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Review of health impact assessments informing agriculture, food, and nutrition policies, programs, and projects in the United States

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Abstract

Policies, programs, and projects related to agriculture, food, and nutrition can significantly affect public health. Health impact assessment (HIA) is one tool that can be used to improve awareness of the health effects of decisions outside the health sector, and increasing the use of HIA for agriculture, food, and nutrition decisions presents an opportunity to improve public health. This study identifies and reviews all HIAs completed in the United States on agriculture, food, and nutrition topics. Studies were identified from HIA

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databases, an Internet search, and expert consultation. Key characteristics were extracted from each study: type of decision assessed, location, level of jurisdiction, lead organization, methods of analysis, and recommendations. Twenty-five eligible HIAs that were conducted between 2007 and 2016 address topics such as regulations on land use for agriculture; food and beverage taxes; and developing grocery stores in food deserts. These HIAs have predominantly supported policy, as opposed to program or project, decisions. Four case studies are presented to illustrate in detail the HIA process and the mechanisms through which HIA findings affected policy decisions. Among other influences, these four HIAs affected the language of legislation and provided guidance for federal regulations. These examples demonstrate several findings: appropriate timing is critical for findings to have an influence; diverse stakeholder involvement generates support for recommendations; and the clear communication of feasible recommendations is highly important. There is substantial scope to increase the use of HIA in the agriculture, food, and nutrition sectors. Challenges include the paucity of monitoring and evaluation of HIAs' effects on health outcomes, and the limited funding available to conduct HIAs. Opportunities include integrating HIAs and community food assessments, and more widely sharing HIA findings to inform related decisions in different jurisdictions and to increase support for additional HIAs that address the food system.

Keywords
Health Impact Assessment; Policy; Food; Nutrition; Agriculture

Introduction

Agricultural activities, food systems, and nutrition impact human health through a range of important pathways, including short- and long-term consequences of changing the natural environment (Horrigan, Lawrence, & Walker, 2002); occupational risks and benefits (Mayhew & Quinlan, 2002); and dietary intake, which alone is one of the strongest individual determinants of health (Institute for Health Metrics and Evaluation, 2013). The impacts of agriculture, food systems, and nutrition on health are both positive and negative, and direct and indirect. Specific health risks from agriculture include antibiotic-resistant infections deriving from animal agriculture, respiratory conditions from air exposures to farm emissions, and the occupational risks of agricultural work, which include exposure to carcinogens and other physical dangers (Institute of Medicine & National Research Council, 2015; Neff, Merrigan, & Wallinga, 2015).

Additionally, food systems structure community-level food environments, which can significantly influence individual dietary decisions (Caspi, Sorensen, Subramanian, & Kawachi, 2012; Wang, Kim, Gonzalez, MacLeod, & Winkleby, 2007; Zenk, Mentz, Schulz, Johnson-Lawrence, & Gaines, 2016). Changes affecting the availability, accessibility, price, marketing, and retailing of food shape opportunities and incentives for purchasing and consuming nutritious foods (Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008), and nutrition is influenced by both physical and social settings (Saelens, et al., 2012). These factors result in poor diet being the leading risk factor contributing to poor health outcomes in the U.S. (Institute for Health Metrics and Evaluation, 2013). In contrast, agriculture and food systems policies can benefit health by promoting and enabling good nutrition, enhancing community development, and protecting the safety of workers, communities, and consumers (Institute of Medicine & National Research Council, 2015; Neff et al., 2015).

Despite the many connections described above and the significant role of food systems in shaping health outcomes, potential health impacts are rarely explicitly considered when designing policies, programs, and projects related to agriculture, food, and nutrition (Caraher & Coveney, 2004; Lang, Barling, & Caraher, 2009). Examining the health impact of food system policy and project decisions can also generate opportunities to leverage the health sector as an ally to advance legislation or project ideas. Making the case that food policies have important health effects can strengthen and expand a coalition by engaging a broader audience, such as the thousands of members of the American Public Health Association (APHA) and departments and boards of health, which exist in almost all

jurisdictions. Physicians in particular are widely viewed as credible spokespeople who may be seen as unbiased and without a financial interest, in contrast to the perceived interests of those most engaged in a given food system decision.

One tool to support greater awareness and consideration of the potential health effects of decisions made outside the health sector is health impact assessment (HIA) (Bhatia et al., 2014; Harris-Roxas & Harris, 2011). HIA is defined as "a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects" (National Research Council, 2011, p. 5). Methods of application vary greatly across HIAs, but each follows a set of six prescriptive steps, outlined in the publication *Minimum Elements and Practice Standards for Health Impact Assessment* (Bhatia et al., 2014).

HIA should not be confused with community food assessment (CFA), which may be more familiar to food and nutrition researchers and practitioners. CFA is primarily used as a tool to assess the needs and resources in a local food system so that appropriate responses can be developed. It may include an evaluation of the role of related sectors, such as transportation, in contributing to food security (Palmer, Chen, & Winne, 2014). HIA and CFA are similar in that they may utilize much of the same data, engage many of the same diverse stakeholders and community processes, and can vary in terms of comprehensiveness (Palmer et al., 2014). However, the two are distinct when it comes to purpose, scope, and timing. HIAs use data and stakeholder input to evaluate potential effects of specific proposed interventions, while CFAs primarily use them in a descriptive way, to characterize an area's food system. HIAs are conducted when decisions are pending, to predict future effects, while CFAs assess existing circumstances. HIAs also cover a wide range of sectors and are not limited to agriculture, food, and nutrition. In addition, HIAs can apply to a much broader geographic area than CFAs, which usually focus on a local scale. Possible avenues for increasing linkages between HIA and CFA are included in the discussion.

