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Do Community Supported Agriculture programmes encourage change to food lifestyle behaviours and health outcomes? New evidence from shareholders

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Community Supported Agriculture (CSA) programmes have recently received attention for their potential to influence food lifestyle behaviours and health outcomes, though studies have mostly drawn from small samples ($n < 25$). Therefore, we designed a survey to test whether CSA participation links to changes in food lifestyle behaviours and health outcomes, and assess if the magnitude of changes varies based on respondent characteristics. A detailed survey was distributed to existing shareholders from three midsized CSAs near Lexington, Kentucky, and produced 151 usable responses. Through 20 paired questions, respondents reported on their food lifestyle behaviours and health outcomes both prior to joining a CSA and then after CSA participation. Paired two-sided *t*-tests assess if paired means are statistically different, and multiple regressions of paired differences on socioeconomic factors, self-reported health, and years of CSA enrolment estimate the effect of respondent characteristics on behaviour change. The results strongly suggest that CSAs have the potential to positively impact shareholders' food lifestyle behaviours and health outcomes, and that those reporting 'poor health' prior to CSA enrolment exhibited the most change overall. These results should be taken as an initial, yet promising, analysis of the impact of CSA participation on shareholder food lifestyle behaviours and health outcomes.

Keywords: Community Supported Agriculture; behaviour change; food lifestyle behaviours; health outcomes

Introduction

Community Supported Agriculture (CSA) programmes have attracted interest from diverse audiences. In a CSA arrangement, consumers directly enter into risk-sharing relationships with producers. In return for an up-front payment prior to the growing season, consumers become shareholders in the production process and receive a regular delivery of that farm's products. Many researchers, local food system advocates, and policy-makers find CSAs compelling because this economic arrangement reshapes social relationships between producers and consumers and has place-specific impacts on environments, economies, and social organization. While CSAs' impacts are subject to many local factors, many academics have detailed the numerous benefits of this direct-to-consumer (DTC) model of production and distribution. For instance, some researchers note that producers may receive higher than wholesale returns for their products (Harmon, 2014; Sabih & Baker, 2000) though this is not guaranteed (Galt, 2013; Ostrom, 2007). Others emphasize the capacity of CSAs to challenge global-scale industrial food models by shortening supply chains, thereby allowing more capital to flow through and remain in the local economy in a variety of related

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industries (Brown & Miller, 2008). Some emphasize the potential of CSAs' flexible delivery attributes and associated incentive programmes to alleviate food deserts in low income communities (Quandt, Dupuis, Fish, & D'Agostino, 2013; Wilkins, Farrell, & Rangarajan, 2015), even as CSAs are generally a middle- to upper-income consumer trend (Goland, 2002; Ostrom, 2007).

Despite researchers' emphasis on economic, social, and environmental benefits of CSAs, research on the potential impacts of CSAs on food lifestyle behaviours and health outcomes has only recently emerged. This research is motivated by reports of steady declines in annual per capita intake of vegetables, fruit, and fruit juices over the last 10 years in Canada and the US (Clary, Ramos, Shareck, & Kestens, 2015; Produce for Better Health Foundation, 2015). A few researchers, motivated by national studies examining determinants of fruit and vegetable intake, have attempted to quantify vegetable consumption changes before and after participation in a CSA or farmers' markets. Participants in farmers' markets, community gardens, and other direct interactions with producers and farm production have led to increased long-term vegetable consumption (Freedman, Choi, Hurley, Anadu, & Hébert, 2013; McCormack, Laska, Larson, & Story, 2010; Quandt et al., 2013). Specific to CSAs, Cohen, Gearhart, and Garland (2012) found that surveyed CSA shareholders in New York City increased fruit and vegetable consumption by 2.2 servings per week. Wilkins et al. (2015) also noted an increase in consumption of specific vegetable categories and varieties by CSA shareholders in rural New York. In this literature, the links between CSAs and health focus on vegetable consumption as a proxy measure of improved health outcomes.

Some of these studies also evaluate the effect of financial incentives and novel social policies on consumers' purchasing and eating behaviours when involved in direct relationships with producers (Freedman et al., 2013; McCormack et al., 2010; Quandt et al., 2013). Specific to CSAs, Russell and Zepeda (2008) found that involvement in a CSA led to behavioural changes related to food preparation, vegetable purchasing, and consuming seasonally appropriate items in a medium-sized CSA in Wisconsin. Yet, Goland (2002) found that only a portion of a small experimental CSA group in central Ohio articulated a preference for changing their food preparation and consumption patterns. However, both studies only considered one CSA with a rather limited sample size ($n < 25$). Without conducting a more rigorous quantitative analysis, one might argue that the observed post-CSA consumer behaviour may not be generalizable.

Our research design addresses this analytic question by developing a detailed survey that considers the combined experiences of 151 CSA shareholders from three separate CSAs. As the CSA model offers a unique bundle of incentives, we hypothesize that (1) the CSA distribution model is linked to positive changes to food lifestyle behaviours and health outcomes, (2) the magnitude of these changes will vary based on individual and household characteristics, and (3) these benefits are stronger in a subscription-based CSA model compared to other DTC arrangements. Our goal in this paper is to test the first two hypotheses by comparing lifestyle changes associated with CSA membership. We identify perceived changes between pre- and post-CSA participation in food consumption, purchasing, preparation, and health-related behaviours, which we are collectively calling food lifestyle behaviours. The results indicate that shareholders report significant behaviour changes along with some positive health indicators in response to their participation in CSAs. These changes include, but are not limited to, significant daily increases in vegetable consumption, fewer meals consumed away from home, and less intake of processed foods. We also analyse for whom these changes were most significant and discuss where shareholders observe the strongest changes in their food lifestyle behaviour and health outcomes.

