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## Biopsychosocial and spiritual factors associated with quality of life in elderly hospitalized patients undergoing post-acute rehabilitation: a cross-sectional study

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5 **Biopsychosocial and spiritual factors associated with quality of life**  
6 **in elderly hospitalized patients undergoing post-acute**  
7 **rehabilitation: a cross-sectional study**  
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## 1 ABSTRACT

2 **Objectives:** We investigated whether biopsychosocial and spiritual factors and satisfaction  
3 with care were associated with patients' perceived quality of life.

4 **Design:** This was a cross-sectional descriptive study.

5 **Setting:** Data were collected from inpatients at a post-acute geriatric rehabilitation center in a  
6 university hospital in Switzerland.

7 **Participants:** Participants aged 65 years and over were consecutively recruited from October  
8 2014 to January 2016. Exclusion criteria included significant cognitive disorder and terminal  
9 illness. Of 227 eligible participants, complete data were collected from 167.

10 **Main outcome measures:** Perceived quality of life was measured using the World Health  
11 Organization Quality of Life questionnaire - version for older people. Predictive factors were  
12 age, sex, functional status at admission, comorbidities, cognitive status, depressive symptoms,  
13 living conditions, and satisfaction with care. A secondary focus was the association between  
14 spiritual needs and quality of life.

15 **Results:** Patients undergoing geriatric rehabilitation experienced a good quality of life.  
16 Greater quality of life was significantly associated with higher functional status ( $r_s = .204$ ,  $p =$   
17  $.011$ ), better cognitive status ( $r_s = .175$ ,  $p = .029$ ), and greater satisfaction with care ( $r_s = .264$ ,  
18  $p = .003$ ). Poorer quality of life was significantly associated with comorbidities ( $r_s = -.226$ ,  $p$   
19  $= .033$ ), greater depressive symptoms ( $r_s = -.379$ ,  $p < .001$ ), and unmet spiritual needs ( $r_s =$   
20  $-.211$ ,  $p = .049$ ). Multivariate linear regression indicated that depressive symptoms ( $\beta:$   
21  $-1.011$ ; 95% confidence intervals [CI]:  $-1.428$ ,  $-0.594$ ;  $p < .001$ ) and satisfaction with care  
22 ( $\beta: 0.254$ ; 95% CI:  $0.016$ ,  $0.493$ ;  $p = .037$ ) significantly predicted quality of life.

23 **Conclusions:** Patient perceptions of quality of life were strongly associated with depression,  
24 functional status, and satisfaction with care. More research is needed to assess whether  
25 considering quality of life could improve care plan creation.

26  
27 **Keywords:** geriatric rehabilitation, quality of life, biopsychosocial and spiritual model,  
28 satisfaction with care.

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3 29 **ARTICLE SUMMARY**  
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6 30 **Strengths and limitations of this study**  
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9 31 ▪ This study uses biopsychosocial and spiritual descriptors to explore determinants of  
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11 32 quality of life in geriatric rehabilitation.  
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13 33 ▪ Design is based on a “real world” setting, with usual clinical practice descriptors of  
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15 34 biopsychosocial and spiritual dimensions, which is likely to result in good ecological  
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17 35 validity.  
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19 36 ▪ Owing to precedent point, the rate of missing values is higher.  
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21 37 ▪ Cross-sectional study cannot conclude in any causal relationships between descriptors and  
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23 38 quality of life.  
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## 39 INTRODUCTION

40 Quality of life is an increasingly interesting outcome in the context of the aging population. It  
41 is relevant to consider quality of life rather than mortality in elderly people, given the high  
42 prevalence of chronic conditions and their impact on functional independence. Elderly people  
43 usually prefer quality of life over long life.[1] It seems therefore valuable to study quality of  
44 life in elderly persons and to identify likely influential factors.

45 Overall, elderly community-dwelling populations retain a good quality of life. For instance, in  
46 a random sample of 999 English respondents over 65 years of age, 82% described their  
47 quality of life as good.[2] Quality of life in elderly persons is affected by a variety of factors;  
48 thus, depressive disorders, functional impairment and other health problems could reduce a  
49 patient's quality of life, whereas social support can positively affect quality of life.[3]  
50 Psychosocial resources can have a substantial influence on quality of life, affecting situations  
51 such as facing a diminution of functionality, for example.[2] Although quality of life can  
52 decrease with physical impairment, elderly persons suffering significant limitations in their  
53 daily lives may nevertheless (and somewhat paradoxically) describe their quality of life as  
54 excellent.[4-5] In a study of 185 community-dwelling older Americans with advanced illness,  
55 Solomon et al. found that 65% of patients reported their quality of life as the best possible or  
56 good.[6]

57 Quality of life in elderly persons has been assessed in a number of health-care settings (acute  
58 care, assisted living and nursing home). Existing studies have similar results, and tend to  
59 show that the perceived quality of life remains good in these settings.[7-8] There are only a  
60 few studies that investigate quality of life in rehabilitation and most of them were focused on  
61 patients with very specific illnesses, such as osteoporosis and hip fracture.[4, 9] However,  
62 measuring quality of life in this setting should be of interest because improving quality of life

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3 63 is typically understood as the ultimate goal of rehabilitation.[10-11] Moreover, it could be a  
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5 64 broader outcome to measure in rehabilitation, in addition to traditional variables linked to  
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7 65 functional independence improvement.  
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10 66 Geriatric rehabilitation is traditionally interdisciplinary, with attention paid to biopsychosocial  
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12 67 issues.[12-13] This setting even integrates the spiritual dimension at different levels, in a  
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14 68 global biopsychosocial and spiritual model of care.[14-15]  
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17 69 The biopsychosocial and spiritual model is a representation of the human being in which the  
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19 70 biological, psychological, social and spiritual dimensions are considered to be simultaneously  
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21 71 in play.[12, 14] Sulmasy hypothesizes that the biological, psychological, social and spiritual  
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23 72 dimensions of this model contribute to quality of life: “the composite state – how the patient  
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25 73 feels physically, how the patient is faring psychologically and interpersonally, as well as how  
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27 74 the patient is progressing spiritually – constitutes the substrate of the construct called quality  
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29 75 of life”.[14]  
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33 76 Thus, we aimed to examine the biopsychosocial and spiritual factors associated with quality  
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35 77 of life in elderly hospitalized patients undergoing post-acute rehabilitation.  
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38 78 Because this population is reliant on the hospital institution and is involved in constant  
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40 79 interaction with health care providers, the patient’s perception of the treatment received has to  
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42 80 be taken into account. Satisfaction with care is one proxy to describe the system from the  
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44 81 perspective of the patient, and the literature has shown the influence of satisfaction with care  
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46 82 on quality of life in other settings.[16-17] Therefore, the inclusion of an evaluation of  
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48 83 satisfaction with the care patients received is relevant.  
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52 84 The following hypotheses are made:  
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3 85 The four dimensions of the biopsychosocial and spiritual model and the patient's satisfaction  
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5 86 with the care received are likely associated with the quality of life of a person undergoing  
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7 87 geriatric rehabilitation.  
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10 88 To confirm this hypothesis, the objectives of this study are to explore:  
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- 13 89 1) The quality of life perceived by the patient in a setting of post-acute geriatric  
14 rehabilitation.  
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17 91 2) The relationship between the biopsychosocial dimensions of the patient and patients'  
18 perceived quality of life. As a secondary focus, the relationship between the spiritual  
19 dimension and patients' perceived quality of life.  
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23 94 3) The relationship between satisfaction with care received and patients' perceived  
24 quality of life.  
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## 30 97 **METHOD**

### 31 98 **Context and Population**

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35 99 This cross-sectional descriptive study was conducted at a post-acute rehabilitation center for  
36 geriatric patients at the Lausanne University Hospital in Switzerland. Participants were  
37  
38 100 consecutively included during a cumulative period of 13 months running from October 2014  
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40 101 to January 2016. The patients spent an average of 20.5 days in this 95-bed center, after an  
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42 102 acute-care hospital stay, and 74% of them then returned home.  
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47 104 Eligible participants were at least 65 years old. Exclusion criteria included significant  
48 cognitive disorders (defined by a score of less than 21 on the Mini Mental State, MMS [18]),  
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50 105 too ill to be able to participate (medically unstable or with uncontrolled symptoms such as  
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52 106 severe pain or significant dyspnea), not French-speaking, or a doctor-estimated life  
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54 107 expectancy of less than 6 months. Patients who had previously been included and excluded  
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3 109 were not re-included as a case of new admission during this period. In the end, 167 patients  
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5 110 participated in the study (Figure 1). An analysis comparing the participants (N = 167) with  
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7 111 patients who refused to participate (N = 60) and with those who did not participate owing to  
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9 112 logistical reasons (N = 177) did not show any characteristic significant differences.

11 [INSERT FIGURE 1]

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15 114 The study was approved by the Cantonal Committee of Vaud on the Ethics of Research on  
16  
17 115 Human Subjects, and all the participants gave their written informed consent. The manuscript  
18  
19 116 was drafted in accordance with the STROBE reporting guidelines (www.strobe-  
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21 117 statement.org/).

