

# A novel dietary improvement strategy: examining the potential impact of community-supported agriculture membership

Angie Vasquez<sup>1,\*†</sup>, Nancy E Sherwood<sup>2</sup>, Nicole Larson<sup>3</sup> and Mary Story<sup>4</sup>

<sup>1</sup>Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN, USA: <sup>2</sup>HealthPartners Institute for Education and Research, Bloomington, MN, USA: <sup>3</sup>Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, Minneapolis, MN, USA: <sup>4</sup>Community and Family Medicine and Global Health, Duke University, Durham, NC, USA

Submitted 2 September 2015: Final revision received 25 November 2015: Accepted 9 December 2015: First published online 9 February 2016

## Abstract

*Objective:* To investigate the use of community-supported agriculture (CSA) as an employer-based health promotion intervention.

*Design:* Quasi-experimental study using a convenience sample of employees at three employers.

*Setting:* Participants and controls from three Minnesota employers completed baseline and follow-up health assessments and surveys about their experiences with CSA.

*Subjects:* A total of 324 participants purchased a CSA share and were eligible for study inclusion. Study participants were matched by age, sex, employer and occupation to a non-randomized control group of individuals who did not purchase a CSA share but completed health assessments during the same time frame as the study participants.

*Results:* The majority of participants were female, white, middle-aged and highly educated. The most common reason for purchasing a CSA share was a desire for fresh food, and the majority of participants were satisfied with their experience. Participants reported a significant increase in the number of vegetables present in the household and the frequency of family meals. The frequency of eating out decreased significantly, especially at fast-food restaurants. Participants also reported an increase in the amount and variety of produce consumed. However, health assessment data did not show significant changes in dietary intake, health status or BMI.

*Conclusions:* CSA participation was associated with improvement in some aspects of the household environment and dietary behaviours. Further research is needed to determine whether employer-based CSA interventions may also lead to improvements in dietary intake and health.

**Keywords**  
Dietary intake  
Health promotion  
Community-supported agriculture  
Household food environment  
Dietary intervention

The prevalence of chronic diseases is of major public health concern and places a burden upon society by increasing the rates of premature morbidity and mortality, decreasing productivity and increasing health-care costs. In the USA, half of all adults had one or more chronic disease and one in four adults had two or more chronic diseases as of 2012<sup>(1,2)</sup>. Recent estimates indicate that US health expenditures total \$US 2.7 trillion and account for 17.9% of the Gross Domestic Product<sup>(3)</sup>. An estimated 78% of these expenditures are attributed to chronic disease<sup>(4)</sup>. Left unchecked, health-care costs are projected to reach \$US 4.6 trillion and to comprise 19.9% of the Gross Domestic Product by 2022<sup>(5)</sup>.

Worksite health promotion programmes to improve employee health and curb health-care costs are growing in popularity in the USA<sup>(6)</sup>. President Obama's American Recovery and Reinvestment Act of 2009 dedicated \$US 650 million to support health promotion initiatives that target obesity, tobacco and other chronic disease risk factors<sup>(7)</sup>, and the Affordable Care Act of 2010 contains specific provisions to encourage employers to implement health promotion programmes<sup>(8)</sup>. Worksites provide an opportune setting for health promotion given that most adults spend more time at work than anywhere else<sup>(9)</sup>. Additionally, characteristics such as a shared purpose and culture, social and organizational support, and robust communication systems can help drive programme adoption and engagement. Worksite health promotion programmes have been demonstrated to positively

† Current address for correspondence: 4133 Drew Avenue South, Minneapolis, MN 55410, USA.

\*Correspondence address: Email vasquez.angie@gmail.com

influence health behaviours, biometric measures and financial outcomes<sup>(10)</sup>, but the effects of these programmes are often small to modest<sup>(11–13)</sup>. The current study builds upon the existing research by evaluating the effectiveness of a novel, worksite health promotion intervention designed to improve the dietary intake and health of employees using community-supported agriculture (CSA). Common health promotion interventions include weight-loss classes, frequent fitness programmes and farmers' markets, and CSA is a unique variant of such programmes. In addition to being one of the first studies to evaluate the use of CSA as an employer-based intervention, the present study fulfills a gap in the existing literature by evaluating the potential of a worksite health promotion intervention to improve the household food environment and dietary behaviours.

CSA is a form of direct marketing in which consumers and farmers engage in a mutually supportive relationship by sharing in the risks and benefits of food production<sup>(14–16)</sup>. Members purchase a share prior to the start of the growing season and, in return, they receive regular allotments of the farm's harvest throughout the season. The core product offerings are typically fresh vegetables and fruits<sup>(17)</sup> that are grown utilizing organic or biodynamic farming methods<sup>(15,16,18,19)</sup>. Offering CSA at the worksite is a potentially cost-effective and far-reaching approach to improving employees' access to a variety of fruits and vegetables. Unlike with farmers' markets, grocery stores and other food venues, where individuals can select only those foods with which they are familiar, CSA provides exposure to a variety of foods and typically provides preparation suggestions. The social cognitive theory of behavioural change provides a framework for understanding how CSA might influence dietary intake and health through changes to environmental, personal and behavioural related factors. Changes in the household food environment and meal patterns related to CSA participation have the potential to increase fruit and vegetable intake. Farm newsletters and the cookbook support self-efficacy for participants to use items in the CSA, and the community aspects of CSA reinforce positive dietary behaviour. The key objectives of the present study were to: (i) evaluate employee participants' overall CSA experience; (ii) determine whether healthful changes occur in participants' household food environment and dietary behaviours; and (iii) investigate the association of CSA participation with dietary intake and health outcomes.

## Methods

### *Study design and population*

The study was conducted by a Minnesota-based health system and included a convenience sample of health system employees and employees of two large government employers located in the Minneapolis/St. Paul metropolitan

area of Minnesota, USA. The two government employers were selected due to their large size and contractual relationship with the health system for their employees' health insurance. Participants were recruited using Intranet postings, newsletters and emails. Study eligibility criteria were purchase of a CSA share for the summer of 2009 (June–October), completion of a health assessment (HA) in the year prior to and following the CSA season, and completion of a baseline and follow-up CSA survey.

