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Impact of Cooking and Home Food Preparation Interventions Among Adults: Outcomes and Implications for Future Programs

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Objective: Cooking programs are growing in popularity; however, an extensive review has not examined their overall impact. Therefore, this study reviewed previous research on cooking/home food preparation interventions and diet and health-related outcomes among adults and identified implications for practice and research.

Design: Literature review and descriptive summative method.

Main Outcome Measures: Dietary intake, knowledge/skills, cooking attitudes and self-efficacy/confidence, health outcomes.

Analysis: Articles evaluating the effectiveness of interventions that included cooking/home food preparation as the primary aim (January, 1980 through December, 2011) were identified via Ovid MEDLINE, Agricola, and Web of Science databases. Studies grouped according to design and outcomes were reviewed for validity using an established coding system. Results were summarized for several outcome categories.

Results: Of 28 studies identified, 12 included a control group with 6 as nonrandomized and 6 as randomized controlled trials. Evaluation was done postintervention for 5 studies, pre- and postintervention for 23, and beyond postintervention for 15. Qualitative and quantitative measures suggested a positive influence on main outcomes. However, nonrigorous study designs, varying study populations, and the use of nonvalidated assessment tools limited stronger conclusions.

Conclusions and Implications: Well-designed studies are needed that rigorously evaluate long-term impact on cooking behavior, dietary intake, obesity and other health outcomes.

Key Words: cooking, food preparation, intervention, diet outcomes, review (*J Nutr Educ Behav.* 2014;46:259-276.)

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INTRODUCTION

The importance of away-from-home meals and convenience foods in the American diet may relate to a lack of time to plan and prepare meals at home.¹ A recent review also implicates a lack of cooking skills and food preparation knowledge as barriers to preparing home-cooked meals.² The percentage of total household food dollars spent on food eaten away from home is now higher compared with 30 years ago (33% in 1970 to 47% in 2010).³

Consumption of fast food and food from away-from-home locations is associated with lower diet quality and obesity among adults.⁴⁻⁸ National dietary intake data from 1994-1996 and 2003-2004 show that each meal away from home is related to an increase in calories by 130/d and a reduction in diet quality by 2 points on the Healthy Eating Index scale.⁹ Food prepared at home provides fewer calories per eating occasion and, on a per-calorie basis, provides less total and saturated fat, cholesterol, and sodium, and more fiber, calcium, and

iron compared with food prepared away from home.¹⁰ Among low-income women, increased frequency of consuming foods prepared from scratch over a 3-day period is associated with an increase in fruit and vegetable, protein, vitamin C, iron, zinc, and magnesium intakes.¹¹

Furthermore, time usage data show that time spent on food preparation and cleanup is less for the average household compared with 30 years ago. In 1995, time spent on food preparation and cleanup was about half (41 min/d) that spent in 1965 (85 min/d) by working women in the US.^{12,13} More recent time usage data (2003-2004) also show that time spent in food preparation decreases as time spent working outside the home increases,¹⁴ with a greater number of women in the US workforce (an increase of 44% from 1984 to 2009).¹⁵ This rise in working women, an amplified perception of time scarcity,¹

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and increased availability of convenience foods based on technological advances and societal demands contribute to the decline in cooking and home food preparation. An observational study of 64 home-cooked dinner meals shows that most meals contain processed, commercial foods possibly because of limited cooking skills.¹⁶

Several cross-sectional, observational studies show a relationship between food preparation skills among adults and associated outcomes. Among mothers of school-aged children, confidence in the ability to prepare a healthy meal is positively associated with healthfulness of the meal.¹⁷ A survey of German adults indicates that ready-meal consumption (ie, consumption of complete, main course meals prepared externally) is inversely associated with cooking skills.¹⁸ A high perceived value of food preparation is associated with greater intake of fruits and vegetables among women in Australia,¹⁹ and when the main home cook is confident in preparing vegetables, households buy a greater variety of vegetables.²⁰

Given the potential positive outcomes related to cooking skills, nutritionists and public health professionals are promoting cooking interventions as a way to improve health. For example, 1 large-scale cooking initiative known as Cooking Matters is under way in at least 45 states. Through the program, local chefs partner with community organizations to teach cooking skills.²¹ Even though the programs are becoming more popular and well-established, an extensive review of the literature that examines the short- and long-term impacts of cooking interventions for adult populations is not available. A review of this type can provide information to improve the effectiveness of current programs and inform the development of new programs. The purpose of the current study was to review previous research on cooking/home food preparation interventions and diet and health-related outcomes among adults. Relevant studies include interventions that focus primarily on home food preparation/cooking as the primary aim. Studies are also reviewed to identify implications for practice and future research.

METHODS

The researchers identified relevant research studies published between January, 1980 and December, 2011 via searches of Ovid MEDLINE, Agricola, and Web of Science databases. The following terms were used in various combinations to perform searches: “intervention,” “demonstration,” “health promotion,” “education,” or “class”; and “food preparation,” “home food preparation,” “cooking or cookery”; and “food habits,” “food intake,” “eating patterns,” “diet,” “dietary intake,” “dietary outcomes,” or “skills.” The search was limited to studies published in the English language and those involving adults (ie, primarily ≥ 18 years of age), including college students.

A total of 373 journal articles and 85 educational materials were retrieved. Educational materials included mostly books as well as visual aids (slide sets, filmstrips, videos, and transparencies), teaching kits, and government publications. Of the 373 journal articles, 54 were repeated in 2 or 3 databases, which left 319 for further review. The authors reviewed abstracts for all articles and excluded studies if they were not intervention studies ($n = 209$: those with a cross-sectional design with qualitative and quantitative methods such as dietary assessment, attitude, and behavioral surveys; focus group and individual interviews; and case studies). Articles were not included if they reported on studies that involved children as the target group, were reports or commentaries on recommendations or resources, or were review articles. Articles were also not included if they were intervention studies that did not have cooking or food preparation as the primary aim, or if only formative development of programs that involved cooking or food preparation was described without evaluation measures. After these exclusions ($n = 306$), the researchers included for further review 13 applicable studies that had cooking or home food preparation as the primary aim. Other potentially relevant studies were identified from bibliographies of these applicable studies. This study was exempt from institutional review board review because it involved a review of previously completed, published studies.