Literature review

The literature suggests that there are many categories of food lifestyle behaviours that we hypothesize lead to better health outcomes and may be influenced by CSA participation. Looking to the

public health and nutrition literature, we identified three key categories of food lifestyle behaviours that are associated with positive health outcomes and that we hypothesize are influenced by CSA participation: (1) consumption of fruits and vegetables versus processed food, (2) food prepared at home versus prepared away from home, and (3) food-purchasing behaviours and decision-making. This literature informs the selection of paired behavioural questions in the survey instrument.

The first category is an increase of fruit and vegetable consumption relative to processed foods. Much of the aforementioned literature examines changes in consumed servings of vegetables – widely considered an important food lifestyle behaviour. Vegetable consumption is strongly associated with many positive health outcomes including decreased rates of chronic health disease, hypertension, stroke, and cancer (Boeing et al., 2012; Dauchet, Amouyel, Hercberg, & Dallongeville, 2006; Harmon, 2014). While these chronic diseases are multi-causal and complex, public officials and researchers have suggested that increased vegetable consumption could be an effective strategy in coping with their detrimental social and economic impacts (Krebs-Smith, Guenther, Subar, Kirkpatrick, & Dodd, 2010; U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010). A few studies have documented a historical trend between the increased rates of chronic disease in industrial societies and the increased presence of processed food products in citizens' diets (Monteiro, Levy, Claro, de Castro, & Cannon, 2011; Moubarac et al., 2013). Processed foods, in these studies, appear to displace fresh fruits and vegetables in the average diet. As such, researchers are interested in how CSAs and farmers' markets may reverse these trends.

A second category of food lifestyle behaviours found in the literature is consuming food prepared at home relative to food prepared away from home. Numerous researchers (Beydoun, Powell, & Wang, 2009; Kant & Graubard, 2004; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008) note that food at restaurants has larger serving sizes and more calorie-dense options than recommended by the United States Department of Agriculture dietary guidelines (2010). These studies also indicate that restaurant food is less nutritious than fresh food prepared at home. Individual consumption behaviours are complex and influenced by political and economic trends in food production and distribution as well as individuals' physical settings and social networks in their home, work, and community (Story et al., 2008). As such, CSAs place shareholders into a different type of food environment (Harmon, 2014). By providing a large amount of constantly changing vegetables each week, CSAs require the shareholder to plan ahead and devise strategies to use or store this produce in a timely manner.

A third category of food lifestyle behaviour is food-purchasing behaviours and decision-making, which the literature also associates with CSA participation. CSA participants are observed to plan meals around vegetables (Perez, Allen, & Brown, 2003; Russell & Zepeda, 2008), spend less time shopping (Durrenberger, 2002; Ostrom, 2007; Perez et al., 2003), and procure a larger variety of produce (Brown & Miller, 2008). Some individuals will favour purchasing organic food following a CSA season (Durrenberger, 2002; Russell & Zepeda, 2008). Another study (Hayden & Buck, 2012) identified potential purchasing behaviours subsequent to joining a CSA that could be generally linked to food lifestyle behaviours, such as participating in distribution, trying new foods, and visiting farms. In general, CSA participants are found to reshape their food-acquisition behaviours.

Conceptual model

Economic theory suggests that individuals make choices in which the marginal benefits outweigh the marginal cost; this tenet is often classified as belonging to value-expectancy theory across numerous disciplines (Crosby, Salazar, & DiClemente, 2013). We begin this section with an

individual-level model of health behaviour grounded in value-expectancy theory known as the Information–Motivation–Behavioural Skills (IMB) model. Figure 1 presents the IMB model, which informs our hypothesis that CSAs have a significantly positive impact on food lifestyle behaviour. Relatively new to public health and behavioural sciences, the IMB model (Fisher & Fisher, 1992) proposes that adoption of a new behaviour is influenced by its eponymous constructs: information, motivation, and behavioural skills. Information refers to having sufficient knowledge pertaining to the new behaviour, motivation refers to the effect of personal and social perceptions of the new behaviour, and behavioural skills refers to having the perceived and actual ability (i.e. self-efficacy and skill) to implement the behaviour. In the model, information and motivation are attained co-dependently and can directly influence a behaviour-adopting decision; they also play an indirect role by affecting the development of behavioural skills, which in turn also influence a behaviour-adopting decision (Crosby et al., 2013). The IMB model can inform how information, motivation, and behavioural skills attained through CSA participation lead to changes in food lifestyle behaviours both during and after the CSA season.

