

# The Cost-Effectiveness of Interventions for Reducing Obesity among Young Children through Healthy Eating, Physical Activity, and Screen Time

Healthy Eating  
Research



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*This brief provides an overview of the goals of cost-effectiveness analysis, the evidence thus far on the cost-effectiveness of different strategies to prevent obesity in the places where very young children (0- to 5-year-olds) live, learn, and play, and the evidence that is still needed for informed decision-making.*

## Introduction

As the prevalence of obesity among children has increased,<sup>1</sup> many public health advocates and researchers have looked to early childhood as a critical period for intervention to improve young children's eating, physical activity, and screen time behaviors.<sup>2,3</sup> Children with obesity are far more likely to have obesity in adulthood,<sup>4</sup> and treating obesity in adulthood is very difficult.<sup>5</sup> Preventing obesity in the early years, before related chronic diseases develop and poor diet and physical activity behaviors become entrenched, is an important public health action goal.



While there is a clear need for early intervention, identifying what should be done is a harder task. Although evidence for programs that improve children's body-mass index (BMI) or obesity status in early childhood is growing quickly, to date there are still few programs that have yet been evaluated using experimental study designs that demonstrate impacts on young children's weight. As a result, it is difficult to know for certain which interventions will truly have an impact. Additionally, even when research has identified an effective intervention for preventing childhood obesity, it is often difficult to know what impact an intervention could have if it were implemented in the real world. Identifying how many children could actually be reached, what the impact on childhood obesity would be, whether it is a good value for money, how implementation could vary by disparities in resources, and whether interventions could either promote health equity or worsen health inequities by socioeconomic position and race/ethnicity is difficult.

Cost-effectiveness analysis (CEA) can help decisionmakers envision what an intervention's potential for real population impact could be by combining data on an intervention's health effects with estimates of the intervention's costs and the number of children who would be reached. CEA can inform decisionmakers' choices between different obesity prevention strategies by helping to identify the relative costs, health benefits, and health care cost savings of implementing one strategy compared to other strategies.

One caveat with early childhood obesity prevention interventions is that few show healthcare cost savings over the short run – say a ten year time frame. Even among young children with obesity, healthcare costs are nowhere near as large as they are for adults with obesity,<sup>6</sup> because most of the expensive chronic conditions resulting from persistent obesity (such as Type 2 diabetes, cardiovascular disease, and orthopedic issues) typically do not show up until adulthood. Thus, early childhood interventions reap far fewer financial benefits in the short run than adult-focused interventions, though they may result in longer term benefits as well as other, non-financial benefits (like improved nutrition knowledge) that are still valuable to society. Additionally, very few health interventions in any age group are cost-saving. As a society, we choose to pay for many interventions that do not reap immediate financial benefits – education is probably the best example. There are a number of early childhood health interventions that have been shown to be cost-saving over a life time, such as vaccines<sup>7</sup> and neonatal intensive care for very low birthweight infants.<sup>8</sup> In the future we may have evidence for longer term impact of early childhood obesity interventions. In the meantime, we can use CEA to find strategies that are the best value for the money spent.

### What is cost-effectiveness analysis?

CEA considers both the costs and health outcomes of different possible courses of action. CEA can compare two or more health interventions, one of which may represent the status quo, to learn not only which interventions produce the most health benefit (e.g., which interventions prevent the most cases of childhood obesity), but also how much that additional benefit costs. This information can be useful to help decisionmakers identify interventions that produce the most health benefit possible with limited resources. In other words, CEA helps decisionmakers identify which interventions will give the most value for money spent.

In CEA, costs are typically calculated using a societal perspective, tallying all of the costs related to the intervention, regardless of who pays them or when they occur. This often captures costs, and cost savings, that do not show up in a single implementing organization's program budget. For example, an intervention may depend on the time of volunteers, which, while not paid for directly out of a program budget, is still a cost in that is time that the volunteers could have been spending on something else. CEAs that focus on childhood obesity prevention include the downstream savings in healthcare costs associated with reductions in future cases of obesity.