A total of 28 studies meeting the inclusion criteria were identified through this search strategy.²²⁻⁴⁹ Intervention studies included cooking or home food preparation through cooking assignments,^{22,23} cooking classes/demonstrations in community or clinical settings,^{24-44,46-49} and viewing a cooking television show.⁴⁵ Studies were grouped according to design (intervention without control groups, nonrandomized control trials, and randomized control trials) and intended outcomes. One author extracted information from studies into a standardized table (Table 1) structured to provide objective information about the population, intervention duration, measures, and measurement tools and outcomes. A second author independently checked information extraction to ensure that consistent detailed information was included for each study.

The validity questions from a quality criteria checklist were used to critically appraise the validity of each study included in this review with respect to research design and implementation. The checklist was available as part of the Evidence Analysis process of the Academy of Nutrition and Dietetics Evidence Analysis Library and allowed for the rating of primary research studies as positive (“clearly addressed issues of inclusion/exclusion, bias, generalizability, data collection, and analysis”), negative (“these issues have not been adequately addressed”), or neutral (“neither exceptionally strong nor exceptionally weak”).⁵⁰ The process to appraise study validity involved several steps in which an external reviewer first used the checklist to generate responses to all validity questions for 26 of the 28 studies (2 based on primarily qualitative evaluation methods were not included in this process^{24,38}). Next, authors generated responses to all validity questions for 2 to 6 studies each for a total of 13 of the 26 studies. Finally, 1 author reviewed responses to the validity questions for all articles reviewed by the external reviewer and other authors, and generated an overall rating of positive, negative, or neutral for each study. Interrater reliability was determined for ratings of the 13 articles by the external reviewer and multiple authors based

Table 1. Study Characteristics, Intervention Methods, Evaluation Measures, and Summary of Outcomes Regarding Diet and Health

Reference	Design	Population	Intervention Duration	Measurement Tools and Measures	Dietary and/or Health Outcomes
Intervention without control group					
Brown and Richards ²²	Post-assessment of intervention without control group: “Cook-an-Entrée” assignment	Students enrolled in a university nutrition course (n = 579), Brigham Young University, UT	1 assignment	Open-ended qualitative survey “What did you learn from this experience?” to assess perception of food prepared	Students perceived the entrée they prepared to be nutritious (46%), easy to prepare (42%), and quick (28%). Most (98%) intended to prepare the entrée again.
Lacey ²³	Post-assessment of intervention without control group: cooking assignment involving whole cereal grains	Students enrolled in a university Experimental Foods course (n = 60), West Chester University, PA	1 assignment	Activity evaluation survey; qualitative responses to assess perception of overall experience	Median student ranking for overall experience was highly positive (7 on Likert scale ranging from 1 [highly negative] to 7 [highly positive]).
Abbott et al ²⁴	Post-assessment of intervention without control group: interviews 6 mo to 5 y after participation in cooking classes	Aboriginal people, ages 19–72 y (mean, 48 y), mostly women, who participated in cooking courses at Aboriginal Medical Service, Australia (n = 23 of 73 total participants)	Attendance at 29 cooking classes	In-depth semistructured interviews analyzed thematically to assess cooking course experience, nutrition knowledge, cooking skills, dietary behavior, factors impacting application of knowledge, and skills from course	Participants reported improved understanding of healthy eating and cooking skills. Dietary changes most often reported were decreased salt and fat intake, and increased use of fresh vegetables. Families’ willingness to accommodate dietary changes was most important influence on applying knowledge/skills from course.
Davies et al ²⁵	Pre-/post-assessment of intervention without control group: peer-led cooking sessions and community nutrition campaigns (assessment at baseline, postintervention, and 1-y follow-up)	South Asian community members in Southampton, United Kingdom (46 individuals attended cooking sessions)	10 tasting sessions and 28 cooking sessions offered (timeline unknown)	Dietary questionnaires, qualitative and quantitative techniques (nonspecific description of tools) to measure healthy eating knowledge, attitudes and behaviors (eating, shopping, and cooking), barriers to change, and maintenance	At 1-y postintervention, participants reported using low-fat dairy products, FV, and high-fiber starchy foods more often; and using less salt and eating fewer fatty, fried, and sugary foods (no information on statistical significance provided).

(continued)

Table 1. Continued

Reference	Design	Population	Intervention Duration	Measurement Tools and Measures	Dietary and/or Health Outcomes
Swindle et al ²⁶	Pre-/post-assessment of intervention without control group: nutrition education classes with cooking demonstration and food preparation skills (assessment at baseline, postintervention, and 3- or 6-mo follow-up)	Limited resource adults (n = 53) in Denver, CO metropolitan area	6 weekly classes	Three behavioral scales (Eating, General, and Shopping Behaviors Scales) with acceptable internal consistency	At 1-y postintervention, participants reported using less fat in cooking and making positive changes in cooking practices. Adults significantly improved all behaviors immediately postintervention based on retrospective pretest and posttest (n = 53). Most changes were retained at 3 and 6 mo after intervention.
Shankar et al ²⁷	Pre-/post-assessment of intervention without control group: cooking lessons, meal planning, grocery shopping, and nutrition education (assessment at baseline, postintervention, and 4-mo follow-up)	Urban, African American women, ages 20–50 y, living in 11 public housing communities in Washington, DC; 18 waves of intervention conducted over 28-mo period (n = 212)	6 90-min sessions twice/wk for 3 wk, plus 1 90-min follow-up booster session 6 wk later (20-wk intervention)	Multiple-pass 24-h recalls at each time point (NDSR protocol) to measure dietary change and sustained dietary patterns based on class attendance; interviews to assess knowledge, attitudes, practices related to food preparation and consumption	Participants who attended at least 5 sessions (n = 68) did not change average servings of FV; nonattendees had significant decrease (n = 23) at follow-up. Those attending at least 5 sessions (n = 75 and 68) showed significant decreases in total calories and percent calories from fat at both posttest and at follow-up.
Condrasky ²⁸	Pre-/post-assessment of intervention without control group: interactive cooking classes featuring commodity foods with cooking demonstrations	Head Start parents/guardians in South Carolina (n = 41: 2 men and 39 women; 60% African American, 30% Hispanic)	2-h weekly sessions for 6 wk	24-h dietary recall to assess changes in dietary intakes; Food Behavior Checklist to assess general food behaviors	From pre- to postintervention, there were no differences in intake of FV, dairy, and grains. Participants were more likely to report shopping with grocery list, thawing foods less often at room temperature, reading Nutrition Facts label when making food choices, and eating something within 2 h of waking up (statistical analyses not reported).

