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Health status and quality of life: results from a national survey in a community-dwelling sample of elderly people

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Abstract
Purpose To investigate the relation between age and HRQoL indicators in a community-dwelling population aged 65 years and older.
Methods Data were collected within a sample stratified by age (65–69; 70–74; 75–79; 80–84; 85–89; 90 years and above) and sex and randomly selected in the population records in Switzerland. The EQ-5D was used to assess HRQoL. Analyses were conducted on the entire available sample ($N = 3{,}073$) and on the subsample with no missing data in the EQ-5D ($N = 2{,}888$), considering age, gender, education and region.
Results Results of multiple regression analyses showed different age-related patterns across the EQ-5D. The proportion of respondents reporting no problems ranged from 51 % in the 65- to 69-year age group to 20 % in the 90 years and above age group. Odds ratio (OR) for Mobility problems increased from 2.04 in the 75- to 79-year age group to 13.34 in the 90 years and above age group; OR for Usual Activities increased from 1.76 to 11.68 and from 1.55 to 2.32 for Pain/Discomfort; OR for Self-Care increased from 5.26 in the 80- to 84-year age group to 30.36 in the 90 years and above age group. Problems with Self-Care remained low, increasing from 6.22 % in the 80- to 84-year age group to 26.21 % in the oldest age group. The magnitude of the gender, region and education effects was much lower than that of age.
Conclusion HRQoL is globally preserved in older adults in Switzerland, even if substantial impairment is reported in very old age affecting mainly functional health dimensions. Anxiety/Depression and Pain/Discomfort did not appear to be affected by age; high rates of difficulties were reported for Pain/Discomfort but not for Anxiety/Depression.

Keywords Health-related quality of life · Aging · Life conditions · Community-dwelling elderly

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Introduction

Over the last decades, industrialized countries have witnessed population aging and a massive growth in the number of individuals reaching very old age [1]. With respect to these sociodemographic changes, Switzerland is no exception [2], and this country, like many others, faces an increase in life expectancy at birth, which is substantially accounted for by a decrease in the mortality of very old individuals. At present, these issues are of even greater relevance given that the baby-boomer generation reaches the age of retirement [3].

While there is no debate on the fact that people grow older now than a century ago, it remains that the variety of life trajectories has also increased [4] leaving open cardinal questions on the diversity of life and health conditions during the course of aging. With this respect, health-related indicators are of central concern, since they weight on the distinction between "successful" and "usual" aging [5], on frailty status [6] or process [7] and ultimately, on mortality [8]. Thus, health factors strongly determine the individual's quality of life [9].

Health-related quality of life (HRQoL) requires major interest, first with respect to individuals themselves, but stands also as a primary concern from public health administrations and professionals. Over the past 25 years, several generic measures of HRQoL have been developed, such as the Short-Form 6-dimensions (SF-6D) [10], the Health Utilities Index (HUI) system [11] and the EuroQoL 5-dimensions questionnaire (EQ-5D) [12]. These instruments were designed for use as general purpose measures of HRQoL, independent of diagnostic categorization or disease severity. Information is used for establishing the degrees of morbidity in the community, enabling different general population or population subgroups to be compared, assessing health needs or informing those responsible for allocating health resources.

Parallel to the demographic changes, HRQoL in the elderly population has received growing attention [13]. However, only few studies have addressed the impact of aging on HRQoL issues and even fewer have included community-dwelling individuals aged 80 years and over. To our knowledge, only one has specifically reported data on a sample of over 1,600 respondents aged 75 years and above from six European countries [14].

We report on a study in which the EQ-5D was used in a survey of the elderly population in Switzerland. Our aim was to investigate the relation between age and HRQoL indicators in a community-dwelling population aged 65 years and above. This study was part of a larger research program assessing physical and psychological health, social relations, economical wealth, individual values and opinions in a representative sample of the Swiss population [for details, see 15].

