Current Research

Meal Programs Improve Nutritional Risk: A Longitudinal Analysis of Community-Living Seniors

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ABSTRACT

Objective To determine the independent association of meal programs (eg, Meals On Wheels and other meal programs with a social component) and shopping help on seniors' nutritional risk.

Design Cohort design. Baseline data were collected with an in-person interview and subjects were followed up for 18 months via telephone interview.

Subjects/setting Cognitively well, vulnerable (ie, required informal or formal supports for activities of daily living) seniors were recruited through community service agencies in southwestern Ontario, Canada. Three hundred sixty-seven seniors participated in baseline interviews and 263 completed data collection at 18-month follow-up; 70% participated in meal programs at baseline.

Main outcome measures The 15-item Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN) questionnaire identified nutritional risk at 18 months.

Statistical analyses performed Descriptive and bivariate analyses were performed and significant associations ($P<0.05$) used to build the full multiple linear regression model. Meal and shopping variables were forced into the model as predictors of follow-up SCREEN questionnaire scores.

Results Meals On Wheels use was independently associated with higher SCREEN questionnaire scores (ie, less risk), as was higher income. Baseline SCREEN questionnaire scores also strongly and positively predicted follow-up scores. Self-reported depression at baseline was associated with lower scores at follow-up. Although use of programs at baseline was associated with decreased risk, if participants experienced increased use of the program (eg, more meals) during the follow-up period this was associated with lower scores, or increased risk.

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Conclusions Meal programs can improve or maintain nutritional risk for vulnerable seniors. Increased use of these programs over time may indicate a senior's declining status. Seniors who are in need of informal or formal supports for food shopping or preparation should be encouraged to participate in meal programs as a means of maintaining or improving their nutrition.
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Nutritional risk, defined as the presence of risk factors that can lead to impaired nutrition states (1,2), is relatively common in community-living seniors (3-6). Risk factors for poor nutrition are multifactorial and include low incomes and education; poor dentition, vision, and hearing; isolation and inadequate informal support; difficulty completing grocery shopping and cooking tasks; polypharmacy, comorbidity, and pain; and depression and poor cognition (7-9). Nutritional risk can lead to poor dietary intake and impaired health (10-13).

It is believed that informal and formal supports for grocery shopping and cooking may help at-risk seniors achieve adequate nutrition. Meal programs such as Meals On Wheels and congregate dining provide a hot meal to a senior in his or her own home or in a social setting (13). Although longitudinal research demonstrating improved nutrition is limited for these programs (14,15), cross-sectional studies have demonstrated better food intakes for participants compared with nonparticipants (16,17). Specifically, the National Evaluation of the Elderly Nutrition Program 1993-1995, conducted by Mathematica Policy Research for the US Department of Health and Human Services (18), found that meal program use resulted in average intakes for most nutrients that exceeded one third of the Recommended Dietary Allowance. Participants in congregate dining had statistically significant increased intake of 16 nutrients compared with nonparticipants and Meals On Wheels participants had increased intakes of 12 nutrients compared with nonusers (18). However, little is known about the effects of discontinuing or decreasing meal-based services in vulnerable seniors. Reports suggest that seniors discontinue services due to their improved condition and belief that there is no longer a need (14) or, alternatively, due to deteriorating health (15). Research demonstrating improvements in food intake when an informal or formal caregiver provides grocery shopping help is also rare (19,20).

The purposes of our analyses were to determine the

independent effect of formal and informal supports for meals and shopping on nutritional risk in seniors, and to determine if frequency or change in the amount of help provided for meals or shopping are independently associated with this nutritional risk. The hypothesis was that meal programs and shopping use would result in less nutritional risk over time.

