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Assessing Competence: The European Survey on Aging Protocol (ESAP)

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Key Words

Competence · Successful aging · Psychosocial determinants · Biophysical measures · Sociodemographics

Abstract

Objectives: The main goal of this research project was to translate and adapt the European Survey on Ageing Protocol (ESAP) to 7 European countries/cultures. This article presents preliminary results from the ESAP, the basic assessment instrument of EXCELSA (European Longitudinal Study of Aging). ***Methods:*** 672 individuals aged 30–85, selected through quota sampling (by age, gender, education and living conditions), participated in this study, with 96 subjects from each of the 7 European countries. The basic research protocol for assessing competence and its determinants was designed to be administered in a 90-min in-home face-to-face interview. It contains a series of questions, instruments, scales and physical tests assessing social relationships and caregiving, mental abilities, well-being, personality, mastery and perceived control, self-reported health, lifestyles, anthropometry, biobehavioral measures and sociodemographic variables. ***Results:*** 84% of ESAP measures are age-dependent and 75% of them discriminate between education levels. Minor differences were found due to gender, and between people living in rural and urban areas. Exploratory factor analysis yielded 10 factors accounting for 67.85% of total variance, one of which was identified as cognitive and physical 'competence'. This factorial structure was tested across countries through concordance coefficients. Finally, using structural equation modeling, our data were fitted into a model of competence. When the sample was split into younger groups (aged 30–49 years) and older ones (50 and more years), the same model was appropriate for our data. ***Discussion:*** The results are discussed in accordance with other findings on psychosocial, biophysical and sociodemographic components of competence, and also in accordance with theories on competence and successful aging.

Several longitudinal studies have been developed in European countries [1, 2], but these studies do not allow us to examine aging phenomena across Europe because they employ different research questions, hypotheses, objectives, and research protocols. From this perspective a methodological condition is necessary: to introduce the European dimension, longitudinal studies with identical conditions in all European countries are required. In order to develop a European knowledge database on the relative contribution of sociodemographic, psychosocial, health, lifestyle and biobehavioral determinants of changes in competence across the life span, the European

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Longitudinal Study of Aging (EXCELSA) was designed. Its first step (EXCELSA-Pilot) has been completed, and this article reports some preliminary results related to the concept of competence.

As has been stated previously [3, 4], EXCELSA assumes that patterns of aging are dependent upon complex interactions among environmental, sociodemographic, psychosocial, health, lifestyle and biophysical factors. The central research question concerns the relationships between age and competence, and the extent to which distal (e.g., sociodemographic) and proximal factors (e.g., psychosocial, biophysical, health and lifestyle factors) are related to the observed differences with age [4].

A key construct of this research project is 'competence'. Competence is a highly complex and not yet well-defined construct that overlaps with other broad concepts such as successful, active and optimal aging, among others. In general terms, competence refers to 'the quality of someone to be competent or to have suitable skill and experience' (see Webster's Dictionary). Competence is usually defined as the adult's ability to perform adequately those activities considering essential for living, and could be considered as synonymous with autonomy [5]. In this sense, competence could be measured through instruments of daily life activities or functional abilities, but this definition would be relevant only in old age when functional status decreases.

From another perspective, Masterpasqua [6] defines this construct emphasizing that competence is the ability to adjust to or cope with life challenges that include cognitive, emotional, and social conditions. Eisenberg and Fabes [7] refer to social competence as including psychological characteristics such as intelligence, personality or coping styles, as facilitating factors for social interactions and for developing a broad social support network. Also, Diehl [8] defines everyday competence as a person's ability to perform a broad range of activities considered essential for independent living involving multiple components such as the person's physical, psychological and social functioning, which interact in complex ways to produce day-to-day behavior.

When competence is analyzed as a concept close to those of successful aging [9], optimal aging [10] or active aging [11], the panorama becomes broadened. For example, Baltes and Carstensen [12] suggest measures of successful aging that include: psychosocial factors, such as life satisfaction and subjective well-being, perceived social support and involvement in life; physical health, functional abilities and lifestyle; biophysical conditions, such as strength or vital capacity; and social conditions, such as social network or education. Schulz and Heckhausen [10], reviewing optimal or successful aging, found several outcome variables: cardiovascular and pulmonary functioning, absence of disability, cognitive and intellectual performance, primary control and achievements in physical or artistic domains. Rowe and Kahn [13, 14], based on a middle-age longitudinal study [15], described successful aging as avoiding disease and disability, high cognitive and physical functioning, and involvement in life. In summary, as Schulz and Heckhausen [10] recognized, several views of successful aging converge: physical and cognitive functioning, absence of impairment and disability, and primary control appear to be the superordinate criteria of successful aging.

Differences between competence and successful aging are not well established. While it is possible to distinguish that competence refers to a set of skills, abilities or individual characteristics, successful aging also seems to embrace those skills, as well as include other individual and social components. Nevertheless, authors agree that competence is a concept as broad as successful aging, and that both can be conceived as meta-concepts [12].

Beyond the definitional difficulties of competence and successful aging, two problematic issues emerge. The first is an 'epistemological' issue: the listed variables appear to confuse competence or successful aging as 'explanandum' (how competence can be described as a scientific subject) with the determinants or 'explanans' of competence (those variables determining or explaining competence). For example, does mastery of a given situation constitute a 'competent' characteristic for successful aging, or is it an explanatory condition for competence? Gibson [16] suggests, from perception theory, that we can distinguish between distal and proximal factors of a specific phenomenon. In this view, distal factors of competence could be education, SES or other historical conditions, while proximal factors could be lifestyles, personality traits, health status, etc. The Structural Equation Modeling conducted by Baltes et al. [17] in the Berlin Ageing Study (70- to 100-year-old subjects), defined competence as activities of daily life (ADL) and an expanded level of activity. Results are in support of the assumption that competence is explained by proximal personal resources (personality, fluid intelligence, balance and depressivity), and also by distal resources such as socioeconomic status, age and physical health.

Others have tried to differentiate between independent and dependent variables, and between mediator and intervening variables [18]. Authors such as Diehl [8] have developed complex models for everyday competence,

making distinctions between antecedents (e.g., individual factors such as health and cognition), components (e.g., intra-individual: physical and mental; contextual: social and physical), mechanisms (e.g., attributions, control beliefs) and outcomes (psychological well-being). Also, Baltes and Baltes [19] distinguish between antecedent conditions (e.g., reduction in general reserve capacity), processes (selection, optimization and compensation) and outcome (effective life). However, these and other highly complex models have minimal empirical support, and continue to constitute theoretical approaches to these highly primitive constructs. In summary, much more cross-sectional and longitudinal research should be carried out in order to define competence operationally and to establish which are determinants or predictors of competence, and which are intermediate conditions.

The second problematic issue refers to competence in relation to the life span. Is competence different at different stages of life? When aging is to be studied from a perspective of life span and with a wide age range, it appears to be assumed that competence may be expressed differently depending on age. In any case, definitions of competence and identification of its best outcome and determinants are empirical issues that should be investigated through longitudinal designs and with a multidimensional approach.

In summary, EXCELSA has been planned as a Cross-European Longitudinal Study of Aging (cross-sectional study in its first phase) in order to develop a European knowledge database about the contribution to the study of competence and its biobehavioral, psychosocial and socioenvironmental determinants across the life span within the European Union. After a review of competence and other related concepts in the literature, and the most important longitudinal studies on aging, a basic research protocol was developed in English. It contains a series of instruments, measures and biophysical tests designed to be administered in a 90-min in-home face-to-face interview called the European Survey on Aging Protocol (ESAP). It has been translated, adapted and evaluated for a set of European countries through a pilot study (EXCELSA-Pilot). The ESAP provides a multidimensional instrument to assess aging, and therefore can be used to explore competence and related factors within the process of aging.

The specific objectives of EXCELSA-Pilot were as follows: (1) to translate and adapt the ESAP to 7 European participant countries (Austria, Finland, Germany, Italy, Portugal, Poland and Spain), and test its psychometric properties (reliability and validity); (2) to test the impact of age and other relevant sociodemographic factors on the ESAP, and (3) to examine whether our data permit the identification of a competence factor, and whether a distinction can be drawn between competence and some of its potential determinants.

Since several reports have already dealt with the ESAP translation/adaptation and reliability and validity results [20, 21], this article focuses on: (1) testing the impact of age, and other relevant sociodemographic variables such as gender, education and living conditions in the selected instruments and measures composing the ESAP; (2) assessing the structure of the ESAP, and (3) exploring competence and its potential determinants.

Therefore, the following predictions will be tested.

(1) Since the ESAP instruments and measures were selected to assess aging, it is predicted that age will be a relevant source of variance of our results.

(2) In testing the selected sociodemographic variables, which guide our sampling, it is predicted that our results will vary according to our targeted sociodemographic conditions: gender, education and living conditions.

(3) The ESAP has been developed to assess competence and its potential determinants and it contains a broad set of factors (or sections), therefore the structure of the ESAP should have theoretical meaning, and we expect to find a factor of competence.

(4) From statistical analyses, it is possible to explore our data in order to distinguish, tentatively, between competence and some of its potential determinants.

Method

Participants and Design

Six hundred and ninety individuals aged 30–85 (mean = 60.58; SD = 15.48) years, 96 from each of the 7 participant European countries (Austria, Finland, Germany, Italy, Poland, Portugal and Spain) participated. Since the objective of EXCELSA-Pilot was the validation of the ESAP, subjects were selected by quota sampling in accordance with the following relevant demographic characteristics: age (four classes: 30–49, n = 175; 50–64, n = 175; 65–74, n = 169, and 75–85, n = 171); gender (two classes: 344 women and 346 men); education (two classes: compulsory, n = 387 and higher, n = 303), and living conditions (two classes: n = 272 rural and n = 418 urban).

