

Implementing Food as Medicine During COVID-19: Produce Prescriptions and Integrative Group Medical Visits in Federally Qualified Health Centers

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Abstract

Background: Food as Medicine is a rapidly developing area of health care in the United States, aimed at concurrently addressing nutrition-sensitive chronic conditions and food and nutrition insecurity. Recipe4Health (R4H) is a Food as Medicine program with an integrative health equity focus. It provides prescriptions for locally grown produce ('Food Farmacy') with or without integrative group medical visits, alongside training for clinic staff.

Objectives: To describe the initial implementation of R4H in four Federally Qualified Health Centers in Northern California, using a convergent mixed-methods approach.

Methods: We used the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) implementation science framework to assess the first two years of R4H (2020–2022). We draw from 40 interviews (26 partner organization staff, 14 patients) and program data on reach and adoption. Qualitative data were analyzed using codebook thematic analysis.

Results: *Reach:* From January 2020 to August 2022, 3255 patients were referred to the program; 1997 of those referred (61%) enrolled in the Food Farmacy only ($N = 1681$) or Food Farmacy + integrative group medical visits ($N = 316$). Participating patients included a wide range of ages (mean age 41.4, [SD 20]; 18% < 18 years old) and racial and ethnic backgrounds (3% American Indian or Alaska Native, 6% Asian or Pacific Islander, 19% Black, 57% Hispanic/Latine, 7% white). 69% were female; 43% primarily spoke Spanish. *Adoption:* 84% of trained clinic staff referred two or more patients to R4H. *Implementation:* Elements of successful implementation included: (1) support from county government leadership, (2) centralized coordination of the multi-sector partnership, and (3) a flexible approach responsive to organizational and COVID-related shifts. R4H implementation informed statewide Medicaid policy changes. *Maintenance:* To date, all four clinics continue to participate in R4H.

Conclusion: Centralized implementation, training, and administration of Food as Medicine programs can strengthen community health centers' capacities to concurrently address chronic conditions and food insecurity. Multi-sector partnerships can support Food as Medicine program sustainability.

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Keywords

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Introduction

Food as Medicine is a rapidly developing area of health care in the United States,^{1,2} and one of multiple approaches to concurrently addressing medical and social needs (eg, the connections between chronic conditions and food insecurity). Federally Qualified Health Centers (FQHCs) are primary care settings with longstanding roles in acknowledging and addressing social and structural determinants of health.³ They are an important site for implementing Food as Medicine programs. Food as Medicine programs have the potential to align with broader efforts for integrative health equity, defined as “optimal health for all through a whole-person approach that explicitly recognizes cultural, social, and structural determinants of health.”⁴

Produce prescriptions are one approach to addressing nutrition-sensitive chronic conditions and food and nutrition insecurity⁵ and fall within a broader category of medically supportive food interventions focused on preventing and treating chronic conditions.² The US Department of Agriculture (USDA) has been a leader in funding produce prescriptions through the GUSNIP program, funded through the Farm Bill, COVID relief funds, and the American Rescue Program Act.⁵ Many produce prescription programs have been implemented in safety-net primary care settings, including FQHCs.^{6,7} In produce prescription programs, health care workers ‘prescribe’ fresh vegetables and fruit to patients with chronic conditions and/or food insecurity. Depending on the program, participating patients can use produce prescriptions in home delivery programs, farmers markets, or grocery stores. USDA-funded produce prescription programs have shared goals of supporting health equity, improving community health, and contributing to local economies.⁵ During the COVID pandemic, increased federal funding allowed produce prescription programs to rapidly expand, alongside other public and private responses to food insecurity, such as the pandemic EBT program and food banks.⁸ A rising number of states, including California, now have waivers from the federal government allowing them to use Medicaid funds to pay for medically supportive food and nutrition programs including produce prescriptions.^{9,10}

Produce prescriptions are being implemented amidst broad efforts to advance health equity in the United States. Notable advocacy and policy change efforts in recent years have aimed to increase food and nutrition security using multiple approaches. These endeavors include the White House Conference on Hunger, Nutrition, and Health¹¹; a growing number of states offering universal free school meals, in an expansion of federally funded school meal

programs originally modeled on those initiated by the Black Panthers^{12,13}; advocacy to maintain and expand SNAP and WIC food benefits after the end of the COVID public health emergency¹⁴; and efforts to increase the number of Black farmers by redressing harms done by past federal policies¹⁵. Qualitative research on the implementation of produce prescription programs highlights the importance of tailoring programs to local conditions and communities,¹⁶ as well as the need for organizational infrastructure to support such programs. Interview studies with clinicians involved in produce prescription programs have emphasized the need for training and staff time to implement and evaluate produce prescription programs,¹⁷ as well as support for integrating programs into clinical workflows.¹⁸ A recently developed theory of change for produce prescription programs highlights the key roles played by health care organizations, patients, farmers, and food retail sites (eg, farmers’ markets and grocery stores).⁵ Research on produce prescription implementation is an important companion to quantitative clinical research on health outcomes associated with participation. Non-randomized, quantitative studies of produce prescription programs have demonstrated clinically significant improvements in food insecurity, fruit and vegetable consumption, and cardiometabolic health among adults with chronic conditions, as well as cost-effectiveness.² Randomized trials and other research on health outcomes, health care utilization, and cost of health care use among people receiving produce prescriptions are ongoing, with multiple efforts to use electronic health records to collect clinical data for research.¹⁹

Group medical visits are a rapidly expanding model of care delivery that many see as an important model for addressing health care inequities.²⁰⁻²² Group visits have been implemented in primary care settings, particularly FQHCs,²³ to provide care for diabetes, prenatal care, and chronic pain, among other conditions. Group medical visits bring multiple patients into the same physical or virtual space with one or more clinicians for billable medical care, peer support, and health education. Integrative group medical visits (IGMVs) also include integrative therapies such as mind-body practices (eg, mindfulness, yoga) or acupuncture. Nutrition education, cooking, and health coaching have also been commonly integrated into IGMVs.^{23,24} Telehealth IGMVs were uncommon before the COVID pandemic but have been growing rapidly, with many organizations continuing to offer virtual IGMVs.^{25,26} Clinical research on IGMVs has demonstrated a wide variety of benefits for chronic conditions,^{21,24,27} and qualitative evidence consistently points to their promise for reducing social isolation and loneliness.²⁸⁻³⁰