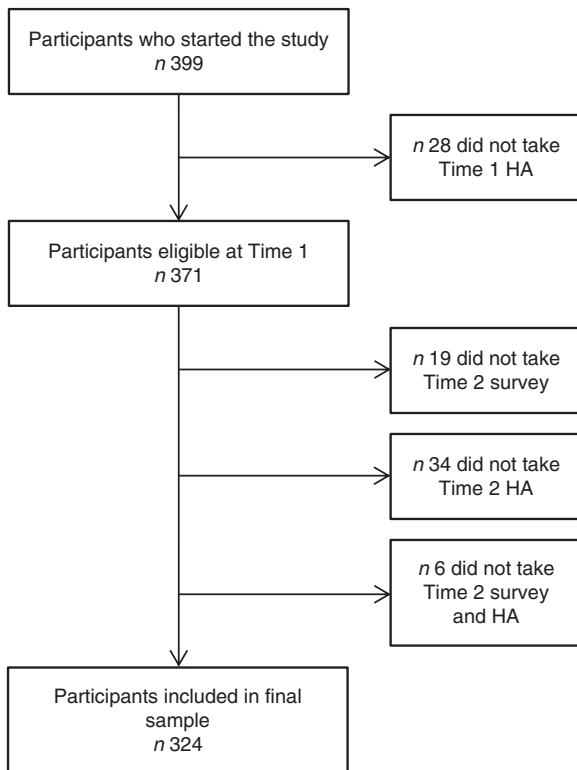
The HA and CSA surveys were administered online and all data were self-reported. The HA is administered annually as part of the employers' health insurance plan and is typically taken in late autumn or early winter depending on the employer's benefits enrolment schedule. It is used to identify individual- and population-level risks and its validity has been previously demonstrated in multiple studies<sup>(20–23)</sup>. Baseline and follow-up surveys assessed the CSA experience, the household food environment and dietary behaviours. Questions regarding the household food environment were developed using a modified version of the Household Food Inventory checklist, which was based on the previously validated Block Food Frequency Questionnaire<sup>(24–27)</sup>.

A total of 371 participants completed the baseline HA and CSA survey; forty-seven of these participants were lost to follow-up, resulting in 324 participants who completed all study inclusion requirements (Fig. 1). Study participants were matched by age, sex, employer and occupation level to a non-randomized control group of individuals who did not purchase a CSA share but completed HA during the same time frame as participants. For two of the employers, each participant ( $n$  188) was matched to three controls. The use of controls for the third employer site was not allowed due to contract specifications with the health plan regarding the use of HA data. Participants were matched to three controls to ensure that each participant had at least one control who completed the HA at baseline and follow-up. A total of sixty-one of the matched controls did not complete one or both HA, leaving 503 controls that were included in the study.

## Measures

### *Sociodemographic and household characteristics*

Participants and controls self-reported their age, race, ethnicity, occupation and educational level on the baseline HA. Occupation was assessed using the categories of administrative support, labour or production, professional/management, retired, sales, service, skilled craft, student, technician or other. Educational level was assessed by asking participants to select the highest level of education completed and responses were summarized using three categories (graduate studies, college degree, some college or less). Participants also reported the number of adults and children living in their household. Weight management status was assessed on the CSA survey using a question that



**Fig. 1** Flowchart describing participation in the community-supported agriculture (CSA) study. Time 1 and Time 2 surveys assessed CSA experience, household food environment and dietary behaviours (HA, health assessment)

asked participants whether they were trying to lose weight, maintain weight or gain weight.

#### *Community-supported agriculture experience*

The baseline CSA survey asked participants whether they had ever purchased a CSA share before and their reasons for participating in CSA from a list of fourteen options (e.g. improve health, support small farmers, family experience). The follow-up survey asked participants about their satisfaction with the CSA experience, what they liked about CSA, share utilization and their future plans. Participants ranked their satisfaction (e.g. produce quantity, quality, freshness, variety, convenience of the pick-up site) using a four-point Likert scale. Overall expectations were also assessed, and participants were asked whether they planned to purchase a CSA share next year.

#### *Household food environment and meal patterns*

The baseline and follow-up CSA surveys asked participants to indicate for thirteen different fruits whether they were present, present and visible, or not present – and similarly for twenty-one different vegetables whether they were present or not present – in their household. CSA farm information was reviewed to ensure that response options were reflective of items commonly received in CSA shares and an ‘other’ category was available for participants to indicate any produce items not listed. Participants reported

on household meal frequency (i.e. breakfast, lunch and dinner) during the past 7 d and responses were summarized to create a total household meal frequency score. Respondents were also asked how many times all or most of their household members planned meals together and the number of times fruits and vegetables were offered at a snack or meal. The total frequency of eating at fast-food, fast casual, casual, full-service and fine dining restaurants combined was evaluated, and fast-food restaurant eating was evaluated separately.

#### *Dietary intake and health outcomes*

The follow-up CSA survey asked participants about whether they thought the amount and variety of produce they consumed had increased, stayed the same or decreased due to CSA participation. The baseline and follow-up HA assessed daily produce servings by asking participants how many fruits and vegetables they consumed on a typical day, with response options ranging from 0 to 11 or more. Weekly produce variety was also assessed on the baseline and follow-up HA by asking participants to indicate the foods they had eaten at least once in the past 7 d from a subset of twelve food items that were selected from the previously validated Recommended Foods Score<sup>(28)</sup> based on their relevance to CSA participation. Health status and BMI were self-reported on the HA at baseline and follow-up.