Methods

Design and participants

Data were collected within a large survey on life and health conditions and drawn from a theoretical sample of 3,600 community-dwelling individuals aged 65 years and above. This survey was part of a research program of the Swiss National Science Foundation. The sample was stratified by age (65–69; 70–74; 75–79; 80–84; 85–89; 90 years and above) and sex and randomly selected in the cantonal population records of three linguistic areas of Switzerland (French, German and Italian). The final sample consisted in 3,073 individuals, among which 2,888 entirely completed the EQ-5D questionnaire, leaving a total of 6.02 % incomplete data (see Table 1). All respondents were cognitively able to give their written informed consent for participation and to answer the questionnaire as verified by a short testing done by trained interviewers. The protocol was approved by each regional ethical committee.

Procedure

Assessment of HRQoL

The survey comprised a self-administered questionnaire and a face-to-face interview which was subsequently conducted. The EQ-5D was used to assess HRQoL and chosen because the scale has been reported as particularly appropriate to quickly assess health states in vulnerable and/or aged individuals. Indeed, the EQ-5D allows a rapid and comprehensive assessment of global health conditions embedding functional, emotional and burden dimensions. More, the questionnaire has good psychometric properties and test–retest reliability [16]. Finally, EQ-5D scores yield results comparable to those of the HUI in chronic conditions [17] but more discriminative than the SF-6D when physical chronic conditions are concerned [18].

The EQ-5D has been applied worldwide [19] yielding opportunities of collecting considerable databases and develop single currencies valuating all relevant health states with a single health utility index using local valuation sets [20]. While these domestic currencies are useful for local purposes since they take into account population differences and social preferences, currencies estimated on inter-regional pooled data are also made available. The most popular is the index proposed by Greiner et al. [21] who provide a value set drawn from eleven studies run across six European countries (Finland, Germany, the Netherlands, Spain, Sweden and United Kingdom). Because the set covers a wide variety of states, situations and cultural backgrounds, the associated currency becomes highly relevant either for comparisons across countries or when domestic value sets are not available—as it is the case for Switzerland. Indeed, and to our knowledge, the only published study on EQ-5D Swiss data [22] actually reported health utility values estimated from the Greiner et al. [21] European coefficients.

Data for the EQ-5D [12] were collected during the interview which was run by local trained interviewers using the computer-assisted personal interview (CAPI) method. The EQ-5D consisted in five three-point (1 = no

problems; 2 = moderate problems; 3 = severe problems) Likert scales assessing Mobility, Self-Care, Usual Activities, Pain/Discomfort, Anxiety/Depression, and a visual analog scale (VAS) that rated overall current health state from worst (0) to best imaginable (100). Measures consisted in the response provided to each of the five items and to the VAS. From these measures, a five-digit health state ordinal score ranging from 11111 to 33333 was computed as the cumulated values across the five items, and a health utility score using Greiner coefficients [21]. The computed coefficients were subsequently rescaled between 1 and 0 so that it corresponds to quality-adjusted life year (QALY) estimates between perfect health and death [23].

Sociodemographic variables

The age group, gender, highest educational level achieved, nationality and linguistic region were considered for the analyses. The linguistic region was coded as a three-level (French, German and Italian) variable. Educational attainment was coded as a three-level variable considering primary (elementary and inferior secondary), secondary (superior secondary and apprenticeships) and higher education (college and university). Nationality was coded as a three-level variable comprising Swiss citizens, citizens from the European community at 15 (EU15) and citizens from outside EU15.

Data analysis

Analyses were conducted on the entire available sample ($N = 3{,}073$) and on the subsample with no missing data in the EQ-5D ($N = 2{,}888$). Unless specified, results were comparable and only results considering the sample with complete data are reported. The EQ-5D data were first analyzed using descriptive procedures. For comparison purposes with available Swiss data [22], the three modalities of responses in the five three-point items were subsequently reduced into two-point scales ("no problem," "moderate or severe problem"). Univariate Chi-square analyses and multivariate regression analyses were conducted on the data. Chi-square analyses aimed at assessing each variable separately, while regressions allowed effect estimations adjusted for all co-variables. For regression analyses, robust binary logistic regressions were conducted, with EQ-5D binary items [analyses for Mobility, Self-Care, Usual Activities, Pain or Discomfort, Anxiety or Depression and highest utility (i.e., 11111)] as dependent variables, and age, gender, region, education and nationality as factors. Cox and Snell pseudo R squared were used to estimate the amount of variance accounted for by the models. Robust linear regressions were conducted, with EQ-5D continuous variables (VAS and HUI) as dependent variables, and age, gender, region, education and nationality as factors. Adjusted R-squared were used to estimate the amount of variance accounted for by the models. For all multivariate models, main effects were assessed. Convergence estimates were set to 10–6 for parameter modifications and 10–12 for singularity tolerance. Wald statistics were used for Chi-square and confidence interval computation. All regression models were assessed using a bootstrap procedure using 1,000 iterations for robust confidence interval (95 %) and p value estimations.

