**Appendices to "Cost-Effectiveness of Childhood Obesity Interventions: Evidence and Methods for CHOICES" by Gortmaker et al.**

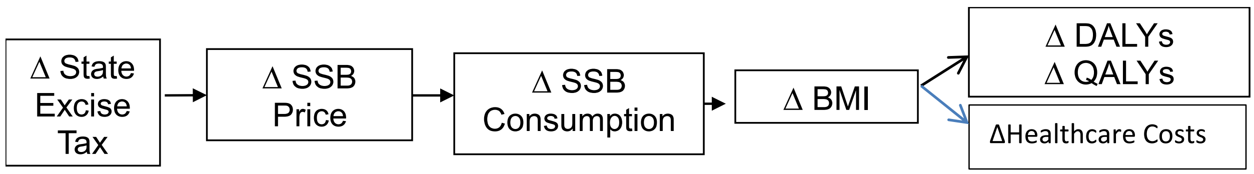
**<u>Supplementary Appendix 1.</u> CHOICES Stakeholders**

| | |
|---|---|
| Jose Alvarez | Harvard Business School |
| Alice Ammerman | The University of North Carolina at Chapel Hill |
| Tatiana Andreyeva | Yale University |
| Heidi Blanck | Centers for Disease Control and Prevention |
| Laura Brennan | Transtria |
| Kelly Brownell | Duke University |
| Sonia Carter | Action for Boston Community Development (ABCD) Head Start |
| Jamie Chriqui | University of Illinois at Chicago |
| Bill Dietz | George Washington University |
| Kelly Evenson | The University of North Carolina at Chapel Hill |
| Amy Eyler | Washington University in St. Louis |
| Billy Fields | Texas State University |
| Tracy Fox | Food, Nutrition and Policy Consultants |
| Steve Golden | National Parks Service |
| Samantha Graff | Public Health Law and Policy |
| Geri Henchy | Food Research and Action Center |
| Nick Jackson | Toole Design Group |
| Manel Kappagoda | Change Lab Solutions |
| Susan Linn | The Campaign for a Commercial-Free Childhood |

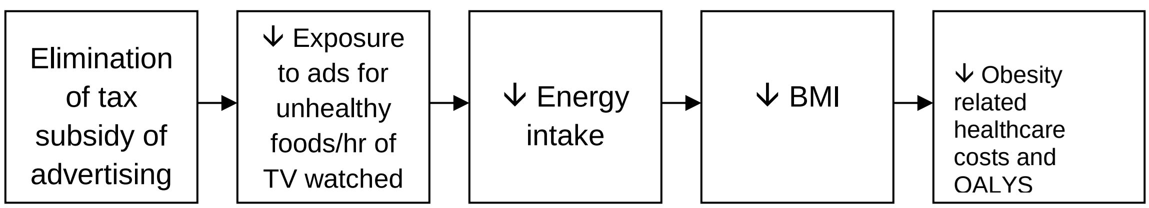
| | |
|---|---|
| Matt Longjohn | The YMCA of the USA |
| Anne McHugh | Boston Public Health Commission |
| Cathy Nonas | New York City Department of Health and Mental Hygiene |
| Tracy Orleans | Robert Wood Johnson Foundation |
| Russ Pate | University of South Carolina |
| Jennifer Pomeranz | Temple University |
| Meredith Reynolds | Centers for Disease Control and Prevention |
| Jim Sallis | University of California San Diego |
| Tom Schmid | Center for Disease Control and Prevention |
| Mary Story | Duke University |
| Elsie Taveras | Massachusetts General Hospital |
| Elizabeth Walker Romero | Association of State and Territorial Health Officials |
| Cara Wilking | Public Health Advocacy Institute |

**Supplementary Appendix 2. Logic Models Used in the Four Modeled Interventions**

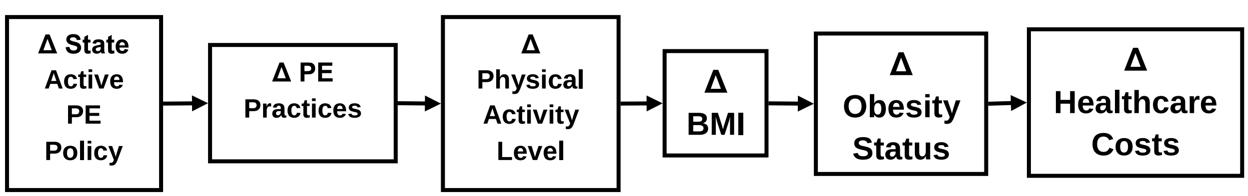
Supplementary Figure 2A. Logic Pathway Linking Excise Tax on Sugar-Sweetened Beverages (SSB) to Change in DALYs and QALYs.[1]