#### *Statistical analyses*

Descriptive statistics were used to evaluate participants’ demographic characteristics, reasons for joining, satisfaction, future intentions and self-reported change in produce consumption and variety. Factor analysis was used to categorize the variables regarding the reasons participants joined CSA, satisfaction and aspects participants liked about their CSA experience due to the large number of potentially related response variables (Table 1). To determine whether CSA history and weekly share utilization were predictive of participants’ future plans for participation, multinomial logistic regression was used. The change in participants’ household food environment, meal patterns and restaurant frequency was evaluated using the paired-samples *t* test or the Wilcoxon signed-rank test. Multiple linear regression models were used to investigate the association between CSA participation and daily produce servings, weekly produce variety, BMI and health status when compared with matched controls. Multiple linear regression was also used to determine whether weekly CSA share utilization was predictive of participants’ change in daily produce servings from baseline to follow-up. Weekly share utilization, daily produce servings, total restaurant frequency and BMI variables were log-transformed due to a skewed distribution. Covariates were included in regression models as described in the Results section for each analysis and included age, sex, educational status, employer, CSA

**Table 1** Factors for reason for joining the CSA, satisfaction and aspects liked about the CSA experience among a convenience sample of employees at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

Factor/variable	<i>a</i>
Joined reason†	
Environment/agriculture	0.72
Concern for the environment	
Organic food	
Support small farmers	
Support sustainable agriculture	
Support local farmers	
Experience/health	0.60
Educational experience	
Family experience	
Improve health	
Improve eating habits	
Recipes	
Satisfaction	
Food	0.73
Quality	
Quantity	
Freshness	
Variety	
Cookbook	
Logistics	0.78
Pick-up site convenience	
Distribution time/day	
Window of time for pick-up	
Community/farm	0.81
Newsletter	
Farm community	
Farm communication	
Farm website	
Packaging	
Employer communication	
Aspects liked about CSA experience	
Food/health	0.72
Fresh food	
Healthy eating	
Exposure to new foods	
Organic food	
Supporting sustainable agriculture	
Experience	0.62
Convenience	
Camaraderie with co-workers	
Educational experience	
Farm activities	
Being connected to farm	
Newsletter	
Recipes	

CSA, community-supported agriculture.

†Fresh food variable excluded because all 324 participants selected this as a reason for joining CSA. Avoid shopping at grocery stores and like to eat in-season variables were excluded due to low eigenvalues.

share type, BMI, health status, readiness to change, reasons joined, satisfaction, daily produce servings, weekly produce variety, liked reasons, sugary food and drink consumption, overall expectations, restaurant frequency, household meal frequency, frequency of servings fruits, CSA price, and change in amount and variety of produce consumed. Inclusion of covariates was based results of bivariate analyses and conceptual relevance to each of the research questions. Analyses were conducted using the statistical software package SAS version 9.3 and a probability level of 0.05 was used to determine statistical significance.

## Results

### *Sociodemographic and household characteristics*

The results of the sociodemographic analysis are provided in Table 2 and showed that the majority of participants were female, white, middle-aged (mean = 44 years) and highly educated. Most participants also lived in households with two adults and children. Additionally, a slight majority of participants were overweight or obese. A slight majority of participants also reported that they were trying to lose weight (64.5%) at baseline, and 29.6% reported that they were trying to maintain their weight. Comparison of the 188 participants and 503 controls showed that there were no significant differences between groups for demographic variables with the exception of education; a greater proportion of participants (44.7%) held a graduate degree compared with controls (31.8%).

### *Community-supported agriculture experience*

Table 3 shows the reasons participants selected for joining a CSA, with the most common being fresh food and a desire to avoid shopping at grocery stores. The majority of participants indicated that the CSA experience met or exceeded their expectations, with produce freshness, quality and logistics receiving the highest satisfaction rankings. Although most participants were satisfied with all aspects of their CSA experience, fewer were satisfied with produce quantity and variety than with other aspects of the experience (Table 4). The aspects that participants liked most about their CSA experience included fresh food, healthy eating and supporting sustainable agriculture. In contrast, the family experience, camaraderie with co-workers and newsletter were the least frequently liked aspects of the CSA experience.

Most participants reported high weekly utilization of their CSA share with 59.6% of respondents using three-quarters or more and another 29.5% using half to three-quarters of the items received. When asked about their plans to purchase a CSA share again in the following year, 38.4% indicated that they planned to purchase a share from the same farm and 5.7% indicated that they planned to purchase a share from a different farm. Approximately one-third of respondents reported that they were unsure of their plans to purchase from the same or a different farm. The reasons participants gave for not planning to participate in CSA the following year are summarized in Table 5. A multinomial logistic regression model was used to understand future plans for CSA participation in the context of an employer-based intervention and to assess the potential for sustained health benefits (Table 6). The model predicted future plans from prior CSA experience and weekly CSA utilization and found that participants with previous CSA experience had a 7.7 greater odds of reporting that they planned to purchase a CSA share in the future than participants without previous CSA experience ( $\beta = 2.04$ , Wald = 10.28,  $P < 0.01$ ). Additionally, participants

**Table 2** Baseline demographic characteristics of the convenience sample of employees (*n* 324)† at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

	<i>n</i>	%
Sex		
Male	45	13.9
Female	279	86.1
Race		
American Indian or Alaska Native	3	0.9
Asian or Pacific Islander	8	2.5
Black or African American	2	0.6
White	299	92.3
Some other race	3	0.9
Choose not to answer	8	2.5
Unknown	1	0.3
Ethnicity		
Hispanic or Latino	7	2.2
Not Hispanic or Latino	297	91.7
Choose not to answer	20	6.2
Education		
8th grade or less	1	0.3
High school diploma or GED	6	1.9
Technical training or associate degree	20	6.2
Some college	32	9.9
College degree	125	38.6
Graduate studies	140	43.2
Occupation		
Professional/management	244	75.3
Administrative support	37	11.4
Sales	11	3.4
Technician	7	2.2
Service	7	2.2
Skilled craft	2	0.6
Labour or production	1	0.3
Other	15	4.6
No. of adults in household		
1	63	19.4
2	230	71.0
3	23	7.1
4	8	2.5
No. of children in household		
0	76	35.7
1	62	29.1
2	55	25.8
3	16	7.5
4	3	1.4
5	1	0.5
BMI category		
Underweight (<18.5kg/m <sup>2</sup> )	2	0.6
Normal weight (18.5–24.9 kg/m <sup>2</sup> )	147	45.4
Overweight (25.0–29.9 kg/m <sup>2</sup> )	101	31.2
Obese (≥30.0 kg/m <sup>2</sup> )	74	22.8

GED, General Educational Development.

†The sample size for different variables may vary from the total sample size due to missing responses.

who reported higher weekly CSA share utilization were more likely to report that they planned to purchase a CSA share in the future ( $\beta = -2.34$ , OR = 0.1, Wald = 10.80,  $P < 0.01$ ; higher scores equal lower utilization rates).