Results

Descriptive analyses

Sample characteristics are reported in Table 1. The number of missing tended to decrease with age in women and the opposite in men. The descriptive statistics for the EQ-5D items are reported in Table 2, showing that severe problems were few (6 % at the maximum for Pain/Discomfort) and that the corresponding VAS was over 50, this providing the basis for regrouping moderate and severe problems. Self-Care had an important ceiling effect (with over 93 % of respondents reporting "no problem"); about

Table 1 Effective sample by age group, gender and linguistic area ($N = 2{,}888$); number of missing responses is reported between parentheses

	French speaking		German speaking		Italian speaking		Total		Total
	Women	Men	Women	Men	Women	Men	Women	Men	
65–69	105 (10)	112 (4)	121 (7)	130 (7)	58 (0)	53 (3)	284 (17)	295 (14)	579 (31)
70–74	106 (7)	109 (4)	116 (6)	113 (8)	54 (2)	66 (1)	276 (15)	288 (13)	564 (28)
75–79	102 (6)	109 (6)	110 (10)	113 (9)	52 (3)	50 (2)	264 (19)	272 (17)	536 (36)
80–84	87 (1)	88 (11)	104 (5)	105 (4)	41 (2)	47 (2)	232 (8)	240 (17)	472 (25)
85–89	73 (6)	80 (8)	86 (3)	92 (10)	42 (2)	45 (4)	201 (11)	217 (22)	418 (33)
90 and above	46 (5)	59 (6)	65 (3)	83 (8)	31 (3)	35 (7)	142 (11)	177 (21)	319 (32)
Total	519 (35)	557 (39)	602 (34)	636 (46)	278 (12)	296 (19)	1,399 (81)	1,489 (104)	2,888 (185)

Table 2 Distribution of the five EQ-5D items among respondents, and association with visual analog scale (VAS) and Greiner health utility index (HUI); $N = 2,888$

	N	%	VAS		HUI	
			M	SD	M	SD
Mobility						
No problems	2,152	74.5	79.8	17.4	0.88	0.13
Moderate or severe	736	25.5	61.8	21.9	0.61	0.18
W/moderate	728	25.2	61.9	21.8	0.61	0.17
W/severe	8	0.3	49.9	30.6	0.13	0.11
Self-care						
No problems	2,695	93.3	76.5	19.3	0.84	0.16
Moderate or severe	193	6.7	57.7	23.9	0.46	0.19
W/moderate	161	5.6	58.3	22.7	0.51	0.17
W/severe	32	1.1	54.7	29.6	0.22	0.10
Usual Activities						
No problems	2,479	85.8	78.1	18.0	0.86	0.15
Moderate or severe	409	14.2	57.8	23.8	0.55	0.19
W/moderate	358	12.4	57.7	23.2	0.59	0.16
W/severe	51	1.8	59.1	27.6	0.27	0.13
Pain/Discomfort						
No problems	1,403	48.6	82.3	17.2	0.95	0.10
Moderate or severe	1,485	51.4	68.5	20.6	0.68	0.15
W/moderate	1,305	45.2	70.8	19.2	0.72	0.11
W/severe	180	6.2	52.2	23.1	0.39	0.11
Anxiety/Depression						
No problems	2,290	79.3	77.6	19.1	0.86	0.16
Moderate or severe	598	20.7	66.2	21.8	0.63	0.17
W/moderate	542	18.8	67.0	21.1	0.66	0.15
W/severe	56	1.9	58.6	26.8	0.35	0.14

three quarters of the respondents reported no problems on the Mobility and Anxiety/Depression items; but more than half of them reported at least moderate problems on the Pain/Discomfort dimension. All dimensions displayed a clear and gradual relationship with the VAS ratings.