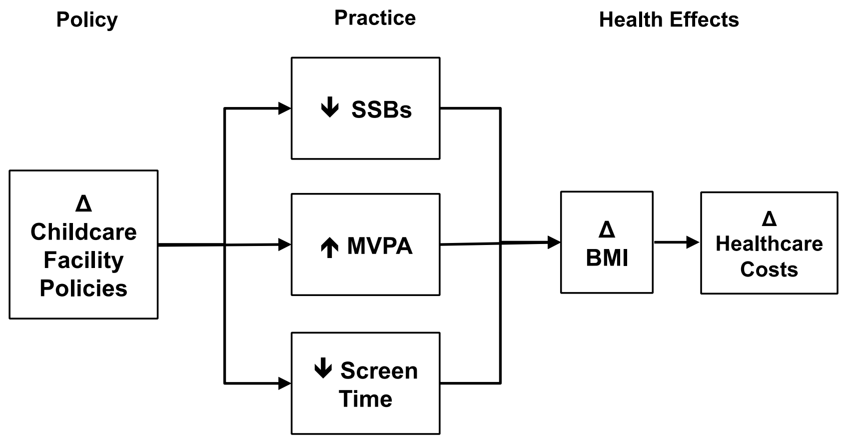

Supplementary Figure 2B. Logic model linking TV advertising policy change to reduction in BMI and healthcare costs and QALYS.[2]




Supplementary Figure 2C. Logic pathway linking elementary school Active Physical Education policy to change in obesity-related healthcare costs.[3]



Supplementary Figure 2D. Logic pathway linking change in SSB consumption, Physical Activity, and Screen Time to changes in Health Outcomes.[4]



## Supplementary Appendix 3. Evidence Reviews for Four CHOICES Cost Effectiveness Studies

The methods used to evaluate evidence are in general agreement with Cochrane guidelines and the GRADE approach.[5,6] These guidelines were generally developed for clinical interventions. Following the GRADE approach we specify four levels of quality of evidence (see Table below adapted from the Cochrane discussion of the GRADE[6] approach). These changes make the GRADE rating more applicable to evaluation of real world interventions where randomized trials may not be possible. In general cross-sectional observational studies are rated as low quality.

Levels of quality of a body of evidence in the GRADE approach as applied to CHOICES

| **Underlying methodology** | **Quality rating** |
|---|---|
| Randomized trials; or double-upgraded observational studies. (For example this could be a high quality evaluation of a natural experiment or quasi experiment with control that was not randomized[7]). | High |
| Downgraded randomized trials; or upgraded observational studies. (For example this can include longitudinal studies of change in exposure and change in outcome, such as studies of a behaviour linked to an outcome, including fixed effects regressions, [8]or evaluation of natural experiments with no control group[9]). | Moderate |

| | |
|---|---|
| Double-downgraded randomized trials; or observational studies. This includes cross-sectional designs. | Low |
| Triple-downgraded randomized trials; or downgraded observational studies; or case series/case reports. | Very low |

For the four cost effectiveness studies compared here, all four rely on randomized controlled trial (RCT) evidence linking the primary behavior to changes in BMI, and two rely on change and change longitudinal observational studies as well. All four of the studies included extensive literature reviews, with the goal of identifying the best evidence for use in CHOICES cost effectiveness modeling. Typically this meant that studies were identified that were high quality, and did not include other behavioral components that might confound the effect estimate. Details of the evidence reviews are provided with each of the papers.

The SSB study included an extensive review of literature (including 13 reviews) linking SSB intake to change in BMI. This review identified one double blind RCT of children, SSB intake and BMI, and four quality longitudinal change in SSB and change in BMI studies in adults [1] that were used for effect estimates in the model.

