ABSTRACT

The purpose of this survey was to estimate the prevalence of nutritional risk among a group of community-dwelling older persons on Prince Edward Island, aged 70 years and over, and to examine the relationships between health-related factors and nutritional risk. Subjects (n=215) were interviewed as part of the 1996 Canadian Study of Health and Aging. The prevalence of nutritional risk, as measured by the DETERMINE checklist, in PEI seniors was 37.1% (95% CI=36.3, 37.9). The prevalence was estimated at 47% after adjusting for the sensitivity and specificity of the checklist. Only pain was a significant predictor of the presence or absence of nutritional risk (logistic regression, $p=0.05$). The only predictor to discriminate between the three categories of no nutritional risk, moderate risk, and high risk was depression (Kruskal-Wallis, $p=0.035$). Several limitations were identified with the use of the DETERMINE checklist.

ABRÉGÉ

L'objectif de ce sondage était d'estimer la prévalence des risques associés à la nutrition chez un groupe de personnes âgées de 70 ans et plus qui résident dans la communauté, à l'Île-du-Prince-Édouard, et d'examiner le lien qui existe entre certains facteurs de santé et les risques associés à la nutrition. Les sujets (n=215) ont été questionnés comme partie de l'Étude sur la santé et le vieillissement au Canada. La prévalence des risques associés à la nutrition chez les personnes âgées de l'Î.-P.-É., telle que mesurée à l'aide de la liste de contrôle DETERMINE, était de 37,1 % (95 % IC=36,3 - 37,9). Seule la douleur a été un prédicteur important de la présence ou de l'absence de risques associés à la nutrition (régression logistique, $p=0,05$). Le seul prédicteur permettant une discrimination entre les trois catégories (pas de risques associés à la nutrition, risques modérés et risques élevés) était la dépression (test de Kruskal-Wallis, $p=0,035$). On a dénombré plusieurs restrictions associées à l'usage de la liste de contrôle DETERMINE.

Screening for Nutritional Risk Among Community-dwelling Elderly on Prince Edward Island

Debbie L. MacLellan, MSc,¹ Linda D. Van Til, DVM, MSc²

Projected increases in the number and proportion of older Canadians through the year 2021 have implications for both the family and our society as a whole, particularly with respect to health care.¹ Older Canadians are more likely to suffer from chronic conditions, to be limited in their daily activities, and to have illnesses that are serious enough to require hospitalization.² It has been estimated that the 11% of Canadians over 65 years account for 30 to 40% of medical and nursing expenses.³

Nutritional well-being is an integral component of the health, independence, and quality of life of older individuals.^{3,4} Estimates indicate that up to 85% of non-institutionalized older persons have one or more chronic conditions that could improve with proper nutrition and that up to 50% have clinically identifiable problems that require nutrition intervention.^{3,5} Nutritional risk has been found to be the most important predictor of total number of visits by older Americans to the hospital, hospital emergency room, and physicians.⁶ Identifying those at risk for poor nutritional status through nutrition screening is the first step towards developing intervention programs to prevent, control, or improve nutrition-related conditions, thus reducing associated health costs.

It is difficult to determine the prevalence of nutritional risk among the elderly due to differences in assessment methods, as well

as the varying degrees of severity of risk.⁷ However, using assessments based on factors associated with malnutrition, 40 to 59% of community-dwelling elderly appear to be at risk of becoming malnourished.^{6,8-10}

Recognizing that screening for risk factors holds the most promise for the early identification of those individuals at risk for poor nutritional status, the American Dietetic Association, the American Academy of Family Physicians and the National Council on Aging in the United States, formed the Nutrition Screening Initiative (NSI).⁹ The NSI developed strategies for detecting nutritional risk among older people in different settings,¹¹⁻¹³ including the development of a 10-question checklist, DETERMINE Your Nutritional Health. A score of 0-2 on the checklist indicates good nutrition status; 3-5 indicates moderate nutrition risk; and 6 or more indicates high nutrition risk.⁵ The NSI checklist has been criticized for poor test characteristics, retaining items that were not significantly associated with outcomes of interest, and using outcomes that are neither well-defined, pathologic states, nor have proven treatments.¹⁴ However, it has been used by several researchers to begin to identify the prevalence of nutritional risk among noninstitutionalized elderly because it is a brief, easily scored instrument that does not rely on anthropometric or biochemical measurements which can be difficult to do in a home setting.^{15,16}

