

# UC Agriculture & Natural Resources

## California Agriculture

### Title

UC ANR research informs, influences and strengthens fruit and vegetable programs and policies

### Permalink

<https://escholarship.org/uc/item/5t83j7mx>

### Journal

California Agriculture, 73(1)

### ISSN

0008-0845

### Authors

Crawford, Patricia B  
Gosliner, Wendi  
Hecht, Kenneth  
[et al.](#)

### Publication Date

2019

### DOI

10.3733/ca.2018a0038

### Copyright Information

Copyright 2019 by the author(s). All rights reserved unless otherwise indicated. Contact the author(s) for any necessary permissions. Learn more at <https://escholarship.org/terms>

Peer reviewed

# UC ANR research informs, influences and strengthens fruit and vegetable programs and policies

UC Nutrition Policy Institute research has helped guide state and national policies that improve child and family health.

by Patricia B. Crawford, Wendi Gosliner, Kenneth Hecht and Lorrene D. Ritchie

**I**ncreasing intake of vegetables and fruit is key to improving health. The scientific basis for the important role that vegetable and fruit consumption plays in lowering the risk of obesity, heart disease, diabetes, stroke and some cancers is well established in the Dietary Guidelines for Americans (USDHHS, USDA 2015). Increases in vegetable and fruit consumption could also reduce national health care expenses. One study estimated that the annual health care costs and lost productivity associated with inadequate vegetable and fruit intake in the United States totaled over \$63 billion in 2012 (Allen 2015). Further, if the population transitioned to more plant-based foods, it would help reduce greenhouse gas emissions and mitigate climate change (Hallström et al. 2017).

Online: <https://doi.org/10.3733/ca.2018a0038>

## Abstract

Vegetable and fruit consumption plays an important role in lowering the risk of obesity, heart disease, diabetes, stroke and some cancers. Yet, only 20% of the population eats the daily recommended amount of produce, and 10% of children do not consume any vegetables or fruit on a daily basis. To increase vegetable and fruit intake across the population, which can extend lives and reduce health care expenditures while also enhancing demand for California agricultural products, the UC Nutrition Policy Institute has conducted research to guide public policy and institutional and community programs. The institute has studied produce consumption among children and families in child care settings, emergency food systems, schools and federal nutrition assistance programs. Conducting research to support policymakers in deciding on effective nutrition programs and policies involves partnering with community organizations and decision-makers from the outset, collecting qualitative as well as quantitative data, and sharing research findings with those who can act upon them.



Currently, only 20% of the U.S. population eats the daily recommended amounts of vegetables and fruits. One study estimated that the annual health care costs and lost productivity associated with inadequate vegetable and fruit intake in the United States totaled over \$63 billion in 2012.

Currently only 20% of the population eats the daily recommended amounts of vegetables and fruit: 2.5 cups of vegetables and 2 cups of fruit for a typical adult consuming 2,000 calories per day. Ten percent of all children do not consume any vegetables or fruit on a daily basis (USDHHS, USDA 2015). The need to improve vegetable and fruit intake is clear.

## Changing physical and social environments

UC Cooperative Extension (UCCE) has been a long-standing leader in educating children and families about healthy diets. More recently, it has paired its conventional healthy eating educational efforts with efforts to change physical and social environments. Environmental change approaches include improving access to vegetables and fruit in places where families live, work, learn and play. The goal is to make healthy choices normative by ensuring they are available, affordable and appealing. Because changing food environments often calls for broad population-level public policy efforts, it is important to understand ways in which academics in UCCE can interact with the policy process. Clearly, research evidence is needed to identify and support the policy and environmental changes that are most effective in changing population behaviors.

The Nutrition Policy Institute (NPI), located in UC's Division of Agriculture and Natural Resources (ANR), was created in 2014. NPI's goal is to conduct

and disseminate research to inform food and nutrition policy and programs that promote nutritional health and prevent obesity and chronic disease. Based upon its research and that of others, NPI provides recommendations to policymakers, administrators, health care providers and community organizations.

The socio-ecological model (fig. 1), which describes multiple circles of influence on the behavior of individuals and families (institutions, community and public policy), can be used to guide planning and evaluation of interventions to improve population nutrition (McLaren and Hawe 2005). To improve vegetable and fruit consumption in California and across the nation, NPI's research targets all three circles of influence: institutions, such as schools and child care facilities; community programs, such as food banks and pantry programs; and government programs, such as the federal food programs.