Protocol

The process of developing the ESAP is summarized in Schroots et al. [3, 4], Fernández-Ballesteros [22], Fernández-Ballesteros et al. [23] and Rudinger and Rietz, [24]. Appendix 1 shows the sections, variables and instruments/measures that constitute the ESAP.

Psychosocial variables for assessing social relationships, cognitive abilities, personality (including self and well-being, and mastery and perceived control) were selected according to previous criteria [23] for these well-known instruments [25–30], or following other well-known studies on aging [17, 31].

Biophysical variables refer to anthropometric and biobehavioral measures. Anthropometric measures were the following: height, measured by a portable stadiometer in standard conditions; weight, measured in standard conditions by an electronic balance (same level in all countries, battery operated to the nearest 0.5 kg.); demispan (distance, measured by metal tape, from the right side of the external notch to the root of the middle and ring fingers of the left hand with the arm stretched out horizontally to the side, and palm facing forward); waist circumference (measured at the level midway between the lower rib margin and iliac crest in millimeters), and hip circumference (maximum circumference over the buttocks in millimeters). Finally, the body mass index (kg/m^2) and waist/hip quotient were calculated.

Regarding biobehavioral measures, pulmonary function was assessed using a standard 'Mini Peak-Flow Meter' [32]. The subject was asked to exhale at maximal effort through the meter in 3 trials and the highest score was used. Strength was assessed using an electronic dynamometer over 4 trials (2 trials with both right and left hands were performed, and the best score taken). Finally, speed was assessed using an electronic tapping test assessing the forefinger rate measure of simple motor speed over 5 s in 3 trials for both hands, with the best score being used.

Health, physical capacity and lifestyle questions were selected from research protocols used in other international studies [33, 34]. Taking our sample (30–85 years) into account, measurement of ADL has been substituted by other, indirect measures of daily living functioning, that is by the number of aids and number of chronic problems. Self-reported health contains questions about subjective health (general health appraisal, comparative assessment with 1 year ago, and most people of age and health), the number of aids used, chronic problems and sleeping problems. Hearing and vision questions were asked for the subject's appraisal of these senses in two conditions: with and without glasses, and with and without hearing aids. The subjective physical capacity section consists of two questions regarding the subject's appraisal of fitness, strength, flexibility, endurance and speed. Finally, the lifestyles section asks about physical activity (3 questions), smoking (6 questions) and alcohol consumption (3 questions).

Finally, the sociodemographic questions were selected from ESOMAR [35], as a European set of variables to be used in surveys of social, demographic and environmental conditions in other European studies.

As previously stated, psychometric data about all of these measures have been reported elsewhere [20, 21].

Procedure

In all countries the ESAP (questionnaires/examinations/conditions and manual of operations) was translated/adapted into the national languages following the same guidelines for instrument translation [22, 23, 36]. With a view to standardizing the administration of ESAP, all interviewers were trained with the same manual of operations and a demonstration video. They were selected from among social and health sciences students with knowledge of aging. The ESAP was administered through an in-home interview.

Data Analysis

Considering the objective in this article, and after assessing reliability, validity and adaptation analysis of the ESAP scales and subscales [20], the main analyses carried out were: (1) to test sociodemographic sources of variance of our protocol, a series of ANOVAs were conducted, separate ANOVAs examine the effect of age, gender, education, and living conditions; (2) in order to explore the structure of the ESAP and 'discover' a factor of competence, exploratory factor analyses were conducted (principal component, varimax rotation); (3) in order to assess structure concordance between countries, factorial concordance coefficients were obtained country-by-country, and (4) finally, in order to find out whether our data fit a theoretical model of competence, step-by-step equation modeling was carried out.

Results

Differences between Sociodemographic Conditions

Table 1 shows ANOVAs according to age (4 levels). Post hoc comparisons were performed (among the 4 age groups). Significant differences were found in 84% of these measures composing the ESAP at the level of probability predicted ($p < 0.05$). Let us make some brief comments on the ANOVA results ($p < 0.05$).

Regarding social relationships, in comparison with younger participants, the oldest group have significantly fewer friends ($F = 4.26$, $p < 0.005$), fewer confidence relationships ($F = 4.96$, $p < 0.002$), less general intimacy and caregiving ($F = 6.38$, $p < 0.000$), and fewer social relationships ($F = 10.9$, $p < 0.000$). The only social relationship not affected by age is family relationships.

Our intelligence measures were highly sensitive to age: young and middle-aged subjects differed significantly from the older groups in digit span and digit symbol in all comparisons ($F = 33.57$, $p < 0.000$ and $F = 158$, $p < 0.000$).

No differences were found in well-being, neuroticism (NEO-PI), sense of coherence and neuroticism, but younger groups were significantly more extraverted ($F = 14.6$, $p < 000$) and more open to experience ($F = 12.78$, $p < 0.000$). Finally, the oldest group perceived significantly less internal control ($F = 4.23$, $p < 0.006$), and the 2 older groups perceived more external control than the other 2 groups ($F = 9.65$, $p < 0.000$).

Our reported health yielded the following results: the oldest group perceived poorer health than the other 3 groups ($F = 5.11$, $p < 0.002$). Older subjects reported a greater number of health problems ($F = 10.97$, $p < 0.000$), a greater number of chronic problems ($F = 8.4$, $p < 0.000$), and more aids used ($F = 67.45$, $p < 0.000$), but only the youngest group showed significantly more sleep problems than the 3 older groups ($F = 3$, $p < 0.03$). Also, the 2 younger groups reported significantly better hearing than the 2 older groups ($F = 23.7$, $p < 0.000$), but only the oldest group reported significantly more visual problems than the other 3 groups ($F = 5.65$, $p < 0.001$).

Table 1. Differences between age groups on ESAP variables

Variables	Age, years					ANOVA		Post hoc comparisons
	total (n = 688)	30–49 (n = 175)	50–64 (n = 175)	65–74 (n =168)	75–85 (n = 170)	F	p	
Social relations								
Family	9.8 (3.1)	9.5 (3.1)	10.2 (3.4)	10.1 (3.1)	9.7 (3.1)	1.56	0.198	
Friends	7.8 (3.5)	8.3 (3)	8 (3.3)	7.8 (3.6)	7 (4)	4.26	0.005	1-4, 2-4, 3-4
Confidence	6.8 (2.3)	7.2 (2.1)	7.2 (2.3)	6.5 (2.5)	6.4 (2.4)	4.96	0.002	1-3, 1-4, 2-3, 2-4, 1-3
Social relationship (sum)	30.8 (7.5)	32.2 (6.6)	32.4 (6.9)	30.5 (7.7)	28.2 (8)	10.9	0.000	1-3, 1-4, 2-3, 2-4, 3-4
Intimacy and caregiving	20.6 (3)	21.3 (2.9)	20.9 (3.2)	20.3 (3.2)	20 (3.1)	6.38	0.000	1-3, 1-4, 2-4
Mental abilities								
Digit span backwards	4.2 (1.2)	4.7 (1)	4.6 (1.3)	3.9 (1.1)	3.7 (1.1)	33.57	0.000	1-3, 1-4, 2-3, 2-4 3-4
Digit symbol	36.2 (16.5)	51.2 (14)	39.7 (12.7)	29.8 (12.4)	23.1 (11.3)	158	0.000	1-2, 1-3, 1-4, 2-2,2-4, 3-4
Well-being and self								
Well-being	9.1 (1.9)	9 (1.9)	8.9 (1.8)	9.2 (1.9)	9.2 (1.9)	1.3	0.274	
Sense of coherence	64.5 (11.5)	64.2 (11.1)	65 (11.2)	65 (10.8)	63.8 (12.8)	0.477	0.699	
Personality								
Neuroticism	30.5 (7.7)	30.3 (8)	29.9 (7.9)	31.4(7.8)	30.4 (7.2)	1.13	0.335	
Extraversion	40.4 (6.7)	42.1 (6.1)	41.4 (6.9)	39.9 (6.7)	37.9 (6.1)	14.06	0.000	1-3, 1-4, 2-3, 2-4, 3-4
Openness	37.6 (6.6)	39.2 (6.3)	39 (6.7)	36.7 (6.2)	35.6 (6.5)	12.78	0.000	1-3, 1-4, 2-3, 2-4
Mastery and personal control								
Internal control	18.9 (3.2)	19.1 (2.8)	19.2 (2.9)	19.1 (3.2)	18.1 (3.7)	4.23	0.006	1-4, 2-4, 3-4
External control	14.9 (4.3)	13.8 (4.2)	14.4 (4)	15.37 (4.2)	16.1 (4.3)	9.65	0.000	1-3, 1-4, 2-3 2-4
Health								
Subjective health	7.9 (1.9)	7.6 (1.8)	7.9 (2)	7.7 (1.7)	8.3 (1.9)	5.11	0.002	1-4, 2-4, 3-4
Health problems	0.41 (0.73)	0.19 (0.44)	0.36 (0.67)	0.45 (0.72)	0.63 (0.96)	10.97	0.000	1-2, 1-3, 1-4, 2-4, 3-4
Chronic problems	0.44 (0.83)	0.2 (0.51)	0.42 (0.82)	0.49 (0.85)	0.64 (1)	8.4	0.000	1-2, 1-3, 1-4, 2-4
Number of aids	0.84 (0.61)	0.37 (0.51)	0.87 (0.43)	0.98 (0.39)	1.1 (0.74)	67.45	0.000	1-2, 1-3, 1-4, 2-4, 3-4
Sleep problems	0.65 (1.03)	0.49 (0.93)	0.58 (0.99)	0.75 (1.06)	0.78 (1.1)	3	0.030	1-3, 1-4
Hearing (self-rating)	0.27 (0.45)	0.15 (0.36)	0.14 (0.35)	0.35 (0.48)	0.46 (0.50)	23.7	0.000	1-3, 1-4, 2-3, 2-4, 3-4
Vision (self-rating)	0.17 (0.38)	0.09 (0.30)	0.12 (0.32)	0.15 (0.36)	0.27 (0.45)	5.65	0.001	1-4, 2-4, 3-4
Life-styles								
Physical activity (sum)	5.7 (1.6)	6.4 (1.5)	6 (1.5)	5.5 (1.5)	5 (1.5)	27.37	0.000	1-2,1-3, 1-4, 2-3, 2-4, 3-4
Alcohol, cm^3	103 (194)	127 (238)	122 (200)	90 (189)	72 (125)	3.22	0.022	1-4, 2-4
Tobacco per day	8.3 (12.3)	10.2 (12.4)	9.8 (13.6)	6.3 (10.4)	6.6 (12.2)	4.81	0.003	1-3, 1-4, 2-3, 2-4
Subjective competence								
Fitness	5.2 (1.5)	5 (1.5)	5.1 (1.5)	5 (1.4)	5.5 (1.6)	4.4	0.004	1-4, 2-4, 3-4
Strength	5.2 (1.5)	5 (1.4)	5.1 (1.5)	5.1 (1.5)	5.5 (1.7)	4.2	0.006	1-4, 2-4, 3-4
Flexibility	5.4 (1.7)	5.2 (1.7)	5.2 (1.7)	5.4 (1.7)	5.8 (1.8)	4.6	0.003	1-4, 2-4, 3-4
Endurance	5 (1.6)	4.9 (1.5)	4.8 (1.6)	4.9 (1.5)	5.5 (1.6)	6.78	0.000	1-4, 2-4, 3-4
Speed	5.2 (1.8)	4.9 (1.6)	5 (1.7)	5.1 (1.6)	5.9 (1.9)	13.37	0.000	1-4, 2-4, 3-4
Physical capacity (sum)	26 (7)	25.1 (6.2)	25.2 (6.6)	25.6 (6.8)	28.3 (7.7)	8.45	0.000	1-4, 2-4, 3-4
Anthropometry								
Body weight	74.4 (14)	73.8 (15)	76.6 (13.7)	74.5 (13)	73 (14.1)	2.156	0.092	2-4
Body height	165.8 (9.8)	169.2 (10)	167.2 (9.3)	164.4 (9.2)	162.4 (9.4)	17.1	0.000	1-3, 1-4, 2-3, 2-4
Body mass	27 (4.2)	25.7 (4.1)	27.3 (4.1)	27.5 (4)	27.5 (4.3)	2.28	0.078	
Waist/hip	0.88 (0.07)	0.86 (0.08)	0.89 (0.07)	0.89 (0.06)	0.90 (0.08)	8.54	0.000	1-2, 1-3, 1-4, 2-3
Biobehavioral measures								
Peak flow (best score)	380 (152)	481 (129)	422 (131)	337 (139)	275 (124)	83.57	0.000	1-2,1-3, 1-4, 2-3, 2-4, 3-4
Tapping test (best score)	24.2 (7.1)	28.7 (5.7)	25.9 (5.4)	22.7 (6.4)	19.2 (7)	75.13	0.000	1-2,1-3, 1-4, 2-3, 2-4, 3-4
Grip strength (best score)	30.8 (11.7)	37.9 (12.6)	33.8 (10.2)	28.1 (9.2)	23.1 (8.3)	68.18	0.000	1-2,1-3, 1-4, 2-3, 2-4, 3-4