First, CSAs provide information to shareholders about where their food comes from, how it is produced, and what vegetables can grow within their local climate region. Overall, shareholders gain a better understanding for the seasonality of vegetable production (Curtis, Allen, & Ward, 2015; Russell & Zepeda, 2008; Schnell, 2013; Wilkins et al., 2015). Moreover, shareholders often gain food preparation and preservation skills and potentially modify consumer behaviour to complement and use the received produce (Curtis et al., 2015; McCormack et al., 2010; Russell & Zepeda, 2008). In our experience with CSAs in Central Kentucky, CSAs also provide information on food production and preparation via direct interaction between farmers and shareholders, farm tours and periodic newsletters/blogs.¹ Collectively, this information potentially helps shareholders to develop skills for intensifying their procurement and consumption of fresh vegetables.

Second, CSAs can generate motivation for shareholders to change their food-purchasing and -consumption behaviour after the CSA season. Research suggests that shareholders are initially motivated to consume their CSA portion because of their initial monetary buy-in, and consequently will experiment to incorporate fresh vegetables into meals to fully consume their share; over time, shareholders modify their palate in subtle ways, effectively changing their ability to enjoy healthier food through the motivation of taste (Harmon, 2014). An informed appreciation of food production methods may also provide motivation that affect behaviours outside the CSA arrangement, likely by influencing a shareholder's personal and social perceptions of the food system (Ostrom, 2007). Relatedly, CSAs are often active in promoting the local foods movement, which may also motivate shareholders to buy more food directly from

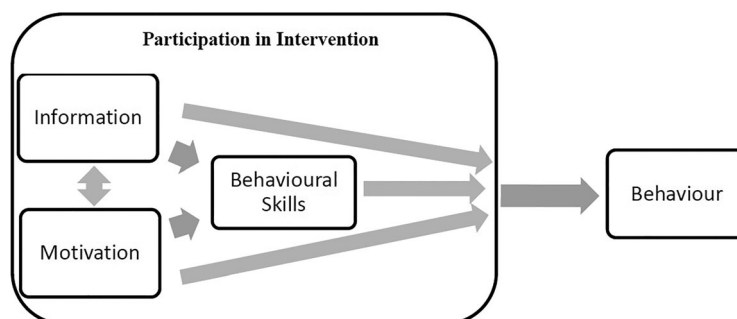


Figure 1. IMB model.

farmers after the CSA season (O'Hara & Stagl, 2002). These and other sources of motivation are fostered during CSA participation and may lead shareholders to reconsider their food-purchasing and -consumption behaviours outside of the CSA arrangement.

Third, the development of behavioural skills through exposure to new information and motivation may potentially lead to different consumption and purchasing patterns after the CSA season concludes. Shareholders potentially gain food preparation and preservation skills as they are exposed to unfamiliar vegetables through CSA participation and experiment with new cooking techniques (McCormack et al., 2010; Russell & Zepeda, 2008). Shareholders also potentially gain the confidence and skills required to shop for and prepare fresh vegetables and healthier food (Harmon, 2014). Together, these skills may allow shareholders to prepare an increased number of meals at home and with a greater variety of fresh foods. Equipped with the information and motivation to experiment with food preparation and preservation during the CSA season, shareholders may develop related behavioural skills that enable them to adopt healthy-eating behaviours.

Data and methods

To test whether participation in a CSA leads to changes in food lifestyle behaviours, the survey instrument was designed to quantify self-reported assessments of diverse food-related behaviour changes among existing shareholders. In particular, the key variables came from one of four categories: (1) fruit and vegetable versus processed food consumption; (2) food prepared at home versus away from home; (3) food-purchasing behaviour and interest in nutrition; and (4) self-reported health outcomes. Whereas the first three of these categories are a product of the health literature reviewed above, the fourth category is an attempt to see if self-reported health outcomes can approximate the direct health effects that shareholders attribute to their CSA participation and changes in their food lifestyle behaviours. While health condition is self-evaluated, researchers have noted that self-reported conditions are strongly related to the results of biometric assessments (Södergren, McNaughton, Salmon, Ball, & Crawford, 2012). Therefore, we aim to test if CSA participants undergoing behaviour shifts towards increased vegetable consumption, food preparation, and the purchasing of organic foods would reflexively evaluate their own health as improved.

For the first category, the survey asked shareholders to quantify their daily fruit and vegetable consumption and indicate how frequently they ate salads and processed foods. For the second category, the survey asked shareholders to indicate how frequently they engaged in certain food at-home behaviours (e.g. preparing dinner, food preservation) and away-from-home behaviours (e.g. expenditures and visits to restaurants). The third category asked shareholders about changes in purchases of organic or locally marketed food as well as discussing and reading labels for nutritional information. These questions seek to understand how CSA participation may affect market preferences and approximate how consumers internalize health-related messages gained by or associated with direct interactions with farmers and organic produce. Finally, the fourth category questions measure self-reported health outcomes, including annual visits to the doctor or health clinic, monthly pharmacy expenditures, and a self-reported health measure chosen from the following options: Poor, Below Average, Average, Good, and Excellent.

To capture the effect of CSA participation, the survey asked shareholders one set of questions from these four categories that described their pre-CSA behaviour, and then another set of questions to describe their current post-CSA behaviour. For most questions, respondents estimated how many times during a month (or year when applicable) that they engaged in certain behaviours, selecting from the following seven options: almost never, 1 to 2 times, 3 to 4 times, 5 to 6 times, 7 to 8 times, 9 to 10 times, more than 10 times; for example, 'In an average month,

how many times do you prepare dinner at home before/after joining a CSA?’ However, respondents had to input a numeric estimate for questions seeking to estimate daily servings of fruits and vegetables, expenditures at pharmacies and restaurants, and annual visits to doctor or health clinic, and the self-reported health measure was categorical. Finally, the survey collected additional data used in the analysis, including household income, number of years in a CSA, and the age, race, education, and sex of the respondent.