## School and child care studies

Local school systems and early childhood educational settings provide an important opportunity for traditional nutrition education to influence behavior. In addition, they can be ideal venues for institutional interventions to change the food environment.

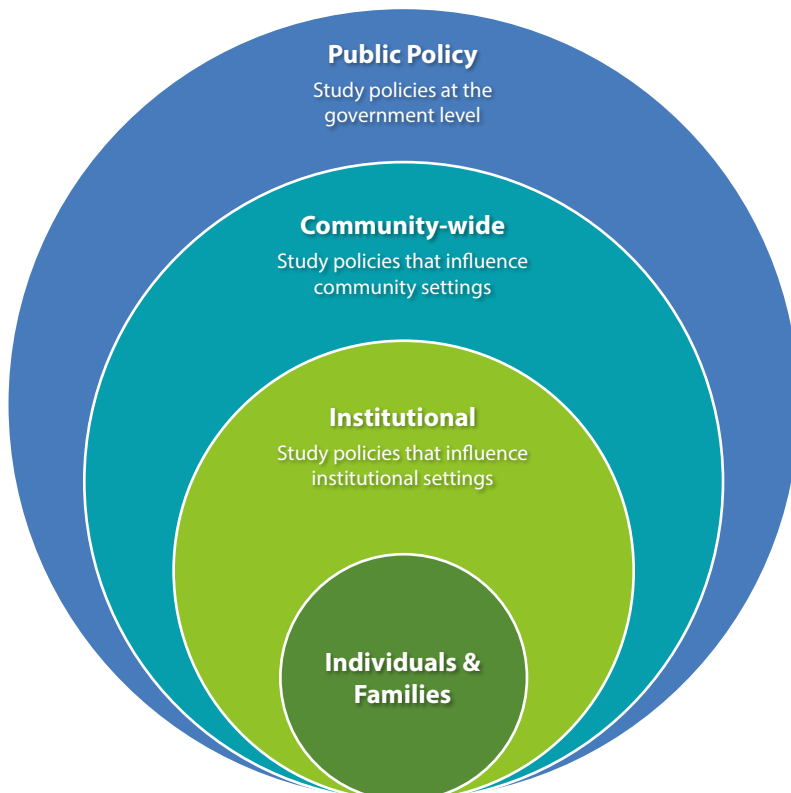
### School Lunch Initiative

One early study by NPI researchers was among the first to demonstrate the effectiveness of combining school nutrition education and hands-on school gardening and cooking programs, and revamping the school meal offerings and dining environment (Wang et al. 2010). It assessed the impact of the School Lunch Initiative, established in the early 2000s by the Berkeley Unified School District in partnership with the Chez Panisse Foundation and the Center for Ecoliteracy. Changes in children's knowledge, attitudes and behaviors were compared according to how often they participated in the educational, gardening and cooking programs.

NPI found that students who participated more often in the educational, cooking and gardening elements of the program increased their consumption of vegetables and fruit by one-third of a cup per day. The study was the first to observe that students in such a program also increase their vegetable and fruit intake during nonschool hours. This research was used to support continued program funding by the Berkeley Unified School District, and it was welcomed by other school districts and advocates across the country as it provided rigorous evidence that well-implemented, comprehensive interventions incorporating menu changes, school gardens and cooking and nutrition education can significantly impact students' produce consumption and, by extension, their health.

### School breakfasts

NPI researchers have also examined the comparative nutritional quality of breakfast at school versus



**FIG. 1.** Socio-ecological model of applications for policy-relevant research.

breakfast at home. Perhaps surprisingly, the evidence suggested that school breakfast participants ate more fruit than their home-eating counterparts, a finding that has supported the work of the federal School Breakfast Program and has encouraged California legislators to retain a small subsidy for the federal School Breakfast Program (Au et al. 2016).

In addition, the research showed vegetable and fruit intake was related to *how* the school breakfast was served. Children who attended schools where breakfast was served in the classroom at the start of the school day (as opposed to in the cafeteria before school began or during the first recess after school began) consumed significantly more total fruit, whole fruit, and greens and beans, a category of vegetables that tends to be inadequately consumed by children (Ritchie et al. 2016). This NPI research provides a strong rationale for the classroom breakfast model.