The purpose of our survey was to describe responses to the DETERMINE checklist and the resulting nutritional risk level of community-dwelling older persons on Prince Edward Island (PEI), aged 70 years and over. An additional purpose was

1. Department of Family and Nutritional Sciences, University of Prince Edward Island, Charlottetown, PEI

2. Epidemiology Unit, Department of Health and Social Services, Charlottetown, PEI

Correspondence and reprint requests: D. MacLellan, Department of Family and Nutritional Sciences, University of Prince Edward Island, 550 University Ave, Charlottetown, PEI, C1A 4P3, Tel: 902-566-0521, Fax: 902-628-4367, E-mail: maclellan@upeil.ca

to determine whether demographics and selected health-related factors were related to DETERMINE checklist results.

METHODS

The Canadian Study of Health and Aging (CSHA) is a longitudinal study designed to estimate the prevalence of dementia among elderly Canadians. The first phase of this study (CSHA-I) was conducted in 1991 and has been described elsewhere.¹⁷ Data for the CSHA-I were collected in urban and rural areas of Prince Edward Island through a random, age-stratified sample of people aged 65 years and older. All subjects (n=453) who participated in the CSHA-I were followed-up five years later for CSHA-II in 1996. Of these, 112 (25%) were deceased, 23 (5%) were institutionalized and 45 (10%) were too ill to complete the study requirements. Thus, 273 subjects were eligible for participation in the CSHA-II. Of these, 43 (16%) refused to participate and 15 (5%) could not be reached. The final sample consisted of 215 subjects (68 males, 147 females) representing a 79% response rate.

Subjects were interviewed in their homes by a trained research assistant. The community screening interview included questions about our outcome of interest which was nutritional risk (DETERMINE checklist) and potential predictors of nutritional risk: age, sex, social support, chronic health problems in the year preceding the interview, self-rated health, adequacy of income, pain in the month preceding the interview, psychological well-being (Ryff Scale¹⁸), and depression (SF36 Mental Health Dimension¹⁹).

Statistical analysis was carried out using STATA (Stata Corporation) software. Frequency distributions were generated for health and demographic variables, nutrition risk scores, and the item responses to the DETERMINE checklist. Subjects were grouped into two age strata (70-79 and 80+ years). For these two age groups, differences in the prevalence of categorical variables such as disease conditions or marital status were tested using an overall Chi-square. If this revealed significant differences, Chi-square was subdivided and

TABLE I
Demographic and Health-related Characteristics of Community-dwelling Elderly

Characteristic	Age Stratum 70-79yr (n=112)	Age Stratum 80+ yr (n=103)
Sex		
Male	38%*	28%*
Female	62%*	72%*
Marital status		
Never married	6%	10%
Married	59%*	31%*
Divorced/Separated	3%	2%
Widowed	32%*	57%*
Living situation		
Alone	28%*	50%*
Housebound	3%*	15%*
Pain	20%	23%
Perceived health		
Very good/Pretty good	82%	83%
Not too good/Very poor	18%	17%
Chronic health problems		
Arthritis/rheumatism	85%	82%
Hypertension	55%	60%
Heart	53%*	37%*
Stomach	27%	30%
Chest	25%	28%
Poor eyesight	21%	21%
Poor eyesight	25%	36%
Income inadequate for needs	9%	6%
Depression (SF36 Mental Health Score)	83/100 Avg score	81/100 Avg score
Psychological Well Being (Ryff Score)	70/100 Avg score	71/100 Avg score

* significant difference between age strata, $p < 0.05$

the probability (p) values adjusted for multiple comparisons using Bonferroni inequality. Differences in depression and psychological health scores (measured on a continuous scale from 0 to 100) between two age groups could not be analyzed using the t-test, since the scores were not normally distributed. These associations were analyzed using the more conservative Mann-Whitney test. For the logistic regression, nutritional risk was grouped into two categories (no risk and at nutritional risk). Associations between nutrition risk (three categories) and mental health scores could not be analyzed using analysis of variance, since the scores were not normally distributed. This association was analyzed using the more conservative Kruskal-Wallis test of significance (Glantz, 1987). For all tests of significance, a p value of less than or equal to 0.05 was considered the minimum level of significance.

