Literature Review

A Scoping Review of the Community Health Worker Model Used for Food Systems Interventions Within the United States

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Abstract

Objective: To document and analyze the food systems interventions delivered by community health workers (CHW) serving as educators within the United States (U.S.)

Data Source: Ten databases (ie, Agricola, CAB Abstracts, CINAHL, ERIC, Proquest Social Science and Education, Proquest Theses and Dissertations, PubMed, Scopus, SocIndex, Web of Science) and gray-literature repositories were searched for publications between 2005-2020.

Study Inclusion and Exclusion Criteria: English-language and U.S. studies included with CHW as educators or facilitators for food systems interventions. Food systems defined as processes of production, processing, distribution, marketing, access, preparation, consumption, and disposal of food products. Studies excluded for clinical settings; non-adult CHWs; CHWs with medical or public health credentials; and programming guides, reviews, and commentaries.

Data Extraction: Variables included CHW and intervention description, priority population, food system processes, and targeted and unexpected outcomes.

Data Synthesis: Data were analyzed by the lead investigator and described narratively.

Results: Of 43 records, CHWs educated for consumption (n = 38), preparation (n = 33), and food access (n = 22) to improve health of priority populations. Community health workers educated for the highest number of food system processes in garden-based interventions. Programs reached many underserved racial and socioeconomic populations.

Conclusions: The CHW model has been used to educate in interventions for all food systems processes and reached many diverse underserved audiences. Future work must explore garden-based food systems education and CHWs as community change agents.

Keywords

community health workers, food systems, nutrition, health disparities, education, health policy, health communications

Objective

In 2010, a coalition of 4 professional organizations in the United States (U.S.), including the Academy of Nutrition and Dietetics (formerly the American Dietetic Association), American Nurses Association, American Planning Association, and the American Public Health Association published a statement defining their shared principles of a community food system. These organizations jointly supported the principles that U.S. food systems should be health-promoting, resilient, economically balanced, transparent, fair, and sustainable.[1] Food systems are defined as: *all of the processes involved in getting food from farm to table to disposal, including production, processing, distributing, preparing, marketing, accessing, consuming, and disposing. Food systems also involve people, farms, businesses, communities, interventions, policies, and politics.*[2]

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Sustainable community food systems integrate the processes described above to improve the environmental, economic, and social health of a place and promote equity amongst all stakeholders.[3] Food systems influence public health through food environments and food supply chains to determine how and what types of foods are available to individuals. Diet-related chronic diseases such as obesity, type 2 diabetes, and cardiovascular disease are experienced in disproportionately high rates by marginalized populations such as racial and ethnic minorities and those with low-income. Health disparities in marginalized populations are amplified by food systems that do not equitably serve all communities.[2] Food systems are a critical component of health promotion and public health researchers and practitioners must explore strategies to mitigate health disparities.

Community health workers (CHWs) are public health practitioners who are trusted community members with a thorough understanding of local cultures.[4] Community health workers serve as knowledge brokers between subject matter experts and community members in populations at high risk of diet-related chronic disease[5-8] by disseminating culturally sensitive education on health behaviors to prevent poor health outcomes.[6,7,9-11] The CHW model has been proven to improve individual health behaviors in communities vulnerable to health disparities.[7,9,11] While the use of the CHW model is established in public health education,[11] this model has not been widely explored in community food systems education. No published review has yet examined the role of CHWs to deliver food systems education to improve public health outcomes. An examination of the CHW model within food systems education is needed given the influence of food systems on public health. The CHW model is a potential strategy to provide education to vulnerable communities in an influential area of health promotion: food systems. The results of this review can be used to plan educational interventions to reach communities marginalized in the current food system who are at high risk for diet-related chronic disease. The purpose of this review was to identify the use of the CHW model as educators in U.S. food systems interventions to inform future inclusive public health food system research and initiatives. The objectives of this scoping review were:

1. To determine the food system processes addressed and populations reached by CHWs serving as educators or facilitators in U.S.- based interventions;
2. To identify and describe the type of food system interventions delivered by the CHW model as an educator, including targeted outcomes and priority populations

Methods

A scoping review was conducted due to the exploratory nature of the research objectives and the overall goal of the paper to provide an overview of the CHW model as an educator within food systems interventions. Scoping reviews allow for identification and description of the evidence within a certain area and permit the inclusion of multiple types of studies and thus the framework presented by Arksey and O'Malley[12] was deemed most appropriate to answer the research objectives of this study. Future systematic reviews may use the results of this study to examine more focused research questions.[12]

Food systems are a series of key processes that form a framework of the cyclical food system from farm to fork and include: production, processing, distribution, marketing, access, preparation, consumption, and disposal.[2] Food systems education includes educational efforts that target 1 or more of the 8 key processes.[2] Agriculture education may target food production and nutrition education commonly targets food preparation, consumption, and access. Food systems education, however, encompasses both subsets of agriculture and nutrition education and may promote connectivity among farm-to-fork processes or may equip participants with knowledge to critically assess the implications of engagement within all 8 food system processes.[13] This study is not a comprehensive review of nutrition education or agriculture education delivered by the CHW model, however, nutrition education and agriculture education are components of some food systems education interventions.

Data Sources

Two content blocks (food systems and CHW synonyms) of search terms were applied to ten electronic databases (ie, Agricola, CAB Abstracts, CINAHL, ERIC, Proquest Social Science and Education, Proquest Theses and Dissertations, PubMed, Scopus, SocIndex, and Web of Sciences) and gray-literature repositories to identify records published between January 2005 and December 2020.