### 22 23 24 25 118 **Data Collected**

26  
27  
28 119 At the time of admission, data were collected on age, sex, reason for admission, living  
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30 120 conditions (living alone, use of home care services, living in a nursing home), functional  
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32 121 status at home prior to admission (from history, using basic activities of daily living [ADL]  
33  
34 122 and instrumental activities of daily living [IADL]; ADL scores ranged from 0 to 6,[19] while  
35  
36 123 IADL scores ranged from 0 to 8,[20] a high score indicating better functional status),  
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38 124 functional status at the time of admission to the geriatric rehabilitation center (measured using  
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40 125 the functional independence measure [FIM], with scores ranging from 18 to 126, a high score  
41  
42 126 indicating better functional status),[21] falls during the previous twelve months, cognitive  
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44 127 status (measured using the MMS, with scores ranging from 0 to 30, a high score indicating  
45  
46 128 better cognitive status)[18] and level of comorbidities (measured using the cumulative illness  
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48 129 rating scale [CIRS-G], with scores ranging from 0 to 56, a high score indicating more  
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50 130 comorbidities).[22] During the second week of hospitalization, a chaplain evaluated the  
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52 131 spiritual needs of the patient (cf. below). All of these assessments were systematically  
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54 132 conducted in the usual clinical setting.  
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3 133 Specifically for this research, a research assistant met with patients during their second week  
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5 134 of hospitalization at the post-acute rehabilitation center to evaluate their quality of life (cf.  
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7 135 below), the presence of depressive symptoms (patient health questionnaire-9, PHQ9, with  
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9 136 scores ranging from 0 to 27, a high score indicating more depressive symptoms)[23-24] and  
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11 137 their satisfaction with the care received (cf. below). The PHQ-9 was specifically chosen for its  
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13 138 psychometric properties, as a usual clinical setting normally has a tool with lower properties.

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17 139 *World Health Organization Quality of Life questionnaire - version for older people*  
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19 140 (*WHOQOL-OLD*). Quality of life was evaluated by the WHOQOL-OLD, a questionnaire  
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21 141 developed using the World Health Organization framework and translated into and validated  
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23 142 in French.[25-26] The WHOQOL-OLD is specifically intended for persons over 60 years of  
24  
25 143 age and emphasizes the following six dimensions, which are particularly relevant to the  
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27 144 quality of life for this segment of the population: “sensory abilities”; “autonomy”; “past,  
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29 145 present and future activities”; “social participation”; “death and dying”; and “intimacy”. The  
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31 146 “sensory abilities” dimension describes sensory functionality (hearing, sight, touch, taste and  
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33 147 smell) and its impact on loss of quality of life. The “autonomy” dimension involves the ability  
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35 148 to maintain control over one’s actions and decisions. The “past, present and future activities”  
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37 149 dimension reflects the feeling of accomplishment during life and perspectives on life as it  
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39 150 continues. The “social participation” dimension assesses patient satisfaction related to his/her  
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41 151 daily activities, particularly social activities. The “death and dying” dimension refers to  
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43 152 preoccupations with death. Finally, the “intimacy” dimension relates to intimate and personal  
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45 153 relations with persons who are close to the respondent. The questionnaire includes 24 answers  
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47 154 evaluated on a Likert scale from 1 to 5. The total score and the score for each dimension  
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49 155 (which are calculated by an algorithm) range from 0 to 100. A high score indicates a higher  
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51 156 quality of life.  
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3 157 *Quality from the Patient's Perspective Short Form (QPP-SF)*. The QPP-SF is a questionnaire  
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5 158 that evaluates care using patient descriptions.[27-28] It covers the following four areas:  
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7 159 medical-technical competences (three factors); physical-technical conditions (three factors);  
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9 160 identity-oriented approach (10 factors); and socio-cultural atmosphere (four factors). The final  
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11 161 score ranges from 20 to 80; a high score indicates high satisfaction with the care received. For  
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13 162 purposes of this study, the questionnaire was translated by two persons whose native language  
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15 163 was French, and a native English speaker performed a reverse translation.  
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19 164 *Spiritual Distress Assessment Tool (SDAT)*. The SDAT evaluates the spiritual needs of  
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21 165 hospitalized elderly patients.[29-30] The SDAT consists of 5 items (the need for life balance,  
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23 166 the need for connection, the need for values acknowledgement, the need to maintain control,  
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25 167 and the need to maintain identity), scored on a Likert scale of 0 (need completely met) to 3  
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27 168 (need completely unmet). The total score ranges from 0 to 15; a high score indicates  
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29 169 important unmet spiritual needs. The SDAT was administered to patients by a specially  
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31 170 trained chaplain using a standardized procedure.  
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### 35 171 **Statistical Analyses**

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38 172 Descriptive analyses of the variables were undertaken. Correlations of the different  
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40 173 descriptive elements and quality of life were determined using Spearman rank correlations.  
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42 174 Quality of life was considered both in overall terms and within each of its dimensions.  
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44 175 Univariate analyses were carried out only with available data (complete case analysis), and  
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46 176 the number of missing data was mentioned (see the Strengths and Weaknesses section for  
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48 177 explanations about missing data). The data were analyzed using Stata 12.0 (Stata Corp LP,  
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50 178 College Station, TX). Finally, a multivariate linear regression was undertaken, with the  
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52 179 WHOQOL-OLD total as the dependent variable, and age, sex, FIM, MMS, PHQ-9, living  
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54 180 conditions and QPP-SF as explanatory variables. The low availability of the chaplain resulted  
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3 181 in many missing SDAT responses; therefore, we considered spirituality as a secondary rather  
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5 182 than a primary focus and did not include it in the multivariate analysis. Multicollinearity  
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7 183 among the explanatory variables was assessed with the variance inflation factor. Parameters  
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9 184 were estimated using multiple imputation (20 imputations), with R version 3.3.1 (www.r-  
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11 185 project.org) and the package mice version 2.25.[31] The number of missing values is also  
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14 186 indicated. The statistical significance was set at  $p < .05$ .  
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## 188 RESULTS

### 189 Population Description

190 The average age of the participants was  $82.3 \pm 7.2$  years, and 65.9% were women. Their  
191 characteristics are described in Table 1. The patients were mostly admitted from orthopedics  
192 and traumatology (42 %), internal medicine (41 %), neurology (6 %) and cardio-vascular  
193 surgery (4 %). Participants from orthopedics and traumatology were admitted after fracture  
194 surgery (40 %), elective surgery (39 %), conservative treatment of fractures (17 %) and other  
195 reasons (4 %). From internal medicine, they were in post-acute rehabilitation for gait and  
196 balance disorders of multifactorial etiology (29 %), an infectious disease (27 %), a cardiac  
197 event (20 %) and other reasons (25 %).  
198

199 *Table 1.* Clinical characteristics of the sample (N = 167).

Characteristics	Mean $\pm$ SD [min; max] or %	Median [interquartile range]	Number of missing values
Age (years)	$82.3 \pm 7.2$ [65; 101]	83.0 [77-88]	0
Women (%)	65.9	(women)	0
ADL index at admission <sup>a</sup>	$5.1 \pm 1.1$ [1; 6]	5 [5-6]	1

IADL index at admission <sup>b</sup>	4.7 ± 2.4 [1; 8]	5 [3-7]	2
Fall during the previous year (%)	68.9	(yes)	0
Living alone (%)	72.5	(yes)	0
Home care before hospitalization (%)	64.1	(yes)	0
Living in nursing home before hospitalization (%)	0.6	(no)	0
FIM <sup>c</sup>	86.4 ± 14.3 [27; 109]	91 [79-96]	1
MMS <sup>d</sup>	26.7 ± 2.7 [21; 30]	28 [25-29]	0
CIRS <sup>e</sup>	14.3 ± 4.9 [4; 33]	14 [11-18]	72
PHQ-9 <sup>f</sup>	7.0 ± 4.8 [0; 27]	6 [4-10]	4
SDAT <sup>g</sup>	6.0 ± 3.1 [0; 12]	6 [3-9]	69
QPP-SF <sup>h</sup>	72.3 ± 8.5 [26; 80]	75 [69-78.5]	30

*Note.* <sup>a</sup>Activities of daily living (score range from min. 0 to max. 6), <sup>b</sup>Instrumental activities of daily living (0 to 8), <sup>c</sup>Functional independence measure (18 to 126), <sup>d</sup>Mini mental state (0 to 30), <sup>e</sup>Cumulative illness rating scale (0 to 56), <sup>f</sup>Patient health questionnaire-9 (0 to 27), <sup>g</sup>Spiritual distress assessment tool (0 to 15), <sup>h</sup>Quality from the patient's perspective short form (20 to 80).

200

## 201 **Quality of Life in Geriatric Rehabilitation**

202 Overall, on a transformed scale of 0 to 100, the quality of life perceived by the patients is 68.3  
 203 ± 12.2 (median 69.3, min. 37.5, max. 94.8) (Figure 2). The dimensions of the WHOQOL-  
 204 OLD range from 60.0 ± 22.7 ("sensory abilities") to 77.4 ± 18.8 ("death and dying").

205 [INSERT FIGURE 2]

## 206 **Univariate Analysis of Factors Associated with Quality of Life**

207 Detailed data are provided in Table 2. Overall better quality of life is significantly associated  
 208 with a higher functional status at the time of entrance (FIM), a better cognitive state (MMS)  
 209 and a better satisfaction regarding care received (QPP-SF). The presence of comorbidities  
 210 (CIRS), lower mood (PHQ-9), and unmet spiritual needs (SDAT) are associated with a lower  
 211 quality of life. We do not see a significant relation for the social evaluation factors.

212

213 *Table 2.* Analysis of associations with the WHOQOL-OLD, both overall and for each  
 214 underlying dimension. Spearman's rank correlation,  $r_s$  [p-value]. Variables with a  
 215 weak to average correlation ( $|r_s| \geq .200$ ) are indicated in gray; those with a significant  
 216 correlation ( $p\text{-value} \leq .050$ ) are in boldface. The number of missing values is indicated  
 217 in parentheses.

