Effect of nutrition information on the lifestyles of older adults

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Abstract

The effect on health-related behaviors of an older adult nutrition education program, Chef Charles (CC), was studied with 2009 and 2011 survey data using multiple regression and structural equation models. The results of the 2009 dataset demonstrate that the program affected those respondents who read CC newsletters and participate in the CC nutrition education significantly more than it affected the respondents who did not participate in nutrition education but who read or had access to CC newsletters. Increasing age has a significant negative effect on subsequent health-related behaviors. The following health problems had positive effects on health-related behavior: heart condition, poor vision, diabetes, asthma, breathing problems, and overweight.

The results of the 2011 dataset demonstrate that participation in the CC program significantly improves health-related behaviors. Increasing age significantly reduces participation in the CC program, and also reduces learning of the content of the materials provided by the program. Nutrition educators improve participation in the CC program and learning the materials provided by the program.

Key Words: multiple regression, structural equation modeling, nutrition education

1. Introduction

In modern times, the demographics of developed countries are characterized by an increasing proportion of elderly in the population. It is important that these people stay in good health as long as possible. Good health can preserve a good quality of life for each individual and benefit the entire society. Healthy older adults require less expenditure of money and effort on medical services than do older individuals with poor health. Consequently, an increasing number of people who will stay in good health as long as possible will decrease spending on social services such as Medicare and preserve public resources.

Obesity is one of the most important health-related problems that is widespread in modern developed countries. This problem relates to the way of life in an environment that contains abundant amounts of food. This is unusual for humans as living organisms, because for thousands of years they struggled with starvations and through evolutionary adaptation they developed an ability to store food energy as fat in their bodies. This property has helped humans survive in the face of starvation resulting from an insufficient food supply. Ease of food accessibility nowadays has resulted in developed countries having an increasing number of cases of overconsumption, resulting in obesity.

In such conditions, the ability to store fat leads to a negative effect on survival because obesity significantly increases morbidity and reduces life expectancy. Many public health organizations have committed resources to struggle with this problem.

The World Health Organization (WHO) uses body-mass index (BMI) for the definition of "overweight" and "obesity." BMI is defined as weight in kilograms divided by the square of the person's height in meters (kg/m^2). WHO defines "overweight" as a BMI equal to or more than 25, and "obesity" as a BMI equal to or more than 30. Complications of obesity include such destructive health diseases as diabetes mellitus, hypertension, stroke, heart attack, and other diseases. Consequently, it is very important to help people maintain normal weight.

Much research literature indicate that rates of obesity are higher among people with low socioeconomic status (SES), and among racial and ethnic minorities. Drewnovski and Specter (2004) indicated that "Analyses of data for 68,556 U.S. adults in the National Health Interview Survey by the Centers for Disease Control and Prevention showed that the highest obesity rates were associated with the lowest incomes and low educational levels" (p. 6). This can be explained by the relationship between energy consumed from the food and energy cost, which suggests that "obesity-promoting" foods are simply those that offer the most dietary energy at the lowest cost" (Drewnovski & Specter, 2004, p. 9). Fruits, vegetables, juices, and milk products are often expensive, and people with lower incomes are unable to buy these products in sufficient amounts to support their health.

It is difficult to change behavior (Glanz, Rimer, & Lewis, 2002) that leads to increasing weight, such as a sedentary lifestyle and unhealthy diets characterized by consumption of high calories, fats, and carbohydrates. According to Ziegelmann and Lipke (2007), "In older age the decrease in the availability and efficiency of resources seems to be linked to a decrease in the use of adaptive strategies" (p. 503).

By using data from the National Health and Nutrition Examination Survey (NHANES), Flegal et al. (2010) found that in 2007-2008, the prevalence of obesity in adults aged 60 and older was 37.1% (range 33.1-41.0) for men and 33.6% (range 30.2-36.9) for women. Flegal et al. found that "for women, the prevalence of obesity showed no statistically significant changes over the 10-year period from 1999 through 2008" (p. 240). For men, the NHANES data showed "significant differences among survey cycles as a categorical variable for 2007-2008 vs. 1999-2000" (p. 238).