Additional Google searches were performed for several gray literature repositories: the American Planning Association Community Health blog, the American Planning Association Community Health reports, reports and issue briefs of the American Public Health Association, Centers for Disease Control and Prevention Stacks, the Johns Hopkins Center for a Livable Future resource collection, National Institute of Health clinical trial registry, and University of California Davis Sustainable Agriculture Research and Education Program resource collection.

The primary investigator (md) conducted a supplemental search using methods modified from Pham et al (2009)[14] in which 20 articles were randomly selected and the reference lists hand-searched to identify additional evidence sources. In addition, the reference lists of all returned reviews were hand searched and additional relevant records were added to the master record file. A secondary search was conducted by (MD) 1 week after the initial search in the Scopus and Web of Science databases using CHW synonyms uncovered in the supplemental search. All searches were executed in

Table 1. Population, Intervention, Comparator, Outcome, Timeline, And Setting Framework for Inclusion and Exclusion Criteria of Records for the Scoping Review.

	Included	Excluded
Population	• U.S. residents, including those of the fifty states, U.S. territories, and sovereign Native American nations	• International populations located outside of the U.S. • CHW has credentials such as registered dietician, registered nurse, master of public health, certified health education specialist, or schoolteacher
	• CHW is a peer lay educator in the adult subset of the priority population	• CHW is a youth, adolescent, or college student
Intervention	• CHW role is an educator or facilitator	• CHW role is one of peer support
	• Strategies that target 1 or more food system processes of food production, processing, distribution, marketing, access, preparation, consumption, and disposal[2]	• Intervention serves to educate on breastfeeding
Comparator	• Any comparator	• Not applicable
Outcome	• Any health behavior	• Primary outcome is mental or spiritual health
Timeline	• Published between 2005-2020	• Published before 2005 or after December 2020
Setting	• Unique intervention or study	• Editorials, opinion papers, formative research, literature reviews, programming guides, programming suggestions, abstracts • Full text not available
	• Written and published in English	• Intervention delivered in clinical setting

Abbreviation: CHW, Community health workers.

December 2020. The full search methodology can be found in Supplementary File 1.

Inclusion and Exclusion Criteria

Table 1 displays the inclusion and exclusion criteria using a population, intervention, comparator, outcome, timeline, and setting (PICOTS) framework. The full text of the criteria can be found in Supplementary File 2.

Data Extraction

The evidence selection process used methods adapted from the recommendations of Levac et al. (2010).[15] Titles and abstracts of all returned records were independently screened by 2 co-investigators (MD and MM) and included or excluded by consensus. The full text review and extraction was completed by the first 2 authors using a grouping method in which MM reviewed 100 records and MD reviewed the remaining records. MD and MM independently completed data extraction on records that were included from their grouping of full-text screens. A random sample of twenty records were independently reviewed and extracted, if applicable, by both MD and MM and results were compared to ensure reliability between the groupings. Disagreements at each stage were resolved through discussion between MD and MM and mediated by a third member of the research team when necessary.

The authors completed data extraction using the Covidence Extraction Tool 2.0 on the variables of intervention priority population, targeted food system processes, description of the intervention, and targeted outcomes. A description of the CHW was extracted using any demographic information provided by the record authors. A full definition of each variable can be found in Supplementary File 2. Table 2 contains the data extracted from the records included in the review.

Data Synthesis

The extracted data was downloaded from Covidence to a Microsoft Excel file and the lead investigator (MD) analyzed the data for each variable. The descriptions of interventions were reviewed and activities collected in a separate Excel column. Education topics such as dietary recommendations and information about food groups were summarized as an activity labeled "nutrition education." The dose of the intervention was listed in a column and the intervention setting was classified as home, community, school, work, or faith community. Targeted, secondary, and unexpected outcomes were analyzed by categorizing by general healthy lifestyle behaviors such as diet quality, and by diet-related chronic disease management outcomes such as body mass index (BMI) or blood glucose. The priority population for each intervention was analyzed and categorized using the data by key demographic characteristics such as race, ethnicity, socioeconomic status, and faith community membership. CHW descriptions were categorized by neighbor and then any additional defining traits, such as faith community membership, female, or existing CHW. A chart with each of the 8 food system

Table 2. Summary of Included Records.

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
Adams et al, 2012[40]	Experienced and respected parents, grandparents, or other community members	Family primary caregivers with children ages 2-5. Native American tribes of Menominee, Lac de Flambeau, Bad River, Oneida in Wisconsin	Preparation, Consumption	Two year obesity prevention intervention. Tool kit lessons delivered by family mentors during home visits. Lessons were: increasing fruit and vegetable intake, decreasing sugary beverages and candy intake, increasing physical activity, decreasing TV time. Year 1: 12 home visits using tool kit lessons, three group sessions with mentors and families. Year 2: mentor-led monthly group meetings with meal, family activities, newsletter	Primary- child BMI z-score, adult BMI Secondary- 24 hour recalls for adults and children, screen time for adults and children, physical activity via 7 days of accelerometer in children and adults Some adults included in biochemical measurements Adults completed 3 surveys: health behavior efficacy, SF-12v12 Health Survey, Cultural Involvement Scale (baseline only)
Ayala et al, 2015[54]	CHWs with experience with Clinicas de Salud del Pueblo	Mexican-origin mothers in a rural U.S.-Mexico border town in California	Consumption	Health communication via electronic video communication (non-episode family situation comedy), home visits, phone calls, family workbook, other print materials delivered over 4 months	Primary- fruit and vegetable consumption Secondary- dietary intake indicators and psychosocial factors related to healthy eating
Bachar et al, 2006[27]	Community mentors matching education and experience criteria, paid	Members of the Eastern Band of Cherokee Indians in rural North Carolina	Preparation, Consumption, Marketing, Access	Mentors conducted school lessons and after-school program. Tribal members participated in physical activity challenges and group sessions at work. Church portion included healthy cooking demos, exercise classes, and stress management lessons. Social marketing included TV series showing community members engaging in healthy behaviors	Primary- diabetes and obesity reduction
Baker et al, 2006[32]	Local community members	Low-income and majority African American neighborhood in St. Louis, Missouri	Access, Preparation, Consumption	Church produce market run by community. Customers transported from other churches, senior centers. CHW provided nutrition info, cooking demos. Nutrition info also shared on bulletin boards, testimonials, sermons. Presentations at local events	Primary- increased fruit and vegetable consumption