Characteristics	WHOQOL-OLD total	Sensory abilities	Autonomy	Death and dying	Past, present and future activities	Social participation	Intimacy
Age (years)	-0.031 [.705] (11)	.095 [.224] (1)	-0.088 [.262] (1)	.088 [.265] (4)	-0.020 [.797] (0)	-0.084 [.284] (2)	.007 [.933] (3)
Women (%)	.004 [.965] (11)	.039 [.614] (1)	-0.13 [.873] (1)	-0.047 [.550] (4)	-0.038 [.628] (0)	.024 [.758] (2)	.015 [.847] (3)
FIM	<b>.204 [.011] (12)</b>	<b>.170 [.029] (2)</b>	<b>.312 [.000] (2)</b>	-0.127 [.107] (5)	<b>.177 [.023] (1)</b>	<b>.210 [.007] (3)</b>	.061 [.443] (4)
MMS	<b>.175 [.029] (11)</b>	.038 [.631] (1)	<b>.212 [.006] (1)</b>	-0.062 [.429] (4)	<b>.202 [.009] (0)</b>	<b>.202 [.035] (2)</b>	<b>.157 [.045] (3)</b>
CIRS	<b>-.226 [.033] (77)</b>	.005 [.961] (72)	<b>-.231 [.025] (73)</b>	-0.087 [.407] (74)	<b>-.230 [.025] (72)</b>	<b>-.337 [.001] (72)</b>	.083 [.430] (74)
PHQ-9	<b>-.379 [.000] (15)</b>	<b>-.331 [.000] (5)</b>	<b>-.319 [.000] (5)</b>	<b>-.265 [.001] (8)</b>	<b>-.156 [.047] (4)</b>	<b>-.317 [.000] (6)</b>	-.101 [.202] (7)
Living alone (%)	-0.063 [.434] (11)	-0.089 [.255] (1)	.080 [.308] (1)	-0.052 [.510] (4)	-0.098 [.209] (0)	-0.048 [.540] (2)	<b>-.170 [.030] (3)</b>
Home care before hospitalization (%)	-0.238 [.003] (11)	-0.106 [.174] (1)	<b>-.245 [.002] (1)</b>	-0.119 [.132] (4)	-0.048 [.056] (0)	-0.152 [.051] (2)	-0.072 [.358] (3)
SDAT	<b>-.211 [.049] (79)</b>	-0.152 [.137] (70)	-0.182 [.073] (69)	-0.052 [.619] (73)	-0.173 [.089] (69)	<b>-.248 [.015] (71)</b>	<b>-.218 [.034] (72)</b>
QPP-SF	<b>.264 [.003] (38)</b>	.045 [.604] (31)	<b>.247 [.004] (31)</b>	.074 [.392] (32)	<b>.179 [.037] (30)</b>	<b>.307 [.000] (31)</b>	<b>.245 [.004] (33)</b>
QPP-SF: medical-technical competences	<b>.207 [.011] (16)</b>	.055 [.488] (7)	<b>.179 [.024] (7)</b>	.076 [.345] (9)	<b>.206 [.009] (6)</b>	<b>.272 [.001] (8)</b>	<b>.218 [.006] (9)</b>
QPP-SF : physical-technical conditions	<b>.252 [.002] (16)</b>	.085 [.286] (7)	<b>.201 [.011] (7)</b>	.130 [.104] (9)	.114 [.150] (6)	<b>.251 [.001] (8)</b>	<b>.311 [.000] (9)</b>
QPP-SF : identity-oriented approach	<b>.231 [.006] (26)</b>	.025 [.758] (17)	<b>.251 [.002] (17)</b>	.006 [.947] (19)	<b>.199 [.014] (16)</b>	<b>.265 [.001] (18)</b>	<b>.257 [.002] (19)</b>
QPP-SF : socio-cultural atmosphere	<b>.242 [.004] (24)</b>	.027 [.739] (16)	<b>.213 [.009] (16)</b>	.052 [.529] (18)	<b>.208 [.010] (15)</b>	<b>.247 [.002] (16)</b>	<b>.325 [.000] (18)</b>

218

219 Table 2 also describes the association between each of the dimensions of WHOQOL-OLD  
 220 and the biopsychosocial and spiritual dimensions. Associations remain similar as those in the  
 221 overall score except for “sensory abilities” and “death and dying”, which are only connected  
 222 with a limited number of markers.

223

### 224 **Linear Multivariate Analysis of Factors Associated with Quality of Life**

225 In multivariate analysis, mood (PHQ-9;  $\beta = -1.011$ ,  $p < .001$ ) and satisfaction with the care  
 226 received (QPP-SF;  $\beta = 0.254$ ,  $p = .037$ ) have a significant association with the quality of life  
 227 (Table 3). The variation explained by all the variables was 26.2% ( $F = 6.254$ ,  $p < .001$ ). No  
 228 multicollinearity was identified between the explanatory variables, because the maximal  
 229 variance inflation factor was 1.28.

230 *Table 3.* Multivariate linear analysis with multiple imputation to predict the  
 231 WHOQOL-OLD total.

Predictive factor	total WHOQOL-OLD (11 missing values)		Number of missing values
	$\beta$ (95% CI)	$p$ -value	
Age (years)	-0.044 (-0.305 to 0.217)	.740	0
Women	0.323 (-3.480 to 4.126)	.867	0
FIM	0.109 (-0.022 to 0.240)	.101	1
MMS	0.088 (-0.601 to 0.777)	.801	0
PHQ-9	-1.011 (-1.428 to -0.594)	<.001	4
Living alone	-1.679 (-5.760 to 2.401)	.417	0
QPP-SF	0.254 (0.016 to 0.493)	.037	30

*Note.*  $\beta$ , regression coefficient.

232

## 233 **DISCUSSION**

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3 234 Elderly patients undergoing rehabilitation after acute care perceived a relatively high level of  
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5 235 quality of life. To our knowledge, these are new data for this specific setting. This is not  
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7 236 surprising, given this environment aims to offer stimulating conditions to promote and regain  
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9 237 a good quality of life. Quality of life has a strong relationship with mood and functional status  
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11 238 in this study. This important link corresponds with research results found in other settings,  
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13 239 such as those found in Conrad et al.[32] Although only a limited number of patients  
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15 240 performed the spiritual needs evaluation, the data show that patients with unmet spiritual  
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17 241 needs experienced a poorer quality of life.  
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21 242 Patients had a high degree of satisfaction with the care they received. This result is consistent  
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23 243 with previous studies with standard adult patients, showing that level of satisfaction is higher  
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25 244 in rehabilitation setting.[33] Satisfaction with care received is strongly associated with quality  
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27 245 of life. Such results are consistent with the literature in other settings, especially with those  
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29 246 reported by Hartgering et al, which reported satisfaction with care received positively related  
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31 247 to older patients' quality of life in an acute care setting with global and integrated care.[16]  
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33 248 Further research is needed to better understand their inter-relationships.[34]  
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37 249 The multivariate model emphasizes the importance of satisfaction with care to quality of life  
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39 250 in this setting. This model, besides confirming the importance of the psychological  
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41 251 dimension, does not allow us to draw conclusions about biopsychosocial factors related to the  
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43 252 quality of life. Functional status and cognitive status were not statistically significant in this  
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45 253 multivariable linear regression, suggesting that, at least in this setting, they were not the most  
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47 254 important drivers of perceived quality of life. This reflects that quality of life is complex and  
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49 255 this study could only partially approach this complexity. Measuring quality of life, not fully  
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51 256 explained from pooling descriptors of usual clinical practice, may surpass these traditional  
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53 257 descriptors.  
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## 258 **Strengths and Weaknesses**

259 This study was undertaken in a “real world” clinical practice. The scales are employed in  
260 usual clinical practice and shared regularly in interdisciplinary meetings. The use of these  
261 tools, widely employed and validated in different clinical contexts, is likely to result in good  
262 ecological validity.

263 This study has certain limitations. First, the results apply only to a sample of elderly  
264 hospitalized patients without severe cognitive disorders, and thus cannot be generalized to  
265 patients with cognitive disorders. Furthermore, the cross-sectional study cannot conclude any  
266 causal relationships between descriptors and quality of life. In addition, the rate of patients  
267 who did not participate might create a risk of selection-based bias, though slight, as the  
268 characteristics of the patients who participated and those who did not showed no significant  
269 differences. In the context of data drawn from usual clinical practice, the social dimension can  
270 be misjudged and fail to demonstrate any link to quality of life; to avoid this result, a purpose-  
271 designed tool such as a scale of social support might be required.[35] Such a scale would  
272 certainly show the importance of social support to quality of life.[36-37] Similarly, some  
273 evaluations were not always undertaken: the chaplain worked part-time and was not able to  
274 conduct all the SDAT, despite excellent patient acceptance. The CIRS were not systematically  
275 completed by the physicians. Conversely, missing data for the WHOQOL-OLD or the QPP-  
276 SF are from patients who did not respond to at least one of the questions asked, preventing  
277 calculation of the total score. Nevertheless, multiple imputation allowed us to limit the  
278 nonresponse bias in the multivariate analysis.