METHODS
Subjects included in this cohort study (18-month follow-up) were vulnerable, community-living seniors. Vulnerability was defined as a senior who required informal or formal supports for activities of daily living (eg, grocery shopping, transportation, cooking, or self-care) to remain in the community. Seniors were recruited from agencies providing services to the elderly (eg, home care agencies, supportive housing units, Meals On Wheels, and congregate dining programs) in southwestern Ontario, Canada. Details on recruitment and sample collection have been previously reported (6,21). To be eligible, participants had to require help for at least one activity of daily living, have adequate cognition to complete the consent form and study procedure, and speak English. Of the 624 seniors who volunteered for the study, 397 were eligible to participate. Of these original 397 participants who signed the consent form, 367 (93% of eligible) completed the baseline interview (drop-outs post consent were due to illness [n=11], death [n=2], or deciding that the study was too complex [n=17]).

The dependent variable was nutritional risk at 18-month follow-up. The interviewer-administered version of the Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN) questionnaire (22) was used to determine nutrition risk. The SCREEN tool is a valid and reliable 15-item questionnaire with scores ranging from 0 to 60, with higher scores indicating less risk. Risk factors included on this index are weight change (loss or gain, and amount); frequency of eating and avoidance of foods; intake of fruits and vegetables, meat and alternatives, milk products, and fluid; difficulties with swallowing, chewing, preparing meals, and grocery shopping; eating alone; poor appetite; use of meal replacements; and perception of adequacy of finances for food purchasing.

Baseline Interview Process
Five interviewers administered a structured questionnaire (108 questions) in the seniors' homes. Question items were chosen from standard interviewer-administered survey schedules like Statistics Canada and details on the data collection have been reported previously (21,23). Independent variables for these analyses were use of meal program services (Meals On Wheels or meals with socialization [day programs, congregate dining, or supportive housing with dining]), frequency (daily/less frequent) of formal support for meals, any family assistance with meals and who provided this assistance, help with grocery shopping (family or agency), and change in help provided during the 18-month period for meals or shopping (decrease, no change, or increase). Covariates chosen for these analyses were based on prior research and identified to be associated with the dependent variable (nutritional risk): demographics, number of reported health problems and medications, current perceived health status compared with others their own age (excellent to poor), smoking and alcohol use, vision and hearing (excellent to poor), self-reported frequency of depression (never to all of the time), satisfaction with life as a whole (very satisfied to very unsatisfied), income, and education (24,25).

Follow-Up Interviews
Telephone follow-up (every 3 months) was used to collect outcome data and seniors self-reported changes in meal program use and help with grocery shopping. A second SCREEN questionnaire at the study end date (ie, 18 months after the baseline interview) was telephone administered if the senior was available for this data collection. Of the original 367 who completed the baseline interview, 263 completed the 18-month follow-up. Losses to follow-up included 46 subjects who were institutionalized, 27 subjects who died, 11 drop outs during the 18-month period, and 20 subjects who refused or were cognitively unable to complete a second questionnaire at follow-up. Participants who dropped out during the study period were no different from follow-up participants. Those who died were more likely to be men (χ^2=16.1, P<0.000) and live with others (χ^2=5.2, P<0.02); nutritional risk and age were independently associated with death (21). Those who were institutionalized were more likely to be older (82±7.7 vs 78.9±7.9 years, P<0.05), be functionally impaired (17.4±4.7 vs 20.7±20.7 on a 28-point scale of activities of daily living, P<0.001), and have cognitive difficulties (41.3% vs 27.4%, P<0.05) than those who were available for follow-up.

Statistical Analyses
Descriptive and bivariate analyses were performed. Descriptive analyses included proportion of participants receiving informal support from different family members and the sharing of help among informal and formal providers. Bivariate comparisons were made between independent or covariate variables and the dependent variables, high nutritional risk (questionnaire score ≤45 at follow-up) and questionnaire score change (18-month follow-up score minus baseline score).