Newman et al ²⁹	Pre-/post-assessment of intervention without control group: cooking classes plus telephone counseling, and newsletters (assessment at baseline and 12 mo)	Women (mean age, 54 y at study entry) who had been treated for early-stage breast cancer (n = 739), adhered to WHEL study, multicenter counseling, and diet assessment protocols	12 monthly cooking classes and newsletters plus 15–23 dietary counseling calls	24-h dietary recalls via telephone (NDSR protocol) to assess changes in dietary intakes; WHEL Adherence score ⁵⁸ to assess relationship between target and estimated dietary intake, association between cooking class attendance and WHEL Adherence score	Telephone and print intervention was associated with significant increase in WHEL Adherence Score. WHEL Adherence Score improved significantly with increased cooking class attendance. Daily servings of FV increased, mean fiber intake increased, and fat intake decreased significantly.
Woodson et al ³⁰	Pre-/post-assessment of intervention without control group: cooking class conducted by peer educators	African American members of faith communities who participated in Food for Health and Soul 2001–2003 (n = 485) ^a	6 60-min, weekly classes in church facilities	Eating Styles Questionnaire (16-item) ⁵⁹ to assess changes in fat, sodium, and fiber intakes; stage of change for reducing fat and sodium intakes	Significant improvements in intakes of fat, fiber, and sodium (n = 349); no significant advancement in stage of change from baseline to postintervention (n = 285).
Brown and Hermann ³¹	Pre-/post-assessment of intervention without control group: produce cooking classes	Oklahoma residents from 28 counties (n = 373 adults), led by county Extension educators	Average of 8 classes over 2 mo	Pre- vs post-education questionnaire to assess changes in FV intakes and safe food-handling behaviors (pilot-tested for reliability)	Mean FV intakes significantly increased; 11% and 8% significantly increased hand and produce washing behaviors before food preparation, respectively.
Keller et al ³²	Pre-/post-assessment of ongoing intervention program without control group: men's cooking group	Retired men from Evergreen Senior Center (n = 29 in 2000 and 2001), Guelph, Ontario, Canada	Monthly 2-h sessions for 8 mo	Cooking skills and attitudes questionnaire; key informant interviews to assess changes in cooking confidence, enjoyment, and attitudes; long-term food intake	Of 19 men completing pre/post questionnaires, most reported developing multiple cooking skills through the program, as well as increased pleasure and confidence cooking (statistical analyses not reported). The majority indicated developing strategies to reduce fat and salt in cooking and to increase fiber and variety.
Foley and Pollard ³³	Pre-/post-assessment of intervention without control group: budget and cooking sessions delivered by trained community advisers, and grocery store tour (assessment at baseline, postintervention, and 6-wk and 4-y follow-up)	Low-income earners, the majority women and the usual shopper, living in Western Australia (n = 612; 150 of these were trained as advisers) (formative research began in 1991, outcome evaluation was completed in 1996)	4 90-min sessions	FFQ (Diet Check) to assess changes in dietary intake and behavior (FV; breads and plain cereal foods; foods high in fat, salt, and sugar); questionnaire and in-person or telephone follow-up to assess spending changes and healthy food budgeting	For paired budget session attendees (n = 86), at 6-wk follow-up there was a significant increase in proportion who spread margarine thinly and who rarely ate "lollies" [candies] or bought cakes. Of those who attended budget/cooking sessions (n = 133), at 6 wk 28% indicated making changes in

(continued)

Table 1. Continued

Reference	Design	Population	Intervention Duration	Measurement Tools and Measures	Dietary and/or Health Outcomes
Ranson ³⁴	Post-intervention and follow-up of intervention without control group: men's cooking class (assessment postintervention and 4- to 6-wk follow-up)	Self-selected adult men (n = 60) (35–65 y) in South Australia (March, 1993 and November, 1994)	1 2-h session once a week for 4 wk	Subjective process and impact questionnaire; group discussion; telephone follow-up to assess changes in cooking frequency and confidence, use of recipes provided	<p>spending and 35% reported making changes in diet as result of program.</p> <p>Advisers at 4-y follow-up (n = 44) indicated spending more on FV (71%) and bread and cereal foods (50%), and less on chocolate/treats (70%) and convenience foods (69%) than before FoodCent\$.</p> <p>Most common verbal and written comment was to report more cooking confidence (detail not provided).</p> <p>At 4- to 6-wk follow-up, most reported cooking at home at least once and using a featured recipe regularly (statistical analyses not reported).</p>
Chapman-Novakofski and Karduck ³⁵	Pre-/post-assessment of intervention without control group: diabetes nutrition education plus cooking demonstrations, tasting	Self-selected adults with diabetes in 11 counties in Illinois in 2000 (n = 239 participants, with pre/post data from about 180)	3 sessions (about 2 h each)	Nutrition knowledge, stage of change, and social cognitive theory questionnaires to assess changes in stage of change for diet behaviors, social cognitive theory variables related to diet, nutrition knowledge	<p>Participants significantly increased nutrition knowledge pre- to postintervention.</p> <p>Confidence to change one's diet, prepare healthful meals, use Nutrition Facts label, and overcome meal preparation difficulty also significantly improved.</p> <p>Significantly different stage distributions for using herbs instead of salt, using artificial sweeteners, and controlling carbohydrates.</p>
Hermann et al ³⁶	Pre-/post-assessment of intervention without control group: cooking demonstration and tasting plus nutrition education and supermarket tour	Oklahoma residents over 55 y of age in 10 counties (n = 76) (mean age, 69 ± 8 y)	8 weekly sessions	Food and Nutrition Behavior Questionnaire (18-item) to assess food selection and preparation, food intake, and food safety, pre/post 24-h dietary	Significant increases were seen in total Food and Nutrition Behavior score and subscale scores with respect to "Food Selection and Preparation," "Food Intake," and "Food

