Nutritional Risk Predicts Quality of Life in Elderly Community-Living Canadians

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Background. Although nutrition parameters have been linked to quality of life (QOL), few studies have determined if nutritional risk predicts changes in QOL over time in older adults.

Methods. 367 frail older adults were recruited from 23 service agencies in the community. Baseline interview included nutritional risk as measured by SCREEN (Seniors in the Community: Risk Evaluation for Eating and Nutrition), as well as a wide variety of covariates. Participants were contacted every 3 months for 18 months to determine QOL as measured by three questions from the Behavioral Risk Factor Surveillance System (BRFSS), a general whole-life satisfaction question, and a general change in QOL question. “Good physical health days” from the BRFSS was the focus of bivariate and multivariate analyses, adjusting for influential covariates.

Results. Seniors with high nutritional risk had fewer good physical health days and whole-life satisfaction at each follow-up point compared with those at low risk. In general, participants reported decreases in QOL from baseline, with those in the moderate nutritional risk category most likely to report this change. Nutritional risk predicted change in good physical health days over time. Other important covariates include: gender, number of health conditions, perceived health, and age.

Conclusions. Nutritional risk is an independent predictor of change in health-related QOL. The results also indicate a relationship between nutrition and the more holistic view of QOL. Evaluation studies of interventions for older adults need to include QOL measures as potential outcomes to further demonstrate the benefits of good nutrition.

Latey, there has been a shift in the concept of healthy and successful aging from a focus on quantity or years of life to the quality of those years (1,2). For example, in a recent review (3), Drewnowski and Evans compared the goal of the Healthy People 2000 report, increasing life span, to that of the Healthy People 2010 report, increasing overall well-being and quality of life (QOL). This shift has brought to the forefront that a healthy lifestyle, and specifically food intake and physical activity, are important determinants of QOL and well-being (3,4). Although there is much discussion on what constitutes QOL (5–7) and on assertions that healthy eating is related to this outcome (3,4), there has been relatively little research to support this link (3,4,8).

In the few studies done in this area, objective nutrition parameters have been associated with well-being scales, and the DETERMINE Checklist has been linked to a general measure of QOL (9,10). As there are potentially many mechanisms by which nutrition can influence QOL (7), it is important to determine the extent of this association and whether nutrition should be a target for intervention.

Good nutrition ensures that the body has sufficient nutrients to maintain its function, prevent deficiency and the secondary symptoms of these deficiencies, and ensure that nutrient intake is “in balance” to delay the onset of chronic diseases associated with over-consumption. Good nutrition can therefore promote health and survival even in elderly individuals (11–13). Poor food intake, primarily as a result of decreased dietary energy intake, is common in the older adult (14,15). Although overt undernutrition is believed to be relatively rare (estimated at about 10%) in older community-living adults (16), nutritional risk, which precedes undernutrition, is more common, ranging from 25%–65% depending on the subgroup of elderly people assessed (17–20).

The independent relationship between nutritional risk and health-related QOL has only just been demonstrated in multivariate analyses controlling for a wide variety of covariates (21). As QOL can change over time, this begs the question whether nutrition influences the trajectory of change or if it can be an important predictor of change in QOL over time. The purpose of this analysis was to demonstrate whether, and to what extent, nutritional risk, as measured by a valid and reliable screening tool, is an independent predictor of QOL changes over time in frail community-living seniors.

Methods

Participants

To promote efficiency, frail seniors were recruited from agencies providing services to elderly persons (e.g., home care agencies, Meals-on-Wheels programs) in southwestern Ontario communities. To promote diversity (22) in the sample, 25 agencies were approached and, of these, 23 agencies participated, although some agencies dictated and controlled recruitment strategies to ensure confidentiality. Invited elderly people included: a) a sample of approximately

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900 senior home care clients randomly chosen from the previous year's client lists (letters inviting clients to participate in the study were mailed by providers); b) Meals-on-Wheels clients (provided a letter of information with their delivered meals); c) all residents of selected supportive housing units (letters of invitation were mailed); d) clients at mobile foot-care clinics (staff provided an information letter to clients) who were aged 65 years or older and functionally dependent; e) clients at congregate dining sites and day-care programs (recruited in person by the coordinator); and f) seniors who were part of a peer visiting program (recruited by case-management staff). A total of 3263 individual information letters or invitations for participation were distributed.