Values are means with standard deviations in parentheses.

Life style items yielded the following results. Older people (all comparisons) performed less physical activity ($F = 27.37$, $p < 0.000$) and smoked less ($F = 4.81$ $p < 0.003$), but only the oldest group drank less than the 3 younger groups ($F = 3.22$, $p < 0.022$).

All subjective capacity items yielded similar results. The oldest groups, in comparison with the other 3, perceived significantly less fitness ($F = 4.4$, $p < 0.004$), strength ($F = 4.2$, $p < 0.006$), flexibility ($F = 4.6$, $p < 0.003$), endurance ($F = 6.78$, $p < 0.000$) and speed ($F = 13.37$, $p < 0.000$).

Regarding anthropometric measures, younger subjects were significantly taller ($F = 17.1$, $p < 0.000$) than older groups, but only the middle-age group significantly differed in weight from the oldest group. All biobehavioral measures discriminate between the 4 groups in all comparisons: significant differences between groups were found in grip strength ($F = 68.18$, $p < 0.000$), peak flow ($F = 83.57$, $p < 0.000$) and tapping ($F = 75.13$, $p < 0.000$).

With regard to education, table 2 shows ANOVAs for the 5 education levels, as well as post hoc comparisons. A high percentage of our measures (62%) discriminate between education levels ($p < 0.05$). Let us briefly describe the significant differences found, taking into consideration the number assigned to each group (no formal education, n = 1; primary, n = 2; secondary, n = 3; higher, n = 4, and university degree, n = 5; $p < 0.05$).

Regarding social relationships, no significant differences between education levels were found in family, friends and total social relationships. Significant differences were found in confidence relationships ($F = 2.7$, $p < 0.03$), subjects without formal education and with primary education reporting fewer confidence relationships than those with higher and university levels of education. Finally, only the group with primary education differed significantly from secondary, higher and university education groups in general intimacy and caregiving ($F = 8.5$, $p < 0.000$).

With respect to mental aptitudes, groups differ significantly according to their educational level. The more educated groups obtained significantly higher scores than those without formal education or with primary education. Digit symbol ($F = 35.2$, $p < 0.000$) shows significant differences in all comparisons, but in digit span backwards ($F = 13.6$, $p < 0.000$). Although there are significant differences due to age, no differences were found between university and higher education groups.

Regarding the self and personality, no differences were found in well-being, but the more educated people (higher and university groups) show significantly higher scores in our measure of coherence ($F = 5.6$, $p < 0.000$). Also, the least educated group (no formal education) shows significantly higher scores in neuroticism ($F = 4$, $p < 0.003$). The university group, in comparison to the primary, secondary and higher education groups, obtained significantly higher scores in extraversion ($F = 6.5$, $p < 0.000$). Openness (in the same line as intelligence scores) was the personality characteristic most sensitive to education, more educated people yielding higher scores in openness than less educated people (with the exception of the 'no formal education' group; $F = 29.2$, $p < 0.000$). Less educated people perceive greater external control than the more educated groups ($F = 6.8$, $p < 0.000$); no differences were found between the higher and university groups. In contrast, the university group perceive significantly more internal control than the groups with primary and higher education ($F = 3.6$. $p < 0.007$).

The more highly educated groups differ significantly from the low educated groups in their perception of better health ($F = 4.3$, $p < 0.002$), but there were no significant differences between groups in the number of health problems, only the primary education group reporting significantly more chronic problems ($F = 9$, $p < 0.000$), number of aids ($F = 2.6$, $p < 0.03$) and sleep problems ($F = 6.43$, $p < 0.000$) than the other groups. No significant differences between groups were reported in hearing and vision.

The 'no formal education' group reported significantly less physical exercise than the other 4 groups ($F = 6$, $p < 0.000$), but groups did not show significant differences in drinking or smoking.

Regarding subjective competence, no differences between groups were found in strength and speed, but the more educated groups reported better fitness, flexibility, endurance and physical capacity (total) than the low educated groups ($F = 2.6$, $p < 0.03$; $F = 2.7$, $p < 0.03$; $F = 3.7$, $p < 0.005$; 2.9, $p < 0.02$).

Anthropometry shows that more highly educated people are taller ($F = 10.2$, $p < 0.000$) with a lower body mass index ($F = 6.04$, $p < 0.000$), but no significant differences were found between groups in weight and waist/hip quotient.

All biobehavioral measures discriminate between groups. More educated people show greater speed (tapping test; $F = 6.1$, $p < 0.000$), vital capacity (peak flow; $F = 11.2$, $p < 0.000$) and strength (grip strength; $F = 4.2$, $p < 0.000$). No differences were found between the primary and secondary education groups and between the higher and university degree groups.