Arterburn, Crane, and Sullivan (2004) noted that data summarized in the research literature has demonstrated an association between obesity and functional limitations that leads to the need for more intensive assistance. An increase in intensity of health and homecare assistance leads to an increase of financial spending for these purposes. Quesenberry, Caan, and Jacobson (1998) found annual health services for the participants of health maintenance organizations aged 60 to 74 cost 18% more for those with a BMI of 30 - 34.9 kg/m^2 than for participants with normal weight and 38% higher for those with BMI 35 kg/m^2 or greater.

Preservation of normal body weight helps older adults live healthy and continue socially active. According to activity theory (Gove, Ortega, & Style, 1989), social interactions are important for maintaining positive self-concepts and self-evaluation. These are important for psychological well-being and a good quality of life. Health care, public, and governmental organizations can help elderly people maintain their health.

1.1 Nutrition Education Program for Older Adults

The Chef Charles (CC) program, created by the Iowa Nutrition Network of the Iowa Department of Public Health, has its purpose to help older adults stay healthy and active. The CC program provides nutrition and physical activity education for older adults by promoting physical exercise and increasing consumption of fruits, vegetables, low-fat milk products, calcium-rich food, and vitamins. This program includes reading the monthly CC newsletter with information about healthy life styles, Snack & Act Bingo game, videos, recipes, samples of healthy food for tasting provided by the instructors, and other activities.

The purpose of the current study is to assess the effect of the CC program on the participants' self-reported health-related behaviors.

1.2 Study Hypotheses

Hypothesis 1: participation in the CC Program positively influences health-related behaviors.
Hypothesis 2: the survey respondents who read the CC newsletter and participate in nutrition education improve their lifestyles more significantly than do respondents who only read the CC newsletter and than respondents who don't read the CC newsletter even though it was available for them.
Hypothesis 3: increasing age negatively influences improvement in lifestyle following participation in the CC program.

2. Method

The survey respondents were randomly selected from the participants of the CC program; 441respondents were selected in 2009 and 1,298 respondents were selected in 2011.

A survey was used to collect data for the CC program evaluation. Respondents completed the questionnaire before and after their participation in the CC program. The survey included questions about consumption of fruits, vegetables, milk products, calcium supplements, and vitamins, as well as questions about physical activity and health conditions. The questions related to the consumption of healthy food were designed as five-point Likert items, with response options ranging from eating the abovementioned food products "every day, usually 3 or more times per day" to "never or less than 3 times per day." The questions related to calcium supplement and vitamin consumption and questions related to physical activity were designed as four-point Likert items with response options ranging from "never" to "almost daily." The questions related to health conditions were designed as dummy variables with answer "yes" if the person has a certain health problem or "no" if he/she does not have this health problem. Additionally, the survey contains questions related to experience with the CC program and assessment of the CC program. These questions were asked only after participation in the CC program, and were designed with "yes" or "no" answer options.

Multiple regression analysis, exploratory factor analysis (EFA), and structural equation modeling (SEM) were used to analyze the survey response data. Data analysis was conducted using SPSS and AMOS software programs.

2.1 Variables

The following variables were constructed on the basis of the EFA results and were included in multiple regression analysis and SEM.

These variables are: "Food" and "Food Post" – consumption of healthy food before and after participation in the program; "Vitamin" and "Vitamin Post" – consumption of vitamins before and after participation in the program; "Activity" and "Activity Post" – physical activity before and after participation in the program; "Learned Behavior;" and "Self-Motivated Behavior."

The variable "Food" was computed from the following variables (Cronbach's $\alpha = 0.581$):
I eat a small, whole fruit or about ½ cup of fruit
I drink a small glass or ½ cup of fruit juice
I eat ½ cup portion of vegetables
I drink milk
I eat yogurt
I eat cheese

The same variables from the post-survey were used to create the variable "Food Post" ($\alpha = 0.539$).

The variable "Vitamin" was computed from the following variables ($\alpha = 0.730$):
How often do you take a calcium supplement?
Do you take a vitamin D supplement separately or as part of a calcium supplement?

The same variables from the post-survey were used to create the variable "Vitamin Post" ($\alpha = 0.748$).

The variable "Activity" was computed from the following variables ($\alpha = 0.787$):
Physical activity
Stretching
Strength training

The same variables from the post-survey were used to create the variable "Activity Post" ($\alpha = 0.663$).