Upon completion, the survey instrument was put into the SurveyMonkey online survey development tool. It was subsequently distributed via email to shareholders from three midsized CSAs (100–450 participants) near Lexington, Kentucky, by the CSA farm directors. To encourage participation, the first 50 respondents were offered a \$10 incentive to complete the survey and a reminder email was sent by the CSA farm directors. Of the approximately 439 shareholders who opened the introductory email, 151 produced usable responses, yielding a 34.4% completion rate.

In our analysis, we estimate the effects of joining a CSA on food lifestyle behaviours and certain health indicators. Initially we employed a two-sample mean-comparison test (i.e. *t*-test) to compare the mean frequency of behaviours, level of expenditures, and self-reported health score in the pre- and post-CSA conditions. Each *t*-test is naturally paired since responses of before and after behaviour come from each respondent in the sample. A paired, two-sided *t*-test assesses the probability that the paired means are not different from each other in a statistically significant way. In this analysis, we tested responses for 20 sets of before and after questions about food purchase and consumption behaviour.

Changes in behaviour are expected to be observed before and after joining a CSA, but may also vary in degree across demographics within the sample. After testing before and after responses for significant differences, we characterize how responses may be correlated with respondent characteristics. To accomplish this, the before measures were subtracted from their respective after measures to create new variables that represented the change in the behaviour. These new variables were then individually situated as a dependent variable in an ordinary least squares (OLS) linear regression. Each regression contained an identical set of independent variables, which included age (continuous, in years), sex (where male is reference category), income (continuous, in thousands of USD), self-reported health before joining a CSA (categorical, selected from ‘excellent health’, ‘good health’, ‘average health’, and ‘poor health’), and years enrolled in a CSA (continuous, in years). Since self-reported health is included as an independent variable, it does not serve as a dependent variable for a regression even though it was included in the *t*-test statistical analysis.

Results

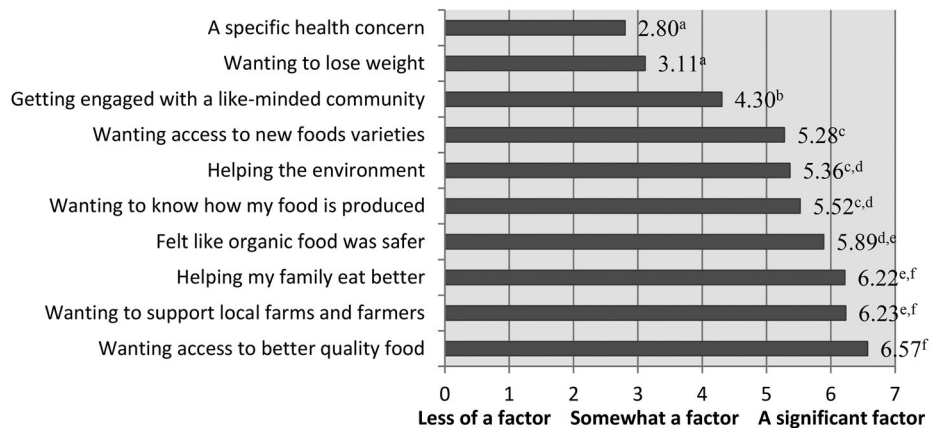
Analysis of these data describes the average CSA shareholder in the sample area around Fayette County, Kentucky. The average CSA shareholder is 45 years old, Caucasian (95%), and female (80%). Additionally, the sample population has either a four year (27%) or advanced degree (67%) and an annual household income of \$110,000. Compared to the average Fayette County resident, the average CSA shareholder is older, more likely to be Caucasian, more likely to be female, more educated, and considerably wealthier (Kentucky Cabinet for Economic Development, 2015; U.S. Census Bureau, 2015). Some of these differences may be location specific, though Russell and Zepeda (2008) also observed that their CSA shareholder respondents were skewed older, Caucasian, and female. Goland (2002) characterized CSA shareholders as being relatively wealthy and well-educated, and Bougherara, Grolleau, and Mzoughi (2009) also found a significant difference in income between surveyed CSA and surveyed non-CSA households. Still, readers are asked to bear these differences in mind when interpreting the results.

Descriptive results demonstrating that existing shareholders report diverse motivations for joining a CSA provide an interesting context to the analytic results. Figure 2 illustrates the mean responses for 151 respondents who answered ‘Which factors caused you to join your CSA initially?’ using a seven-point scale, with one representing ‘Less of factor’ and seven representing ‘A significant factor’. Responses ranged from one to seven except for ‘Wanting access to better quality food’, which had a minimum response of four. That all respondents scored this factor a four or higher partially explains why it was, on average, the top reason for initially joining a CSA. Shareholders also reported that ‘Wanting to support local farms and farmers’ and ‘Helping my family eat better’ were very influential factors.