HIA has been used increasingly over the past 20 years to support decision-making in an array of sectors, including housing, planning, education, and criminal justice, at the federal, regional, state, and local levels, in the U.S. and globally (Cole & Fielding, 2007; Collins & Koplan, 2009). The use of HIA is endorsed by the National Research Council of the National Academies of Science, Engineering, and Medicine (National Research Council, 2011). In circumstances when a proposed policy, program, or project has the potential to affect health, HIA brings a health perspective to inform the design and/or implementation of the proposed initiative. The many significant links between agriculture, food systems, nutrition, and health make these important topics to consider applying HIA to, but there is a general lack of knowledge about HIA among researchers and policy-makers in these fields. The purpose of this article is to introduce HIA to a mainstream audience, provide key resources to conduct an HIA, review the state of HIA in these fields, and, using the four case studies, provide descriptive examples of the nature and scope of HIAs and illustrate the substantial impacts HIA can have on decisions.

Of the approximately 400 total HIAs completed or in progress in the U.S., relatively few have been related to agriculture, food, and/or nutrition (The Pew Charitable Trusts, 2015). This article complements recently published sector-specific reviews of completed HIAs on transportation, housing, planning, criminal justice, and education decisions, all of which follow a similar format of identifying all relevant studies, reviewing key characteristics, and exploring example cases (American Planning Association, 2016; Dannenberg et al., 2014; Gase et al., in press; Hom, Dannenberg, Farquhar, & Thornhill, 2017; National Center for Healthy Housing & National Housing Conference, 2016). Similar reviews of HIAs in additional sectors are in progress.

Methods

We conducted a systematic search and review of all HIAs focused on agriculture, food, and nutrition

completed in the U.S. as of June 2016. We defined these three categories as follows: *agriculture*—pertaining to food production, encompassing plant-based foods, animal products, and seafood; *food access and availability*—concerning access to and availability of food and food distribution, particularly where food can be purchased; and *nutrition*—relating to standards affecting the nutritional content of food and the provision of nutrition information to consumers, including nutrition-based purchasing incentives.

To identify HIAs, we searched two databases of completed HIAs. From the Health Impact Project database (The Pew Charitable Trusts, 2015), we selected all HIAs categorized under the sector "Agriculture, Food, and Drug." We identified additional HIAs by reviewing the full list of HIA titles for possible relevance. From the UCLA HIA Clearinghouse (n.d.) we selected all HIAs matching the search terms "agriculture," "food," or "nutrition." We conducted confirmatory searches using Google, Google Scholar, and Open Grey,[1] using the search terms "health impact assessment" AND ("agriculture" OR "food" OR "nutrition"). Collectively, these searches yielded 146 HIAs for detailed review.

HIAs were included if they (1) were conducted in the U.S., (2) were completed by June 2016, (3) had a report or executive summary available for review, (4) were referred to by the authors as "HIA," and (5) had a primary focus on a policy, program, or project related to agriculture, food, or nutrition. While many HIAs, particularly those focused on redevelopment projects or built-environment policies, assess food access or nutrition as one of the health determinants examined, this review only includes HIAs with a *primary* focus on agriculture, food, or nutrition. HIAs of tobacco, alcohol, and marijuana policies, programs, and projects were excluded because the pathways through which these products impact health are distinct from those connecting agriculture, food, and nutrition to health.

After excluding duplicates and studies not meeting the inclusion criteria, 24 HIAs were eligible for inclusion in this study. This list of eligible studies was reviewed by an external HIA expert, who identified one additional HIA for inclusion, for a final total of 25 HIAs in this review. HIAs were classified as pertaining to agriculture, food access and availability, or nutrition; many fit more than one category but were classified based on the best fit.

One of the study authors (Cowling) reviewed each of the reports included in order to extract the following key information about each HIA: location, year, lead organization, level of decision (federal, state, or local), decision assessed, data sources and/or methods, modes of stakeholder engagement, equity considerations, primary health impacts, and sample recommendations. A second author (Pollack) repeated data abstraction for a random sample of 20% of the reports to ensure the reliability of the information recorded. Selected details of each HIA are provided in the Appendix; the remaining information on each study is provided in the supplemental online file. In the findings, we summarize characteristics across these HIAs, focusing on ways in which the studies adhere to or depart from practice standards and highlighting novel data sources and analyses.

Of the 25 HIAs included in this review, four were selected for additional investigation. These HIAs were chosen because the results influenced decision-makers or were used by advocates, demonstrating the ability of HIA to affect decisions, empower stakeholders, and improve health. These four HIAs are not intended to be representative of all 25 HIAs reviewed, but rather to highlight the potential benefits of applying HIA in diverse circumstances. These studies were purposefully selected to represent a range of jurisdictional levels and topics: one is at the local level, two are at the state level, and one is at the federal level. Two pertain to agriculture, one to food access and availability, and one to nutrition. The authors of all four HIAs provided feedback on their case studies in response to invitations to review and edit the summaries provided.

Results

The included HIAs were published between 2007

[1] http://www.opengrey.eu

and 2016, with all but two published in 2010 or later, reflecting the relative infancy of HIA in these fields and the more recent growth in their use. Of the 25 HIAs, 40% focused on agriculture (*n*=10), 44% on food access and availability (*n*=11), and 16% on nutrition (*n*=4).

In addition to the national scope of the two federal-level HIAs, the geographic areas addressed by these HIAs fall within 14 states: five in California; two each in Florida, Hawaii, New Mexico, Tennessee, and Illinois; and one each in Ohio, North Carolina, Oregon, Wisconsin, Kansas, Virginia, Indiana, and New Jersey. Nonprofit organizations led the majority of these HIAs (*n*=16), with government agencies and academic institutions leading five and four, respectively; in many cases, multiple institutions collaborated. This breakdown by institutional type suggests that most of these HIAs were privately, rather than publicly, funded.