The variable "Learned Behavior" was computed from the following variables ($\alpha = 0.664$ in 2009, $\alpha = 0.590$ in 2011):
Learned new nutrition information
Tasted fruits and vegetables that were new to me
Tried new recipes provided at the meal site
Tried new recipes at home

The variable "Self-Motivated Behavior" was computed from the following variables ($\alpha = 0.749$ in 2009, $\alpha = 0.696$ in 2011):
Eat more fruits and vegetables at meals
Eat more fruits and vegetable snacks
Am more physically active
Drink milk more often with my meals
Eat more calcium-rich foods or calcium-fortified foods

Set personal goals to improve my diet and physical activity

Multiple regression analysis included the following health variables:
Heart Disease
Poor Vision
Diabetes
Balance problems
Asthma
Osteoporosis
Overweight
Arthritis

3. Results

3.1 Multiple regression analysis (2009 dataset)

The CC 2009 dataset has been divided into two groups:
Group 1 - Participants who responded that they read the CC newsletter and participated in nutrition education (228 participants).
Group 2 - Participants who responded that they only read or had access to the newsletter (97 participants).

The multiple regression analysis was conducted separately for each group. The dependent variable for the multiple regression analysis models was Self-Motivated Behavior. Regression model results for participants who read the CC newsletter and participated in CC activities are summarized in Table 1. Parallel results of the regression model for participants who only read or had access to the CC newsletter are provided in Table 2.

Table 1: Regression Models (Dependent Variable: Self-Motivated Behavior)
Participants who responded that they read the Chef Charles newsletter and participated in activities (228 participants)

	Model 1	*Model 2*	*Model 3*	*Model 4*
Intercept	2.034	-1.731	-0.974	-1.426
Food Post	0.004	0.009	0.002	-0.013
Vitamin Post	0.109*	0.087	0.064	0.102*
Activity Post	-0.003	0.09	0.093	0.087
Learned Behavior		0.499**	0.463**	0.551**
Age	- 0.219**	-0.179	-0.165	-0.107
Heart Disease		1.047**		
Poor Vision			1.062*	
Diabetes				0.932*
Balance Problems				
Asthma				
Osteoporosis				
Overweight				
Arthritis				
Model SS	49.786	73.903	64.905	68.805
MSE	3.018	1.881	1.997	1.947
F	4.124**	6.55***	5.416***	5.891***
R^2	0.074	0.338	0.297	0.315

	Model 5	*Model 6*	*Model 7*
Intercept	-1.473	-1.715	-1.75
Food Post	0.012	-0.001	-0.008
Vitamin Post	0.074	0.081	0.09
Activity Post	0.074	0.103*	0.091
Learned Behavior	0.529**	0.458**	0.392*
Age	-0.146	-0.111	- 0.18*
Heart Disease			0.567
Poor Vision			0.728
Diabetes			0.963*
Balance Problems			0.205
Asthma	0.771*		0.5
Osteoporosis			0.298
Overweight		0.818*	0.294
Arthritis			0.501
Model SS	63.813	65.969	99.755
MSE	2.012	1.984	1.699
F	5.287***	5.543***	4.516***
R^2	0.292	0.302	0.456

*p<0.05, **p<0.01, ***p<0.001

These results demonstrate that Learned Behavior has a positive and significant effect on Self-Motivated Behavior in all models. This supports Hypothesis 1 that participation in the CC program positively influences health-related behaviors. Age has a negative and significant effect on Self-Motivated Behavior if it is not suppressed by the presence in the model of other independent variables. Vitamin Post and Activity Post have a positive and significant effect on Self-Motivated Behavior in the models in which these variables are not suppressed by other predictors Heart Disease, Poor Vision, Diabetes, Asthma, and Overweight significantly and positively influenced Self-Motivated Behavior.

Table 2: Regression Models (Dependent Variable: Self-Motivated Behavior)
Participants who responded that they only read or had access to the Chef Charles newsletter (97 participants)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Intercept	0.569*	0.734	-1.076	-0.133	3.26
Food Post			0.05	0.055	0.044
Vitamin Post				-0.34	-0.086
Activity Post				-0.028	-0.137
Learned Behavior	0.658***	0.642***	0.627***	0.661***	0.817
Age		-0.012	-0.041	-0.063	-0.213
Heart Disease					-0.598
Poor Vision					1.078
Diabetes					-0.881
Balance Problems					0.608
Asthma					-1.277
Osteoporosis					0.091
Overweight					0.293
Arthritis					0.532

Model SS	50.198	41.86	44.55	46.71	43.936
MSE	2.252	2.476	2.473	2.509	3.38
F	22.292***	8.453***	6.006**	3.724**	1.728
R^2	0.193	0.171	0.186	0.195	0.494

*p<0.05, **p<0.01, ***p<0.001

Model 1, Model 2, Model 3, and Model 4 showed that the variable Learned Behavior significantly and positively influences the dependent variable Self-Motivated Behavior. No significant effects were found in Model 5.

