Predictive Validity of a Postal Questionnaire for Screening Community-dwelling Elderly Individuals at Risk of Functional Decline

RÉJEAN HÉBERT, GINA BRAVO, NICOL KORNER-BITENSKY, LOUIS VOYER

Summary
Screening elderly individuals who are at risk of functional decline in the community is essential in order to implement effective programmes of assessment and surveillance in a context of secondary prevention. The postal questionnaire technique consists of sending a simple questionnaire to all elderly individuals living in a defined area in order to identify those who are at risk. The objective of this study was to develop a postal questionnaire and to test its capacity to predict functional decline in community-dwelling elderly people. A 21-item postal questionnaire was sent with a birthday card to a representative sample of community-dwelling individuals over the age of 75 years (n = 842). One month after sending the questionnaire, all subjects were contacted by a nurse for an in-home interview (n = 655) that included assessment of functional autonomy. One year later, the subjects (n = 607) were reassessed by the same nurse. Of the eligible subjects, 87.4% returned the postal questionnaire. During the year following the completion of the postal questionnaire, 43 subjects died, 13 were institutionalized and 109 had experienced a significant decrease on the autonomy scale, for a total annual occurrence of functional decline of 27.2%. Age and 14 of the 21 items of the questionnaire were associated with a significant relative risk of functional decline. The relative risk associated with not responding to the questionnaire was 2.1. A stepwise logistic regression analysis showed that six items were independent predictors of functional decline. This 6-item Sherbrooke Postal Questionnaire identifies as positive 56% of the population with 75% sensitivity and 52% specificity. We conclude that a postal questionnaire is a feasible and valid technique for screening elderly individuals at risk for functional decline.

Introduction
During the past 30 years, life expectancy of elderly people has increased more rapidly than active life expectancy. For women of 65, only 10.6 years of their 19.5 expected years of life will be free of disability; for men, the figures are 9.3 of 13.1 years [1, 2]. The major challenge of the next decade will be to increase the quality of life in old age, 'to add life to years instead of years to life'. The development of geriatric services has greatly improved the assessment and management of health problems of elderly people. However, the efficacy of these services is limited by the irreversibility of the damage already done and interventions must take place before the process of declining autonomy begins. Effective screening or case-finding would allow early interventions that postpone dependency [3] and compress morbidity [4, 5], thereby squaring the curve of functional decline across time [6] and increasing active life expectancy.

There are two different ways of implementing screening or case-finding: opportunistic or universal [7, 8]. The opportunistic approach takes place when the screening is applied to individuals when they contact a health-care professional. This type of screening has many pitfalls. Ten to 20% of elderly people do not consult a physician or other health professional during any given year [9, 10] and there are many controversies in the literature about the state of health of the non-consulters [11-14]. Yet, even in those who are followed by a physician, many serious problems may not be identified [15]. Finally, an opportunistic approach must take into account the compliance of health professionals in applying the preventive programme.

The universal approach implies screening of all elderly individuals living in a catchment area. A number of clinical trials have investigated the effects of such screening programmes [16-22]. Although many of these studies suffer from methodological problems, particularly with regard to outcome measures and sample size, the findings suggest that the efficacy of these costly programmes is limited to a
reduction in the number of hospitalizations and length of stay without significant effects on morbidity, well-being or autonomy of the participants. The efficacy and especially the efficiency of these programmes could be improved by targeting ‘at risk’ groups within the elderly population. This would obviate the dilution of the beneficial effect resulting from the unnecessary assessment of many healthy subjects [23—25]. Vetter and his colleagues [26] have demonstrated that age by itself, even age over 75, is not a sufficient criterion for identifying a target population. Rather, there is a need for a simple method of targeting the subgroup of elderly individuals who are particularly at risk and on whom a preventive programme should focus [27]. This two-step approach has been shown to be more effective [28] and would be less expensive to implement.