Two HIAs were conducted on decisions being considered at the federal level; seven on decisions at the state level; and 16 on decisions at the local level. Examples of agriculture-related decisions include the development of community gardens, policies promoting local food production, and the establishment of a concentrated animal feeding operation (CAFO). HIAs focused on food access and availability examined legislation restricting the location of food vendors, the development of grocery stores in food deserts, and modifications to a farmers market, among other examples. Nutrition-focused HIAs included mandated menu labeling, a tax on sugar-sweetened beverages (SSBs), and a waiver to exclude SSBs from federal food assistance purchases. The populations potentially affected by these decisions ranged dramatically in size, from a community of a few thousand residents (Mo'omomi Community-Based Subsistence Fishing Area HIA) to the tens of millions of recipients of federal food assistance (Proposed Changes to the Supplemental Nutrition Assistance Program [SNAP] HIA).

There was substantial variability in the scope of health impacts examined, data sources and methods employed, and presentation of results among the included HIAs; this is common for HIAs due to the flexible nature of the methodological guidelines. Most (*n*=18) of these studies examined health impacts linked to changes in food access, food security, or dietary intake, as well as a range of additional impacts, including employment, air quality, and social capital. HIAs typically rely on existing sources of information; all of the included reports cited a literature review of relevant topics and/or analyzed or presented findings from recent survey or census data. Some HIAs used novel data sources and methods, including economic analyses (HB 2800: Oregon Farm to School and School Garden Policy HIA, Potential Health Effects of Changes to the Kansas Corporate Farming Law HIA); reviews of administrative and legal documents (Rock Prairie Dairy HIA); modeling of projected traffic and air flows (The Potential Health Impact of a Poultry Litter-to-Energy Facility in the Shenandoah Valley, Virginia, HIA); and a comparative analysis of matched schools (Street Vendor Legislation and Student Nutrition in South Los Angeles HIA).

The HIA teams conducted stakeholder engagement using a variety of strategies: surveys of residents in affected areas, stakeholder interviews, focus groups, and community meetings. Most (*n*=17) HIAs mentioned using multiple techniques to engage stakeholders and elicit their opinions. A focus on equity—identifying and addressing systemic, avoidable, and unjust differences in factors important to health between population groups (SOPHIA Equity Working Group, 2014)—was included in these HIAs in several ways. Many of the HIAs had a primary focus on low-income or otherwise disadvantaged populations; others conducted analyses, presented results, or formulated recommendations specific to certain subpopulations, as defined by income, age, race, or ethnicity. Only two HIAs (South LA Fast Food HIA and Menu Labeling as a Potential Strategy for Combating the Obesity Epidemic HIA) did not explicitly mention any emphasis on sensitive subpopulations in the analysis or results.

Each HIA offered multiple recommendations, in many cases ranging in scope from broad suggestions—for example, to improve walkability—to very specific actions, such as revisions to policy provisions. Some recommendations were

definitive, while many encouraged additional investigation to reach firmer conclusions or evaluate impacts going forward. Equity-focused recommendations emphasized inclusiveness in decision-making and encouraged measures that protect against negative effects specific to vulnerable populations. While key recommendations targeted decision-makers with jurisdiction over the policy, program, or project in question, other recommendations focused on officials in related departments or agencies with the ability to impact extenuating circumstances. Additional recommendations also addressed a diverse set of stakeholders, including school officials, business owners, and parents.

To illustrate the contents of individual HIAs in greater detail, four descriptive case studies are presented to provide a sense of the HIA process, including circumstances that led to each HIA, how stakeholder opinions were integrated, the development of recommendations, and how findings were used.

Case Studies

Case Study 1: Growing for Kane Food and Farmland Ordinance HIA

Kane County, Illinois, is a productive agricultural region on the outskirts of Chicago, but due to economic and population pressure, much of its farmland is at risk of non-agricultural development. The county has implemented policies since 2001 to reduce farmland loss. In 2013, an amendment to an existing ordinance was introduced that would "offer incentives through the farmland protection program to diversify food crop acres and increase acres dedicated to food production" (Forbes, Hill, Hoff, & VanKerkhoff, 2013, p. 10). The Kane County Health and Development and Community Services departments jointly received funding from the Health Impact Project (a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts) to conduct an HIA on this decision. The HIA examined possible health effects from changes in dietary consumption (if the available local produce led to increased consumption), and on the local economy, due to increasing local fresh food production.

Kane County is a rich agricultural area, yet faces significant diet-related health challenges, with low per-capita fruit and vegetable consumption and almost two-thirds of adults being overweight or obese. Based on existing literature, resident and farmer surveys, and local stakeholder input, the HIA projected the strongest likely health impacts of the proposed amendment would be reducing rates of chronic diseases and reducing health disparities among vulnerable populations. Less conclusive possible health effects, likely to be of smaller magnitude, included reduced obesity rates, improved social and emotional wellness, and increased life expectancy.

The HIA recommended that instead of amending an existing ordinance, the county should create a new separate ordinance, the Growing for Kane program, to fund temporary or permanent easements on leasing land for food production. The HIA developed additional policy and programmatic recommendations related to increasing production and distribution of healthy local foods. In the reporting phase, the HIA team shared findings and recommendations in formal meetings with representatives from several relevant city agencies.

In August 2013, the Kane County Board unanimously adopted the resolution proposing the Growing for Kane program. The HIA findings, particularly those demonstrating support from various stakeholders, were essential to the passage of the resolution. After the HIA's completion, researchers from Northern Illinois University conducted a formal evaluation of the HIA process and impacts, concluding that they successfully increased awareness of the decision's health implications and finding unanimous belief among interviewees that the HIA was useful (American Planning Association, 2016; Forbes, Hill, Hoff, & VanKerkhoff, 2013).