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
Balcázar et al, 2012[53]	promotoras certified as CHW in Texas and at least 2 years experience	low-income areas of El Paso, Texas	Preparation, Consumption	Community coalition effort to create a nutrition and exercise-promoting neighborhood environment. Activities included charlas (coffee health talks), heart-healthy cooking demonstrations, heart-healthy grocery tours, promotora-led physical activities	Test the schedule of activities, promotora readiness, preparation for participant enrollment and data collection for HEART 2 study-designed to create a cardiovascular health-promoting neighborhood environment
Barnidge et al, 2015[33]	Community advocates	African American adults in rural Missouri	Production, Preparation, Access, Consumption	Nutrition education, cooking demonstrations at churches and community centers, goal setting, family dinner nights, taste tests at grocery stores or community venues, bulletin boards in community settings. Community gardens worked by participants, intervention staff, community advocates	Primary- perceived fruit and vegetable consumption Secondary- hypertension, BMI
Buscemi et al, 2019[51]	SNAP-Ed and EFNEP peer nutrition educators	Low-income preschool children (2-5 years old) that were recipients of SNAP-Ed or EFNEP at participating sites and their parents in Illinois	Preparation, Access, Consumption	Hip-Hop to Health curriculum delivered through EFNEP and SNAP-Ed to parent-child dyads (1 parent/1 child per household). 8 lessons delivered over 6-8 weeks, curriculum consistent with 2010 Dietary Guidelines for Americans	Primary- changes in diet, physical activity, and screen time among children and parents
Bustillos and Sharkey, 2015[41]	Female, Hispanic/Latino, Texas colonia residents, Spanish-speaking	Established promotoras-researchers in Texas	Preparation, Consumption	Eight monthly workshops, 4 hours each. Didactic methods and hands-on activities. Nutrition education topics included nutrition science, public health, human behavior, food preparation using limited resources, healthy food resource management, home food safety, and food label reading	Primary- improvement of knowledge of nutrition and nutrition-related topics and empowerment
Carney et al, 2012[34]	Promotores, other characteristics not specified	Migrant seasonal farm worker families in rural Oregon	Production, Preparation, Access, Consumption, Disposal	Home gardening support via resources, materials, volunteer support. Community building via monthly group meetings, end of season fiesta, promotore check-ins. Group sessions used popular education techniques. Topics included plant selection, composting, organic pest control options, preparing the land, garden maintenance, harvest	Primary- vegetable intake, food security, and family relationships

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
Connell et al, 2015[42]	Lower Mississippi Delta communities	Women in civic, social, and faith-based organizations in Lower Mississippi Delta region	Preparation, Consumption	First treatment arm was 5, 60-minute sessions with multiple message approach on fruit, vegetable, whole grains, lean proteins, and solid fats, alcohol, and added sugars. Second arm was 5, 60-minute sessions with single message approach on solid fats, alcohol, and added sugars. Last session for each arm was summary and potluck. Monthly sessions in a community setting. Interactive sessions with discussion, games, activities, food demos, home challenge, newsletter. Phone calls	Primary- diet quality
Crespo et al, 2012[18]	Females, with Spanish-speaking abilities. Recruited through participating school	K-2 Latino children and their parents at elementary schools in San Diego County, California (CA)	Marketing, Access, Preparation, Consumption	Four conditions: Home/Family environmental change, Community-only environmental change, Family-plus-Community-environmental change, and no- treatment. Family intervention was home environment, parenting, monthly home visits for 7 months, 4 phone calls. Community intervention was school and community environment via school playgrounds, salad bars, restaurant menus, classroom equipment, frequent produce buyer cards	Primary- child BMI z-score Secondary- child diet, physical activity, sedentary behavior
Cullen et al, 2010[50]	EFNEP educators	EFNEP clients in 3 cities in Texas	Preparation, Consumption	Six, 60-minute lessons including: nutrition basics and portion size, breakfast and snacks, fruit and vegetables, dairy and meat, breads and grains, and smart shopping. Intervention video included in class sessions. Goal sheets distributed at each class	Primary- goal attainment for diet
Cummings et al, 2013[22]	African American females, recommended by local public health agencies	Rural, African American women with uncontrolled type 2 diabetes in rural southeastern U.S.	Consumption, Access	Sixteen lifestyle coaching sessions by CHW over 12 months. Behaviorally-centered and culturally-relevant	Primary- change in HbA1c Secondary- psychosocial measures