The TV AD paper relied on a recent systematic evidence review including 49 studies by the Guide to Community Preventive Services, that recommended behavioral interventions to reduce recreational sedentary screen time among children, finding evidence for significant reductions in BMI and obesity prevalence.[10] This finding was similar to that of two recent meta-analyses, as well as a systematic review among young children. The authors reviewed all studies in the systematic reviews, looking for RCTs of screen time interventions that manipulated only screen time (e.g. not diet), included ages 2-18; measured change in weight, BMI z-score or BMI, demonstrated significant change in screen time and lasted six months or more. Two RCTs met these criteria, and these found similar effects so this effect estimate was used.[2] Other evidence from these studies indicated the relationship between TV and BMI was mainly due to increased energy intake and in particular commercial TV viewing, as well as the large number of hours of TV still watched by children and the focus of TV advertising on junk foods and beverages.[11]

The Active PE paper conducted an extensive literature review to identify RCTs of physical activity interventions without nutrition, screen time, or other intervention components, and with objective meausures of BMI and physical activity. More than 600 articles were reviewed and ultimately one RCT was identified. A quality change in physical activity and change in BMI longitudinal study was also identified and these two produced very similar estimates that were combined for the cost effectiveness modeling.

The ECE policy paper relied on estimates from the other three studies linking reduced SSB intake, higher physical activity levels and less TV viewing to lower levels of BMI.

The randomized trials used are generally rated as high quality, and longitudinal observational studies of change in the exposure associated with change in the outcome are generally rated as moderate because there was no manipulation of the exposure. Note however that all of the papers utilize multiple studies to specify a complete intervention that can be implemented nationally, and that a high quality study cannot guarantee that a nationally implemented intervention can be successfully brought to scale. For this reason other implementation and equity considerations are also reviewed in the discussion.

As noted in the Cochrane guide, there are multiple reasons why a study can be upgraded, including: a large magnitude of effect, if all plausible confounding would reduce a demonstrated effect or suggest a spurious effect when results show no effect, or if there is a dose-response gradient. There are also multiple reasons why a study can be downgraded, including: "limitations in the design and implementation of available studies suggesting high likelihood of bias; indirectness of evidence (indirect population, intervention, control, outcomes); unexplained heterogeneity or inconsistency of results (including problems with subgroup analyses); imprecision of results (wide confidence intervals); high probability of publication bias."[6] There is growing consensus that the evaluation of natural experiments and policy changes can result in strong evidence for causal impact and these approaches needs to be used more often and the strength of this sort of evidence needs to be recognized.[7,9,12] For example, consideration of broader types of evidence was important in tobacco control research. Natural experimental evaluations indicated effectiveness of cigarette taxes in reducing smoking; this example is a policy change where RCT's are generally not possible,[13] and the same situation applies to many of the policy interventions that are the focus of our efforts here.

A recent published report[14] modeled interventions that are somewhat similar to those in this CHOICES overview. However this simulation based their model on coefficients from a cross sectional regression analysis predicting BMI from respondent reports of dietary intake and physical activity. We have concerns about the validity of this approach, and prefer the CHOICES approach that conducts evidence reviews and then bases estimates of effect on the best available evidence. In this case, for the current interventions this means randomized trial results and longitudinal changes studies directly affecting change in BMI.

**Supplemental Appendix 4. Overview of simulation model, model data sources, methods and assumptions for calculation of population values, mortality, morbidity, DALYs and QALYs**

The model used in this study is a Markov cohort model that simulates the effects of interventions on BMI change as well as costs of the intervention in yearly steps over a 10 year time period, 2015-2025. The model is stochastic so that the cohort simulations sample from probability distributions of input parameters and then generate outcome distributions. The model used a proportional multi-state life table[15 16] to simulate the morbidity and mortality experience of the 2015 population of the United States (ages 2 or older in 2015) followed for ten years or until death or 100 years of age. The baseline national population in the closed cohort model is based on the U.S. Census middle series 2012 National Population Projections for 2015 by sex and five-year age groups (2 years and older). Baseline and age-related increases in BMI by age and sex were based on NHANES data for 2009-2012 (see Appendix Table 4).

The Dismod II software program, which was developed for the Global Burden of Disease 2000 study, was used to model the incidence and case fatality of the nine obesity-related diseases. The Dismod II software uses a series of differential equations to model the complete epidemiology of each disease using incomplete, but the most reliable, publicly-available combination of disease-specific estimates of incidence, mortality, relative risk of mortality, or prevalence by age and sex. Details on inputs used to model each disease are included in Supplemental Appendix Table 3.

