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Implementing federal food service guidelines in federal and private worksite cafeterias in the United States leads to improved health outcomes and is cost saving

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Human subjects protection The Partners Institutional Review Board issued an exemption for this study as it used only de-identified data from publicly available resources and did not involve any human participation.

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Abstract

Poor diet increases cardiometabolic disease risk, yet the impact of food service guidelines on employee health and its cost effectiveness is poorly understood. Federal food service guidelines (FFSG) aim to provide United States (U.S.) government employees with healthier food options. Using microsimulation modeling, we estimated changes in the incidence of cardiometabolic disease, related mortality, and the cost effectiveness of implementing FFSG in nationally representative model populations of government and private company employees across 5 years and lifetime. We based estimates on changes in workplace intake of six FFSG dietary targets and showed lifetime reductions of heart attacks (– 107/million), strokes (– 30/million), diabetes (– 134/million), ischemic heart disease deaths (– 56/million), and stroke deaths (– 8/million). FFSG is cost saving overall, with total savings in discounted healthcare costs from $4,611,026 (5 years) to $539,809,707 (lifetime) $U.S. This study demonstrates that FFSG improves health outcomes and is cost saving.

Keywords

Diet; Government; Health policy; Workplace

Introduction

Approximately 24% of employed adult workers in the United States (U.S.) consume foods and beverages obtained at their workplace during their work week [1, 2]. The prevalence of obesity, one of the biggest modifiable risk factors for cardiovascular disease (CVD) and diabetes, has increased from approximately 30% to 40% among adults in the United States between 1999 and 2018 [3]. The highest percent of obesity (44.8%) is among adults aged 40–59 in 2017–2018, who make up approximately 41% of all working adults [4]. Providing workers with workplace meal choices that meet dietary guidelines [5] can improve health outcomes. Food service guidelines in worksites are a policy tool to improve access to healthier food and beverages [6, 7]. The U.S. Federal Food Service Guidelines (FFSG) [8] aim to provide employees in federal facilities [9] with healthier food options through contractual obligations (contract food services) with food vendors, who must adhere to food and nutrition standards and provide improved educational and choice architecture promoting behavioral change. New and renewal contracts require vendors to immediately implement FFSG; implementation remains voluntary for those with current contracts [10].

Despite the established etiologic link between diet quality and cardiometabolic diseases [11, 12], and small reductions in cancer resulting from diets lower in red and processed meats [13], the health impact of food service guidelines are not well understood outside of hospital cafeterias [14] and there is little evidence on its cost-effectiveness [15, 16]. There is no evidence on the impact of FFSG on health outcomes or its cost effectiveness.

We addressed these critical gaps in knowledge by using a validated microsimulation model [17] to estimate health outcomes and the cost effectiveness of FFSG implementation in federal workplace cafeterias, as well evaluating the extension of FFSG to large private sector companies with at least 500 full-time employees [18].

Methods

The intervention in this analysis is the implementation of FFSG in the U.S. federal workplace and large, private employer cafeterias, respectively. We modeled the resulting changes in cardiometabolic health outcomes and related mortality from consumption changes in six FFSG dietary targets s (fruits, vegetables, whole grains, processed meat, sodium, and sugar-sweetened beverages) that have been shown to be large contributors to cardiometabolic-related deaths in the U.S. [11, 12]. We also performed a cost-effectiveness analysis of the intervention.