The most commonly reported health states are provided in Table 3. Data reported in Table 3 demonstrate that a substantial amount—i.e., 38.5 %—of the sample reports no problem at all on the five EQ-5D dimensions, along with a fairly high self-perceived overall health state (84.1 $\pm$ 16.3, M $\pm$ SD on VAS score). Similarly, severe problems (i.e., 3) were few and reported only by 15 % of the sample. The second most reported health state is 11121, indicating that nearly 20 % of the population reported moderate problems in Pain/Discomfort in absence of any other difficulties. Pain/Discomfort was also the dimension that was most frequently reported with severe problems (21131 and 21231).

Results from Chi-square analyses are reported in Table 4. Results from the first step inferential statistics

Table 3 Most commonly reported health state patterns and corresponding visual analog scale (VAS) and Greiner health utility index (HUI); $N = 2,888$

Health state patterns	*N*	%	% Cum	VAS		HUI
				M	SD	
11111	1,113	38.54	38.54	84.1	16.3	1.00
11121	605	20.95	59.49	77.4	15.6	0.79
21121	186	6.44	65.93	68.5	18.2	0.73
11122	172	5.96	71.88	70.8	17.4	0.71
11112	126	4.36	76.25	78.9	17.4	0.80
21111	73	2.53	78.77	71.9	19.6	0.82
21221	62	2.15	80.92	60.5	21.1	0.71
21122	56	1.94	82.86	62.8	18.1	0.65
21222	46	1.59	84.45	56.8	21.7	0.63
22221	34	1.18	85.63	56.2	18.5	0.60
21131	32	1.11	86.74	56.7	17.3	0.45
22222	29	1.00	87.74	52.9	21.3	0.52
21231	27	0.93	88.68	45.7	26.4	0.43
11131	26	0.90	89.58	66.3	19.3	0.52
Other	300	10.39	99.97	–	–	–
33333	1	0.03	100.00	20.0	–	0.00
Total	2,888	100.00	100.00	–	–	–

using each pair of dependent/independent variable separately showed that nearly 40 % of the sample reported no problem. The rates of reported problems increased with age for all dimensions, except for Anxiety/Depression which peaked at 24.6 % of respondents aged 85–89 years. Figure 1 shows the impact of age on problem-reporting with a significant increase in most dimensions of HRQoL, starting from the age group 75–79 years except for Pain/Discomfort which showed a steady growth across all age groups. The number of dimensions affected tended to increase with age (Fig. 2).The mean rating of overall current health state decreased from about 80 to 71 in the oldest age group (Table 4). Men reported fewer problems on all dimensions. The linguistic region had an effect but of small amplitude with the German-speaking respondents reporting fewer problems. Less educated respondents reported a higher number of problems. Nationality had a very marginal effect only on the Anxiety/Depression dimension (Table 4).

Regression analyses

Results of multiple regression analyses are reported in Table 5. They showed a significant increase in problem-reporting in most dimensions of the EQ-5D in relation with age, starting from the age group 75–79 years except for Anxiety/Depression. Odds ratio (OR) for Mobility problems increased from 2.04 in the 75- to 79-year age group to 13.34 in the 90 years and above; similarly, OR for Usual

Table 4 Percent of problems (moderate or severe) on the five subscales [Mobility (MO), Self-Care (SC), Usual Activities (UA), Pain/Discomfort (PD), Anxiety/Depression (AD)], and corresponding visual analog scale (VAS) and Greiner health utility index (HUI) by age group, gender, linguistic area, education and nationality