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
de la Torre et al,2013[19]	Local health educator who lives in community	Mexican-origin communities and families with children between 3-8 years in California (CA)	Preparation, Consumption, Access	Nutrition intervention has family nights at school with discussion, activity, food demo, and tasting. Each lesson was 1 hour. Participants must attend a minimum of 15 classes over 3 years. Topics are basic nutrition education. Each family gets $25/ month for fruit and vegetable purchases. Additional component of school-based nutrition education	Primary- reduce childhood obesity Secondary- improve family self-efficacy
Dollahite et al, 2014[52]	Paraprofessional educators with 2 or more years of experience delivering EFNEP	Low-income adults with children who qualify for EFNEP but had not previously enrolled in EFNEP in New York City (NYC)	Preparation, Consumption	8-week EFNEP curriculum delivered by paraprofessional educators. Hands-on, dialogue-based activities including recipe preparation and food tasting	Primary- improved nutrition behaviors such as diet quality, food safety, food security, food resource management
Elder et al, 2009[55]	Latina women, Spanish language dominant, recruited for personality traits	Mexican/Mexican-American women in San Diego County, CA	Preparation, Consumption	Three-arm randomized control trial: Promotora plus tailored print, tailored print only, print only	Primary- dietary behavior change and psychosocial outcomes
Evans and Hudson, 2014[28]	Lay members of faith communities	Diverse faith communities (n = 19) in New Jersey	Preparation, Consumption, Access	Adapted Body and Soul curriculum,[18] 3 phases. Monthly educational sessions, physical activity program development, increase access to local fruits and vegetables	Primary- increased fruit and vegetable consumption and physical activity level
Flood et al,2015[29]	Food Justice Leaders. Tenderloin residents hired for the Coalition	Tenderloin (low-income and food swamp) neighborhood residents in San Francisco, CA	Access	Healthy corner store initiative led by community coalition. Education components taught by food justice leaders (CHW). CHW educated corner store owners on healthy food environment	Primary- healthy food access
Forster-Cox et al, 2010[56]	Promotoras	U.S.-Mexico border colonia residents, primarily women, in New Mexico	Preparation	Promotoras assessed home safety and delivered education on environmental hazards and food safety in 2-3 home visits. Provided incentives like smoke detectors and meat thermometers	Primary- knowledge and behaviors related to fire and food safety
Goldfinger et al, 2008[25]	Peer leader with background similar to participants	East Harlem adults with overweight or obesity, of minority races, pilot test at Black Harlem church in NYC	Access, Preparation, Consumption	Ten-week nutrition and physical activity course. Eight sessions delivered at church by peer leaders	Primary- weight loss Secondary- knowledge, attitudes, behavior
Hamilton et al, 2020[16]	Peer educator: member of the target community	SNAP recipients in the state of Washington	Consumption, Access	Peer to peer education and farmer's market promotion to use SNAP benefits	Primary- use of SNAP benefits at farmers markets

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
Horowitz et al, 2011[23]	Peer educators	Adults with pre-diabetes in East Harlem, NYC	Preparation, Consumption, Access	Peer-led group health education (diabetes info, healthy eating, food access in neighborhood, physical activity) workshops delivered in community locations. Pairs of peer leaders. Eight 90-min classes across 8 weeks	Primary- Weight loss
Islam et al,2013a[43]	bilingual Korean American CHW	Korean American adults at risk for diabetes in NYC	Preparation, Consumption	Six CHW-led 2-h group sessions with topics: diabetes prevention, nutrition, physical activity, complications, stress and family support, access to health care. Ten one-on-one calls across 6 months	Primary- weight, BMI, hip to waist ratio reduction, access to and utilization of care, knowledge and practice of physical activity and healthful eating Secondary- participant experience
Islam et al,2013b[44]	Bilingual Bangladeshi CHWs who are community leaders. One male, 1 female	Bangladeshi American adults with type 2 diabetes in NYC.	Preparation, Consumption	Six monthly group sessions, each 2.5 hours. Session topics were diabetes overview, nutrition, physical activity, diabetes complications, stress and family support, access to health care. Each participant had 3 one-on-onesessions with the CHW at months 3, 6, 9 for 60-90 min each	Primary- HbA1c, weight, nutrition and physical activity behaviors, access to healthcare Secondary- participant satisfaction
Islam et al, 2014[45]	Bilingual Sikh Asian Indian CHW and a supervisor with the same characteristics. Supervisor from a community organization	Sikh Asian Indians at risk for diabetes in NYC.	Preparation, Consumption	Six group interactive sessions, each 2 h led by CHWs in community setting. Culturally adapted lessons on diabetes prevention, nutrition, physical activity, health complications from diabetes, stress, access to health care. Ten individualized phone calls from the CHW.	Primary- weight, BMI, blood pressure, glucose reduction, healthcare use, knowledge and behaviors of physical activity and healthy eating Secondary- participant satisfaction
Johnson et al, 2010[57]	Cosmetologist	African American women in rural South Carolina	Consumption	Three-part motivational sessions delivered by cosmetologist across 6 weeks to meet diet and physical activity goals. Provided info packet and food samples	Primary- fruit and vegetable consumption, physical activity, water consumption
Kannan et al, 2010[39]	Senior women recognized as experts by community. Assistant CHWs were age 19-25	African-American women of childbearing age in Genesee County, Michigan	Preparation, Consumption	Culturally relevant lessons (n = 13) on healthy selections and cooking, gardening, food attitudes. Delivered by Black CHW pairs of older lead and younger assistant. Reading and PowerPoint slides. One lesson per week with celebration dinner at end	Primary- Maternal diet quality, diet and health habits, shift to action stage