Base case and intervention dietary habits

For the base case (FFSG not implemented), we used dietary intake as reported in the 2009–2016 NHANES surveys [19] in non-school cafeterias only (excluding vending machine foods) to estimate the average amounts and types of specific foods and beverages consumed in the workplace using 1-day and 2-day recall periods. For the intervention (FFSG implemented), we adjusted these mean intakes by the percent changes in food and beverage consumption changes in workplace cafeterias as reported in Table 1. We estimated intervention effect sizes for this analysis by reviewing results from a prior systematic review and meta-analysis of evidence for the impact of workplace wellness programs on dietary change and measures of adiposity [20]. Then we focused on studies with interventions that targeted food nutrition standards or promoted similar behavioral changes to FFSG. We converted effect sizes reported as per-meal changes in consumption to changes in percentage of daily consumption and adjusted to reflect an average weekly consumption of two meals per week, based on the number of meals sold in federal facility cafeterias in the National Capital Region 11 in 2015. There were no studies on the consumption of processed meats in workplace interventions so we estimated an effect size based on reported workplace dietary sodium intake from the National Health and Nutrition Examination Surveys (NHANES) at lunch [21]. There is also no published evidence on workplace interventions targeting whole grains so we estimated an effect size from a study of food package revision changes to WIC (Special Supplemental Nutrition Program for Women, Infants and Children) [22], designed by nutritionists, physicians, and other health professionals working for the Food and Nutrition Service (FNS) of the United States Department of Agriculture (USDA) and at individual state WIC agencies [23], to increase the intake of fruits, vegetables, and whole grains by mother–child pairs. We summarized detailed information on the methods for the literature review, assumptions, and calculations of all six effect size estimates and present in Memo 1 (Supplementary Material).

Model populations

Using sampling with replacement, we created a nationally representative population of one-million full-time employees aged 35–65 working at least 35 h per week using data for federal, state, and local government employees from 2009 to 2016 NHANES surveys [26] as their CVD risk factor profiles were similar (Supplementary Material, Figure S1). We created a second population of one-million full-time private sector workers aged 35–65 from the same NHANES cycles, using the same methods.

Model description

CVD PREDICT [17] is a validated microsimulation model that uses a representative U.S. population to predict health outcomes, associated costs, and cost effectiveness of specific dietary and policy interventions (Supplementary Material, Figure S2) [27, 28]. The model uses individual-level CVD risk factors (age, sex, race, current smoking status, diabetes status, systolic blood pressure, total cholesterol) to calculate annual CVD risk transition probabilities. Individuals age through the model over defined time horizons, with disease transition probabilities updated annually, including remaining disease free, having a first or recurrent CVD event (myocardial infarction, cerebrovascular accident, and ischemic heart disease), or dying from CVD or other causes. We applied evidence-based age-specific relative risks (Table 1) in the model [11, 12, 29, 30]. Based on their health state, acute and chronic healthcare costs (Supplementary Material, Table S1) and health state utilities (Supplementary Material, Table S2) are applied to individuals annually. The model generates numbers of ischemic and cerebrovascular events (morbidity), related mortality, and quality-adjusted life years (QALYs), and costs associated with the intervention. Cost effectiveness is calculated as the incremental cost-effectiveness ratio (ICER) comparing the health outcomes and total costs due to the intervention, compared to the base case. Both costs and health benefits were discounted at an annual rate of 3% [31].

Intervention costs

We standardized all costs, adjusted for inflation [32], and reported in 2018 $U.S.D. We excluded workplace consumption of food from vending machines in our cost estimates as we found no data for vending machine expenditures or changes in consumption in the federal workplace setting. We found no evidence to suggest economic benefit or harm to the individual consumer because of paying more for higher quality meals at work.

Our comprehensive description of cost assumptions and calculations appear in Memo 2 (Supplementary Material). Our key methodological assumptions for intervention cost calculations were (1) there would be no vendor FFSG implementation costs, as all costs are passed to the client, as permitted by 'no-cost' government contracts [33]; (2) the government would incur only program administration costs, which we estimate to be 0.7637% of client costs, as the General Services Administration (GSA) budget includes the cost of administering real estate and acquisition costs [34]; (3) the ratio of meals sold per employee in Capitol Region 11 is similar to other regions in the U.S.

No-cost government contracts allow food vendors to pass on costs associated with providing products complying with the food nutrition standards of FFSG directly to the consumer, while prohibiting charges to the government for these costs. We used the National School Lunch Program (NSLP) implementation experience [35], a similar federal program to FFSG, to estimate client costs and assumed: (1) federal employees would purchase an average of 2 meals per week in the base case; (2) an average cost of $4.61 per meal; and (3) a price per meal increase of 8.1% ($0.37). Cost inputs for the intervention included use of the average cost of implementing food nutrition standards to meals in the National School Lunch Program over five years. Specifically, the average costs from the NLSP included overall cost changes, food, labor, and state administrative costs.