To be eligible, participants had to be dependent in at least one instrumental activity of daily living or basic activity of daily living, have adequate cognition to complete the consent form and study procedure, and speak English; 624 seniors volunteered for the study and 395 were eligible to participate. Of the original 395 participants, a small number (n = 28) of seniors did not complete the baseline interview due to illness (n = 11) or deciding that the study was too complex (n = 17); baseline interviews were completed for 367 eligible participants.

Baseline Interview Process

The study protocol included an interview with 1 of 5 trained research assistants, typically in the senior’s home. Interviews were conducted between October 1998 and November 1999. The interview included 108 questions and took on average of 1 hour to complete. Structured, closed-ended questions were chosen from standard interviewer-administered survey schedules such as Statistics Canada (Survey of Veterans Care Needs 1996/1997, Census 1996, Survey on Ageing and Independence 1985, National Population Health Survey 1996), AHEAD (1993), and the Aging in Manitoba Interview Schedule (1996). Covariates specific to this analysis are included in the appendix. Functional ability was assessed with 16 questions based on the Multidimensional Functional Assessment Questionnaire (23).

The interviewer-administered version of SCREEN (Seniors in the Community: Risk Evaluation for Eating and Nutrition) was used to determine nutritional risk (24). This is a valid and reliable 15-item questionnaire with scores ranging from 0 to 60; each item has several possible response options ranging from 0 to 4, with higher scores indicating less risk (24). Compared with a dietitian’s clinical judgment in 128 seniors, SCREEN was found to be sensitive (Se) and specific (Sp); sensitivity was higher at the 49/50 cut-point (Se = 94%, Sp = 32%) than the 45/46 cut-point (Se = 81%, Sp = 55%). Test–retest reliability of the self-administered version has also been demonstrated (r = 0.68, ICC [intraclass correlation coefficient] = 0.57) in 247 members of a seniors center (24). For these analyses, nutritional risk was categorized as either “low” (SCREEN score = 50–60), “moderate” (SCREEN score = 46–49), or “high” (SCREEN score ≤ 45).

Health-related QOL was measured with several indicators. At baseline, a global “whole-life satisfaction” question was used (“How do you feel about your life as a whole?”) with potential options of “very dissatisfied” to “very satisfied.” This question was dichotomized for analysis (“very satisfied” to “neutral” vs “dissatisfied” to “very dissatisfied”). Questions from the Behavioral Risk Factor Surveillance System (BRFSS) were also used at baseline (25). These questions were chosen as they could be administered over the telephone for the follow-up (26): a) “How many days during the previous 30 days was your physical health not good because of injury or illness?”; b) “How many days during the previous 30 days was your mental health not good because of stress, depression, or problems with emotions?”; and c) “How many days during the previous 30 days did your physical or mental health prevent you from performing your usual activities, such as self-care, work or recreation?” Responses were reverse-coded to provide the number of days when physical health, mental health, or activities were not limited (25) and were referred to as “good” physical health days, and so forth (values were truncated at zero if the resulting number of days was negative). The whole-life satisfaction question and these BRFSS questions were also asked at each follow-up. A final general question was asked about the senior’s perception of his or her whole quality of life at each follow-up: “Do you think that your quality of life has changed since you were first interviewed for this study?” (seniors were given a reminder of the date if necessary). If they responded “yes,” they were asked if this was a decrease or an increase in the quality of life that they were experiencing.

Follow-Up Interviews

Telephone follow-up with the participant or, in the event that the senior could not be reached, a family contact, was used to collect outcome data. Participants were phoned every 3 months by the project coordinator until the study end date, i.e., 18 months after their baseline interview. There were 11 dropouts after the baseline data collection. These participants were compared with those who were followed throughout the study period; there were no significant differences in demographic, health, or nutritional risk variables collected at baseline.

Statistical Analyses

Although data were available on several health-related QOL variables, the “good physical health days” variable from the BRFSS was believed to be the variable most readily influenced by nutritional risk, and was therefore the primary focus of analyses. Analyses were also completed on “good mental health days” and the combined measure of “no-bed days” as recommended (25), but will not be presented in detail.