	N[a]	% of problems by EQ-5D dimension[a]					HUI[b]		%[a]	VAS[b]	
		MO	SC	UA	PD	AD	M	SD	11111	M	SD
Total	2,792	25.5	6.7	14.2	51.6	20.9	0.81	0.19	38.4	75.17	20.25
Age		**0.001**	**0.001**	**0.001**	**0.001**	**0.204**	**0.001**		**0.001**	**0.001**	
65–69	567	9.5	1.2	5.6	42.0	18.2	0.87	0.16	51.0	79.29	19.54
70–74	552	11.8	1.1	6.0	45.5	20.5	0.85	0.16	45.5	78.68	16.58
75–79	507	18.5	2.8	9.9	53.5	20.9	0.83	0.17	40.2	76.26	19.37
80–84	450	29.8	6.2	13.8	55.8	20.0	0.80	0.18	34.4	72.88	21.09
85–89	407	45.2	12.5	23.6	58.5	24.6	0.76	0.21	27.0	68.86	22.12
90 and above	309	58.6	26.2	39.8	61.8	23.3	0.71	0.23	20.4	71.21	21.94
Gender		**0.001**	**0.032**	**0.001**	**0.001**	**0.001**	**0.001**		**0.001**	**0.001**	
Female	1,356	28.2	7.7	17.6	58.4	26.4	0.78	0.20	31.7	73.26	21.26
Male	1,436	22.9	5.7	10.9	45.1	15.7	0.84	0.17	44.7	76.97	19.08
Region		**0.599**	**0.001**	**0.036**	**0.001**	**0.001**	**0.001**		**0.001**	**0.001**	
French	1,043	25.1	7.7	15.4	56.5	23.0	0.80	0.19	34.6	74.50	20.30
German	1,201	25.1	4.6	12.2	45.0	15.1	0.83	0.19	44.8	76.80	19.74
Italian	548	27.2	9.5	16.1	56.8	29.7	0.79	0.19	31.6	72.89	20.98
Education		**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**		**0.001**	**0.001**	
Elementary	550	37.3	10.4	21.5	63.8	30.9	0.75	0.21	25.8	69.55	21.80
Secondary	1,452	23.9	6.2	12.8	49.6	19.9	0.82	0.19	40.0	75.89	20.08
Tertiary	790	20.3	5.1	11.6	46.7	15.8	0.84	0.17	44.2	77.77	18.67
Nationality		**0.793**	**0.718**	**0.885**	**0.241**	**0.003**	**0.385**		**0.014**	**0.001**	
Swiss	2,580	25.6	6.6	14.2	51.3	20.2	0.81	0.19	38.6	75.61	20.18
EU15	201	24.4	8.0	14.4	56.2	30.3	0.80	0.19	35.3	69.90	20.23
Outside EU	11	18.2	9.1	9.1	36.4	27.3	0.87	0.16	54.5	68.82	24.40

[a] All analyzes were conducted list wise; due to missing data in sociodemographic variables the sample was $N = 2{,}792$. Categorical variables were analyzed using Chi-squares

[b] Continuous variables were analyzed using one-way ANOVAs; corresponding p values are provided in bold

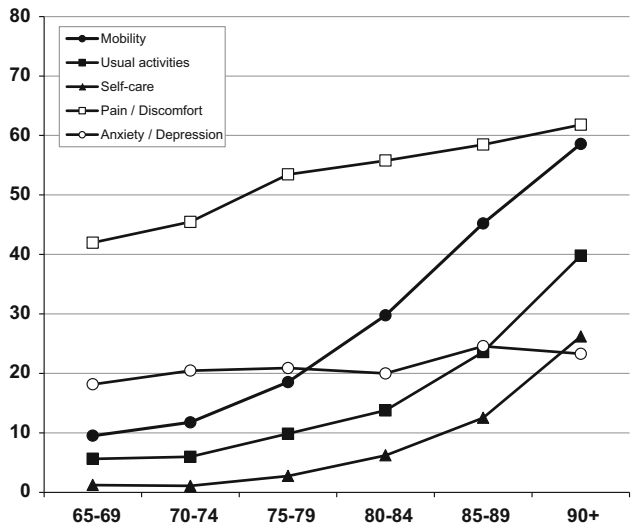

Fig. 1 Percent of problems (moderate and severe) reported in the five EQ-5D dimensions as a function of age group