Recipe4Health (R4H), a Food as Medicine initiative, addresses food insecurity and nutrition-sensitive chronic conditions among patients in FQHCs in Alameda County, CA (see Figure 1). R4H includes: (1) produce prescriptions for locally grown fruit and vegetables ('Food Farmacy'); (2) IGMVs that include medical care, peer support, health coaching, nutrition and movement, and mind-body practices; and (3) training for FQHC clinicians and staff to implement Food as Medicine. Alameda County Health, an arm of the County government, was the lead agency for developing the program and coordinating the partners. R4H partners during the period discussed in this article included Dig Deep Farms, a local farm led by Black farmers that grows food for the Food Farmacy using organic and regenerative approaches; Open Source Wellness, a local non-profit that provides health coaches and curriculum for IGMVs; Community Health Center Network, a county-wide consortium of FQHCs; Alameda Alliance for Health, a local Medicaid managed care plan; four multi-site FQHCs, and multi-disciplinary researchers at Stanford and University of California San Francisco (see Table 4). The program has been funded by the USDA, local Medicaid managed care, local government, and philanthropic sources. Quasi-experimental quantitative evaluation of R4H effectiveness has found improvements in produce consumption and clinical outcomes, and has been described elsewhere.^{31,32}

Recipe4Health works concurrently towards multiple goals. First, the program strives to prevent, treat and reverse chronic conditions, using broad eligibility criteria that include people of any age living with food insecurity or a range of nutrition-sensitive chronic conditions. Second, it increases access to vegetables and fruit. Third, R4H works to advance health equity through implementation in FQHCs, which serve

racially and ethnically diverse, low-income populations primarily insured through Medicaid. The program trains a wide range of health care workers to 'prescribe' produce and IGMV participation. Finally, R4H contributes to local economies, with a focus on climate and soil health and employing people from the communities it serves. Partner organization Dig Deep Farms is led by BIPOC farmers and was originally an affiliate of the Alameda County Sheriff's Office. Dig Deep Farms provides job training to people in re-entry from incarceration and uses regenerative agriculture approaches focused on improving soil health as well as nutrient density of food.

This article focuses on the initial implementation of Recipe4Health (2020-2022). We used a mixed methods approach informed by the RE-AIM implementation science framework to assess reach, adoption, implementation and maintenance of the program^{33,34} with a focus on understanding the roles of participating partner organizations in this multi-sector partnership.

Methods

Setting

Alameda County is a large region in Northern California, with a high cost of living in urban and suburban areas. In 2022 (when this analysis ended), nearly 10% of county residents were experiencing food insecurity, but notably half of those had incomes too high to qualify for SNAP nutrition benefits.⁸ A recent analysis demonstrated that food insecurity in the county is almost three times as high in formerly redlined neighborhoods as in neighborhoods that were not redlined.³⁵ The county has eight FQHCs, each with multiple primary care sites.

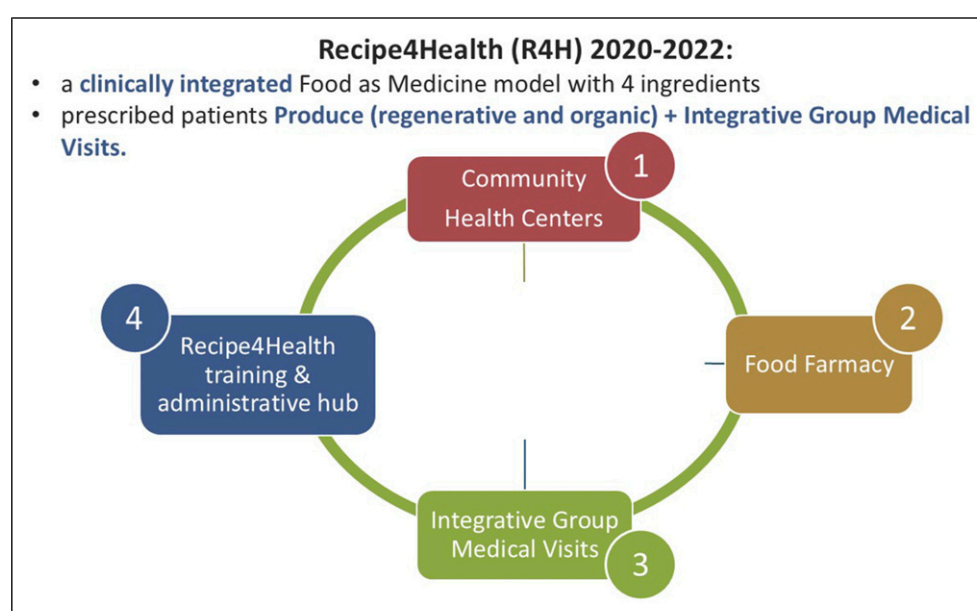


Figure 1. Recipe4Health model ingredients.

Intervention

Recipe4Health was planned prior to the COVID pandemic with the intention of offering in-person integrative group medical visits at each site, as well as onsite produce stands (“Food Farmacies”) staffed by Dig Deep Farms staff. In this planned implementation, R4H participants would receive produce using their prescriptions, and other patients and staff could purchase produce using cash or SNAP benefits. Due to COVID, R4H quickly adapted in the first two months of implementation. During the period discussed in this article, the program provided telehealth IGMVs for adults and doorstep delivery of produce to both adults and children. Staff and clinicians at participating FQHC sites referred patients to R4H if they screened positive for food insecurity, and/or because of diagnosis with one or more nutrition-sensitive chronic conditions (including diabetes, hypertension, pre-diabetes, hyperlipidemia, depression and anxiety, chronic kidney disease, irritable bowel disease, and others). The program provided doorstep delivery of produce with or without IGMV participation depending on patient preference. All enrolled patients received 16 weeks of produce delivery, and adult participants who chose to participate in the IGMV attended 16 weekly sessions co-facilitated by a primary care provider with trained health coaches. The R4H Food Pharmacy and IGMV (sometimes called a ‘Behavioral Pharmacy’) have been described in detail in prior publications.³¹ Clinics also assessed whether participating patients were enrolled in SNAP/CalFresh (colloquially known as ‘food stamps’) to support ongoing food access.