## 279 **Implications for Clinical Practice**

280 Evaluating quality of life is relevant in geriatric rehabilitation because we observe that  
281 variables traditionally used in clinical practice may not be sufficient to explain the quality of

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3 282 life and therefore insufficient to achieve that goal. Knowing the necessary elements for a good  
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5 283 quality of life for each patient is fundamental to better understanding him/her, and might  
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7 284 improve guidance in setting goals of care. This information could contribute to offer truly  
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9 285 patient-centered care in hospital environments, and is therefore useful to the different  
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11 286 professionals in charge of these patients.  
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14 287 However, further development of a biopsychosocial and spiritual model can only be  
15  
16 288 encouraged. Similarly, this work suggests the importance of integrating an evaluation of the  
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18 289 satisfaction with care received because it is also associated with quality of life.  
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22 290 Considering the following quotation: “Therapeutic success depends in part upon the  
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24 291 therapist’s ability to set a story in motion which is meaningful to the patient as well as to  
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26 292 herself”,[38] this work, which accounts for a patient’s quality of life, also has an ethical  
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28 293 impact. In fact, this measure might help balance aspects of beneficence and respect for  
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30 294 autonomy in a system that should not be paternalistic, but that also cannot meet all of a  
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32 295 patient’s expectations.  
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### 34 35 36 296 **Conclusion**

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39 297 Patients undergoing post-acute geriatric rehabilitation perceive a good quality of life.  
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41 298 Satisfaction with care they received is strongly associated with quality of life. In this setting,  
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43 299 biopsychosocial and spiritual descriptors used in clinical practice are only moderately  
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45 300 associated with quality of life. A follow-up to this study might evaluate how to better  
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47 301 integrate quality of life in the construction of the care project, in addition to the usual  
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49 302 descriptors of the clinical practice.  
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3 303 **FOOTNOTES**  
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7  
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9  
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11 306 **Competing interests:** None declared.  
12

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14 307 **Ethics approval:** Cantonal Committee of Vaud on the Ethics of Research on Human  
15  
16 308 Subjects, Lausanne, Switzerland.  
17

18  
19 309 **Data sharing statement:** The full anonymized data set can be provided on request.  
20

21  
22 310 **Contributors:** MAB, ERT, ER and SM designed the research. MAB and JP conducted  
23  
24 311 statistical analysis. All authors interpreted the data. MAB wrote the first draft of the  
25  
26 312 manuscript. All authors participated in the writing of subsequent versions and approved the  
27  
28 313 final article.  
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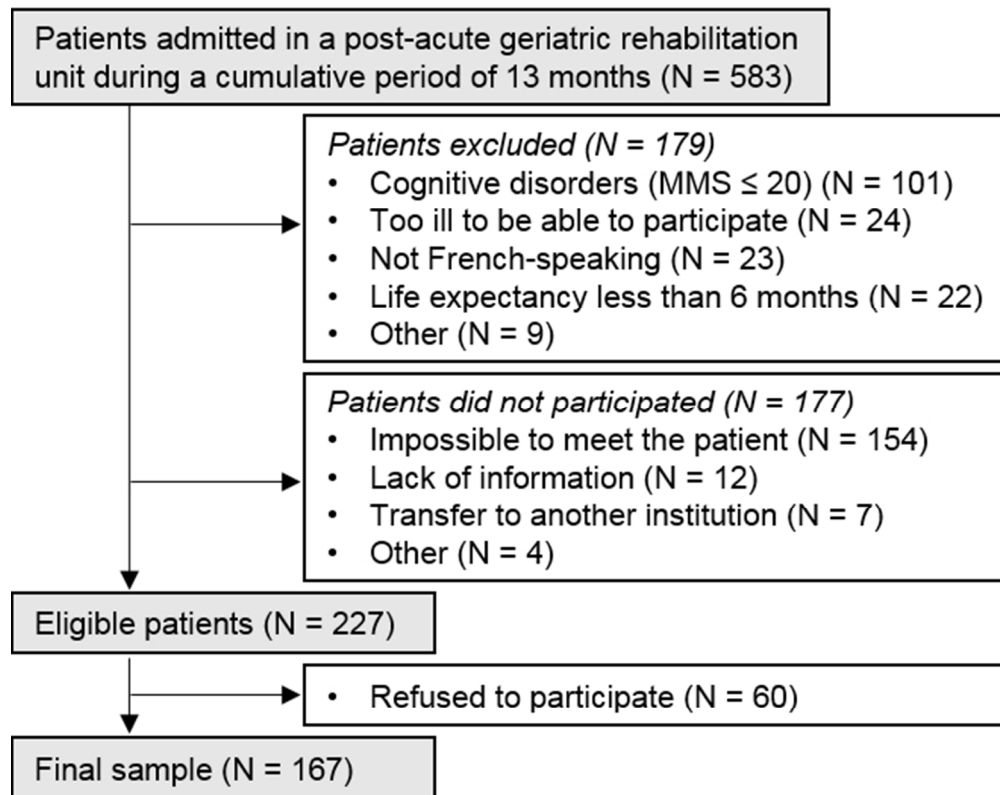
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3 400 **FIGURE LEGENDS**  
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6 401 Figure 1. *Study flow chart.*  
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9 402 Figure 2. *WHOQOL-OLD scores describing the overall quality of life and each underlying*  
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11 403 *dimension. The number of missing values is indicated in parentheses.*  
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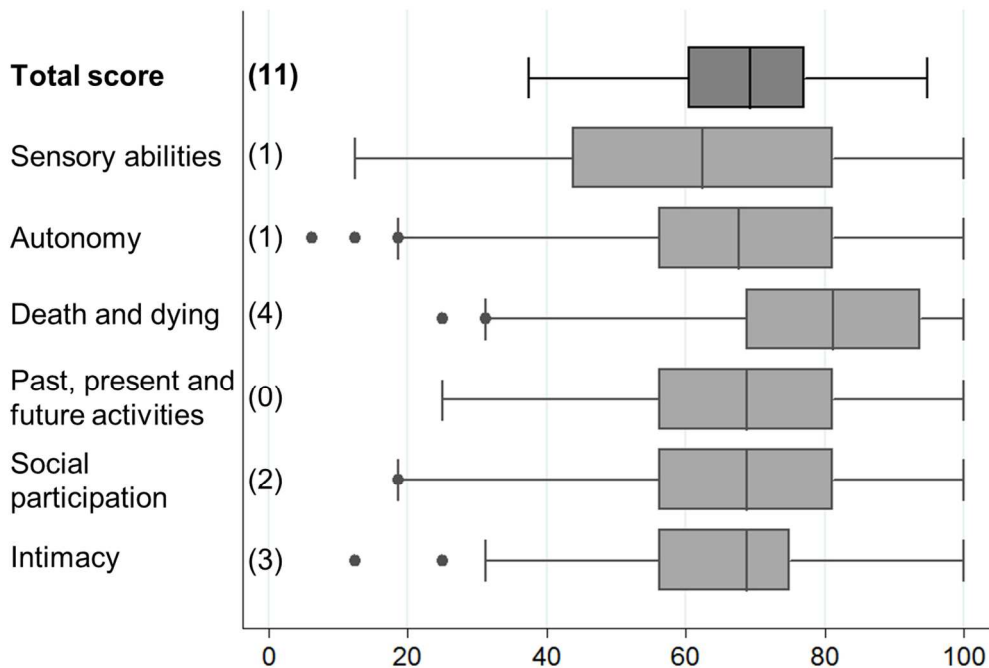
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For peer review only



Study flow chart.

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WHOQOL-OLD scores describing the overall quality of life and each underlying dimension. The number of missing values is indicated in parentheses.

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View only



STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cross-sectional studies

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1 - 2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 - 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5 - 6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7 - 9
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7 - 9
Bias	9	Describe any efforts to address potential sources of bias	6, 9
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	9
		(c) Explain how missing data were addressed	9, 15
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a

<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	<b>6 , Figure 1</b>
		(b) Give reasons for non-participation at each stage	<b>Figure 1</b>
		(c) Consider use of a flow diagram	<b>Figure 1</b>
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	<b>10, Table 1</b>
		(b) Indicate number of participants with missing data for each variable of interest	<b>Tables 1 - 3, Figure 2</b>
Outcome data	15*	Report numbers of outcome events or summary measures	<b>Figure 2, Tables 2 - 3</b>
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	<b>13, Table 3</b>
		(b) Report category boundaries when continuous variables were categorized	<b>n/a</b>
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	<b>n/a</b>
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	<b>n/a</b>
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	<b>13 - 14</b>
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	<b>14 - 15</b>
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	<b>13 - 16</b>
Generalisability	21	Discuss the generalisability (external validity) of the study results	<b>14 - 15</b>
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	<b>17</b>

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Factors associated with quality of life in elderly hospitalized patients undergoing post-acute rehabilitation: a cross-sectional analytic study in Switzerland

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Keywords:	GERIATRIC MEDICINE, geriatric rehabilitation, quality of life, biopsychosocial and spiritual model, satisfaction with care

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5 **Factors associated with quality of life in elderly hospitalized**  
6 **patients undergoing post-acute rehabilitation: a cross-sectional**  
7 **analytic study in Switzerland**  
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11 Marc-Antoine Bornet, MMed<sup>1§</sup>, Eve Rubli Truchard, MD<sup>2</sup>, Etienne Rochat, MTh<sup>1</sup>,

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54 Word count (excluding title page, abstract, references, figures and tables): 3257 words.  
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3 **ABSTRACT**  
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5 **Objectives:** We investigated whether biopsychosocial and spiritual factors and satisfaction  
6 with care were associated with patients' perceived quality of life.  
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9 **Design:** This was a cross-sectional analytic study.  
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11 **Setting:** Data were collected from inpatients at a post-acute geriatric rehabilitation center in a  
12 university hospital in Switzerland.  
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14 **Participants:** Participants aged 65 years and over were consecutively recruited from October  
15 2014 to January 2016. Exclusion criteria included significant cognitive disorder and terminal  
16 illness. Of 227 eligible participants, complete data were collected from 167.  
17