### What's the difference between cost-effectiveness analysis and return on investment?

Often people casually talk about the “return on investment” (ROI) in public health interventions. This can be confusing since, in business economics, analysis of ROI is usually concerned solely with financial returns to the investor. For example, a manufacturing company might do an ROI analysis to inform a decision about investing in a new piece of equipment for a factory. Similarly, policymakers must consider the return that will come from spending money on a public health intervention. While the principal concern of the manufacturing company deciding about equipment is financial return on investment, for those investing in public health interventions such as childhood obesity prevention, the primary goal is improved health and quality of life – not just financial returns. Therefore, usually for public health interventions, we are more interested in CEA, not ROI. The reason: CEA analyzes both the financial returns (offset by intervention costs) and health benefits simultaneously.

### The Evidence

The following research has been conducted by the Childhood Obesity Intervention Cost-Effectiveness Study (CHOICES). To date, few studies have focused on the cost-effectiveness of obesity prevention interventions for children under the age of 5 years. CHOICES compares what would happen if various obesity prevention strategies were put in place in the U.S. population. CHOICES projects compare this action with what is projected to happen in the absence of an intervention, and then it estimates the costs, health impact, number of children reached, and healthcare cost savings that would occur over a ten-year time period. To decide which interventions to model, the CHOICES Project engaged a diverse group of stakeholders, including research scientists; public health department officials; leaders of community organizations; policy consultants; pediatricians; registered dietitians; grocery industry leaders; and public health lawyers. This group was charged with reviewing and selecting potential strategies that were: supported by evidence of impact on children's body weight, energy intake, or energy expenditure and based on experimental studies using objective measures; had the potential to be implemented on a broad scale; and were of interest to policymakers and advocates.<sup>10,11</sup> For more information about the methods behind the CHOICES Project, please visit <http://choicesproject.org>.

### Interventions at a societal level

- **Applying a sugary drink excise tax.** A one-cent-per-ounce excise tax (a type of tax on a specific good which is usually included in the price of the product) on sugary drinks is estimated to impact the entire U.S. population, including children under age 5. This tax would cost relatively little to implement, involving costs for conducting tax audits and for industry to comply with the tax. It is projected to save over \$14 billion, including substantial healthcare cost savings, and prevent over a half a million cases of childhood obesity in 2025.<sup>10</sup> This tax could be local, state, or national in scope. Revenue from the tax is not included in this analysis, but would raise \$12.5 billion/year.<sup>7</sup>
- **Eliminating the tax deductibility of advertising unhealthy foods and beverages to children.** Modifying the tax code to eliminate the ability of corporations to deduct expenses related to advertising foods and beverages to children could drive up the cost of such ads; evidence on the price elasticity of advertising costs suggests this would result in companies advertising less,<sup>12</sup> thus resulting in reductions in the number of ads children see every day. This lower exposure to food and beverage advertising could substantially reduce obesity risk.

This policy is estimated to impact all U.S. children, including those under age 5. It is projected to save about \$260 million, and prevent about 129,000 cases of childhood obesity in 2025 (again applying to all children, not just those under 5).<sup>10</sup>

### Interventions in early care and education settings

Over 60 percent of 3- to 5-year-olds in the United States attend some kind of early care and education (ECE) program outside the home.<sup>13</sup> ECE programs typically serve children snacks and/or meals and provide physical activity opportunities to children, making such settings important for ensuring healthy habits.<sup>2</sup>

- The Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC)** is a widely implemented and studied intervention that engages childcare providers in a process of guided self-assessment of nutrition and physical activity practices, action planning for changes to practices, and technical assistance and training to help providers realize their change goals.<sup>14,15</sup> One option for large-scale implementation of NAP SACC is incorporating it as a required activity to reach certain levels of certification in

state Quality Rating and Improvement Systems, which nearly all states use to incentivize childcare providers to improve their practices across many domains.<sup>16</sup> This strategy could reach about 1.18 million children nationwide aged 3-5 years, at a cost of \$76 million per year (about \$64 per child reached), and about \$613 per BMI unit reduced. About 38,000 cases of childhood obesity could be prevented in 2025 as a result of implementation, and about \$30 million in healthcare costs would be saved over ten years, offsetting about 5 percent of the program's cost.<sup>10</sup>

In several partnerships with different state and local health agencies, the CHOICES study team has also modeled NAP SACC within different local contexts using local data on existing resources and implementation strategies. Depending on what kinds of existing infrastructure a state already may have for implementing this kind of intervention, we found that the costs per child could range from \$36 to \$101,<sup>17-19</sup> compared to the national estimate of \$64 per child.<sup>10</sup> These findings highlight that the costs of implementing this intervention can be very different between states.