Bivariate analyses were used to compare nutritional risk by mean number of good physical health days at each time point. Repeated measures analysis using the number of good physical health days for each time point (baseline, 3, 6, 9, 12, 15, and 18 months) using PROC MIXED (SAS Institute, Inc., Cary, NC) assessed whether nutritional risk was an independent covariate of QOL over time. The Residual Maximum Likelihood estimation method was used, and the Type III test for fixed effects is presented with estimated least square means for number of good physical health days.
A summary measure, number of good physical health days in 12 months, was also created, by summarizing the answers to this question for the first 12 months of the follow-up period (baseline + 3 months + 6 month + 9 month + 12 month). Although somewhat skewed, residuals were normally distributed and multiple linear regression analyses were conducted using this measure. Significant bivariate associations that did not exhibit collinearity were chosen to demonstrate the independent effect of nutritional risk on number of good physical health days in 12 months.

The general whole-life satisfaction question asked at baseline and at each follow-up point is plotted by nutritional risk to demonstrate the change over time by risk group. Finally, bivariate analyses were completed on the senior’s report of change in QOL from baseline. The proportion of seniors believing that their QOL changed and the proportion who reported that it had decreased are presented for the three nutritional risk groups (low, moderate, high). SPSS (version 10.0; SPSS, Inc., Chicago, IL) and SAS (version 8.0) were used for all data management and statistical analyses.

**RESULTS**

Three hundred sixty-seven seniors completed the baseline assessment. Almost three quarters (73.6%) of respondents were female, and the average age was 79.3 years (SD [standard deviation] 7.9 years; range, 54–100 years). The majority of participants, particularly women, were widowed (58.6% total; 36.1% of men and 66.3% of women) or lived alone (74.1% total; 59.8% men and 79.3% women). Almost half (49.9%) had a high school diploma. Participants on average reported 5.6 health problems, and 46.6% perceived their health to be fair to poor. Twenty-seven of the participants (7.4%) died during the follow-up period. Means ranged from 20.4 to 22.3 (SD 11.1–12.9), although the data were skewed as the medians ranged from 28.5 to 30. The mean “total good physical health days in 12 months” was 262.6 (±107.11), although the median was 307.5. Over half (57%) had fewer than 320 good health days during 12 months.

When low/moderate nutritional risk was compared with high risk for the mean number of good physical health days per 12 months, significant associations were noted (p < .05). The mean and standard deviation for each time point were compared between those at low/moderate nutritional risk and those at high risk and are presented in Table 1. The slight increase in the mean number of good health days noted in the high nutritional risk participants over time was probably related to those seniors leaving the study due to death or institutionalization.

Table 2 presents the seniors’ perception of whether their QOL had changed since baseline. The proportion that reported a change and, of those who changed, reported a decrease, are presented for the three nutritional risk groups. In general, the proportion that reported a change in QOL from baseline increased over time for all nutritional groups, although the greatest change was seen for the moderate nutritional risk group (15.1% at 3 months to 47.8% at 18 months). Of those who reported a change in QOL, more than 50% reported a decrease from baseline, which progressed to approximately 75% by the end of the study follow-up, regardless of nutritional grouping. High-risk seniors who reported a change appeared to have a higher proportion who reported a decrease in QOL at 3 months and consistently throughout the follow-up period, as compared with the other groups.

Table 3 presents the bivariate associations between select covariates and number of good physical health days (dichotomized at 320/321). Associations were in the expected direction for all covariates. Those seniors who reported fewer good physical health days had poorer perceived health, more nutritional risk, more pain, poorer vision, were more likely to be female, had poorer total functional ability, more physician visits, and increased use of medications and reported health conditions.

