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Adaptation, data quality and confirmatory factor analysis of the Danish version of the PACIC questionnaire

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Background: The Patient Assessment of Chronic Illness Care (PACIC) 20-item questionnaire measures how chronic care patients perceive their involvement in care. We aimed to adapt the measure into Danish and to assess data quality, internal consistency and the proposed factorial structure. **Methods:** The PACIC was translated by a standardised forward–backward procedure, and filled in by 560 patients receiving type 2 diabetes care. Data quality was assessed by mean, median, item response, missing values, floor and ceiling effects, internal consistency (Cronbach's α and average inter-item correlation), item-rest correlations and factorial structure was assessed by confirmatory factor analysis (CFA). **Results:** The item response was high (missing answers: 0.5–2.9%). Floor effect was 2.7–69.2%, above 15% for 17 items. Ceiling effect was 4.0–40.4%, above 15% for 12 items. The subscales had average inter-item correlations over 0.30 and CFA showed high factor loadings (range 0.67–0.77). All had α over 0.7 and included items with both high and low loadings. The CFA model fit was good for two indices out of six (TLI and SRMR). **Conclusions:** Danish PACIC is now available and validated in primary care in a type 2 diabetes population. The psychometric properties were satisfactory apart from ceiling and floor effects. We endorse the proposed five scale structure. All the subscales showed good model fit, and may be used for separate sum scores.

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Introduction

Initiatives are taken to develop and implement evidence-based activities to improve the care for the chronically ill.[1,2] A crucial part of evaluating the public health impact of new initiatives is adequate instruments to collect valid data. Danish chronic care systems lack such instruments, especially instruments covering the full patient perspective.

The Patient Assessment Chronic illness Care (PACIC) questionnaire[3] includes five subscales related to a patient perspective on chronic care based on the Chronic Care Model (CCM),[4,5] and is therefore adequate for a recent Danish chronic care effort inspired by the CCM.[6] The PACIC measure was developed and validated in USA for patients with diabetes.[1,3] The PACIC assesses the key elements of self-management support and planned, proactive population-based care and is designed for use in a variety of health-care service settings. The patients rated the care they received from their primary health-care team for the chronic illness that they had identified as the most influential on their life.

PACIC has been translated and validated into Spanish, Dutch and German.[7–10] The validation studies revealed problems with the data quality and diverse conclusions were drawn about scale properties, when adapting PACIC to different health-care systems. Therefore, the 20-item PACIC scale required validation in a Danish population before interpretation.

The aim of this study was to achieve a Danish language version of the 20-item English-language PACIC questionnaire that was conceptually equivalent to the original questionnaire.[1,3] We further aimed to evaluate the Danish version according to psychometric properties by assessing data quality and internal consistency and the proposed factorial structure. Our hypothesis was that five subscales composed the factorial structure of the original PACIC.

Methods

Design and setting

We performed a standardized translation and cultural adaptation followed by a cross-sectional survey study among type 2 diabetes patients sampled from a national diabetes register based on a validated algorithm.[11,12]

PACIC questionnaire

The 20 items were separated into five *a priori* scales based on some of the key components of the 'activated, informed patient' in the CCM. The five subscales are: Patient activation (Items 1–3), Decision support (Items 4–6), Goal setting (Items 7–11), Problem solving (Items 12–15) and Coordination/Follow-up (items 16–20).[3] Each item had five response categories with scores from 1 (never) to 5 (always). Higher scores indicated more structured chronic care. Each subscale is scored by averaging items completed within the scale and the overall PACIC score is an average across all 20 items. The PACIC literature offers no strategy for handling missing values.

Translation and adaptation from English to Danish

We used the method recommended by the WHO for the process of translation and adaptation of instruments to ensure good cross-cultural validity. We went through the five steps including a forward–backward translation, expert panel discussion, back-translation, pre-test and a cognitive briefing.[13] The forward translation was done by two languages experts with Danish as their mother tongue, and the backward translations by two native English language experts. The four translators and three senior researchers in the fields of chronic care, health-care system and questionnaire methodology comprised the expert panel, who worked closely with the original developers. The level of comprehensibility and cognitive equivalence of the preliminary translated version[14,15] was tested in face-to-face cognitive interviews among eight women and four men, aged from 41 to 70 years and duration of type 2 diabetes for 0–5 years from a local diabetes out-patient clinic. The patients filled in the questionnaire at home and participated in a focus group interview on the following day. The interviewer (HTM) facilitated a discussion on comprehensiveness followed by a review of each items. The participants were asked to think out loud, highlight problems and express their attitude. This procedure led to substantial adaptations, mainly to clarify the items.