### Household food environment and meal patterns

Table 7 shows the results of changes in the household food environment, meal patterns and restaurant frequency reported by participants prior to and following participation in the worksite CSA programme. There was a significant decrease in the average number of fruits present in the

**Table 3** Reasons for joining the CSA among the convenience sample of employees (*n* 324)† at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

	<i>n</i>	%
Fresh food		
Yes	319	100.0
No	0	0.0
Dislike grocery store		
Yes	304	93.8
No	20	6.2
Educational experience		
Yes	261	80.6
No	63	19.4
Family experience		
Yes	226	69.8
No	98	30.3
Recipes		
Yes	219	67.6
No	105	32.4
Concern for the environment		
Yes	179	55.3
No	145	44.8
Improve health		
Yes	137	42.3
No	187	57.7
Organic food		
Yes	134	41.4
No	190	58.6
Support sustainable agriculture		
Yes	112	34.6
No	212	65.4
Desire to eat produce in season		
Yes	91	28.1
No	233	71.9
Improve eating habits		
Yes	85	26.2
No	239	73.8
Support small farmers		
Yes	81	25.0
No	243	75.0
Support local farmers		
Yes	50	15.4
No	274	84.6

CSA, community-supported agriculture.

†The sample size for different variables may vary from the total sample size due to missing responses.

household from baseline to follow-up, whereas the change in the number of fruits present and visible from baseline to follow-up was not significant. Participant reports of the number of vegetables present also showed a significant increase from baseline to follow-up. The frequency with which participants served fruits and vegetables at snacks or meals as well as the frequency of family meals increased from baseline to follow-up. Participants' frequency of eating at all restaurant types decreased from baseline to follow-up. Independent-samples *t* tests were also used to determine whether there were significant differences in results based on participants' weight management status at baseline, with the only difference being the frequency of serving vegetables at snacks or meals. Participants who were trying to lose weight at baseline reported a greater increase in the number of vegetables they served (mean = 0.62, SD = 1.21) than those who were not trying to lose weight (mean = 0.24, SD = 1.22,  $t(230) = 2.67$ ,  $P < 0.008$ ).

**Table 4** Satisfaction with the CSA among the convenience sample of employees (*n* 324)† at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

	<i>n</i>	%
Pick-up site		
Very satisfied	267	83.7
Satisfied	44	13.8
Unsatisfied	6	1.9
Not applicable	2	0.6
Quantity		
Very satisfied	153	48.0
Satisfied	103	32.3
Unsatisfied	49	15.4
Very unsatisfied	14	4.4
Quality		
Very satisfied	195	61.1
Satisfied	103	32.3
Unsatisfied	19	6.0
Very unsatisfied	2	0.6
Freshness		
Very satisfied	223	69.9
Satisfied	81	25.4
Unsatisfied	13	4.1
Very unsatisfied	2	0.6
Variety		
Very satisfied	104	32.6
Satisfied	146	45.8
Unsatisfied	62	19.4
Very unsatisfied	7	2.2
Distribution time of day		
Very satisfied	220	69.0
Satisfied	81	25.4
Unsatisfied	11	3.5
Very unsatisfied	5	1.6
Not applicable	2	0.6
Window of time for pick-up		
Very satisfied	225	70.5
Satisfied	75	23.5
Unsatisfied	15	4.7
Very unsatisfied	1	0.3
Not applicable	3	0.9
Quality of newsletter		
Very satisfied	176	55.2
Satisfied	98	30.7
Unsatisfied	24	7.5
Very unsatisfied	3	0.9
Not applicable	18	5.6
Farm community		
Very satisfied	90	28.2
Satisfied	90	28.2
Unsatisfied	14	4.4
Very unsatisfied	5	1.6
Not applicable	120	37.6
Farm communication		
Very satisfied	110	34.5
Satisfied	98	30.7
Unsatisfied	14	4.4
Very unsatisfied	3	0.9
Not applicable	94	29.5
Quality of farm website		
Very satisfied	111	34.8
Satisfied	109	34.2
Unsatisfied	17	5.3
Very unsatisfied	6	1.9
Not applicable	76	23.8
Packaging of produce		
Very satisfied	152	47.7
Satisfied	137	43.0
Unsatisfied	21	6.6
Very unsatisfied	3	0.9
Not applicable	6	1.9

**Table 4** Continued

	<i>n</i>	%
Employer communications		
Very satisfied	126	39.5
Satisfied	129	40.4
Unsatisfied	17	5.3
Not applicable	47	14.7
Cookbook		
Very satisfied	172	53.9
Satisfied	120	37.6
Unsatisfied	12	3.8
Very unsatisfied	6	1.9
Not applicable	9	2.8
Price		
Too high	88	27.7
About right	228	71.7
Too low	2	0.6
Overall expectations		
CSA experience exceeded my expectations	100	31.5
CSA experience matched my expectations	142	44.7
CSA experience fell short of my expectations	67	21.1
I had no expectations	9	2.8

CSA, community-supported agriculture.

†The sample size for different variables may vary from the total sample size due to missing responses.

### Dietary intake and health outcomes

The majority of participants reported the amount (71.5%) and variety (87.5%) of the produce they consumed increased as a result of CSA participation and there was no significant difference in results based on participants' weight management status at baseline. However, daily produce servings as reported on the HA did not show CSA participation to be predictive of the change in dietary intake in models that included matched controls ( $F(9, 681) = 0.77, P = 0.643, R^2 = -0.003$ ). Similarly, CSA participation was not found to be predictive of the change in weekly produce variety ( $F(9, 674) = 1.63, P = 0.10, R^2 = 0.008$ ). Models used for these analyses controlled for age, sex, educational status, and sugary food and drink consumption. CSA participation was also not predictive of BMI change ( $F(9, 674) = 0.64, P = 0.76, R^2 = -0.005$ ) or perceived health status ( $F(9, 674) = 1.75, P = 0.08, R^2 = 0.010$ ). Covariates in these models included age, sex, educational status, daily produce servings, weekly produce variety, health status, BMI, and sugary food and drink consumption. Weekly CSA share utilization was not predictive of the change in daily produce servings ( $F(9, 205) = 0.85, P = 0.57, R^2 = 0.040$ ). This model controlled for BMI, weekly produce variety, readiness to change, the household presence of vegetables, frequency of serving fruits, household meal frequency, restaurant frequency and consumption of sugary foods and beverages.