The Markov cohort simulation model was based on a spreadsheet version used for ACE Prevention,[17,18] but modified with US population, health care costs, morbidity and mortality data.

Details of the US population, morbidity and mortality data are provided below in Appendix 3 Table. These results were replicated in a compiled programming language (JAVA) and data were analyzed in 2014.

The model calculated costs and effectiveness of the interventions through their impact on BMI changes and cost per BMI change in the cohort in the short term (over a two year period). “We model no effect of the interventions over the first year, and full effect beginning in the second year. We use this simplified approach to take into account the time frame of effectiveness evidence (see individual papers – many of these studies last less than one year and almost all less than two years), and the work of Hall et al that documents the time course of weight change in children and adults. The Hall et al models indicate it takes about a year for relatively full effects of interventions in children, and half effects in less than a half year. In contrast, adult models indicate it takes approximately three years for 95% effect, two years for 80% and one year for half effect. Modeling no effect in year one and full effect in year two is thus a conservative approach for adults and children.”.[19,20]

Over the 10 year period 2015-2025 the model calculates intervention costs, BMI change, obesity prevalence, costs per BMI change, obesity-related health care costs, net costs, and in the case of the SSB intervention, obesity-related disease incidence, disability adjusted life years (DALYs), and quality adjusted life years (QALYs). For the TV-AD model we also calculate QALYs. For the SSB, TV-AD and ECE models we calculate net savings per dollar spent on the intervention. Note that we do not report the DALY outcomes for the other three interventions (besides SSB) because subjects will be less than age 30 at 10 years follow-up and relative risks of obesity related diseases are 1.0 below age 35.[21 22] We do not report QALYs for the ECE and Active PE interventions because few subjects over the 10 years will fall into the age range of 18 and older where QALY weights are defined (see Table).

For the SSB intervention the model estimated incidence and prevalence of the obesity related diseases: stroke, ischemic heart disease, hypertensive heart disease, diabetes mellitus, osteoarthritis, post-menopausal breast cancer, colon cancer, endometrial cancer, and kidney cancer using relative risks risks[15] linking changes in BMI to disease incidence.[17,18] Detailed Data sources and analysis of incidence and prevalence of the obesity related diseases are described in Supplemental Appendix 3. Also listed are the sources for DALY and QALY weights.

Probabilistic sensitivity analysis was used extensively by simultaneously sampling all parameters values from predetermined distributions. Results are reported as 95% uncertainty intervals (around point estimates). To estimate costs per BMI units reduced over two years, @Risk software (Version 6.0. Ithaca, NY: Palisade Corporation; 2009) was used to calculate 95% uncertainty intervals from 10,000 iterations of the model. In estimating 10 year healthcare costs, net costs, net cost saved per dollar spent, and DALY and QALY outcomes, uncertainty intervals were calculated using Monte Carlo simulations programmed in JAVA and 1,000,000 iterations of the model. Model uncertainty was also assessed by modifying the primary scenario with alternative logic pathways. Further details for the different scenarios are provided in the individual papers.

Reporting of these results follows guidelines developed in the ACE approach,[23,24] recommendations of the US Panel on Cost-Effectiveness in Health and Medicine were followed,[25] as well as the example provide by recent simulation efforts by Basu et al.

**Supplementary Appendix 4 Table. Overview of model data sources, methods and assumptions for calculation of population values, mortality, morbidity, DALYs and QALYs**

| **Model input** | **Data sources** | **Methods** | **Assumptions** |
|---|---|---|---|
| Life tables for US population, 2009 | Arias E. United States life tables, 2009. National vital statistics reports; vol 62 no 7. Hyattsville, MD: National Center for Health Statistics. 2014. http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_07.pdf | Used probabilities calculated from Vital Statistics | Life table remains stable over time |
| United States of America population figures in the year 2015 | US Census Bureau: Monthly Resident Population **Source:** US Census Bureau Month of July; U.S. Census Bureau. 2012 National Population Projections: Downloadable Files, Middle Series. Suitland, Md: U.S. Department of Commerce,U.S. Census Bureau. Accessed September 12, 2014. Available online: www.census.gov/population/projections/data | Estimated residential population by sex and single year of age. Population of the residents in the US during the month of July in 2015 without overseas population numbers. | July is the best measure for 2015 as it is close to the middle of the year. |