18 **Main outcome measures:** Perceived quality of life was measured using the World Health  
19 Organization Quality of Life questionnaire - version for older people. Predictive factors were  
20 age, sex, functional status at admission, comorbidities, cognitive status, depressive symptoms,  
21 living conditions, and satisfaction with care. A secondary focus was the association between  
22 spiritual needs and quality of life.  
23

24 **Results:** Patients undergoing geriatric rehabilitation experienced a good quality of life.  
25 Greater quality of life was significantly associated with higher functional status ( $r_s = .204$ ,  $p =$   
26  $.011$ ), better cognitive status ( $r_s = .175$ ,  $p = .029$ ), and greater satisfaction with care ( $r_s = .264$ ,  
27  $p = .003$ ). Poorer quality of life was significantly associated with comorbidities ( $r_s = -.226$ ,  $p$   
28  $= .033$ ), greater depressive symptoms ( $r_s = -.379$ ,  $p < .001$ ), and unmet spiritual needs ( $r_s =$   
29  $-.211$ ,  $p = .049$ ). Multivariate linear regression indicated that depressive symptoms ( $\beta =$   
30  $-0.961$ ; 95% confidence intervals [CI]:  $-1.449$ ,  $-0.472$ ;  $p < .001$ ) significantly predicted  
31 quality of life.  
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33 **Conclusions:** Patient perceptions of quality of life were significantly associated with  
34 depression. More research is needed to assess whether considering quality of life could  
35 improve care plan creation.  
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52 **Keywords:** geriatric rehabilitation, quality of life, biopsychosocial and spiritual model,  
53 satisfaction with care.  
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3 29 **ARTICLE SUMMARY**  
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6 30 **Strengths and limitations of this study**  
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9 31 ▪ This study uses biopsychosocial and spiritual descriptors to explore determinants of  
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11 32 quality of life in geriatric rehabilitation.  
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13 33 ▪ Design is based on a “real world” setting, with usual clinical practice descriptors of  
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15 34 biopsychosocial and spiritual dimensions, which is likely to result in good ecological  
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17 35 validity.  
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19 36 ▪ Owing to the precedent point, the rate of missing values is higher, which may induce a  
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21 37 bias. To address this, the multivariate analysis included multiple imputation.  
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23 38 ▪ All evaluations were not made at the same time, and we cannot exclude the possibility that  
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25 39 symptomatic change may have occurred in some patients.  
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## 40 INTRODUCTION

41 Quality of life is an increasingly interesting outcome in the context of the aging population. It  
42 is relevant to consider quality of life rather than mortality in elderly people, given the high  
43 prevalence of chronic conditions and their impact on functional independence. Elderly people  
44 usually prefer quality of life over long life.[1] It seems therefore valuable to study quality of  
45 life in elderly persons and to identify likely influential factors.

46 Overall, elderly community-dwelling populations retain a good quality of life. For instance, in  
47 a random sample of 999 English respondents over 65 years of age, 82% described their  
48 quality of life as good.[2] Quality of life in elderly persons is affected by a variety of factors;  
49 thus, depressive disorders, functional impairment and other health problems could reduce a  
50 patient's quality of life, whereas social support can positively affect quality of life.[3]  
51 Psychosocial resources can have a substantial influence on quality of life, affecting situations  
52 such as facing a diminution of functionality, for example.[2] Although quality of life can  
53 decrease with physical impairment, elderly persons suffering significant limitations in their  
54 daily lives may nevertheless (and somewhat paradoxically) describe their quality of life as  
55 excellent.[4-5] In a study of 185 community-dwelling older Americans with advanced illness,  
56 Solomon et al. found that 65% of patients reported their quality of life as the best possible or  
57 good.[6]

58 Quality of life in elderly persons has been assessed in a number of health-care settings (acute  
59 care, assisted living and nursing home). Existing studies have similar results, and tend to  
60 show that the perceived quality of life remains good in these settings.[7-8] There are only a  
61 few studies that investigate quality of life in rehabilitation and most of them were focused on  
62 patients with very specific illnesses, such as osteoporosis and hip fracture.[4, 9] However,  
63 measuring quality of life in this setting should be of interest because improving quality of life

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3 64 is typically understood as the ultimate goal of rehabilitation.[10-11] Moreover, it could be a  
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5 65 broader outcome to measure in rehabilitation, in addition to traditional variables linked to  
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7 66 functional independence improvement.  
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10 67 Geriatric rehabilitation is traditionally interdisciplinary, with attention paid to biopsychosocial  
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12 68 issues.[12-13] This setting even integrates the spiritual dimension at different levels, in a  
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14 69 global biopsychosocial and spiritual model of care.[14-15]  
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17 70 The biopsychosocial and spiritual model is a representation of the human being in which the  
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19 71 biological, psychological, social and spiritual dimensions are considered to be simultaneously  
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21 72 in play.[12, 14] Sulmasy hypothesizes that the biological, psychological, social and spiritual  
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23 73 dimensions of this model contribute to quality of life: “the composite state – how the patient  
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25 74 feels physically, how the patient is faring psychologically and interpersonally, as well as how  
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27 75 the patient is progressing spiritually – constitutes the substrate of the construct called quality  
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29 76 of life”.[14]  
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33 77 Thus, we aimed to examine the biopsychosocial and spiritual factors associated with quality  
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35 78 of life in elderly hospitalized patients undergoing post-acute rehabilitation.  
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38 79 Because this population is reliant on the hospital institution and is involved in constant  
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40 80 interaction with health care providers, the patient’s perception of the treatment received has to  
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42 81 be taken into account. Satisfaction with care is one proxy to describe the system from the  
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44 82 perspective of the patient, and the literature has shown the influence of satisfaction with care  
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46 83 on quality of life in other settings.[16-17] Therefore, the inclusion of an evaluation of  
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48 84 satisfaction with the care patients received is relevant.  
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51 85 The following hypotheses are made:  
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3 86 The four dimensions of the biopsychosocial and spiritual model and the patient's satisfaction  
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5 87 with the care received are likely associated with the quality of life of a person undergoing  
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7 88 geriatric rehabilitation.  
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10 89 To confirm this hypothesis, the objectives of this study are to explore:  
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13 90 1) The quality of life perceived by the patient in a setting of post-acute geriatric  
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15 91 rehabilitation.  
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17 92 2) The relationship between the biopsychosocial dimensions of the patient and patients'  
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19 93 perceived quality of life. As a secondary focus, the relationship between the spiritual  
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21 94 dimension and patients' perceived quality of life.  
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24 95 3) The relationship between satisfaction with care received and patients' perceived  
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26 96 quality of life.  
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## 30 98 **METHOD**

### 31 99 **Context and Population**

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35 100 This cross-sectional analytic study was conducted at a post-acute rehabilitation center for  
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37 101 geriatric patients at Lausanne University Hospital in Switzerland. Participants were  
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39 102 consecutively included during a cumulative period of 13 months running from October 2014  
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41 103 to January 2016. The patients spent an average of 20.5 days in this 95-bed center, after an  
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43 104 acute-care hospital stay, and 74% of them then returned home.  
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47 105 Eligible participants were at least 65 years old. Exclusion criteria included significant  
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49 106 cognitive disorders (defined by a score of less than 21 on the Mini Mental State, MMS [18]),  
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51 107 too ill to be able to participate (medically unstable or with uncontrolled symptoms such as  
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53 108 severe pain or significant dyspnea), not French-speaking, or a doctor-estimated life  
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55 109 expectancy of less than 6 months. Patients who had previously been included and excluded  
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3 110 were not re-included as a case of new admission during this period. In the end, 167 patients  
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5 111 participated in the study (Figure 1). An analysis comparing the participants (N = 167) with  
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7 112 patients who refused to participate (N = 60) and with those who did not participate owing to  
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9 113 logistical reasons (N = 177) did not show any characteristic significant differences.

11 114 [INSERT FIGURE 1]

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15 115 The study was approved by the Cantonal Committee of Vaud on the Ethics of Research on  
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17 116 Human Subjects, and all the participants gave their written informed consent. The manuscript  
18  
19 117 was drafted in accordance with the STROBE reporting guidelines (www.strobe-  
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21 118 statement.org/).

### 22 23 24 25 119 **Data Collected**

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28 120 At the time of admission, data were collected on age, sex, reason for admission, living  
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30 121 conditions (living alone, use of home care services, living in a nursing home), functional  
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32 122 status at home prior to admission (from history, using basic activities of daily living [ADL]  
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34 123 and instrumental activities of daily living [IADL]; ADL scores ranged from 0 to 6,[19] while  
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36 124 IADL scores ranged from 0 to 8,[20] a high score indicating better functional status),  
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38 125 functional status at the time of admission to the geriatric rehabilitation center (measured using  
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40 126 the functional independence measure [FIM], with scores ranging from 18 to 126, a high score  
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42 127 indicating better functional status),[21] falls during the previous twelve months, cognitive  
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44 128 status (measured using the MMS, with scores ranging from 0 to 30, a high score indicating  
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46 129 better cognitive status)[18] and level of comorbidities (measured using the cumulative illness  
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48 130 rating scale [CIRS], with scores ranging from 0 to 56, a high score indicating more  
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50 131 comorbidities).[22] During the second week of hospitalization, a chaplain evaluated the  
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52 132 spiritual needs of the patient (cf. below). All of these assessments were systematically  
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54 133 conducted in the usual clinical setting.  
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3 134 Specifically for this research, a research assistant met with patients during their second week  
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5 135 of hospitalization at the post-acute rehabilitation center to evaluate their quality of life (cf.  
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7 136 below), the presence of depressive symptoms (patient health questionnaire-9, PHQ9, with  
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9 137 scores ranging from 0 to 27, a high score indicating more depressive symptoms)[23-24] and  
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11 138 their satisfaction with the care received (cf. below). The PHQ-9 was specifically chosen for its  
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13 139 psychometric properties, as a usual clinical setting normally has a tool with lower properties.