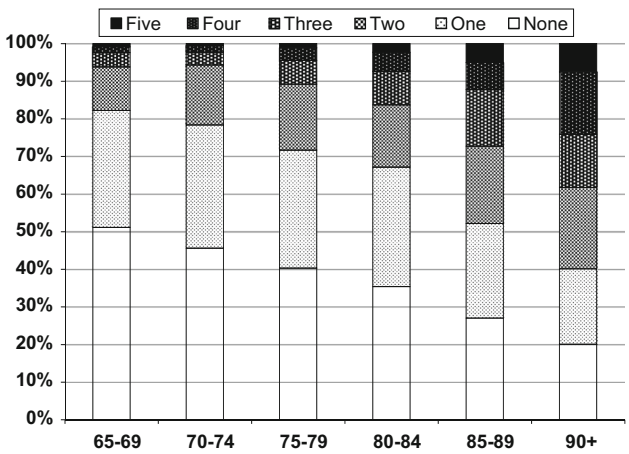

Fig. 2 Number of EQ-5D dimensions reported with moderate or severe problems as a function of age group

Table 5 Results of multiple logistic (OR) and linear (*B*) regressions analyses by dimension adjusted for all variables in the table

C.Det.	*N*[a]	MO OR[b] 0.146	SC OR[b] 0.087	UA OR[b] 0.101	AD OR[b] 0.055	PD OR[b] 0.046	11111 OR[b] 0.080	HUI *B*[c] 0.106	VAS *B*[c] 0.054
Age									
65–69	567	–	–	–	–	–	–	–	–
70–74	552	1.32	1.02	1.15	1.17	1.13	0.81	−0.01	−0.68
75–79	507	1.96**	1.87	1.63*	1.65***	1.09	0.65**	−0.03***	−2.84*
80–84	450	4.04***	4.94***	2.78***	1.71***	1.14	0.52***	−0.06***	−6.07***
85–89	407	7.30***	10.05***	4.72***	1.84***	1.46*	0.37***	−0.10***	−9.46***
90 and above	309	13.62***	28.43***	12.73***	2.46***	1.29	0.23***	−0.16***	−8.31***
Gender									
Female	1,356	–	–	–	–	–	–	–	–
Male	1,436	0.75**	0.69*	0.53***	0.60***	0.54***	1.74***	0.06***	3.12***
Region									
French	1,043	–	–	–	–	–	–	–	–
German	1,201	0.93	0.48***	0.68**	0.62***	0.61***	1.62***	0.03***	1.84*
Italian	548	0.93	1.05	0.90	0.93	1.30*	0.98	0.00	−0.55
Education									
Elementary	550	–	–	–	–	–	–	–	–
Secondary	1,452	0.66***	0.92	0.71*	0.71**	0.74**	1.45**	0.04**	3.92***
Tertiary	790	0.51***	0.74	0.66*	0.68**	0.58***	1.60***	0.05***	5.66***
Nationality									
Swiss	2,580	–	–	–	–	–	–	–	–
EU15	201	1.11	1.37	1.03	1.10	1.45	0.95	−0.01	−4.99***
Outside EU	11	0.63	1.26	0.57	0.49	1.58	2.25	0.059	−6.55

C.Det Coefficients of determination: Cox and Snell pseudo *R*-squared for binomial regressions; adjusted *R*-squared for linear regressions; *MO* Mobility, *SC* Self-Care, *UA* Usual Activities, *PD* Pain/Discomfort, *AD* Anxiety/Depression, *HUI* Greiner health utility index, *VAS* visual analog scale

Associated *p* values are of: * $p < 0.05$; ** $p < 0.01$ and *** $p < 0.001$, estimated after bootstrap

[a] All analyzes were conducted list wise; due to missing data in sociodemographic variables the sample was of $N = 2{,}792$

[b] OR = odd ratios estimated by robust logistic regressions for binomial variables

[c] B = beta value estimated by robust linear regressions for continuous variables

Activities increased from 1.76 to 11.68 and from 1.55 to 2.32 for Pain/Discomfort. Even more clearly, OR for Self-Care increased from 5.26 in the 80- to 84-year age group to 30.36 in the 90 years and above age group. However, it is noteworthy that the presence of problems with Self-Care remained rather low, increasing from 6.2 % in the 80- to 84-year age group to 26.2 % in the oldest age group.