Conversely, ‘Wanting to lose weight’ and ‘A specific health concern’ ranked in the lower half of the scale, suggesting these reasons were less motivating for first-time CSA enrolment. While ‘A specific health concern’ and ‘Wanting to lose weight’ are reported as the least important motivations, shareholders make an indirect connection between vegetable consumption and health through their scoring of questions related to ‘Wanting access to better quality food’, ‘Helping my family eat better’, and ‘Felt like organic food was safer’. In other words, health does not seem to be a primary motivating factor for shareholders joining a CSA, but it still plays an indirect role.

The analytic results are shown in Tables 1 and 2. Table 1 presents the results from the set of paired *t*-tests that compare self-reported measures of food purchase and consumption behaviour and health indicators for respondents before and after joining a CSA. The Before CSA and After CSA columns display descriptive statistics for each variable and represent the frequency of behaviour at that point in time. The paired differences column presents descriptive statistics for changes in the frequency of behaviour (i.e. After CSA – Before CSA) across the sample *N*. Importantly, the paired differences mean represents the average difference in the frequency of behaviour across the sample *N* for most variables; some of the Other Indicators measure servings, expenditures, or a categorical measure of health. Finally, the paired *t*-test column shows the results of testing the null hypothesis that the mean difference between the paired observations is zero (i.e. Before CSA = After CSA). As shown in Table 1, all paired means are significantly different at the 99% level, except for the last variable which is significant at the 95% level.

Overall, this analysis suggests that CSA participation accompanies a statistically significant decrease in the frequency and expenditure at restaurants, eating processed foods or while in the car, visits to a doctor or health clinics, and expenditures at pharmacies. Additionally, CSA participation also accompanies a significant increase in an interest in nutrition labels and nutrition-based



Like superscripts indicate that factor means do not statistically differ ($P > 0.05$) by Tukey's statistic=0.58; $n=151$.

Figure 2. Factors for initially joining a CSA.

Table 1. Paired *t*-tests on food lifestyle behaviours and health outcomes before and after joining a CSA.

	Before CSA			After CSA			Paired differences						Paired <i>t</i> -test		
	N	Mean	Std. Dev.	Std. Err.	Mean	Std. Dev.	Std. Err.	Mean	Std. Dev.	Std. Err.	95% CI interval		<i>t</i> -Score	df	Sig.
											Lower	Upper			
<i>In an avg. month, how many times do you ...</i>															
Eat breakfast at restaurants	151	1.19	2.28	0.19	0.91	1.79	0.15	-0.27	0.95	0.08	-0.42	-0.12	-3.51	150	0.0006
Eat dinner at restaurants	151	4.23	3.26	0.27	3.25	2.52	0.21	-0.98	1.77	0.14	-1.27	-0.69	-6.79	150	0.0000
Eat in the car	151	1.50	2.62	0.21	1.20	2.29	0.19	-0.30	1.42	0.12	-0.53	-0.07	-2.61	150	0.0099
Eat processed snack foods	151	5.07	4.09	0.33	3.39	3.28	0.27	-1.69	2.55	0.21	-2.10	-1.28	-8.13	150	0.0000
Eat processed foods for meals	151	3.81	3.51	0.29	2.16	2.69	0.22	-1.66	2.27	0.18	-2.02	-1.29	-8.96	150	0.0000
Read nutrition labels	151	8.06	4.11	0.33	8.73	3.75	0.31	0.67	2.44	0.20	0.27	1.06	3.35	150	0.0010
Eat salads	151	7.30	3.86	0.31	9.34	2.83	0.23	2.05	2.70	0.22	1.61	2.48	9.31	150	0.0000
Discuss nutrition with friends/colleagues	151	4.91	3.93	0.32	6.66	3.86	0.31	1.74	2.79	0.23	1.29	2.19	7.67	150	0.0000
Buy organic foods	142	4.49	4.14	0.35	7.50	3.98	0.33	3.01	3.66	0.31	2.40	3.62	9.81	141	0.0000
Buy food marketed as locally produced	142	4.56	3.47	0.29	7.66	3.47	0.29	3.10	3.47	0.29	2.52	3.67	10.64	141	0.0000
Prepare dinner at home	142	10.40	2.37	0.20	10.94	1.85	0.16	0.53	1.28	0.11	0.32	0.74	4.96	141	0.0000
<i>In an avg. year, how many times do you ...</i>															
Preserve food by freezing	142	4.50	4.29	0.36	8.08	3.86	0.32	3.58	3.81	0.32	2.95	4.22	11.20	141	0.0000
Preserve food by canning	140	1.01	2.53	0.21	2.41	3.66	0.31	1.40	2.64	0.22	0.96	1.84	6.27	139	0.0000
Visit a farm	141	1.58	3.11	0.26	3.56	3.81	0.32	1.98	2.96	0.25	1.48	2.47	7.91	140	0.0000
Buy food from farmers/farmers' markets	141	5.35	3.88	0.33	7.24	4.00	0.34	1.89	4.24	0.36	1.18	2.60	5.30	140	0.0000

(Continued)

Table 1. Continued.