				recall to assess food group intake changes; BMI; fasting total cholesterol	Safety” (n = 70). Participants significantly increased mean daily servings of vegetables, grains, and dairy; and decreased mean daily servings of fats, oils, and sweets (n = 67). No change in BMI; average fasting total serum cholesterol concentration significantly decreased (n = 72).
McMurry et al ³⁷	Pre-/post-assessment of intervention without control group: nutrition education plus cooking demonstrations plus group discussion taught by dietitians	Individuals identified with hypercholesterolemia (n = 336) who attended at least 1 class; n = 49 attending ≥ 4 classes evaluated for plasma lipid changes, Salt Lake City, UT	12–13 monthly nutrition classes followed by refresher classes at 6-mo intervals	Plasma cholesterol measurements, BMI Plasma cholesterol concentrations	Of participants completing at least 4 nutrition classes (n = unknown), 49 could be evaluated for plasma lipid changes. For all participants combined, mean plasma total and low-density lipoprotein cholesterol significantly decreased on average 8% from initial to final measurement; plasma high-density lipoprotein cholesterol, triglycerides, and BMI did not significantly change.
Nonrandomized controlled trial					
Condrasky et al ³⁸	Post-assessment of intervention with control group: cooking classes with professional chef and nutrition educator vs printed program material only	Low-income and minority caregivers (3 focus groups participated in evaluation; n = unknown; interviews with 12 key stakeholders), 3 counties in South Carolina	5 sessions (2 h each)	Focus groups with participants, in-depth interviews with key stakeholders to assess perceived impact of program	Focus group participants reported increased awareness of healthy eating guidelines and preparation techniques for fruits and vegetables, and increased confidence to try new foods. Key stakeholders commented on program delivery logistics, need to expand program, and importance of hands-on skill building.
Wrieden et al ³⁹	Nonrandomized controlled trial: introductory educational session plus cooking lessons vs introductory educational session only (assessment at pre-/postintervention and 6-mo follow-up)	Adults living in areas of social deprivation in 8 urban communities in Scotland (n = 113 total; dietary intake data from 29 intervention and 21 control participants)	7 weekly classes	7-day food and shopping diaries to assess FV, fiber, fish, bread, pasta, rice, and starchy food consumption; cooking skills questionnaires ⁶⁰ to assess cooking confidence and ability	Between baseline and 6-mo follow-up, intervention participants significantly increased confidence in following recipe. Fruit intake increased significantly in intervention group (n = 29) between pre- and

(continued)

Table 1. Continued

Reference	Design	Population	Intervention Duration	Measurement Tools and Measures	Dietary and/or Health Outcomes
Kennedy et al ⁴⁰	Nonrandomized controlled trial: nutrition education classes with guided “hands-on” food preparation and cooking sessions vs no intervention (assessment at baseline, postintervention, and 3-mo follow-up)	Low-income mothers with young children, 26 intervention participants and 13 nonparticipants matched for sociodemographic characteristics, Deighton, United Kingdom	10 weekly 2-h sessions	Semistructured interviews to assess changes in dietary habits, attitudes, changes in food-related practices, and factors that support and inhibit dietary change; questionnaire items on nutrition knowledge adapted from those used in similar studies to assess nutrition knowledge changes	postintervention compared with control (n = 21), but not maintained at follow-up. No other significant changes were observed for reported dietary intake. Significantly higher quantitative scores in 2 of 4 treatment groups compared with control in nutrition knowledge, about half of participants in treatment groups reported changing food-related practices. Intervention participants reported gaining knowledge in translating abstract messages, changing cooking methods, and reducing fat intake.
Auld and Fulton ⁴¹	Nonrandomized controlled trial: cooking classes vs no intervention (assessment before and after classes and 3-mo follow-up)	Female clients of life skills training program in Colorado (20 intervention participants and 9 control participants)	5 sessions	FFQ to measure changes in dietary intake; food attitudes survey to assess changes in cooking attitudes (acceptable test-retest reliability)	Intervention group significantly increased consumption of grains compared with control group but intakes of dairy, fruit, and meats were not significantly different.
Jacoby et al ⁴²	Intervention with control group: infant feeding counseling, cooking demonstration, and recipe pamphlet vs infant feeding counseling and recipe pamphlet (assessment at baseline, 48 h postintervention, and 30-d follow-up)	Mothers of child 5–15 mo of age from 1 of 11 poor districts in Lima, Peru, attending Oral Rehydration clinic. Mothers had initiated weaning, children were fully rehydrated (70 mothers in cooking demonstration group and 73 mothers in pamphlet group with pre/post data)	1 session with 20-min cooking demonstration	Interviews with recall of food preparation practices and foods given to child on previous day to assess infant food preparation practices (use of adequate weaning food), child’s health status, and maternal knowledge); consistency of foods as proxy for energy density based on photographs and pretesting	Both intervention conditions significantly increased maternal knowledge and rates of using adequate weaning food; differences between groups were negligible.
McKellar et al ⁴³	Nonrandomized controlled trial: Mediterranean-type	Female patients in socially deprived areas with	6 2-h weekly sessions	Change in lifestyle, disease activity, and cardiovascular	Intervention group significantly increased weekly total

diet cooking class vs healthy eating information control group (assessment at baseline and 3- and 6-mo follow-up)

rheumatoid arthritis ages 30–70 y (n = 130; 75 cooking class and 55 control), Glasgow, United Kingdom

risk were assessed with rheumatoid arthritis clinical features (ie, tender and swollen joint count and C-reactive protein levels), cardiovascular risk assessment (ie, smoking habits, BMI, blood pressure, serum cholesterol, and glutathione); FFQ⁶¹ to assess changes in dietary intakes

consumption of FV and legumes and improved ratio of monounsaturated to saturated fats consumed; no changes were observed for control group.
Intervention participants significantly benefited compared with controls in patient global assessment at 6 mo, pain score at 3 and 6 mo, duration of early morning stiffness at 6 mo, and health assessment questionnaire scores at 3 mo.
Intervention group showed significant drop in systolic blood pressure; control group showed no change. No intervention dependent changes were observed for BMI or cardiovascular risk factors.