### A longer lunch period

Another study by NPI researchers identified additional factors associated with increased vegetable and fruit consumption at school. A longer lunch period, the presence of a salad bar, better-quality fruit and student involvement in food service decision-making were all associated with increased produce consumption at school (Gosliner 2014). These findings were used as scientific evidence to support a bill, California AB 292 (Santiago 2015–2016), to increase the time public school students are allotted for eating lunch. While the bill has not yet passed, the issue continues to be on the policy agenda. Collectively, these school-based studies identified a number of program, policy and environmental changes that schools can take to maximize students' consumption of vegetables and fruit.

### Child care nutrition

Reflecting concern about the alarming rates of obesity among our youngest children, NPI has made early childhood nutrition a high priority for its research. In 2008, at a time when almost nothing was known about the food-related policies and practices in early childhood settings, NPI partnered with California Food Policy Advocates to conduct the first statewide survey of nutrition in licensed child care facilities in California (Ritchie et al. 2012).

Included in the study were over 400 child care sites ranging from Head Start centers and state preschools to private centers and home-based programs. Some of the centers and homes (including Head Start and state preschools) participated in USDA's Child and Adult Care Food Program (CACFP), the child care equivalent of the National School Lunch Program.

Results demonstrated that CACFP sites in general, and Head Start centers in particular, served more vegetables and fruit than child care sites that did not participate in CACFP. The study findings provided much-needed evidence to support efforts to provide better nutrition to all children in child care and were



Peter Howard, USDA

influential in informing the first major updates to the CACFP nutrition standards, which went into effect in October 2018.

The study results also formed the basis of California AB 2084 (Brownley 2010), the Healthy Beverages in Child Care Act, which contains the country's strongest nutrition standards for what children drink in child care. Further, the drinking water requirement in AB 2084 was incorporated in the Healthy, Hunger-Free Kids Act of 2010 (HHFKA). HHFKA is the federal law reauthorizing CACFP and the other child nutrition programs; thus, NPI's research informed the law that now ensures that children in child care anywhere in the country are guaranteed access to free, fresh drinking water throughout the day.

## Food bank nutrition studies

Outside of school and child care, produce availability in other community settings can affect family consumption patterns. Food banks and their associated pantries are an important community resource. As more families, even those with working adults, struggle to make ends meet financially, local food banks have grown to meet the need. Currently, emergency food organizations help to feed approximately 14% of all people in the United States annually, including 12 million children (Feeding America 2014).

The Food Bank of Central New York (FBCNY), an agency at the forefront of food banks concerned about the nutritional impact of the food distributed, asked NPI to evaluate its 2006 policy to decline donations of sodas, snack foods and candy. Many stakeholders in food banking felt client choices should not be limited in that way. NPI gathered food preference information from clients of FBCNY's food pantries to inform potential revision of the food bank's soda and candy policy.

Results showed that pantry clients overwhelmingly preferred to receive vegetables and fruit as well as meat, poultry and fish over soda, candy and snack foods (Campbell et al. 2011). Altogether, 90% or more reported that vegetables and fruit were very important or important to receive at a pantry, and

Researchers with the UC Nutrition Policy Institute found that childcare sites participating in the federal Child and Adult Care Food Program served more fruits and vegetables to young children than sites not participating in the program.

more than 85% reported that soda, candy and snacks were only somewhat or not important. As a result of this study, FBCNY strengthened its policy prohibiting donation of sugary beverages and snacks, and it demonstrated the substantial reduction in distribution of these products by monitoring the annual inventory over a 4-year period. NPI's research has helped to galvanize food banks across the country to enact similar policies.

In California, NPI monitored fresh vegetable and fruit donations using inventory data from six food banks between 2007 and 2010. During this period, produce donations increased to make up over 50% of the weight of total foods in the food banks' inventory, with fresh vegetables and fruit becoming the largest source of produce (Ross et al. 2013).

To help other food banks mirror the successes of the New York and California food banks, Kaiser Permanente funded NPI to provide technical assistance to 20 food banks across the country (including 11 in California) to develop and implement nutrition policies that emphasized the need for increased produce and discouraged donations of sugary beverages and snack foods. All of these food banks now have such policies in place, confirmed by a follow-up process evaluation conducted by NPI.

Finally, to widely disseminate technical assistance and support for food bank nutrition policies, Kaiser

Permanente funded the development of a free massive open online course, or MOOC (Campbell et al. 2015). To date, thousands of people across the country, including UCCE advisors and staff, have participated in this course and have downloaded the resource guides produced. The MOOC promotes healthful offerings at food banks and

pantries by detailing the steps necessary for adopting nutrition policies. This course has helped to change the culture of food banking — from focusing on the distribution of the maximum poundage of any food to focusing on the distribution of nutritious food that supports health.