The results also showed a gender effect with males having fewer risks of reporting problems in Mobility (OR 0.76) but also in Usual Activities (OR 0.54), Pain/Discomfort (OR 0.60) and Anxiety/Depression (OR 0.55). The region effect was of the same magnitude with fewer risks in the German-speaking responders to report problems in Self-Care (OR 0.51), Usual Activities (OR 0.71), Pain/Discomfort (OR 0.62) and Anxiety/Depression (OR 0.62). As for the level of education, higher levels seemed to protect from various HRQoL problems. The magnitude of these effects was, however, much lower than the magnitude of the effect of age (Table 5), which display the largest effect not only within each ability, but also across them. As reported in Fig. 2, the number of dimensions with moderate/severe problems tends to accumulate with age. While in the younger age range, 82 % of the sample reported either no difficulties or difficulties in a single dimension, and this percentage decreased continuously across age ranges to reach 40 % in the oldest age group, hence being reduced by half. As a corollary, the amount of the sample reporting problems on more than one dimension increased with age. Interestingly, the number of dimensions affected also increased with age, revealing that in the older age group, more problems were reported and these problems affected a growing number of dimensions within individuals. Nearly 25 % of the oldest sample reported problems in four (16.6 %) or in all five dimensions (7.5 %). The

corresponding value in younger age groups was of 1.4 %, respectively, with 0.5 % in four and 0.9 % in five dimensions.

Discussion

The results of this study provide an important insight into the health-related quality of life of the Swiss elderly population. These results show that, overall, HRQoL in elderly Swiss individuals is fairly good, with nearly 40 % of the sample reporting no problem in any of the five dimensions of the EQ-5D. Severe problems were rarely reported. The rate of moderate problems remained between 6 and 25 % except for the Pain/Discomfort dimension which reached 45 %. Taken together, moderate and severe problems indicated a high level of Pain or Discomfort, with over 50 % of the respondents reporting problems.

Different age-related patterns emerge across the five dimensions of the EQ-5D. The proportion of respondents reporting no problems ranges from 51 % in the 65- to 69-year age group to 20 % in the 90 years and above age group. Mobility, Usual Activities and Self-Care demonstrated a clear age-related decline that became steeper in the oldest age groups, starting with the 75- to 79-year age group. Findings for Pain/Discomfort showed that nearly 40 % of the youngest age group reported moderate or severe problems on this dimension and that this proportion rose to more than 60 % in the oldest age group. As for Anxiety/Depression, results showed that the effect of age was not significant and that only the 85- to 90-year and 90 years and above age groups reported more difficulties than the other age groups. Interestingly, even in these groups, it did not involve more than 25 % of the respondents which is comparable to previously reported data [24], including Switzerland [25]. When considering odd ratios, group differences increased across older age groups, with an exponential trend. These findings on age-related patterns are in line with previous reports on functional abilities and their change with age. Indeed, the 65- to 69-year age group and 70- to 74-year age group did not significantly differ on the amount of problems in Mobility, Self-Care and Usual Activities, with only 10 % of the individuals reporting moderate or severe problems, which is comparable to the results reported by Perneger et al. [22]. Self-Care had an important ceiling effect. The presence of ceiling effects has been largely documented in various studies and populations, including patients with chronic conditions [26–28] and general populations [22, 29]. These effects may hamper the ability of the instrument to identify minor but clinically relevant differences. The results of this study confirm the presence of a ceiling effect in community-dwelling older individuals, in particular for the Self-Care dimension.

Together, the results reported on the functional health items replicate findings on age-related differences in functional health as measured with other tools, e.g., with the standard Katz et al. [30] ADL scale [31].

Mobility was the most sensitive to age, followed by Usual Activities and Self-Care, which is in line with previous findings demonstrating differential age-related prevalence in functional health dimensions [32]. Thus, not all dimensions are equally sensitive to age, and the age-related pattern suggests that the five dimensions actually assess three domains, namely physical or functional health, psychosocial health and pain. This is in line with previous reports on the psychometric properties of five health-related quality of life instruments that demonstrated that the five dimensions of the EQ-5D could actually be reduced into three [33]. Regarding functional health, our findings bring additional evidence to the fact that the so-called young–old report high HRQoL, while age-related difficulties appear and cumulate in the "old–old" (Fig. 2) and that difficulties in Mobility, Usual Activities and Self-Care show drastic increase after age 80 (Fig. 1), which is in line with previous reports [3, 7].