In the base case, we assumed no change in either the price per meal or average number of meals purchased weekly after implementation of FFSG. We estimated annual employee costs of implementing the FFSG for over 2 million federal employees to be $72,857,488 and government program administration costs at $556,471 (0.76% of employee costs).

Data analysis and perspectives

We conducted our analysis from a government perspective and included all administrative costs for the intervention and downstream healthcare costs averted or induced by it, because the government is responsible for a large proportion of their employees' health insurance [36]. We included program administration costs and formal healthcare costs, as recommended for cost-effectiveness analyses in health and medicine [37]. We assessed both changes in health outcomes and the cost effectiveness across two time horizons. Lifetime simulations, which assumed no change to the current FFSG, estimated the costs and benefits for the current employed cohort, with individuals dropping out of the analysis when they died or reached age 70, which is the age when approximately 68% of U.S. workers retire [38]. A 5-year time horizon-simulated outcomes if current FFSGs are updated 5 years after being issued. We created an open cohort that brought in new 35 year olds entering each year to account for trends in risk factor demographics. These trends capture changes in risk factors for CVD with increasing age, as well as over time as better treatments to manage the condition may become available.

Sensitivity analysis

First, we scaled all observed costs and benefits to all the U.S. full-time government and private sector workers, respectively. Next, we added an increase of 8.1% ($0.37) in the price per meal to the intervention costs to explore the impact on model estimates. A case study of FFSG implementation in a federal cafeteria showed customers purchased 34% more meals [39] after implementation; thus, we performed sensitivity analyses for 25% and 50% increases in the number of meals purchased, while assuming no increase in per-meal cost. We performed a threshold analysis of incremental cost-effectiveness ratios (ICERs) to determine the per-meal cost increases that would keep the intervention below the commonly accepted U.S. healthcare cost thresholds of $150,000 per Quality-Adjusted Life Year (QALY) and $50,000 per QALY [40, 41]. In the absence of published estimates of implementation and program costs to private employers, we doubled the government program administration costs (0.76% to 1.52%) to explore the impact on outcomes. The study team performed probabilistic sensitivity analyses (PSA) over the lifetime horizon for the main analysis by jointly incorporating the uncertainty distributions of key model parameters, including costs and utilities (Supplementary Material Table S3). We performed one thousand simulations and generated 95% uncertainty intervals [42].

Results

Population characteristics and mean daily intake of the dietary targets for the government model population used in the main analysis are provided in Supplementary Material Table S4. In this population, the intervention was estimated to result in reductions in cardiometabolic events and CVD mortality, compared to the base case: a lifetime reduction in the number of heart attacks (– 107/million), strokes (– 30/million), cases of diabetes (– 134/million), deaths from ischemic heart disease (– 56/million), and deaths from stroke (– 8/million) (Supplementary Material Table S5). The per-person cost for the intervention is $1.27 (5 years) and $3.82 (lifetime) (Supplementary Material Table S6), and it is estimated to be cost saving across both time horizons (Table 2). When the benefits of the intervention are expanded to include full-time employees in both government and private sectors over the lifetime horizon, the intervention remains cost saving (Table 2).

We estimated expanding the intervention to all government and private full-time employees [18] at large companies to generate $752,070,585 in combined total healthcare costs savings over the lifetime horizon (Table 3).

In both sectors, the largest healthcare costs savings come from chronic care over a lifetime and from acute care over 5 years. Among approximately 15 million full-time government workers [43] aged 35–65, estimated overall savings in healthcare costs range from $4,611,026 (5-year horizon) to $212,260,877 (lifetime horizon). The estimated costs of administering the intervention for government workers range from $19,520,008 (5 years) to $58,713,726 (lifetime). Adding an annual increase of 8.1% per-meal cost to the intervention costs results in the intervention no longer being cost saving or cost effective (Table 4). When there is no increase in the cost of meals but 25% and 50% per capita increases of in the number of meals purchased, the intervention remains cost saving across the lifetime horizon (Table 4).

The threshold analysis (Supplementary Material Table S5) shows that an increase of 0.5% and 1% in meal costs would result in the intervention being cost effective at the $50,000/QALY and $150,000/QALY thresholds, respectively. The probabilistic sensitivity analyses projected that the intervention remained cost effective over 1000 runs with all results estimated to be less expensive and more effective compared to not implementing the FFSG (Supplementary Material Figure S3).

