

ORIGINAL RESEARCH

Produce Rx Programs for Diet-Based Chronic Disease Prevention

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Abstract

Background: To explore the ethical and policy implications of produce prescription (Rx) programs, PubMed, Embase, and Scopus databases were searched for peer-reviewed literature on existing Rx programs in February 2018.

Methods: A review of the literature identified 19 articles published on produce Rx programs; all were included in the review. Inclusion criteria were interactions between a medical professional and patient in a health care setting where a prescription for the consumption of fruits and vegetables was provided. Programs were further classified by whether patients were recruited based on eligibility criteria such as low socioeconomic status, diet-related condition, and the type of referring physician. An ethical matrix was then used to evaluate well-being, autonomy, and fairness from the perspectives of adult and child patients, patient families, participating local farmers, physicians, and government assistance programs.

Results: Patients with low income were subjects of 14 articles; 13 studies identified populations with diet-related health conditions such as diabetes or hypertension. Only 9 studies examined both health conditions and low socioeconomic status. An ethical analysis indicated that despite reducing financial burdens and increasing food choice, Rx programs might have unintended psychosocial consequences on participants with low income. Health care professionals benefit from employing a partnership model of care, building trust, and emotional intelligence. Participating farmers benefit from an enlarged customer base but might experience greater financial burdens. Some produce Rx programs could use existing government assistance programs (ie, Medicaid in medically underserved areas or the Supplemental Nutrition Assistance Program, or SNAP, in food deserts), although disbursement may be cost inefficient and disorganized without policy cohesion at all levels of government.

Conclusions: Future research must test a variety of produce Rx program designs to ameliorate tradeoffs between well-being, fairness, and autonomy. As pilots grow in scale, produce Rx programs must acknowledge the critical roles and perspectives of health care professionals and local participating farmers. Programs must also determine whether Rx incentives will use the existing government assistance programs to identify patients with low income, with diet-related health conditions, or with both.

Preventative “Prescription” Programs for Fruits and Vegetables for At-Risk Patients

Across the country, local partnerships between farmers’ markets, community health clinics, community based organizations (CBOs), and research institutions have piloted numerous produce “prescription” (Rx) programs. In these programs, physicians identify at-risk patients—either by a diagnosed diet-related health condition (such as diabetes, obesity, or celiac disease), a qualifying income level, or both—and write prescriptions for the consumption of subsidized nutrient-rich foods, including fruits and vegetables (FVs). Produce Rx programs use monetary incentives to reduce the social cost of attitudinal change (ie, altering preferences through nutrition education) and the financial cost of behavioral change (ie, subsidizing healthy foods for consumers with low income). The cost of the FVs is subsidized by stakeholder groups, such as research institutions and CBOs, or through private, local, or state grants. At this time, the federal government has proposed \$4 million for produce Rx pilot programs for each fiscal year 2019 through 2023 in the Agriculture Improvement Act of 2018.^{1,2}

Produce Rx programs are unique among preventative interventions in using a [partnership model of care](#) whereby an authority figure (ie, the referring physician) rewards and positively reinforces repeated health-seeking behaviors.^{3,4} The interplay between patients’ financial incentives and the physician-patient relationship is central to the structure of produce Rx programs. As a result of the relative youth of such programs in preventative medicine, no known research to date has considered the varied perspectives of involved stakeholders or the programs’ ethical implications.

This article aims to (1) review the academic literature on published accounts of existing produce Rx programs and their stakeholders and (2) use an ethical matrix to evaluate the ethical implications of produce Rx programs and their potential scale-up in state and federal policy.

Methods

PubMed, Embase, and Scopus databases were used to search the peer-reviewed literature on existing Rx programs in February 2018. In this review, inclusion criteria were at least 1 interaction between a medical professional and patient in a health care

setting where a prescription for the consumption of fresh, canned, or frozen fruits and vegetables was issued.