### Comparison of cost, reach, effect, and cost-effectiveness outcomes for four proposed strategies to impact young children's obesity risk

	<b>Sugar-sweetened beverage tax</b>	<b>Removing deductibility of food and beverage advertising</b>	<b>NAP SACC implemented in state QRIS</b>	<b>Hip Hop to Health Jr. implemented nationally to fulfill a new state licensing requirement for physical activity training</b>
<b>Policy reach</b>	All individuals in U.S. between ages 2 and 100 years old	All children between ages of 2 and 19 years old	About 23% of the estimated 44% of 3-5 year olds attending a licensed child care program nationally	Estimated 44% of 3-5 year olds attending a licensed child care program nationally
<b>Number of individuals reached from 2015-2025 (95% uncertainty interval)</b>	306.6 million (306.2, 307.0)	72.3 million (71.9, 72.8)	1.18 million (1.14, 1.23)	4.8 million
<b>Net costs (95% uncertainty interval)</b>	-\$14,169,000,000 (-47,119,000,000, -2,645,000,000)	-\$260,000,000 (-\$431,000,000, -\$94,000,000)	\$731,000,000 (\$706,000,000, 754,000,000)	\$1014 (\$900, \$1143)
<b>Cases of childhood obesity prevented in 2025 (95% uncertainty interval)</b>	575,936 (131,794, 1,890,715)	129,061 (48,200, 212,365)	38,385 (8,258, 69,111)	93,065 (-88,279, 248,174)

- **The Hip Hop to Health Jr. program** is a curriculum that focuses on using ECE teacher-led dance activities in the classroom (using a CD with kid-friendly songs) to engage children in physical activity.<sup>20–22</sup> Implementing Hip Hop to Health Jr. throughout the country in all licensed ECE settings to promote structured physical activity is estimated to impact 4.8 million young children, at a cost per child of \$22.64.<sup>23</sup> As a result, there could be 93,000 fewer cases of obesity by 2025, although because the original study did not show a very strong, significant impact on BMI, there is a substantial lack of certainty about this—the program’s benefits could range from no cases prevented to many more than 93,000.

### Emerging evidence from states and localities

Over the last few years, several states and cities have worked with the CHOICES study to model out novel strategies for early childhood obesity prevention in their states and localities. Although these strategies currently lack direct evidence for effectiveness (i.e., no one has directly evaluated the impact of a sugary drink ban in ECE settings on children’s BMI), and thus only a few preliminary results are presented, they could show promise.

- **Policies to limit sugary drinks and/or screen time in ECE settings.** The city of Philadelphia worked with the CHOICES study to estimate the impact of widespread adoption of a city policy to eliminate sugary drinks and 100 percent juice and limit noneducational screen time to 30 minutes per week. The city’s health department found that, with the investment of minimal costs for training and technical assistance to providers (\$638,000 over 10 years), over 100,000 children (3–5 years old) would be reached, and child care providers would save money by replacing sugary drinks and juice with water—on average, about \$674 per center per year.<sup>24</sup> State health agencies and ECE partners in Oklahoma and Mississippi estimated, using their local data, that implementing policies statewide just to limit screen time to 30 minutes per week could reach large numbers of children in those states while costing very little to implement.<sup>25,26</sup>
- **State-delivered trainings in the Fit5Kids curriculum.** Mississippi’s state health department modeled the impact of the state offering trainings in the Fit5Kids curriculum, an evidence-based program focused on educating children and parents about the benefits of reducing television viewing.<sup>27,28</sup> Mississippi estimated that over 27,000 children would be reached by this state-delivered program, at a cost of about \$20 per child.<sup>29</sup>

### What we still need to know

Several areas where we need more evidence for impact on childhood obesity include:

- **Evidence for effectiveness of more policies impacting young children’s obesity risk.** Several policies, such as making the default options for children’s restaurant meals healthier or limiting sugary drink portion sizes, could impact the diets of young children, yet currently lack consistent evidence for an impact on childhood obesity, energy intake, or energy expenditure and thus cannot yet be evaluated using CEA.
- **Evidence for the impact of federal food programs and potential changes to those programs.** The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), the Child and Adult Care Food Program (CACFP), and the Supplemental Nutrition Assistance Program (SNAP) all impact the diets of millions of children under the age of 5.<sup>30–32</sup> However, while their role in preventing food insecurity is clear, their potential impact on obesity is less so. One proposed change to SNAP, the Healthier Incentives Program, which would incentivize purchases of fruits and vegetables using SNAP benefits, has been shown to result in increased fruit and vegetable consumption, but its impact on obesity risk is not yet known.<sup>33</sup> Recent changes to WIC and CACFP in particular have been designed to promote healthier options while still addressing food insecurity, and preliminary evidence suggests that the changes to WIC in particular have beneficially impacted the diets of young children enrolled in the program.<sup>34,35</sup> More evidence is needed on the potential for these programs to address obesity among low-income children.
- **Readiness to Learn and Obesity Prevention.** While it’s certainly plausible that interventions that promote healthier eating, more physical activity, and less screen time for young children could have the additional benefit of improving children’s readiness to learn, we simply do not know at this point whether obesity-focused strategies have a meaningful impact on readiness to learn.
- **Understanding of long-term impacts.** While research on early childhood learning interventions, such as the Abecedarian project<sup>36,37</sup> or the Perry/High Scope preschool project,<sup>38,39</sup> has demonstrated long-term benefits for participants’ health and wellbeing, we lack evidence on whether the benefits of obesity prevention interventions in ECE settings continue on later in life, or what is needed to maintain those benefits later in life.

## Conclusions

Investing in young children's health is critically important. Emerging evidence shows that there are several strong policy options for national, state, and local policymakers to implement that can help prevent thousands of cases of childhood obesity and cost relatively little. There are some strategies, like taxing sugary drinks and reducing advertising exposure, that could potentially be cost saving to society. However, many interventions, like NAP SACC, will likely require an upfront investment. No one intervention will solve the childhood obesity epidemic; instead, multiple interventions, across multiple settings and at many levels of influence (local, state, federal) will need to be applied together. While few of these may be cost saving in the short-run, we can still identify interventions that prove the the best value. Further, early interventions in other domains (particularly early literacy and school readiness) have demonstrated that investing in young children's healthy development can have a profound influence on their later health. What's more, evidence on how intractable obesity can become later in life points to the urgency of preventing the development of obesity before it starts.

## Policy Implications

This review highlights several areas where information is urgently needed. More support is needed for research to investigate the impact of different childhood obesity prevention policies and strategies using rigorous measures and study designs, in order to better inform stakeholders' options when

it comes to childhood obesity prevention. This review also highlights that policymakers and advocates should be realistic about the likely short-term financial implications of early childhood obesity prevention interventions. While some interventions can result in cost savings to certain stakeholders (e.g., reducing purchases of sugary drinks by childcare providers), most will not see financial returns until children get older. Recognizing that it may be more important to focus on the best long-term value, broadly defined, for money invested, rather than on whether or not an intervention results in immediate financial returns, is essential. Based on the evidence thus far, however, we can recommend two existing strategies:

- Policies to limit sugary drink consumption broadly, like a sugary drink excise tax, hold promise for reducing obesity across the entire population, including very young children, and also have the greatest potential for substantial economic returns.
- To date, the NAP SACC program shows the best evidence for impact on early childhood obesity risk among interventions specifically targeted to children under 5; it has been rigorously evaluated, across multiple contexts, and demonstrated an impact on reducing obesity risk in experimental studies in several states. In contrast, several other interventions for young children do not yet have NAP SACC's strong evidence for impact – so while \$64 per child is an investment, it is not money wasted, while spending money on unproven programs may be.