Formal data-sharing agreements between partner organizations allowed (1) clinic staff to refer to R4H through the EHR, (2) Dig Deep Farms and Open Source Wellness staff to receive and process referrals for the Food Pharmacy and IGMV, and (3) researchers to receive anonymized EHR and survey data for quantitative evaluation of program effectiveness.

Study Design & Recruitment

This research is part of a larger mixed-methods, longitudinal evaluation of R4H effectiveness and implementation. The present analysis used the RE-AIM implementation science framework to assess R4H reach, adoption, implementation and maintenance (effectiveness is reported in a separate publication currently under review).³³ RE-AIM typically includes individual-level data on a program’s reach and effectiveness, as well as program-level data on adoption, implementation and maintenance. All research procedures were approved by the Institutional Review Boards at UCSF (#19-28766, #21-34511) and Stanford University (#57239).

Measures and Data Sources

Reach. Reach is generally defined in the RE-AIM framework as the number and characteristics of program participants, as

compared with broader populations in the same settings. We compare demographic data for patients referred to and participating in R4H with overall patient populations at the same FQHCs. Demographics for people referred to R4H were collected from FQHC electronic health records with formal data sharing agreements, while broader demographic data from R4H clinics were publicly available online through the Community Health Center Network.

Adoption and Maintenance. The Recipe4Health coordinating hub in county government provided data on program adoption and maintenance. We defined adoption as number of clinic staff trained to refer to R4H who referred at least two patients. This data was only available for 2022. We defined maintenance as whether an FQHC continued participating in R4H (as of fall 2024).

Implementation. Implementation was evaluated qualitatively through interviews. Interview guides were developed by our interdisciplinary team and informed by the RE-AIM framework. A total of 40 interviews were conducted with patients and R4H partner organization staff from Spring 2020-Spring 2022. Researchers fluent in Spanish and English (DR and ATL) conducted interviews using Zoom video-conferencing, phone calls, or in-person, and informed consent was obtained from all participants. All interviewees received a \$50 gift card. Additionally, researchers attended weekly meetings of R4H partner organization leadership as participant-observers in program implementation. These meetings included detailed discussion of program reach, adoption, implementation and maintenance that informed our analysis.

Staff interviews. Staff members were recruited from partner organizations including three FQHCs, Dig Deep Farms, Open Source Wellness, and Recipe4Health staff from county government. All staff involved in R4H and employed by one of these organizations were invited via email and staff meetings to participate in an interview.

Patient interviews. We conducted interviews with patients participating in IGMV with concurrent Food Pharmacy deliveries. A researcher attended virtual IGMV sessions at three R4H sites to observe and meet patients before inviting them to participate. Interviews were conducted in Spanish or English according to patient preference.

Data Analysis

All interviews were audio recorded and professionally transcribed. Interviewers wrote summary memos after each interview, and quality checking of interview transcripts was completed by listening to recordings while reviewing transcriptions. A team of five researchers with qualitative research experience conducted data analysis using a

codebook thematic analysis approach and Dedoose qualitative data management software.³⁶ The analysis team developed an initial codebook using inductive and deductive approaches. Interviews were coded in their original language (Spanish or English). We met regularly to refine inductive codes, reconcile coding differences, and ensure accuracy, while simultaneously participating in weekly meetings with a larger R4H evaluation team. Themes were then reviewed and refined through discussion with the interdisciplinary author team, which includes the R4H Chief Medical Officer, as well as researchers with backgrounds in sociology, epidemiology, psychology, food systems, group visits, nutrition, and health equity. Interview data on referral processes, patient perspectives on participation in Food Farmacy and IGMVs and other programmatic insights were shared as feedback for program optimization using the lightning report method.³⁷

Results

In alignment with the RE-AIM implementation science framework, we discuss the reach, adoption, implementation, and maintenance of the Recipe4Health program. Data sources include demographics of participating patients, program implementation data, and 40 qualitative interviews. Patient interviewees ($N = 14$) were all participants in the Food Farmacy + IGMV program. The majority were women (93%), Black (29%) or Latine (43%), and had hypertension (57%) and/or chronic pain (50%) as well as other chronic conditions (see Table 1). Staff interviewees ($N = 26$) worked for partner FQHCs, Open Source Wellness, or Dig Deep Farms in a variety of roles including clinicians, medical assistants, health coaches and farmers. The majority were women (92%) and identified as Latine (35%) or white (54%); 46% spoke Spanish (see Table 2).

Reach

Recipe4Health was implemented at four FQHC sites between January 2020 and January 2022. From January 2020 to August 2022, 3255 patients were referred to the program, and 1997 or 63% of those referred enrolled. The majority of these participated in the Food Farmacy only (1681 patients). Adults 18 and over could additionally participate in the integrative group medical visits, which were available in English at all sites and in Spanish at some sites; 316 people participated in IGMVs during the analysis period.

Table 3 provides descriptive demographics for all patients referred to and enrolled in Recipe4Health, relative to all patients at the FQHCs with sites participating in R4H. Participants in R4H were fairly representative of the overall patient populations in participating FQHCs, with some notable demographic differences.

Patients enrolled in R4H included a wide range of ages (mean age 41.4 years, [SD 20]; 18% < 18 years old) and racial/ethnic backgrounds (19% Non-Hispanic Black, 57%

Hispanic/Latine, 6% Asian/Pacific Islander, 7% Non-Hispanic white, 3% American Indian or Alaska Native). Compared to overall FQHC demographics, R4H participation generally mirrored patient age breakdown, although the percentage of children served by R4H was smaller than the percentage of children served by FQHCs overall (18% vs 29%). By gender, more R4H participants were female (69%) than the percentage of females served by FQHCs overall (57%). Compared to FQHCs overall, R4H referrals and enrollees included more non-Hispanic Black participants (19% of those enrolled in R4H vs 12% of clinics overall), Hispanic/Latine participants (57% of those enrolled vs 53% served in clinics overall), and mixed race participants (3% of those enrolled vs 1% served in clinics overall). Fewer Asian/Pacific Islander patients participated in R4H (6% of those enrolled vs 14% served in clinics overall). Among patients referred to R4H, 43% of participants spoke Spanish; language data was not available for the full FQHC population.