Six stakeholder groups were identified. The analysis separated patients into 3 subcategories: adult patients, child patients, and patient families, including those both with and without children. Health care professionals and local participating farmers are included in this analysis as they are critical to program design. Lastly, although government assistance programs are not yet *participating* in produce Rx programs, the rapidly growing research on such programs is of *interest* to agencies seeking new incentive models to promote health and nutrition among beneficiaries. As a result, social services relevant to produce Rx programs include food and nutrition benefits (ie, the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) health care insurance (ie, Medicaid and Medicare), and income assistance (ie, Temporary Assistance for Needy Families (TANF)).

The 6 stakeholder groups identified in the review were then used to form an ethical matrix (EM), or an analytical tool that evaluates the ethical considerations of several policy alternatives from the perspective of 4 or more stakeholders.⁵ Mepham identified 3 standard principles relevant to stakeholders with an interest in a certain set of public policies, including well-being (maximizing benefits and minimizing harms), autonomy (freedom and choice), and fairness (reducing disparities resulting from socioeconomic status or health condition).⁶ EMs evaluate policies with respect to these 3 criteria and are divided by stakeholder group. Each cell in an EM represents beneficial or harmful outcomes from the perspective of a stakeholder group, depending on traditional power dynamics, expected impacts, and the specific contexts and communities where programs are implemented.

Article Characteristics

A total of 19 articles are included in this review.⁷⁻²⁵ Fourteen articles evaluated the impact of produce Rx programs, including 10 peer-reviewed articles and 4 conference abstracts (see table 1). Five articles—1 study and 4 commentary pieces—were qualitative descriptions of the organizations or systems that operate and facilitate produce Rx programs.

Of the 19 articles, 14 featured patients of low socioeconomic status (SES) at either federally qualified health clinics (FQHCs) or community health clinics (CHCs); 12 identified a specific population with a diet-related health condition; and 9 featured both. Five articles described food environments outside the United States, including Italy and the United Kingdom. All of the 14 evaluative articles were observational or quasi-experimental studies. Study design varied, with 8 retrospective cohort studies, 3 prospective cohort studies, 2 qualitative evaluations, and 1 cross-sectional study.

Average study duration was 11.6 weeks, with a range of 4 to 22 weeks. Studies occurred at various times during the year, including both winter and summer months.

Table 1. Published Evaluations of Produce Rx Programs by Rx Type, Design, and Participant Characteristics