### Discussion

The current study evaluated the effectiveness of using CSA as an employer-based health promotion intervention.

**Table 5** Reasons for not purchasing a CSA share in the future among the convenience sample of employees (*n* 324) at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

	<i>n</i>	%
Prefer farmers' market		
Yes	120	37.0
No	204	63.0
Not worth cost		
Yes	68	21.0
No	256	79.0
Prefer grocery store		
Yes	61	18.8
No	263	81.2
Too little variety		
Yes	50	15.4
No	274	84.6
Too much produce		
Yes	44	13.6
No	280	86.4
Planning on growing own produce		
Yes	41	12.7
No	283	87.4
Too little produce		
Yes	37	11.4
No	287	88.6
Personal financial situation		
Yes	27	8.3
No	297	91.7
Dissatisfied with quality		
Yes	25	7.7
No	299	92.3
Household issues		
Yes	19	5.9
No	305	94.1
Inconvenient pick-up		
Yes	16	4.9
No	308	95.1

CSA, community-supported agriculture.

Participants had similar demographic characteristics to CSA members in previous studies. A desire for fresh food was the most common reason for purchasing a CSA share, and the majority of participants were satisfied with their experience. Participants also reported a significant increase in the number of vegetables present in the household and family meals, whereas the frequency of eating at restaurants decreased. There were no significant changes in dietary intake and health status compared with controls. The results showed that CSA is a valuable tool for improving the household food environment and dietary behaviours, but further research is needed to determine whether these changes can lead to improvements in dietary intake and health outcomes.

It was hypothesized that an employer-based CSA intervention might expand the reach of CSA to involve more demographically diverse participants, but the results were generally not supportive. Consistent with previous research<sup>(14,16,17,19,29–38)</sup>, the demographic profile of CSA participants was relatively homogeneous. One notable exception is that participants in the present study reported slightly lower education levels than those in previous studies. For example, a study by MacMillan *et al.* found that 88.5% of participants completed a bachelor's or graduate degree in comparison to 71.5% of members in the present study<sup>(35)</sup>. Although this is a small difference from previous studies, these results lend some support to the idea that an employer-based intervention might expand the reach of CSA to a broader demographic. Replication of the intervention in different regions and industries might also attract a more diverse population of

**Table 6** Multinomial logistic regression predicting future farm intentions from CSA utilization and history† among the convenience sample of employees at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

	Unsure		Yes	
	OR	95% CI	OR	95% CI
CSA utilization	0.93	0.36, 2.44	0.10**	0.02, 0.39
CSA history	1.60	0.52, 4.66	7.70**	2.21, 26.82
CSA matched expectations	1.22	0.52, 2.89	1.43	0.36, 5.63
CSA exceeded expectations	1.78	0.49, 6.39	13.93**	2.63, 73.83
CSA price	0.79	0.37, 1.68	4.23*	1.22, 14.71
CSA share type (whole share <i>v.</i> less than half share)	1.64	0.58, 4.61	1.47	0.38, 5.75
CSA share type (half share <i>v.</i> less than half share)	2.06	0.95, 4.47	2.00	0.70, 5.63
Employer (employer 1 <i>v.</i> employer 3)	1.18	0.44, 3.13	2.60	0.74, 9.17
Employer (employer 2 <i>v.</i> employer 3)	3.90***	1.76, 8.66	7.10***	2.55, 19.81
Change in amount of produce consumed	1.06	0.52, 2.18	2.22	0.78, 6.38
Change in variety of produce consumed	1.65	0.64, 4.24	5.77*	1.17, 28.41
Education (college degree <i>v.</i> some college or less)	0.69	0.30, 1.57	0.92	0.28, 3.03
Education (graduate studies <i>v.</i> some college or less)	1.65	0.69, 3.93	3.45	0.98, 12.16
Join reason – environment or agricultural	1.13	0.90, 1.42	1.01	0.75, 1.37
Join reason – experience or health	1.02	0.80, 1.29	0.87*	0.63, 1.20
Liked reason – food or health	1.28	0.93, 1.77	1.47	0.88, 2.43
Liked reason – experience	0.97	0.78, 1.20	1.39*	1.06, 1.83
Satisfaction – food	1.30**	1.08, 1.55	1.45**	1.13, 1.87
Satisfaction – logistics	1.12	0.89, 1.40	0.94	0.68, 1.30
Satisfaction – community and farm	0.95	0.88, 1.02	0.92	0.83, 1.01

CSA, community-supported agriculture.

\**P* < 0.05, \*\**P* < 0.01, \*\*\**P* < 0.001.

† $\chi^2(40) = 236.04$ , *P* < 0.001, *R*<sup>2</sup> = 0.526.

**Table 7** Household food environment† before and after the employer-based CSA health promotion intervention among the convenience sample of employees (*n* 324) at three employers in the Minneapolis/St. Paul metropolitan area of Minnesota, USA

	Baseline			Follow-up			<i>t</i>	<i>P</i>
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD		
No. of fruits present in household	324	3.58	2.12	318	3.08	2.23	3.69	<0.01
No. of fruits present and visible in household	324	2.38	1.88	318	2.38	2.02	0.11	0.91
No. of fruits present or present and visible in household	324	8.34	3.26	318	8.79	3.69	2.36	0.02
No. of vegetables present in household	324	11.52	3.30	318	12.52	3.41	6.29	<0.01
Frequency fruits typically served at snacks or meals	324	4.91	1.38	318	5.20	1.40	3.67	<0.01
Frequency vegetables typically served at snacks or meals	324	5.26	1.20	318	5.75	1.25	7.04	<0.01
Frequency of household meals in past 7 d‡	277	8.54	3.87	274	8.98	4.25	2.07	0.04
Frequency of household planning meals in past 7 d§	277	2.39	1.96	272	2.50	2.15	414.5	0.37
Frequency of eating at all restaurant types in past 7 d	324	2.65	1.83	318	2.21	1.82	-3248.0	<0.01
Frequency of eating at fast-food restaurants in past 7 d	324	1.56	0.75	318	1.37	0.63	-1503.5	<0.01

CSA, community-supported agriculture.