Case Study 2: HB 2800: Oregon Farm to School and School Garden Policy HIA

In 2011, the Oregon House of Representatives considered House Bill 2800, the Oregon Farm to School and School Garden legislation. The bill proposed two new programs: reimbursements for school meals incorporating Oregon food products, and grants for school gardens and agricultural education. With funding from the Health Impact

Project and the Northwest Health Foundation, a local public health research and advocacy organization, Upstream Public Health, conducted an HIA on this proposed legislation in 2010, to inform the vote in 2011 (Henderson et al., 2011).

Improving the variety and nutritional content of school meals has clear health benefits, but this HIA also sought to illuminate the less obvious potential results of economic changes and to bring a specific focus on low-income children, children of color, and rural communities. Using literature review, analysis of existing data, economic analysis of food procurement, and substantial stakeholder input, the HIA examined health effects from changes in employment, diet and nutrition, school garden education, environmental health, and social capital. Key decisions throughout the HIA process were informed by two advisory committees made up of diverse stakeholders, ranging from technical experts to advocates and representatives of affected population groups. The HIA team also held a communications workshop to train stakeholders in disseminating HIA results.

There were three primary recommendations. First, schools should only be reimbursed for food produced or processed in Oregon (as opposed to packaged or packed in Oregon) to maximize local economic benefits. Second, education program grants should be provided preferentially to schools with large populations of students from low-income households or serving a larger proportion of students of color or living in food deserts. Third, the education grants should be awarded to programs with multiple farm-to-school elements that include local food procurement, nutrition and garden education, local food and nutrition promotion, and community involvement (Henderson et al., 2011).

In early 2011, the HIA authors were invited to testify during a House committee hearing on the bill. The original bill was amended, fully incorporating two of the HIA recommendations and partially incorporating the third recommendation, and the amended bill passed in April 2011 (Henderson et al., 2011).

Case Study 3: Food Tax in New Mexico HIA

New Mexico repealed a statewide tax on grocery-store food in 2004, but by 2014 was considering proposals to reinstate such a tax—either at the state level or by granting cities and counties the option to enact a local food tax. With financial support from the Health Impact Project, the nonprofit organization New Mexico Voices for Children conducted an HIA on this decision, which was expected for a vote as early as the 2016 legislative session.

The HIA used initial interviews with a range of stakeholders, including community groups, community service organizations, and government agencies, and focus group discussions with community members, to identify the health determinants that would be the focus of the study. Three primary effects were selected for detailed analysis: families' economic security and nonfood spending; food spending, food security, and nutrition; and government spending. The HIA concluded that reinstating a tax on food would have an overall negative impact on health, with a minimal likelihood of certain positive health effects from increased government revenue. The study estimated that a food tax would cost the average New Mexico household US$350 per year—a cost that could affect households' ability to afford food or necessary health care or prescription medications. They concluded the tax would harm lower- and middle-income households the most.

In addition to recommending against a food tax, the HIA presented a range of recommendations to reform the state's tax revenue in alternate ways, including increasing tax credits for low-income families and instituting a minimum corporate franchise tax rate (Wallin, Casau, Jimenez, Bradley, & Kayne, 2015). Findings and recommendations were shared widely through a communications strategy that included targeted fact sheets, press coverage, posting key findings on social media, and presentations at hearings and meetings. This HIA provided valuable new information to a debate raised in the New Mexico legislature several times in the last few years and contributed to the defeat, once again, in 2016 of a bill reinstating a food tax (Think New Mexico, n.d.). Despite the 2016 outcome, this debate may not be over in New Mexico, and the HIA will continue to be useful in future years.

Case Study 4: National Nutrition Standards for Snack and a la Carte Foods and Beverages Sold in Schools HIA

The 2010 Healthy Hunger-Free Kids Act directed the U.S. Department of Agriculture (USDA) to align nutrition standards for all foods and beverages sold in schools during the school day with current dietary guidelines. In 2012, the Kids' Safe and Healthful Foods Project and the Health Impact Project worked with Upstream Public Health to conduct an HIA to inform the USDA's update to nutrition standards for foods and beverages sold outside of school meal programs. At the time of the study, the USDA had not yet proposed updated standards, so the HIA assessed a plausible hypothetical set of standards, developed with input from the HIA advisory committee, which would align with the 2010 Dietary Guidelines for Americans.

The key impacts examined were possible health effects via changes in diet and nutrition; school food services; other school revenue; and impacts specific to vulnerable populations. The HIA team conducted interviews with a broad range of stakeholders, including students, school administrators, and industry representatives. They used a difference-in-difference analysis of school districts in several states to understand the effects of previous changes in state legislation that mirrored aspects of the proposed federal regulations. The study concluded that reforming the standards would decrease students' consumption of unhealthy foods and beverages and would not lead to a decline in revenue for schools and districts, and that benefits would accrue disproportionately to vulnerable populations.

Based on these findings, the HIA team developed specific recommendations for the content of USDA standards for foods and beverages sold outside of school meal programs, and recommended policies and practices to ensure the effective implementation of those standards (Kids' Safe and Healthful Foods Project & Health Impact Project, 2012). Findings and recommendations were distributed to various audiences through public presentations, a policy brief, a press release, and postings in newsletters.

When the USDA subsequently developed these standards, they incorporated nearly all the HIA's recommendations (The Pew Charitable Trusts, 2015). New information provided by the HIA regarding possible impacts on food-service revenue for schools and districts was considered particularly useful and "this was the first HIA to inform a federal rule-making process" (The Pew Charitable Trusts, n.d., "Outcome," para. 1). These standards were implemented in 2014–15 and are in effect in all U.S. schools participating in school meal programs; evaluation research suggests these are effective overall, though they work best when incorporated alongside nutrition education or incentive programs (Cullen & Dave, 2017).