Validation survey

Data collection for psychometric analyses was done as a postal survey recruiting patients from a national sample of general practices. In 2008, we sampled all patients registered with diabetes (types 1 and 2) in a national diabetes register. The patients were registered with 32 general practices (15 solo practices) with 63 GPs who took part in a feedback programme to enhance structured diabetes care. A total of 2476 patients were sent a survey with the Danish version of PACIC together with the Danish version of EUROPEP[16] and questions on comorbidity and socio-demographic characteristics. There was no reminder procedure. A total of 1171 (47.3%) patients did not return the survey and 40 (1.6%) did not want to fill it in. Thirty-seven patients were excluded because of death, changes of address and language problems. A total of 561 (22.7%) patients did not have type 2 diabetes >2 years, 89 (3.6%) did not receive treatment and 18 (0.7%) filled in <50% of items. We included 560 participants (22.6%) with type 2 diabetes for >2 years and with medical treatment to ensure a homogeneous group of patients. For the CFA-analyses, 481 participants (19.4%) with no missing data were included.

The study was approved by the Danish Data Protection Agency (journal no.: 2007-41-1026).

Analyses

The psychometric elements of the PACIC were examined in two parts: First, we assessed the data quality, internal consistency and correlations between items and domains. Second, we explored the five-domain structure using the confirmatory factor analysis (CFA). Analyses were performed with Stata 11 and factor analysis with Mplus 4.2.[17] The analyses included questionnaires in which at least 50% (>9) of answered items. Data quality was assessed by mean, median, percentage of missing data and extent of ceiling and floor effects. Floor and ceiling effects between 1% and 15% were defined as optimal.[18] Internal consistency was assessed using Cronbach's α and average inter-item correlation. We defined an α of 0.70 as the lowest acceptable value.[19,20] In contrast to α, the average inter-item correlation is independent of the number of items and sample size when measuring internal consistency. We regarded an average inter-item correlation in the moderate range of at least 0.30 as good. A high inter-item correlation (>0.80) is an indication of redundancy and is therefore not desirable. In contrast, if all correlations are near 0, there is no meaningful construct.[21]

The correlation analyses assessed whether each item had a high correlation with the sum score of the rest of the scale (internal item convergence) and a higher correlation with the items in its own scale than with those of other scales (item discriminant validity).[20,22] Correlations were fixed at a minimum of 0.60 to reflect a high level of internal convergence.[20,23] We defined a sufficient item discriminant validity as a correlation with the items in its own scale two standard deviations above that obtained with other scales [calculated as the 95% confidence intervals for the coefficients based on Fisher's transformation (Stata, ci2-option)].[21]

The factorial structure was evaluated by the CFA, where items were analysed as categorical measures with a variance adjusted weighted least-squares method (WLSMV) estimator. The objective of the CFA was to explore the extent to which the correlations between the variables could be explained by the five domains. We defined a basic model where an item was linked to its own domain with unspecified correlation between domains. A number of indices are available to assess the fit of a model based on categorical data and we present the six indices, which have proved to be useful in assessing model fit.[24–27]

Chi-squared goodness-of-fit statistic assesses the discrepancy between the sample and fitted covariance matrix (the null hypothesis is that the model fits the data. An insignificant test indicates good fit (*P*-value above 0.1).

The chi-squared statistic is extremely sensitive to sample size (about 200 cases) and in large samples it tends to result in a rejection of the model. For this reason, less sensitive additional fit indices are recommended (using the non-centrality parameter and taking into account sample size and degrees of freedom).

Comparative fit index (CFI) assesses fit relative to a null model and ranges from 0 to 1 with values of 0.90–0.95 indicating acceptable and over 0.95 good fit.

Tucker Lewis index (TLI) adjusts for the number of model parameters and is interpreted as CFI.