Discussion

Our microsimulation modeling estimates that implementing FFSG in government facility cafeterias will yield modest improvements in cardiometabolic health outcomes and related mortality, despite the relatively small number of overall meals consumed in the workplace; this is consistent with evidence from worksite dietary interventions [45].

Our study projects intervention cost saving overall in government and private employer settings, with potential overall healthcare costs savings ranging from $4,611,026 (5 years) to $539,809,707 (lifetime). The largest savings in healthcare costs over 5 years are from acute care, while the largest lifetime savings come from chronic care up to age 70, consistent with what would be expected with advancing age and competing morbidities. The FFSG only requires that 40–60% of food choices offered by vendors meet the specified food nutrition standards and analysis assumes this level of compliance. If vendors exceed this level of compliance, then our results underestimate effects and, if they fail to meet the required threshold, our results would overestimate effects.

If increased per-meal costs of 8.1% per meal per year are added to the client intervention costs, the intervention becomes cost ineffective. The threshold analysis shows that maintaining cost effectiveness for this intervention requires per-meal price increases capped at 0.5%–1.0%. However, this analysis including the 8.1% price increases overstates the true social cost increases, because the higher food prices may reflect higher utility value of the purchased food. That is to say that the demand for healthier foods is high and thus consumers are willing to pay more for these meals, even at an increased cost. In the absence of published costs, these results provide first estimates toward determining accurate cost breakdowns for FFSG implementation.

We recognize that private employers face different operational costs than government. Our additional analysis, doubling intervention costs for private employers, shows the intervention remained cost saving with improved health outcomes (results not shown), consistent with the main analysis. These results provide private employers with a benchmark to consider when weighing their willingness to pay for improved health outcomes against budgetary considerations (such as costs of contributions to employee health insurance premiums) as part of employee benefits policies. Sensitivity analyses exploring the effect of a 25%—50% increase in the consumption of average weekly meals over the base case show an increase in cost savings. This increase in consumption is consistent with evidence that workers value more nutritious workplace meals even if it costs more [39, 46].

Strengths and limitations

The CVD PREDICT model allows for individual-level assignment of known risk factors, annual adjustment of probabilities for developing disease, experiencing events, and accounting for potential confounding by multiple risk factors and competing causes of morbidity and mortality. Excluding consumption of foods subject to FFSG from vending machines due to the lack of available costing data likely means we are underestimating the full effect of the FFSG. There are currently no published direct cost estimates or cost measures related to FFSG implementation and our costs exclude startup implementation cost. However, estimation of annual program costs for implementation does incorporate initial costs based on the average of the first 5 years of implementing the NSLP, a similar federal program with less stringent vendor standards, thus, providing a reasonable estimate of implementation costs. The current FFSG require that at least 75% of products provided by vendors meet specific food nutrition standards. This is likely to result in reduced additional costs to the vendor, compared to policies requiring 100% implementation. A large government agency in Los Angeles County implemented such a policy [47]; during implementation, observers saw a drop in sales and vendor revenue for both beverages and foods. We are, thus, likely underestimating the benefits of FFSG implementation by excluding the impact of consuming more nutritious food products from vending machines.

We also note that consumption patterns of employees in US Capitol Region 11 may not be representative of all government employees, and thus, our results may not be representative of the overall government experience with implementation. Our analysis did not account for costs due to absenteeism; this remains to be explored in future work.

There is limited evidence on the etiologic effects of dietary changes in workplace settings; therefore, we restricted our analysis to dietary targets for which there is significant evidence of strong etiologic relationships with CVD. We used relative risks from studies that address measurement error due to the independent and joint effects of dietary targets on health outcomes, multivariate-adjusted relative risks derived from meta-analyses of prospective studies, and those with assessments of measurement validity [12, 13]. We did not include an assessment of dietary intake on cancer risk [48] in this analysis, likely resulting in an additional underestimate of the true health benefits from consuming more nutritious meals in workplace cafeterias.