The primary hypothesis was that meal programs and shopping help would promote better nutrition status and thus prevent declines in SCREEN questionnaire scores (ie, increased risk) over time. Multiple linear regression analyses were used to test this hypothesis and meal and shopping variables were forced into the model. Informal providers of meals were amalgamated for analyses due to small proportions and overlap in providing care. Covariates for inclusion in the full model were selected based on significant bivariate associations with high nutritional risk at follow-up (Table 1). Colinearity was assessed and variables eliminated from the model based on lack of significance and violating colinearity specifications (ie, sex, total number of medications, and perceived health). SPSS (version 12.2, 2004, SPSS Inc, Chicago, IL) was used for all analyses. Ethical review for this study was

Table 1. Description of sample of vulnerable, community-living seniors (n=263) and comparisons by high nutritional risk status and mean change in Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN) questionnaire scores

| Independent variable | Total Sample | | High nutritional risk at follow-up (%)[a] | Mean change in SCREEN score[b] |
	%	n		
Meal program use				
Meals On Wheels	28.1	74	29.7	2.03±0.63
Meals with socialization	42.2	111	33.3	0.56±0.60
No meal program	29.7	78	42.3	−0.06±0.60
Unpaid meal help				
Daily	10.3	27	11.1	1.26±1.34
Weekly	9.1	24	29.2	1.8±1.3
Paid meal help				
Daily	20.9	55	27.3	1.6±0.73
Wants more help with meals (baseline)	9.9	26	39.3	3.96±1.3
Change in help for meals				
Decrease	23.2	61	26.2	2.92±0.75
No change	70.7	186	37.6	0.09±0.42
Increase	6.1	16	37.5	0.75±1.19**
Shopping				
Others help	60.3	158	37.3	0.61±0.63
Does alone	39.7	104	30.8	1.21±0.44
Wants more help with shopping (baseline)	11	29	50	3.3±1.21
Change in help for shopping				
Decrease	6.8	18	50	0.89±1.8
No change	89	234	35	0.64±0.38
Increase	4.2	11	9.1	3.81±1.1
Baseline nutritional risk				
High risk (SCREEN score ≤45)	41.4	109	56.9	3.57±0.60
Moderate risk (score 46–49)	25.5	67	31.3	0.77±0.55
Low risk (score ≥50)	33.1	87	10.3**	−2.7±0.44**
Sex				
Female	76.4	201	38.8	0.75±0.42
Male	23.6	62	22.6*	0.90±0.72
Living situation				
Lives with others	23.6	62	17.7	1.7±0.77
Lives alone	76.4	201	40.3**	0.51±0.41
Income				
<$20,000/y	68	151	42.4	0.48±0.47
≥$20,000/y	32	71	16.9**	1.4±0.66
Education				
Less than high school	52.1	137	41.6	0.55±0.51
Graduated high school	47.9	126	27.8*	1.03±0.51
Perceived health				
Fair/poor	43	113	46	1.68±0.57
Good/excellent	57	150	26.7**	0.11±0.46
Depression				
Never/rarely	49	129	27.9	0.71±0.51
Sometimes/most of the time	51	134	41.8*	0.87±0.51
Life satisfaction				
Neutral/very dissatisfied	16.3	43	55.8	2.39±1.02
Satisfied/very satisfied	83.7	220	30.9*	0.47±0.37*
Vision				
Fair/poor	41.4	109	45	1.49±0.56
Good/excellent	58.6	154	27.9*	0.29±0.47
Hearing				
Fair/poor	32.3	85	40	1.40±0.62
Good/excellent	67.7	178	32.6	0.49±0.44

(continued)

Table 1. Description of sample of vulnerable, community-living seniors (n=263) and comparisons by high nutritional risk status and mean change in Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN) questionnaire scores (continued)

| Independent variable | Total Sample | | High nutritional risk at follow-up (%)[a] | Mean change in SCREEN score[b] |
	%	n		
Smoking				
No	85.9	226	34.5	0.94±0.39
Yes	14.1	37	37.8	−0.14±0.85
Alcohol intake				
<1/week	74.9	197	35	0.85±0.43
1/week or more	25.1	66	34.8	0.29±0.65