Comparison of Group 1 (participants who responded that they read the CC newsletter and participated in nutrition education) and Group 2 (participants who responded that they only read or had access to the newsletter) revealed that the effect of Learned Behavior on Self-Motivated Behavior is stronger in Group 1 because this effect was not suppressed by the health variables as it was in Group 2 (Model 5). This supports Hypothesis 2.

3.2 Structural Equation Models (2009 dataset)

The CC dataset also was analyzed using SEM. This method provides the possibility of estimating the direction and strength of causal effects between the variables in a simultaneous equation framework in which a dependent variable in one equation may be an independent variable in another equation. SEM also provides the opportunity to estimate indirect effects associated with mediator variables as well as the direct effects that are estimated by regression coefficients. These SEM models were constructed on the basis of Social Cognitive Theory.

The SEM analysis was repeated with each of the survey variables related to health problems. Only two of these variables—"Heart Disease" and "Poor Vision"—had a significant influence on the respondents' behaviors after their participation in the CC program.

The model for Heart Disease in visualized in Figure 1.

3.2.1 SEM for Heart Disease

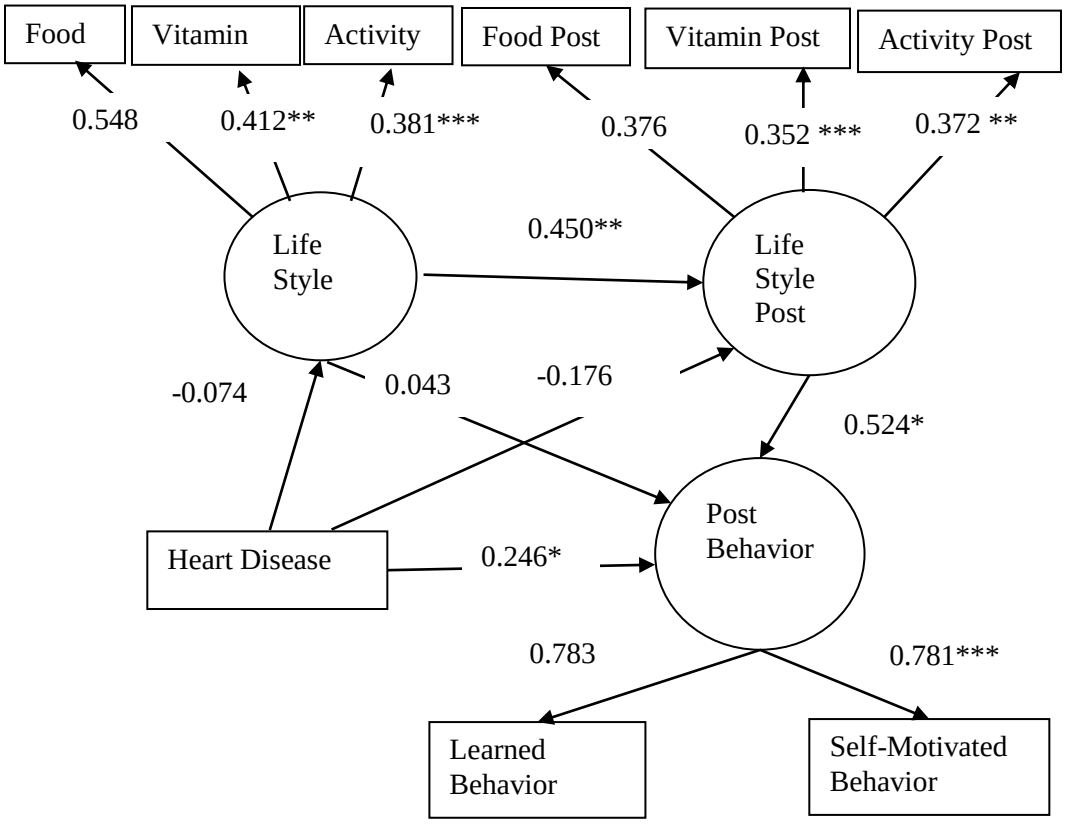

Figure 1: SEM with "Heart Disease," *p<0.05, **p<0.01, ***p<0.001

The model fits the data well: χ^2 =26.476, (p = 0.151); NFI = 0.943; TLI = 0.965; CFI = 0.985; RMSEA = 0.027.