| | | | |
|---|---|---|---|
| | /national/2012/downloadablefiles.html | | |
| PYLD (prevalent years lived with disability) rate | Taken from Australian Model as used in ACE Prevention: Vos T, Carter R, Barendregt J, et al. *Assessing cost-effectiveness in prevention (ACE-Prevention): final report.* Brisbane: University of Queensland and Deakin University; 2010. | | Assumption that Australian data can be applied to US. |
| Height, weight, BMI distributions 2009-2012 | Baseline sex- and age-specific height, weight, and BMI distributions are now based on data from the National Health and Nutrition Examination Surveys 2009-2012. www.cdc.gov/nchs/nhanes.htm. | Based upon data from the National Health and Nutrition Examination Survey. Smoothed out from 5 year groups using the mean ages and extrapolation. | |

| | | | |
|---|---|---|---|
| Incidence and mortality of colorectal cancer for males and females | Incidence: http://wonder.cdc.gov/cancer-v2005.html. United States Cancer Statistics: 1999 - 2005 Incidence, WONDER On-line Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; August 2008. Mortality: http://wonder.cdc.gov/CancerMort-v2005.html. United States Cancer Statistics: 1999 - 2005 Mortality, WONDER On-line Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention; August 2008. | Used Dismod: population incidence rate (population rates) (CDC WONDER), mortality rate (CDC WONDER), and remission set to "0" (ASSUMPTION) as only inputs. Output incidence rates (hazard rates) and case fatality rates for 1-year age categories to be used in BMI-to-DALYs Model. | DisMod fitted values |
| Incidence and mortality of | Incidence: http://wonder.cdc.gov/cancer-v2005.html. United States Cancer Statistics: 1999 - 2005 Incidence, WONDER | DisMod: Used incidence rate (population rates) | DisMod fitted values |

| | | | |
|---|---|---|---|
| breast cancer for females | On-line Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; August 2008. Mortality: http://wonder.cdc.gov/CancerMort-v2005.html. United States Cancer Statistics: 1999 - 2005 Mortality, WONDER On-line Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention; August 2008. | (CDC WONDER), mortality rate (CDC WONDER), and remission set to "0" (ASSUMPTION) as only inputs. Output incidence rates (hazard rates) and case fatality rates for 1-year age categories to be used in BMI-to-DALYs Model. | |
| Incidence of and mortality of NIDDM or type 2 diabetes for | Incidence: http://www.cdc.gov/diabetes/statistics/incidence/fig5.htm. Relative Risk of Mortality: Woodward M, Zhang X, Barzi F, Pan W, Ueshima H, Rodgers A, MacMahon S; Asia Pacific Cohort Studies Collaboration. (2003) 'The effects of diabetes on the risks of major cardiovascular diseases and death in the | Utilized incidence, prevalence, and relative risks; remission set to 0. | DisMod fitted values |

| | | | |
|---|---|---|---|
| | Asia-Pacific region' Diabetes Care;26(2):360-6<br>Mortality: http://wonder.cdc.gov/ucd-icd10.html. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2009 on CDC WONDER Online Database, released 2012.<br>Prevalence: http://www.ncbi.nlm.nih.gov/pubmed/19017771 Cowie CC, Rust KF, Ford ES, etla. Full accounting of diabetes and pre-diabetes in the U.S. population in 1988-1994 and 2005-2006. Diabetes Care 2009;(32(2):287-97. | | |
| Incidence and mortality of arthritis | Prevalence: http://www.ncbi.nlm.nih.gov/pubmed/18163481.<br>Mortality: http://wonder.cdc.gov/ucd-icd10.html. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2009 on CDC WONDER Online Database, released 2012.<br>Helmick CG et al. Estimates of the Prevalence of Arthritis and Other Rheumatic Conditions in the United States. | Prevalence modeled. Remission set to 0. | DisMod fitted values |

| | | | |
|---|---|---|---|
| | Arthritis and Rheumatism. 2008; 58 (1), 15-25. | | |
| Incidence and mortality of kidney cancer | Incidence: http://wonder.cdc.gov/cancer-v2005.html. United States Cancer Statistics: 1999 - 2005 Incidence, WONDER On-line Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; August 2008. Mortality: http://wonder.cdc.gov/CancerMort-v2005.html. United States Cancer Statistics: 1999 - 2005 Mortality, WONDER On-line Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention; August 2008. | Used incidence rate (population) (CDC WONDER), mortality rate (CDC WONDER), and remission set to "0" (ASSUMPTION) as only inputs Output incidence rates (hazard rates) and case fatality rates for 1-year age categories to be used in BMI-to-DALYs Model. | DisMod fitted values |