Discussion

This review identifies and describes all HIAs conducted on agriculture, food, and nutrition policies, programs, and projects in the United States. Of approximately 400 HIAs completed or in progress across the U.S., less than 10% to date have addressed these topics (The Pew Charitable Trusts, 2015). Across the HIAs reviewed here, key elements of the practice standards were clearly identifiable, and several common traits emerged. First, HIAs were more commonly used for policy rather than program or project decisions: 18 of the 25 HIAs, including all four case studies, involved a policy decision. Second, practitioners used diverse and sometimes creative sources of data to complete their assessments, and employed various means to engage multiple stakeholder groups, such as opinion surveys and community meetings. Third, nearly all the HIAs examined potential impacts through the lens of health equity, whether by applying HIA to a decision with the potential to substantially affect a vulnerable population; by focusing on equity dimensions of the decision in the analysis and recommendations; or by effectively engaging underrepresented stakeholders.

Lessons from Existing HIAs

These HIAs reveal a range of pathways through which agriculture, food, and nutrition decisions can affect health, which go beyond traditional conceptions of these links as being focused primarily on nutrition and food security. The wide variety of impacts highlights the importance of assessing

policies, programs, and projects in detail to elucidate unexpected relationships with health, particularly in regard to vulnerable populations, so that health disparities are not exacerbated. A common challenge of exploring indirect links—between policies outside the health sector and health outcomes—is the paucity of data documenting health impacts through a cascade of events. These pathways may have no or limited evidence, leading to difficult decisions about when to apply imperfect evidence or the level of confidence in its appropriateness to inform the decision at hand. In some cases this evidence may be contested, as in, for example, the impact of carcinogens such as Bisphenol A (BPA) in food packaging and the widespread use of genetically modified organisms in the food supply. These challenges arising in the conduct of HIAs highlight priorities for new research, particularly the need for more socio-ecological research that illuminates indirect linkages between upstream determinants and health outcomes in the fields of agriculture, food, and nutrition.

The case studies, in particular, illustrate how HIA findings and recommendations can inform policy decisions and exemplify several characteristics common to effective HIAs. A recent review of over 200 HIAs identified several factors that influence the likelihood of an HIA having an impact (Dannenberg, 2016); the four cases reviewed here are consistent with the findings of this larger review. First, the timing of the study must be appropriate so that findings and recommendations are released sufficiently in advance of a final decision. If information is provided too late, there will not be adequate time to consider the study's findings during decision-making or the opportunity to modify opinions or plans. An HIA can be conducted with a range of resources, depending on the time and resources available. If limited, a rapid HIA can be conducted in a few weeks, while a comprehensive HIA typically takes several months to two years. Second, stakeholder engagement is critical and best when done throughout the HIA process—from the initial screening to the final monitoring and evaluation—and involving a broad range of actors. Early and ongoing engagement helps to generate buy-in for study recommendations and involving vulnerable populations represents an opportunity to bring new voices to a decision and improve health equity. Third, recommendations should be presented in a clear, feasible, and targeted manner. Working closely with stakeholders helps to ensure that recommendations are realistic and have the potential to be adopted. Lastly, a clear and readable report and a dissemination plan are crucial to communicate and publicize findings. In each of the case studies, the HIA team used tailored dissemination strategies to reach various audiences. Such targeted dissemination may encourage decision-makers to act on an HIA's findings and recommendations and embolden advocates to use the findings to encourage particular decisions.

In terms of the applicability of HIA findings, several of the HIAs reviewed discuss the likelihood that a policy, program, or project under consideration in one location may be simultaneously or subsequently proposed elsewhere. For example, the *Menu Labeling as a Potential Strategy for Combating the Obesity Epidemic HIA* (Simon, et al., 2008) investigated a proposal to mandate menu labeling in California, which was subsequently considered in many other jurisdictions. In such cases, study findings may be useful in multiple locations. Some impacts and conclusions will be specific to particular environments, but often insights from an HIA can be more widely applicable. To facilitate shared learning, relevant HIA findings and recommendations should be disseminated among agriculture, food, and nutrition researchers, policymakers, and practitioners—for example, through publications or conference presentations. Widespread dissemination can increase the impact of each study by promoting health benefits and reducing health risks in different jurisdictions; and can lead to broader awareness of and appreciation for HIA as a decision-support tool, thereby generating interest in applying HIA in new settings.

A unique advantage of performing HIAs on agriculture, food, and nutrition decisions is the potential to link HIAs with CFAs, particularly those CFAs designed to include sectors outside of food and agriculture that contribute to a community's food security (Palmer, Chen, & Winne, 2014). HIA and CFA may be mutually beneficial; the ideal combination may be to conduct these

studies sequentially. If a CFA was previously conducted in an area where an HIA is planned, the CFA may provide substantial useful background information for the assessment, and vice versa. The information gathered for the initial study could reduce the resources required by building on the stakeholder relationships already established and utilizing the data sources previously compiled. In addition, since an HIA is intended to assess the implications of an actively pending decision, any subsequent CFA in the same area could serve as follow-up to the HIA. This would help to address one of the critical gaps in HIA practice—the paucity of monitoring and evaluation after initial studies are completed.

Agencies, organizations, or other groups conducting an HIA for the first time may benefit from partnering with an experienced researcher or agency that can advise on the HIA process. Potential collaborators may be identified through the Society of Practitioners of Health Impact Assessment (SOPHIA), a global network of HIA practitioners.[2] As is evident from the HIAs included in this review, many are collaborative efforts of multiple agencies or institutions.