The results demonstrate a significant regression coefficient of "Post Behavior" on "Life Style Post" (t =2.175, p = 0.030). "Life Style" is the variable that corresponds to the lifestyle of respondents before they received information about a healthy diet. The regression coefficient of "Life Style Post" on Life Style" was significant (t = 2.732, p = 0.006). These results could be interpreted as demonstrating that the information received by the respondents influences their lifestyles and subsequent behaviors, and that lifestyle before participation in the CC program influences lifestyle after participation in the CC program. These results also demonstrate a significant regression coefficient of "Post Behavior" on Heart Disease t = 2.263, p =0.024. This result can be interpreted as showing that having a heart health problem positively influences subsequent behavior.

3.2.2 SEM for Poor Vision

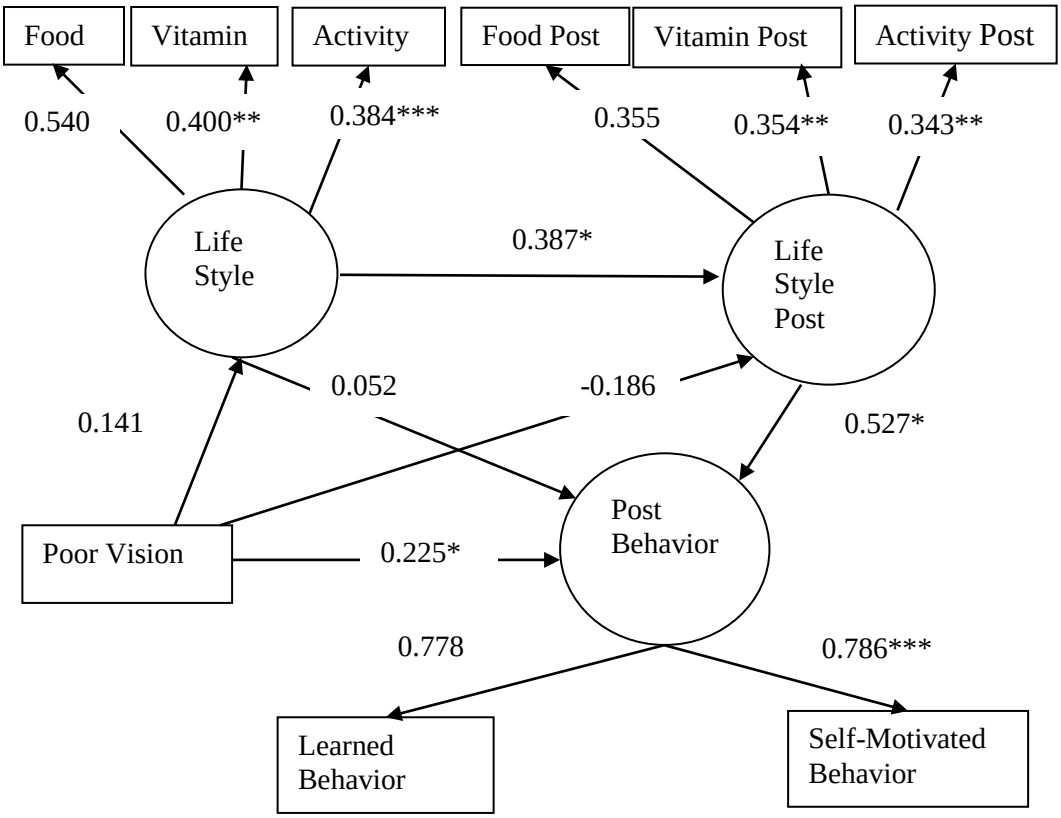

Figure 2: SEM with "Poor Vision," **p*<0.05, ***p*<0.01, ****p*<0.001

The model fits the data well: χ^2 = 26.051 (*p* = 0.129); NFI = 0.945; TLI = 0.961; CFI = 0.984; RMSEA = 0.029. The results demonstrate a significant regression coefficient of "Post Behavior" on Poor Vision *t* = 2.055, *p* =0.040. This result can be interpreted as signifying that poor vision positively influences subsequent behavior.