Randomized controlled trial

Condrasky et al ⁴⁴	Randomized controlled trial: cooking classes vs lesson materials and recipes (assessment at baseline and postintervention)	Parents/caregivers of preschool children, Spartanburg, SC (n = 29 total, 15 intervention participants, 14 control participants)	Lessons (n = unknown) in 2-h sessions	Questionnaires, informal focus group discussions to assess changes in mealtime practices, use of flavors in cooking at home, FV intake, parental support	Significant changes in intervention group included awareness of how to prepare simple, healthful meals using spices compared with control group. No significant changes in FV intake among either group.
Clifford et al ⁴⁵	Randomized controlled trial: viewing cooking show episodes vs episodes on sleep disorders (assessment at pre- and postintervention and 4-mo follow-up)	Upper-level college students from non-health courses (50 intervention participants and 51 control participants), Fort Collins, CO	4 15-min weekly episodes	FFQ based on NCI Health Habits and History food frequency questionnaire ⁶² to assess changes in FV intake and personal factors survey to assess changes in knowledge, motivators/barrier, self-efficacy (content validity, test-retest reliability and internal consistency established for survey).	Significant improvements in Dietary Guidelines for Americans knowledge in intervention compared with control group. Significant pre/post improvements in cooking motivators and barriers and self-efficacy in intervention (n = 50) compared with control group (n = 51), but this was not maintained at follow-up (n = 30/group).

(continued)

Table 1. Continued

Reference	Design	Population	Intervention Duration	Measurement Tools and Measures	Dietary and/or Health Outcomes
Levy and Auld ⁴⁶	Randomized controlled trial: cooking class intervention vs cooking demonstration (assessment at baseline and 1, 2, and 3 mo postintervention)	Self-selected sophomore-level students at Colorado State University (Fort Collins, CO) spring and fall, 2002 (n = 65); 33 cooking class group participants; 32 demonstration group participants	Intervention: 4 2-h cooking classes and supermarket tour, 1 cooking demonstration	Eating habits and cooking/food preparation surveys, 72-h food preparation recalls to assess changes in attitudes, knowledge, and behaviors regarding cooking (content validity, test-retest reliability, and internal consistency established for surveys.)	No significant change in intervention group compared with control group for FV motivators and barriers, self-efficacy, or consumption. Cooking class participants (n = 26) had more statistically significant positive shifts in attitudes including self-efficacy in using various cooking techniques compared with demonstration group (n = 26). At 3-mo posttest, cooking class participants (n = 26) had significantly greater levels of cooking enjoyment, self-efficacy and viewing cooking as beneficial compared with demonstration group (n = 26).
Karvetti ⁴⁷	Randomized controlled trial with 2 interventions and control group: nutrition education plus lecture vs nutrition education plus cooking demonstrations vs usual care (assessments at baseline, beginning of rehabilitation period, and 3, 5, 6, 12, and 24 mo post-myocardial infarction)	Adult men, 27–64 y of age, who had a myocardial infarction, treated at Turku University Hospital, Turku, Finland (98 lecture plus cooking demonstration and 96 control with baseline data, 86 in lecture plus cooking demonstration group, and 78 in control group at 1 y; 77 in the lecture plus cooking demonstration group and 66 in control group at 2 y)	3 individual counseling sessions plus 6 group nutrition classes; 6 food demonstrations	24-h recalls and dietary history to assess changes in dietary/nutrient intakes	No significant differences between lecture and food demonstration groups; food intake changes between the 2 groups were almost identical. Two years after myocardial infarction, treatment groups combined significantly reduced high-calorie and cholesterol-containing food consumption to greater extent than control group; combined treatment groups also significantly increased FV, fats, and low-fat milk product consumption compared with control group.
Flesher et al ⁴⁸	Randomized controlled trial: individual nutrition counseling plus cooking and exercise classes vs	Control (n = 17) and experimental (n = 23) groups of chronic kidney disease patients in	Cooking classes over 4 wk for 2 h/session plus shopping tour,	Blood tests, urine tests, blood pressure measurements to assess changes in urinary protein	In experimental group, significantly more patients (61%) improved in 4 of 5 measures. whereas

standard care (assessments at baseline and 6- and 12-mo follow-up)	greater Vancouver, Canada area	plus cookbook, 12-wk exercise class (3 1-h sessions)	and sodium, blood pressure, glomerular filtration rate, and total cholesterol	only 12% of control group improved in 4 of 5 measures.
Carmody et al ⁴⁹ Randomized controlled trial: cooking classes related to plant-based foods, fish, whole grains, and vegetables plus mindfulness training vs usual treatment (assessment at baseline, postintervention, and 3-mo follow-up)	3 cohorts of men with prostate cancer who had undergone primary treatment and subsequent prostate-specific antigen level increase, and had not received other therapy within previous 6 m (17 cooking class participants and 19 wait-list control participants), Worcester, MA	11 2.5-h weekly classes	Multiple pass 24-h dietary recall (NDSR protocol) to assess addition of plant-based foods and fish and avoidance of meat, poultry, and dairy products; BMI, Quality of Life Functional Assessment of Chronic Illness Therapy tool to assess quality of life outcome index; serum prostate-specific antigen velocity to measure change in prostate-specific antigen	Intervention participants (n = 10) significantly reduced consumption of saturated fat and animal proteins and increased consumption of vegetable protein and total dietary fiber compared with control group (n = 14). Intervention group showed a significant increase in quality of life on trial outcome index compared with control group. No significant difference was found between the 2 groups in weight gain/loss or rate of prostate-specific antigen increase.

BMI indicates body mass index; FFQ, food frequency questionnaire; FV, fruits and vegetables; NCI, National Cancer Institute; NDSR, Nutrient Data System for Research; WHEL, Women's Healthy Eating and Living study.

^aLocation not specified.

on a simple kappa coefficient (0.71) and percentage agreement of 84.6%.

Table 2 presents information about the evaluation tools used to measure quantitative outcomes, literature sources, and pilot testing. A wide variety of outcomes (qualitative or quantitative dietary outcomes and health outcomes such as weight or blood lipids) across studies was reported based on a variety of evaluation measures.

To better describe the type of cooking/food preparation studies conducted from 1980 to 2011, the authors quantified the number of studies based on study design (inclusion of a control group and randomization of participants) and the type and timing of evaluation to assess effectiveness (post-assessment only, pre- and post-assessment, and whether follow-up was completed after post-assessment). Outcomes based on study objectives were summarized based on several categories including dietary change, knowledge/cooking skills, self-efficacy and intentions, and changes in health outcomes such as metabolic biomarkers or weight. Overall findings were highlighted and examples were provided to further illustrate the type of studies and participants used to generate the findings for each outcome category.