†Paired-samples *t* tests were used in all analyses with the exception of the frequency of household members planning meals together, restaurant eating and fast-food restaurant eating, for which the Wilcoxon signed-rank test was used. In these latter analyses, the signed-rank test statistic is illustrated.

‡Household meal frequency includes the number of times all or most of the participants' household members ate breakfast, lunch or dinner together.

§Household planning meals includes the number of times all or most of the participants' household members planned meals together.

participants. This is important in that expanding the reach of CSA might help target populations who are at high risk for chronic disease such as minorities or individuals of lower socio-economic status. One possible explanation for the lack of diversity among CSA members is the pre-payment of membership fees that is typically required, which might preclude individuals of lower socio-economic status from participation. A small number of interventions provided financial support for CSA participation to low-income and underserved households and found that participants experienced many of the same benefits as those reported in other studies<sup>(33,39)</sup>.

Participants' motivations for joining CSA were similar to those of members in previous studies with a few notable exceptions<sup>(17,19,29,31-33,37,40-44)</sup>. The majority of CSA members in previous studies reported a desire to support local farmers as a reason for joining CSA<sup>(16,31,37)</sup> whereas this was not a frequently cited reason for joining in the present study. For example, almost all CSA members (94.8%) in a study by Landis *et al.* selected support for local farms as a reason for joining<sup>(31)</sup>, and another study by Cooley and Lass found that 97% of participants cited support for local farming as a reason for joining<sup>(45)</sup>. Employee participants' focus on the health-related aspects of CSA might be explained by the fact that the CSA programme was part of their employers' wellness programmes. As such, employers' marketing of the CSA programme might have focused on the health benefits of CSA rather than on the environmental and community benefits.

As expected, participants were very satisfied overall, but opportunities were identified for improving certain aspects of the CSA experience. Satisfaction related to logistics was even higher than in previous research, which is not surprising given that CSA shares were delivered to employees' worksites. One of the most common reasons study participants cited for joining a CSA – fresh food – was

also one of the aspects they liked most about the CSA experience. In contrast, the family and educational experience were less frequently indicated as aspects of the CSA experience that participants liked despite being among the most common reasons for joining CSA.

Less than half of the study participants planned to renew their CSA membership the following year despite high levels of satisfaction with their experience. Another third of the participants reported that they were unsure of their plans for the following year. These renewal rates are somewhat less than reported in previous studies<sup>(16,34,37)</sup>. However, not all previous studies included 'unsure' as a response category, making direct comparison of results difficult<sup>(16,34,37)</sup>. The one study that included 'unsure' as a response category reported that 60% of respondents had plans to renew, but only 18% were unsure, so the actual discrepancy in renewal rates might be less than reported depending on what unsure members decide. The lower renewal rates in the present study might partially be explained by the fact that the majority of participants were first-time CSA members and previous research has shown that first-time members are less likely to renew their membership than those with previous CSA experience<sup>(16,19,37)</sup>. Not surprisingly, participants who utilized more of the food received in their CSA share were more likely to report plans to renew their membership. Participants who reported an increase in the variety of produce they consumed during the CSA season were also more likely to report plans to renew their membership. This is promising in that one of the key objectives of the present intervention was to increase the variety of produce consumption. It suggests that an employer-based CSA intervention could help support sustained rather than just short-term changes in dietary intake given that those employees who reported an increase in produce variety were also more likely to continue CSA participation in the future.



As expected, there was a significant increase in the amount and variety of vegetables present in the household. It was also expected that the number of fruits present and present and visible would increase given that CSA shares are comprised primarily of produce, but this was not the case. This is likely due to the fact that the geographic region of the study is unsuitable for growing many varieties of fruit crops (e.g. citrus, stone fruits). Of the thirty-one different summer crops grown by the most frequently used farm in the present study, only four of the crops were fruit. It is possible that participants relied primarily on the CSA for their household produce rather than supplementing with other produce items, which could provide some explanation for the fact that fruits present and present and visible did not increase from baseline to follow-up. Also, the increase in the number of vegetables present in the household might have displaced fruits that participants typically keep in the house. Seasonality and the availability of specific produce items might also have been a factor.

The present results showed, as hypothesized, that CSA participation was associated with an improvement in meal patterns and that it also has the potential to improve the dietary patterns of household members. The fact that CSA participants increased the frequency of household meals is important given that previous research has demonstrated an association between family meals and healthy dietary behaviours<sup>(46)</sup>. The frequency of serving fruits and vegetables at snacks or meals also increased despite the decrease in the presence of household fruits. Perhaps CSA participation resulted in a greater focus on incorporating produce into the diet and, as such, fruits were served more often despite the fact that there was not a significant increase in their household availability. The reduction in participants' frequency of eating at all types of restaurant and fast-food restaurants specifically also supports the hypothesis that CSA participation has the potential to improve dietary intake given that restaurant eating has been associated with higher energy intake, higher fat intake and increased body weight<sup>(47–50)</sup>. These results are consistent with anecdotal reports from CSA members in previous studies regarding restaurant eating<sup>(34,37)</sup>.

As hypothesized, study participants' responses to the follow-up CSA survey questions regarding dietary intake indicated that they felt they had increased the amount and variety of produce consumed as a result of CSA participation, which is consistent with previous research<sup>(16,35,37)</sup>. Surprisingly, CSA participation was not associated with an increase in participants' daily produce servings or weekly produce variety as reported in response to the HA survey. One possible explanation for this is that there was a significant time delay between completion of the CSA season and administration of the HA survey. The questions that assessed weekly produce variety were also limited to a select number of produce items and did not include an

'other' category, potentially affecting the accuracy of results. BMI and health status were also measured via the HA and the delayed administration of the HA might explain the lack of significant change in these variables from baseline to follow-up. Additionally, if there were healthy changes in dietary intake associated with CSA participation, these changes might not have been large enough or sustained for a long enough time period to affect BMI and health status.