In 1980, Barber and colleagues proposed a postal questionnaire to screen elderly individuals at risk [29, 30]. It is a simple questionnaire sent to all elderly individuals living in a catchment area and those at risk are identified by their answers (yes or no) or if they fail to return the questionnaire. Several other postal questionnaires have been developed and validated [9, 31—35]. The principal characteristics of these questionnaires are presented in Table I. All have shortcomings that must be addressed. First, none includes all of the risk factors identified in studies. Second, validity was studied concurrently by comparing the questionnaire with clinical evaluations or disability scales in cross-sectional studies. It would be more convincing to test the predictive validity, that is the capacity of the questionnaire to predict functional decline. Furthermore, the proportion of subjects screened positive by these questionnaires is generally high (over 75%), thereby decreasing only minimally the number of subjects labelled ‘at risk’ to be enrolled into the second step of a preventive programme. Finally, few studies have explored the risk associated with non-respondents although Bowns et al. [35] found that non-respondents were more dependent and cognitively impaired than respondents. They were also the only researchers to report an item analysis, that is an analysis of the performance of each question in order to select the best ones.

The objectives of the study reported here were to develop a postal questionnaire and to test its capacity to predict functional decline in an elderly population living at home. This study is the first phase of a research programme aiming to design and test the efficacy of a method of preventing elderly people from losing autonomy.

**Materials and Methods**

The items of the postal questionnaire were developed according to risk factors identified in the many surveys done on elderly populations: to be widowed, never married, socially isolated or without children, living alone [36], recently moved, recently discharged from hospital [37], with bad self-perceived health [38—41], depressed, suffering major life events [42], falling [43—46], taking medication [47—49], using assistance for activities of daily living, using ambulatory aids, mentally disoriented [50, 51], with impaired vision or hearing [52], being without a relative who could be called on for help and unable to have a hot meal every day [30]. For each of these factors, we created a simple question to be answered ‘yes’ or ‘no’, with the exception of the first question about marital status for which a multiple choice answer was given.

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The questionnaire was pre-tested with 20 elderly patients attending a day hospital to correct wording and check the understanding of the questions. A test-retest reliability study was done on 37 subjects by sending the postal questionnaire twice, one week apart. Kappa coefficients for the individual items ranged from 0.64 to 1.00. Minor corrections were made to some questions in

**Table I. Comparison of postal questionnaires**

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>% returned</th>
<th>% positive</th>
<th>Validity criterion</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodside Screening Letter (9 items)</td>
<td>83</td>
<td>77</td>
<td>Clinical assessment</td>
<td>0.95</td>
<td>0.68</td>
</tr>
<tr>
<td>Barber et al. [29]</td>
<td>85</td>
<td>80</td>
<td>Clinical assessment</td>
<td>0.97</td>
<td>0.73</td>
</tr>
<tr>
<td>Barber [30]</td>
<td>91—94.6</td>
<td>80</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cameron and Wright [31]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nottingham Postal Questionnaire (5 items)</td>
<td>83—94</td>
<td>—</td>
<td>Clinical assessment</td>
<td>0.79</td>
<td>0.82</td>
</tr>
<tr>
<td>Ebrahim et al. [9]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRCA Vulnerability index (11 items)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morris et al. [32]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wisconsin Functional Assessment Screener (8 items)</td>
<td>72</td>
<td>—</td>
<td>Clinical assessment</td>
<td>0.91</td>
<td>0.64</td>
</tr>
<tr>
<td>Pannill and Fisk [33]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duke University IADL Screener (5 items)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fillenbaum [34]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Kent (6 items)</td>
<td>91</td>
<td>58</td>
<td>Disability scale</td>
<td>0.87</td>
<td>0.50</td>
</tr>
<tr>
<td>Bowns et al. [35]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

— Not indicated.
order to increase reliability. The 21 questions of the final version are presented in Table III.

The questionnaire was sent to a representative sample of community-dwelling individuals over 75 years of age, living in Sherbrooke (Quebec, Canada), a town of 75,000 inhabitants. All individuals over 75 years of age with birthdays between 29 July and 24 November were identified from the electoral list, which contains the name, address, phone number and date of birth of all citizens. The list had been updated one year prior to the study. Subjects who were dead, had moved outside the area, were institutionalized or did not speak French were excluded. Eligible subjects received the questionnaire with a birthday card asking for their participation in the study [54]. The Dillman’s Total Design Method was applied to maximize response rate [55]. A postcard reminder was sent after one week to every subject and a follow-up personalized letter was sent after three weeks to those who had not yet returned the questionnaire.