| Source | Time | Study Design | Food Retail | Rx Design | Participant Inclusion Criteria | | | |
|--------------------------------|-------|-------------------|--|---|--------------------------------|---------|--------------------------------------|------------------------------------|
| | | | | | Patient Type (N) | Low SES | Diet-Related Condition | Physician Referral |
| Peer-Reviewed Articles | | | | | | | | |
| Blickenderfer, 2016 | NR | Qual (thesis) | CG | Discounted 5 lb FV bag per mo in CSA | Adult (12) | | | GP, CHW |
| Bryce, 2017 | 13 wk | Retro cohort | FQHC onsite FM | \$40 voucher (\$10/wk over 4 wks) | Adult (65) | | Diabetic | GP |
| Buyuktuncer, 2014 ^a | 4 wk | Prospect cohort | Local grocery | £1 discount for £3+ spent on FV/week | Adult (124) | X | | GP, NP, midwife |
| Cavanagh, 2017 | 13 wk | Retro cohort | Mobile market | Booklet of 13 coupons for 1 wk of FV, or \$7 value | Adult (54) | X | Hypertensive, obese, and/or diabetic | CHW |
| Friedman, 2014 | 22 wk | Retro cohort | FQHC onsite FM | Preprinted "prescription" (\$5 coupon). Bonus \$25 and \$40 at pre-, mid-, and post-study | Adult (44) | X | Diabetic and/or obese | GP, NP, social worker |
| George, 2016 | 8 wk | Retro cohort | FQHC onsite FM and CG | \$50/wk voucher | Child (22) Family (4) | X | Overweight and/or obese | Medical students |
| Goddu, 2015 | NR | Retro cohort | FM or local grocery | Either \$5 coupon off \$20 purchase at 9 Walgreen's or \$10 voucher at FM | Adult (NR) | X | Diabetic | CHW, GP |
| Kearney, 2005 ^a | NR | Prospect cohort | See Buyuktuncer, 2014 | | Adult (NR) | X | | GP, NP, midwife |
| Muhammad, 2017 | NR | Cross-sectional | Pharmacy or local grocery ^b | UK program ^b for celiac patients to obtain GF foods, either free or with small charge (£8.60) | Adult (375) | | Celiac | GP, RD |
| Trapl, 2016 | 16 wk | Retro cohort | FMs | \$40/mo voucher | Adult (75) | X | Pregnant < 24 wk gestation | CHW, midwife, RD, patient advocate |
| Conference Abstracts | | | | | | | | |
| Chrisinger, 2016 | 16 wk | Prospect cohort | FMs | \$10/wk voucher for FV | Child (NR) Family (353) | | | Pediatrician, GP |
| Joshi, 2016 ^c | 12 wk | Retro cohort | FMs | \$10/wk voucher for FV | Adult (224) | X | Hypertensive | Pharmacist, medical assistants |
| Omar, 2016 | 8 wk | Retro cohort | FQHC onsite FM | Rechargeable debit card (\$ value NR) | Adult (6) | X | Obese and/or diabetic | RD |
| Schlosser, 2016 ^c | NR | Qual ^d | FMs | Thematic results: Rx program enthusiasm; increased FV intake; economic hardship; comorbidity; social interactions; beliefs about patient agency | Adult (23) | X | Hypertensive | GP, CHW |

Abbreviations: CG = community garden; CHW = community health worker; CSA = community-supported agriculture (in-kind); FM = farmer's market; FQHC = federally qualified health center; FV = fruits and vegetables; GF = gluten-free; GP = general practitioner; lb = pound; mo = month; NP = nurse practitioner; NR = Not reported; Prospect = Prospective; Qual = qualitative; RD = registered dietician; Retro = Retrospective; SES = socioeconomic status; wk = week.

^{a,c} Two published accounts of the same study.

^b In most of the United Kingdom (UK), patients diagnosed with celiac disease can receive gluten-free staple foods through a federally-funded program once prescribed by their GP. Prescriptions are free of charge for children throughout the UK. In Wales, Scotland, and Northern Ireland, prescriptions are free for all patients. In England, each prescription charge costs £8.60 unless income qualifies for reduced or free rates.

^d The study design was semi-structured interviews.

Rx Type and Design

Five Rx types were identified based on the support of food retail. Farmers' markets (FMs) were the primary source of food for study participants, including onsite FMs at the FQHC or CHC where the physician-patient interaction occurred (n = 4), as well as local, participating FMs (n = 5). Grocery stores were either locally owned (n = 1) or a local branch of a national store (n = 1). Other retail included community garden (CG; n = 2) and mobile market (n = 1). Two studies gave participants a choice of where to shop—at an FM and a CG or a participating grocery. Nine of the programs were subsidized using vouchers. The dollar value of the incentive varied between \$10 and \$50 per week.

Participant Characteristics

Table 2 provides a summary of characteristics of participants in all studies. The most common clinician was a general practitioner or primary care practitioner (n = 12), followed by a community health worker (n = 7), and a registered dietician (n = 5). Most articles (n = 10) used a household income at or below the poverty level for recruitment. Obesity and diabetes were the most common noncommunicable disease criteria (n = 5), followed by hypertension (n = 3), and celiac disease (n = 2).