Despite a lack of age effects on the reports of Pain/Discomfort, it should be pointed out that the overall rate of Pain/Discomfort problems was high, which highlights pain as a dimension of interest in disability surveys. Pain is a complex and multifactorial experience and thus difficult to describe using specific standardized tools. Pain qualities and localization convey effects independent from pain intensity in the patients' report regarding their pain-related perceived levels of physical and emotional functioning [34]. The assessment of HRQoL related to pain is another way to consider the subjective nature of the pain experience. Pain, and especially chronic pain in older people, is associated with a reduced sense of well-being [35] as well as with many health problems and a disturbed functioning, thus being a common reason for seeking medical care [36]. According to published reports, crude prevalence of pain can be as high as 95 % but also as low as 0 %, indicating how variations in the population, methods and definitions affect prevalence estimates [37]. Indeed, whether current pain, chronic pain, or cancer/non-cancer pain is considered modifies the estimates; similarly, pain prevalence in residential care is higher (80–95 %) than that in community-dwelling older individuals.

Significant differences were also found between population subgroups with respect to gender, education and linguistic region. These findings compare with findings reported elsewhere [14, 38]. Male gender was associated with fewer problems in most of the EQ-5D dimensions; this finding was also observed in other contexts [38], including elderly populations [14]. It has also been shown that women display specific problems related to aging: they

live longer, often alone, report more problems and handicaps, and a longer duration of symptoms prior to death, even after adjustment for older age at death [39]. Short duration of education was associated with more problems in most of the EQ-5D dimensions. Again, this finding parallels those of other studies emphasizing the association between education and HRQoL [38, 40].

In the present study, health utility was estimated using the European currency [21] established on a dataset pooled from 11 different studies run in six European countries. This currency was adopted for several reasons, although using coefficients estimated on pooled data has been criticized [41, but see 42]. The first reason underlying this choice was that, to our knowledge, there is no available value set for Switzerland. Further, using the Greiner index allowed comparing with previous reports of Swiss data [22]. A final argument is that the data were collected in three linguistic regions of Switzerland which might indeed reflect what some have called "Swiss subcultures" [43]. Hence, we cannot leave aside the eventuality of genuine cultural differences close to those reported across countries in terms of health-related behaviors [44], social beliefs and cultural appraisal of health, as well as differences possibly accounted for by the various cantonal social policies [45].

This study has limitations that need to be acknowledged. The sampling was limited to individuals living in the community and thus tended to exclude people who had severe problems. Thus, the results may well overestimate HRQoL of the general aging population. Another limitation is the response rate of the survey. Information is lacking regarding non-participants and non-participation motives (refusals to participate, dropouts, or unavailability for the interview, e.g., hospitalization, death). However, the non-response rate for those participants who accepted was equally distributed among the different age groups.

Not all potential confounding variables could be considered in the regression analyses. In particular, the economic situation has been posited as a main determinant of health status [40]. In our study, all information was not available to categorize the respondents' economic status (e.g., in these older people, income was dependent not only on the socio-professional category, but also on the presence or absence of various pensions, allowances and personal wealth). We used education as a proxy, as is often the case in epidemiological studies where the effect of education on proximal measures of social position, occupation and income has been described [40, 46]. A final drawback of the study lies in its cross-sectional design which does not allow for any extrapolation on HRQoL changes over time and their predictive value on the evolution of global health outcomes. Moreover, cross-sectional regression models cannot account for unobserved heterogeneity. Yet, the relationship between self-rated HRQoL and morbidity and mortality has been established, thus further stressing the importance of perceived HRQoL [8].

In conclusion, HRQoL is globally preserved in older adults in Switzerland, even if substantial impairment is reported in very old age, affecting mainly functional health dimensions. Anxiety/Depression and Pain/Discomfort do not appear to be affected by age; high rates of difficulties are reported for Pain/Discomfort but not for Anxiety/Depression, however. As life expectancy has considerably increased, many challenges are ahead and in particular the need to organize health care and anticipate age-related health problems. Older people get better care, suffer from fewer disabilities or cope better with the limitations, in relation also with the improvements of assistive technology, housing standards or transportation, and social policies as well [31]. The challenge is not so much living longer, but preserving the highest levels of HRQoL as possible. Another challenge may well be the necessity to consider subjective criteria in the definition of health-related quality of life in the aging process.

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