Four weeks after the first mailing, one of three trained research nurses contacted the subject to ask for an in-home interview. The nurses were ‘blinded’ to whether or not the subject had returned the postal questionnaire and if so, to their answers. After explaining the study, a written consent to participate was obtained from the subject or a proxy. During the interview, the Functional Autonomy Measurement System (SMAF) was administered, along with a questionnaire on socio-demographic and health-related information specially designed for the study.

The SMAF [56] is a 29-item scale designed to measure functional disabilities on five dimensions: activities of daily living (ADL) (7 items), mobility (6 items), communication (3 items), mental functions (5 items) and instrumental activities of daily living (IADL) (8 items). Each item is scored on a 4-point scale from 0 (independent) to 3 (dependent) for a maximum score of 87. An inter-rater reliability study showed mean Cohen’s weighted Kappas of 0.75 [57]. Validity was tested comparing SMAF scores to the nursing time required for care (r = 0.88). The SMAF has also been shown to discriminate between levels of functional autonomy of residents in institutional settings offering different levels of care.

**POSTAL QUESTIONNAIRE**

*sent to all people born between July 29 and November 24 over 75 y.o.*

**Subjects Not Eligible**

- admitted in Institution (197)
- dead (61)
- not speaking French (45)
- moved outside the region (17)
- not found (13)

N = 842

Respondents 736 (87.4%)

Non-respondents 106 (12.6%)

**Nurse Contact (4 weeks after)**

- Accept to Participate
  - Respondents 594 (80.7%)
  - Refuse 187 (22.2%)

- Accept to Participate
  - Non-respondents 142 (19.3%)
  - Accept to Participate
  - Non-respondents 45 (57.5%)

**Assessment 1**

- No functional decline 442 (72.8%)
  - SMAF < 5

**Assessment 2**

- Functional decline 165 (27.2%)
  - SMAF ≥ 5
  - Admitted to Institution (13)

Figure. Flow of the subjects through the study.
A difference of 5 or more in scores between two assessments has been shown to represent a significant change in functional autonomy [59].

One year after the first home interview, each subject was reassessed by the same nurse who did not have access to the results of the previous home interview. The SMAF was completed again along with a questionnaire on utilization of health-care services. The provincial mortality registry and regional nursing-home admission lists were also used to trace missing subjects or to confirm information obtained from relatives.

Functional decline, the main outcome variable, was defined as one of the following: (1) an increase of 5 points or more on the SMAF score between the two home interviews; (2) admission to a nursing home or a long-term-care hospital; (3) death during the reference year. Group differences according to the dichotomized variable 'functional decline' were analysed using Student's t-test, Wilcoxon Rank Sum Test and χ² statistics. Relative risks of functional decline associated with the demographic data (age, sex, marital status), with each item of the postal questionnaire and with a failure to return the questionnaire were calculated. Stepwise logistic regression analyses were performed including each variable that showed a significant relative risk (95% confidence interval excluding 1.0) in order to identify independent predictors of functional decline. For the exploratory analysis, the alpha level was set at 0.15, as suggested by Hosmer and Lemeshow [60]. Recognizing that indices derived from even a large data base are sensitive to a particular data base being used, a sub-sample of 45 subjects was randomly chosen and put aside to form a validation data set. The items retained by the analysis as independent predictors of functional decline were combined into a shorter questionnaire. Sensitivity, specificity and predictive values were calculated using standard definitions [61]. All statistical analyses were done with SAS software. This study was approved by the Ethics Committee of Sherbrooke University's Medical School, Quebec, Canada.

Results

Of the 842 eligible subjects (310 men and 532 women), 736 (87.4%) returned the postal questionnaire. The mean age of the subjects was 79.9 years (SD 4.2). Sixty-one subjects who did not return the questionnaire agreed to the first home interview by the nurse, allowing calculation of the relative risk associated with non-response to the postal questionnaire. One hundred and eighty-seven (22.2%) subjects refused the first home interview. At the time of the second home interview, 48 subjects (7.3%) were lost to the study, 42 because of refusal. Thus, 607 individuals had complete data from both home interviews. The Figure presents the flow of the subjects through the study. The annual occurrence of functional decline was 27.2%. The 13 subjects who were institutionalized during the reference year also fulfilled the criterion of an increase of 5 points or more in SMAF scores. Subjects who experienced functional decline were significantly older and were more depressed, cognitively impaired and dependent at the first interview than those who did not experience decline (Table II). They were also more likely to have been hospitalized and to have received home services during the year of follow-up.