Conclusions

This is one of the first studies to investigate the impact of FFSG on both health outcomes for employees and its cost effectiveness. Our results suggest that implementing FFSG leads to modest improvements in cardiometabolic health and is cost saving but more work on costing is needed. Given that American workers consume almost twice as much free food as purchased food at work [2], future work should also evaluate the effects of extending FFSG to workplace events with catered food.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Onufrak SJ, Zaganjor H, Moore LV, et al. Foods Consumed by US Adults From Cafeterias and Vending Machines: NHANES 2005 to 2014. Am J Health Promot. 2019;33(5):666–74. [PubMed: 30602283]
2. Onufrak SJ, Zaganjor H, Pan L, et al. Foods and beverages obtained at worksites in the United States. J Acad Nutr Diet. 2019;119(6):999–1008. [PubMed: 30683617]
3. Hales CM, Carroll MD, Fryar CD, et al. Prevalence of obesity and severe obesity among adults: United States, 2017–2018. NCHS Data Brief. 2020;360:1–8.
4. Bureau of Labor Statistics. Labor Force Statistics from the Current Population Survey, 2017. Washington, D.C.: United States Department of Labor. Contract No. March 4.
5. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th Edition. December 2015.

6. Korre M, Tsoukas M, Frantzeskou E, et al. Mediterranean diet and workplace health promotion. Curr Cardiovasc Risk Rep. 2014;8(12):1–7.
7. Raulio S, Roos E, Prättälä R. School and workplace meals promote healthy food habits. Public Health Nutr. 2010;13(6A):987–92. [PubMed: 20513270]
8. Food Service Guidelines Federal Workgroup; Department of Health and Human Services. Washington, DC: Food Service Guidelines for Federal Facilities. 2017.
9. FedScope Employment Cube: December 2017. 2017. https://www.opm.gov/data/index.aspx.
10. D'souza V Federal food service operations: implementation of the HHS/GSA Health and Sustainability Guidelines. Washington, DC: United States Government Accountability Office. 2014.
11. Micha R, Peñalvo JL, Cudhea F, et al. Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the united states. JAMA. 2017;317(9):912–24. [PubMed: 28267855]
12. Micha R, Shulkin ML, Penalvo JL, et al. Etiologic effects and optimal intakes of foods and nutrients for risk of cardiovascular diseases and diabetes: Systematic reviews and meta-analyses from the Nutrition and Chronic Diseases Expert Group (NutriCoDE). PLoS ONE. 2017;12(4):e0175149. [PubMed: 28448503]
13. Vernooij RWM, Zeraatkar D, Han MA, et al. Patterns of red and processed meat consumption and risk for cardiometabolic and cancer outcomes: a systematic review and meta-analysis of cohort studies. Ann Intern Med. 2019;171(10):732–41. [PubMed: 31569217]
14. Moran A, Lederer A, Johnson Curtis C. Use of nutrition standards to improve nutritional quality of hospital patient meals: findings from New York City's Healthy Hospital Food Initiative. J Acad Nutr Diet. 2015;115(11):1847–54. [PubMed: 26320410]
15. Rice L, Benson C, Podrabsky M, et al. The development and adoption of the first statewide comprehensive policy on food service guidelines (Washington State Executive Order 13–06) for improving the health and productivity of state employees and institutionalized populations. Transl Behav Med. 2019;9(1):48–57. [PubMed: 30590860]
16. Mckinnon RA, Siddiqi SM, Chaloupka FJ, et al. Obesity-related policy/environmental interventions: a systematic review of economic analyses. Am J Prev Med. 2016;50(4):543–9. [PubMed: 26707464]
17. Pandya A, Sy S, Cho S, et al. Validation of a cardiovascular disease policy microsimulation model using both survival and receiver operating characteristic curves. Med Decis Making. 2017;37(7):802–14. [PubMed: 28490271]
18. United States Census Bureau. Number of establishments with corresponding employment change by employment size of the enterprise for the United States and all states, totals: 2015–2016. Washington, DC: United States Census Bureau; 2019.
19. National Health and Nutrition Examination Dietary Data (NHANES). Hyatsville, MD: Department of Health and Human Services, Centers for Disease Control and Prevention, 2009–2016. Department of Health and Human Services, Centers for Disease Control and Prevention. 2009–2016. https://wwwn.cdc.gov/nchs/nhanes/Search/DataPage.aspx?Component=Dietary.
20. Penalvo Jose L, Micha R, Smith Jessica D, et al. Do worksite wellness programs improve dietary behaviors and adiposity? A systematic review and meta-analysis (Abstract MP005). Circulation 2017;135(suppl_1):AMP005–AMP.
21. National Health and Nutrition Examination Dietary Data (NHANES). Hyatsville, MD: Department of Health and Human Services, Centers for Disease Control and Prevention, 2009–2014. Department of Health and Human Services, Centers for Disease Control and Prevention. 2009–2014. https://wwwn.cdc.gov/nchs/nhanes/Search/DataPage.aspx?Component=Dietary.
22. Odoms-Young AM, Kong A, Schiffer LA, et al. Evaluating the initial impact of the revised Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) food packages on dietary intake and home food availability in African-American and Hispanic families. Public Health Nutr. 2014;17(1):83–93. [PubMed: 23544992]
23. National Research Council Panel to Evaluate the USDA'S methodology for estimating eligibility participation for the W. I. C. Program. Estimating Eligibility and Participation for the WIC