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
Kattelmann et al, 2009[46]	Tribal member	Adult Northern Plains Indians from Cheyenne River Sioux Tribe with type 2 diabetes in South Dakota	Preparation, Consumption	Six nutrition ed lessons using Medicine Wheel Nutrition Model (traditional diet of Northern Plains Indians). Two-hour group classes met monthly for 6 months. Co-facilitated by registered dietician and a trained tribal member. Individualized meal plans created	Primary- improved control of type 2 diabetes Secondary- weight, BMI, HbA1c, fasting serum glucose and lipid parameters, circulating insulin, diet, physical activity, dietary satiety
Kehm et al, 2017[21]	Bilingual Somali CHWs	Somali mothers in Minneapolis, Minnesota	Preparation, Access, Consumption	Four sessions, each 1.5 hours over 6 weeks delivered by Somali CHWs. Used culturally modified healthy eating Extension curriculum, group cooking session in community kitchen, grocery store tour with gift card	Primary- Dietary behavior change for increased fruit and vegetable consumption Secondary- fruit and vegetable intake of children of participants
Ko et al, 2016[20]	Bilingual and bicultural community health educator	Hispanic/ Latino adults and the main cook for the family in metro area of Seattle, Washington	Preparation, Consumption, Access	Eight-week nutrition education with CHW-led group discussion, cooking demos, take-home food basket, newsletters. Four total classes, each 90 minutes	Primary- fruit and vegetable consumption Secondary-Knowledge, perceived barriers, food efficacy, food outcomes
Lee et al, 2015[30]	Supermarket employees	Supermarket customers in a low-income neighborhood of Baltimore, Maryland	Access, Marketing	Promotion of healthy items in supermarket using ads, taste tests, labels, increased stocking, community events. Trained store employees on healthy food choices	Primary- healthy purchases by customers
Mello et al, 2017[35]	Women conscious about neighborhood problems	Low-income residents in Grand Rapids, Michigan	Production, Processing, Preparation, Access, Consumption, Disposal	Peer led gardening workshops, food demonstrations	Primary- food security in local food system, overall health of residents
Plescia et al, 2008[17]	Lay health advisor. Natural helpers recruited via neighborhood organizations and social networks	Low-income northwest area neighborhoods in Charlotte, North Carolina	Preparation, Access, Consumption	Door to door visits, walking groups, diabetes support groups, health house parties facilitated by CHWs. Additional interventions co-developed with CHWs and professionals: media campaign for healthy behaviors, local farmer's market, community exercise venues, tobacco tax advocacy, promoting healthy food labeling	Primary- create capacities to reduce incidence of cardiovascular disease and diabetes

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
Quintiliani et al, 2014[31]	Selected public housing resident health advocates trained as healthy living advocates for the study	Families living in public housing. Evaluation conducted among mother-daughter (8-15 years) pairs in Boston, Massachusetts	Access, Preparation, Consumption, Marketing	Multicomponent healthy living in public housing: CHWs promote mobile fruit and vegetable van, attend health screenings to link participants to clinicians, walking group leaders, promote cooking demos, promote intervention social media, provide neighborhood resource maps at all events	Primary- diet and physical activity behaviors
Siegrist and Chandler, 2014[38]	Volunteers for a 4-day festival, many were Master Composters	Festival attendees in New York	Disposal	Compost Crew at a music festival sort waste bins, education at booth, collect food scraps from vendors	Primary- divert organic waste from landfill to compost facility
Staten et al, 2005[47]	Existing promotoras recruited from community health centers. Worked in junior/ senior pairs. 10 women, 1 male	U.S. Hispanic adults in living in border communities of Arizona	Preparation, Consumption	Pasos Adelante topics: risk for cardiovascular disease, physical activity, risk for diabetes, blood pressure, salt and sodium, fat and cholesterol, healthy weight, healthy community, glucose and sugar, healthy eating is a family affair, healthy eating, smokefree lifestyle, review. Weekly 2-hour classroom sessions and walking clubs in community locations	Primary- reduce risk factors for cardiovascular disease, diabetes, and diet-related NCD
Stluka et al, 2019[37]	Garden coordinators hired from within communities. Many, but not all, were Master Gardeners	Adults with high prevalence or risk of obesity and SNAP participation in counties of South Dakota	Production, Processing, Distribution, Preparation, Access, Consumption	Establish food demo garden to include nutrition education, food processing and preservation outreach	Primary- improve access to and consumption of fruit and vegetables in counties with greater than 40% adult obesity and high percentage of SNAP participants
Treiber et al, 2016[26]	Hmong adults recruited by community organization	Hmong adults in California	Preparation, Consumption, Access	Three 2-hour sessions, weekly. Lessons: SNAP, SNAP for healthy lifestyle, physical activity, healthy eating, food resource management, sugar sweetened beverages. Interactive lessons	Primary- healthy eating and exercise promotion Secondary- SNAP enrollment
Warren et al, 2009[36]	Lay health ministers from church population	Church communities, primarily African American and nearby families in Raleigh, North Carolina	Distribution, Access, Consumption	Establishment of community garden on church grounds, youth nutrition education provided by North Carolina Extension, health promotion to adults via Body and Soul curricula,[18] walking groups	Primary- reduce proportion of youth and adults who engage in no leisure-time physical activity and increase number of youth and adults who eat at least 5 servings of fruit and vegetables per day

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Table 2. (continued)

First authors, Year	CHW description	Priority population and Location	Food system processes	Description of intervention	Targeted outcomes
White et al, 2019[48]	Community educators	Adult and child (aged 9-10) dyads, and adults who were the main food preparers in households across 5 states (Maine, Nebraska, South Dakota, Tennessee, and West Virginia)	Preparation, Consumption	Eight 2-hr, biweekly sessions on cooking, eating, and playing together. Youth also recorded these activities at home	Primary- childhood obesity incidence Secondary- cooking competence, family mealtimes, physical activity
Wieland et al, 2016[58]	Bilingual family health promoters from the community	Hispanic, Somali, Sudanese immigrant families in Rochester, Minnesota	Consumption	Twelve modules, each 30-90 min delivered in-home to families by CHWs over 6 months. Biweekly phone calls. Tailored goal-setting. Topics: physical activity and nutrition	Primary- weekly physical activity, dietary intake Secondary- BMI, blood pressure, waist circumference, waist to hip ratio
Wilson and Rodriguez, 2019[24]	Caseworker employed by refugee resettlement organization, usually former refugee	Recently resettled refugees in a large Midwest city	Access	Exploring caseworker role in introducing refugees to U.S. food systems: initial meal; grocery store tour; connect to SNAP; Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); food pantries and banks	Understand how caseworker introduces U.S. food system to refugee families
Woodson et al, 2005[49]	Peer educators from faith communities	African Americans in faith communities in Nevada	Preparation, Consumption	Six 60-min classes using Food for Health and Soul curriculum taught by faith community peer educators	Primary- diet quality

Abbreviation: CHW, Community health workers; BMI, body mass index; SNAP, supplemental nutrition assistance Program; HbA1c, hemoglobin A1c.

processes (ie, production, processing, distribution, access, marketing, preparation, consumption and disposal)[2] was created and the targeted processes of each study were tracked so a total count of studies targeting each food system process could be presented.