Table II shows the relative risks (RR) associated with age, sex, each item of the questionnaire and non-response to the postal questionnaire. Question #1 on marital status was not associated with a significant risk, regardless of the categorization used. Age and 14 of the questions were found to be associated with a significant RR. Unexpectedly, subjects living alone were found to be at lower risk of functional decline. Non-respondents to the postal questionnaire had a 2.1-fold increase in risk of declining autonomy at 1 year.

Table II. Characteristics of the subjects in relation to subsequent decline in functional autonomy

<table>
<thead>
<tr>
<th>Variables</th>
<th>No functional decline</th>
<th>Functional decline</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the first interview</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age: mean (SD)</td>
<td>n = 442</td>
<td>n = 165</td>
<td></td>
</tr>
<tr>
<td>Women (%)</td>
<td>80.38 (3.77)</td>
<td>81.61 (4.04)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Married (%)</td>
<td>63.8</td>
<td>64.2</td>
<td>0.92</td>
</tr>
<tr>
<td>Years at school: mean (SD)</td>
<td>7.79 (4.07)</td>
<td>7.22 (3.34)</td>
<td>0.31</td>
</tr>
<tr>
<td>% Income &lt; $100000.00/year</td>
<td>23.9</td>
<td>20.9</td>
<td>0.31</td>
</tr>
<tr>
<td>SMAF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: mean/87 (SD)</td>
<td>8.03 (7.86)</td>
<td>13.47 (11.32)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ADL: mean/21 (SD)</td>
<td>0.48 (1.08)</td>
<td>1.04 (2.38)</td>
<td>0.02</td>
</tr>
<tr>
<td>Mobility: mean/18 (SD)</td>
<td>0.51 (1.44)</td>
<td>1.19 (2.43)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Communication: mean/9 (SD)</td>
<td>0.40 (0.68)</td>
<td>0.67 (0.99)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mental: mean/15 (SD)</td>
<td>0.87 (1.39)</td>
<td>1.59 (2.16)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>IADL: mean/24 (SD)</td>
<td>5.77 (5.36)</td>
<td>8.98 (6.48)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Between the two interviews</td>
<td>n = 442</td>
<td>n = 122*</td>
<td></td>
</tr>
<tr>
<td>Days hospitalized: mean (SD)</td>
<td>15.24 (20.86)</td>
<td>23.93 (27.44)</td>
<td>0.004</td>
</tr>
<tr>
<td>% receiving home services</td>
<td>9.07</td>
<td>23.97</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Those who died are not included.
Table III. Relative risk of functional decline associated with each variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>% at risk</th>
<th>Relative risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (≥ 85 years)</td>
<td>13.8</td>
<td>1.56 (1.13 to 2.10)*</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>64.0</td>
<td>0.99 (0.75 to 1.29)</td>
</tr>
<tr>
<td>2. Do you live alone? (yes)</td>
<td>38.0</td>
<td>0.71 (0.50 to 0.99)*</td>
</tr>
<tr>
<td>3. Have you been hospitalized during the past year? (yes)</td>
<td>27.1</td>
<td>1.39 (1.02 to 1.90)*</td>
</tr>
<tr>
<td>4. In general, do you have any health problems that require you to limit your activities? (yes)</td>
<td>40.5</td>
<td>1.64 (1.21 to 2.22)*</td>
</tr>
<tr>
<td>5. In general, do you have any health problems that require you to stay at home? (yes)</td>
<td>21.7</td>
<td>1.66 (1.23 to 2.25)*</td>
</tr>
<tr>
<td>6. Do you take more than three different medications every day? (yes)</td>
<td>25.4</td>
<td>1.57 (1.17 to 2.12)*</td>
</tr>
<tr>
<td>7. During the past year, have you been affected by the death or the severe illness of a person close to you? (yes)</td>
<td>38.3</td>
<td>1.21 (0.90 to 1.63)</td>
</tr>
<tr>
<td>8. Do you need someone to help you on a regular basis? (yes)</td>
<td>21.0</td>
<td>1.68 (1.24 to 2.27)*</td>
</tr>
<tr>
<td>9. Have you moved during the past year? (yes)</td>
<td>8.9</td>
<td>1.17 (0.73 to 1.87)</td>
</tr>
<tr>
<td>10. In comparison to other people your own age, do you think you are in good health? (no)</td>
<td>10.2</td>
<td>1.77 (1.23 to 2.54)*</td>
</tr>
<tr>
<td>11. Do you hear well? (no)</td>
<td>25.5</td>
<td>1.48 (1.09 to 2.01)*</td>
</tr>
<tr>
<td>12. Do you see well? (no)</td>
<td>20.9</td>
<td>1.78 (1.32 to 2.41)*</td>
</tr>
<tr>
<td>13. In case of need, can you count on someone close to you? (no)</td>
<td>6.3</td>
<td>0.81 (0.41 to 1.60)</td>
</tr>
<tr>
<td>14. Are you getting along well with the people close to you? (no)</td>
<td>1.7</td>
<td>1.38 (0.54 to 3.52)</td>
</tr>
<tr>
<td>15. Are you satisfied with your present place of residence? (no)</td>
<td>2.8</td>
<td>0.53 (0.15 to 1.95)</td>
</tr>
<tr>
<td>16. Normally, do you eat at least one hot meal every day? (no)</td>
<td>1.1</td>
<td>1.34 (0.43 to 4.21)</td>
</tr>
<tr>
<td>17. Did you fall during the past year? (yes)</td>
<td>22.9</td>
<td>1.60 (1.18 to 2.16)*</td>
</tr>
<tr>
<td>18. Do you regularly use a cane, a walker or a wheelchair to move about? (yes)</td>
<td>14.1</td>
<td>1.83 (1.33 to 2.52)*</td>
</tr>
<tr>
<td>19. Do you have problems with your memory? (yes)</td>
<td>29.8</td>
<td>1.53 (1.14 to 2.06)*</td>
</tr>
<tr>
<td>20. In general, do you feel sad or depressed? (yes)</td>
<td>17.0</td>
<td>1.51 (1.08 to 2.11)*</td>
</tr>
<tr>
<td>21. Did you need help to answer this questionnaire? (yes)</td>
<td>17.2</td>
<td>1.80 (1.33 to 2.44)*</td>
</tr>
<tr>
<td>Questionnaire not returned</td>
<td>9.2</td>
<td>2.10 (1.57 to 2.81)*</td>
</tr>
</tbody>
</table>