| | | | |
|---|---|---|---|
| Incidence and mortality of CVS | Incidence: http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf. National Institutes of Health, National Heart, Lung, and Blood Institute. Incidence and Prevalence: 2006 Chart Book on Cardiovascular and Lung Diseases. Bethesda, MD: National Heart, Lung, and Blood Institute; 2006. Mortality: http://wonder.cdc.gov/ucd-icd10.html. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2009 on CDC WONDER Online Database, released 2012. Prevalence: http://circ.ahajournals.org/content/119/3/e21.short. Heart | Incidence input used incidence rate (population) (CDC WONDER), mortality rate (CDC WONDER), and remission set to "0" (ASSUMPTION) as only inputs Output incidence rates (hazard rates) and case fatality rates for 1-year age categories used in BMI-to- | DisMod fitted values |

| | | | |
|---|---|---|---|
| | Disease and Stroke Statistics-2009 Update: A Report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation. 2009;119:e21-e181 | DALYs Model. | |
| Incidence and mortality of Ischemic Heart Disease (IHD) | Incidence: http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf. National Institutes of Health, National Heart, Lung, and Blood Institute. Incidence and Prevalence: 2006 Chart Book on Cardiovascular and Lung Diseases. Bethesda, MD: National Heart, Lung, and Blood Institute; 2006. Mortality: http://wonder.cdc.gov/ucd-icd10.html. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2009 on CDC WONDER Online Database, released 2012. Prevalence: http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf. | Modeled using mortality, prevalence, incidence, and remission set to "0". | DisMod fitted values |

| | | | |
|---|---|---|---|
| | National Institutes of Health, National Heart, Lung, and Blood Institute. Incidence and Prevalence: 2006 Chart Book on Cardiovascular and Lung Diseases. Bethesda, MD: National Heart, Lung, and Blood Institute; 2006. | | |
| Incidence and mortality of Hypertensive Heart Disease (HHD2) | Incidence: http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf. National Institutes of Health, National Heart, Lung, and Blood Institute. Incidence and Prevalence: 2006 Chart Book on Cardiovascular and Lung Diseases. Bethesda, MD: National Heart, Lung, and Blood Institute; 2006. Mortality: http://wonder.cdc.gov/ucd-icd10.html. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2009 on CDC WONDER Online Database, released 2012. Prevalence: http://www.nhlbi.nih.gov/resources/docs/06a_ip_chtbk.pdf. | Modeled with RR=2, remission=0, prevalence extended to 95-99 using exponential function in Excel. | DisMod fitted values |

| | | | |
|---|---|---|---|
| | National Institutes of Health, National Heart, Lung, and Blood Institute. Incidence and Prevalence: 2006 Chart Book on Cardiovascular and Lung Diseases. Bethesda, MD: National Heart, Lung, and Blood Institute; 2006. | | |

CHD – Coronary heart disease, NIDDM – Non-insulin dependent diabetes mellitus (type 2 diabetes), YLD – years lived with disability, CVA – Cerebrovascular attack, IHD – Ischemic heart disease, CVD – Cardiovascular Disease

**Supplementary Appendix 5: Costing of Interventions and Obesity Related Health Care Costs**

**Costing of Interventions**

Costing interventions in the CHOICES project followed three steps common to many cost-effectiveness projects[26,27] and building on protocols as outlined in the ACE studies:[24,28]
1) Identification of all the different types of resources used; 2) Measurement of the quantity of each resource used per person or per state included in the model; 3) Valuation of resource utilization in monetary terms.

A modified societal perspective was employed, which means that all costs and benefits regardless of who pays or who benefits are combined into a single cost-effectiveness ratio. This is considered a modified societal perspective because it does not account for costs in time and other resources that program participants incur in order to participate in a program.
Resources were only included as costs if they differ between the intervention scenario and the natural history comparator. This is because the methodology used is an incremental costing relative to an explicit comparator as opposed to a "full" costing. For example, while the time of a PE teacher during PE class is necessary to implement an Active PE curriculum, the same amount of time would be utilized to implement a traditional PE curriculum. As such, this intervention does not lead to an incremental increase in PE teacher time. Start-up costs were not included; the intervention was considered "at steady state." Costs for advocating for the passage of a given policy were not included, but costs of policy dissemination were included.