### Table 1. Average “Good Physical Health Days” by Nutritional Risk Grouping for Each Follow-Up Time Point

<table>
<thead>
<tr>
<th>Period</th>
<th>Low/Moderate Nutritional Risk</th>
<th>High Nutritional Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>24.4 ± 9.7</td>
<td>16.6 ± 13.1</td>
</tr>
<tr>
<td>3 months</td>
<td>22.6 ± 11.5</td>
<td>16.4 ± 12.7</td>
</tr>
<tr>
<td>6 months</td>
<td>21.7 ± 12.4</td>
<td>18.6 ± 13.3</td>
</tr>
<tr>
<td>9 months</td>
<td>23.0 ± 11.2</td>
<td>16.7 ± 13.6</td>
</tr>
<tr>
<td>12 months</td>
<td>22.9 ± 11.0</td>
<td>19.9 ± 12.3</td>
</tr>
<tr>
<td>15 months</td>
<td>24.0 ± 10.2</td>
<td>20.3 ± 12.2</td>
</tr>
<tr>
<td>18 months</td>
<td>25.0 ± 8.8</td>
<td>18.4 ± 13.2</td>
</tr>
</tbody>
</table>

### Table 2. Self-Reported Change in General Quality of Life From Baseline by Nutritional Risk

<table>
<thead>
<tr>
<th>Level of Nutritional Risk</th>
<th>Follow-Up Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Low risk (SCREEN 50–60), n = 115</td>
<td></td>
</tr>
<tr>
<td>Changed</td>
<td>19.1 (21)</td>
</tr>
<tr>
<td>Decreased</td>
<td>as % of changed</td>
</tr>
<tr>
<td>Moderate risk (SCREEN 46–49), n = 89</td>
<td></td>
</tr>
<tr>
<td>Changed</td>
<td>15.1 (13)</td>
</tr>
<tr>
<td>Decreased</td>
<td>as % of changed</td>
</tr>
<tr>
<td>High risk (SCREEN ≤ 45), n = 163</td>
<td></td>
</tr>
<tr>
<td>Changed</td>
<td>32.9 (50)</td>
</tr>
<tr>
<td>Decreased</td>
<td>as % of changed</td>
</tr>
</tbody>
</table>

*Notes:* Drop outs and those who left the study (death, institutionalization) for each time point at each level of risk are excluded when calculating percentages.

SCREEN = Seniors in the Community: Risk Evaluation for Eating and Nutrition.
Table 3. Bivariate Associations With Good Physical Health Days
Over the First 12 Months of the Study

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Good Physical Health Days</th>
<th>Good Physical Health Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;320 in 12 Months</td>
<td>≥320 in 12 Months</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>(n = 106)</td>
<td>(n = 80)</td>
</tr>
<tr>
<td>Age</td>
<td>77.4 (7.4)</td>
<td>79.2 (8.6)</td>
</tr>
<tr>
<td>Number of medical conditions</td>
<td>6.3 (2.6)</td>
<td>4.1 (2.2)**</td>
</tr>
<tr>
<td>Number of medications</td>
<td>6.7 (3.9)</td>
<td>4.3 (3.6)**</td>
</tr>
<tr>
<td>Hours of all household help in past week</td>
<td>6.5 (10.6)</td>
<td>4.9 (5.1)</td>
</tr>
<tr>
<td>Number of physician visits in past 6 months</td>
<td>5.2 (8.2)</td>
<td>2.9 (3.9)*</td>
</tr>
<tr>
<td>Number of nights in hospital in past 6 months</td>
<td>22.5 (30.9)</td>
<td>12.0 (9.2)</td>
</tr>
<tr>
<td>SCREEN **</td>
<td>44.6 (6.4)</td>
<td>48.9 (5.8)**</td>
</tr>
<tr>
<td>Total Function Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ADL + Mobility + IADL)</td>
<td>19.7 (4.9)</td>
<td>22.3 (5.0)**</td>
</tr>
</tbody>
</table>

Proportion

| Wants more contact with family/friends          | 41.5                      | 31.3                      |
| Good/excellent perceived health                | 44.3                      | 77.5***                   |
| Health better or same as previous year         | 60.4                      | 86.3***                   |
| Nutritional risk (SCREEN ≤ 45)                | 51.9                      | 22.5***                   |
| Pain prevents activities                       | 43.4                      | 10.0***                   |
| Fall inside home in past 6 months             | 30.2                      | 13.8***                   |
| Gender (male)                                  | 21.7                      | 37.5*                     |
| Good vision                                    | 60.4                      | 76.3*                     |

Notes: *Significant at p = .05; **significant at p = .01 to .001; ***significant at p < .001.