RESULTS

Study Type and Outcome Measures

Of the 28 studies, 16 did not include a control group. Of these, 4 used post-assessment measures only,^{22-24,34} whereas 12 had pre- and postintervention assessments.^{25-33,35-37} Of the 12 studies that included a control group, 6 did not randomize group assignment³⁸⁻⁴³ and 6 did.⁴⁴⁻⁴⁹ The total number of sessions in each intervention varied widely, from 3³⁵ to 4,^{33,45} 6,^{26-28,30} 8,^{31,32,36} 12-13,^{29,37} and 38 sessions.²⁵ Some studies also contained additional components such as refresher sessions 6 months after intervention completion.³⁷ Across all 28 studies identified in this review, 15 assessed potential impacts of the intervention beyond the immediate postintervention assessment, including 5 that did not include a control group^{25-27,33-34} and 10 that did.^{39-43,45-49}

These follow-up assessments ranged from 1 to 48 months after the intervention concluded.

Studies varied with respect to type of participant, intervention activities and duration, and expected outcomes. Most studies involved adults; however, several targeted parents because of the role they have in promoting healthful diets and prevention of chronic disease among children.^{42,44} The majority of the 28 studies focused on changing outcomes that could be measured quantitatively. Table 2 presents information about quantitative tools used to assess dietary outcomes and outcomes related to nutrition or cooking knowledge, attitudes, and practices. Diet-related assessment tools ranged from questionnaires regarding frequency of dietary behaviors (eg, eating fruits and vegetables, drinking low-fat milk) to standard dietary intake data collection methods (eg, 24-hour dietary recalls). For some studies, little or no information was provided about the source of evaluation tools or whether they had been validated.^{25,32,34} Other studies described a process whereby content validity, internal consistency, and/or test-retest reliability were assessed.^{26,39,45,46} Still other studies referenced previous research from which tools were drawn directly, with or without modification,^{29,30,43} or research from which tools had been adapted for use in the intervention.^{35,36,39,45} Some studies used qualitative interviews alone or in conjunction with other measures to assess outcomes^{22-24,34,38} or physical and laboratory measures for outcomes, such as change in blood pressure or serum cholesterol.^{36,37} Only 4 studies examined effects on body weight.^{36,37,43,49}

Process Evaluation

Process measures were not reported for some studies and varied widely for studies that included this type of evaluation. Most studies reported the number of participants recruited and the number in the final sample, but few discussed the differences in these samples brought about by attrition. Some studies reported attendance at intervention sessions or completion of intervention activities,^{25-27,29,33,37} differences in outcomes according to

attendance,²⁷ and preferences for follow-up methods.²⁶ Other studies explored opinions and feedback about programs and participant experiences.^{28,32-34,38,44,45} Reasons for not completing intervention sessions were presented in several studies,^{39,47-49} and only a few studies provided information about program cost.^{43,46}

Evidence Analysis Library Process of Validity Ratings

Based on the Evidence Analysis Library validity questions, a positive rating was assigned to 11 studies, a neutral rating to 1 study, and a negative rating to 13 studies. A “no” response to > 6 validity questions resulted in a negative rating. Most often these questions were related to specification of inclusion/exclusion criteria, handling of withdrawals, use of standard, valid and reliable data collection instruments, and adequate description of statistical analysis. “Not applicable” responses to questions were not considered in the rating. Most often, those questions were related to comparability of study groups and blinding for studies without a control group.

Outcome Evaluation: Dietary Intake

Of the 28 studies, 19 evaluated the impact of a cooking intervention on dietary intake, assessed in various ways. Despite varying study designs and measurement tools, 16 studies reported a positive impact on food intake. Ten of these were interventions without a control group; all showed beneficial changes in intake of various nutrients, food groups, and specific foods after the intervention, each using different measurement tools.^{24-27,29-31,33,35,36} Using dietary questionnaires, 1 of which was a previously tested Eating Styles Questionnaire,³⁰ an intervention aimed at members of a South Asian community in the United Kingdom,²⁵ and an intervention aimed at African American faith community members³⁰ resulted in reported improvements in intakes of dietary sources of fat, fiber, sugar, or sodium.^{25,30} The intervention arm of the Women's Healthy Eating and Living Study

included 12 monthly cooking lessons for women previously treated for breast cancer.²⁹ Increased cooking class attendance was significantly associated with improvement in participants' Women's Healthy Eating and Living Adherence Score, an index measuring achievement of dietary targets, such as fruit, vegetable, and fiber intakes and percentage of energy from fat.

Of the interventions including a control group (n = 12), 5 showed that intervention participants' dietary intakes improved to a greater degree than those of the control group.^{39,41,43,47,49} For example, a multiple-pass, 24-hour recall was used to assess outcomes of a healthy eating class for men with prostate cancer vs a control group receiving usual treatment.⁴⁹ A significant reduction in the consumption of saturated fat and animal proteins and increased vegetable protein consumption was observed for the intervention group compared with the control group.

Two of the nonrandomized trials showed mixed results for the intervention group compared with the control group, as measured by Food Frequency Questionnaire or food diaries.^{39,41} Cooking class intervention participants significantly increased consumption of grains compared with the control group that received no intervention, but their intakes of dairy, fruits, and meats were not significantly different.⁴¹ Adults living in areas of social deprivation in Scotland who were exposed to a nutrition education and cooking class intervention significantly increased their intake of fruit pre- to postintervention, but this was not maintained at the 6-month follow-up.³⁹

Outcome Evaluation: Knowledge/Skills

Using qualitative measurements/tools, 3 cooking class interventions assessed cooking knowledge/skills.^{24,32,38} Participants of all 3 interventions reported an improved understanding of healthy food preparation and healthier cooking strategies. Four studies reported effects on nutrition and fruit and vegetable knowledge.^{35,38,40,45} For example, using theory-based

Table 2. Description of Evaluation Tools Used to Measure Quantitative Outcomes Regarding Dietary Intake, Cooking Behaviors, Knowledge, and Attitudes: Literature Sources and Pilot-Testing Information