Comparing those enrolled in the Food Farmacy only (which was also available to children) to those enrolled in the Food Farmacy + IGMV, those enrolled in Food Farmacy + IGMV tended to be older (mean age 48.6 vs 40.1 years) and were predominantly female (81% vs 69% of Food Farmacy only participants). There were dramatically fewer Hispanic/Latine participants in the Food Farmacy + IGMV program (29% vs 63% of Food Farmacy-only participants), likely because few clinics offered Spanish-language IGMVs during this period. Only 13% of Food Farmacy + IGMV participants spoke Spanish as their primary language, compared with 52% of Food Farmacy only participants.

Adoption

Four clinic sites, each from a different FQHC organization, implemented R4H between January 2020 and August 2022. R4H intentionally developed a very inclusive definition of which staff could ‘prescribe’ produce and IGMV participation. R4H ‘prescribers’ included all primary care clinicians, as well as mental health clinicians, pharmacists, nutritionists and dietitians, Certified Diabetes Educators, nurses and community health workers.

As each clinic prepared to launch R4H, all staff received at least two hours of experiential training in which they experienced an IGMV session and also received training in R4H workflows, including food insecurity screening and referring to R4H programs through the electronic health record. Primary care and mental health clinicians, nurses, health educators, dietitians and nutritionists all received an additional eight hours of training on food and nutrition, focused on the prevention and treatment of chronic conditions (see Rosas et al. 2023 for a more detailed description of training).³¹ In interviews with clinic staff, many mentioned that high rates of staff turnover meant that not all clinicians and support staff were trained in R4H, and this affected consistency of referrals. In 2021, a primary care clinician described how half

Table 1. Patient Interviewee Demographics.

| | (N = 14) | |
|---|-----------|---------|
| | N or mean | % or SD |
| Gender | | |
| Female | 13 | 92.9 |
| Age (years; range: 32-65) | 52.7 | 11.0 |
| Race/ethnicity (self-identified) | | |
| Black/African American | 4 | 28.6 |
| Hispanic/Latine | 6 | 42.9 |
| American Indian/Native American | 2 | 14.3 |
| White | 2 | 14.3 |
| Highest level of education | | |
| Completed college | 4 | 27.5 |
| Some college or vocational school | 3 | 20.4 |
| High school graduate or GED | 3 | 21.4 |
| Less than high school or GED | 4 | 27.5 |
| Primary language | | |
| English | 9 | 64.3 |
| Spanish | 5 | 35.7 |
| Health conditions (self-reported) | | |
| Pre-diabetes or diabetes | 6 | 42.9 |
| Hypertension | 8 | 57.1 |
| Mental health condition | 3 | 21.4 |
| Chronic pain | 7 | 50.0 |
| Other (eg, heart disease, hypothyroidism) | 9 | 64.3 |
| Interview year | | |
| 2020 | 7 | 50.0 |
| 2021 | 2 | 14.3 |
| 2022 | 5 | 35.7 |

of the clinicians at their site had left over the course of a year and been replaced by new clinicians who were not present for the initial R4H training. She said, “we’ve told them about Recipe for Health, but they didn’t get the same introduction. And I don’t know if it’s possible to [provide the full training again] but some version would probably be good to get them bought in.”

Despite challenges with staff turnover at multiple sites, adoption of the program was high in 2022, the year for which quantitative data was available. Of clinic staff trained to refer patients to R4H, in 2022 84% referred 2 or more patients. With rare exceptions, produce was delivered to all participants for all 16 weeks (exact adherence data is not available). IGMV attendance was evenly divided, with about one-third of participants attending fewer than 50% of sessions, one-third attending 50%-75% of sessions, and one-third attending >75% of sessions.

Implementation

After quickly adapting planned implementation at the beginning of the COVID-19 pandemic, R4H consistently provided doorstep home delivery of produce and telehealth

IGMV throughout the early years of the COVID pandemic. Qualitative analysis identified multiple implementation ingredients that facilitated the success of R4H. These included: (1) political will and material support from multiple levels of government; (2) a multi-sector partnership with centralized coordination; (3) a flexible, pragmatic approach to program implementation. Recipe4Health also faced multiple implementation challenges including: (1) clinics’ frequently shifting priorities due to the ongoing COVID pandemic; (2) communication challenges, intensified by remote collaboration due to COVID; and (3) limited access to land to grow food for the produce prescription program.

Implementation Strengths

- (1) *Political will and material support:* Recipe4Health was initiated as part of ALL IN Alameda County, a broad effort to implement county-level anti-poverty initiatives developed by the late County Supervisor Wilma Chan.³⁸ Federal funding from the USDA GUSNIP produce prescription program allowed the ALL IN team to initially implement the program, with additional funding from the county government, a local Medicaid managed care plan, and philanthropic

Table 2. Staff Interviewee Demographics.

| | (N = 26) | |
|--|-----------|---------|
| | N or mean | % or SD |
| Professional role | | |
| Integrative group medical visit health coach | 6 | 23 |
| Farmer | 2 | 7.7 |
| Organizational administrator | 4 | 15.4 |
| Primary care clinician | 4 | 15.4 |
| Clinic-medical assistant | 5 | 19.2 |
| Mental health clinician | 5 | 19.2 |
| Gender | | |
| Female | 24 | 92.3 |
| Male | 2 | 7.7 |
| Age (years; range: 21-67) ^a | 39.04 | 13.0 |
| Race/ethnicity | | |
| Black/African-American | 2 | 7.7 |
| Asian/Pacific Islander | 2 | 7.7 |
| Hispanic/Latine | 9 | 34.6 |
| American Indian/Native American | 3 | 11.6 |
| White | 14 | 53.9 |
| Languages spoken | | |
| English | 26 | 100 |
| Spanish | 12 | 46.15 |
| Interview year | | |
| 2020 | 10 | 38.46 |
| 2021 | 15 | 57.69 |
| 2022 | 1 | 3.85 |

^aOne staff interviewee's age was missing.

foundations. Multiple sources of COVID-related funding supported R4H expansion. Additionally, Dig Deep Farms, as part of the Alameda County Sheriff's Office, received support from the county government. One Dig Deep staff member explained that it was founded "because we wanted to create jobs for people coming out of jail. And we wanted the job to be connected to doing something healthy for the environment and the world first. So, we started the farm. That was 10 years ago.... We basically are calling our work, the community capital model of public safety." In addition to collaborating with local government, Recipe4Health leadership participated in efforts to make Food as Medicine programs a covered service through California's Medicaid program, which were ultimately successful in 2022 as part of CalAIM statewide Medicaid reform efforts.