Root mean square error of approximation (RMSEA) expresses the lack of fit per degree of freedom of the model. Values are interpreted as follows: ≤ 0.05 indicates very good, $>0.05–0.08$ good and ≥ 0.10 poor fit. Standardized root mean square residual (SRMR) is the average of the differences between the observed and predicted correlations and has a range from 0 to 1. Values of <0.08 indicate good fit. Weighted root mean square residual (WRMR) is also a residually based measure where values above 0.90 indicate poor fit.

ANOVA were used to reveal differences of subscale scores among groups of sex, age (30–64 years vs. ≥ 65 years), self-rated health (good vs. bad) and comorbidity (0–1 vs. ≥ 2).

Results

The translation and adaptation procedure

The two forward translations from English to Danish agreed on most items. Different Danish words were occasionally used, but were semantically equivalent. A few conceptual discrepancies were identified; e.g. 'Health Care Team' as used in the introductory wordings is not an established term in the Danish Health Care System. The patients might be in contact with a diabetes team at an out-patient clinic, but many patients do not refer to a specific team, but to a general practitioner. The closest concept is health carers or health-care providers. Another concept with a different meaning was 'treatment' in Items 1, 9 and 13. In everyday Danish language, it would refer to the pharmacological treatment, but in the PACIC the concept covers both the pharmacological and the non-pharmacological treatment. Primarily, we translated it to the Danish word 'behandling', meaning treatment, but after the procedure including debriefing, we included the following sentence in the introduction section: 'Treatment includes both your medical treatment and the non-pharmacological treatment such as diet and exercise'. All items that raised questions were debated in the expert panel who sought information for the conceptual basis in the literature[1,3,28] and with the developers (Judith Schaefer) to ensure the right meaning.

At expert panel meetings, the two translated versions were combined into a single translation that related to Danish terminology. The first back-translation included all items; the second back-translation included the five items with most discrepancies (Items 3, 5, 10, 13 and 14). The emphasis on the back-translation was the conceptual and cultural equivalence as recommended by Wild *et al.*[14] and not linguistic as recommended by WHO.[13] In the briefing process, the participants found all of the 20 items easy to understand and relevant for evaluating their care, although, for example, receiving a care plan had not been a part of their treatment so far.

The expert group incorporated the results from the briefing process in the draft version, and proofreaders corrected the spelling and grammar.

Participants in survey

The mean age of the participants was 66.4 (SD 10.7) and 60.0% were male. The duration of type 2 diabetes was mean 8.7 years (SD 6.6).

Data quality analysis

Eleven of the items had responses evenly distributed over the five categories (median = 3 for Items 1, 3, 4, 7, 8, 9, 11, 12, 15, 18 and 20). Items 5, 6 and 19 were left-skewed, and Items 2, 10, 13, 14, 16 and 17 were right skewed with 10, 16 and 17 highly right skewed (table 1). The item response was high with a small number of missing answers

(0.5–2.9%). Floor effect was 2.7–69.2%, above 15% for 17 items. Ceiling effect was 4.0–40.4%, above 15% for 12 items.

Cronbach's α ranged from 0.71 to 0.86 for the five subscales, and was 0.94 for the 20-item scale. The average inter-item correlation for the 20-item scale was 0.43 and for the subscales, the range was from 0.33 to 0.62 (table 2). Item-rest correlation (internal item convergence) (range 0.40–0.77) was below 0.60 for all items in the scale concerning 'Follow-up/coordination' (items from 16 to 20) as well as for Items 4, 5 and 10. For nine items (4, 7, 10, 11, 12, 16, 17, 18 and 19), the correlation with own scale (item discriminant validity) was lower than with other scales (table 2).

Confirmatory factor analysis

The CFA showed high factor loadings for items in scales 'Patient activation' and 'Problem solving/contextual' (range 0.67–0.77) (table 3). The remainder of the scales included items with both high and low loadings (range 0.31–0.73). The indices for model fit (table 4) show that the data fitted well for two indices (TLI and SRMR) and was a poor fit for four indices (χ^2, CFI, RMSEA and WRMR).

Subgroup analysis

No statistically significant differences in reporting were found according to sex and age. With regard to subgroups of self-rated health, the group with good health reported significantly higher score on the subscales 'patient activation' ($P = 0.027$), 'decision support' ($P < 0.001$) and 'goal setting' ($P = 0.022$). Patients with more than one additional chronic diseases reported statistically significantly lower score on two scales ['patient activation' ($P = 0.002$) and 'decision support' ($P = 0.024$)].

