Effects were found for BMI, diabetes incidence, LDL, and SBP, as summarized in **Table 1**. For persons who drop out midway through an intervention, the treatment effects are proportionally applied during that year.

**Table 1: Summary of treatment effects from intensive multi-component obesity interventions**

| Risk Factor | Effect | Source |
|---|---|---|
| BMI ($kg/m^2$) | -6% | 21-31 |
| Diabetes incidence (RR) | 0.44 | 21,32,33 |
| LDL (mg/dL) | -6.40 | 21,22,24,28 |
| SBP (mm Hg) | -2.62 | 21,22,26,28,30,31,34,35 |

Notes: BMI = body mass index; RR = relative risk; LDL = low-density lipoprotein; SBP = systolic blood pressure.

Screening frequency

The Task Force reports that no evidence was found regarding optimal screening intervals for obesity; however, for our analysis, we assumed that there is at least one screening opportunity per year.

Intervention costs

Intervention costs are summarized in **Table 2**. The additional cost of screening for obesity is assumed to be zero, as measurement of height and weight is routine to clinical care. Few studies directly report costs of intensive obesity interventions. We estimated standardized program costs based upon program components and resource use reported in studies of intensive interventions from which we estimated intervention effectiveness and from studies of similar intensity that were excluded from our estimation of effect size due to differences in the population to whom they were targeted. Direct medical costs for intensive obesity interventions were estimated from the combination of two components: (a) the cost for health professional services (including dietitian, behavioral therapist, and athletic trainer) and (b) a standard cost for printed program materials (which we estimated to average $16 in 2012 dollars).[36] We determined hours of health professional time from study reports and assigned costs to health professional time based on average earnings for each profession, plus total benefits costs, based on National Occupational Employment and Wage Estimates and Employer Costs for Employee Compensation.[37,38] We used occupation code 29-1031 for dietitians, codes 19-3031 and 21-1011 for psychologist counselors, and 29-9091 for athletic trainers. We added a 50% indirect rate for these labor costs to approximate facility costs and intervention support staff.

Direct costs incurred by participants consist of extra costs associated with exercise and healthy diet. Costs of a gym membership (assumed to be $45 per month) or portion of a gym membership for interventions with less intensive exercise component, were added to capture average out-of-pocket costs for physical activity. For interventions with a diet component, we approximated the cost of an improved diet from two studies. From a study by Monsivais et al.,[39] we estimated incremental annual dietary costs of moving from a lower tercile to the next highest tercile of food cost and healthiness where the terciles were derived from a dietary survey and local food prices in King County, Washington. From a study by Rehm et al.,[40] we estimated the incremental cost of improved diet from the margin between the 2nd and 4th quintiles of energy-adjusted diet cost where the quartiles were derived from 2001-2002 National Health and Nutrition Examination Survey and national food price data. The average incremental cost for higher quality diet we derived from these estimates was $819 per year.

Time costs incurred by participants include time spent with health professionals, additional time costs for tracking diet and preparing healthy meals and for physical activity. Patient time was valued at the average hourly earnings plus benefits of all U.S. employees ($31 per hour).[38]

Our standardized costs reflect total costs for patients with complete adherence with study protocol. The model incorporates adherence explicitly. Thus, average costs per patient will be lower than our standardized costs as those failing to adhere to the entire intervention will be allotted only a portion of the intervention costs.