	Before CSA			After CSA			Paired differences					Paired <i>t</i> -test			
	N	Mean	Std. Dev.	Std. Err.	Mean	Std. Dev.	Std. Err.	Mean	Std. Dev.	Std. Err.	95% CI interval		<i>t</i> - Score	df	Sig.
											Lower	Upper			
<i>Other indicators: report your ...</i>															
Avg. daily fruit and vegetables servings	142	4.55	1.61	0.14	7.22	2.26	0.19	2.67	1.69	0.14	2.39	2.95	18.80	141	0.0000
Weekly expenditure at restaurants	141	39.88	44.41	3.74	25.93	33.94	2.86	-13.95	20.14	1.70	-17.30	-10.59	-8.22	140	0.0000
Self-reported categorical rating of health	138	3.75	0.90	0.08	4.16	0.78	0.07	0.41	0.64	0.05	0.30	0.51	7.50	137	0.0000
Monthly expenditure at the pharmacy	136	20.42	45.55	3.91	17.23	43.77	3.75	-3.19	13.77	1.18	-5.53	-0.86	-2.70	135	0.0078
Annual visits to doctor or health clinic	139	3.18	2.11	0.18	3.03	1.76	0.15	-0.15	0.89	0.08	-0.30	0.00	-2.00	138	0.0478

Table 2. OLS regressions on paired differences to food lifestyle behaviours and health outcomes from before and after joining a CSA.

Dependent variables	Paired differences mean	Age coef.	Sex.F coef. ^a	Income coef.	Health.Good coef. ^b	Health.Avg coef. ^b	Health.Poor coef. ^b	Years in CSA coef.	_cons coef.	N	R ²
<i>In an avg. month, how many times do you ...</i>											
Eat breakfast at restaurants	-0.27	-0.0085	-0.0239	-0.0004	-0.2697	-0.1431	-1.0004***	0.0634	0.2358	125	0.1066
Eat dinner at restaurants	-1.06	0.0028	-0.3182	-0.0006	-0.7455*	-0.4029	-0.8859	0.0608	-0.5321	125	0.0446
Eat in the car	-0.30	-0.0150	0.0753	0.0013	0.1141	-0.0877	-0.4581	0.1239*	-0.1890	125	0.0584
Eat processed snack foods	-1.73	0.0095	-0.5004	0.0060*	-0.5313	-0.0809	-3.2394***	0.0920	-2.0948*	125	0.1868
Eat processed foods for meals	-1.70	0.0066	-0.1367	0.0054	-0.2536	0.4096	-1.8049**	-0.0193	-2.2269**	125	0.0950
Read nutrition labels	0.57	-0.0207	-0.0405	0.0035	0.6350	1.4911**	2.3284***	0.0118	0.2323	125	0.0911
Eat salads	2.14	-0.0186	-1.0790*	-0.0073*	0.9497	0.9068	1.4384	0.2474*	3.1218**	125	0.1267
Discuss nutrition with friends/colleagues	1.56	-0.0166	0.3457	0.0006	0.6466	0.8000	2.4664**	0.1437	0.8135	125	0.0694
Buy organic foods	2.86	-0.0402	-0.2916	0.0090*	0.5336	1.5829	3.5923***	0.3697**	1.8454	125	0.1126
Buy food marketed as locally produced	2.93	-0.0203	0.6987	-0.0012	0.4709	0.6818	4.0824***	0.2213	1.9863	125	0.1338
Prepare dinner at home	0.48	-0.0064	0.0441	-0.0021	-0.0881	0.1042	0.0954	0.0313	0.8645	125	0.0308
<i>In an avg. year, how many times do you ...</i>											
Preserve food by freezing	3.62	-0.0729**	0.2793	-0.0043	1.1373	-0.4495	1.1906	0.1390	6.1733***	125	0.1028
Preserve food by canning	1.48	-0.0053	0.7148	0.0010	0.9182	0.4619	-0.0659	0.0949	0.2529	123	0.0413
Visit a farm	1.83	-0.0281	-0.2749	0.0006	0.4769	0.1360	2.1014**	0.2215	2.1311	124	0.0756
Buy food from farmers/farmers' markets	1.89	-0.0549*	0.5566	0.0032	2.4588**	1.8340	4.1141***	0.2981	0.7313	124	0.1242

(Continued)

Table 2. Continued.

Dependent variables	Paired differences mean	Age coef.	Sex.F coef. ^a	Income coef.	Health.Good coef. ^b	Health.Avg coef. ^b	Health.Poor coef. ^b	Years in CSA coef.	_cons coef.	N	R ²
<i>Other indicators: report your ...</i>											
Avg. daily fruit and vegetables	2.66	-0.0301**	-0.4571	-0.0038	-0.1003	-0.1966	-0.0139	0.1194	4.5116***	125	0.1032
Weekly expenditure at restaurants	-14.25	0.1327	1.5747	-0.0590*	-4.3164	-4.6009	-10.4400	1.2917	-14.6758	124	0.0637
Monthly expenditure at the pharmacy	-3.29	-0.0551	-2.2195	-0.0018	-4.1405	-3.0090	-11.5133**	-0.7122	6.8480	122	0.0544
Annual visits to doctor or health clinic	-0.17	0.0021	-0.1724	-0.0005	-0.1426	-0.4982*	-1.0013***	-.1203***	0.5656	125	0.1418

* $p < 0.10$.** $p < 0.05$.*** $p < 0.01$.^aCoefficients to be interpreted relative to reference category of 'Sex: Male'.^bCoefficients to be interpreted relative to reference category of 'Excellent Health'.

discussions, healthy-eating behaviours like eating salads and preparing dinner at home, purchase of local and organic food, food preservation, visiting farms and purchasing food from farmers, fruit and vegetable consumption, and self-perceived overall health. For all variables, the direction of the effect of CSA participation – positive or negative – was as expected and was consistent with the idea that CSAs encourage healthy food purchase and consumption behaviours.