Table 2. Summary of Participant Characteristics in Evaluation and Qualitative Studies

| Characteristics | No. (% of Total) |
|--|------------------|
| Health Care Professional^a | 19 (100.0) |
| General practitioner or primary care clinician | 12 (63.2) |
| Community health worker | 7 (36.8) |
| Registered dietician | 5 (26.3) |
| Pediatrician | 3 (15.8) |
| Midwife | 3 (15.8) |
| Nurse practitioner | 3 (15.8) |
| Pharmacist, pharmacy technician | 2 (10.5) |
| Medical student | 1 (0.1) |
| Patient advocate | 1 (0.1) |
| Social worker | 1 (0.1) |
| Specialist | 1 (0.1) |

| | |
|--|-----------|
| Determination of SES Eligibility^b | 14 (73.7) |
| At or below poverty level, or otherwise low income | 10 (52.6) |
| Medically underserved populations | 4 (21.1) |
| Enrollment in SNAP | 2 (10.5) |
| Food insecurity Experience questions | 1 (0.1) |
| Enrollment in WIC | 1 (0.1) |
| Health Condition^c | 13 (68.4) |
| Obesity | 5 (26.3) |
| Diabetes | 5 (26.3) |
| Hypertension | 3 (15.8) |
| Celiac disease | 2 (10.5) |
| Pregnancy | 1 (0.1) |
| Use of Government Assistance Programs | 5 (26.3) |
| Participants who paid for FV (after redeeming incentive) with SNAP benefits ^d | 2 (10.5) |
| Participants who were enrolled in Medicaid ^e | 3 (15.8) |
| <p>Abbreviations: FV = fruits and vegetables; SES = socioeconomic status; SNAP = Supplemental Nutrition Assistance Program; WIC = Women, Infants, and Children Federal Nutrition Assistance Program.</p> <p>^a Most studies partnered with multiple clinicians (n = 17).</p> <p>^b Most studies used more than one method to determine SES eligibility (n = 10).</p> <p>^c Some studies recruited participants with multiple diet-related health conditions (n = 4).</p> <p>^d The only 2 articles that explicitly indicated SNAP benefits were used within the study were Goddu et al.¹⁶ and Trapl et al.²⁴ This number is likely higher, as growth of SNAP and WIC Farmers' Market Nutrition Programs have allowed most FMs to purchase and operate the technology to support EBT card transactions.</p> <p>^e No studies used enrollment in Medicaid as a measure of eligibility. Three studies (Bryce et al.,¹⁰ Cavanagh et al.,¹² Goddu et al.¹⁶) included descriptive statistics about Medicaid enrollment.</p> | |

Stakeholder Groups

The ethical matrix comprising the 6 stakeholder groups and 3 ethical considerations appears in Table 3. The + and - symbols refer to potential outcomes (benefits and harms, respectively) as a result of produce Rx programs.

Table 3. An Ethical Matrix of Produce Rx Programs

| Stakeholder | Ethical Implications of Rx Programs, by Potential Benefit (+) and Harm (-) | | |
|---------------------------------|---|--|---|
| | Well-Being | Autonomy | Fairness |
| Child patients | + Initiating interventions early in life enhances health-promoting behaviors | +/- Tests attitudinal change in a choice-protected and choice-constrained environment | + Lower food costs reduce financial barriers to healthy food procurement - Negative feedback loops and coupon stigma |
| Adult patients | + Promotes consumption of healthier foods to ameliorate existing or high-risk poor health outcomes | + Informed consumer choice in purchasing nutrient-rich foods | |
| Patient families | + Higher adherence and greater social acceptability among family-based interventions | - Program can restrict locations and budgets for grocery shopping | |
| Health care professionals (all) | + Nonpharmacological intervention initiates deeper and more personal engagement with patients | + Firsthand experience employing partnership model of care (ie, role modelling) | +/- Resources may not be prioritized for programs in FQHCs/CHCs |
| Local participating farmers | + Larger customer base improves income, livelihoods - Profits can vary with seasonality | - Onsite FM at FQHCs/CHCs can reduce choice in market location, increasing transport, storage costs + Redemption at local FMs | +/- Incentive cost can be program prohibitive, unless otherwise covered |
| Government assistance programs | + Enlarges evidence base for integrating prevention and treatment in public policy (health care, food access, income) | - Cost-inefficient, disorganized disbursement of incentives - Rx dollar value affected by political budget negotiations | +/- Integration of public services for food deserts and medically underserved areas/populations |

Abbreviations: CHC = community health clinic; FM = farmer's market; FQHC = federally qualified health center.