Future Challenges for HIA

While this review identified cases in which HIA informed and influenced decisions, the ultimate impacts of these HIAs on health outcomes are currently unknown. This is an important limitation of HIAs generally; in most cases, there is no monitoring and evaluation of impacts once an HIA is complete, particularly of impacts on health outcomes (Dannenberg, 2016). The evaluation of the *Oregon Farm to School Policy HIA* (case study 3) provides an example of an assessment of the HIA process, but without an evaluation of effects on health outcomes (Diep, Henderson, & Rader, 2011). This lack of monitoring and evaluation is a common occurrence, despite many HIA reports including an implementation plan to assess such impacts; the *2010 Hawai'i County Agriculture Development Plan HIA* provides a good example of this type of plan. Several factors may contribute to the general absence of monitoring and evaluation: a lack of funding for these activities, the typical delay between a decision and its impact on health outcomes, and the difficulty in attributing impacts specifically to HIA. These challenges must be managed to generate evidence of the ability of HIA to drive improvements in health outcomes and develop greater appreciation among those outside the health sector of the value of investing in and using HIA.

In addition to the need for funding for monitoring and evaluation, there is a need for more institutionalized funding to conduct HIAs. Many of the studies included in this review were funded by the Health Impact Project, which has been a major source of funding for HIAs in the U.S. Relying on voluntary, philanthropic funding is likely not a sustainable model for HIA, however. To become more commonplace, HIA may require committed public funding, at various levels of jurisdiction, or cooperative partnerships with industry, as employed in the oil and gas sector in Alaska (Anderson, Yoder, Fogels, Krieger, & McLaughlin, 2013). Objectivity in the assessment and recommendations, however, may need to be more carefully managed if strong financial incentives exist for an industry partner.

Study Limitations

Several limitations may affect the conclusions of this review. First, one relevant HIA was excluded because no report or executive summary was publicly available. Additional eligible studies may not have been identified in the search process. We attempted to minimize the possibility of missing studies by searching multiple sources and also consulting an external expert. Second, this review focuses on HIAs completed in the U.S. Internationally, there are additional relevant HIAs that could provide valuable lessons and insights for U.S. researchers, policy-makers, and practitioners in these sectors. Third, the many HIAs of built environment projects and other decisions that substantially affect a local food system may also provide important examples to inform the understanding of the role of HIA in the agriculture, food, and nutrition sectors but were not included here.

[2] https://sophia.wildapricot.org/

Relevant HIAs from other countries and sectors should also be examined to inform the practice of HIA on agriculture, food, and nutrition policies, programs, and projects in the U.S. Finally, there was no explicit quality control of the HIAs included, and some HIAs that have been completed do not fully meet established practice standards (Bhatia et al., 2014; Schuchter, Bhatia, Corburn, & Seto, 2014). Our inclusion criteria specified only that the authors referred to the study as an HIA. It is possible that the term may have been misused, although the studies we included appear to adhere generally to these guidelines.

Conclusion

This review summarizes the use of HIA in the U.S. in the agriculture, food, and nutrition sectors, introducing potential applications of HIA to researchers, policy-makers, and practitioners in these fields who are unfamiliar with the tool. The number and type of completed studies suggest that HIA could be more widely used in these sectors. To date, these HIAs have been conducted in many states in several different regions, most often at the local level, and have been predominantly applied to policy decisions. Collectively, these studies suggest there is a need to conduct more socio-ecological research linking distal determinants to health outcomes to inform HIAs in these sectors; identify the potential for HIA findings to be used for similar decisions in different jurisdictions; and highlight the opportunity to link HIA with CFA. Common attributes of influential HIAs confirmed by this study include ensuring timing is appropriate to inform a decision; engaging stakeholders throughout the HIA process; developing clear and feasible recommendations; and producing a strong report that is widely disseminated. Challenges observed in these studies include a lack of monitoring and evaluation of the process and impacts of HIAs, and questions about sustainable sources of funding to conduct future HIAs.

Many other types of policies, programs, and projects in the food and agriculture sectors may benefit substantially from the application of HIA during the decision-making process. Possible examples span the processes of food production, transportation, and retail, including regulations on antibiotic use by livestock producers, tax incentives to encourage local food production and consumption, and advertising restrictions regarding false claims or foods with low nutritional value (Muller & Wallinga, 2014). In addition, research indicates that the health of low-income communities and communities of color is disproportionately negatively affected by determinants in the agriculture, food, and nutrition sectors, including living in food desserts and experiencing obesity and diabetes (Chang & Lauderdale, 2005; Walker, Keane, & Burke, 2010). Therefore, HIA can play an important role in identifying strategies to address health inequities stemming from agriculture, food, and nutrition decisions. Finally, applying HIA provides opportunities to broaden the coalition supporting a policy change or program proposal by giving health advocates both data and a reason to lend support, and may help to inform public opinion by identifying relevant health issues. Expanding the use of HIA in the agriculture, food, and nutrition sectors can help to modify decisions that may harm public health and can contribute to the adoption of health-promoting policies, programs, and projects across these sectors.

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Appendix. Key Characteristics of 25 Health Impact Assessments Focused on Agriculture, Food, and Nutrition in the U.S. and Included in this Meta-analysis (see note for explanation of acronyms)