The current study builds upon previous research by being the first to evaluate the use of CSA as an employer-based health promotion intervention. Previous research has not evaluated associations between CSA participation and meal patterns, the household food environment, dietary intake and health outcomes by quantitatively measuring these variables at baseline and follow-up. The current study also builds upon the existing literature by examining demographic factors and the CSA experience in the context of an employer-based intervention. Limitations of the study include the fact that it was not a randomized trial. Funding limitations also precluded the intervention from being tested in other geographic areas and limited the number of employers that could be included. As such, some findings may not be generalizable to other regions or industries. Additionally, participants were not provided any support or financial incentive for purchasing a CSA share, which could have precluded some socio-economic groups from participating. Participants' knowledge regarding food preparation and cooking practices might have had an effect on dietary change and health outcomes. Farm newsletters and recipes were provided to help participants increase their knowledge, but self-efficacy was not directly assessed in the study. The delay in HA administration and design of questions regarding weekly dietary variety are also important limitations. Lastly, the self-report nature of the HA and surveys might have impacted the accuracy of results. A systematic review of the literature conducted by Gorber *et al.* comparing direct with self-reported measures found that BMI is commonly under-reported<sup>(51)</sup>.

## Conclusion

The present study provides support for the use of CSA as an employer health promotion intervention and provides a foundation for future research in this area. The findings showed that CSA participation is associated with improvements in the household food environment, frequency that produce is served at snacks and meals, frequency of household meals and frequency of restaurant eating. Results regarding the association between CSA participation and dietary intake and health were less definitive. Although participants indicated that they felt the amount and variety of produce they consumed had increased as a result of CSA participation, comparisons

with matched controls did not yield significant findings. Opportunities for future research include interventions in different regions and industries, improvements in data collection methods, interventions that investigate the use of financial incentives to offset the cost of CSA shares, and interventions that explore complementary support (e.g. education, family activities) to enhance the benefits of CSA participation. Studies that further explore the association between CSA share utilization and outcomes such as the change in household food environment, meal patterns, dietary intake and health outcomes would also be useful. Additionally, studies that directly measure anthropometric and other clinical measures (e.g. BMI, blood pressure, cholesterol) would be helpful in understanding the potential of CSA to improve health outcomes.

### Acknowledgements

*Acknowledgements:* Data for this research were from the Local Food/Local Health Renewed study, which was conducted by the HealthPartners Institute for Education and Research in collaboration with the State of Minnesota and Hennepin County. Support was provided by study team members Dr Marcus Thygeson, Scott Aebischer and Dawn Barker from HealthPartners; Paul Hungunin from the Minnesota Grown Program; and Linda Feltes from Minnesota Management and Budget. Dr Rich MacLehose provided statistical support and Dr Jamie Stang provided input regarding study findings and interpretation. *Financial support:* This work was supported by the HealthPartners Research Foundation Partnership Grant (grant number 08–092). In-kind support was provided by Minnesota Management and Budget (MMB) and the Minnesota Department of Agriculture (MDA). The HealthPartners Research Foundation, MMB and MDA had no role in the design, analysis or writing of this article. *Conflict of interest:* None. *Authorship:* A.V. drafted the manuscript and conducted the statistical analysis. N.E.S. was the principal investigator and formulated the research questions. All authors contributed to the interpretation of results and manuscript reviews. *Ethics of human subject participation:* This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the HealthPartners Institutional Review Board. Written informed consent was obtained from all participants.

### References

- Centers for Disease Control and Prevention (n.d.) Chronic disease and health promotion. <http://www.cdc.gov/chronic-disease/overview/index.htm> (accessed November 2012).
- Ward BW, Schiller JS & Goodman RA (2014) Multiple chronic conditions among US adults: a 2012 update. *Prev Chronic Dis* **11**, E62.
- Centers for Medicare & Medicaid Services (2012) National health expenditure data. <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html> (accessed April 2012).
- Anderson G (2004) Chronic conditions: making the case for ongoing care. <http://www.partnershipforsolutions.org/DMS/files/chronicbook2004.pdf> (accessed January 2013).
- Centers for Medicare & Medicaid Services (2010) National health expenditure projections 2010–2020. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/proj2010.pdf> (accessed November 2012).
- Buck Consultants (2009) Working well: a global survey of health promotion and workplace wellness strategies. <https://www.worldatwork.org/waw/adimLink?id=363092009> (accessed November 2012).
- New York Times* (2009) Obama's speech on health care reform. <http://www.nytimes.com/2009/06/15/health/policy/15obama.text.html?pagewanted=all> (accessed November 2012).
- Goetzel RZ, Pei X, Tabrizi MJ *et al.* (2012) Ten modifiable health risk factors are linked to more than one-fifth of employer-employee health care spending. *Health Aff (Millwood)* **31**, 2474–2484.
- Person AL, Colby SE, Bulova JA *et al.* (2010) Barriers to participation in a worksite wellness program. *Nutr Res Pract* **4**, 149–154.
- Goetzel RZ & Pronk NP (2010) Worksite health promotion – how much do we really know about what works? *Am J Prev Med* **38**, 2 Suppl., S223–S225.
- Soler R, Leeks K, Razi S *et al.* (2010) A systematic review of selected interventions for worksite health promotion. The assessment of health risks with feedback. *Am J Prev Med* **38**, 2 Suppl., S237–S262.
- Mhurchu CN, Aston L & Jebb S (2010) Effects of worksite health promotion interventions on employee diets: a systematic review. *BMC Public Health* **10**, 62.
- Sorensen G, Linnan L & Hunt MK (2004) Worksite-based research and initiatives to increase fruit and vegetable consumption. *Prev Med* **39**, 94–100.
- Kolodinsky J & Pelch L (1997) Factors influencing the decision to join a community supported agriculture (CSA) farm. *J Sustain Agric* **10**, 129–141.
- DeMuth S (2008) 1993 Community supported agriculture (CSA): an annotated bibliography and resource guide. <http://www.nal.usda.gov/afsic/pubs/csa/at93-02.shtml> (accessed March 2012).
- Oberholtzer L (2004) Community supported agriculture in the mid-Atlantic region: results of a shareholder survey and farmer interviews. [http://www.smallfarmsuccess.info/CSA\\_Report.pdf](http://www.smallfarmsuccess.info/CSA_Report.pdf) (accessed January 2011).
- Cone CA & Kakaliouras A (1995) Community supported agriculture: building moral community or an alternative consumer choice. *Cult Agric* **15**, 28–31.
- Lass D, Stevenson GW, Hendrickson J *et al.* (2003) CSA across the nation: findings from the 1999 CSA survey. <http://www.cias.wisc.edu/wp-content/uploads/2008/07/csacross.pdf> (accessed January 2011).
- Cone CA & Myhre A (2000) Community-supported agriculture; a sustainable alternative to industrial agriculture? *Hum Organ* **59**, 187–197.
- Pronk N, Lowry M, Maciosek M *et al.* (2011) The association between health assessment-derived summary health scores and health care costs. *J Occup Environ Med* **53**, 872–878.
- Pronk N, Katz A, Gallagher J *et al.* (2011) Adherence to optimal lifestyle behaviors is related to emotional health indicators among employees. *Popul Health Manag* **14**, 59–67.
- Pronk N, Lowry M, Kottke T *et al.* (2010) The association between optimal lifestyle adherence and short-term