- (2) *Multi-sector partnership with centralized coordination:* Recipe4Health partner organizations represented health care, government, non-profit organizations, agriculture, and research, each holding distinct roles (see Table 4). A small team based in the county's health care services department served as the convenors, trainers, and implementers of R4H. Clinic

staff at FQHCs had the essential role of identifying and referring patients to participate in R4H. In interviews, staff and patients alike shared that patients were more likely to participate when referred by a trusted member of a health care team. One IGMV facilitator said that it was "powerful for a health care provider to tell a patient, 'I've got to write your prescription, but it's not for medication, it's for participation in the community.' And so patients take it seriously, they are primed to feel like this is the real deal, and to commit to it in a way that I think is really supported by having the provider there." Dig Deep Farms held the key role of growing and delivering food for the produce prescription program, and their contract with R4H supported the organization's overall growth. A Dig Deep staff member explained, "We're not a huge farm site so our salaries are subsidized by Recipe4Health and other governmental agencies that support Dig Deep Farms." Representatives of partner organizations met weekly to discuss program implementation and evaluation in a process that one staff person described as "really supportive, and it can also just be a little bit convoluted or laborious to figure out who needs to be involved and what decisions and where are both the accountabilities, and decision-making power?...it's just been a learning process." During the rapid transitions of program implementation during the COVID pandemic, frequent communication was an essential and complex aspect of creating a multi-sector partnership.

- (3) *Flexible, pragmatic approach to program implementation:* R4H has consistently provided services since March 2020, throughout all stages of the COVID pandemic. It carefully selected FQHC sites based on clinic leadership support, County Board of Supervisors priorities, and the R4H team's capacity to provide training and technical assistance. The program built on strong relationships between the Community Health Center Network and individual FQHC sites (eg, use of a shared electronic health record). The substantial roles played by partner organizations meant that patients could continue accessing R4H services even as clinics navigated shifting priorities due to COVID. For example, Open Source Wellness health coaches co-facilitated IGMVs with clinic-based primary care providers. Health coaches were able to focus fully on IGMV implementation, with roles that included helping patients navigate telehealth—described by one as, "going the extra mile to help [patients] get onto Zoom....Everyone's kind of split into a million ways and asking them to spend a little extra time helping out their parents or their sibling or whoever it is to get them onto Zoom is sometimes a little bit tough to navigate." From the patient perspective, many

Table 3. Demographics of Patients Referred and Enrolled to Recipe4Health (R4H), Compared With all Patients at R4H Partner FQHCs N (%), Unless Otherwise Noted.

| Demographic characteristic | Referred to R4H | | | Enrolled in R4H | | | All patients of R4H partner FQHCs ^a | | | | |
|--|--|------------------------------|--|-------------------------|------------------------------|---|--|--------------------------------|-----------------------|-------------------------------|---------------------------|
| | All referrals (Jan 2020 – Aug 2022) (n = 3255) | Food farmacy only (n = 2074) | Food farmacy + integrative group medical visits (n = 1181) | All enrolled (n = 1997) | Food farmacy only (n = 1681) | Food farmacy + integrative group medical visits (n = 316) | All clinics | Tiburcio Vazquez Health Center | LifeLong Medical Care | Native American Health Center | Bay Area Community Health |
| Total patients served (2022) | | | | | | | | 28 592 | 57 082 | 8224 | 64 157 |
| Age (years), mean (SD) | 43.0 (19.6) | 39.9 (21.0) | 48.4 (15.3) | 41.4 (20.0) | 40.1 (20.8) | 48.6 (13.6) | -- ^b | -- ^b | -- ^b | -- ^b | -- ^b |
| Age category | | | | | | | | | | | |
| <18 years | 483 (14.8) | 451 (21.7) | 32 (2.7) | 359 (18.0) | 359 (21.4) | 0 (0.0) | 29.1% | 42% | 25% | 44% ^c | 25% |
| 18-44 years | 1090 (33.5) | 651 (31.4) | 439 (37.2) | 657 (23.9) | 530 (31.5) | 127 (40.2) | 59.2% | 52% | 61% | 49% ^c | 62% |
| 45-64 years | 1277 (39.2) | 738 (35.6) | 539 (45.6) | 765 (38.3) | 614 (36.5) | 151 (47.8) | | | | | |
| 65+ years | 405 (12.4) | 234 (11.3) | 171 (14.5) | 216 (10.8) | 178 (10.6) | 38 (12.0) | 11.8% | 6% | 14% | 7% ^c | 13% |
| Gender | | | | | | | | | | | |
| Female | 2192 (67.3) | 1347 (64.9) | 845 (71.5) | 1368 (68.5) | 1113 (66.2) | 255 (80.7) | 57.2% ^d | 59% ^d | 57% ^d | 61% ^d | 56% ^d |
| Male | 1060 (32.6) | 725 (35.0) | 335 (28.4) | 628 (31.4) | 567 (33.7) | 61 (19.3) | 42.8% ^d | 41% ^d | 43% ^d | 39% ^d | 44% ^d |
| Not binary | 2 (0.1) | 2 (0.1) | 0 (0.0) | 1 (0.1) | 1 (0.1) | 0 (0.0) | -- ^d | -- ^d | -- ^d | -- ^d | -- ^d |
| Race/ethnicity | | | | | | | | | | | |
| Hispanic/Latine | 1786 (54.9) | 1202 (58.0) | 584 (49.4) | 1142 (57.2) | 1052 (62.6) | 90 (28.5) | 52.9% | 70% | 39% | 58% | 57% |
| White (non-hispanic) | 292 (9.0) | 179 (8.6) | 113 (9.6) | 147 (7.4) | 116 (6.9) | 31 (9.8) | 10.5% ^e | 6% ^e | 13% ^e | 4% ^e | 11% ^e |
| Black (non-hispanic) | 601 (18.5) | 339 (16.3) | 262 (22.2) | 381 (19.1) | 254 (15.1) | 127 (40.2) | 11.8% ^f | 4% ^f | 25% ^f | 15% ^f | 3% ^f |
| Asian or pacific islander (non-hispanic) | 235 (7.2) | 135 (6.5) | 100 (8.5) | 111 (5.6) | 102 (6.1) | 9 (2.8) | 13.5% ^g | 7% ^g | 6% ^g | 7% ^g | 24% ^g |
| American Indian or Alaskan native (non-hispanic) | 73 (2.2) | 42 (2.0) | 31 (2.6) | 50 (2.5) | 35 (2.1) | 15 (4.7) | | | | | |
| Mixed race | 73 (2.2) | 49 (2.4) | 24 (2.0) | 56 (2.8) | 39 (2.3) | 17 (5.4) | 1.2% ^h | -- ^h | 2% ^h | 2% ^h | 1% ^h |
| Unknown/other | 195 (6.0) | 128 (6.2) | 67 (5.7) | 110 (5.5) | 83 (4.9) | 27 (8.5) | 9.9% | 13% | 15% | 10% | 4% |
| Preferred language | | | | | | | | | | | |
| English | 1758 (54.0) | 1036 (50.0) | 722 (61.1) | 1037 (51.9) | 763 (45.4) | 272 (86.7) | -- ^b | -- ^b | -- ^b | -- ^b | -- ^b |
| Spanish | 1396 (42.9) | 962 (46.4) | 434 (36.7) | 906 (45.4) | 866 (51.5) | 40 (12.7) | -- ^b | -- ^b | -- ^b | -- ^b | -- ^b |
| Other | 101 (3.1) | 76 (3.7) | 25 (2.1) | 54 (2.7) | 52 (3.1) | 2 (0.6) | -- ^b | -- ^b | -- ^b | -- ^b | -- ^b |