Discussion

We have translated and adapted the original 20-items PACIC scale into a Danish version. The response rate was acceptable, as no reminders were delivered. A large proportion of responders answered $>50\%$ of the items suggesting good face validity. The validation analyses revealed problems with floor and ceiling effects, but acceptable internal consistency for the five proposed subscales and a reasonable good model fit of the proposed factorial structures.

The subgroup analysis revealed differential reporting in the two groups of self-rated health on the first three subscales, and in the two groups of comorbidity on the first two subscales.

A high floor, but a particularly high ceiling effect for PACIC may affect the responsiveness of the questionnaire,[29] and calls for a further assessment of how these questions cohere with the present opportunities for chronic care within the Danish Health Care system. A recent validation study of the Dutch PACIC used in general practice[8] showed similar problems, whereas this was not present in a Spanish validation[9] of PACIC delivered in an ambulatory care clinic, where the staff had received an intensive course given by Ed Wagner, a leading proponent of the CCM. The validation of the original PACIC and the PACIC cross-cultural validation studies from The Netherlands and Spain[8,9] concluded that PACIC was to be reported as an average overall score, and the PACIC has been reported as such in recent intervention studies.[7,30] The model fit in our validation study confirms these results and each of the five scales may be regarded as unidimensional and reported as such. PACIC is developed to measure the perception of provided chronic care, and not meant to be a diagnostic tool. In that case, stricter cut-off points for Cronbach's α and inter-item correlations could be recommended, as well as further validity is required. This is in line with a recent review of the existing evidence on the PACIC's factorial validity, where it is argued how the PACIC has to be seen more accurately as a formative measure.[31]

According to the recent Consensus-based Standards (COSMIN) of assessing methodological quality of patient-reported measures[32] reliability, validity and responsiveness must be evaluated before we implement these instruments in research and development. Thus, we need to take a step backwards and look at the content, criteria and construct validity of

Table 1 Data quality of the PACIC in a Danish population with type 2 diabetes (*n* = 560)

Over the past 12 months, when I received care for my chronic conditions, I was:	*n*	Mean (SD)	Median	Missing (%)	Floor (%)	Ceiling (%)
Patient activation						
1. Asked for my ideas when we made a treatment plan.	549	2.88 (1.36)	3	2.0	23.5	13.5
2. Given choices about treatment to think about.	550	2.39 (1.35)	2	1.8	37.5	7.8
3. Asked to talk about any problems with my medicines or their effects.	550	3.01 (1.46)	3	1.8	23.8	19.5
Delivery system design/decision support						
4. Given a written list of things I should do to improve my health.	548	2.85 (1.48)	3	2.1	30.5	16.8
5. Satisfied that my care was well organized.	555	4.11 (0.97)	4	0.9	2.7	40.4
6. Shown how what I did to take care of myself influenced my condition.	555	3.87 (1.17)	4	0.9	6.9	36.0
Goal setting/tailoring						
7. Asked to talk about my goals in caring for my condition.	548	2.93 (1.42)	3	2.1	25.0	16.2
8. Helped to set specific goals to improve my eating or exercise.	554	3.28 (1.36)	3	1.1	16.3	22.7
9. Given a copy of my treatment plan.	546	2.96 (1.54)	3	2.5	30.0	21.1
10. Encouraged to go to a specific group or class to help me cope with my chronic condition.	552	1.81 (1.32)	1	1.4	67.2	8.5
11. Asked questions, either directly or on a survey, about my health habits.	553	2.70 (1.44)	3	1.3	32.6	14.7
Problem solving/contextual						
12. Sure that my doctor or nurse thought about my values, beliefs, and traditions when they recommended treatments to me.	547	3.15 (1.41)	3	2.3	20.3	20.5
13. Helped to make a treatment plan that I could carry out in my daily life.	549	2.56 (1.49)	2	2.0	39.0	13.7
14. Helped to plan ahead so I could take care of my condition even in hard times.	544	2.56 (1.49)	2	2.9	38.4	13.4
15. Asked how my chronic condition affects my life.	557	2.68 (1.50)	3	0.5	34.7	16.9
Follow-up/coordination						
16. Contacted after a visit to see how things were going.	552	2.09 (1.41)	1	1.4	54.5	10.0
17. Encouraged to attend programs in the community that could help me.	549	1.65 (1.13)	1	2.0	69.2	4.0
18. Referred to a dietician, health educator, or counsellor.	550	2.66 (1.53)	3	1.8	37.1	18.0
19. Told how my visits with other doctors, like an eye doctor or surgeon, helped my treatment.	557	3.59 (1.43)	4	0.5	15.8	36.5
20. Asked how my visits with other doctors were going.	550	2.84 (1.62)	3	1.8	35.6	23.8