RESULTS

Study population

The population of seniors in this study are elderly and live in the community. In order to allow stratification of the results by age group, seniors 80 years and over were oversampled. In the study sample, 48% were 80 years or more, compared to 37% of PEI seniors. Males in this study are slightly undersampled with 32% males, compared to 40% of PEI seniors.

Selected demographic and health-related characteristics are summarized in Table I. None of the health characteristics showed a significant difference between sexes ($p > 0.05$). The only health characteristic to show a significant difference between age strata was hypertension. As would be expected, significantly more subjects in the 80+ years age stratum were female, widowed, lived alone and were housebound while significantly more subjects in the 70-79 years age stratum were still married ($p \leq 0.05$). The majority of

Depression and psychological well-being scores for this sample of PEI seniors are shown in Figure 1. Depression was measured using the SF-36 mental health dimension scores, on a scale from 0 (worst health) to 100 (best health). A person with a score of 80 feels calm and happy most of the time, and feels nervous and down only a little of the time.¹⁹ The Ryff scale of psychological well-being was also scaled from 0 (worst health) to 100 (best health). A person with a Ryff score over 80 does not rely on the judgement of others, has a sense of mastery over his environment, accepts the good and bad qualities in herself and others, and feels that life still has exciting challenges.¹⁸ There was no statistically significant difference between the scores of the two age groups (Mann-Whitney, $p=0.166$, $p=0.199$). There was also no difference between the scores of men and women (Mann-Whitney, $p=0.884$, $p=0.376$).

Nutritional risk

The overall prevalence of nutritional risk (according to a DETERMINE score of 3 or greater) in community-dwelling PEI seniors 70 years and older was 37.1% (95% CI=36.3, 37.9), after adjusting for the stratified sample design. Responses to specific areas on the DETERMINE Checklist are shown in Table II. The most common contributions to nutritional risk were: taking three or more medications per day (40%), eating alone (38%), changing food intake due to illness (24%), and eating few raw fruits or vegetables or milk products (23%). Differences in responses due to age were not statistically significant except in regards to ability to shop, cook and/or feed themselves. Significantly more subjects in the 80+ year age stratum responded yes to this question ($p=0.011$).

The distribution of DETERMINE checklist scores is shown in Figure 2. One hundred and thirty-six subjects (63%) had no nutritional risk; 58 (27%) had moderate nutritional risk; and 22 (10%) were at high nutritional risk. Chi-square analysis showed no statistically significant difference in nutritional risk between the two age categories ($p=0.51$). Analysis of nutritional risk, taking into account both age stratum and sex, showed neither as statisti-

TABLE II
Responses to the DETERMINE Checklist[†]

Wt‡ DETERMINE Checklist Questions	Seniors answering YES	
	Age Stratum 70-79yr	Age Stratum 80+ yr
2 I have an illness or condition that made me change the kind and/or amount of food I eat.	21%	28%
3 I eat fewer than 2 meals per day.	1%	3%
2 I eat few raw fruits or vegetables, or milk products.	24%	21%
2 I have 3 or more drinks of beer, liquor or wine almost every day.	1%	2%
2 I have tooth or mouth problems that make it hard for me to eat.	4%	4%
4 I don't always have enough money to buy the food I need.	3%	3%
1 I eat alone most of the time.	32%	44%
1 I take 3 or more different prescribed or over-the-counter drugs a day.	38%	41%
2 Without wanting to, I have lost or gained 10 pounds in the last 6 months.	8%	8%
2 I am not always physically able to shop, cook and/or feed myself.	6%*	17%*

† "Determine Your Nutritional Health" checklist developed by and available from the Nutrition Screening Initiative, 1010 Wisconsin Ave. Washington, DC, 20007.
‡ weight given to each YES answer, for a maximum score of 21.
* significantly different, $p<0.05$

subjects (84%) had at least one chronic health condition, with arthritis or rheumatism most commonly reported (58%).