**Table 2: Annual costs for enrollment in an intensive adult obesity management intervention**

| | Annual Cost | | Source |
|---|---|---|---|
| **Direct Medical Costs** | | | |
| Dietician Costs (including overhead) | $ | 230 | 29,31,32,36,41-48 |
| Behavioral Therapist Costs (including overhead) | $ | 166 | 29,31,32,36,41-48 |
| Athletic Trainer Costs | $ | 497 | 29,31,32,36,41-48 |
| Literature/Books/Misc | $ | 3 | 36 |
| **Total Direct Medical Costs** | **$** | **896** | |
| | | | |
| **Direct Non-Medical Costs (Excluding Patient Time)** | | | |
| Athletic Club Membership | $ | 540 | Assumed |
| Food Costs | $ | 819 | 39,40 |
| Transportation Costs | $ | 297 | Assumed |
| **Total Direct Non-Medical Costs** | **$** | **1,656** | |
| | | | |
| **Patient Time Costs** | | | |
| Behavioral and Dietary Change Classes | $ | 1,035 | 29,31,32,36,38,41-47 |
| Exercise Sessions | $ | 3,894 | 29,31,32,36,38,41-47 |
| **Total Patient Time Costs** | **$** | **4,929** | |

Notes: All costs are expressed in 2012 U.S. dollars.

### E. Clinically Preventable Burden (CPB) Estimate

Our estimate of lifetime CPB for a birth cohort of 4 million persons initially aged 18 is 1,354,965 QALYs. In sensitivity analysis, this estimate ranged from 420,056 to 2,327,374 QALYs.

### F. Cost-Effectiveness (CE) Estimate

Our estimate of the incremental cost-effectiveness of screening for and management of obesity in adults is $77,652 per QALY. In sensitivity analysis, this estimate ranged from $17,976 to $172,312 per QALY.

### G. Limitations

The microsimulation model design and the results of these analyses are limited by the quality of data and evidence used to inform them. Our sensitivity analysis results indicate that CPB estimates are most sensitive to adherence to intensive obesity management programs, and CE estimates are most sensitive to assumptions regarding obesity intervention efficacy and costs. The marginal benefit of obesity screening and management is dependent on baseline risk factors and disease rates, but ModelHealth: CVD is shown to validate reasonably well with U.S. data (**Technical Supplement, Table 30**).

**References**


**1.** Moyer VA. Screening for and management of obesity in adults: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med.* Sep 4 2012;157(5):373-378.

**2.** Screening for obesity in adults: recommendations and rationale. *Ann Intern Med.* 2003 Dec 2 2003;139(11):930-932.

**3.** Framingham Heart Study-Cohort. Biologic Specimen and Data Repository Information Coordinating Center, National Institutes of Health2010.

**4.** Framingham Heart Study-Offspring. Biologic Specimen and Data Repository Information Coordinating Center, National Institutes of Health2010.

**5.** Behavioral Risk Factor Surveillance System Survey Data (2009). Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2010. http://www.cdc.gov/brfss/technical_infodata/surveydata/2009.htm.

**6.** National Center for Health Statistics. National Health Interview Survey, 2007. Hyattsville, Maryland: National Center for Health Statistics, Centers for Disease Control and Prevention2008.

**7.** Hughes JR, Keely JP, Niaura RS, Ossip-Klein DJ, Richmond RL, Swan GE. Measures of abstinence in clinical trials: issues and recommendations. *Nicotine Tob Res.* Feb 2003;5(1):13-25.

**8.** Wetter DW, Cofta-Gunn L, Fouladi RT, Cinciripini PM, Sui D, Gritz ER. Late relapse/sustained abstinence among former smokers: a longitudinal study. *Prev Med.* Dec 2004;39(6):1156-1163.

**9.** Chobanian AV, Bakris GL, Black HR, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension.* 2003 Dec 2003;42(6):1206-1252.

**10.** Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation.* 2002 Dec 17 2002;106(25):3143-3421.

**11.** National Health and Nutrition Examination Survey Data (2001-2002). Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2004. http://www.cdc.gov/nchs/nhanes/nhanes2001-2002/nhanes01_02.htm.

**12.** National Health and Nutrition Examination Survey Data (2003-2004). Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2005. http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/nhanes03_04.htm.

**13.** National Health and Nutrition Examination Survey Data (2005-2006). Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2007. http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/nhanes05_06.htm.