Table 2. Differences between education level on ESAP variables

Variables	Level of education						ANOVA		Post hoc comparisons
	total (n = 688)	no formal (n = 29)	primary (n = 191)	secondary (n = 166)	higher (n = 180)	university (n = 122)	F	p	
Social relations									
Family	9.9 (3.2)	10.4 (3.8)	10.1 (3.1)	9.9 (3.2)	9.8 (3)	9.3 (3.3)	1.6	0.171	
Friends	7.8 (3.5)	7.9 (4.4)	7.7 (3.9)	7.7 (3.6)	7.8 (3)	8 (3.1)	0.19	0.944	
Confidence	6.8 (2.3)	6 (2.8)	6.5 (2.3)	6.9 (2.2)	6.8 (2.5)	7.3 (2.1)	2.7	0.027	1-5, 2-5
Social relationship	30.9 (7.5)	29.8 (11.8)	30.2 (7.8)	31.6 (7.2)	30.7 (7)	31.2 (7.2)	0.92	0.449	
Intimacy and caregiving	20.6 (3)	11 (3.5)	11.2 (3.1)	11.8 (2.9)	12.1 (3)	12.2 (2.9)	8.5	0.000	2-3, 2-4, 2-5
Mental abilities									
Digit span backwards	4.2 (1.2)	3.1 (0.85)	3.9 (1)	4.3 (1.1)	4.4 (1.3)	4.6 (1.2)	13.6	0.000	1-2, 1-3, 1-4, 1-5, 2-3, 2-4, 2-5,3-5
Digit symbol	36.2 (16.5)	17.1 (10)	29.6 (14)	35.7 (15)	41.2 (15)	44.8 (16)	35.2	0.000	1-2, 1-3, 1-4, 1-5, 2-3, 2-4, 2-5,3-4, 3-5
Well-being and self									
Well-being	9.1 (1.9)	8.9 (2.6)	9.1 (1.8)	8.8 (1.9)	9.2 (1.8)	9.2 (1.9)	1.1	0.331	
Sense of coherence	64.5 (11.4)	55.7 (11.5)	64.1 (12)	63.8 (11.1)	65.3 (10.4)	66.7 (12)	5.6	0.000	1-2, 1-3, 1-4, 1-5, 2-5, 3-5
Personality									
Neuroticism	30.5 (7.7)	34.7 (7.3)	30.6 (7.8)	31.2 (8)	30 (7.2)	29 (7.8)	4	0.003	1-2, 1-3, 1-4, 1-5, 2-5, 3-5
Extraversion	40.4 (6.7)	40.7 (6.7)	38.8 (6.6)	40.3 (6.6)	40.5 (7)	42.6 (5.9)	6.5	0.000	2-3, 2-4, 2-5, 3-5, 4-5
Openness	37.6 (6.6)	33.7 (5.7)	34.8 (6.5)	36.7 (5.8)	39.3 (5.8)	41.5 (6.5)	29.2	0.000	1-3, 1-4, 1-5, 2-3, 2-4, 2-5,3-4, 3-5,
Control									
Internal control	18.9 (3.1)	18.7 (3.7)	18.4 (3.4)	19 (3.2)	18.7 (3)	19.7 (3)	3.6	0.007	2-5, 4-5
External control	14.9 (4.3)	17.7 (5)	15.4 (4.4)	15.1 (4.3)	14.2 (4)	13.9 (3.8)	6.8	0.000	1-2, 1-3, 1-4, 1-5, 2-4, 2-5, 3-4, 3-5
Health									
Subjective health	7.9 (1.7)	8.4 (2.3)	8.2 (1.9)	7.9 (1.8)	7.7 (1.8)	7.4 (1.6)	4.3	0.002	1-5, 2-4, 2-5, 3-5
Health problems	0.41 (0.73)	0.48 (0.57)	0.51 (0.87)	0.36 (0.66)	0.35 (0.66)	0.38 (0.72)	1.4	0.222	
Chronic problems	0.44 (0.83)	0.24 (0.44)	0.74 (1.1)	0.3 (0.67)	0.36 (0.71)	0.33 (0.66)	9	0.000	1-2, 2-3, 2-4, 2-5
Sleep problems	0.65 (1.03)	0.52 (0.85)	0.91 (1.17)	0.50 (0.93)	0.55 (0.99)	0.56 (0.92)	6.43	0.000	1-2, 2-3, 4-5
Number of aids	0.84 (0.61)	0.93 (0.65)	0.94 (0.69)	83 (0.63)	0.74 (0.52)	0.84 (0.54)	2.6	0.03	2-4
Hearing (self-rating)	0.27 (0.45)	0.31 (0.47)	0.37 (0.48)	0.27 (0.45)	0.23 (0.42)	0.18 (0.39)	2.05	0.08	2-3, 2-4, 2-5
Vision (self-rating)	0.17 (0.38)	0.24 (0.44)	0.23(0.43)	0.17 (0.36)	0.14 (0.35)	0.09 (29)	2.3	0.06	2-4, 2-5
Life-style									
Physical activity	5.7 (1.6)	4.4 (2)	5.7 (1.5)	5.7 (1.6)	6 (1.4)	5.8 (1.6)	6	0.000	1-2, 1-3, 1-4, 1-5
Alcohol, cm^3	103 (193)	90.1 (200)	107 (213)	109 (231)	102 (162)	94 (147)	0.16	0.96	
Tobacco per day	8.3 (12.3)	8.5 (13.4)	8.2 (13.1)	9.4 (13.6)	8.5 (10.8)	6.4 (10.9)	1.1	0.355	
Subjective competence									
Fitness	5.2 (1)	5.7 (2)	5.3 (1.5)	5.2 (1.5)	5 (1.4)	4.9 (1.5)	2.6	0.03	1-4, 1-5, 2-5, 3-5
Strength	5.2 (1)	5.4 (2.4)	5.2 (1.5)	5.2 (1.5)	5.1 (1.4)	5.1 (1.4)	0.32	0.867	
Flexibility	5.4 (1.7)	5.9 (2.4)	5.6 (1.6)	5.5 (1.7)	5.3(1.6)	5.1 (1.9)	2.7	0.028	1-5, 2-4, 2-5
Endurance	5 (1.1)	5.5 (2.1)	5.3 (1.6)	5 (1.7)	4.9 (1.4)	4.7 (1.5)	3.7	0.005	1-5, 2-4, 2-5
Speed	5.2 (1.7)	5.3 (2.3)	5.5 (1.8)	5.3 (1.8)	5.1 (1.5)	5 (1.8)	1.8	0.13	
Physical capacity sum	26 (6.9)	28.2 (10.3)	27 (6.8)	26.3 (7)	25.4 (6.3)	24.8 (6.9)	2.9	0.02	1-4, 1-5, 2-4, 2-5
Anthropometry									
Body weight	74.5 (14)	70.7 (13.1)	74.3 (13.3)	76.1 (14.8)	74.3 (15)	73.6 (12.6)	0.2	0.301	
Body height	166 (9.8)	158 (10.9)	164 (9.7)	165 (9.7)	167 (9.7)	169 (8.3)	10.2	0.000	1-1, 1-2, 1-3, 1-4, 1-5, 2-4, 2-5, 3-5
Body mass	27 (4.2)	28 (4)	27.5 (3.9)	27.7 (4.3)	26.5 (4.2)	25.7 (4.1)	6.04	0.000	1-4, 1-5. 2-4, 2-5, 3-4, 3-5
Waist/hip	0.88 (0.07)	0.90 (0.07)	0.89 (0.08)	0.88 (0.07)	0.87 (0.07)	0.87 (0.09)	2.05	0.09	2-4, 2-5
Biobehavioral measures									
Peak flow (best score)	380 (153)	264 (177)	359 (153)	356 (148)	415 (142)	420 (145)	11.2	0.000	1-2, 1-3, 1-4, 1-5, 2-4, 2-5, 3-4, 3-5
Tapping test	24.2 (7.1)	19 (9.4)	23.7 (6.6)	23.8 (7.2)	25 (6.9)	25.6 (6.6)	6.1	0.000	1-2, 1-3, 1-4, 1-5, 2-5, 3-5
Grip strength	30.8 (11)	24.2 (10.9)	30.3 (11.2)	30 (11.3)	31.8 (12.2)	33.1 (11.6)	4.2	0.000	1-2, 1-3, 1-4, 1-5, 2-5, 3-5

Values are means with standard deviations in parentheses.

Table 3. Differences between gender on ESAP variables

Variables	Total (n = 689)	Gender		ANOVA	
		male (n = 345)	female (n = 344)	F	p
Social relations					
Family	9.9 (32)	9.3 (34)	10.4 (29)	20.4	0.000
Friends	7.8 (3.5)	7.7 (3.4)	7.9 (3.5)	0.757	0.384
Confidence	6.81 (2.3)	6.51 (2.2)	7.11 (2.4)	11.02	0.001
Social relationship (sum)	30.9 (7.5)	30.5 (7.5)	31.2 (7.5)	1.51	0.220
General intimacy and caregiving	20.6 (3.1)	20.1 (3)	21.1 (3)	16.8	0.000
Mental abilities					
Digit span backwards	4.2 (1.2)	4.3 (1.2)	4.2 (1.2)	2.12	0.146
Digit symbol	36.2 (16.5)	36.4 (16.4)	36 (16.7)	0.093	0.760
Well-being and self					
Well-Being	9.1 (1.9)	9.04 (1.9)	9.13 (1.9)	0.440	0.507
Sense of coherence	64.5 (11.5)	65.3 (11.6)	63.7 (11.3)	3.22	0.073
Personality					
Neuroticism	30.5 (7.7)	28.6 (7.6)	32.4 (7.4)	43.5	0.000
Extraversion	40.4 (6.7)	40.1 (6.7)	40.6 (6.7)	1.22	0.270
Openness	37.6 (6.6)	37.5 (6.5)	37.8 (6.8)	0.308	0.579
Mastery and perceived control					
Internal control	18.9 (3.2)	19.2 (3.2)	18.6 (3.2)	5.73	0.017
External control	14.9 (4.3)	14.4 (4.3)	15.4 (4.1)	10.05	0.002
Health					
Subjective health	7.9 (1.9)	7.7 (1.8)	8.1(1.9)	7.43	0.007
Health problems	0.41 (0.73)	0.36 (0.67)	0.45 (0.79)	2.98	0.084
Chronic problems	0.44 (0.83)	0.39 (0.73)	0.49 (0.92)	2.6	0.107
Number of aids	0.84 (0.61)	0.82 (0.65)	0.87 (0.56)	1.25	0.263
Sleep problems	0.65 (1.02)	0.55 (0.95)	0.75 (1.08)	6.87	0.009
Hearing (self-rating)	0.27 (0.45)	0.29 (0.45)	0.26 (0.44)	0.795	0.373
Vision (self-rating)	0.17 (0.38)	0.16 (0.36)	0.18 (0.39)	0.708	0.400
Life-style					
Physical activity (sum)	5.74 (1.72)	5.78 (1.72)	5.71 (1.4)	0.354	0.552
Alcohol, cm^3	103 (194)	165 (247)	40.5 (78)	79.5	0.000
Tobacco per day	8.3 (12.3)	12.2 (14.4)	4.3 (7.9)	80.5	0.000
Subjective competence					
Fitness	5.16 (1.5)	5.01 (1.5)	5.31 (1.5)	6.7	0.010
Strength	5.2 (1.5)	5 (1.5)	5.3 (1.6)	7.6	0.006
Flexibility	5.4 (1.7)	5.4 (1.7)	5.4 (1.8)	0.046	0.830
Endurance	5 (1.6)	5 (1.6)	5.1 (1.6)	1.26	0.261
Speed	5.2 (1.7)	5.2 (1.7)	5.2 (1.7)	0.005	0.944
Physical capacity	26 (7)	25.6 (7)	26.5(6.9)	2.58	0.108
Anthropometry					
Body weight	74.4 (14)	80.5 (13.2)	68.4 (12.1)	154.2	0.000
Body height	166 (9.8)	172 (7.8)	159 (7.2)	489.5	0.000
Body mass	27 (4.2)	27.1 (3.7)	27 (4.6)	0.219	0.640
Waist/hip	0.88 (0)	0.93 (0)	0.83 (0)	401.2	0.000
Biobehavioral measures					
Peak flow (best score)	380 (153)	434 (161)	325 (121)	100.2	0.000
Tapping test (best score)	24.2 (7.1)	25.7 (7.3)	22.7(6.5)	32.5	0.000
Grip strength (best score)	30.8 (11.6)	38.5 (10.6)	23.1 (6.4)	523.1	0.000

Values are means with standard deviations in parentheses.