Possible range: 0 (highest risk)–60 (lowest risk).

Possible range: 0 (complete dependence)–32 (complete independence).

SD = standard deviation; ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living; SCREEN = Seniors in the Community: Risk Evaluation for Eating and Nutrition.

Figure 1 presents the unadjusted mean rating for the global whole-life satisfaction question over time with scores ranging from 1 (very dissatisfied) to 5 (very satisfied) for two nutritional risk groups, low/moderate, as compared to high nutritional risk. As can be seen from the graph, those with high nutritional risk had a consistently lower mean rating for this question at baseline and at each follow-up time point as compared to those with low/moderate nutritional risk. For both groups, there was a decrease in the rating of whole life satisfaction over time.

Tables 4 and 5 present the multivariate analyses determining if nutritional risk (low/moderate vs high risk) was independently associated with good physical health days. Both analyses identified nutritional risk to be an important and significant covariate. In Table 4, on average, over time, those with high nutritional risk had 2.2 fewer good physical health days per month than their low/moderate risk counterparts. Those who perceived their health to be good to excellent and men also reported a higher number of good physical health days. Age and age-squared were also significant covariates with good physical days decreasing over time with age. The squared variable was included in this analysis, as it was hypothesized that the relationship between age and QOL would not be linear, when plotted good health days decreased to the age of 81 and then increased; results not shown.] Those with more health conditions also had fewer good physical health days over time. The interpretation of the results from the multiple linear regression analyses noted in Table 5 is similar. Respondents with high nutrition risk had fewer good physical health days over the 12-month follow-up period; B demonstrates the number of good physical health days per year for each unit change of the covariate, thus, those at high nutritional risk had 31 fewer good physical health days than their low-risk counterparts over the year, or approximately 2.5 days per month.

DISCUSSION

There has been little work done to examine QOL over time in community-based samples of frail seniors (3). This is the first report to have used a valid screening instrument to determine if nutritional risk was associated with self-reported QOL over time in frail older adults (3). Although a convenience sample was used and this work should be considered preliminary, the results support the contention that nutrition is an important predictor of QOL. Specifically, these analyses have identified that QOL over time, whether measured with a global whole-life satisfaction question or reported good physical health days, declines over a relatively short period (18 months) in frail older adults. Nutritional risk, which is believed to precede poor nutritional health, morbidity, and mortality (27), is a predictor of this decline in QOL (Tables 4 and 5). Although there appears to be a similar pattern to the decline in whole-life satisfaction when level of nutritional risk is considered (Figure 1), those at moderate nutritional risk may have a faster rate of decline than seniors at low or high risk (Table 2). When the concept of health-related QOL is measured by good physical health days, significant covariates in addition to nutritional risk include medical conditions, medications, functional status, self-perceived health, pain, falls, and gender.

The few previous studies that have been presented in this area demonstrate an association between nutrition parameters or indicators and QOL (9,10,29,30). There are also a few reports that suggest there is no link (31) between nutrition and health-related QOL, although poor measurement of nutrition parameters may explain the lack of effect (4).
The different indicators of QOL used in this analysis (including results not shown on good mental health days and no-bed days) provide support for the idea that nutrition has a multidimensional influence on QOL (3,28), although more research is required to determine how nutrition is integrated into the QOL concept (3).

From the results, it appears that there is a strong relationship between nutritional risk and the “physical” portion of QOL. Amarantos and colleagues (11) suggest that this health-related QOL (subjective sense of physical and/or mental well-being) is directly associated with nutritional well-being, as nutrition can influence transport proteins, hormones, muscle mass, and functional ability. Nutritional risk as measured with an Australian version of the DETERMINE Checklist in a large sample of Australian women found risk to be associated with measures of physical and mental health and health service utilization measures (32). Multivariate analyses have found an independent effect of protein undernutrition and obesity on SF-36 scores, and these scores are predictive of death (29). These analyses suggest a direct link between nutrition and health-related QOL. Others have found independent associations between nutrition parameters and health and functional measures (33,34), further corroborating this direct link between nutrition and the physical portion of QOL. Finally, a longitudinal study identified the DETERMINE Checklist to predict functional disability and depression, but not mortality, 1 year later in community-dwelling seniors (35).