The degree of change for certain behaviours appears to vary by certain demographics. [Table 2](#) presents results from the set of OLS regressions that seek to explain which factors were associated with differences in behaviour because of CSA participation. In order to accommodate results from 19 regressions, [Table 2](#) organizes each individual regression horizontally and only provides the estimated coefficient and a symbol of its significance for each independent variable. The mean of the dependent variable in the first column indicates whether or not CSA participation had a positive or negative association with the specified behaviour.² If a dependent variable has a negative mean – suggesting that CSA participation accommodated a decrease in the behaviour – then negative coefficients for the independent variables suggest an even greater post-CSA decrease in the behaviour for that segment of respondents. A positive coefficient for an independent variable would suggest a smaller decrease for that demographic. Conversely, if the dependent variable has a positive mean, then positive coefficients for the independent variables suggest an even greater increase in the behaviour after CSAs while a negative coefficient suggests a smaller increase. An *R*-squared statistic is also provided for each regression, which ranges between 0.03 and 0.18. Given the complex myriad of biological, behavioural, and social factors that influence these behaviours, we are not surprised that the regressions only explained about 9% of the data's variance, on average.

The estimated coefficients in [Table 2](#) suggest that the measure of self-reported health before joining a CSA was the factor most often associated with changes in behaviour due to CSA participation. In 11 regressions, the coefficients on poor health reinforce the behaviour change with statistical significance at the 95% level or above, suggesting that CSA membership had a more transformative effect on these individuals. In other words, relative to those who reported excellent health prior to joining a CSA, those reporting poor health prior to joining a CSA also reported, on average, greater changes following completion of a shareholding season. At the 99% confidence level, these behaviours include eating breakfast at restaurants less often, eating less processed snack foods, reading nutrition labels, buying more organic foods, buying more food marketed as locally produced, buying more food from farmers or farmers' markets, and fewer visits to the health clinic. At the 95% level, these behaviours include eating less processed foods for meals, discussing nutrition with friends and colleagues, visiting farms more often, and decreased expenditure at pharmacies. A few other statistically significant coefficients showed that the correlation between CSA participation and buying more organic foods and fewer visits to a health clinic is reinforced with each additional year spent in a CSA, and the correlation between CSA participation and increased consumption of fruits and vegetables and increased preservation by freezing is diminished with increased age.

It is worth noting that, when tested, there was no significant correlation between demographic factors, including self-rated health and reasons for joining a CSA. In other words, those who rated their pre-CSA health poorly were not more likely to express a health-related reason for participation. Again, motivations for becoming a shareholder were varied and did not correspond to any specific demographic category.

Discussion

According to our survey results, CSAs have the potential to positively impact shareholders' food lifestyle behaviours and selected health outcomes. Fruit and vegetable consumption increased on

average 2.7 servings per day. These results are comparable to or exceed the consumption increase noted in other CSA studies (Cohen et al., 2012; Wilkins et al., 2015). Nutritionists generally consider 5 servings of fruits and vegetables per day an important threshold for long-term health outcomes (Bellavia, Larsson, Bottai, Wolk, & Orsini, 2013). Additionally, vegetable consumption has been associated with decreased risk of cancer, stroke, and chronic disease (Boeing et al., 2012; Dauchet et al., 2006; Harmon, 2014). As such, CSA participation may beget tremendous public health benefits based on observed changes in vegetable intake.

CSA participation is also associated with changes to food lifestyle behaviours. Shareholders note a marked decrease in processed food and food-away-from-home consumption, changes which would decrease shareholders' exposure to calorie-dense offerings with larger serving sizes and preservatives. Shareholders' increased purchasing of organic food, salad intake, and food preparation indicates a general shift towards a set of food behaviours that run counter to trends that are usually associated with chronic disease (Monteiro et al., 2011; Moubarac et al., 2013). Even more encouragingly, these shifts are more strongly realized in shareholders who view their own health as poor prior to CSA participation. These results indicate CSAs' strong transformative potential. Another point of promise is that while health issues or a desire to lose weight are not explicit reasons people initially join a CSA, stakeholders still perceive a shift towards healthier consumption behaviours. Improved food lifestyle behaviours and associated health outcomes, then, appear to be an added benefit of participation, a point noted by other researchers (Durrenberger, 2002; Hayden & Buck, 2012; Ostrom, 2007; Perez et al., 2003; Russell & Zepeda, 2008).