	Not at high risk (n=171) mean±SEM[c]	At high risk (n=92) mean±SEM	Correlation with SCREEN change score (Spearman's ρ)
Age (y)	78.8±0.61	78.7±0.86	−0.11
Total No. of medical conditions	5.15±0.19	6.4±0.28**	0.09
Total No. of medications	5.39±0.3	6.53±0.38*	−0.01
Total function score[d]	21.0±0.4	20.6±0.45	−0.04

[a]High nutritional risk defined as SCREEN scores at follow-up ≤45/60.
[b]Mean change in SCREEN score based on 18-month follow-up SCREEN score minus baseline SCREEN score.
[c]SEM=standard error of the mean.
[d]Higher score=more independent.
*$P<0.05$.
**$P<0.001$.

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RESULTS

Two hundred sixty-three participants completed the SCREEN questionnaire at the 18-month follow-up; 76% were women who lived alone and the average age was 78.7±8.0 years. More than two thirds had incomes <$20,000 at baseline. Almost one third received Meals On Wheels (28%) and 42.2% participated in meals provided in a social setting. About 10% reported needing more help with meal preparation or grocery shopping at baseline. Approximately one third experienced changes in meal assistance during the follow-up period, with 23.2% having a decrease in meal help and 6% an increase. Fewer seniors experienced changes in shopping help; 6.8% experienced declines and 4.2% had increases in assistance. The mean SCREEN questionnaire score at follow-up was 46.9±5.7, indicating a large proportion (41%) could be considered to be at high nutritional risk (score <45) at follow-up. On average, participants experienced a less than one unit change on this 60-point scale with the mean change in questionnaire scores (18 months minus baseline) being 0.79±5.9. However, the standard deviation indicates a wide variation in this change score among participants. Additional descriptive data are provided in Table 1.

Comparisons are provided in Table 1 for those identified being at high nutritional risk at follow-up by independent and covariate variables. The mean change in

SCREEN questionnaire scores by independent and covariate variable categories was also calculated. Although not statistically significant, trends suggest that those receiving formal support and frequent (daily) informal support for meals were less likely to be at high nutritional risk at follow-up. Those who experienced a decrease in meal help during the 18-month period had higher scores at follow-up (ie, positive change score), whereas those experiencing no change or an increased provision of meal assistance had on average a less than one unit change in their score. Shopping help was not associated with the dependent variables in bivariate analyses. As expected, those who were at high risk or moderate risk at baseline were more likely to be at high nutritional risk (56.3% and 31.3%, respectively) at follow-up. Participants at baseline who were high risk on average improved their SCREEN questionnaire scores at follow-up and those at low risk at baseline on average experienced a decrease in their score at follow-up.

Women, those living alone, with low income, reporting low education, fair/poor perceived health, depression, dissatisfaction with life as a whole, and fair/poor vision also were more likely to be at high nutritional risk at follow-up. Those at high nutritional risk also used more medications and had more medical problems than those who were not at high nutritional risk.

Table 2 presents the overlap of providers assisting with meal preparation and shopping and frequency of help for meals. Due to recruitment methods, almost three quarters of participants received meal support from an agency and this assistance was evenly distributed among those

Table 2. Description of providers of assistance with meals and shopping for vulnerable, community-living seniors by frequency of help and overlap with other providers[a]

Provider	Meal Help				Shopping help
	Total	Daily	Weekly	<Weekly	
Spouse	7.6% (n=20)	n=19	n=1	n=0	10.6% (n=28)
+ Daughter	n=0				n=1
+ Son	n=0				n=0
+ Other relative	n=1				n=1
+ Agency	n=8				n=0
Daughter	6.5% (n=17)	n=6	n=10	n=1	16% (n=42)
+ Son	n=2				n=6
+ Other relative	n=0				n=2
+ Agency	n=7				n=0
Son	3.4% (n=9)	n=0	n=8	n=1	11% (n=29)
+ Other relative	n=1				n=2
+ Agency	n=6				n=1
Other relative	5.2% (n=11)	n=3	n=6	n=2	13.3% (n=35)
+ Agency	n=6				n=4
Agency	70.3% (n=185)	n=55	n=66	n=64	14.8% (n=39)