^aFor all clinic level statistics, we relied on publicly available 2022 data provided by Community Health Center Network. Only percentages were available.^bThis data was not reported in publicly available Clinic data.^cNote, Native American Health Center's public data for age was only available as categorized in the following groupings: 0-19 years, 20-64 years, 65 years+.^dPublicly available data for clinics was only provided for sex assigned at birth, not gender.^eClinic data was only provided as "White."^fClinic data was only provided as "African American."^gClinic data was only provided as "Asian."^hClinic data was only provided as "More than 1 race."

appreciated the details of how R4H was implemented. For example, multiple patients found the doorstep produce delivery to be a more flexible and person-centered approach than in-person pickup of produce would have been. One patient said, “I love it. Well, I don’t have any complaints. Because they text you and say we’re on our way.... And so I text back and ... There’s your bag and it’s right there!...I want to find that farm too. I want to see the location [where the food is grown].”

Implementation Challenges

- (1) *COVID Pivots:* During the implementation period described, clinics needed to make what several referred to as ‘constant pivots’ to respond to the COVID pandemic. At many points, clinic staff needed to prioritize COVID vaccination campaigns or shifting safety protocols for in-person care. In interviews, staff described relief that Recipe4Health could address patient needs related to food security, social support, and care for chronic conditions. For some staff and at some time points, R4H felt like a support that made their jobs easier. One medical assistant shared a sense of relief that food insecurity screening could lead to an R4H referral: “When I’m doing different screening tools and asking [patients] different questions, I think that it’s a nice surprise, that at the end of one of them, they get free produce....that feels like a really valuable resource, being able to just ask somebody, ‘Are you hungry? Oh, here’s some food.’ It feels like just a very direct way to support somebody in a really simple, but really important way.” For other staff and in other moments, prioritizing consistent food security screening and program referrals felt like one more challenge to deal with. Early in the pandemic, one clinic staff member said: “Our medical assistants are supposed to be screening for food insecurity and then immediately recommending that patients get a referral to the Food Farmacy. I don’t feel like that’s happening consistently. I’m not really sure why. Maybe it’s because of the way telemedicine visits are structured compared to when patients are coming in person. I think a lot more things are falling through the cracks [because of COVID].” Over a year later, another staff person described creative approaches like texting patients who were eligible for R4H and using the program as a way to motivate attendance at medical visits. Regardless of shifting COVID safety protocols, R4H was able to continue due to its development as a program that did not require in-person, face-to-face interaction.
- (2) *Partnership communication:* Due to COVID, communication between organizational partners took place almost entirely remotely (via videoconference, email, and phone) despite most partners being in the same county. At times this led to communication challenges between organizations, and between patients and those providing R4H services. Clinic staff sometimes were confused about how R4H operated, and whether they should truly refer all eligible patients. One said, “They keep telling us ‘Send more referrals, send more referrals!’ I’m assuming they have bandwidth to take on more patients. I don’t know if there’s a limit to how many patients...But I would hope that if it’s working that they would continue to do it.” Clinic staff attempted to support patient enrollment in R4H but sometimes were unsure how to reach partner organizations. Early in the program’s implementation, a clinician wished they could “directly call Open Source Wellness and talk to somebody about the group, if it was like the [patient] wasn’t getting calls or I’ve referred, but nobody had followed up. Sometimes that happens where there’s just not a follow-up and probably what happens is they call the patient and don’t get through until they close the referral.” During the implementation period, partner organizations worked to strengthen communication with patients via telehealth, as well as provide direct communication channels between clinics and other partner organizations through the Electronic Health Record and other standardized communications. Offering IGMVs via telehealth made the program more accessible for some people, and addressed social isolation worsened by COVID. One patient called the IGMV “practically a social gathering and it’s like time for us, spending time for ourselves.” For other patients, Internet access, low tech literacy, and limited literacy overall made telehealth IGMVs challenging to access. In spring 2020, an IGMV staff member explained that “some people dropped off because of [the virtual format]. They just decided I’ll go back when it’s in person, but they didn’t know it was going to last this long.” In the IGMV program, staff sought to align discussions of cooking and nutrition with the specific foods that were delivered through the Food Farmacy. However, this was not always possible, and sometimes led to patients feeling confused or embarrassed about their lack of knowledge about certain foods. One said, “In the group...I should bring the bag out and say, ‘Hey, can you tell us all what this is?’ Because I think it’s purple kale. I think it’s Swiss chard, but it doesn’t have a name, and I don’t normally eat like that.” This kind of discussion of food was straightforward in an in-person group, but more challenging to coordinate for virtual group visits. Over time, the Dig Deep Farms team began providing additional information about the food provided.
- (3) *Land, delivery and food needs:* The doorstep delivery format of the Food Farmacy provided access to people with transportation and scheduling challenges