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17 140 *World Health Organization Quality of Life questionnaire - version for older people*  
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19 141 (*WHOQOL-OLD*). Quality of life was evaluated by the WHOQOL-OLD, a questionnaire  
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21 142 developed using the World Health Organization framework and translated into and validated  
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23 143 in French.[25-26] The WHOQOL-OLD is specifically intended for persons over 60 years of  
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25 144 age and emphasizes the following six dimensions, which are particularly relevant to the  
26  
27 145 quality of life for this segment of the population: “sensory abilities”; “autonomy”; “past,  
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29 146 present and future activities”; “social participation”; “death and dying”; and “intimacy”. The  
30  
31 147 “sensory abilities” dimension describes sensory functionality (hearing, sight, touch, taste and  
32  
33 148 smell) and its impact on loss of quality of life. The “autonomy” dimension involves the ability  
34  
35 149 to maintain control over one’s actions and decisions. The “past, present and future activities”  
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37 150 dimension reflects the feeling of accomplishment during life and perspectives on life as it  
38  
39 151 continues. The “social participation” dimension assesses patient satisfaction related to his/her  
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41 152 daily activities, particularly social activities. The “death and dying” dimension refers to  
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43 153 preoccupations with death. Finally, the “intimacy” dimension relates to intimate and personal  
44  
45 154 relations with persons who are close to the respondent. The questionnaire includes 24 answers  
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47 155 evaluated on a Likert scale from 1 to 5. The total score and the score for each dimension  
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49 156 (which are calculated by an algorithm) range from 0 to 100. A high score indicates a higher  
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51 157 quality of life.  
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3 158 *Quality from the Patient's Perspective Short Form (QPP-SF)*. The QPP-SF is a questionnaire  
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5 159 that evaluates care using patient descriptions.[27-28] It covers the following four areas:  
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7 160 medical-technical competences (three factors); physical-technical conditions (three factors);  
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9 161 identity-oriented approach (10 factors); and socio-cultural atmosphere (four factors). The final  
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11 162 score ranges from 20 to 80; a high score indicates high satisfaction with the care received. For  
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13 163 purposes of this study, the questionnaire was translated by two persons whose native language  
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15 164 was French, and a native English speaker performed a reverse translation.

16 165 *Spiritual Distress Assessment Tool (SDAT)*. The SDAT evaluates the spiritual needs of  
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18 166 hospitalized elderly patients.[29-30] The SDAT consists of five items (the need for life  
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20 167 balance, the need for connection, the need for values acknowledgement, the need to maintain  
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22 168 control, and the need to maintain identity), scored on a Likert scale of 0 (need completely  
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24 169 met) to 3 (need completely unmet). The total score ranges from 0 to 15; a high score indicates  
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26 170 important unmet spiritual needs. The SDAT was administered to patients by a specially  
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28 171 trained chaplain using a standardized procedure.

## 29 30 31 32 33 34 35 172 **Statistical Analyses**

36  
37 173 Descriptive analyses of the variables were undertaken. Correlations of the different  
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39 174 descriptive elements and quality of life were determined using Spearman rank correlations.  
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41 175 Quality of life was considered both in overall terms and within each of its dimensions.  
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43 176 Univariate analyses were carried out only with available data (complete case analysis), and  
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45 177 the number of missing data was mentioned (see the Strengths and Weaknesses section for  
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47 178 explanations about missing data). The data were analyzed using Stata 12.0 (Stata Corp LP,  
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49 179 College Station, TX). Finally, a multivariate linear regression was undertaken, with the  
50  
51 180 WHOQOL-OLD total as the dependent variable, and age, sex, FIM, MMS, CIRS, PHQ-9,  
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53 181 living conditions, SDAT and QPP-SF as explanatory variables. The number of participants  
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3 182 required for the study was initially based on a rule of thumb of 10 times the number of  
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5 183 coefficients, but this was then majored owing to missing values. Multicollinearity among the  
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7 184 explanatory variables was assessed with the variance inflation factor. The residual variance  
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9 185 was homogenous, excluding any heteroscedasticity. No clear outliers emerged from the  
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11 186 diagnostic plots. Parameters were estimated using multiple imputation (20 imputations), with  
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13 187 R version 3.3.1 (www.r-project.org) and the package mice version 2.25.[31] The number of  
14  
15 188 missing values is also indicated. The statistical significance was set at  $p \leq .050$ .

## 189 RESULTS

### 190 Population Description

191 The average age of the participants was  $82.3 \pm 7.2$  years, and 65.9% were women. Their  
192 characteristics are described in Table 1. The patients were mostly admitted from orthopedics  
193 and traumatology (42 %), internal medicine (41 %), neurology (6 %) and cardio-vascular  
194 surgery (4 %). Participants from orthopedics and traumatology were admitted after fracture  
195 surgery (40 %), elective surgery (39 %), conservative treatment of fractures (17 %) and other  
196 reasons (4 %). From internal medicine, they were in post-acute rehabilitation for gait and  
197 balance disorders of multifactorial etiology (29 %), an infectious disease (27 %), a cardiac  
198 event (20 %) and other reasons (25 %).

199 *Table 1.* Clinical characteristics of the patient sample.

Characteristics	Number of missing values	Total sample (N = 167)	Women (N = 110)	Men (N = 57)	Orthopedics and traumatology (N = 70)	Internal medicine (N = 68)
Age (years) (mean $\pm$ SD)	0	$82.3 \pm 7.2$	$82.5 \pm 7.5$	$81.8 \pm 6.7$	$80.7 \pm 7.5^\dagger$	$84.3 \pm 6.6$
Women (%)	0	65.9	100.0*	0.0	74.3	60.3
ADL index before admission <sup>a</sup>	1	$5.1 \pm 1.1$	$5.1 \pm 0.9$	$5.0 \pm 1.3$	$5.4 \pm 0.8^\dagger$	$4.8 \pm 1.2$
IADL index before admission <sup>b</sup>	2	$4.7 \pm 2.4$	$5.1 \pm 2.3^*$	$4.1 \pm 2.3$	$5.9 \pm 2.2^\dagger$	$3.5 \pm 1.9$
Fall during the	0	68.9	72.7	61.4	70.0	72.1

previous year (%)						
Living alone (%)	0	72.5	81.8*	54.4	70.0	82.4
Home care before hospitalization (%)	0	64.1	63.6	64.9	42.9†	79.4
Living in nursing home before hospitalization (%)	0	0.6	0.9	0.0	0.0	1.5
FIM <sup>c</sup>	1	86.4 ± 14.3	87.9 ± 14.1*	83.4 ± 14.4	86.9 ± 13.2	84.9 ± 14.9
MMS <sup>d</sup>	0	26.7 ± 2.7	26.7 ± 2.8	26.8 ± 2.7	27.2 ± 2.7†	26.1 ± 2.8
CIRS <sup>e</sup>	72	14.3 ± 4.9	13.4 ± 4.3*	16.2 ± 5.5	12.5 ± 4.0†	15.6 ± 5.2
PHQ-9 <sup>f</sup>	4	7.0 ± 4.8	7.0 ± 4.9	7.0 ± 4.6	6.7 ± 4.8	7.2 ± 4.9
SDAT <sup>g</sup>	69	6.0 ± 3.1	5.9 ± 2.9	6.2 ± 3.5	5.8 ± 3.1	6.4 ± 3.2
QPP-SF <sup>h</sup>	30	72.3 ± 8.5	72.6 ± 8.1	71.7 ± 9.3	71.5 ± 10.0	72.9 ± 7.4

Note. \*Women vs Men,  $p \leq 0.050$ , †Orthopedics and traumatology vs Internal medicine,  $p \leq 0.050$

<sup>a</sup>Activities of daily living (score range from min. 0 to max. 6), <sup>b</sup>Instrumental activities of daily living (0 to 8), <sup>c</sup>Functional independence measure (18 to 126), <sup>d</sup>Mini mental state (0 to 30), <sup>e</sup>Cumulative illness rating scale (0 to 56), <sup>f</sup>Patient health questionnaire-9 (0 to 27), <sup>g</sup>Spiritual distress assessment tool (0 to 15), <sup>h</sup>Quality from the patient's perspective short form (20 to 80).

200

## 201 Quality of Life in Geriatric Rehabilitation

202 Overall, on a transformed scale of 0 to 100, the quality of life perceived by the patients is 68.3  
 203 ± 12.2 (median 69.3, min. 37.5, max. 94.8) (Figure 2). The dimensions of the WHOQOL-  
 204 OLD range from 60.0 ± 22.7 (“sensory abilities”) to 77.4 ± 18.8 (“death and dying”).

205 [INSERT FIGURE 2]

## 206 Univariate Analysis of Factors Associated with Quality of Life

207 Detailed data are provided in Table 2. Overall better quality of life is significantly associated  
 208 with a higher functional status at the time of entrance (FIM), a better cognitive state (MMS)  
 209 and a better satisfaction regarding care received (QPP-SF). The presence of comorbidities  
 210 (CIRS), lower mood (PHQ-9), and unmet spiritual needs (SDAT) are associated with a lower  
 211 quality of life. We do not see a significant relation for the social evaluation factors.