Most subjects (57%) had not completed high school. One subject had no support

network, 11% had one person they could count on for help and support, and 23% had two persons. The average size of a subject's support network was 4.8 persons, with a median of three.

cally significant predictors, and there was no interaction between age stratum and sex (ANOVA, $p=0.59$).

The relationship between nutritional risk and possible predictors suggested by the literature was examined using logistic regression. The full model was constructed using the dichotomous outcome presence/absence of nutritional risk, and the predictors sex, age stratum, self-rated health, chronic disease, pain, income, depression, and psychological well-being, and interactions. Backward elimination of non-significant terms initially eliminated all interaction terms. The most parsimonious model contained only the predictor pain, with an odds ratio of 2.0 (95% CI=1.0, 4.1). This resulted in a marginal statistically significant difference ($p=0.05$) between the 33.5% prevalence of nutritional risk among persons with no pain, and the 49.0% prevalence of nutritional risk among persons experiencing moderate to severe pain.

However, when nutritional risk was measured as three categories (no risk, moderate, and high risk), pain could not discriminate between moderate and high nutritional risk ($p=0.12$). The only predictor to discriminate between the three categories was depression. The average mental health score for subjects at no risk was 86.2, at moderate risk was 83.0, and at high risk was 78.3 (Kruskal-Wallis, $p=0.035$).

DISCUSSION

The results of this study indicate that 37% of community-dwelling elderly on Prince Edward Island may be at risk for poor nutritional status, using the DETERMINE checklist. These results are lower than other studies of more urban populations that used the same criteria. In Toronto, 45% of Canadian-born seniors were considered at nutritional risk.¹⁰ In New England, 62% of seniors were considered at nutritional risk.⁵

The distribution of reported individual nutritional risk factors in this sample was similar to previously reported findings in that the same four items were identified most frequently as problems.^{10,20-23} However, it is important to recognize that

Figure 2. Distribution of DETERMINE Nutrition Risk Scores for PEI seniors

several problems were encountered with the use of the DETERMINE checklist as a screening tool in this present study. Several questions are not very specific (e.g., I eat few raw fruits or vegetables or milk products) and the negative phrasing of some questions was noted as a problem by the interviewers (e.g., I don't always have enough money to buy the food I need). In addition, respondents found several questions difficult to understand (e.g., when asked if they ate fewer than 2 meals per day, respondents had difficulty deciding what a "meal" consisted of).

The ability of the DETERMINE checklist to detect risk of malnutrition is also an area of concern. Early detection of malnutrition is very important as it is difficult to reverse once it has deteriorated. However, despite the current availability of several nutrition screening instruments, the ideal test, one which has high sensitivity as well as high specificity, has yet to be developed.²⁴ Most screening tools sacrifice specificity to achieve high sensitivity and thus often overestimate the prevalence of nutritional risk. In contrast, the validity study on the DETERMINE checklist, conducted by Posner and co-workers, showed low sensitivity.⁵ For seniors who

reported low nutrient consumption, the checklist identified only 36% as high risk, and 60% as moderate or high nutritional risk. As well, Phillips found no significant correlation between risk as identified by the checklist and risk as detected by dietary inadequacy measured by the 131-question food frequency questionnaire of Willett.²⁵

When the estimated prevalence of nutritional risk in PEI seniors is adjusted for the 60% sensitivity and 60% specificity of the DETERMINE checklist,⁵ the resulting estimate is that 47% of PEI seniors may be at nutritional risk. This result is in the range of findings by other studies that used 24-hour recalls of dietary intake to define nutritional risk. Recommended levels of energy intake were not met by more than 65% of seniors in a Quebec home care program,²⁶ or by 50% of seniors in a Saskatchewan Meals-on-Wheels program.²⁷ Recommended levels of protein intake were not met by more than 50% of the Quebec seniors,²⁶ or by 30% of the Saskatchewan seniors.²⁷