## Federal program evaluations

Changes to government programs and policies have had a significant impact on improving dietary behaviors; they impact large segments of the population and can profoundly impact vegetable and fruit intake. NPI's numerous studies of federal food programs, including the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), CACFP, National School Lunch Program, and School Breakfast Program, have contributed to these changes.

## WIC food package changes

NPI's work with WIC demonstrates how research can affect policy. WIC provides supplemental foods to qualifying low-income children and pregnant and postpartum women. It is a large program: More than half the babies born in California are enrolled in WIC. In addition to food, the program provides nutrition education, which includes teaching families why and how to eat more vegetables and fruit.

At the federal level, the package of supplemental foods available to WIC participants was slated to change in 2009, to add vegetables and fruit, among other improvements — the first such change to the program since its establishment in the early 1970s. To understand whether vegetable and fruit education would support participants in using the newly provided access to produce, NPI collaborated with PHFE-WIC (the largest WIC program in California) and the state WIC branch to evaluate educational sessions being provided by all California WIC clinics.

In 2008, a telephone survey was administered to a cross-section of more than 3,000 California WIC participants immediately before and 6 months after they received the produce-promoting education from WIC. Six months following the nutrition education, the women and caregivers reported increased recognition of the educational messages and increased family consumption of fruit (but not vegetables) (Ritchie et al. 2010). These results supported the policy changes to WIC foods and highlighted the effectiveness of the combination of educational and structural support.

NPI researchers also conducted other studies of the impact of the 2009 WIC food package changes. One study examined diet quality data from the National Health and Nutrition Examination Survey, which included a national sample of 1,197 preschool children, age 2 to 4 years, from low-income families before and after the food package changes. Increases in intakes of greens and beans were higher for WIC participants than those for non-WIC participants during a time when vegetable consumption seemed to decrease for children not participating in WIC (Tester et al. 2016). In a California study, random samples of children participating in WIC (3,004 children in 2009, 2,996 in 2010) were surveyed before and after the 2009 changes to WIC foods. The findings revealed small but significant increases in consumption of vegetables and fruit (Whaley et al. 2012).

For informing future directions, it's important not only to document the dietary impacts of policy change but also to understand the perceptions of those impacted. Thus, NPI evaluated participant satisfaction with the WIC food package changes. Although WIC participants reported being highly satisfied with all changes (more whole grains, lower-fat dairy, less juice and cheese), the addition of vegetables and fruit was among the most highly rated (Ritchie et al. 2014).

Taken together, these WIC studies documented that the new food package was well accepted and impactful.

The MOOC . . . has helped to change the culture of food banking — from focusing on the distribution of the maximum poundage of any food to focusing on the distribution of nutritious food that supports health.

This type of information can play a role in supporting program reforms and in informing members of Congress when they are considering WIC authorization or appropriations.

### Fresh Fruit and Vegetable Program

In 2010-2011, NPI collaborated on a nationwide evaluation of the USDA Fresh Fruit and Vegetable Program (FFVP), a program in which schools with high numbers of low-income students are funded to provide free vegetable and fruit snacks to all students (Olsho et al. 2015). Schools participating in FFVP are encouraged to distribute a wide variety of fresh vegetables and fruit, at least two per week, including types to which students might not otherwise be exposed.

The study compared the intake of 4,696 elementary students at schools that did and did not participate in FFVP. The results showed that daily mean vegetable and fruit intake was one-third of a cup higher among students at schools participating in FFVP compared to the intake of those at nonparticipating schools. In addition, vegetable and fruit consumption increased outside of school. Evidence like this informs the policymakers whose decisions determine whether such successful nutrition programs will continue.

### National leadership

Researchers can impact policy also by participating in efforts that shape national policies, such as serving on committees of the National Academy of Sciences, state-wide commissions and similar influential bodies. NPI researchers have provided national leadership on ways to improve vegetable and fruit consumption by serving on the committee that recently contributed to the government's Healthy People 2020 initiative.

Healthy People 2020 provides science-based national objectives for improving the health of Americans. These objectives provide guidance for state and local public health planning and programming. Recently, NPI co-authored the Healthy People 2020 Law and Health Policy Project report on successful policy strategies to improve vegetable and fruit consumption (Crawford et al. 2018). The report contains examples of effective policy interventions that can help shape the environment to improve vegetable and fruit consumption. Examples of these include the use of tax revenues to support vegetable and fruit programs in schools that both educate and encourage students to try new kinds of vegetables and fruit and the use of state and local policies to alter the built environment to provide increased space for vegetable and fruit stands and mobile carts.