* Significant relative risk (95% confidence interval excluding 1.0).

From the stepwise logistic regression analyses, six questions remained in the model as independent predictors of functional decline: item 2—not living alone (RR = 1.6); 6—taking more than three medications a day (RR = 2.0); 11—problems with hearing (RR = 1.5); 12—problems with seeing (RR = 2.1); 18—using ambulatory aids (RR = 2.0); 19—problems with memory (RR = 1.5). Age and the other eight questions did not significantly improve the prediction of functional decline.

Further analyses were performed on the 6-item Sherbrooke Postal Questionnaire, in order to determine its screening characteristics. Given that the odds ratios associated with each of the six questions were quite similar, a score of one was attributed to the presence of each risk factor. Subjects who did not return the questionnaire were included in the positive (at risk) group. Table IV shows that a cut-off score of 2 and higher is the best compromise between sensitivity and specificity for the purpose of a screening instrument in the context of a two-step approach. With this cut-off score, the Sherbrooke Postal Questionnaire identified 56% of the subjects as positive (that is, being 'at risk') with 75% sensitivity and 52% specificity. These figures

Table IV. Characteristics of the 6-item Sherbrooke Postal Questionnaire according to the different cut-off scores

<table>
<thead>
<tr>
<th>Cut-off score*</th>
<th>Screened positive (%)</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Predictive value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/1</td>
<td>88</td>
<td>93</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>1/2</td>
<td>56</td>
<td>75</td>
<td>52</td>
<td>38</td>
</tr>
<tr>
<td>2/3</td>
<td>35</td>
<td>59</td>
<td>75</td>
<td>48</td>
</tr>
<tr>
<td>3/4</td>
<td>20</td>
<td>37</td>
<td>87</td>
<td>52</td>
</tr>
<tr>
<td>4/5</td>
<td>13</td>
<td>26</td>
<td>92</td>
<td>56</td>
</tr>
<tr>
<td>5/6</td>
<td>11</td>
<td>20</td>
<td>92</td>
<td>50</td>
</tr>
</tbody>
</table>