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## References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014;311(8):806-814.
2. Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? A review of the evidence and call for research efforts. *J Am Diet Assoc*. 2011;111(9):1343-1362.
3. Kaphingst KM, Story M. Child care as an untapped setting for obesity prevention: state child care licensing regulations related to nutrition, physical activity, and media use for preschool-aged children in the United States. *Prev Chronic Dis*. 2009;6(1):A11. <http://www.ncbi.nlm.nih.gov/pubmed/19080017>.
4. Ward ZJ, Long MW, Resch SC, Giles CM, Cradock AL, Gortmaker SL. Simulation of Growth Trajectories of Childhood Obesity into Adulthood. *N Engl J Med*. 2017; 377(22):2145-2153.
5. Dombrowski SU, Knittle K, Avenell A, Araújo-Soares V, Sniehotta FF. Long term maintenance of weight loss with non-surgical interventions in obese adults: systematic review and meta-analyses of randomised controlled trials. *BMJ Br Med J*. 2014;348. <http://www.bmj.com/content/348/bmj.g2646.abstract>.
6. Finkelstein EA, Trogon JG. Public health interventions for addressing childhood overweight: analysis of the business case. *Am J Public Heal*. 2008;98(3):411-415.
7. Zhou F, Shefer A, Wenger J, et al. Economic evaluation of the routine childhood immunization program in the United States, 2009. *Pediatrics*. 2014;133(4):577-585.
8. Cutler DM, McClellan M. Is technological change in medicine worth it? *Health Aff (Millwood)*. 2001;20(5):11-29.
9. Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW. *Methods for the Economic Evaluation of Health Care Programmes*. Oxford university press; 2015.
10. Gortmaker SL, Wang YC, Long MW, et al. Three interventions that reduce childhood obesity are projected to save more than they cost to implement. *Health Aff*. 2015;34(11).
11. Cradock AL, Barrett JL, Kenney EL, et al. Using cost-effectiveness analysis to prioritize policy and programmatic approaches to physical activity promotion and obesity prevention in childhood. *Prev Med*. 2017;95 Suppl:S17-s27.
12. Chou S, Rashad I, Grossman M. Fast-Food Restaurant Advertising on Television and Its Influence on Childhood Obesity. *J Law Econ*. 2008;51(4):599-618.
13. Snyder TD, Dillow SA, Education USD of. Digest of Education Statistics 2013 (NCES 2015-011). (Statistics NC for E, ed.). Washington, DC: *Institute of Education Sciences*; 2015.
14. Ward DS, Benjamin SE, Ammerman AS, Ball SC, Neelon BH, Bangdiwala SI. Nutrition and physical activity in child care: results from an environmental intervention. *Am J Prev Med*. 2008;35(4):352-356.
15. Alkon A, Crowley AA, Neelon SEB, et al. Nutrition and physical activity randomized control trial in child care centers improves knowledge, policies, and children's body mass index. *BMC Public Health*. 2014;14.
16. Geary NA, Dooyema CA, Reynolds MA. Supporting Obesity Prevention in Statewide Quality Rating and Improvement Systems: A Review of State Standards. *Prev Chronic Dis*. 2017;14:E129.
17. Macedo C, Case S, Simpson K, Khan F, U'ren S, Giles K, Flax C, Cradock A, Gortmaker S, Ward Z, Kenney E. *Oklahoma Nutrition And Physical Activity Self-Assessment For Child Care (NAP SACC) Intervention [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-nap-sacc-oklahomal>.
18. Kenney E, Giles C, Flax C, Gortmaker S, Cradock A, Ward Z, Foster S, Hammond W. *New Hampshire: Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) Intervention [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-cost-effectiveness-of-nap-sacc-intervention-in-new-hampshire/>.
19. Cradock, A., Gortmaker, S., Pipito, A., Kenney, E., Giles C. *NAP SACC Researching an Intervention to Create the Healthiest Next Generation [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-nap-sacc-early-achievers-washington/>.
20. Fitzgibbon ML, Stolley MR, Schiffer LA, et al. Hip-Hop to Health Jr. Obesity Prevention Effectiveness Trial: postintervention results. *Obes (Silver Spring)*. 2011;19(5):994-1003.
21. Kong A, Buscemi J, Stolley MR, et al. Hip-Hop to Health Jr. Randomized Effectiveness Trial: 1-Year Follow-up Results. *Am J Prev Med*. 2016;50(2):136-144.
22. Fitzgibbon ML, Stolley M, Schiffer L, Van Horn L, KauferChristoffel K, Dyer A. Two-year follow-up results for hip-hop to health Jr.: A randomized controlled trial for overweight prevention in preschool minority children. *J Pediatr*. 2005;146(5):618-625.
23. Cradock AL, Barrett JL, Kenney EL, et al. Using cost-effectiveness analysis to prioritize policy and programmatic approaches to physical activity promotion and obesity prevention in childhood. *Prev Med (Baltim)*. 2017;95.
24. Pharis M, Lawman H, Root M, Dryden S, Wagner A, Bettigole C, Mozzaffarian, RS, Kenney EL, Cradock AL, Gortmaker SL, Giles CM WZ. *Philadelphia Childcare Policies Can Build a Better Future [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-screen-time-philadelphial>.
25. Case S, Simpson K, Khan F, U'ren S, Giles K, Kenney E, Flax C, Gortmaker S, Ward Z, Cradock A. *Oklahoma: Updated Requirements in Reaching for the Stars to Reduce Non-Educational Screen Time for Young Children in Family Child Care Homes [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-ece-screen-time-oklahomal>.
26. Grant T, Wiggins C, Shelson S, Cradock A, Gortmaker S, Pipito A, Kenney E, Giles C. *Mississippi: State Regulations to Reduce Non-Educational Screen Time for Young Children in Licensed Care [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-state-regulations-screen-time-mississippi/>.
27. Dennison BA, Russo TJ, Burdick PA, Jenkins PL. An intervention to reduce television viewing by preschool children. *Arch Pediatr Adolesc Med*. 2004;158(2):170-176.
28. Mendoza JA, Baranowski T, Jaramillo S, et al. Fit 5 Kids TV Reduction Program for Latino Preschoolers: A Cluster Randomized Controlled Trial. *Am J Prev Med*. 2016;50(5):584-592.
29. Grant T, Wiggins C, Shelson S, Cradock A, Gortmaker S, Pipito A, Kenney E, Giles C. *Mississippi: Training to Reduce Non-Educational Screen Time for Young Children [Issue Brief]*. Boston, MA; 2017. <http://choicesproject.org/publications/brief-ece-screen-time-mississippi/>.