Results

The search yielded 2594 records and 898 duplicates were removed by the Covidence algorithms. The 1335 records excluded in the title and abstract screening include the count of duplicate records removed manually. The full-text review was performed on 361 records and 43 records were ultimately included. Figure 1 displays the evidence selection process in a visual format adapted from the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.

Description of Interventions and Targeted Food Systems Processes

Each of the food system processes were targeted in at least 1 study, with preparation and consumption being the most common targets in 33 and 38 studies, respectively. Table 3 displays the number of studies that targeted each food

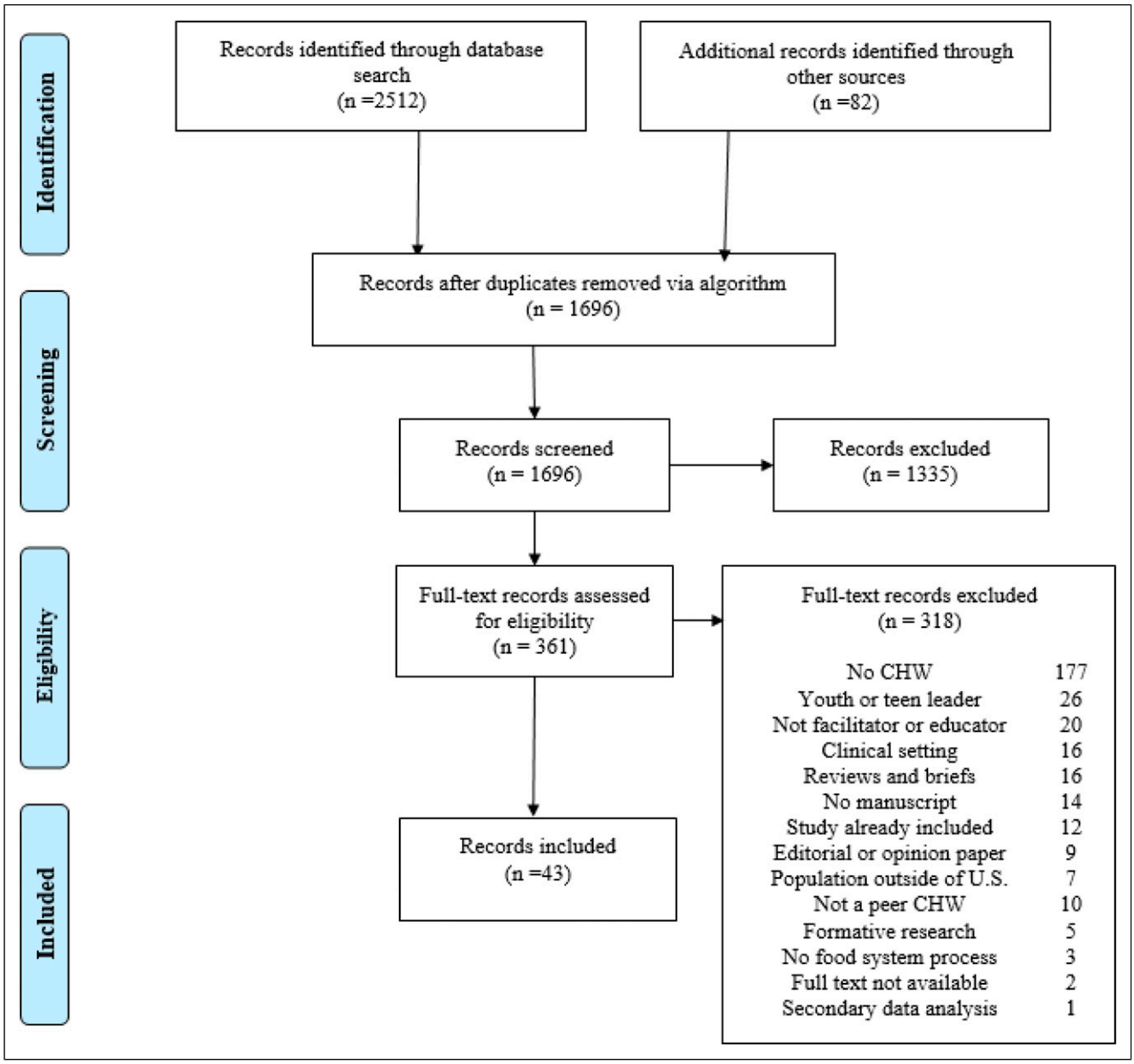

Figure 1. Evidence selection process.

system process.[1] Slightly more than half (n = 22) of the studies included a food access component. Food access was targeted via farmers market promotion,[16,17] food baskets or vouchers,[18-21] resource education on healthy neighborhood options,[22-25] Supplemental Nutrition Assistance Program (SNAP) promotion,[24,26] or efforts to create a healthy food environment in community settings.[18,27-32] Multiple studies used home or community gardens as a platform to increase access to fresh produce and educate participants on healthier food production and consumption choices.[33-37] Each food system process of production,[33-35,37] processing,[35,37] distribution,[33,36,37] marketing,[18,27,30,31] and disposal[34,35,38] was targeted in less than 5 studies per process.