All other health variables demonstrate no significant influence on subsequent behavior, that is, on "Life style" and "Life style post."

3.2.3 SEM for Age

As visualized in Figure 3, Age has been included as one of the predictors of health-related behavior after participating in the CC program.

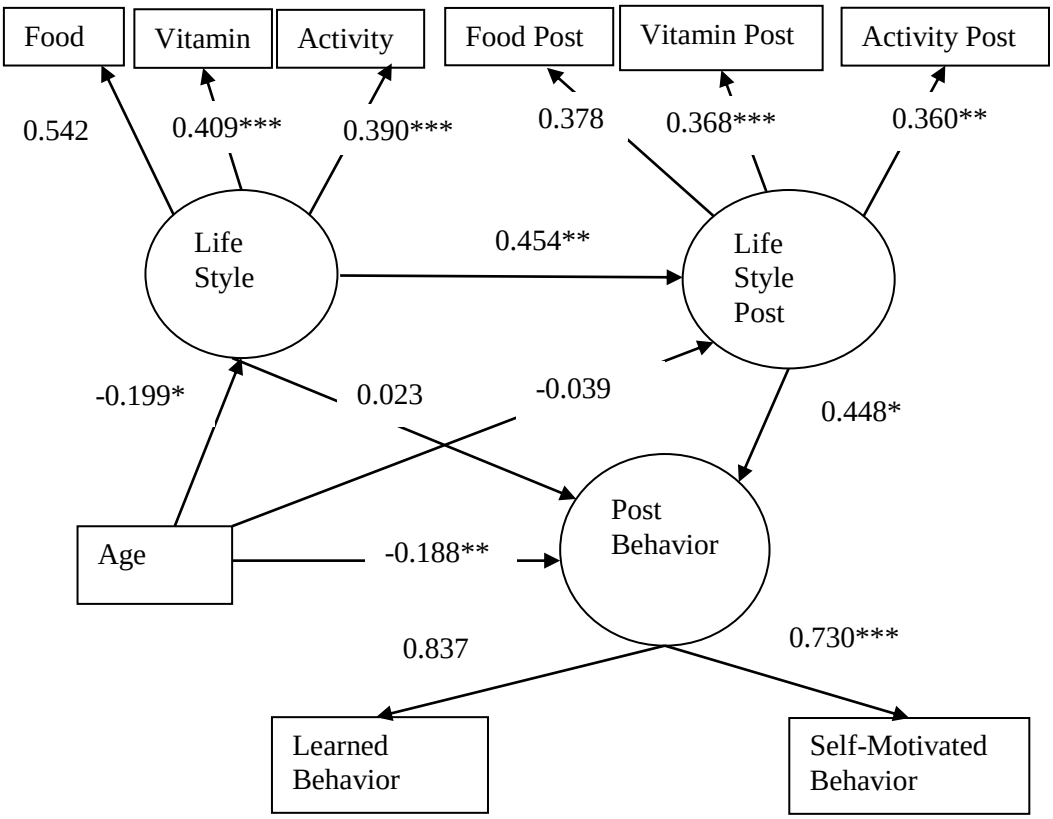

Figure 3: SEM with "Age," *p<0.05, **p<0.01, ***p<0.001

The model fits the data well: $\chi 2 = 24.304$ (p = 0.229); NFI = 0.950; TLI = 0.978; CFI = 0.990; RMSEA = 0.022. The regression coefficient of "Life Style" on age was negative and significant (t = -2.537, p =0.011); increasing age negatively influences Life Style before participation in the CC program.

The regression coefficient of "Life Style Post" on age was not significant (t = -0.457, p =0.647). This can be interpreted as denoting that participation in the CC program mitigated the negative effect of age on Life Style. This finding does not support Hypothesis 3, that increasing age negatively influences improvement in lifestyle after participation in the CC program.

The model results also demonstrate a significant negative regression coefficient of "Post Behavior" on age (t = - 2.947, p =0.003). These results can be interpreted as showing that increasing age negatively influences health-related behavior after participation in the CC program.

3.3 Multiple regression analysis with Age (2011 dataset)

To cross-validate findings regarding the effect of age from the 2009 data, we conducted a partial replication of these analysis with the 2011 survey data. The dependent variable for the multiple regression analysis models was "Self-Motivated Behavior." Findings are summarized in Table 3.