Table 2 Correlations between items and (i) the rest of the items in its own scale (item-rest correlation) and (ii) the other scales (Scale 1–5)

Over the past 12 months, when I received care for my chronic conditions, I was:	Item-rest*	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Scale 1 (inter-item correlation = 0.62, α = 0.83)						
Item 1	0.71	–	0.56	0.61	0.59	0.46
Item 2	0.72	–	0.51	0.61	0.60	0.48
Item 3	0.64	–	0.58	0.63	0.64	0.49
Scale 2 (inter-item correlation = 0.47, α = 0.73)						
Item 4	0.49	0.52	–	0.67	0.60	0.47
Item 5	0.52	0.45	–	0.48	0.47	0.40
Item 6	0.66	0.57	–	0.65	0.60	0.47
Scale 3 (inter-item correlation = 0.46, α = 0.81)						
Item 7	0.62	0.71	0.63	–	0.67	0.48
Item 8	0.69	0.54	0.69	–	0.67	0.57
Item 9	0.65	0.59	0.64	–	0.65	0.55
Item 10	0.44	0.33	0.32	–	0.45	0.50
Item 11	0.61	0.53	0.53	–	0.67	0.53
Scale 4 (inter-item correlation = 0.60, α = 0.86)						
Item 12	0.62	0.64	0.60	0.67	–	0.56
Item 13	0.75	0.55	0.60	0.73	–	0.61
Item 14	0.77	0.59	0.58	0.69	–	0.62
Item 15	0.67	0.60	0.55	0.66	–	0.57
Scale 5 (inter-item correlation = 0.33, α = 0.71)						
Item 16	0.48	0.38	0.37	0.49	0.56	–
Item 17	0.41	0.29	0.27	0.44	0.42	–
Item 18	0.40	0.27	0.31	0.47	0.36	–
Item 19	0.49	0.47	0.47	0.51	0.52	–
Item 20	0.55	0.46	0.47	0.47	0.54	–

Table 3 Results of the CFA showing the standardized factor loadings and standardized residuals for each item when modelled with its own scale

Over the past 12 months, when I received care for my chronic conditions, I was:	Standardized factor loading	Standardized residual variance
Patient activation		
Item 1	0.715	0.285
Item 2	0.724	0.276
Item 3	0.744	0.256
Delivery system design/decision support		
Item 4	0.628	0.372
Item 5	0.461	0.539
Item 6	0.727	0.273
Goal setting/tailoring		
Item 7	0.669	0.331
Item 8	0.668	0.332
Item 9	0.643	0.357
Item 10	0.372	0.628
Item 11	0.538	0.462
Problem solving/contextual		
Item 12	0.669	0.331
Item 13	0.767	0.233
Item 14	0.774	0.226
Item 15	0.667	0.333
Follow-up/coordination		
Item 16	0.540	0.460
Item 17	0.417	0.583
Item 18	0.311	0.689
Item 19	0.568	0.432
Item 20	0.596	0.404

Table 4 The model statistics of the CFA of the Danish version of the PACIC questionnaire (*n* = 481)

Statistics	χ^2	df	P	CFI[a]	TLI[a]	RMSEA	SRMR	WRMR
Model fit for basic model with five dimensions	558.078	73	<0.0001	0.875	0.976	0.118	0.062	1.702

a: Number of free parameters = 30. Chi-squared = Chi-squared goodness-of-fit with df = degrees of freedom and P = P-value (reference: P ≥ 0.1). CFI (reference: 0.90–0.95 = acceptable, >0.95 = good). TLI (reference: 0.90–0.95 = acceptable, >0.95 = good). RMSEA (reference: ≤ 0.05 = good, ≥ 0.10 = poor fit). SRMR = Standardized root mean square residual (reference: <0.08 = good fit). WRMR (reference: >0.90 = poor fit).