Table 4. Recipe4Health Partner Organizations.

| Organization | Type of organization | Role in R4H | Strengths identified |
|--|---|---|--|
| Alameda County Health | Local government agency | Central convener, lead training & implementation | Recipe4Health leadership embedded in local government made it possible to implement |
| Dig Deep Farms | Local farming non-profit | Grow vegetables for the Food Farmacy, and deliver to patients' home | -Local sourcing of produce using regenerative and organic farming with benefits for human & soil health -Supports local economy through job training focused on BIPOC farmers & re-entry population |
| Open Source Wellness | Local non-profit organization | Contract with FQHCs to provide IGMV program (health coaches & curriculum), survey patients for clinical research on R4H | -Skilled in virtual & in-person IGMV facilitation -Multilingual health coaching staff, majority BIPOC -Experience collaborating with multiple FQHCs |
| Community Health Center network | County-wide network of Federally Qualified Health Centers | Share electronic health record data with R4H-affiliated researchers in alignment with formal data-sharing agreements | -Centralized access to EHR and other data across FQHCs -Built centralized dashboard for all participating FQHCs |
| LifeLong Medical Care | Federally Qualified Health Center | Refer patients to R4H, and staff IGMV program with primary care clinicians | -Represents northern Alameda County -History of established group medical visit programs at multiple sites |
| Bay Area Community Health | Federally Qualified Health Center | Refer patients to R4H, and staff IGMV program with primary care clinicians | -Represents southern Alameda County -Serves diverse population including many recently arrived refugees |
| Tiburcio Vasquez Health Center | Federally Qualified Health Center | Refer patients to R4H, and staff IGMV program with primary care clinicians | -Represents mid county area -Primarily serves Hispanic/Latine communities |
| Native American HealthCenter | Federally Qualified Health Center | Refer patients to R4H, and staff IGMV program with primary care clinicians | -Represents mid county area -Centers Native American communities |
| Alameda Alliance for Health | Non-profit Medicaid managed care plan | Seed funding to support early implementation of R4H | Collaboration to ensure operational readiness in preparation for 2022 Medicaid 1115, 1915b, ILOS waivers |
| Stanford University, Food for Health Equity Lab | Academic medical center | Research and evaluation | -Financial support for research from university sources -Experienced researchers |
| University of California San Francisco, Osher Center for Integrative Health & Department of Pediatrics | Academic medical center | Research and evaluation | -Experienced researchers from multiple departments |

that would have kept them from picking up food at clinics. However, clinic staff noted that the Food Farmacy did not support “people that don’t have an address” or were unhoused, as well as those who could not receive food delivery or did not have access to cooking facilities. Additionally, the doorstep delivery allowed for limited discussion and education about the food itself. For some patients, the specific and limited

kinds of produce available (particularly in the winter) were confusing; some wanted food like avocados that are not widely grown in the region, or foods that were not in season. Others noted that because only produce was delivered, recipes provided included ingredients that they might not have at home. These issues highlighted the complex nature of food insecurity, and the challenges of a produce prescription program in addressing it.

A broader implementation challenge was the need for access to more land to provide adequate food for the growing program. Though Dig Deep Farms steadily increased the amount of land available, farmers noted that growing large supplies of fruit was a multi-year process. Despite these challenges, patients reported that R4H supported consistent access to fresh produce during their participation. However, patient perspectives depended on their unique situations, including how many people they lived with, access to other food resources, and enthusiasm about trying new foods. Over time, Dig Deep Farms worked to respond to patients' requests for more information about what produce to expect and how to prepare new foods, and provided bilingual recipes for the produce provided each week. The Food Farmacy team was in ongoing discussion about how to provide foods that would be familiar to an extremely diverse group of participants, while growing them locally and year-round. Recipe4Health implementation was constrained in many ways by the pandemic conditions in which it took place, but partners went to great efforts to make the program accessible to as many people as possible.

Maintenance

As of fall 2024, all FQHCs that have implemented Recipe4Health continued to participate in the program. Clinics faced varying challenges relating to program sustainability including staff turnover and associated difficulties sustaining referrals, as well as other COVID-related difficulties described above. However, all clinics continue to offer R4H services; two have expanded to additional sites, and when one FQHC closed its R4H site, services were shifted to an alternate site. Since 2022, several have begun offering in-person IGMVs as well as new IGMVs in Spanish that allow them to serve a broader range of patients. R4H implementation informed statewide Medicaid policy changes that were implemented in September 2022, making medically supportive foods a covered service across the state for 5 years through CalAIM, California's version of the combined Medicaid Waiver 1115, 1915b, and In Lieu of Services.

Discussion

As part of a mixed-methods evaluation of the Recipe4Health produce prescription and Integrative Group Medical Visits program,³¹ we report on the implementation of Recipe4Health from 2020-2022. During this time, the program served a total of 1997 patients (61% of those referred by primary care teams) with 1681 participating in the Food Farmacy and 316 in the Food Farmacy with Integrative Group Medical Visits. The program was adopted by four FQHCs in Alameda County, all of which continue to provide R4H services. Successful implementation of R4H was supported by county

government and federal funding for produce prescriptions through a multi-sector partnership with a centralized team responsible for coordination and implementation. Given its initial implementation during the COVID pandemic, it was essential that the program took a flexible, pragmatic approach. Challenges to R4H implementation included clinics' frequently shifting priorities due to the ongoing pandemic; communication challenges, intensified by largely remote communication; and initial limitations in land access for the farmers growing produce.