Table 3: Regression Models for 2011 (dependent variable "Self-Motivated Behavior"; 1,298 participants)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Intercept	1.468***	1.366***	0.889***	0.89***	1.917***
Learned Behavior	0.877***	0.813***	0.783***	0.783***	
Age	0.046	0.062*	0.064*	0.064*	
Know more about the Iowa Food Assistance Program		0.791***	0.761***	0.762***	1.275***
Participation			0.217**	0.217**	0.753***
Educator				-0.003	0.207*
SSR	2107.216	2245.793	1941.378	1941.382	863.736
MSE	2.913	2.808	2.744	2.747	3.728
F	361.69***	266.59***	176.87***	141.37***	77.22***
R^2	0.359	0.382	0.393	0.393	0.175

*p<0.05, **p<0.01, ***p<0.001

These results demonstrate that the variable "Learned Behavior" has a positive and significant effect on the dependent variable Self-Motivated Behavior in all models. Age was not significant in Model 1, but became significant in Model 2 and Model 3.

The variable "Know more about the Iowa Food Assistance Program" was significant and positive in Model 2, Model 3, Model 4, and Model 5. These results show that knowledge about the Iowa Food Assistance Program positively influences Self-Motivated Behavior.

The variable "Participation" was significant and positive in Model 3, Model 4, and Model 5. These results show that participation in the Chef Charles Program positively influences Self-Motivated Behavior.

The variable "Educator" was not significant in Model 4. However, it became significant in Model 5, when the variables "Learned Behavior" and "Age" were removed from the model. This indicates that age and learned behavior suppress the effect of educator on self-motivated behavior.

3.4 Structural Equation Model with Age (2011 dataset)

The Chef Charles 2011 dataset was analyzed further by SEM. Estimated paths are shown in Figure 4. A brief summary of the key findings from that analysis follows.

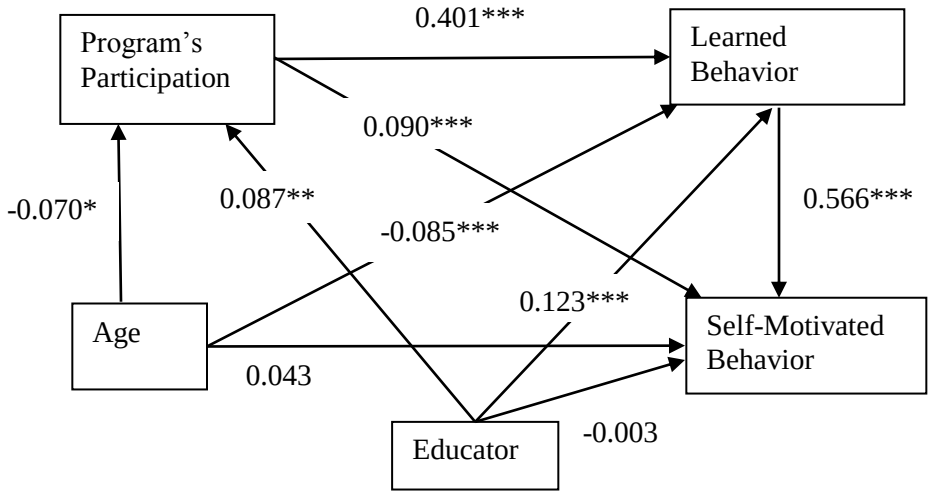

Figure 4: SEM for Age with 2011 data, *p<0.05, **p<0.01, ***p<0.001

The model fits the data well: $\chi 2 = 3.579$ (p = 0.059); NFI = 0.996; TLI = 0.953; CFI = 0.997; RMSEA = 0.045.

The results for the 2011 data shown in Figure 4 indicate that:

a) Participation in the Chef Charles program significantly increases Self-Motivated Behavior.
b) Participation in the Chef Charles program significantly increases learning of the materials provided by the program.
c) Increasing age significantly reduces learning of the materials provided by the Chef Charles program.
d) Increasing age significantly reduces participation in the Chef Charles program.
e) An educator significantly improves the learning of materials provided by the Chef Charles program.
f) An educator significantly improves participation in the Chef Charles program.
g) The effect of an educator on self-motivated behavior was not significant.