Construct	Tool	Original Source for Tools/ Information About Pilot Testing	Psychometric Data (If Available)
Dietary behavior change	7-d food diary ³⁹		
	24-h dietary recall ^{27-29,36,47,49}		
	FFQ ^{33,41,43,45}	FFQ ⁴³ from previously validated tool ⁶¹ FFQ ⁴¹ adapted from instruments used in national surveys FFQ ⁴⁵ adapted from NCI Health Habits History Questionnaire ⁶²	FFQ ⁴³ : significant correlations (0.27–0.75) for major nutrients estimated from FFQ and 7-d weighed dietary records ⁶¹ FFQ ⁴⁵ : ≥ 80% agreement between FFQ and 3-d food record for fruit ($r = 0.43$) and vegetable ($r = 0.65$) intake by 77% of subjects ⁶² and reliability confirmed (test-retest correlations ≥ 0.60) ⁴⁵
	Index of dietary intake meeting target intake based on 24-h dietary recalls ²⁹	Women's Healthy Eating and Living study Adherence Score ²⁹ also described in Pierce et al ⁵⁸	Women's Healthy Eating and Living study score ²⁹ based on relationship between national dietary guidance and dietary recall results, relationship tested and confirmed in feasibility study based on circulating concentrations of carotenoids ⁶³
	Dietary history ⁴⁷		
	FV intake ^{31,44}	Pre-post questionnaire pilot-tested for reliability ³¹	Reliability data not reported ³¹
	Frequency of reported dietary behaviors ^{25,26,28,30,33,36} or number of participants reporting dietary change ⁴⁰	General and Eating Behavior Scales of Operation Frontline questionnaire ²⁶ internal consistency established Eating Styles Questionnaire ³⁰ from Hargreaves et al ⁵⁹	General, Eating, Shopping Behavior Scales ²⁶ : Cronbach $\alpha \geq .68$ Eating Styles Questionnaire ³⁰ : Coefficient $\alpha = .90$, significant correlations between fat and fiber intakes based on dietary screener ⁶⁴ were $-.65$ and $-.40$, respectively
	Eating habits survey ⁴⁶	Eating habits survey ⁴⁶ reviewed for content validity and tested for reliability	Agreement between responses at time 1 and time 2 > 70% with no differences in means
	Mealtime practices, use of flavors in cooking ⁴⁴		

(continued)

Table 2. Continued

Construct	Tool	Original Source for Tools/ Information About Pilot Testing	Psychometric Data (If Available)
Cooking skills, habits	Cooking skills questionnaire, ^{32,39} cooking survey of attitudes, behavior, and knowledge ^{32,46} ; cooking confidence/frequency questions ^{32,34}	Cooking skills questionnaire ³⁹ based on previous nutrition knowledge questionnaire tested for reliability and internal consistency ⁶⁰ Cooking survey ⁴⁶ reviewed for content validity; test-retest reliability and internal consistency established	Cooking skills questionnaire ³⁹ : based on previous questionnaire with Cronbach α $\geq .56$ for knowledge and skills scales and significant correlations for time 1 and time 1 scores $\geq .381$ ⁶⁰ Cooking survey ⁴⁶ : agreement between responses at time 1 and time 2 > 70% with no differences in means; attitude and knowledge scales verified with Cronbach α .
Food preparation	72-h food preparation recall ⁴⁶		
Nutrition knowledge	Nutrition knowledge questionnaire ^{35,40}	Questions ³⁵ from existing Dining with Diabetes program Questions ⁴⁰ adapted from similar studies and reviewed for content validity	
Attitudes	8-item attitude questionnaire ⁴¹	Questionnaire ⁴¹ developed by experts to reflect program objectives and test-retest reliability established	Test-retest correlations ranged from 0.77 to 0.93 for attitudes ⁴¹
Cooking knowledge, attitudes, behaviors	Knowledge, attitudes, behavior questionnaires ^{27,45}	Measures ²⁷ selected based on previous work and pilot tested Personal Factors Survey ⁴⁵ reviewed for content validity; test-retest reliability and internal consistency established	Personal Factors Survey ⁴⁵ test-retest reliability correlations (≥ 0.50) and internal consistency verified with Cronbach α
General food behaviors	10-item Food Behavior Checklist ²⁸ ; 18-item Food and Nutrition Behavior questionnaire ³⁶	Food Behavior Checklist ²⁸ designed with procedures from Perkin ⁶⁵ Food and Nutrition Behavior questionnaire ³⁶ adapted from Oklahoma Expanded Food Nutrition Education Program	

FFQ indicates food frequency questionnaire; FV, fruit and vegetables.

knowledge questions adapted from a questionnaire used in an existing program, a diabetes education and cooking demonstration intervention resulted in an increase in nutrition knowledge pre- to postintervention.³⁵

Outcome Evaluation: Cooking Self-Efficacy/ Confidence, Intention/Behavior, and Attitudes

Three cooking class interventions,^{32,34,39} 2 of which were aimed specifically at men, resulted in an increase in cooking confidence. Two of these studies also showed an increase in cooking activity at postintervention³² and at 4- or 6-week follow-up.³⁴ A third study found a significant increase in confidence in following a recipe between baseline and 6-month follow-up, as measured by an untested cooking skills questionnaire.³⁹ Two cooking class interventions reported positive results with respect to participants' cooking attitudes and enjoyment,^{32,41} although the findings were not significant or significance was not reported. Attitudes were determined by various surveys, 1 of which had been evaluated for test-retest reliability,⁴¹ and another by key informant interviews.³²

Outcome Evaluation: Health Outcomes

Four studies reported positive health outcomes^{36,37,43,48}; 2 of these involved positive changes in serum cholesterol.^{36,37} Other studies addressed improvement in parameters associated with conditions or diseases. For example, patients with rheumatoid arthritis significantly improved according to a variety of rheumatoid arthritis measures compared with the control group, which received only healthy eating information.⁴³ More patients with chronic kidney disease improved in parameters such as urinary protein, urinary sodium, and blood pressure in an experimental group receiving cooking and exercise classes, compared with a standard care control group.⁴⁸ Men with biopsy-confirmed prostate cancer who completed a cooking class intervention showed a significant increase in quality of life compared

with the control group, but no impact on body weight was observed.⁴⁹ Similarly, body mass index did not change from pre- to post-intervention among hypercholesterolemic individuals.^{36,37}

DISCUSSION

This review indicates that interventions involving home food preparation and/or cooking may result in favorable dietary outcomes, food choices, and other health-related outcomes among adults. However, the results should be interpreted with caution based on weaknesses in study design, varying study populations, and the lack of rigorous assessment.