Ideally, screening tools also identify a specific condition that can be prevented or cured before it leads to more serious consequences.²⁴ A recent study by Sahyoun, Jacques, Dallal, and Russell showed that

some, but not all, of the individual questions of a NSI checklist equivalent were significantly associated with mortality and suggested that using the DETERMINE checklist as a screening instrument may ignore some risk factors that could be eliminated or delayed by intervention.²⁸ Payette and co-workers showed that several common risk factors in the general elderly population (financial resources, social isolation, dentition) did not predict dietary intake in a sample of free-living frail elderly. However, vision and stressful events did emerge as independent determinants of dietary adequacy in their study.²⁹ In the present study, pain and depression were the only variables that were significantly different among nutritional risk categories. The state of depression has been found to be associated with decreased appetite and thus a lower food intake, as well as increased reliance on home-delivered meal services.^{30,31} Poor nutrition, resulting from lower food intake, further impairs mental status.³² Changes in marital status, bereavement, increased isolation, decreased income, and declining functional status may all contribute to feelings of loneliness, anxiety, and depression.⁶ These results reinforce that a question relating to mental health status might be a valuable addition to nutrition screening tools.

The DETERMINE checklist was originally produced as an awareness and educational tool and the evidence now seems to indicate that it has limited effectiveness as a nutrition screening tool. Given the complexity inherent in the assessment of nutritional status in the elderly, it may be that the "ideal" screening tool may never be developed. However, the goal of attempting to develop nutritional screens should be pursued. Nutrition screening increases awareness of nutrition-related problems and, when used as an educational instrument, could have a major public health impact on the mortality of community-dwelling elderly people.³³ However, it is important to remember that nutrition screening is only the beginning of an ongoing process. Screening tools are not designed to diagnose malnutrition and thus people identified as being "at risk" for poor nutritional status should be further

evaluated through the use of more extensive nutritional assessment by trained nutrition care specialists.

ACKNOWLEDGEMENTS

This work was supported in part by the National Health Research Development Program of Health Canada through the Canadian Study of Health and Aging. Thanks are due to the CSHA team in Prince Edward Island, and to Dr. M. Brimacombe of UPEI for his assistance in the data analysis.