Interventions that included a gardening component spanned more food system processes than any other programming category. Carney et al (2012)[34] built a home gardening community using CHWs to provide support and materials to families. The nutrition education series developed by Kannan et al (2010)[39] included lessons on herb and vegetable container gardening to incorporate culturally relevant foods into home-cooked meals so that participants could share nutrition knowledge with their extended families through gardening "show and tell." Other studies incorporated community gardens.[33,35-37] The community gardens established in the intervention published by Stluka et al (2019)[37] were used as platforms to deliver nutrition education via garden coordinators. Table 4 displays the food system processes targeted in each gardening study.

Table 3. Food System Processes Targeted Within the 43 Included Records.

Food system process	Number of studies with process
Production	4
Processing	2
Distribution	3
Marketing	4
Access	22
Preparation	33
Consumption	38
Disposal	3

Across all included studies, the most common intervention delivery method was via group sessions.[17,19-21,23,25-28,34,39-53] Many classes were participatory and included demonstrations and taste tests.[19-21,26,33,34,40-42,45,48,50,52] One-on-one mentoring between the CHW and participants was included in 7 studies[18,42-45,54,55] and 6 studies used this approach exclusively.[16,22,24,56-58] Multiple studies supplemented group sessions with individualized phone calls or home visits by the CHW to the participant.[17,40,42-45,54] Studies also used newsletters, print materials, or videos to deliver intervention messages.[20,31-33,40,42,50,51,54,55,57]

Description of the CHWs

Several studies recruited individuals to serve as CHWs because of their status as natural helpers, mentors, leaders, or respected neighbors.[17,20,26,27,29,39,40,55] Others recruited CHWs for the intervention from existing networks of CHWs, promotoras, or Cooperative Extension Master volunteers.[19,38,44,45,47,53,54,56] Two studies used CHWs from occupations not traditionally associated with health promotion: cosmetologists[57] in a beauty salon and supermarket employees in Baltimore.[30] In 4 studies, the CHWs were members of faith communities,[25,28,36,49] with Warren et al (2009)[36] describing the CHWs as "lay health ministers." Nine studies reported that females served as CHWs.[5,18,22,35,39,41,47,55,57]

Priority Populations

Ten studies reported specific priority populations at risk of or experiencing obesity and/or type 2 diabetes.[22,23,27,37,43-46,51] A common priority population was individuals and families with low income.[16,17,29-32,35,37,50-53] Racial and ethnic minorities included in study populations were Hispanic,[18-20,41,47,53-56,58] Black,[22,25,32,33,36,39,49,57] Somali,[21,58] Native American,[27,40,46] Sudanese,[58] Hmong,[26] Korean,[43] Bangladeshi,[44] and Sikh Asian Indian.[45] Refugees,[24] immigrant families,[58] and migrant farmworkers[34] also participated in studies as the priority audience. Following the inclusion criteria, CHWs shared sociodemographic characteristics with the populations participating in the studies.

Table 4. Targeted Food System Processes of Garden-Based Studies Examined, 2009-2019.

Food system processes	Production	Processing	Distribution	Marketing	Access	Preparation	Consumption	Disposal
Barnidge et al, 2019[33]	X		X		X	X	X	
Carney et al, 2012[34]	X				X	X	X	X
Mello et al, 2017[35]	X	X			X	X	X	X
Stluka et al, 2019[37]	X	X	X		X	X	X	
Warren et al, 2009[36]			X		X		X	

Targeted Outcomes

All studies targeted healthy lifestyle behaviors or environmental health outcomes.[38] Increasing markers of diet quality, including fruit and vegetable consumption, was the most common primary targeted outcome.[20,21,26,28,31,32,34,36,37,39,42-45,47,49-52,54,55,57,58] Many of the nutrition education efforts also aimed to increase physical activity levels for obesity and diet-related chronic disease prevention.[18,26,28,31,36,40,43-45,48,51,53,57,58] A variety of biomarkers were used to assess healthy lifestyles, including weight, BMI, and waist to hip ratio.[18,23,25,33,40,43-46,51,58] Diabetes management interventions included biomarkers such as hemoglobin A1c (HbA1c), fasting serum glucose, and lipid parameters.[22,44-46] Additional outcomes measured for interventions included food security,[34,35,37,52] food safety,[56] food self-efficacy,[19,20,48,50,54] participant experience,[43-45,53] SNAP enrollment and participation,[16,26] screen time,[40,51] and health behavior knowledge.[40,41]

Unexpected Outcomes

Ten studies reported outcomes not included in the project objectives. In a study with Hmong participants,[39] the CHW assisted in additional lesson design and the CHW-led intervention was a noted source of pride for the Korean American community in New York City.[44] Treiber et al (2016)[26] discovered additional training needs of the CHW to continue with effective implementation. Political leaders recruited the Food Justice Leaders of the Tenderloin neighborhood of San Francisco to lobby for health promoting local and state policies.[29] Mental health benefits and physical activity increases were reported by participants in a gardening project designed to increase vegetable consumption.[34] Peer educators working in a farmers market SNAP promotion initiative reported that their participation had increased their own healthy behaviors.[16]

Conclusions

The use of the CHW model to provide education on public health issues is well-established.[59-62] The food system processes most associated with nutrition education, preparation and consumption, were the most common processes included in the 43 educational interventions. Given that most studies educated only on food preparation and consumption practices, future work should explore how the CHW model can expand educational efforts across a greater number of food system processes. The garden-based studies included in this review had education on the greatest number of food system processes. Gardens allow an opportunity to learn about each food system process and the connectivity of individual processes to the larger food system, often in a culturally relevant manner, as plants and foods important in cultures marginalized in the U.S. can be grown and used in garden-based education for populations commonly reached by the CHW model.[63,64]

The nutrition education activities included in this review were culturally tailored to priority populations. The results demonstrate that the CHW model can connect individuals to culturally relevant foods through education on food preparation and consumption,[17-23,25-28,31-37,39-58] and these CHW-facilitated connections are emerging into food access efforts, evidenced by the 22 included studies with a food access component. However, the limited number of studies that provided education on multiple food system processes beyond preparation and consumption indicates that the CHW model has not been widely used in broad lens food systems educational interventions. Future research could build on included studies with garden-based educational programs that spanned the greatest number of food systems processes, to facilitate connections to culturally relevant foods for underserved populations.