Our findings point to the benefits and challenges of particular ways of structuring produce prescription programs. Broad eligibility criteria (in this case based on a range of diagnoses and food insecurity status) and substantial staff training made it more feasible for FQHC staff to implement the program. Though this was not a study of the COVID pandemic, it became one. The ongoing COVID context interwove with existing challenges in safety-net health care, which affect organizations, staff, and patients. At the patient level, clinic staff spoke to the broad accessibility of the program while acknowledging limitations where multiple social needs intersect. For example, unhoused people and Single Room Occupancy hotel residents were unable to use produce prescriptions due to lack of stable housing and kitchen access, while people who did not speak English or Spanish were unable to participate in IGMVs because they were offered in a limited number of languages. However, the unanticipated shift from offering food in clinic waiting rooms to providing home delivery meant that produce prescriptions were accessible for people without reliable transportation. At the staff level, primary care staff turnover and burnout continue to be high and clinic teams faced tremendous personal and professional challenges related to the pandemic. At the organizational and structural levels, clinics grappled with how to implement R4H—a program they supported—while juggling competing priorities, including COVID care and vaccine provision, clinician and staff shortages, and the challenge of providing patient-centered care in 10-15 minute primary care visits. Recipe4Health required ongoing commitment to daily patient referral and organizational partnership while providing IGMVs to acknowledge and support the context of health behavior change, address social isolation worsened by COVID, and address food insecurity through home delivery of produce.

Strengths of this study include its mixed-methods, longitudinal approach with a research team embedded in an ongoing program. The nature of this partnership will allow for continued longitudinal research on Recipe4Health implementation, including its current stage funded in part through the CalAIM Medicaid 1115 waiver.³⁹ Limitations include the fact that qualitative data were collected over 2 years in a rapidly changing context due to the COVID pandemic, and inability to thoroughly examine site-level differences in implementation. Like many programs to address food insecurity, Recipe4Health serves a disproportionate number of women (approximately two-thirds of those

referred and enrolled); future research should explore the roles of clinic staff referral patterns and patient preferences in this gender imbalance.⁴⁰ Additionally, due to COVID-related research challenges, our qualitative participants were a convenience sample that was almost entirely female and did not include patients who received produce prescriptions only.

Amidst large expansion of Food as Medicine initiatives with and without accompanying education, clinical and social support programs such as IGMVs, many questions remain. Future research might compare implementation experiences of programs with varied “doses” including program length, virtual vs in-person education and support programs, group medical visits vs non-clinical programs, and distinct kinds of organizations serving as the primary program convener. Qualitative studies can use purposive sampling to include participants with a wide range of identities (eg, gender, housing status, age) and levels of participation.⁴¹ As has been acknowledged elsewhere, Food as Medicine programs must be flexible and creative in adapting to the needs of people and communities who they aim to support.^{16,17} Recipe4Health is part of a growing shift in what counts as health care and who can prescribe care for concurrent medical and social needs. In tackling nutrition-sensitive chronic conditions (both physical and mental health-related), as well as food insecurity and social isolation, Recipe4Health brings together two established approaches: produce prescriptions and integrative group medical visits. Each of these has a body of encouraging health outcomes research,^{2,42-44} and a growing body of research on implementation and sustainability in safety-net settings.^{16,17,21,45-47} Our findings demonstrate that Recipe4Health uses many of the best practices for produce prescription programs that have been identified in prior literature,^{17,48} including (1) integration into health care organizations (screening for food insecurity, electronic health record integration, and staff training in food as medicine); (2) expanding access via home delivery; (3) multi-sector collaboration, including with small farms and health care payors. Additionally, R4H has broad eligibility criteria for patient participation (including chronic conditions as well as food insecurity), allows people in many clinical roles to ‘prescribe’ participation in telehealth or in-person visits, and offers IGMVs in two languages. While cooking classes and nutrition education are a fairly common accompaniment to produce prescription programs, IGMVs also provide ongoing support with health-related behavior change (eating, movement, stress management), clinical care (eg, reducing medication doses when chronic conditions improve), and peer support. Other programs could tailor these practices to their specific populations, offering IGMVs in different languages or collaborating with other kinds of local food purveyors.

The national conversation about Food as Medicine continues to develop rapidly as part of broader conversations about health equity, social and structural determinants of health, and the important role of nutrition in preventing, treating and reversing chronic conditions.⁴⁸ Funders

including the American Heart Association and the Rockefeller Foundation have committed to funding large-scale research on Food as Medicine programs. At the federal level, Alameda County’s longtime Congressman, Barbara Lee,⁴⁹ introduced a bill in 2024 to increase funding for Food as Medicine programs, largely modeled after R4H (eg, with a focus on sourcing food from local and regional farms run by farmers from historically marginalized groups, using regenerative and organic practices). Meanwhile, the governor of California vetoed a 2024 bill by Alameda County representative Mia Bonta that would have enshrined Food as Medicine programs as a permanent covered benefit in the state’s Medicaid program. Given the vital role of food and nutrition in integrative health care, it is essential that integrative health equity practitioners and researchers work in partnership with Food as Medicine programs supporting marginalized communities. They can be involved in policy advocacy to make Food as Medicine programs nationally covered benefits in Medicaid and Medicare, as well as efforts to strengthen the role of the USDA in supporting local and regional agriculture.

Centralized implementation, training, and administration of Food as Medicine programs can support Federally Qualified Health Centers’ capacities to concurrently address medical and social needs through an integrative health equity approach. Findings from Recipe4Health suggest that it is more feasible for clinics to do this work when eligibility criteria are broad, focused on preventing as well as treating chronic conditions. As FQHCs have known from the beginning, food is the medicine for food insecurity—not only for chronic conditions.³ Primary care clinics cannot do this work alone, and partnership is labor-intensive but essential for providing equitable care and ensuring broad reach and adoption of Food as Medicine. Investments by government, philanthropic organizations, payors and health care organizations must include support for multi-sector partnership development, maintenance, and communication to sustain Food as Medicine programs.

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Ethical Statement

Ethical Considerations

This research was approved by Institutional Review Boards at UCSF (#19-28766, #21-34511) and Stanford University (IRB-57239).

Informed Consent

Interviewees provided informed verbal consent according to IRB guidelines, and a waiver of consent was obtained for EHR data. All authors have approved the manuscript for submission.

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