Program: Final Report. Estimating Eligibility and Participation for the WIC Program: Final Report. 2003.

24. Lassen AD, Beck A, Leedo E, et al. Effectiveness of offering healthy labelled meals in improving the nutritional quality of lunch meals eaten in a worksite canteen. Appetite. 2014;75:128–34. [PubMed: 24373732]
25. French SA, Harnack LJ, Hannan PJ, et al. Worksite environment intervention to prevent obesity among metropolitan transit workers. Prev Med. 2010;50(4):180–5. [PubMed: 20079369]
26. National Health and Nutrition Examination Survey Data (NHANES). Hyatsville, MD: Department of Health and Human Services, Centers for Disease Control and Prevention, 2009–2016. Department of Health and Human Services, Centers for Disease Control and Prevention. 2009–2016. https://wwwn.cdc.gov/nchs/nhanes/default.aspx.
27. Lee Y, Mozaffarian D, Sy S, et al. Cost-effectiveness of financial incentives for improving diet and health through Medicare and Medicaid: a microsimulation study. PLoS Med. 2019;16(3):e1002761. [PubMed: 30889188]
28. Mozaffarian D, Liu J, Sy S, et al. Cost-effectiveness of financial incentives and disincentives for improving food purchases and health through the US Supplemental Nutrition Assistance Program (SNAP): a microsimulation study. PLOS Med. 2018;15(10):e1002661. [PubMed: 30278053]
29. Rehm CD, Peñalvo JL, Afshin A, et al. Dietary intake among US adults, 1999–2012. JAMA. 2016;315(23):2542–53. [PubMed: 27327801]
30. Micha R, Kalantarian S, Wirojratana P, et al. Estimating the global and regional burden of suboptimal nutrition on chronic disease: methods and inputs to the analysis. Eur J Clin Nutr. 2012;66(1):119–29. [PubMed: 21915137]
31. Weinstein MC, Russell LB, Gold MR, et al. Cost-effectiveness in health and medicine. Oxford: Oxford University Press; 1996.
32. U.S. Department of Labor. The Bureau of Labor Statistics' Consumer Price Index 2017. https://www.bls.gov/data/#prices.
33. U. S. Government Accountability Office (GAO). Appropriations Law Forum (2008): GAO Fact Sheet: No Cost Contracts 2008. https://docslib.org/gao-fact-sheet-no-cost-contracts.
34. U.S. General Services Administration. 2018 Agency Financial Report. U.S. Government; 2018. https://www.gsa.gov/reference/reports/budget-performance/annual-reports/2018-agency-financial-report.
35. Concannon K In: Agriculture, DO, editor. Federal Register: Nutrition Standards in the National School Lunch and School Breakfast Programs, Final Rule. Washington, D.C.: Food and Nutrition Service (FNS), USDA; January 26, 2012.
36. U.S. Office of Personnel Management (OPM). Federal employees guide me: insurance 2017. https://www.opm.gov/healthcare-insurance/Guide-Me/Federal-Employees/Health/How-much-do-I-pay-for-coverage/#url=Overview.
37. Neumann PJ, Sanders GD, Russell LB, et al. Cost-effectiveness in health and medicine. Oxford: Oxford University Press; 2016.
38. Hipple SF. People who are not in the labor force: why aren't they working? Beyond the Numbers: Employment and Unemployment, vol. 4, no. 15 U.S. Bureau of Labor Statistics.
39. Ai B, Hair E, Harris Brewer K, et al. The HHS Hubert H. Humphrey Building Cafeteria Experience: Incorporation of the Dietary Guidelines for Americans, 2010 into Federal Food Service Guidelines. Prepared by NORC at the University of Chicago. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation, Washington, DC; May, 2012 May, 2012.
40. Neumann PJ, Rosen AB, Weinstein MC. Medicare and cost-effectiveness analysis. N Engl J Med. 2005;353(14):1516–22. [PubMed: 16207857]
41. Neumann PJ, Cohen JT, Weinstein MC. Updating cost-effectiveness—the curious resilience of the $50,000-per-QALY threshold. N Engl J Med. 2014;371(9):796–7. [PubMed: 25162885]
42. Hatswell AJ, Bullement A, Briggs A, et al. Probabilistic sensitivity analysis in cost-effectiveness models: determining model convergence in cohort models. Pharm Econ. 2018;36(12):1421–6.
43. Wise R Employment and Wages, Annual Averages 2017. Washington, DC: U.S. Bureau of Labor Statistics; 2017.