### Scaled and combined interventions

These case examples highlight different types of research undertaken to inform, influence and strengthen policy and programs related to vegetable and fruit



consumption in the various circles of influence in the socio-ecological model. Research-based action in more than one circle is critical because it has the greatest chance of success in expanding vegetable and fruit demand and consumption (IOM 2012). Connections between circles of influence can be explicit or discovered over time. For example, changing public policy by modifying the WIC food package or school meal regulations has driven changes in community food environments, and local institutions have responded by implementing additional supportive interventions. The more changes that support increased vegetable and fruit consumption, the more likely they are to lead to the desired outcomes: improved consumption among individuals and families, better population health and expanded markets for California-grown produce.

Although the dietary impact of a single intervention will not likely be large, if interventions are scaled and combined, the impact can be dramatic (IOM 2012). Even an increase in vegetable and fruit intake of one-fourth cup daily can substantially impact population health and reduce health care costs while increasing demand for vegetables and fruit. For example, if all residents of California were to increase their daily vegetable and fruit consumption by one-fourth cup, Californians would purchase 3.6 billion more cups of vegetables and fruit every year. Further, if consumption levels increased enough to move any portion of the population from eating vegetables and fruit less than once to more than three times daily, those who improved their intake could see as much as a 27% lower risk of stroke, a 24% lower risk of heart disease and a 15% lower risk of all-cause mortality (Bazzano et al. 2002).

### Lessons on using research to create change

Throughout more than a decade of policy-relevant research, NPI has learned important lessons that can be applied in other fields and on topics other than vegetable and fruit consumption. These include the value of providing research-based guidance to advocates and

The more changes that support increased vegetable and fruit consumption, the more likely they are to lead to the desired outcomes: improved consumption among individuals and families, better population health and expanded markets for California-grown produce.

policymakers in clear and actionable ways. Documents such as the Healthy People 2020 Law and Health Policy Project report provide a wide variety of research-based strategies by which local and state government and nongovernment agencies can work to improve vegetable and fruit access. Translating findings using reports, briefs and fact sheets and presenting results and recommendations directly to advocates and policymakers can facilitate the use of research to create positive change.

While quantitative data often are beneficial for informing policy debates, qualitative data also are influential. Qualitative data that capture the voices of those impacted by change provide illustrative insights and important context for interpreting quantitative data. Sometimes, a compelling anecdote that makes a personal connection can influence policymakers more than the most rigorous scientific findings. Under contract with the California Endowment, NPI interviewed kindergarten children on what they thought of after-school meal standards that had increased vegetable and fruit offerings. From the mouths of children came “We love the new purple and green foods.” Complete stories, with the numbers linked to an anecdote or quote, are the most compelling to policymakers.

The science that UC ANR brings to policy debates is fundamental, but the right research questions must be developed to supply the information that policymakers need. NPI has learned to work closely with agencies and participant populations to identify critical areas that can benefit from research that is both scientifically valid and policy relevant. In this way, the research

provides a bridge between academia and the world at large and is facilitated by partnerships, which is an ANR goal. Partnering with community organizations from the outset helps to ensure that the research questions posed are relevant and that the answers can offer realistic and practicable solutions.

Finally, NPI has learned that discussing the research study findings at meetings with stakeholders, including policy- and decision-makers, is important. It provides an opportunity for stakeholders to identify meaningful solutions, and for researchers to learn of the policy-relevant questions that have the highest priority and need answering next. In sum, we’ve learned that conducting policy-relevant research involves collaboration throughout the entire process — partnering from the outset with community organizations and decision-makers, collecting and collaboratively evaluating qualitative as well as quantitative data, interpreting results with consideration of policy relevance, and sharing results and recommendations with those who can act upon them. [CA](#)

---

*P.B. Crawford is Emeritus Director of Research and UC Cooperative Extension Specialist, W. Gosliner is Director of Strategy and Project Scientist, K. Hecht is Director of Policy, and L.D. Ritchie is Director and UC Cooperative Extension Specialist, Nutrition Policy Institute, UC Division of Agriculture and Natural Resources.*