As food intake is not just the physical act of eating food but also involves sociological and cultural aspects of eating, the broader view of QOL, frequently termed “life satisfaction,” also has the potential to be influenced by nutrition (11,36). It can even be argued that good food and happy meals are an integral part of QOL. Crude analyses of whole-life satisfaction and self-reported change in general QOL over time suggest that these more-holistic measures are also influenced by nutritional risk. These results suggest that nutrition also has the potential to influence QOL as viewed from a psychological and/or interpersonal perspective, in addition to the physical portion of QOL. In a randomized trial of megestrol acetate in institutionalized seniors, improvement in physiological markers for anorexia of aging (appetite, weight) was shown to improve mood, well-being, and an “enjoyment list” (37). The proposed mechanism was improved appetite with use of the drug, improved weight, improved prealbumin, and thus improved sense of well-being and QOL. Breakfast consumption was found to be associated with less depression, less emotional stress, and lower levels of perceived stress in persons aged 20–79 years (38). However, as these data were cross-sectional, it was unclear if skipping meals was predictive of these measures of well-being or whether affect influences eating habits. The potential pathway of positive well-being, affecting what is consumed and thus nutritional status, has been further explored (39). In 107 older women, self-esteem, perceived health, health self-determinism, and demographics were significantly associated with nutrition-health-promoting behaviors when data were collected at one point in time (39). Finally, in an attempt to determine the predictive relationship between nutrition and well-being, Balacombe and colleagues (30) measured well-being (Philadelphia Geriatric Center Morale Scale) and body mass index (BMI) in 31 older adults on admission to hospital and 3 months later. A positive linear relationship was found between well-being and BMI at follow-up, suggesting that changes in BMI lead to changes in well-being. However, no independent effect was found when other variables were considered, suggesting that BMI does not have a direct influence on well-being. However no independent effect was found when other variables were considered, suggesting that BMI does not have a direct influence on well-being. However no independent effect was found when other variables were considered, suggesting that BMI does not have a direct influence on well-being. However no independent effect was found when other variables were considered, suggesting that BMI does not have a direct influence on well-being.
between nutrition and the broadly defined QOL may be indirect or direct. In either case, improving nutritional well-being should be viewed as an important mechanism for improving QOL in older adults. Future nutrition intervention studies in elderly individuals should include QOL measures as viable outcomes.

ACKNOWLEDGMENTS

The authors thank the senior participants, service provider organizations, interviewers (L. Boudreau, D. Dewaal, P. Vanderkooy, S. Chamberlain, R. Davidson), and the project coordinator (J. McKenzie) for being instrumental to this study. Also, the authors acknowledge the support of M. Pattillo, the Region of Halton, and the Regional Geriatric Program of Central West Ontario.

SCREEN (Seniors in the Community: Risk Evaluation for Eating and Nutrition) is a copyrighted program.

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REFERENCES


Received January 16, 2003 Accepted January 17, 2003

APPENDIX: COVARIATES USED IN ANALYSIS

Age; sex; number of reported health problems and medications; current perceived health status as compared with others their own age (excellent to poor) and as compared with one’s own health 1 year ago (better, same,
worse); smoking and alcohol use at least monthly; usually pain free (yes/no); occurrence of at least one fall inside or outside the home in the past 6 months; vision and hearing (excellent to poor); number of social visits in the past week; size of social network and satisfaction with level of social contact (wants more, wants less, wants the same); self-reported frequency of depression (“never” to “all of the time”); satisfaction with life as a whole (“very satisfied” to “very unsatisfied”); and current household income. Functional dependence in basic and instrumental activities of daily living, mobility (stair-climbing, walking 1 block, using mobility aids), and transportation was also assessed with 16 questions based on the Multidimensional Functional Assessment Questionnaire (23); previously been in the Canadian Study of Health and Aging. For each of these activities, total dependence for completion of the task was scored as 0, partial dependence scored as 1, and complete independence scored as 2 (23). Thus, higher scores indicated greater independence; the 7 Activities of Daily Living, 6 Instrumental Activities of Daily Living, and 3 mobility/transportation scores were added together for a Total Function Score (range 0–32).