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44. Employee Tenure Summary [Press Release]. Washington, DC: U.S. Bureau of Labor Statistics; 2018.
45. Geaney F, Kelly C, Greiner BA, et al. The effectiveness of workplace dietary modification interventions: a systematic review. Prev Med. 2013;57(5):438–47. [PubMed: 23850518]
46. Price S, Hartwell H, Hemingway A, et al. Workplace foodservice; perception of quality and trust. Appetite. 2016;97:169–75. [PubMed: 26686582]
47. Wickramasekaran RN, Robles B, Dewey G, et al. Evaluating the potential health and revenue outcomes of a 100% healthy vending machine nutrition policy at a large agency in Los Angeles county, 2013–2015. J Public Health Manag Pract. 2018;24(3):215–24. [PubMed: 29227423]
48. Ubago-Guisado E, Rodríguez-Barranco M, Ching-López A, et al. Evidence update on the relationship between diet and the most common cancers from the European Prospective Investigation into Cancer and Nutrition (EPIC) study: a systematic review. Nutrients. 2021. 10.3390/nu13103582.

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Key messages

- Federal food service guidelines require food vendors in workplace cafeterias to sell meals with healthy nutritional profiles.
- Nutritious meals sold in workplace cafeterias have the potential to improve the overall, daily dietary intake of employees who regularly purchase food at work.
- We demonstrate that implementing federal food service guidelines in government cafeteria has the potential to improve health outcomes for employees and is cost saving for the government.

Table 1

Intervention effect sizes and range of age-specific relative risks in analysis

Dietary targets (units of consumption) and FFSG requirements for foods offered for sale in cafeterias[a] [8]	Expected change in daily consump tion in workplace cafeteria foods[b] (%)	Sources[c]	Range of age-specific relative risks of cardiometabolic diseases[d] (units) [11]
Fruits[e] (g/day): Offer at least 3 fruits (no added sugar)	3.50	Lassen [24]	0.64–0.97 (100 g/day)
Vegetables[e] (g/day): Offer at least 3 vegetables (not fried)	3.50	Lassen [24]	0.77–0.98 (100 g/day)
Sugar sweetened beverages (8-oz servings): Mild and fortified soy beverage: low-fat without added sugars 100% juice only with no added sugars ≥ 50% of beverage choices contain < 40 kcal per 8 fluid ounces (excluding 100% fruit juice)	− 2.40	French [25]	0.66–0.92 (8 oz/day)
Whole grains[f] (g/day): Offer half of total grains as whole grain products	1.30	Odoms-Young [22]	0.83–0.98 (50 g/day)
Processed meat[g] (g/day): none	− 1.20	NHANES [21]	0.55–0.86 (50 g/day)
Sodium [g] (mg/day): <600 mg/entree or < 800 mg/meal (with the potential of affecting processed meat provision at the cafeteria)	− 0.80	NHANES [21]	SBP change (mmHg) 1.87–5.84 (2300 mg/day)