* Subjects not returning the Questionnaire were included in the positive (at risk) group.
were only slightly different when the Questionnaire was applied to the random validation sub-sample (n = 45): 53% of the subjects were declared positive for a sensitivity of 68% and a specificity of 54%. The occurrence of functional decline for individuals screened positive was 38%, as opposed to 16% for those screened negative, resulting in a 2.4 relative risk of functional decline when screened positive. Of those screened positive, only 15% were already receiving home-care services. The 6-item Sherbrooke Postal Questionnaire is reproduced in the Appendix.

**Discussion**

To increase the efficacy of a preventive programme for elderly people, a two-step approach must be followed. Individuals at risk have to be identified as the first step in order to be enrolled into a more extensive assessment and surveillance programme. By itself age is not a good criterion for selecting those who are at risk. Therefore, there is a need for a simple method of identifying elderly individuals who are truly in need. This study tested the predictive validity of a postal questionnaire for this purpose.

The response rate to the questionnaire (87.4%) was comparable with that to other postal questionnaires (Table I), thus confirming the feasibility and acceptability of this technique in an elderly population. The birthday card and the two reminders had an important effect on response rate. In contrast with the other studies, the letter introducing the questionnaire was signed by the principal investigator and not by the subject’s physician. In real life, response rates should be even higher if the procedure identifies health professionals or care settings already known to the elderly individual.

The criteria used in this study to define functional decline require some comments. In order to identify people at risk, these criteria should result in a dichotomous decision. The increase of 5 points on the SMAF score has been determined to be a significant change, given the reliability of the instrument. Such a cut-off score avoids the regression towards the mean phenomenon and allows the true signal to be distinguished from the noise associated with measurement error [62]. Admission to an institution is usually a legitimate proxy for functional decline although some institutionalization could be primarily due to social breakdown. In this study, all 13 subjects admitted to institutions also showed an increase of more than 5 points on the SMAF score. Dying is more controversial since factors associated with mortality are probably different from those associated with functional decline. In this study, the number of deaths (43) was too small in comparison with subjects fulfilling the two other criteria (122) to give enough power to differentiate factors associated with each outcome. Nevertheless, from a public health point of view, people at risk of dying should also be identified. Moreover, there are some indications that the deceased undergo a period of functional decline prior to death [63]. For all these reasons, we decided to include death as one of the outcomes defining functional decline.

Although this study was not primarily designed to analyse the factors associated with functional decline, it is interesting to discuss the risk associated with each question. However, it must be kept in mind that factors were explored only with a very simple postal questionnaire and associations may be related either to death or functional decline or both. This study challenges the myth of the old widowed woman living alone as being particularly at risk, and thus requiring special attention in preventive programmes. Age is still a risk factor in this very elderly group but sex and marital status are not predictors of functional decline. These results are consistent with those of Branch [50, 51] and the Aberdeen Survey [64, 65]. The results on living alone are more surprising. In our study, people living alone were more independent (p < 0.001) and living alone was associated with a significant reduction in the risk of functional decline, even after adjusting for other factors through a logistic regression analysis. This factor seems to be independent since this question was not significantly correlated with any other question of the questionnaire. Living alone could be acting as a proxy for good health at this age rather than a risk factor. In two American studies [51, 66], living alone was associated with a significant risk of institutionalization in order to solve the problem of functional decline. This could be consistent with our results because, although living alone is a factor for remaining independent, once functional decline occurs, it may then increase the likelihood of choosing institutionalization in order to solve the problem of functional decline. Mor et al. [67] found a significant risk of functional decline associated with living alone but this association was no longer significant in a multivariate analysis. In the Aberdeen Survey [64, 65], living alone was associated with few chronic conditions and better health. Our study confirms that living alone is not a risk factor for functional decline but can be viewed as a marker for good health.