4. Discussion and conclusion

The results of the multiple regression analysis with the 2009 dataset demonstrate that learning new nutrition information significantly influences the subsequent health-related behaviors of the respondents who read the CC newsletter and participate in nutrition education. Developing new habits to take calcium and vitamin D supplements and being more physically active after participation in the CC program positively and significantly influence subsequent health-related behaviors. Developing a new habit to eat healthy food does not have a significant effect on subsequent health-related behaviors. Increasing age has a significant negative effect on subsequent health-related behaviors. The health problems of heart condition, poor vision, diabetes, asthma, and overweight have a positive effect on health-related behavior following participation in the CC program. That indicates that people with these health problems strive to improve their health and

receiving information from the CC program helps them to achieve their goals. These findings coincide with prior research literature. Cohen-Mansfield et al. (2003) and Schutzer and Graves (2004) indicated that barriers to exercise can serve as positive motivators to be physically active. For example, "deteriorating health, which can reduce an older adult's ability to exercise, was also frequently cited as a motivator for increasing physical activity" (Schutzer & Graves, p. 1059). One direction for future research can be to investigate the influence of the CC program on health-related behavior as a function of the severity of health problems.

The results reported here demonstrate that learning new nutrition information by reading the CC newsletter significantly influences subsequent health-related behaviors. However, the health bahaviors of eating healthy food, taking calcium and vitamin D supplements, and being physically active were not affected .

Comparison of the results for Group 1 (participants who read the CC newsletter and participated in nutrition education) and Group 2 (participants who only read or had access to the newsletter revealed that the effect of Learned Behavior on Self-Motivated Behavior is stronger in Group 1 than in Group 2. This result can be explained by the differences in the intensity of program impact between the two groups

Structural Equation Models for the 2009 data demonstrated that the information received by CC program participants positively influenced their lifestyles and subsequent health-related behaviors. Problems with heart and poor vision positively influenced health-related behavior of the respondents. Increasing age negatively influenced the Life Styles of the respondents before their participation in the CC program. Increasing age also negatively influenced the health-related behaviors of the respondents after their participation in the CC program. However, increasing age does not have a significant influence on the Life Styles of the respondents after their participation in the CC program. This result can be interpreted as stating that participation in the CC program mitigated the negative effect of age on Life Styles.

The results of the 2011 dataset demonstrate that participation in the CC program significantly improves health-related behaviors. Increasing age significantly reduces participation in the CC program, and reduces learning of the content of the materials provided by the program. Nutrition educators improve participation in the CC program and improve learning the materials provided by the program.

References

Arterburn, D.E., Crane, P.K., & Sullivan, S.D. (2004). The coming epidemic of obesity in elderly Americans. *Journal of the American Geriatric Society, 52*(11), 1907-1912.

Cohen-Mansfield, J., Marx, M.S., & Guralnik, J.M. (2003). Motivators and barriers to exercise in an older community-dwelling population. *Journal of Aging and Physical Activity, 11,* 242-253.

Drewnovski, A., & Specter, S.E. (2004). Poverty and obesity: The role of energy density and energy costs." *The American Journal of Clinical Nutrition, 79,* 6-16.

Flegal, K.M., Carroll, M.D., Ogden, C.L., & Curtin, L.R. (2010). Prevalence and trends in obesity among US adults, 1999-2008. *The Journal of the American Medical Association, 303*(3), 235-241.

Glanz, K., Rimer, B.K., & Lewis, F.M. (2002). *Health behavior and health education: Theory, research, and practice.* San Francisco, CA: Jossey-Bass.

Gove, W.R., Ortega, S.T., & Style, C.B. (1989). The maturational and role perspectives on aging and self through the adult years: An empirical evaluation. *The American Journal of Sociology, 94*, 1117-1145.

Quesenberry, C.P., Jr,, Caan, B., & Jacobson, A. (1998). Obesity, health service use, and health care costs among members of a health maintenance organization. *Archives of Internal Medicine, 158*, 466-472.

Schutzer, K.A., & Graves, B.S. (2004). Barriers and motivations to exercise in older adults. *Preventive Medicine, 39*(5), 1056-1061.

World Health Organization. (2012, May). Obesity and overweight: Fact sheet N^{o} 311. Available at http://www.who.int/mediacentre/factsheets/fs311/en/index.html.

Ziegelmann, J.P., & Lipke, S. (2007). Use of selection, optimization, and compensation strategies in health self-regulation: Interplay with resources and successful development. Journal of Aging and Health, 19(3), 500-518.