Findings Related to Changes in Dietary Intake and Health Outcomes

Dietary behavior change for an individual may be based on a progression of tasks involving food selection/acquisition, preparation, and consumption. Given this progression, food preparation knowledge and skills are critical components that can facilitate dietary change. As expected, the majority of interventions in the current study that targeted changes in food preparation knowledge and skills produced positive effects on dietary intake. Previous cross-sectional studies have suggested a relationship between food preparation knowledge or skills and consumption of particular foods.^{51,52} For example, among adult WIC participants, the likelihood of consuming fruits and vegetables was strongly related to knowing how to prepare most fruits and vegetables,⁵¹ and barriers to long-term intake of whole grain foods was related to cooking skills among adults in the United Kingdom.⁵² Several calls have been made recently for culinary skills education programs for children,^{53,54} based on the likelihood that these skills would persist into adulthood. However, if adults lack these skills and the confidence that might accompany their development, as observed in several studies reviewed,^{32,34,39} programs to educate adults with respect to food preparation knowledge and skills are also important.

Several studies in this review identified barriers to dietary changes based

on implementing practices encouraged by the cooking intervention.^{24,40} Primary barriers were family food norms/preferences and resistance to change, as well as financial constraints. Cooking programs have the unique ability to help parents address resistance to dietary change by including family members in the instruction or by providing information about ways to make dietary change more palatable and acceptable. Studies included in this review expanded the intervention's breadth in such ways as providing professional support and including budgeting sessions alongside cooking instruction. It may not be practical to target all cooking barriers (eg, a deficit of cooking skills, nutrition knowledge, cooking facilities, and food accessibility) in a single intervention. Furthermore, if these barriers were addressed through an intervention, it is unlikely that long-term positive outcomes would result unless the removal of barriers was sustained. Multiple cooking barriers are an opportunity for researchers to creatively partner with organizations working on such issues as food access. Interventions that target multiple cooking barriers are also an opportunity to demonstrate the need for comprehensive community responses to food environment issues.

Certain promising strategies emerged from intervention studies designed for community programs interested in implementing cooking programs. Several studies used peer leaders to guide cooking, nutrition, and budgeting sessions, and demonstrated positive outcomes.^{25,33} In addition to positive outcomes for the participants, peer advisors of 1 intervention indicated positive dietary intake changes 4 years after the completion of the intervention.³³ Four additional studies were successful in tailoring healthy cooking interventions to populations with specific health concerns: specifically, hypercholesterolemia,³⁷ rheumatoid arthritis,⁴³ prostate cancer,⁴⁹ and myocardial infarction.⁴⁷ In addition to having a significantly positive impact on dietary intake, these interventions positively affected rheumatoid arthritis measurements and blood pressure,⁴³ serum cholesterol,³⁷ and quality of life for men with prostate cancer.⁴⁹

Interpretation of Results Based on Study Design

Study design differences make it challenging to draw conclusions about the potential benefits of interventions. More than half of the studies included in the review (16 of 28) did not include a control group, and of the 12 studies that did include concurrent control groups, only 6 involved randomization of group assignment. The limited number of studies with longer-term follow-up assessments (15 of 28) imposes further restrictions on the ability to draw conclusions about effectiveness. Although some exceptions exist, the majority of longer-term follow-up assessments demonstrated maintenance of positive dietary and health outcomes. However, the length of time between postintervention and follow-up assessment varied widely. Although the measured outcomes for most interventions were primarily positive, little consistency existed among the intervention programs with respect to method of delivery (ie, cooking class, cooking show), number of participants, type of participant (ie, men, college students, low-income women), or the time passed between postintervention and the final assessment.

Community programs almost certainly have selection bias in which participants interested in cooking are naturally drawn to a cooking intervention, which results in a higher likelihood that positive outcomes will be found. Selection bias can be moderated by conducting interventions among pre-formed groups (eg, senior housing complexes) where there is a wider range of interest in cooking because participants do not self-select to participate. Small sample sizes and a small number of intervention sessions also yield concerns about representativeness, generalizability, and intervention dose in many intervention studies.

INTERPRETATION OF RESULTS BASED ON EVALUATION/OUTCOME ASSESSMENT

A wide assortment of measurement tools were used to evaluate effectiveness of the cooking/home food pre-

paration interventions, many of which were neither validated nor well-established measures of dietary intake, such as the 24-hour dietary recall. The wide range of nonvalidated, unique surveys, and questionnaires makes it difficult to compare results across studies. Few validated instruments exist for measurement of cooking intervention outcomes including cooking knowledge, self-efficacy, and skills. For example, only recently has the validation/testing of several measures of cooking self-efficacy been reported.^{55,56}

For many studies reviewed, consistent process evaluation was absent. Whereas several studies addressed participant withdrawals, discussion of program implementation and expected output is noticeably absent from most studies. Process evaluation measures are particularly important as cooking programs are being implemented more widely. Process evaluation is important in measuring the degree to which interventions are implemented as planned.⁵⁷ Without these measures, it is difficult to assess the efficiency of a cooking program or how well the program is being implemented.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Regardless of the lack of definitive evidence to support a relationship between cooking instruction and long-term cooking behavior or health outcomes, public health professionals have aggressively moved forward with cooking initiatives. Many programs exist at the national, state, and community levels that promote cooking as a necessary and appropriate response to overweight/obesity and food insecurity, such as the Cooking Matters program.²¹ To enhance the impact of these types of popular programs, additional research is needed regarding the needs of noncooking individuals and the most effective methods of delivering and evaluating cooking interventions. The most pertinent and essential recommendation for future studies is the necessity for stronger study designs, such as those using control groups. Recruitment strategies and sampling biases

should also be considered. The use of standard, valid, and reliable data collection instruments and adequate description of statistical analysis is necessary to move this research area forward with rigor. Additional validated evaluation tools may become available as more studies are published with respect to cooking intervention outcomes. Research teams should also incorporate process evaluation measures to report recruitment and retention of study participants, exposure to the intervention, and fidelity of program implementation to the study design. Reporting inclusion/exclusion criteria and handling of withdrawals has become more common in recent studies, but should be a priority to address validity of studies in the future.

Despite imperfections, public excitement over cooking programs is an opportunity for public health professionals to harness this energy and discover the most beneficial approaches to promote long-term dietary changes and subsequent health outcomes. Continued conversation about the direction of cooking initiatives and implementation of these initiatives alongside interrelated measures such as increasing food accessibility and affordability are essential. Because of the current rates of overweight and obesity in the US, strong public enthusiasm for cooking classes provides a rare public health opportunity to engage the community while working to affect dietary outcomes, overweight and obesity, and related health conditions.

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