212 *Table 2.* Analysis of associations with the WHOQOL-OLD, both overall and for each  
 213 underlying dimension. Spearman's rank correlation,  $r_s$  [p-value]. Variables with a  
 214 weak to average correlation ( $|r_s| \geq .200$ ) are indicated in gray; those with a significant

215 correlation ( $p$ -value  $\leq .050$ ) are in boldface. The number of missing values is indicated  
 216 in parentheses.

Characteristics	WHOQOL-OLD total	Sensory abilities	Autonomy	Death and dying	Past, present and future activities	Social participation	Intimacy
Age (years)	-.031 [.705] (11)	.095 [.224] (1)	-.088 [.262] (1)	.088 [.265] (4)	-.020 [.797] (0)	-.084 [.284] (2)	.007 [.933] (3)
Women (%)	.004 [.965] (11)	.039 [.614] (1)	-.013 [.873] (1)	-.047 [.550] (4)	-.038 [.628] (0)	.024 [.758] (2)	.015 [.847] (3)
FIM	<b>.204 [.011]</b> (12)	<b>.170 [.029]</b> (2)	<b>.312 [.000]</b> (2)	-.127 [.107] (5)	<b>.177 [.023]</b> (1)	<b>.210 [.007]</b> (3)	.061 [.443] (4)
MMS	<b>.175 [.029]</b> (11)	.038 [.631] (1)	<b>.212 [.006]</b> (1)	-.062 [.429] (4)	<b>.202 [.009]</b> (0)	<b>.202 [.035]</b> (2)	<b>.157 [.045]</b> (3)
CIRS	<b>-.226 [.033]</b> (77)	.005 [.961] (72)	<b>-.231 [.025]</b> (73)	-.087 [.407] (74)	<b>-.230 [.025]</b> (72)	<b>-.337 [.001]</b> (72)	.083 [.430] (74)
PHQ-9	<b>-.379 [.000]</b> (15)	<b>-.331 [.000]</b> (5)	<b>-.319 [.000]</b> (5)	<b>-.265 [.001]</b> (8)	<b>-.156 [.047]</b> (4)	<b>-.317 [.000]</b> (6)	-.101 [.202] (7)
Living alone (%)	-.063 [.434] (11)	-.089 [.255] (1)	.080 [.308] (1)	-.052 [.510] (4)	-.098 [.209] (0)	-.048 [.540] (2)	<b>-.170 [.030]</b> (3)
Home care before hospitalization (%)	-.238 [.003] (11)	-.106 [.174] (1)	<b>-.245 [.002]</b> (1)	-.119 [.132] (4)	-.048 [.056] (0)	-.152 [.051] (2)	-.072 [.358] (3)
SDAT	<b>-.211 [.049]</b> (79)	-.152 [.137] (70)	-.182 [.073] (69)	-.052 [.619] (73)	-.173 [.089] (69)	<b>-.248 [.015]</b> (71)	<b>-.218 [.034]</b> (72)
QPP-SF	<b>.264 [.003]</b> (38)	.045 [.604] (31)	<b>.247 [.004]</b> (31)	.074 [.392] (32)	<b>.179 [.037]</b> (30)	<b>.307 [.000]</b> (31)	<b>.245 [.004]</b> (33)
QPP-SF: medical-technical competences	<b>.207 [.011]</b> (16)	.055 [.488] (7)	<b>.179 [.024]</b> (7)	.076 [.345] (9)	<b>.206 [.009]</b> (6)	<b>.272 [.001]</b> (8)	<b>.218 [.006]</b> (9)
QPP-SF : physical-technical conditions	<b>.252 [.002]</b> (16)	.085 [.286] (7)	<b>.201 [.011]</b> (7)	.130 [.104] (9)	.114 [.150] (6)	<b>.251 [.001]</b> (8)	<b>.311 [.000]</b> (9)
QPP-SF : identity-oriented approach	<b>.231 [.006]</b> (26)	.025 [.758] (17)	<b>.251 [.002]</b> (17)	.006 [.947] (19)	<b>.199 [.014]</b> (16)	<b>.265 [.001]</b> (18)	<b>.257 [.002]</b> (19)
QPP-SF : socio-cultural atmosphere	<b>.242 [.004]</b> (24)	.027 [.739] (16)	<b>.213 [.009]</b> (16)	.052 [.529] (18)	<b>.208 [.010]</b> (15)	<b>.247 [.002]</b> (16)	<b>.325 [.000]</b> (18)

217

218 Table 2 also describes the association between each of the dimensions of WHOQOL-OLD  
 219 and the biopsychosocial and spiritual dimensions. Associations remain similar as those in the  
 220 overall score except for “sensory abilities” and “death and dying”, which are only connected  
 221 with a limited number of markers.

## 222 Linear Multivariate Analysis of Factors Associated with Quality of Life

223 In multivariate analysis, mood (PHQ-9;  $\beta = -0.961$ ,  $p < .001$ ) has a significant association  
 224 with quality of life (Table 3). Satisfaction with the care received is at the limit of having a  
 225 significant relationship (QPP-SF;  $\beta = 0.237$ ,  $p = .054$ ) with quality of life. The variation  
 226 explained by all the variables was 26.7% ( $F=4.170$ ,  $p < .001$ ). No multicollinearity was  
 227 identified between the explanatory variables, the maximal variance inflation factor was 1.58.

228 *Table 3.* Multivariate linear analysis with multiple imputation to predict the total  
 229 WHOQOL-OLD score.

Predictive factor	total WHOQOL-OLD (11 missing values)		Number of missing values
	$\beta$ (95% CI)	<i>p</i> -value	
Age (years)	-0.025 (-0.301 to 0.251)	.861	0
Women	0.255 (-3.940 to 4.450)	.904	0
FIM	0.109 (-0.039 to 0.256)	.147	1
MMS	0.055 (-0.653 to 0.763)	.878	0
CIRS	-0.007 (-0.617 to 0.603)	.983	72
PHQ-9	-0.961 (-1.449 to -0.472)	<.001	4
Living alone	-1.504 (-5.920 to 2.913)	.502	0
Home care before hospitalization	-2.302 (-6.898 to 2.294)	.321	0
SDAT	-0.006 (-0.995 to 0.983)	.990	69
QPP-SF	0.237 (-0.004 to 0.479)	.054	30

230 *Note.*  $\beta$ , regression coefficient.

## 231 DISCUSSION

232 Elderly patients undergoing rehabilitation after acute care perceived a relatively high level of  
 233 quality of life. For example, we found higher WHOQOL-OLD scores than those reported by  
 234 Fang et al. using data of a developmental study of the WHOQOL-OLD, which included 5566  
 235 respondents from 20 international centers (opportunistic sample of ill and well patients).[32]  
 236 To our knowledge, these are new data for this specific setting. This is not surprising, given



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3 237 this environment aims to offer stimulating conditions to promote and regain a good quality of  
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5 238 life. In this study, quality of life had a significant relationship with mood (both in univariate  
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7 239 and multivariate analysis) and functional status (only in univariate analysis). This link  
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10 240 corresponds with research results found in other settings, such as those found in Conrad et  
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12 241 al.[33] Although only a limited number of patients performed the spiritual needs evaluation,  
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14 242 the data show that patients with unmet spiritual needs experienced a poorer quality of life.

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17 243 Patients had a high degree of satisfaction with the care they received. This result is consistent  
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19 244 with previous studies with standard adult patients, showing that level of satisfaction is higher  
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21 245 in rehabilitation setting.[34] Satisfaction with care received is associated with quality of life.  
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23 246 Such results are consistent with the literature in other settings, especially with those reported  
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25 247 by Hartgering et al, which reported satisfaction with care received positively related to older  
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27 248 patients' quality of life in an acute care setting with global and integrated care.[16] Further  
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29 249 research is needed to better understand their inter-relationships.[35]

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33 250 In addition to confirming the importance of the psychological dimension, the multivariate  
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35 251 model does not allow us to draw conclusions about biopsychosocial factors related to quality  
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37 252 of life. Functional status and cognitive status were not statistically significant in this  
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39 253 multivariable linear regression, suggesting that, at least in this setting, they were not the most  
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41 254 important drivers of perceived quality of life. This reflects that quality of life is complex and  
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43 255 this study could only partially approach this complexity. Measuring quality of life, not fully  
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45 256 explained from pooling descriptors of usual clinical practice, may surpass these traditional  
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47 257 descriptors.