**14.** National Health and Nutrition Examination Survey Data (2007-2008). Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2009. http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/nhanes07_08.htm.

**15.** National Health and Nutrition Examination Survey Data (2009-2010). Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2011. http://wwwn.cdc.gov/nchs/nhanes/search/nhanes09_10.aspx.

**16.** Agency for Healthcare Research and Quality. Medical Expenditure Panel Survey. 2001-2010; http://meps.ahrq.gov/mepsweb/.

**17.** Ingenix. *2012 National Fee Analyzer* OPTUMInsight; 2012.

**18.** Walgreens. Search Results for Aspirin. 2011; http://www.walgreens.com/search/results.jsp?Ntt=aspirin. Accessed 7-1-11.

**19.** clinicaltrials.gov. A service of the U.S. National Institute of Health. PREMIER: Lifestyle Interventions for Blood Pressure Control.

http://clinicaltrials.gov/ct2/show/NCT00000616?term=premier&rank=12. Accessed January 29, 2014.

**20.** Gold MR, Siegel JE, Russell LB, Weinstein MC, eds. *Cost-effectiveness in health and medicine*. New York: Oxford University Press; 1996.

**21.** Leblanc ES, O'Connor E, Whitlock EP, Patnode CD, Kapka T. Effectiveness of primary care-relevant treatments for obesity in adults: a systematic evidence review for the U.S. Preventive Services Task Force. *Ann Intern Med.* Oct 4 2011;155(7):434-447.

**22.** Wood PD, Stefanick ML, Williams PT, Haskell WL. The effects on plasma lipoproteins of a prudent weight-reducing diet, with or without exercise, in overweight men and women. *N Engl J Med.* 1991 Aug 15 1991;325(7):461-466.

**23.** Cohen MD, D'Amico FJ, Merenstein JH. Weight reduction in obese hypertensive patients. *Fam Med.* Jan 1991;23(1):25-28.

**24.** Wood PD, Stefanick ML, Dreon DM, et al. Changes in plasma lipids and lipoproteins in overweight men during weight loss through dieting as compared with exercise. *N Engl J Med.* Nov 3 1988;319(18):1173-1179.

**25.** Langford HG, Blaufox MD, Oberman A, et al. Dietary therapy slows the return of hypertension after stopping prolonged medication. *JAMA.* Feb 1 1985;253(5):657-664.

**26.** Stevens VJ, Corrigan SA, Obarzanek E, et al. Weight loss intervention in phase 1 of the Trials of Hypertension Prevention. The TOHP Collaborative Research Group. *Arch Intern Med.* 1993 Apr 12 1993;153(7):849-858.

**27.** Woollard J, Burke V, Beilin LJ, Verheijden M, Bulsara MK. Effects of a general practice-based intervention on diet, body mass index and blood lipids in patients at cardiovascular risk. *J Cardiovasc Risk.* 2003 Feb 2003;10(1):31-40.

**28.** Simkin-Silverman LR, Wing RR, Boraz MA, Kuller LH. Lifestyle intervention can prevent weight gain during menopause: results from a 5-year randomized clinical trial. *Ann Behav Med.* 2003 Dec 2003;26(3):212-220.

**29.** Haffner S, Temprosa M, Crandall J, et al. Intensive lifestyle intervention or metformin on inflammation and coagulation in participants with impaired glucose tolerance. *Diabetes.* 2005 May 2005;54(5):1566-1572.

**30.** Burke V, Beilin LJ, Cutt HE, Mansour J, Wilson A, Mori TA. Effects of a lifestyle programme on ambulatory blood pressure and drug dosage in treated hypertensive patients: a randomized controlled trial. *J Hypertens.* Jun 2005;23(6):1241-1249.

**31.** Kulzer B, Hermanns N, Gorges D, Schwarz P, Haak T. Prevention of diabetes self-management program (PREDIAS): effects on weight, metabolic risk factors, and behavioral outcomes. *Diabetes Care.* Jul 2009;32(7):1143-1146.