**Obesity related health care costs**

One of the limitations of the ACE obesity[29] and ACE prevention[30] model approach is that health care cost offsets only occur after obesity related disease onset, and these diseases occur relatively rarely before age 35, meaning that childhood obesity interventions can show minimal or no health care cost offsets via this approach for 20-35 years. However, research in the United States clearly indicates excess health care costs associated with obesity among children and youth,[31,32] and analyses among adult populations show clear excess costs associated with obesity during ages 20-40, as well as even greater excess costs associated with obesity among older ages.

For the CHOICES interventions, effects were modeled for the outcomes mean BMI, obesity prevalence and the impact of changes in obesity on changes in health care costs (for obese compared to non-obese). Estimates of health care costs relied on analyses by Finkelstein and Trogden[31] that indicated higher health care costs for obese children and youth (compared to non-obese), and steadily increasing excess rates associated with obesity as age increases. For ages below six no extra health care costs were associated with obesity. For ages 6-19 there were added health care costs per year if the child is obese, compared to non-obese; inflated to 2014 US dollars the difference is $282.[31] Larger differences are observed for ages 20 and above.[31] Medical Expenditure Panel Survey data for the years 2001-3 were the source for these estimates, and costs were adjusted for inflation using the Bureau of Labor Statistics Consumer Price Index for healthcare expenditures. Further analyses of these data indicated that excess costs were related to outpatient visit, prescription drug and emergency room expenditures.[32]

It could be argued the assumption of excess health costs associated with obesity is unrealistic because reductions in obesity may take many years to show effects on reduced health care costs (because obesity related diseases take a long time to develop). However it can also be argued that the main effects of the interventions in childhood will be to lower rates of childhood BMI and obesity, and in this way prevent excess health care costs. It is useful to remember that obesity rates in the US among children increase from about 12% among ages 2-5 to 18% among ages 12-19 to 28% among ages 20-34. Thus it appears reasonable to assume that interventions have the effect of accumulating cost offsets with interventions that lower short term BMI and obesity rates in childhood and that these lower rates in turn will persist into adulthood. In this way the growth of obesity and excess health care costs can be reduced.

**References**

1. Long MW, Gortmaker SL, Ward ZJ, et al. Cost-effectiveness of a sugar-sweetened beverage excise tax in the United States. Under review.

2. Sonneville KR, Long MW, Ward ZJ, et al. Estimated impact of eliminating the tax subsidy of food and beverage television advertising directed at children and adolescents on BMI and healthcare costs in the United States. . Under review.

3. Barrett J, Gortmaker S, Long M, et al. *Cost-effectiveness of a state policy requiring minimum levels of moderate-to-vigorous physical activity during elementary school physical education classes.* in press, American Journal of Preventive Medicine.

4. Wright DR, Kenney E, Giles C, et al. The impact of child care center policy changes on BMI and healthcare costs in the United States. . Under review.

5. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: what is "quality of evidence" and why is it important to clinicians? *British Medical Journal.* 2008;336(7651):995-999B.

6. Cochrane Handbook for Systematic Reviews of Interventions In: Green JPH, ed. *Version 5.2.10*: The Cochrane Collaboration; 2011.

7. Institute of Medicine. *Bridging the Evidence Gap in Obesity Prevention: A Framework to Inform Decision Making.* Washington, DC2010.

8. Allison P. *Fixed Effects Regression Methods for Longitudinal Data Using SAS.* Cary, NC: SAS Institute, Inc.; 2005.

9. Shadish WR, Cook TD, Campbell DT. *Experimental and quasi-experimental designs for generalized causal inference.* Boston, MA: Houghton Mifflin Company; 2002.

10. The Guide to Community Preventive Services. Obesity Prevention and Control: Behavioral Interventions that Aim to Reduce Recreational Sedentary Screen Time Among Children. 2014; http://www.thecommunityguide.org/obesity/behavioral.html. Accessed Dec, 5 2014.

11. Hohman KH, Price SN, Sonneville K, et al. Can the Internet Be Used to Reach Parents for Family-Based Childhood Obesity Interventions? *Clinical Pediatrics.* 2012;51(4):314-320.