[a] Federal Food Service Guidelines Dietary Targets for Prepared Meals

[b] Final change in daily consumption used in analyses after adjusting effect sizes from reviewed studies to reflect the analytic assumption that the average purchase of 2 meals per week in workplace cafeterias in the National Capital Region in 2015 reflects the typical number of meals purchased and consumed per capita, per week by employees in all 11 federal regions

[c] Full details for the calculation of effect sizes from the individual studies and sources appear in Memo 1 (Supplementary Material)

[d] Age-specific and outcome-specific relative risks (RRs) [11] applied to individuals in the model as described in Memo 1 (Supplementary Material). The RRs are standardized magnitudes of effect sizes for cardiometabolic outcomes (hypertension, coronary heart disease, ischemic stroke, hemorrhagic stroke, diabetes) and related mortality. We note RR changes per unit of consumption for individual dietary targets on a daily basis in parentheses

[e] Net difference in reported change due to the intervention split equally: (54%–21%)/2

Table 2

Cost effectiveness of implementing federal food service guidelines (2018 $U.S.), per person

	Discounted cost[b]	Discounted QALY[c]	ICER[d]
Main analysis: government employees only			
Lifetime model[a]			
Usual care	20,124.97	13.5158	
Intervention	20,111.16	13.5161	Cost saving
5-year model			
Usual care	5656.05	4.62	
Intervention	5655.74	4.62	Cost saving
Expanded analysis: all full-time employees [e]			
Lifetime model[a]			
Usual care	26,050.35	14.7658	
Intervention	26,019.32	14.7667	Cost saving

[a]Time from age of entry into the model until death or age 70

[b]Discounted cost in 2018 $US

[c]Discounted Quality-Adjusted Life Years

[d]Incremental Cost-Effectiveness Ratio

[e]All full-time government and private sector employees

Table 3

Estimated average discounted healthcare costs savings over 5 years and lifetime, by employment sector, in millions of $US (2018), compared to base case (no implementation of FFSG)

	Government employees[a]	Private sector employees[a]	Total
Lifetime model [b]			
Total	$212,260,877	$539,809,707	$752,070,585
Acute	$116,966,349	$297,462,120	$414,428,469
Chronic	$151,702,741	$385,801,724	$537,504,466
Drug	$2,305,513	$5,863,248	$8,168,761
Intervention	$58,713,726	$149,317,385	$208,031,110
Five-year model			
Total	$4,611,026	$11,726,496	$16,337,522
Acute	$17,521,897	$44,560,685	$62,082,583
Chronic	$6,455,436	$16,417,095	$22,872,530
Drug	$153,701	$390,883	$544,584
Intervention	$19,520,008	$49,642,167	$69,162,175

Costs and quality-adjusted life years (QALYs) were discounted by 3% annually

All costs inflated to constant 2018 $U.S. dollars using the Bureau of Labor Statistics' Consumer Price Index [32]

Healthcare cost savings calculated as averted direct costs from chronic/acute disease states, surgical procedures, screening, and drug use; excludes production and consumption costs

[a]Employee populations scaled to include non-seasonal, full-time workers aged 35 and over in the government sector (15,370,085) and at private employer with at least 500 workers (39,088,321) [43, 44]

[b]Time from age of entry into the model until death or age 70

Table 4

Results for additional analyses

	Discounted cost[b]	Discounted QALY[c]	ICER[d]
Annual 8.1% increase in cost per meal added to intervention cost (base case)			
Lifetime model[a]			
Usual care	20,124.97	13.5158	
Intervention	20,610.78	13.5161	1,619,366.67
Increase of 25% in number of meals purchased (consumption)			
Lifetime model[a]			
Usual care	20,124.97	13.5158	
Intervention	20,107.07	13.5162	Cost saving compared to usual
Increase of 50% in number of meals purchased (consumption)			
Lifetime model[a]			
Usual care	20,124.97	13.5158	
Intervention	20,102.06	13.5163	Cost saving compared to usual

[a] Time from age of entry into the model until death or age 70

[b] Discounted Cost in 2018 $U.S

[c] Discounted Quality-Adjusted Life Years

[d] Incremental Cost-Effectiveness Ratio