HIA Title / Location / Year	Lead Organization	Level of Decision	Decision Assessed	Primary Health Determinants and Health Impacts Examined	Equity Considerations	Example Recommendation
I. AGRICULTURE						
Knox County Health Department Community Garden *Knox County, Tennessee 2010*	Knox County Health Department	Local	Decisions related to the placement and maintenance of community gardens	Access to healthy food; physical activity; community collaboration and cohesion	Recommendations highlight need to prioritize low-income communities for community gardens	Site gardens in food deserts
* **HB 2800: Oregon Farm to School and School Garden Policy** *Oregon 2011*	Upstream Public Health	State	Oregon House Bill (HB) 2800: Farm to School and School Garden Policy	Employment; diet and nutrition; farm-to-school and school garden K-12 education opportunities; environmental health; social capital	Considered vulnerable populations specific to each pathway	Amend HB 2800 to specify that schools can only get reimbursed for foods produced or processed in Oregon to increase economic activity in the state
Rock Prairie Dairy *Bradford, Wisconsin 2011*	Rock County Health Department	Local	Proposal to build the Rock Prairie Dairy, a concentrated animal feeding operation (CAFO)	Hazardous gas and particulate emissions; nuisance odors; groundwater quality; surface water quality; economic impact; traffic; noise; visual; insect-borne disease	Assessed impacts on vulnerable populations in terms of income, race, ethnicity, and age	Install vegetative buffers to help decrease aesthetic, noise, odor, and emission effects around the facility and manure application fields
2010 Hawai'i County Agriculture Development Plan *Hawai'i County, Hawaii 2012*	The Kohala Center	Local	Selected provisions of Hawaii County Agricultural Development Plan: local buying by government institutions and NGOs; agriculture for the local market; home, community, and school gardening	Hunger (food security) and diet quality (nutrition security); obesity; food-borne illness; economy; well-being and cultural connectedness	Farm-to-school buying assessed with a focus on vulnerable populations (Native Hawaiian and Pacific Islanders, SNAP eligible)	Facilitate collaboration between businesses, NGOs, and Department of Human Services to increase acceptance of cash vouchers, EBT, and credit cards at farmers markets
Urban Agriculture Overlay District *Cleveland, Ohio 2012*	Place Matters	Local	Establishment of an Urban Agriculture Overlay (UAO) district, which will permit intense urban agriculture uses: chickens, bees, livestock, urban farm, market gardens	Environmental hazards; empowerment; food access	Surveyed low-income and minority residents	Identify transitional neighborhoods with abundant vacant land and a fair housing market where the presence of an UAO district can have positive market impacts for adjacent homeowners

* **Growing for Kane food and farm ordinance** *Kane County, Illinois* *2013*	Kane County Health Department	Local	Amendment to the "Growing for Kane" food and farm ordinance, which would increase the number of farms that produce fruits, vegetables, meats, and dairy for human consumption	Food security; nutrition; employment; physical activity	Examined differences in health status by race and/or ethnicity and income; conducted geographic analysis of concentrated areas of vulnerable families in relation to fresh food availability	The Farm Bureau and Kane County should participate in linking procuring institutions with local growers for pre-season contracts
The Potential Health Impact of a Poultry Litter-to-Energy Facility in the Shenandoah Valley, VA *Shenandoah Valley, Virginia* 2013	Virginia Commonwealth University	Local	Developing a facility to convert poultry litter to energy	Air quality; water quality; economic effects; employment; other community factors	Impacts examined by income, race and/or ethnicity, and age	Ensure that the location of the facility is not only in an area of low population, but also in one with few older adults
Food System Plan to Promote Healthy, Local Food Production and Consumption in Davidson, NC *Davidson, North Carolina* *2014*	Davidson Design for Life	Local	Promoting the development of the local food system, including efforts to increase local production, processing, distribution, consumption, and disposal	Seven dimensions of health: physical, emotional, social, environmental, spiritual, intellectual, economic (occupational)	Quoted USDA nutrition recommendations specific to pregnant women and elderly populations	Plant edible landscaping whenever possible along streetscapes and within parks
Potential Health Effects of Changes to the Kansas Corporate Farming Law *Kansas* *2015*	Kansas Health Institute	State	Amendments to the Kansas Corporate Farming Law, which would allow any agricultural business to operate anywhere in the state	Jobs; property value and taxes; population; waste; antibiotic use	Special attention given to populations likely to be most affected, including people with respiratory conditions	Compensate neighboring property owners for negative externalities associated with livestock operations, such as property depreciation
Mo'omomi Community-Based Subsistence Fishing Area *Moloka'i Island, Hawaii* *2016*	The Kohala Center	Local	Proposed establishment of a CBSFA	Self-determination and control of resources; traditional marine resource management and transmission of ancestral knowledge; access to marine resources for family and community subsistence; commercial fish sales and commercial fisher income	Focus of the HIA is on a low-income area with a majority indigenous population	Support the CBSFA as a place for the study and teaching of traditional Native Hawaiian fishery management practices

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II. FOOD ACCESS AND AVAILABILITY						
Modifications to the Trenton Farmers Market *Trenton, New Jersey* *2007*	UCLA HIA Group	Local	Three possible alternative modifications to the Trenton Farmers Market: minor changes; full implementation of Project for Public Spaces recommendations—major remodeling; market outreach—e.g., satellite markets	Nutrition; physical activity; economics (vendors and surrounding community); social capital; public health services	Assessed impacts on three subpopulations, defined based on geographic proximity to the market and varying sociodemographic characteristics	Set up vendor stalls, especially those selling fresh fruits and vegetables, with EBT machines to take WIC and other government benefit cards
Development of Big Box Grocery in West Oakland *Oakland, California* *2011*	Alameda County Public Health Department	Local	Plan to develop a large ("big-box") Foods Company grocery store in a West Oakland neighborhood with no full-service grocery store	Access to healthy foods; jobs and economic development; traffic safety	Focus of HIA is a low-income community without an accessible grocery store	Consider pedestrian- and bicyclist-centered design to promote alternative modes of transportation
Impacts of Allocating Resources toward Access to Healthy Foods Strategies in an Underserved South Florida Community *Broward County, Florida* *2012*	Florida Public Health Institute	Local	Allocating funding from the Transforming Our Community's Health (TOUCH) Initiative to access to healthy foods strategies	Nutritional quality of foods and beverages available in schools; accessibility, availability, affordability, and identification of healthy foods in communities; jurisdictionwide nutrition policies and practices in early childcare settings; the number of baby-friendly hospitals	Focus of HIA is on access to healthy foods in disadvantaged communities	Establish a corner store network or co-op to enhance economic development and access to healthy foods
Development of a Full-Service Grocery Store Within a Food Desert *Indianapolis, Indiana* *2013*	Center for Health Policy, Indiana University	Local	Proposed development of a full-service grocery store in the Meadows community	Access to healthy foods; nutrition; obesity and related chronic diseases	Focus of HIA is a low-income community without an accessible grocery store	Support sidewalk expansion and increased transit to the area
Evaluating Transportation Access to Healthy Food Sources *Alachua County, Florida* *2013*	Amanda Marie Douglas (University of Florida)	Local	City of Gainesville and Regional Transit System Transit Development Plan; the "Mobile Food Market Feasibility Study"	Walkability and bikeability; public transit accessibility; access to healthy foods	Focus of HIA is on low-income and minority neighborhoods; children, people with disabilities, and elderly also examined as vulnerable populations	Begin supermarket carpool and/or shuttle service