REFERENCES

1. Statistics Canada. Population Projection for Canada, Provinces and Territories, 1984- 2006 (cat no 91-520). Ottawa, Ontario, 1985.
2. Health Canada Communications and Consultation Directorate. Report on the Health of Canadians. Ottawa, Ontario, 1996.
3. Chandra R, Imbach A, Moore C, et al. Nutrition of the elderly. *Can Med Assoc J* 1991;145:1475-87.
4. Mowe M, Bohmer T. Nutrition problems among home living elderly people may lead to disease and hospitalization. *Nutrition Reviews* 1996;54:S22-S24.
5. Posner BM, Jette AM, Smith KW, Miller DR. Nutrition and health risks in the elderly: The Nutrition Screening Initiative. *Am J Public Health* 1993;83:972-78.
6. Codispoti CL, Bartlett BJ. Food and Nutrition for Life: Malnutrition and Older Americans. US Department of Health and Human Services, Administration on Aging, 1994.
7. Dwyer JT. Screening Older Americans' Nutritional Health: Current Practices and Future Possibilities. Washington, DC: Nutrition Screening Initiative, 1991.
8. Dwyer JT, White J, Ham RJ, et al. Screening older Americans' nutritional health: Future possibilities. *Nutr Today* 1991;26:21-24.
9. Nutrition Screening Initiative. Nutrition Screening I: Toward A Common View, Consensus Conference. Washington, DC: Nutrition Screening Initiative, 1992.
10. City of Toronto Department of Public Health. 1994 Nutrition Survey of Seniors Living Independently in the City of Toronto. Toronto: City of Toronto Department of Public Health, 1995.
11. White JV. Risk factors associated with poor nutritional status in older Americans. In: Report of Nutrition Screening I: Toward a Common View. Washington, DC: Nutrition Screening Initiative, 1991.
12. Lipschitz DA. The development of an approach to nutrition screening for older Americans. In: Report of Nutrition Screening I: Toward a Common View. Washington, DC: Nutrition Screening Initiative, 1991.
13. Ham RJ. Indicators of poor nutritional status in older Americans. In: Report of Nutrition Screening I: Toward a Common View. Washington, DC: Nutrition Screening Initiative, 1991.
14. Rush D. Evaluating the Nutrition Screening Initiative. *Am J Public Health* 1993;83:944-45.
15. Coulston AM, Craig L, Voss AC. Meals-on-wheels applicants are a population at risk for poor nutritional status. *J Am Diet Assoc* 1996;96:570-73.
16. Herndon AS. Using the Nutrition Screening Initiative to survey the nutritional status of clients participating in a home delivered meals program. *J Nutr for the Elderly* 1995;14:15-25.
17. Canadian Study of Health and Aging Working Group. Canadian Study of Health and Aging: Study methods and prevalence of dementia. *Can Med Assoc J* 1994;150:899-913.
18. Ryff CD. Happiness is everything or is it? Explorations on the meaning of psychological well-being. *J Pers Soc Psychol* 1989;57:1069-81.
19. Brazier JE, Harper R, Jones NMB, et al. Validating the SF-36 health survey questionnaire: New outcome measure for primary care. *Br Med J* 1992;305:160-64.
20. Spangler AA, Eigenbrod JS. Field trial affirms value of DETERMINE-ing nutrition-related problems of free-living elderly. *J Am Diet Assoc* 1995;95:489-90.
21. Melnik TA, Helferd SJ, Firmery LA, Wales KR. Screening elderly in the community: The relationship between dietary adequacy and nutritional risk. *J Am Diet Assoc* 1994;94:1425-27.
22. Garofalo JA, Hynak-Hankinson MT. New Jersey's Nutrition Screening Initiative: Activities and results. *J Am Diet Assoc* 1995;95:1422-24.
23. Wilson D, Benedict J. Nevada's elderly: Nutrition screening, risk, and interventions. *Nutr Rev* 1996;54:S45-S47.
24. Reuben DB, Greendale GA, Harrison GG. Nutrition screening in older persons. *J Am Ger Soc* 1995;43:415-25.
25. Phillips BE. Nutrition Assessment of an Older Adult Population in Washoe County, Nevada (thesis). Reno, Nevada: University of Nevada, 1995.
26. Payette H, Gray-Donald K. Risk of malnutrition in an elderly population receiving home care services. *Facts and Research in Gerontology* 1994;Suppl. No. 2:71-85.
27. Lee E, Olson JP, Friel JK. Nutrient intakes of institutionalized and non-institutionalized elderly. *J Can Diet Assoc* 1984;45:234-44.
28. Sahyoun NR, Jacques PF, Dallal GE, Russell RM. Nutrition Screening Initiative checklist may be a better awareness/educational tool than a screening one. *J Am Diet Assoc* 1997;97:760-64.
29. Payette H, Gray-Donald K, Cyr R, Boutier V. Predictors of dietary intake in a functionally dependent elderly population in the community. *Am J Public Health* 1995;85:677-83.
30. Owen R, Kronld M, Csima A. Contribution of consumed home-delivered meals to dietary intake of elderly women. *J Can Diet Assoc* 1992;53:24-29.
31. Kennedy J. The Effect of Acetylsalicylic Acid and Dose, Osteoarthritis and Psychosocial Factors on the Appetite and Energy Intake of Free-living Elderly Persons (thesis). Toronto, Ontario: University of Toronto, 1985.
32. Goodwin JS, Goodwin JM, Garry PJ. Association between nutritional status and cognitive functioning in a healthy elderly population. *JAMA* 1983;249:2917-21.
33. Sahyoun NR, Jacques PF, Russell RR. Evaluating the Nutrition Screening Initiative checklist as a screening and educational tool in an elderly population. *J Am Diet Assoc* 1994;94:A13.

Received: October 14, 1997

Accepted: April 7, 1998