### 51 258 **Strengths and Weaknesses**

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54 259 This study was undertaken in a “real world” clinical practice. The scales are employed in  
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56 260 usual clinical practice and shared regularly in interdisciplinary meetings. The use of these  
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3 261 tools, widely employed and validated in different clinical contexts, is likely to result in good  
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5 262 ecological validity.  
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8 263 This study has certain limitations. First, the results apply only to a sample of elderly  
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10 264 hospitalized patients without severe cognitive disorders, and thus cannot be generalized to  
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12 265 patients with cognitive disorders. Furthermore, the rate of patients who did not participate  
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14 266 might create a risk of selection-based bias, though slight, as the characteristics of the patients  
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16 267 who participated and those who did not showed no significant differences. In addition, all  
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18 268 evaluations were not made at the same time (first and second week of hospitalization), and we  
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20 269 cannot exclude the possibility that symptomatic change may have occurred in some patients.  
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23 270 In the context of data drawn from usual clinical practice, the social dimension can be  
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25 271 misjudged and fail to demonstrate any link to quality of life; to avoid this result, a purpose-  
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27 272 designed tool such as a scale of social support might be required.[36] Such a scale would  
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29 273 certainly show the importance of social support to quality of life.[37-38] Similarly, some  
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31 274 evaluations were not always undertaken: the chaplain worked part-time and was not able to  
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33 275 conduct all the SDAT, despite excellent patient acceptance. The CIRS assessments were not  
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35 276 systematically completed by the physicians. Conversely, missing data for the WHOQOL-  
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37 277 OLD or the QPP-SF are from patients who did not respond to at least one of the questions  
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39 278 asked, preventing calculation of the total score. Nevertheless, multiple imputation allowed us  
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41 279 to limit the nonresponse bias in the multivariate analysis.  
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#### 46 280 **Implications for Clinical Practice**

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49 281 Evaluating quality of life is relevant in geriatric rehabilitation because we observe that  
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51 282 variables traditionally used in clinical practice may not be sufficient to explain the quality of  
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53 283 life and therefore insufficient to achieve that goal. Knowing the necessary elements for a good  
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55 284 quality of life for each patient is fundamental to better understanding him/her, and might  
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3 285 improve guidance in setting goals of care. This information could contribute to offer truly  
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5 286 patient-centered care in hospital environments, and is therefore useful to the different  
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7 287 professionals in charge of these patients.  
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10 288 However, further development of a biopsychosocial and spiritual model can only be  
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12 289 encouraged. Similarly, this work suggests the importance of integrating an evaluation of the  
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14 290 satisfaction with care received because it is also associated with quality of life.  
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17 291 Considering the following quotation: “Therapeutic success depends in part upon the  
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19 292 therapist’s ability to set a story in motion which is meaningful to the patient as well as to  
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21 293 herself”,<sup>[39]</sup> this work, which accounts for a patient’s quality of life, also has an ethical  
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23 294 impact. In fact, this measure might help balance aspects of beneficence and respect for  
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25 295 autonomy in a system that should not be paternalistic, but that also cannot meet all of a  
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27 296 patient’s expectations.  
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### 30 297 **Conclusion**

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34 298 Patients undergoing post-acute geriatric rehabilitation perceive a good quality of life.  
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36 299 Depressive symptoms were significantly associated with quality of life. In this setting,  
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38 300 biopsychosocial and spiritual descriptors used in clinical practice are only moderately  
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40 301 associated with quality of life. A follow-up to this study might evaluate how to better  
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42 302 integrate quality of life in the construction of the care project, in addition to the usual  
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44 303 descriptors of the clinical practice.  
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3 304 **FOOTNOTES**  
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7  
8 306 for projects related to the “Quality of Life of Elderly Persons”.

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10  
11 307 **Competing interests:** None declared.  
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13  
14 308 **Ethics approval:** Cantonal Committee of Vaud on the Ethics of Research on Human  
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16 309 Subjects, Lausanne, Switzerland.  
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19 310 **Data sharing statement:** The full anonymized data set can be provided on request.  
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21  
22 311 **Contributors:** MAB, ERT, ER and SM designed the research. MAB and JP conducted  
23  
24 312 statistical analysis. All authors interpreted the data. MAB wrote the first draft of the  
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26 313 manuscript. All authors participated in the writing of subsequent versions and approved the  
27  
28 314 final article.  
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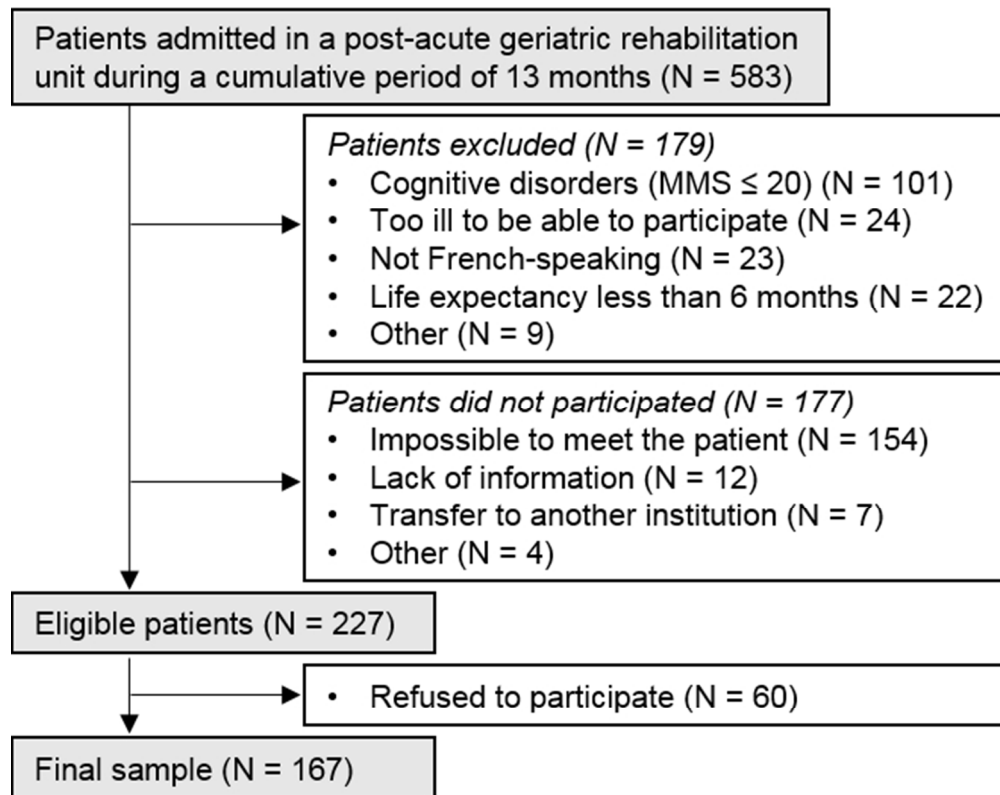
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3 403 **FIGURE LEGENDS**  
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6 404 Figure 1. *Study flow chart.*  
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9 405 Figure 2. *WHOQOL-OLD scores describing the overall quality of life and each underlying*

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11 406 *dimension. The number of missing values is indicated in parentheses.*  
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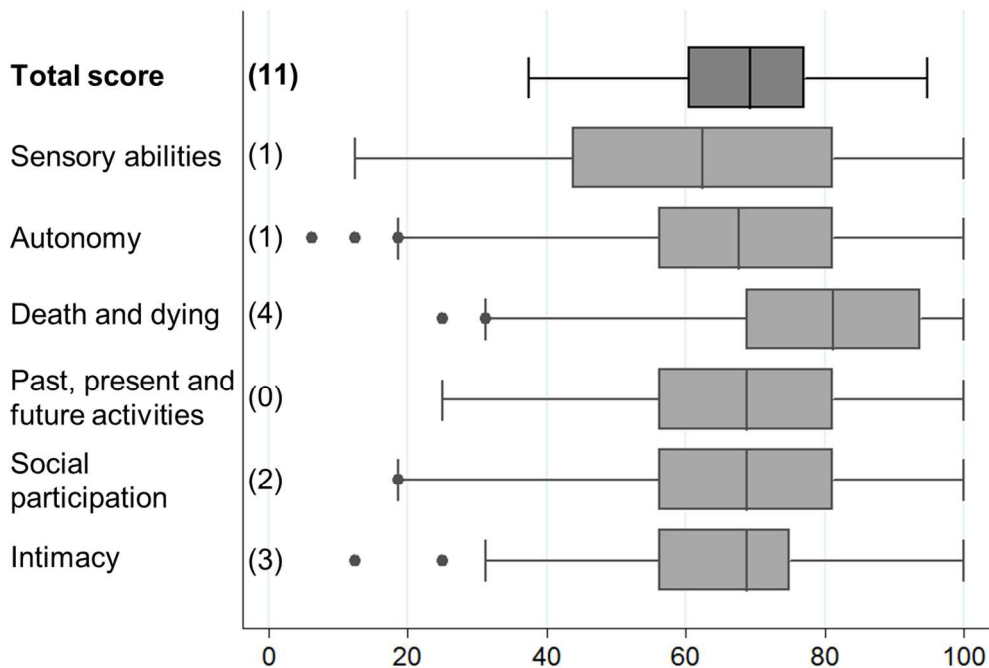
For peer review only



Study flow chart.

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WHOQOL-OLD scores describing the overall quality of life and each underlying dimension. The number of missing values is indicated in parentheses.

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View only

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1 - 2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 - 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5 - 6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7 - 9
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7 - 9
Bias	9	Describe any efforts to address potential sources of bias	6, 9
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	9
		(c) Explain how missing data were addressed	9, 15
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a

<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	<b>6 , Figure 1</b>
		(b) Give reasons for non-participation at each stage	<b>Figure 1</b>
		(c) Consider use of a flow diagram	<b>Figure 1</b>
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	<b>10, Table 1</b>
		(b) Indicate number of participants with missing data for each variable of interest	<b>Tables 1 - 3, Figure 2</b>
Outcome data	15*	Report numbers of outcome events or summary measures	<b>Figure 2, Tables 2 - 3</b>
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	<b>13, Table 3</b>
		(b) Report category boundaries when continuous variables were categorized	<b>n/a</b>
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	<b>n/a</b>
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	<b>n/a</b>
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	<b>13 - 14</b>
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	<b>14 - 15</b>
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	<b>13 - 16</b>
Generalisability	21	Discuss the generalisability (external validity) of the study results	<b>14 - 15</b>
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	<b>17</b>

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).