## References

- Allen R. 2015. 2015 GAP Analysis — The Federal Fruit and Vegetable Consumption Challenge: How Federal Spending Falls Short of Addressing Public Health Needs. Produce for Better Health Foundation. [www.pbhfoundation.org/](http://www.pbhfoundation.org/)
- Au LE, Rosen NJ, Fenton K, et al. 2016. Eating school lunch is associated with higher diet quality among elementary school students. *J Acad Nutr Diet* 116:1817–24.
- Bazzano LA, He J, Ogden LG, et al. 2002. Fruit and vegetable intake and risk of cardiovascular disease in US adults: The first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. *Am J Clin Nutr* 76:93–9.
- Brownley J. 2010. California AB 2084 Healthy Beverages in Child Care Act. [www.leginfo.ca.gov/pub/09-10/bill/asm/ab\\_2051-2100/ab\\_2084\\_bill\\_20100930\\_chaptered.html](http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_2051-2100/ab_2084_bill_20100930_chaptered.html)
- Campbell E, Hudson H, Webb K, Crawford PB. 2011. Food preferences of users of the emergency food system. *J Hunger Env Nutr* 6:179–87.
- Campbell E, Webb K, Ross M, et al. 2015. Nutrition-Focused Food Banking. *National Academy of Sciences, Engineering and Medicine*. p 1–11. <https://nam.edu/perspectives-2015-nutrition-focused-food-banking/>
- Crawford PB, Dunning L, Kappagoda M, O’Connor J. 2018. Healthy People 2020: Law and Health Policy Project. Centers for Disease Control and Prevention, Atlanta, GA. [www.cdc.gov/phlp/publications/topic/hp2020.html](http://www.cdc.gov/phlp/publications/topic/hp2020.html)
- Feeding America. 2014. Hunger in America. [www.feedingamerica.org/hunger-in-america/our-research/hunger-in-america/](http://www.feedingamerica.org/hunger-in-america/our-research/hunger-in-america/)
- Gosliner W. 2014. School-level factors associated with increased fruit and vegetable consumption among students in California middle and high schools. *J Sch Health* 84:559–68.
- Hallström E, Gee Q, Scarborough P, Cleveland DA. 2017. A healthier US diet could reduce greenhouse gas emissions from both the food and health care systems. *Climate Change* 142:199–212.
- [IOM] Institute of Medicine. 2012. *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. Washington, DC: The National Academies Press. 478 p.
- McLaren L, Hawe P. 2005. Ecological perspectives in health research. *J Epidemiol Commun H* 59:6–14.
- Olsho LEW, Klerman JA, Ritchie L, et al. 2015. Increasing child fruit and vegetable intake: Findings from the US Department of Agriculture Fresh Fruit and Vegetable Program. *J Acad Nutr Diet* 115:1283–90.
- Ritchie LD, Boyle M, Chandran K, et al. 2012. Participation in the child and adult care food program is associated with more nutritious foods and beverages in child care. *Child Obes* 8:224–9.
- Ritchie L, Rosen NJ, Fenton K, et al. 2016. School breakfast policy is associated with dietary intake of fourth and fifth grade students. *J Acad Nutr Diet* 116:449–57.
- Ritchie LD, Whaley SE, Spector P, et al. 2010. Favorable impact of nutrition education on California WIC families. *J Nutr Ed Behav* 42:S2–S10.
- Ritchie LD, Whaley SE, Spector P, et al. 2014. Satisfaction of California WIC participants with food package changes. *J Nutr Ed Behav* 46:571–578.
- Ross M, Campbell EC, Webb KL. 2013. Recent trends in the nutritional quality of food banks’ food and beverage inventory: Case studies of six California food banks. *J Hunger Env Nutr* 8:294–309.
- Santiago M. 2015–2016. California AB 292 Pupil nutrition: Free or reduced-price meals: Adequate time to eat. [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB292](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB292)
- Tester JM, Leung CW, Crawford PB. 2016. Revised WIC food package and children’s diet quality. *Pediatrics* 137(5).
- [USDHHS, USDA] US Department of Health and Human Services and US Department of Agriculture. 2015. 2015–2020 Dietary Guidelines for Americans (8th ed.). 144 p. <http://health.gov/dietaryguidelines/2015/guidelines/>
- Wang MC, Rauzon S, Studer N, et al. 2010. Exposure to a comprehensive school intervention increases vegetable consumption. *J Adolesc Health* 47:74–82.
- Whaley SE, Ritchie LD, Spector P, Gomez J. 2012. Revised WIC food package improves diets of WIC families. *J Nutr Ed Behav* 44:204–9.