South LA Fast Food *Los Angeles, California* *2013*	Community Health Councils	Local	Community plan that may modify regulations of a current ban on the development of new stand-alone fast food restaurants	Nutrition; quality of life; air pollution exposure; pedestrian injuries; physical activity	Not mentioned	Expand regulations to non–stand-alone restaurants
Proposed Changes to the Supplemental Nutrition Assistance Program (SNAP) *U.S.* *2014*	Health Impact Project	Federal	Changes to SNAP included in House and Senate bills during the 112th and 113th Congresses	Food insecurity and its impact on the risk of illnesses such as diabetes; diet, nutrition, and the risk of illnesses related to poor diet, such as obesity and heart disease; the impact of poverty on health and people's ability to afford essentials related to health, including housing, home energy, and medical care	Focus of HIA is on low-income populations eligible for federal food assistance	Raise the asset limit for SNAP eligibility
* **Food Tax in New Mexico** *New Mexico* *2015*	New Mexico Voices for Children	State	Reinstatement of a tax on food purchased for consumption at home	Family economic security: changes to nonfood living expenses; family economic security: changes to food budget, food insecurity, diet, and nutrition; changes in government spending: maintaining current services	Assessed impacts on vulnerable populations, including low-income children, communities of color, the working poor, and seniors	Consider legislation that addresses food desert zoning
Improving the Quality and Quantity of Food in Southwest New Mexico Food Pantries *New Mexico* *2015*	National Center for Frontier Communities	State	Revisions to the USDA's Emergency Food Assistance Program distribution formula	Access to healthy food (quantity and quality); diet-related health conditions for adults and children	Focus of HIA is on populations accessing food assistance	Establish a statewide advisory committee to review, study, and ultimately change the formula to more accurately reflect the need for healthy food supplies at the local level
Street Vendor Legalization and Student Nutrition in South Los Angeles *Los Angeles, California* *2015*	Community Health Councils	Local	Legislation to legalize sidewalk vending	Street vendor presence; snack and beverage consumption among students; bicyclist and pedestrian presence near schools	Focus of HIA is on schools in high poverty areas and with large Spanish-speaking populations	Continue to prohibit sidewalk and mobile food vending within 500 feet (152 meters) of school campuses

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Tennessee Food Desert Relief Act *Tennessee* *2016*	Prevention Research Center in St. Louis	State	Tennessee Senate Bill 1176: Food Desert Relief Act	Presence of obesity and chronic disease; employment; stress; environmental impact	Considered impacts on vulnerable populations including racial and ethnic minorities, those living in poverty, rural residents, elderly, and people with disabilities	Consider redefining "food desert relief enterprise" using criteria for nutritional content of "healthy food" and percentage of "healthy" products sold
III. NUTRITION						
Menu Labeling as a Potential Strategy for Combating the Obesity Epidemic *Los Angeles County, California* *2008*	County of Los Angeles	Local	California Senate Bill 120 (2007) and California Senate Bill 1420 (2008), which propose menu labeling	Obesity	Not mentioned	To maximize impact, use community education efforts, pricing incentives, or other strategies to increase the degree to which restaurant patrons use the posted information to select reduced calorie meals
* **National Nutrition Standards for Snack and a la Carte Foods and Beverages Sold in Schools** *U.S.* *2012*	Kids' Safe and Healthful Foods Project	Federal	Updates to USDA standards for snack and a la carte foods and beverages sold in schools	School district revenue and student health; diet and nutrition and student health	Assessed effects on low-income and ethnic minority students	USDA should establish nutrition standards for all foods sold regularly on school grounds outside of the school meal programs
California Senate Bill 622: Sugar-Sweetened Beverage Tax *California* *2014*	Community Health Councils	State	Proposed state bill to impose a $0.01 per ounce tax on SSB distributors	SSB consumption; healthy nutrition awareness; total short-term physical activity	Focused on impacts on low-income and households of color with children under age 5	Utilize tax revenues to make healthier drinks more accessible
SNAP Decisions *Illinois* *2014*	Illinois Public Health Institute	State	Requesting a waiver from the USDA to exclude SSBs from SNAP-eligible purchases	Diet and nutritional intake; diet-related health conditions; food security and economic hardship; stigma and stress; budget impacts from administrative costs to the state	Focus of HIA is on low-income populations eligible for food assistance	Rather than seek a waiver for restricting SSBs in SNAP as a stand-alone approach, combine restrictions with incentives and education

* HIA presented as a case study.

Abbreviations: CBSFA=Community-Based Subsistence Fishing Area; EBT=Electronic Benefit Transfer; HB=House bill; HIA=health impact assessment; NGO=nongovernmental organization; SSB=sugar-sweetened beverage; UAO=Urban Agriculture Overlay; USDA=U.S. Department of Agriculture; WIC=Special Supplemental Nutrition Program for Women, Infants and Children