Socio-demographic variables (sex, marital status, education, income) are not good predictors of functional decline, confirming the results of the Aberdeen Survey [64, 65]. These variables are not helpful in identifying a more vulnerable subgroup. Even age does not remain a significant factor after adjusting for answers on the postal questionnaire in the logistic regression analyses. This emphasizes that means other than socio-demographic data are needed to identify elderly individuals who are at risk.

The majority of risk factors identified in the literature were associated with a significant risk of functional decline when used in the form of a postal questionnaire. Those that were not significantly related to the risk of functional decline presented a relatively low rate of positive response (under 10%). This study did not have sufficient power to detect a significant RR associated with such a low proportion of positive response. Not returning the questionnaire presented...
the highest RR of functional decline (2.1), confirming the intuition of Barber [30] and the cross-sectional data of Bowns et al. [35].

Except for the item measuring living status, all the questions were correlated (r = 0.10–0.40). The logistic regression analysis highlighted six questions that were most predictive of functional decline. By labelling those who did not return the questionnaire as being at risk, this 6-item Sherbrooke Postal Questionnaire identified high-risk individuals with a 75% sensitivity and a 52% specificity. While these figures are lower than those reported by Barber et al. [29, 30] and Cameron and Wright [31] with the Woodside Screening Letter (Table I), the Questionnaire labelled as positive 56% of the subjects rather than the previously reported 77–80%, thus reducing the number of elderly individuals potentially earmarked for an assessment and surveillance programme. This better filtration could increase the cost-effectiveness of a screening programme. The Questionnaire presents the same proportion of positively screened individuals as Bowns’ questionnaire but is less sensitive (0.87). However, the sensitivity of Bowns’ questionnaire was calculated using a disability scale as criterion in a cross-sectional design (concurrent validity). Predictive sensitivity is more relevant in the context of labelling individuals at risk of functional decline.

The screening characteristics of the Sherbrooke Postal Questionnaire should be interpreted in relation to other preventive screening instruments used in public health and to the high prevalence of functional decline. The 75% sensitivity is comparable with one of the most widely used screening tests, the Pap smear for cervical cancer, which presented sensitivity figures between 55% and 80% according to the studies [68]. Given that the questionnaire should be administered every year (as is the Pap test), the false negatives may be identified on the subsequent screens. The 52% specificity is low but it must be considered that the administration of the questionnaire is very cheap and the false positives will be identified subsequently on the second phase by the assessment programme. This second step consists of a standardized evaluation by a nurse which is relatively cheap and can be worthwhile even for the false positives. Moreover, there are neither risks associated with the screening process nor anxiety generated by falsely labelling people. Despite the moderate specificity, the positive predictive value is relatively high (38%) given the high incidence of the target condition. In comparison, the positive predictive value of mammography in screening for breast cancer is 11.8% [69]. With this cheap and simple screening questionnaire, the occurrence of functional decline is increased from 27% in the general population to 38% in the population screened positive, and the number of people to be fully assessed is decreased by half. Finally, as opposed to other screening procedures, this questionnaire also gives information on the non-compliant, identifying as positive the non-respondents.

In conclusion, this study produces a 6-item Postal Questionnaire to be used as the first step in a preventive programme designed to reduce or postpone functional decline in elderly individuals. The Questionnaire identifies a subgroup of the elderly population who are at a 2.4-fold increased risk of functional decline during the coming year. Given the high incidence of this condition, this represents a difference in risks (attributable risk) of 22% (0.38–0.16). If this risk can be acted upon, it would have a significant potential impact on disability and morbidity in this age group. As a follow-up to this study, an assessment and surveillance programme targeting this high-risk group has been developed and piloted. Its efficacy to prevent functional decline is presently being tested in a randomized controlled trial.

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References

13. Williams EI. Characteristics of patients aged over 75 not


*Appendix.* The Sherbrooke Postal Questionnaire
(answer in parenthesis indicates the risk)

Do you live alone? (No)
Do you take more than three different medications every day? (Yes)
Do you regularly use a cane, a walker or a wheelchair to move about? (Yes)
Do you see well? (No)
Do you hear well? (No)
Do you have problems with your memory? (Yes)

Individual is at risk of functional decline if: he/she presents more than one risk factor or he/she does not return the questionnaire


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