12. McKinnon RA, Orleans T, Kumanyika SK, et al. Considerations for an Obesity Policy Research Agenda. *American Journal of Preventive Medicine.* 2009;36(4):351-357.

13. Jha P, Chaloupka FJ, Corrao M, Jacob B. Reducing the burden of smoking world-wide: effectiveness of interventions and their coverage. *Drug and Alcohol Review.* 2006;25(6):597-609.

14. Kristensen AH, Flottemesch TJ, Maciosek MV, et al. Reducing Childhood Obesity through US Federal Policy A Microsimulation Analysis. *American Journal of Preventive Medicine.* 2014;47(5):604-612.

15. Barendregt JJ, Van Oortmarssen GJ, Van Hout BA, Van Den Bosch JM, Bonneux L. Coping with multiple morbidity in a life table. *Math Popul Stud.* 1998;7(1):29-49, 109.

16. Forster M, Veerman JL, Barendregt JJ, Vos T. Cost-effectiveness of diet and exercise interventions to reduce overweight and obesity. *Int J Obes (Lond).* 2011.

17. Cobiac L, Vos T, Veerman L. Cost-effectiveness of Weight Watchers and the Lighten Up to a Healthy Lifestyle program. *Australian and New Zealand Journal of Public Health.* 2010;34(3):240-247.

18. Vos T, Carter R, Barendregt J, et al. *Assessing Cost-Effectiveness in Prevention (ACE–Prevention): Final Report.* University of Queensland, Brisbane and Deakin University, Melbourne.;2010.

19. Hall KD, Sacks G, Chandramohan D, et al. Obesity 3 Quantification of the effect of energy imbalance on bodyweight. *Lancet.* 2011;378(9793):826-837.

20. Hall KD, Butte NF, Swinburn BA, Chow CC. Dynamics of childhood growth and obesity: development and validation of a quantitative mathematical model. *Lancet Diabetes & Endocrinology.* 2013;1(2):97-105.

21. Finkelstein EA, Brown DS, Trogdon JG, Segel JE, Ben-Joseph RH. Age-specific impact of obesity on prevalence and costs of diabetes and dyslipidemia. *Value in Health.* 2007;10:S45-S51.

22. James W, Jackson-Leach R, Mhurchu C, et al. *Overweight and obesity (high body mass index).* Geneva (CHE):: World Health Organisation; 2004.

23. Carter R, Vos T, Moodie M, Haby M, Magnus A, Mihalopoulos C. Priority setting in health: Origins, description and application of the Assessing Cost Effectiveness (ACE) Initiative. *Expert Rev Pharmacoecon Outcomes Res.* 2008;8:593-617.

24. Carter R, Moodie M, Markwick A, et al. Assessing cost-effectiveness in obesity (ACE-obesity): an overview of the ACE approach, economic methods and cost results. *BMC public health.* 2009;9:419.

25. Siegel JE, Weinstein MC, Russell LB, Gold MR. Recommendations for reporting cost-effectiveness analyses. Panel on Cost-Effectiveness in Health and Medicine. *JAMA : the journal of the American Medical Association.* 1996;276(16):1339-1341.

26. Drummond M, Scuplher M, Torrance G, O'Brien B, Stoddard G. *Methods for the Economic Evaluation of Health Care Programmes.* Oxford: Oxford University Press; 2005.

27. Gold MR, Siegel JE, Russell LB, Weinstein MC. *Cost-effectiveness in Health and Medicine.* Oxford University Press; 1996.

28. Vos T, Carter R, Doran C, Anderson I, Lopez A, A W. *ACE–Prevention Project 2005–09 Economic Evaluation Protocol* September 2007.

29. Haby MM, Vos T, Carter R, et al. A new approach to assessing the health benefit from obesity interventions in children and adolescents: the assessing cost-effectiveness in obesity project. *International Journal of Obesity.* 2006;30(10):1463-1475.

30. Vos T, Carter R, Barendregt J, et al. *Assessing cost-effectiveness in prevention (ACE-Prevention): final report.* Brisbane: University of Queensland and Deakin University;2010.

31. Finkelstein EA, Trogdon JG. Public health interventions for addressing childhood overweight: Analysis of the business case. *American Journal of Public Health.* 2008;98(3):411-415.

32. Trasande L, Chatterjee S. The Impact of Obesity on Health Service Utilization and Costs in Childhood. *Obesity.* 2009;17(9):1749-1754.