Patients. Children are dependent on adults for both the physical provision of food and the less tangible components of food choice, including cooking knowledge and grocery shopping. This is particularly true for children with diet-related health conditions who are vulnerable to the cognitive, psychosocial, and physiological effects of poor nutrition, as well as teens and adolescents who independently form their own food behaviors. Produce Rx programs hoping to recruit children have potential to enhance [health-promoting behaviors](#) and attitudes early in life. These programs simultaneously protect and constrain food choices, which results in either resistance or eagerness to change behavior, particularly among teenagers. The extent of family involvement as well as children's age and gender affects their responses.^{26,27} Substantial evidence also indicates that food choice interventions are more successful in both the short- and long-term when family-based approaches are used.^{28,29}

Among adult patients, produce Rx programs promote consumption of nutrient-rich foods that can ameliorate existing or [high-risk diet-related health conditions](#). Compared to children, parents or caregivers who receive the Rx have both a larger knowledge base and a greater set of choices in purchasing nutrient-rich foods. However, as the results of this review show, produce Rx programs by design must restrict the locations available for participants to partake in grocery shopping, limiting choices to what is available at an onsite FM or local grocery.

Research on customer experience with store cashiers has found reinforcing feedback loops between feelings of embarrassment, perceived discrimination, and low long-term coupon redemption rates, or coupon stigma.³⁰ This psychosocial effect is particularly strong in grocery stores, where the “devaluation effect” can supersede expected cost savings for consumers of low SES.³¹ The Electronic Benefit Transfer (EBT) card replaced paper vouchers in 2004 for SNAP beneficiaries, partially to reflect technological change and to reduce the stigma of identifiable stamp usage.³² Future produce Rx designs must consider the role of coupon stigma and the potential usefulness of EBT.

Health care professionals. The 11 health care professionals identified in Table 3 reflect a variety of experiences and career stages. By design, Rx programs provide physicians of all levels an opportunity to prescribe a nonpharmacological intervention. Unlike most medications, prescriptions of nonpharmacological treatments require the collection of qualitative data, including patient expectations and experiences.^{33,34} Repeated interactions through follow-ups tend to enhance physician’s emotional intelligence, communication skills, and patient trust.³⁵

Produce Rx programs provide an alternative to the paternalistic model of the physician-patient relationship.³⁶ The partnership model assumes mutual participation, whereby health care professionals and patients are colleagues in pursuit of improved health as a shared goal.³⁷ Physicians, regardless of experience level, were described in some of the 19 studies reviewed as providing mentorship (n = 1), role modelling (n = 2), and counseling (n = 3).

Only a few Rx programs were implemented in medically underserved areas (MUAs), or communities in which preventative care services are unavailable to low-income, vulnerable groups (eg, rural communities, non-English speaking minorities).³⁸ Physicians who treat medically underserved populations (MUPs) operate at a near-constant level of resource constraint, including unpredictable budgets and insufficient administrative personnel. These constraints may be exacerbated by an additional preventative program.