30. Agriculture USD of. Supplemental Nutrition Assistance Program Participation and Costs. <https://fnis-prod.azureedge.net/sites/default/files/pdf/SNAPsummary.pdf>. Published 2018.
31. Oliveira V, Frazao E. The WIC Program: Background, trends, and economic issues, 2015 edition. *Econ Inf Bull*. 2015;(134).
32. United States Department of Agriculture. Child and Adult Care Food Program (CACFP). <https://www.fns.usda.gov/cacfp/child-and-adult-care-food-program>. Published 2018.
33. Olsho LE, Klerman JA, Wilde PE, Bartlett S. Financial incentives increase fruit and vegetable intake among Supplemental Nutrition Assistance Program participants: a randomized controlled trial of the USDA Healthy Incentives Pilot. *Am J Clin Nutr*. 2016;104(2):423-435.
34. Schultz DJ, Byker Shanks C, Houghtaling B. The Impact of the 2009 Special Supplemental Nutrition Program for Women, Infants, and Children Food Package Revisions on Participants: A Systematic Review. *J Acad Nutr Diet*. 2015.
35. Tester JM, Leung CW, Crawford PB. Revised WIC Food Package and Childrens Diet Quality. *Pediatrics*. 2016;137(5):e20153557.
36. Muennig P, Robertson D, Johnson G, Campbell F, Pungello EP, Neidell M. The effect of an early education program on adult health: the Carolina Abecedarian Project randomized controlled trial. *Am J Public Health*. 2011;101(3):512-516.
37. Campbell F, Conti G, Heckman JJ, et al. Early childhood investments substantially boost adult health. *Science*. 2014;343(6178):1478-1485.
38. Heckman JJ, Moon SH, Pinto R, Savelyev PA, Yavitz A. The Rate of Return to the High/Scope Perry Preschool Program. *J Public Econ*. 2010;94(1-2):114-128.
39. Conti G, Heckman J, Pinto R. The Effects of Two Influential Early Childhood Interventions on Health and Healthy Behaviour. *Econ J (London)*. 2016;126(596):F28-F65.

### About Healthy Eating Research

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