[a]Primary provider and overlap with other helper is provided. For example, 7.6% of participants received meal help from their spouse. However, less than half (9/20) of these spouses were assisted by others and their primary overlap was with agencies (n=8).

receiving daily, weekly, or less-than-weekly support. Spouses were the most common informal providers of help with meals and shopping; meal help was predominately provided on a daily basis. Few spouses shared meal or shopping help with other family members, although almost 50% shared meal provision with an agency. Daughters were more involved in meal assistance than other relatives (outside of spouses) and were the most common providers of shopping help (16%). More daughters provided help with meals on a weekly basis than on a daily basis. About 50% of daughters shared meal assistance with other relatives or an agency; however, they infrequently shared shopping help with others (n=8 out of 42). Almost all sons who provided help with meals shared in this assistance with others and were involved primarily on a weekly basis. As with daughters, if sons were helping with grocery shopping, they were typically the sole provider. Other relatives were more common providers of assistance than sons, but tended to share meal assistance with others, and specifically agencies. They did not share shopping assistance with agencies.

Table 3 presents the regression model predicting 18-month SCREEN questionnaire score. The coefficient represents the change in the value of the score consistent with the presence of the independent variable or covariate (ie, those participants receiving Meals On Wheels at baseline had a 1.6-point higher questionnaire score at 18-month follow-up than those who did not participate in these meal programs). If the 95% confidence interval for the coefficient spans zero (ie, lower bound below zero), this indicates lack of statistical significance. As expected, baseline SCREEN questionnaire scores were highly associated with the 18-month follow-up scores. Those who participated in Meals On Wheels or meals with socialization at baseline also had higher follow-up scores than those who were not participants in these meal programs

Table 3. Regression model predicting 18-month Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN) questionnaire scores of vulnerable, community-living seniors (n=263)[a]

Variable	β	t	P	95% Confidence interval
Baseline SCREEN score	.41	7.92	0.000	(0.31, 0.52)
Meals On Wheels	1.62	2.00	0.04	(0.02, 3.23)
Meals with socialization	1.26	1.69	0.09	(−0.21, 2.72)
Agency provides meals daily	.13	0.17	0.86	(−1.42, 1.69)
Family helps with meals	1.01	1.14	0.26	(−0.74, 2.76)
Change in help with meals (increase, none, decrease)	−1.70	−2.77	0.006	(−2.91, −0.49)
Family helps with shopping	−1.03	−1.52	0.13	(−2.36, 0.31)
Agency helps with shopping	.51	0.58	0.56	(−1.21, 2.23)
Change in help with shopping (increase, none, decrease)	1.42	1.59	0.11	(−0.34, 3.19)
Lives alone	−1.14	−1.33	0.19	(−2.83, 0.55)
Depressed (sometimes-always)	−1.23	−1.98	0.05	(−2.45, −0.003)
Income (≥$20,000/y+)	1.71	2.41	0.01	(0.31, 3.10)
No. medical conditions	−.20	−1.64	0.10	(−0.45, 0.04)

[a]Full model adjusted for baseline SCREEN score, living situation, income, education, depression, number of medical conditions, vision, and life satisfaction. Sex, number of medications, and perceived health were not included in the full model due to multicollinearity. Adjusted R^2=0.39, f=11.8, P=0.000, degrees of freedom=13.

at baseline, although only participation in Meals On Wheels was significant. Those who experienced an increase in meal help during the follow-up period still had lower questionnaire scores at follow-up, suggesting that increased meal help was in response to the senior's deteriorating health condition and nutritional risk level. Other independent variables were not statistically significant. Significant covariates included income and depression; those with baseline incomes above $20,000 had higher SCREEN questionnaire scores at follow-up and those self-reporting depressive feelings at baseline had lower scores, or more nutritional risk, at follow-up. The final model explained almost 40% of the variance in 18-month questionnaire scores.