Table 4. Differences between living conditions on ESAP

Variables	Living conditions					ANOVA		Post hoc comparisons
	total (n = 689)	capital (n = 164)	large town (n = 116)	small town (n = 137)	village (n = 272)	F	p	
Social relations								
Family	9.9 (3.2)	8.8 (3.4)	10 (3)	10.2 (2.7)	10.2 (3.2)	7.7	0.000	1-2, 1-3, 1-4
Friends	7.8 (3.5)	7.4 (3.2)	7.6 (3.5)	7.9 (3.5)	8 (3.6)	1.4	0.220	
Confidence	6.8 (2.3)	7.1 (2.5)	6.5 (2.3)	6.8 (2.3)	6.8 (2.3)	1.13	0.336	
Social relationship (sum)	30.9 (7.5)	29.9 (7.6)	29.9 (7.4)	31.1 (7.1)	31.7 (7.6)	2.5	0.057	1-4, 2-4
General intimacy and caregiving	20.6 (3.1)	12.1 (3.2)	11.7 (3.2)	11.7 (2.8)	11.5 (3.1)	0.895	0.443	
Mental abilities								
Digit span backwards	4.2 (1.2)	4.1 (1.3)	4.4 (1.1)	4.2 (1.2)	4.2 (1.1)	1.79	0.147	
Digit symbol	36.2 (16.5)	34.9 (16.5)	37.3 (15.3)	37.7 (17.3)	35.8 (16.7)	0.94	0.418	
Well-being and self								
Well-being	9.1 (1.9)	9 (1.9)	8.8 (1.9)	9.3 (1.8)	9.2 (1.9)	1.7	0.164	
Sense of coherence	64.5 (11.4)	62.6 (11.2)	63.6 (11.4)	64.5 (9.9)	66 (12.2)	3.2	0.022	1-4
Personality								
Neuroticism	30.5 (7.7)	30.8 (7.7	31.7 (7.8)	29.4 (7)	30.2 (8)	1.9	0.124	
Extraversion	40.4 (6.7)	41.7 (6.3)	39.1 (7.1)	40.2 (7.1)	40.2 (6.4)	3.8	0.009	1-2, 1-3, 1-4
Openness	37.6 (6.6)	38.4 (6.8)	37.1 (7)	37.4 (6.2)	37.5 (6.5)	1.01	0.385	
Mastery and perceived control								
Internal control	18.9 (3.2)	19.1 (3.4)	18.5 (3.2)	18.9 (2.7)	18.9 (3.3)	0.703	0.550	
External control	14.9 (4.3)	14.7 (4.1)	14.6 (4.3)	14.8 (3.9)	15.2 (4.5)	0.877	0.453	
Health								
Subjective health	7.9 (1.9)	7.9 (1.7)	7.8 (1.9)	8 (1.8)	7.9 (2)	0.144	0.934	
Health problems	0.41 (0.73)	0.32 (0.60)	0.32 (0.68)	0.5 (0.92)	0.45 (0.71)	2.25	0.081	
Chronic problems	0.44 (0.83)	0.26 (0.61)	0.33 (0.67)	0.67 (1.1)	0.48 (0.85)	6.91	0.000	1-3, 1-4, 2-3, 3-4
Sleep problems	0.65 (1.03)	0.57 (0.96)	0.64 (0.91)	0.73 (1.18)	0.67 (1.03)	0.609	0.609	
Number of aids	0.84 (0.61)	0.82 (0.56)	0.8 (0.57)	0.9 (0.68)	0.85 (0.62)	0.671	0.570	
Hearing (self-rating)	0.27 (0.45)	0.17 (0.38)	0.22 (0.42)	0.39 (0.49)	0.30 (0.46)	6.92	0.000	1-3, 1-4, 2-3
Vision (self-rating)	0.17 (0.38)	0.14 (0.35)	0.16 (0.37)	0.16 (0.36)	0.20 (0.40)	0.711	0.546	
Life-style								
Physical activity	5.7 (1.6)	5.7 (1.6)	5.8 (1.5)	5.6 (1.5)	5.8 (1.6)	0.884	0.449	
Alcohol, cm^3	103 (194)	102 (216)	152.4 (265)	89.6 (139)	89.4 (162)	3.21	0.022	1-2, 2-3, 2-4
Tobacco per day	8.3 (12.3)	9.3 (13.9)	9.5 (13.7)	7.1 (10.5)	7.6 (11.4)	1.44	0.228	
Subjective competence								
Fitness	5.2 (1.5)	5.2 (1.4)	5.2 (1.5)	5.3 (1.5)	5 (1.6)	1.11	0.344	
Strength	5.2 (1.5)	5.3 (1.4)	5.1 (1.7)	5.3 (1.4)	5.1 (1.6)	0.69	0.557	
Flexibility	5.4 (1.7)	5.5 (1.7)	5.4 (1.7)	5.6 (1.5)	5.3 (1.8)	0.84	0.474	
Endurance	5 (1.6)	4.8 (1.4)	5.1 (1.6)	5.3 (1.6)	5 (1.7)	2.34	0.072	
Speed	5.2 (1.8)	5.3 (1.7)	5.2 (1.8)	5.4 (1.6)	5.1 (1.8)	0.889	0.446	
Physical capacity (sum)	26 (7)	26.1 (6.6)	26.1 (6.9)	26.8 (6.6)	25.6 (7.4)	0.868	0.457	
Anthropometry								
Body weight	74.4 (14)	75.1 (14.7)	74.2 (13.2)	75.1 (12.8)	73.8 (14.5)	0.452	0.716	
Body height	166 (9.8)	167 (9.7)	165 (8.7)	167 (9.4)	165 (10.4)	1.73	0.159	
Body mass	27 (4.2)	26.9 (4.7)	27.2 (4.1)	27 (3.7)	26.9 (4.1)	0.112	0.953	
Waist/hip	0.88 (0.07)	0.88 (0.08)	0.89 (0.07)	0.87 (0.08)	0.88 (0.07)	0.833	0.476	
Biobehavioral measures								
Peak flow (best score)	380 (153)	356 (149)	401 (144)	402 (153)	374 (156)	3.22	0.022	1-2, 1-3
Tapping test (best score)	24.2 (7.1)	22.2 (7.7)	24.8 (6.1)	24.6 (7)	24.9 (6.9)	5.66	0.001	1-2, 1-3, 1-4
Grip strength (best score)	30.8 (11.6)	28.6 (11.4)	31.8 (11.4)	31.7 (11.4)	30.8 (11.9)	2.76	0.041	1-2, 1-4

Values are means with standard deviations in parentheses.

Table 3 shows ANOVAs and post hoc comparisons by gender. Approximately, half of our variables (51%) yielded significant differences between men and women ($p < 0.05$). It should be borne in mind that these percentages decrease if biophysical measures (anthropometric and biobehavioral) are not taken into consideration. In other words, when only psychosocial, health and lifestyles are considered, 41.4% measures differentiated men from women.

Women report significantly more family relationships ($F = 20.4$, $p < 0.000$), more confidence relationships ($F = 11.02$, $p < 0.000$) and more intimacy and caregiving ($F = 18.8$, $p < 0.000$) than men. No differences in any of the intelligence tests were found between men and women. Women score more than men in neuroticism ($F = 43.5$, $p < 0.000$) and in external control ($F = 10.5$, $p < 0.002$), and perceive less internal control than men ($F = 5.73$, $p < 0.017$). No differences in extraversion, openness, well-being and sense of coherence are found.

Women report significantly poorer subjective health than men ($F = 7.43$, $p < 0.007$), and more sleep problems ($F = 6.87$, $p < 0.009$), but men and women do not differ in the number of health problems or chronic problems and number of aids used, or in self-rated hearing and vision. Men and women do not differ in physical exercise, but women drink ($F = 79.5$, $p < 0.000$) and smoke ($F = 80.5$, $p < 0.000$) significantly less than men. Regarding subjective capacity, men and women do not differ in their evaluation of flexibility, endurance and speed, but women perceive less fitness and strength than men. Body mass is the exception, but men are heavier ($F = 154.2$, $p < 0.000$), taller ($F = 489.5$, $p < 0.000$) and with higher waist/hip quotients ($F = 401.2$, $p < 0.000$). Finally, women have less strength ($F = 523.1$, $p < 0.000$), speed ($F = 32.5$, $p < 0.000$) and vital capacity ($F = 100.2$, $p < 0.000$).

Finally, table 4 shows ANOVAs and post hoc comparisons between living conditions (capital, large town, small town, village). Only 40% of measures showed significant differences between these 4 classes of living conditions. People living in large cities reported fewer family relationships ($F = 7.7$, $p < 0.000$), but no differences were found in the other social relationships. No differences due to living conditions were found in intelligence, well-being, neuroticism and openness, and internal and external control, but people living in capitals were more extraverted ($F = 3.8$, $p < 0.009$), and differed from those living in villages in their sense of coherence ($F = 3.2$, $p < 0.022$). Although there are no significant differences among groups in subjective health, health and sleep problems, or aids, people living in small towns and villages report more chronic problems ($F = 6.91$, $p < 0.000$) and poorer hearing ($F = 6.92$, $p < 0.000$) than people living in capitals or large towns. Regarding life styles, no differences were found in physical exercise and smoking, but people living in large towns drink more than the other groups ($n = 3.21$, $p < 0.022$). No differences were found between groups in subjective competence and anthropometry, but people living in capitals scored less in the peak flow test ($F = 3.22$, $p < 0.022$), were slower in the tapping test ($F = 5.66$, $p < 0.001$), and had less strength in grip strength.