- incidence of chronic conditions among employees. *Popul Health Manag* **13**, 289–295.
23. Pronk NP, Tan AW & O'Connor P (1999) Obesity, fitness, willingness to communicate and health care costs. *Med Sci Sports Exerc* **31**, 1535–1543.
  24. Cade J, Thompson R, Burley V *et al.* (2002) Development, validation and utilisation of food-frequency questionnaires – a review. *Public Health Nutr* **5**, 567–587.
  25. Subar AF, Thompson FE, Kipnis V *et al.* (2001) Comparative validation of the Block, Willett, and National Cancer Institute food frequency questionnaires: the Eating at America's Table study. *Am J Epidemiol* **154**, 1089–1099.
  26. Block G, Thompson FE, Hartman AM *et al.* (1992) Comparison of two dietary questionnaires validated against multiple dietary records collected during a 1-year period. *J Am Diet Assoc* **92**, 686–693.
  27. Block G, Hartman AM & Naughton D (1990) A reduced dietary questionnaire: development and validation. *Epidemiology* **1**, 58–64.
  28. Kant AK (2000) A prospective study of diet quality and mortality in women. *JAMA* **283**, 2109–2115.
  29. Goland C (2002) Community supported agriculture, food consumption patterns, and member commitment. *Cult Agric* **24**, 14–25.
  30. Schnell SM (2007) Food with a farmer's face: community supported agriculture in the United States. *Geogr Rev* **97**, 550–564.
  31. Landis B, Smith TE, Lairson M *et al.* (2010) Community-supported agriculture in the Research Triangle region of North Carolina: demographics and effects of membership on household food supply and diet. *J Hunger Environ Nutr* **5**, 70–84.
  32. Brehm JM (2008) Motivations for participating in community-supported agriculture and their relationship with community attachment and social capital. *Southern Rural Sociol* **23**, 94–115.
  33. Andreatta S, Rhyne M & Dery N (2008) Lessons learned from advocating CSAs for low-income and food insecure households. *Southern Rural Sociol* **23**, 116–148.
  34. Russell WS (2008) The adaptive consumer: shifting attitudes, behavior change and CSA membership renewal. *Renew Agric Food Syst* **23**, 136–148.
  35. MacMillan Uribe AL, Winham DM & Wharton CM (2012) Community supported agriculture membership in Arizona: an exploratory study of food and sustainability behaviours. *Appetite* **59**, 431–436.
  36. Lang KB (2005) Expanding our understanding of community supported agriculture (CSA): an examination of member satisfaction. *J Sustain Agric* **26**, 61–79.
  37. Perez J, Allen P & Brown M (2003) Community supported agriculture on the central coast: the CSA member experience. <http://escholarship.org/uc/item/5wh3z9jg> (accessed January 2011).
  38. Jekanowski MD (2000) Consumers' willingness to purchase locally produced agricultural products: an analysis of an Indiana survey. *Agric Resour Econ Rev* **29**, 43–53.
  39. Quandt SA, Dupuis J, Fish C *et al.* (2013) Feasibility of using a community-supported agriculture program to improve fruit and vegetable inventories and consumption in an under-resourced urban community. *Prev Chronic Dis* **10**, E136.
  40. O'Hara S & Stagl S (2001) Global food markets and their local alternatives: a socio-ecological economic perspective. *Popul Environ* **22**, 533–554.
  41. Conner DS (2003) Community supported agriculture pricing and promotion strategies: lessons from two Ithaca, NY area farms. [http://dyson.comell.edu/outreach/extensionpdf/2003/Cornell\\_AEM\\_eb0307.pdf](http://dyson.comell.edu/outreach/extensionpdf/2003/Cornell_AEM_eb0307.pdf) (accessed January 2012).
  42. Bougherara D (2009) Buy local, pollute less: what drives households to join a community supported farm? *Ecol Econ* **68**, 1488–1495.
  43. McFadden S (2012) Community farms in the 21st century: poised for another wave of growth? <http://newfarm.rodaleinstitute.org/features/0104/csa-history/part1.shtml> (accessed February 2012).
  44. Farnsworth RL, Thompson S, Drury K *et al.* (1996) Community supported agriculture: filling a niche market. *J Food Distrib Res* **27**, 90–98.
  45. Cooley J & Lass D (1998) Consumer benefits from community supported agriculture membership. *Rev Agric Econ* **20**, 227–237.
  46. Fulkerson JA, Larson N & Horning M (2014) A review of associations between family or shared meal frequency and dietary and weight status outcomes across the lifespan. *J Nutr Educ Behav* **46**, 2–19.
  47. Kant AK & Graubard BI (2004) Eating out in America, 1987–2000: trends and nutritional correlates. *Prev Med* **38**, 243–249.
  48. McCrory MA, Fuss PJ, Hays NP *et al.* (1999) Overeating in America: association between restaurant food consumption and body fatness in healthy adult men and women ages 19 to 80. *Obes Res* **7**, 564–571.
  49. French SA, Harnack L & Jeffery RW (2000) Fast food restaurant use among women in the Pound of Prevention study: dietary, behavioral and demographic correlates. *Int J Obes Relat Metab Disord* **24**, 1353–1359.
  50. Lachat C, Nago E & Verstraeten R (2012) Eating out of home and its association with dietary intake: a systematic review of the evidence. *Obes Rev* **13**, 329–346.
  51. Gorber SC, Tremblay M, Moher D *et al.* (2007) A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review. *Obes Rev* **8**, 307–326.