DISCUSSION

As with many seniors who use community-based services to maintain their independence, a high proportion of our seniors were at high nutritional risk (6). In previous analyses with these data, nutritional risk at baseline was found to predict mortality and health-related quality of life (21,23); thus, it is extremely important to identify how nutritional risk can be ameliorated among these vulnerable seniors. This analysis demonstrates that formal meal programs do prevent further declines in nutritional risk, as participation was significantly and independently associated with higher SCREEN questionnaire scores at follow-up. However, increased use of meal help, regardless of provider, is significantly associated with lower questionnaire follow-up scores, or increased risk. It is hypothesized that these seniors were on a declining trajectory and increased meal help was provided in a response to this need.

Previous work has demonstrated better food intake in participants of meal programs (16,17), but research with Meals On Wheels participants has shown marginal statistical significance in change using standardized instruments (14,26). This is the first report to determine a statistically significant change in nutritional risk (using a valid index) with participation in formal meal programs while also considering frequency of meal assistance, informal assistance, and change in assistance over time. In our analysis, frequency of formal meal assistance was limited to daily or less frequent assistance. Although not significant in this analysis, previous work supports frequent provision of meals from a formal agency as a means for improving food intake (17). These analyses also extend previous qualitative work, which suggests that seniors decrease their meal program use over time due to feeling better, or believing that the service was no longer needed (14). In this sample 23% experienced a decrease in their meal help during the follow-up and had higher SCREEN questionnaire scores (ie, less risk) at follow-up.

As demonstrated in previous research, spouses and daughters are typically the providers of informal help (27,28). Although meal assistance from informal providers was not significantly associated with nutritional risk in these analyses, previous research supports the benefit of informal providers or living with others on the dietary intake of older adults (29). Certainly living alone and not having informal supports are part of the concept of nutritional risk (24). Lack of an independent association in this analysis may be the result of inclusion of highly vulnerable seniors where the majority (70%) used formal meal programs. The inclusion of highly vulnerable participants may also explain the lack of association between informal or formal assistance with shopping and nutritional risk. Assistance with shopping typically occurs before the need for assistance with meal preparation arises. It is recommended that to determine the benefit of informal providers for food-related activities and formal providers for shopping, participants need to be less vulnerable and not involved in formal meal programs.

Nutritional risk screening has been advocated as an essential component of formal meal programs (7). Our analysis suggests that the measurement of nutritional risk over time with easy-to-use, reliable, and valid indexes may be helpful for evaluation purposes. In addition, screening could help seniors become aware of their nutritional risk and may enhance their participation in meal programs (15).

This study is not without limitations. The follow-up SCREEN questionnaire was completed over the telephone with one interviewer, compared with the baseline with five interviewers, which may influence reliability of the instrument. To overcome this limitation, the multivariate analysis used the follow-up score as the dependent variable rather than the change in score from baseline to follow-up. Changes in meal and shopping help provided during the 18-month follow-up period were collected solely via telephone interviews with participants. These data were not confirmed, due to privacy and confidentiality concerns. Finally, this sample is potentially biased because participants were volunteers who were cognitively well and had survived for 18 months, despite being vulnerable.

CONCLUSIONS

Our analyses indicate that formal meal programs can prevent further declines in nutritional risk as measured by the SCREEN questionnaire. However, increased use of the programs over time suggests declining status of the senior and discontinued use is associated with better nutrition. Meal assistance by informal providers and shopping help appear to be of little importance in preventing declines in nutrition for these highly vulnerable seniors who received assistance with meals. Meal programs, whether they are home-delivered or congregate, are a valuable resource for vulnerable community-living seniors. These programs have the potential to improve or maintain the nutritional status of seniors and prevent health and quality of life declines. Seniors should be encouraged to participate in these programs and communities and providers should continue to develop these programs so that they meet the expanding needs and preferences of this population.

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