ESAP Structure

As shown in table 5, after an exploratory factor analysis of 46 of our measures (principal components, varimax rotation; factor analysis took subscales into consideration), ten factors were found that explained 67.85% of total variance. The first factor is loaded by all items assessing subjective competence (fitness, strength, flexibility, endurance, speed and subjective health; eigenvalue 5.7; explained variance 12.5%). The second factor could be identified as personality because it is loaded by sense of coherence and its subscales, neuroticism, external and internal control and well-being (eigenvalue 4.6; explained variance 10.1%) The third factor is called cognitive and physical competence, and is loaded by three types of variables: intelligence (working memory and learning), physical capacity (speed and vital capacity) and age (eigenvalue 4.1; explained variance 8.92%). The fourth factor is loaded by anthropometric measures (demispan, height, and weight) and grip strength (best mean scores), and is called strength (eigenvalue 3.1; explained variance 6.75%). The fifth factor (eigenvalue 3.04; explained variance 6.62%) is loaded by all items referring to pro-social behaviors (general intimacy, caregiving and extraversion). The sixth factor is loaded by sociodemographic conditions, such as level and years of education and income; it is also loaded by openness, and is called SES (eigenvalue 2.72; explained variance 5.93%). The seventh factor is loaded by all social relationship items (eigenvalue 2.32; explained variance 5.05%). The eighth factor is called illness, being loaded by reported and chronic health, number of aids and sleep problems (eigenvalue 2.15; explained variance 4.68). The ninth factor is loaded by activity items (eigenvalue 1.91; explained variance 4.15). Finally, the tenth factor is loaded by smoking and alcohol consumption, and is called lifestyle (eigenvalue 1.43; explained variance 3.17%).

Table 6 shows the concordance coefficients [37] between this factorial structure and the structure yielded in the 7 countries. The majority of factors show very high

Table 5. Exploratory factor analysis, principal component, varimax rotation and EXCELSA-Pilot for all countries (n = 672)

	Subjective competence	Personality	Physical and cognitive competence	Strength	Prosocial behavioral	SES	Social relationship	Illness	Activity	Life-style
Subjective physical capacity	0.956	−0.130	−0.125	−0.017	−0.056	−0.051	−0.068	0.103	−0.113	−0.019
Subjective fitness	0.853	−0.172	−0.101	−0.042	0.024	−0.057	−0.093	0.115	−0.066	−0.008
Subjective strength	0.816	−0.082	−0.037	−0.180	−0.040	0.061	−0.023	0.056	−0.102	−0.017
Subjective speed	0.792	−0.068	−0.184	0.040	−0.074	−0.031	−0.014	0.093	−0.098	0.016
Subjective flexibility	0.790	−0.119	−0.114	0.089	−0.069	−0.060	−0.076	0.108	−0.081	−0.044
Subjective endurance	0.782	−0.114	−0.078	−0.002	−0.070	−0.127	−0.086	0.062	−0.130	−0.028
Subjective health	0.671	−0.194	−0.129	−0.060	−0.057	−0.147	−0.061	0.209	0.032	0.064
Coherence	−0.106	0.946	0.070	0.014	0.090	0.049	0.113	0.013	0.057	0.017
Manageability	−0.047	0.860	0.069	0.054	0.015	0.031	0.058	−0.031	−0.007	−0.007
Comprehension	−0.087	0.856	0.022	−0.003	−0.015	−0.031	0.098	−0.016	0.021	0.149
Neuroticism	0.277	−0.672	−0.044	−0.245	−0.127	−0.017	0.011	−0.009	0.145	−0.068
Meaningfulness	−0.136	0.651	0.096	−0.012	0.258	0.147	0.132	0.090	0.126	−0.141
Well-being	−0.142	0.571	−0.087	0.100	0.081	0.062	0.068	−0.015	−0.039	−0.310
External control	0.231	−0.571	−0.232	−0.124	−0.184	−0.132	−0.053	0.152	0.115	−0.072
Tapping (left hand)	−0.194	0.131	0.813	0.133	0.036	0.006	0.094	−0.035	0.061	0.109
Tapping (right hand)	−0.218	0.081	0.783	0.149	0.044	0.037	0.078	−0.052	−0.010	0.048
Digit symbol	−0.071	0.084	0.722	0.023	0.136	0.362	0.102	−0.132	0.074	−0.015
Years	0.037	0.126	−0.716	−0.157	−0.181	−0.175	−0.081	0.305	−0.149	0.053
Peak flow	−0.189	0.151	0.632	0.469	0.053	0.127	−0.040	−0.050	−0.003	0.014
Digit span	−0.129	0.061	0.574	0.037	0.042	0.257	0.122	0.126	−0.024	0.190
Height	−0.070	0.127	0.211	0.836	0.016	0.166	−0.031	−0.077	0.010	0.167
Weight	0.098	0.048	−0.058	0.781	0.017	−0.010	−0.098	0.052	0.013	0.057
Demispan	−0.055	0.101	0.285	0.748	−0.078	0.075	0.110	−0.057	0.017	0.141
Grip strength	−0.164	0.099	0.476	0.709	−0.012	−0.006	0.003	−0.150	0.045	0.111
Intimacy and caregiving	−0.029	0.109	0.104	−0.052	0.950	0.067	0.072	−0.018	0.058	0.001
General intimacy	0.001	0.009	0.109	−0.056	0.829	0.166	0.028	−0.039	0.071	−0.029
Caregiving	−0.057	0.198	0.066	−0.031	0.798	−0.076	0.105	0.014	0.023	0.037
Extraversion	−0.182	0.189	0.003	0.125	0.500	0.194	0.116	−0.073	0.023	−0.025
Education level	−0.033	0.050	0.118	−0.015	0.093	0.894	0.004	−0.082	0.021	−0.042
Education years	−0.063	0.046	0.254	0.061	0.100	0.866	0.010	−0.027	0.013	0.011
Income	−0.098	0.163	0.081	0.160	0.013	0.617	0.011	−0.192	0.079	0.035
Openness	−0.176	−0.019	0.185	0.010	0.390	0.504	−0.014	0.151	−0.074	−0.048
Social relations (sum)	−0.139	0.150	0.156	0.023	0.182	0.038	0.899	−0.066	0.103	−0.077
Friends	−0.120	0.044	0.092	0.080	0.064	0.040	0.785	−0.025	−0.004	0.116
Family	−0.051	0.162	0.116	−0.221	−0.001	−0.087	0.660	0.092	0.081	0.019
Confidence	−0.094	0.177	−0.030	0.096	0.332	0.124	0.470	−0.110	0.020	−0.385
Chronic problems	0.208	0.022	−0.029	0.022	−0.018	−0.116	−0.029	0.796	−0.024	−0.063
Health problems	0.322	0.010	−0.109	0.014	0.022	0.002	−0.011	0.775	0.011	0.028
Aids	0.097	0.146	−0.308	−0.179	−0.063	0.053	−0.057	0.522	0.017	0.324
Sleep problems	0.047	−0.177	−0.011	−0.106	−0.042	−0.128	0.046	0.486	−0.078	−0.223
Subjective activity	−0.146	−0.044	−0.072	−0.027	0.078	0.054	0.032	−0.059	0.865	0.011
Physical activity (sum)	−0.415	0.004	0.246	0.068	0.076	0.024	0.126	−0.025	0.834	−0.006
Physical life activities	−0.471	0.039	0.400	0.116	0.047	−0.008	0.152	0.010	0.512	−0.016
Tobacco	−0.032	−0.068	0.065	0.182	0.059	0.017	0.032	−0.045	0.020	0.732
Alcohol	−0.035	0.062	0.154	0.290	−0.058	−0.029	0.019	−0.077	−0.032	0.531
Eigenvalue	5.7	4.6	4.1	3.1	3.04	2.7	2.3	2.15	1.9	1.43
Explained variance, %	12.5	10.1	8.9	6.7	6.6	5.93	5.05	4.7	4.15	3.17

concordance in the majority of countries. As can be seen in table 6, only one country (Portugal) yielded low concordance coefficients for this factorial structure.

In summary, this exploratory factor analysis yielded the expected results about the factorial structure of the ESAP, closely similar to the rationale behind our sections. Even so, it is not easy to decide what is to be understood as our key concept 'competence'. The first factor, subjective competence, is threatened by the method used (self-report) and the 'wording' of every question. However, our third factor is loaded by age and also by 'objective' measures assessing cognitive and physical competence. Without doubt this factor can be considered as representing cognitive and physical 'competence'.

Table 6. Factorial concordance coefficient between the 7 countries participating and the total of the sample

Country	Subjective competence	Personality	Physical and cognitive competence	Strength	Pro-social behavior	SES	Social relations	Health	Activity	Life-style
Spain	0.83	0.65	0.80	0.11	0.36	0.75	0.78	0.80	0.76	0.64
Germany	0.90	0.60	0.83	0.95	0.92	0.86	0.86	0.81	0.87	0.09
Austria	0.92	0.64	0.89	0.13	0.88	0.82	0.71	0.00	0.89	0.67
Finland	0.93	0.70	0.74	0.90	0.89	0.09	0.97	0.34	0.87	–0.06
Italy	0.91	0.66	0.87	0.87	0.85	0.78	0.84	0.71	0.75	0.24
Poland	0.94	0.70	0.89	0.84	0.81	0.77	0.75	0.81	0.69	0.04
Portugal	–0.68	0.28	–0.14	0.44	–0.07	0.12	0.23	0.43	–0.02	0.38

Equation Modeling

Considering our exploratory factor analysis, it seems that the best measure of competence is factor 3. On the basis of our theoretical introduction, and in order to respond to our hypothesis, a step in the desired direction would be to seek the role played by socioenvironmental, psychosocial, health and lifestyle variables with respect to competence. The best statistical method available for this is a confirmatory factorial analysis.