To understand why past CSA shareholders have experienced behaviour changes relating to healthier eating, we return to the IMB model, which theorizes that behaviour-adopting decisions are influenced by information, motivation, and behavioural skills. Thus, the results suggest that CSA participation equipped surveyed shareholders with the information, motivation, and skillsets required to adopt healthier eating behaviours, especially if they considered themselves to be in poor health prior to enrolment. Information is attained as CSA participation establishes a connection between the shareholder and an alternative set of food-purchasing outlets. By experiencing new categories and varieties of produce (organic, heirloom, etc.), shareholders may gain an appreciation or preference for products that are unavailable at conventional retail outlets (Brown & Miller, 2008). Motivations are altered as CSAs generally increase interactions between shareholders and producers, developing social relationships that encourage consumers to source their produce differently. By pulling consumers into different purchasing relationships and venues, CSAs may also motivate shareholders to explore other DTC venues such as farmers' markets or on-farm retail (Brown & Miller, 2008; Hayden & Buck, 2012; Hinrichs, 2000). Finally, behavioural skills are developed as shareholders push to consume, prepare, and preserve the contents of each vegetable box in order to make the most of their CSA subscription (McCormack et al., 2010; Russell & Zepeda, 2008). Here, the initial monetary buy-in and weekly delivery of varied produce may work as strong motivators to develop skills to prepare and store larger amounts of vegetables in a timely manner. Additionally, as indicated by Russell and Zepeda (2008), CSAs restrict choice over what the consumer receives and may displace the purchasing of other foods, such as processed snack foods or restaurant meals. Shareholders' relationships with producers may also act to structurally restrict other food-purchasing options. Overall, by engaging in certain economic or social behaviours which favour the acquisition of fresh vegetables, CSA participants gradually shift their behaviour towards healthier eating, even if their motivations are not strictly health related.

These results, however, should be taken as an initial yet promising analysis of the impact of CSA participation on shareholder health behaviour. While the IMB model hypothesizes that these behaviour changes result from improvements in information, motivation, and behavioural skills

relating to healthier food lifestyle behaviours, measuring the magnitude of each influencing factor is beyond the scope of this survey. Pairing this quantitative assessment with semi-structured interviews would help detail motivations for joining a CSA and the thought process involved in modifying consumption behaviour. Additionally, as these results were obtained through a one-time survey of shareholders, many of whom participated in CSAs for multiple seasons, participants noted that it was sometimes difficult to recall details of pre-CSA activities. This is particularly important as all responses were self-reported, though others have noted that self-assessment in matters related to health, behaviour, and food intake correlate well with detailed quantitative assessments (Södergren et al., 2012).

Another concern is that the sample itself may not be representative of the US population which may limit the generalizability of the results. It is conceivable that the surveyed shareholders (1) were predisposed to supporting alternative political economic arrangements; (2) were already considering healthy behavioural changes; or (3) had a preference for fresh or organic produce. In the first condition, consider that 'Wanting to support local farms or farmers' was tied as the second greatest motivator for joining the CSA, indicating strong interest for 'buying local'. Additionally, many of the survey participants were repeat CSA subscribers, which would suggest that they find this consumer strategy compelling. Furthermore, the sample of CSA shareholders made up a relatively affluent demographic; the sample's annual household income of \$110,000 was considerably greater than the average resident in Fayette County, Kentucky. This is unsurprising since CSAs require a large initial buy-in and a greater commitment to food preparation. Unfortunately, these barriers may systematically exclude lower-income individuals who suffer chronic health issues and might otherwise benefit most from structured weekly delivery of produce. Thus, more evidence may be needed to determine how effectively a CSA intervention could foster healthy-eating behaviours among a non-predisposed population.

We recognize these critiques and address them in an ongoing research experiment. Parallel to this survey, we have offered 90 first-time CSA shareholders a voucher incentive to offset one-third of the total share cost and incentivized 90 individuals from the same population to serve as a control group. In return, they will complete separate before and after surveys with the same questions from this current survey. By randomly offering a voucher incentive to those with no CSA experience, we intend to draw from a cross-section of participants with different attitudes, expectations, tastes, health conditions, and incomes. Additionally, we have noticed more income diversity in our experimental survey. This expanded participant pool will provide an interesting comparison to our current sample and provide expanded insights. Furthermore, we intend to conduct semi-structured interviews with experiment participants to better match the motivations for behaviour change with the statistical analysis of the survey.

Conclusion

The data presented in the paper provide an initial indication that CSA participation is associated with significant changes towards healthy lifestyle and consumption behaviours – an observation supported by the existing literature and further confirmed by optional free-response comments in the survey and through email correspondence. These data come from 151 existing CSA shareholders near Lexington, Kentucky, who reported on their behaviours and health outcomes prior to joining a CSA and then reported their behaviours and health outcomes after joining a CSA for 20 paired questions. Paired, two-sided *t*-tests found that all paired means are statistically different at the 95% level, which strongly suggests that CSAs have the potential to positively impact shareholders' food lifestyle behaviours, and health outcomes. These results contribute to the existing literature by using a regression to determine for whom behaviour changes were

most significant, finding that those who considered themselves to be in poor health prior to CSA enrolment exhibited the most change. By finding incentives or programmes to expand CSA participation, public institutions, companies with wellness programmes, and non-profit organizations may create the infrastructure to simultaneously benefit producers and public health. In this way, CSAs have the potential to be socially, economically, and individually transformative.

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Notes

1. For example, Elmwood Stock Farm – a partnering CSAs for this study – maintains information on their website <http://www.elmwoodstockfarm.com/csa.htm> and their blog <http://elmwoodstockfarm.blogspot.com/>.
2. These means slightly differ from those examined in Table 1. Twenty-five respondents did not answer demographic questions used as independent variables and were thus excluded from the linear regression model.

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