Garden-based programming is a platform from which nearly all of the food system processes can be connected in an educational intervention and is an effective health promotion tool.[65,66] The garden-based interventions incorporated 6 of 8 food system processes.[35,37] The choices that are accessible within preparation and consumption processes are shaped by the contextual processes of production, processing, distribution, access, marketing, and disposal.[2] Food systems education that spans multiple processes, such as garden-based programming, more fully integrates health promotion into the community and may allow for sustained success in making healthy changes.[67,68]

The diverse characteristics of the priority populations of the studies included in this review confirms that the CHW model can reach underserved communities who often experience diet related disparities[69,70] to provide education on health-related topics.[71] Culturally sensitive modes of educational outreach to populations that experience health disparities must be integrated into efforts to advance equity by reducing health disparities.[72] As health promotion efforts which address food systems issues for underserved communities continue to grow,[73-75] the CHW model can be considered a key programming component in these interventions. This review is the first step in understanding how the CHW model has been used to deliver education in food systems to reach underserved communities. The unequal structures and reach of food systems programming for underserved communities was exposed by the Covid-19 pandemic,[76,77] and researchers and practitioners must explore strategies that can mitigate health disparities exacerbated by the current food system.

Food systems education to influence individual behavior change can be a tool for health promotion in underserved communities, however, root causes of health disparities must be addressed through interventions that address policies, systems, and environments of food systems and the

broader social determinants of health.[78,79] This review confirms that the CHW model can connect with underserved communities and identifies how the CHW model has been used as an educator in food systems interventions for public health. Food systems and health promotion researchers and practitioners should prioritize future exploration of the CHW model as community change agents within food system structures. Exploration of CHW as community change agents would support the recommendations of Kumanyika (2019)[72] and Golden & Earp (2012)[80] to incorporate equity into multi-level health promotion interventions. The emergent nature of CHWs educating on 3 or more food systems processes provides researchers and practitioners a blueprint from which to explore the CHW model as an agent in community food system change and a support to social ecological health promotion. Food system researchers and practitioners should continue to explore the CHW model as a tool to deliver garden-based programming to create health-promoting community food systems through educational interventions. Research should extend into an exploration of the CHW model as an advocacy tool for underserved communities and a method of advancement for health and food equity.

Although this review documented the processes of the food system in which CHW have engaged as educators, future work must document how the CHW model can advance equity in food systems. Food systems frameworks that expand beyond the key processes[2] used in this review and include considerations for community development and social equity should guide future examinations of the CHW model in promoting community social, economic, and environmental health and sustainability through food systems initiatives. A comprehensive collection of nutrition education and agriculture education records were not included in this review due to the search strategy focus on common food systems terms. Future reviews should utilize a more targeted search strategy to understand the role of the CHW model in these subsets of food systems education. Future systematic reviews of the CHW model within food systems education could include research questions to explore the outcomes of interventions, intervention designs, or preparation of the CHW to deliver the intervention. In addition, future systematic reviews could focus on specific populations so that public health researchers and practitioners can better design culturally sensitive interventions. The scope of the review was limited to U.S. food systems programs. The definition of CHWs employed by the review limited the known scope of practice of CHWs as many CHWs are engaged in activities outside of education and facilitation. Future reviews should explore expanded roles, such as community change agents and advocates, of the CHW model in food systems. The CHW population included in this study was exclusively adults. We included most aspects of a PRISMA scoping review[81] in this study, however, we did not assess the study quality or risk of bias in studies given the exploratory nature of the research objectives to understand the scope of educational reach of CHWs within food systems efforts. The review was not registered in a literature review database.

So What?

What is already known on this topic?

Community health workers are proven effective for health promotion education with communities who experience health disparities. Food systems are a key determinant of public health. Strategies for food system interventions are needed to mitigate health disparities.

What does this article add?

This article documents the use of the CHW model as food systems educators within the U.S. and confirms that the CHW model can reach underserved populations for food systems-related education. The CHW model has not been widely implemented for food systems education beyond preparation and consumption practices.

What are the implications for health promotion practice or research?

Health promotion researchers and practitioners can use this review as a tool for future research on food systems educational interventions and program planning. The CHW model is a strategy for education to combat health disparities in underserved communities and additional educational interventions should be planned for food system understanding. Food systems educational interventions that include gardening span many food systems processes that, coupled with a CHW model, can promote health in underserved communities. The role of CHWs as community change agents to advocate for health-promoting food systems should be explored.

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Author Contributions

MD and SM designed the study. MD performed the searches and MD and MM completed the data extraction process. MD wrote the manuscript with input from SM. MD, SM, MC, VK, and ES conceptualized the study and provided substantial edits. All authors have read and approved the final manuscript.

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Supplemental Material

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Note

1. A study may be included multiple times in Table 3. The table shows the frequency of food system processes across the 43 included studies. For example, a study that educated on production, preparation, and consumption is included 3 times in Table 3.

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