In order to obtain the final model, we proceeded step-by-step, testing different sub-models [38]. The strategy followed was, first, to check the possible models involving only two of the relevant variables: how competence is influenced by social networks, for example. From these two-variable models that fit the sample data, more complex, three-variable models were developed. In this way, the number of variables in the model was increased at each step.

Several of the hypothesized relevant variables dropped out of this final model. The final model is that which best fits all the significant variables measured in our research.

Figure 1 shows the final theoretical model. It includes all of the coefficients that are significant beyond the $p < 0.05$ level. The structural model accounted for 87% of the variance in competence (when age is eliminated from the model, all latent variables continue to be present in it, but only 38% of variance is explained by such a model). Results of the model indicated a reasonable fit of the model to the data: the tests yielded a goodness of fit index (GFI) of 0.903; a root mean square error of approximation (RMSEA) of 0.06; a CMIN/DF (relative χ^2) of 2.82, and an djusted goodness of fit index (AGFI) of 0.876.

Four latent variables have a direct effect on competence (measured by digit symbol, digit span, peak flow and tapping): age (years); socioeconomic status (education, and income); subjective capacity (with regard to flexibility, fitness, strength, endurance and subjective health), and lifestyles (alcohol consumption and smoking and physical activity).

Age is the factor with the most important direct effect on competence (–0.63): it has a direct effect on lifestyle (–0.78), illness (0.11), socioeconomic status (–0.39) and social relationships (–0.26). The total effect of age on competence is –0.88.

Subjective capacity is a buffer that mediates the influence of other posited variables, such as social network (family and friends relationships and caregiving), internal control and illness (health and chronic health problems). Its direct effect on competence is –0.12, and the effect deriving from social relationships is –0.29, from illness 0.39 and from internal control –0.19. Lifestyle has direct and indirect effects on competence: its direct effect is 0.18 and its total effect on competence (0.22) goes through the effect it has on illness (–0.22).

Finally, it should be emphasized that this model also fits, in a separate way, two sub-samples of young (30–50 years; GFI = 0.79, RMSEA = 0.63, CMIN/DF 1.804, and AGFI = 0.74) and old (51–85 years; GFI = 0.89, RMSEA = 0.063, CMIN/DF 2.43, and AGFI = 0.86) people, in addition to its fitting quite well (separately) in 5 countries.

Discussion

As predicted in our first hypothesis, ESAP is highly sensitive to age. Age differences were found in the majority of our variables. Therefore, in this cross-sectional study differences in age groups yielded results similar to those of other studies [13, 14, 17, 32, 34, 39–41]. By comparison

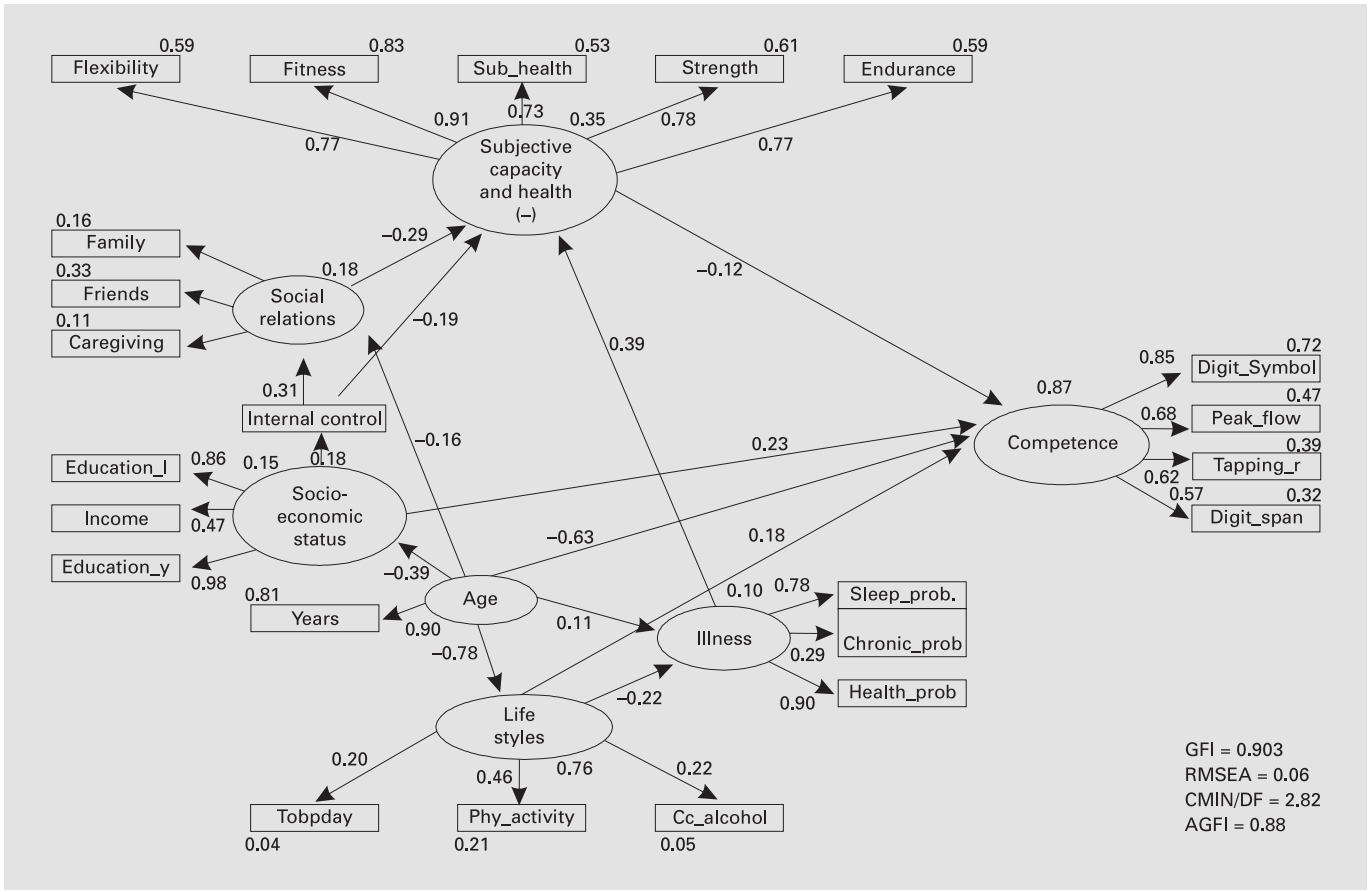

Fig. 1. Competence confirmatory analysis.

with the 3 younger groups, the oldest subjects reported significantly fewer social relationships (with the exception of family relationships). Intelligence scores in tests measuring fluid intelligence (working memory and performance) differ significantly between groups in almost all comparisons. That is, in this cross-sectional study there is a decline in fluid intelligence with age, as is found in other research [42–44]. Also, as has repeatedly been shown, extraversion and openness are two personality dimensions that decline over the life cycle [39]. From several perspectives, internal/external control is an age-related personality characteristic, but in this study only the oldest group perceived less internal control than the other 3; at the same time, it yielded higher external control scores.

The oldest group reports poorer subjective health, more chronic problems, higher number of aids used, and poorer hearing and vision than younger groups. Physical exercise is declining with age, and other activities, such as smoking and drinking, are decreasing. By comparison with the 3 younger groups, the oldest subjects reported less fitness, strength, flexibility, endurance and speed. From an anthropometric point of view, younger groups are taller than older ones, with higher waist/hip quotients. Although only the oldest subjects differ from the others in their subjective perceptions of competence, when objective measures are used for assessing speed, strength and vital capacity, the decline is linear across age. As has frequently been emphasized, there is no concordance between subjective and objective measures of the same construct: both types of measures should be taken into consideration [33, 34]. Also, and in accordance with aging research, older people do not present significant differences in well-being [45, 46], and neuroticism [39]. Our results do not support Antonovski's [25] assumption: age has no influence on sense of coherence. Regarding social relationships, there are no significant differences in family relationships, but significant differences between younger groups and the oldest one (75–85 years) were found

with regard to friends and general social relationships. This result is in accordance with those of other longitudinal and cross-sectional studies [15, 42, 47].

With regard to education, taking into consideration our sample, the results are in accordance with other studies emphasizing the importance of education in the process of aging [13, 40, 48, 49]. Better-educated people reported more confidence relationships, more intimacy and caregiving, higher intelligence, less extraversion and neuroticism, more openness, greater sense of coherence and internal control, and less external control. Results on health are inconsistent: while those subjects with more schooling reported better subjective health and fewer aids used, they also reported more chronic and sleep problems than people with no formal education. No differences were found in the number of health problems and appraisal about hearing and vision. Lifestyles present differences only in physical activity: more educated people reported higher levels of physical activity than less educated people, but no differences were found in alcohol consumption or smoking. Regarding subjective competence, those with more schooling reported higher levels of fitness, flexibility, endurance and global physical capacity. These results are in accordance with objective measures: more educated people presented higher levels of speed, strength and vital capacity, as measured by our biobehavioral measures. Finally, from an anthropometric point of view, more educated people are significantly taller and, while they do not differ in body weight, they have less body mass. In summary, as reported in other research on aging (both cross-sectional and longitudinal), education is an important source of variance in psychosocial, health, lifestyles, anthropometry and biophysical measures.

It is assumed that gender is an important source of variance in the aging process, and even the World Health Organization [11] considers gender a risk factor for healthy aging. Nevertheless, gender had less influence in our measures and protocol, at least in comparison with age and education. As expected, all anthropometric and biobehavioral measures yielded significant differences between men and women (with the exception of body mass). Also, as in other research on social support, women presented more family relationships and confidence relationships, general intimacy and caregiving than men [47, 50], as well as presenting more neuroticism and external control and less internal control than men [51].