**32.** Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med.* 2001 May 3 2001;344(18):1343-1350.

**33.** Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002 Feb 7 2002;346(6):393-403.

**34.** Ratner R, Goldberg R, Haffner S, et al. Impact of intensive lifestyle and metformin therapy on cardiovascular disease risk factors in the diabetes prevention program. *Diabetes Care.* 2005 Apr 2005;28(4):888-894.

**35.** Mitsui T, Shimaoka K, Tsuzuku S, Kajioka T, Sakakibara H. Gentle exercise of 40 minutes with dietary counseling is effective in treating metabolic syndrome. *Tohoku J Exp Med.* Aug 2008;215(4):355-361.

**36.** Wylie-Rosett J, Swencionis C, Ginsberg M, et al. Computerized weight loss intervention optimizes staff time: the clinical and cost results of a controlled clinical trial conducted in a managed care setting. *J Am Diet Assoc.* Vol 1012001:1155-1162; quiz 1163-1154.

**37.** U.S. Bureau of Labor Statistics. May 2012 National Occupational Employment and Wage Estimates. 2012; http://www.bls.gov/oes/2012/may/oes_nat.htm. Accessed June 3, 2015.

**38.** Bureau of Labor Statistics. Employer Costs for Employee Compensation - September 2012. 2012; http://www.bls.gov/news.release/archives/ecec_12112012.pdf.

**39.** Monsivais P, Aggarwal A, Drewnowski A. Following federal guidelines to increase nutrient consumption may lead to higher food costs for consumers. *Health Aff (Millwood).* Aug 2011;30(8):1471-1477.

**40.** Rehm CD, Monsivais P, Drewnowski A. The quality and monetary value of diets consumed by adults in the United States. *Am J Clin Nutr.* Nov 2011;94(5):1333-1339.

**41.** Parikh P, Simon EP, Fei K, Looker H, Goytia C, Horowitz CR. Results of a pilot diabetes prevention intervention in East Harlem, New York City: Project HEED. *Am J Public Health.* Apr 1 2010;100 Suppl 1:S232-239.

**42.** Heshka S, Anderson JW, Atkinson RL, et al. Weight loss with self-help compared with a structured commercial program: a randomized trial. *JAMA.* 2003 Apr 9 2003;289(14):1792-1798.

**43.** Jalkanen L. The effect of a weight reduction program on cardiovascular risk factors among overweight hypertensives in primary health care. *Scand J Soc Med.* 1991 Mar 1991;19(1):66-71.

**44.** Jones DW, Miller ME, Wofford MR, et al. The effect of weight loss intervention on antihypertensive medication requirements in the hypertension Optimal Treatment (HOT) study. *Am J Hypertens.* Dec 1999;12(12 Pt 1-2):1175-1180.

**45.** Munsch S, Biedert E, Keller U. Evaluation of a lifestyle change programme for the treatment of obesity in general practice. *Swiss Med Wkly.* 2003 Mar 8 2003;133(9-10):148-154.

**46.** Effects of weight loss and sodium reduction intervention on blood pressure and hypertension incidence in overweight people with high-normal blood pressure. The Trials of Hypertension Prevention, phase II. The Trials of Hypertension Prevention Collaborative Research Group. *Arch Intern Med.* 1997 Mar 24 1997;157(6):657-667.

**47.** Whelton PK, Appel LJ, Espeland MA, et al. Sodium reduction and weight loss in the treatment of hypertension in older persons: a randomized controlled trial of nonpharmacologic interventions in the elderly (TONE). TONE Collaborative Research Group. *JAMA.* 1998 Mar 18 1998;279(11):839-846.

**48.** Bureau of Labor Statistics. *Occupational Employment and Wages -- May 2012*: Bureau of Labor Statistics, U.S. Department of Labor;2013.