Local participating farmers. Recent evaluations indicate that financial incentives at FMs benefited local participating farmers, increasing revenue³⁹ and community engagement.⁴⁰ However, redemption rates tended to be greatest during the summer and

fall months. Furthermore, produce Rx programs represent an additional source of income beyond a local food producer's presence at FMs. These programs can may be unreliable from one season to the next, covering only a few weeks or months. While still in pilot phases, produce Rx programs might not recur, contributing to economic instability among local food producers.⁴¹

Some of the produce Rx programs in this review attempted to ameliorate the transportation barriers faced by patients with low income by providing an onsite FM (see table 1). However, the reduced transaction costs for patients may have the unintended consequence of increasing fixed costs for farmers. These costs include an increase in transport and storage costs that pose time constraints and restrict choice of market locations. Other produce Rx programs provide an incentive coupon for redemption at local FMs, ameliorating these cost issues.

Participating farmers are most impacted by the cost structure of the incentive—how it is funded, subsidized, or otherwise covered by program partners. In this review, some studies covered the cost of the incentive in the research budget. But the majority of studies did not report who bore the cost burden of the incentive. The farmers who are forced to internalize the cost of subsidized produce may be unable to participate in any incentive program.

Government assistance programs. As shown in table 2, most existing programs did not work with the assistance programs and systems in place for beneficiaries with low SES despite using SES as a primary eligibility criterion. Produce Rx programs that seek to enroll participants with low SES could make greater use of existing public assistance systems through which incentives could be disbursed, such as SNAP and Medicaid, thereby enlarging public data on the complex intersections between health care, food access, and income. However, administration of federal programs—including determination of participant eligibility, funding, and bureaucratic functions—varies between states and localities. Without substantial policy cohesion from federal to municipal levels, any produce Rx program is likely to be cost inefficient and disorganized, as well as subject to the politics of annual budget negotiations.

Most studies used the umbrella term “low-income” to identify participants (see table 3). As Rx programs grow, clinicians must become systematic in selecting participant eligibility criteria. One solution is using the federal government's systems for defining low-income by “who” and “where.” The designers of produce Rx programs could identify the overlap between geographic areas or communities defined by the US Department of Agriculture for SNAP and WIC (food deserts) and by the Department of Health and Human Services for Medicaid and Medicare (MUAs, MUPs). However, the complexities of government assistance implementation remain, and procedures must be enacted to modify varying state and local systems.

Conclusions

Compared to other diet-related preventative interventions, produce Rx programs are relatively young. The majority of studies identified in this article were private or small-scale pilots that enrolled a small sample of eligible patients. The author knows of no published studies based on randomized controlled trials that test the effects of varied Rx designs and program structures on outcomes. More research is necessary to evaluate the Rx prescription model with respect to a variety of independent variables, such as (1) standard medical measurements of diet-related health indicators, including body mass index, Hb1AC levels, and blood pressure and (2) evaluations of attitudinal and behavioral change, including whether there is a positive relationship between the dollar value of redeemed incentives and improvements in both nutrition outcomes and confidence in food preparation skills. Other variables to be tested include variations in eligibility criteria, prescription type (coupon, CSA, voucher) and dollar value, timeline of redemption, extent of nutrition education associated with the prescription, integration with federal assistance programs, use of electronic medical records to inform prescription type, and food retail location(s) accepting the prescription in place of a monetary exchange.

This review also found that no programs are yet linked to federal assistance program systems, including Medicaid, SNAP, and WIC. Policymakers should consider whether to replace the prescription with an EBT card or a more discreet incentive to ameliorate potential coupon stigma concerns. Further research must determine whether a prescription remains effective if it only provides guidance, instructions, recipes, or servings of seasonally available foods rather than serving the purpose of a financial exchange.

Cost appears to be a primary policy barrier to scaling up produce Rx programs nationwide. Results from this review indicated that other stakeholders or grants provided the funds to subsidize the FVs, but varying program design could leave local participating farmers at risk of bearing the cost burden. As produce Rx programs begin to grow in size and scope, researchers, clinicians, and other health care stakeholders should partner to design the incentive structure, acknowledging the critical role played by physicians, local participating farmers, and government assistance programs.

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Editor's Note

For further information about this study, please contact the author(s).

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