However, and in contrast to the findings of other studies [34, 52, 53], no differences between men and women were found for cognitive abilities or in the majority of health measures: men and women do not differ significantly in working memory, learning and performance, number of health and chronic problems, number of aids used or subjective appraisal of hearing and vision. As a post hoc assumption, it can be stated than equalitarian policies and universal protection systems in Europe may be at the root of these similarities between the two genders. Nevertheless, as in other studies [34] women reported significantly poorer subjective health and lower fitness and strength levels than men (backed up by objective tests). Although it should be emphasized that women have significantly healthier life styles than men: they drink and smoke much less, while exercising just as much.

In order to evaluate these results, post hoc comparisons were performed. Since our sample starts at a very young age (30 years), comparison between younger and older men and women was made. When age is taken into account and men's and women's groups are split into young (under 50 years) and old (over 50 years), differences due to gender are reduced in some of our variables, with younger and older women's groups showing different patterns. For example, younger men and women do not differ in internal and external control (internal control in younger men = 19.28, women = 18.86; external control in younger men = 13.41, women = 14.51), while older people do differ (internal control in older men = 19.16, women = 18.52, $F = 4.746$, $p < 0.030$; external control in older men = 14.78, women = 15.76, $F = 6.642$, $p < 0.01$). Along the same line, there are no differences between younger men and women in subjective health (mean for men 7.54; mean for women 7.72), whereas in the general group, older women report poorer health than men (mean for men 7.75; mean for women 8.21; $F = 7.308$, $p < 0.007$). In other words, not only were the gender differences small, but they also seemed to be reduced in younger cohorts in comparison with the other groups. This is in accordance with our previous post hoc assumption.

It can be stated that, in general, comparisons between Europeans living in rural and urban contexts reveal small differences, and this may be due mainly to sociopolitical and geographical factors: urban sprawl, mass media, transport availability and health and social services systems [54]. In line with this, minor differences were found in the EXCELSA-Pilot: people living in large cities reported more extraversion and more alcohol consumption than people living in small towns, while people living in small towns and villages reported more family relationships, more sense of coherence, more chronic problems and poorer hearing, but showed, through objective measures, more vital capacity, speed and strength.

In summary, as predicted in our hypothesis 2, education, gender and living conditions (in that order) are relevant dimensions, but much more analysis of these sociodemographic variables is required in our next European longitudinal study.

Regarding our exploratory factor analysis, using all the measures of the ESAP gives interesting results. The ESAP structure is in accordance with our sections rationale. A subjective capacity or competence, including subjective health, emerges as the first factor. A second factor is loaded by most of those personality characteristics inserted in our protocol related to instruments assessing sense of coherence, control, well-being and neuroticism. Strength or size is another physical factor mainly loaded by anthropometric measures. Speed (tapping), vital capacity (peak flow) and intelligence (digit span backwards and digit symbol) load the same factor, clearly measuring physical and cognitive competence [55, 56]; moreover this is the only factor significantly loaded by age. The subscales measuring pro-social attitude and behaviors (inticare, general intimacy, caregiving and extraversion) load the same factor. Two sociodemographic factors, education and income, and a personality factor, openness, load the same factor, called SES. All subscales related to social relationships load the same factor. Health emerges as a factor loaded by the number of health and chronic problems and the number of aids, and it has been called 'illness'. Items related to activity load the same factor and, finally, two anthropometric measures, circumference and weight, load our last factor.

In accordance with our third prediction, from this factor analysis we arrive at two important findings. First, that the general structure of our protocol is based not only on a logical distribution of social relationships, cognitive skills, personality, anthropometry, biobehavioral measures, self-reported health, subjective capacity, lifestyles and sociodemographic variables, but also on those sections that have an empirical base and factorial structure.

The ESAP has been designed to assess competence, and even though the EXCELSA-Pilot is only a pilot study, it is extremely important to try and discover whether our protocol does assess competence. Two factors are related to competence: (1) subjective capacity, loaded by the subject's appraisal of his/her fitness, strength, endurance, flexibility, speed and subjective health, and (2) objective cognitive and physical competence, assessed by measures of cognitive abilities (working memory and learning and performance), vital capacity (assessed by peak flow) and speed (assessed by a tapping test). Bearing in mind that no definition or theory of competence proposes that competence is simply a subjective condition, we consider that our cognitive and physical competence factor could be a good measure of at least two important components of competence. Moreover, this factor is also loaded by age covering two conditions from two individual characteristics which have been proposed as important components of successful aging: physical and cognitive performance [13, 14]. From another perspective, both cognitive and physical measures could be considered as markers of aging [57]. All these four measures fit several of the criteria for markers of aging proposed by Arking [58] (change with time at a given rate; monitoring some basic important process; being nonlethal and noninvasive; being highly reproducible, etc.). Obviously, much more research should be conducted in order to examine this factor of cognitive and physical performance.

Finally, it should be stated that the factorial concordance analysis between our 7 countries shows that the structure of our protocol has a very high degree of statistical concordance in 5 of the 7 participating countries.

As our 4th prediction states, our final concern refers to the investigation of the determinants of competence. Obviously, this is a most important question that requires longitudinal and multidisciplinary studies, and cannot be dealt with here. Since this is a pilot cross-sectional study, any reference to causality of competence would be totally inappropriate, both because the definition of competence (as cognitive and physical competence) is premature and because a cross-sectional study does not allow us to establish determinants of competence. Nevertheless, in an attempt to explore the role of different conditions assessed by ESAP, we considered structural equation modeling as a potentially useful tool. Although this statistical strategy developed for testing previous hypothetical modeling emerged from a confirmatory approach, it does not mean that it cannot be used from a (more conservative) exploratory approach. In other words, if a step-by-step analysis is conducted with a set of variables, it is possible to arrive at a given model by differentiating independent from dependent (cognitive and physical competence) variables (fig. 1).

Our final model is in agreement with other theoretical assumptions in the field of competence [8, 10, 12–14]. The following conditions were posited as determinants of cognitive and physical competence. (1) Education, income and age are historical or distal factors related to the history of the subject which have an important influence on competence even in old age, when competence is assessed through ADL [42]. (2) Social relationships, personality (internal control), lifestyles, and illness can be

understood as proximal factors, as in the majority of optimal aging assumptions [13]. (3) Finally, subjective appraisal of competence seems to play the role of a buffer for social relationships, internal control and illness that theoretically depends on these proximal factors. Finally, cognitive and physical competence is posited as the explanandum, dependent or outcome variable. Cognitive and physical competence are also in the majority of models on successful aging as outcome variables [13, 14], but in other models they are posited as proximal factors in very old persons as determinants of ADL [42].

As has been stated above, this is a preliminary study conducted in a sample of Europeans from 7 countries with the same procedures and protocols. It has been shown that ESAP is sensitive to age. The empirical definition of cognitive and physical competence emerges from a factor analysis, and should be re-tested in other samples and with other designs. Determinants posited in our post hoc confirmatory analysis should be tested through longitudinal designs. We look forward to the possibility of carrying out the EXCELSA main study in order to test these highly provisional but exciting results.

Appendix 1

Sections, Variables, Instruments/Measures, and Number of Items in the ESAP

Part	Sections	Variables	Instruments/measures[1]	Items
I Psychological	1 Social relationships	Social network: Friends, family, confidence, general intimacy and caregiving	Lubben [27], Social Network Scale (4) (1)	10 9
	2 Cognitive abilities	Working memory	Wechsler [29], Digit Backward (1)	Max 8
		Memory, learning and performance	Wechsler [29], Digit Symbol (1)	Max. 67
	3 Personality	Neuroticism, extroversion, openness	Costa and McCrae [26], NEO (3)	36
		Well-being	Lykken and Tellegen [59], Well-being Questions (1)	5
		Sense of coherence	Antonovski [25], Sense of Coherence Questionnaire (1)	13
		External control	Pearlin and Schooler [30] (1)	7
		Internal control	Pearlin and Schooler [30] (1)	6
II Biophysical	4 Anthropometry	Height	Body height (1)	1
			Demispan (1)	2
		Weight	Body weight (1)	1
		Waist	Waist circumference (1)	1
		Hip	Hip circumference (1)	1
	5 Bio-behavioral measures	Speed	Tapping test (1)	4
		Strength	Grip strength (1)	5
		Pulmonary function (vital capacity)	Peak flow (1)	4
III Health, physical capacity and life-style	6 Self-reported health	Self-assessment health	de Bruin et al. [33] (1)	3
		Health problems	de Bruin et al. [33] (1)	3
		Chronic problems	de Bruin et al. [33] (1)	3
		Aids	de Bruin et al. [33] (1)	1
		Sleep problems	de Bruin et al. [33] (1)	5
		Hearing	de Bruin et al. [33] (1)	7
		Vision	de Bruin et al. [33] (1)	7
	7 Subjective physical capacity	Fitness	de Bruin et al. [33] (1)	2
		Strength	de Bruin et al. [33] (1)	2
		Flexibility	de Bruin et al. [33] (1)	2
		Endurance	de Bruin et al. [33] (1)	2
		Speed	de Bruin et al. [33] (1)	2
	8 Life-style	Physical activity	(1)	3
		Smoking	(1)	5
		Alcohol consumption	(1)	6

➤

Appendix 1 (continued)

Part	Sections	Variables	Instruments/measures[1]	Items
IV Socio-environmental	9 Sociodemographics	Age, gender, size of household and community, region, marital status, children in household, structure of household, housing/type of dwelling, homemaker, education of respondent (years), education degree of respondent, education of HoH (degree), working status of respondent, working status of HoH, profession of respondent, profession of HoH, income of respondent, income of HoH, social class (country specification), living conditions (four classes: capital, large town, small town and village)		21

HoH = Head of household.
[1] Scores per variable in parentheses.

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