PACIC as this study may point out critical issues. There may be a content discrepancy between the questions asked in the PACIC and the present chronic care offered in Denmark. Questions 10 'I was encouraged to go to a specific group or class to help med cope with my chronic disease' (mean 1.8) and questions 17 'I was encouraged to attend programmes in the community that could help me' (mean 1.7) had the lowest mean score and floor effects at 67.2 and 69.2% covering the response category 'never'. This clearly demonstrates that the implementation of these aspects of the CCM and the use of disease management programmes is missing. Question 5 'I was satisfied that my care was well organised' (mean 4.1) had the highest mean score and a critical ceiling effect at 40.4%, which on the other side indicates that the patient with type 2 diabetes are satisfied with the overall organization, primarily provided in general practice.

In a German study,[7] the usual care of people with type 2 diabetes was compared with a new, more structured chronic care reflecting the core elements of the CCM. In the 'usual care' group, the mean PACIC score was 2.86, whereas it was 3.21 (*P* < 0.001) in the new structured care. The mean PACIC sum score in the Danish population was 2.83, comparable with the perception of chronic care assessment in the German 'usual care'. It would be of interest in further validation of the PACIC to relate the care characteristics reported using PACIC with other information on the care, e.g. how often the patients were seen in primary care, the prescriptions made, patient evaluation measured from a standardized questionnaire, and further take into account the information provided by the subgroups analysis of how the subscale functioned differently in subgroups of self-rated health and comorbidity.

Strengths and weaknesses

First of all, we sought to ensure the cross-cultural validity by a systematic translation and adaptation procedure and investigated the content and face validity in an expert panel cooperation with the authors and a cognitive briefing with patients. We further assessed the internal structure of the items by measuring internal consistency and average inter-item correlations and used a classical psychometrical procedure to assess the construct validity by CFA. We performed a survey with a reasonable response rate, and ensured a patient sample for which the PACIC should work well in a psychometric evaluation by restricting the sample to those patients with type 2 diabetes at least 2 years in medical treatment. Further, the patients were all registered in practices that were active in a national project for improving diabetes care. The homogeneous group of GPs and patients increases the generalizability of our results; namely that among patients with a chronic disease the PACIC did perform acceptable good in a Danish setting. An analysis of non-responders was not possible to perform, but the population in the validation study was comparable with 8297 persons with type 2 diabetes and comparable in relation to age, gender, duration of diabetes and medically treated registered in a database from one Danish county, 2007, with an average age at 67.0 (SD 12.0), and 54.8% were men.

Implications

This study contributes to the present status that the PACIC scale composes a realistic and relevant landscape of the components relevant for the future evaluation of Danish chronic care. This is in line with a recent Dutch study[33] of 37 generic instruments to measure self-reported experience with chronic care, where PACIC was considered the most appropriate. Yet, we stress the need for further development of the PACIC before using it as a composite measure. First of all, the content

of the questions and the response categories should be evaluated. Second, attention has to be made to the subscales that function differently in different subgroups of patients. To fulfil a validation of PACIC, the assessment of criterion validity and responsiveness in various populations will be the next step before considering PACIC as a reliable and valid aggregate measurement instrument in research and clinical use.

Key points

- The PACIC seem to compose a realistic and relevant landscape of the components relevant for the future patient-reported evaluation of chronic care.
- The Danish PACIC has good face validity and the initial validation endorsed the five proposed scales, for patient-reported involvement in chronic care.
- Further validation on criteria validity and responsiveness is decisive to develop evidence based public health strategies in chronic illness care and to evaluate interventions in the field.

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Determinants of self-rated health in Spain: differences by age groups for adults

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Background: Identifying factors associated with self-rated health (SRH) in two age groups (16–49 and $\geq$50 years) in the context of action for health promotion in adults. **Methods:** The data used came from the household and adults questionnaires of the National Health Survey of Spain for 2006. SRH was categorized as positive (very positive or positive) and negative (fair, poor or very poor). Odds ratios for positive SRH compared with negative SRH were calculated using logistic regression models for complex samples. The determinants of the positive SRH were obtained for the total population and for two age groups. **Results:** Among the population aged $\geq$16 years, 66.6% reports positive SRH, 78.6% in the 16- to 49-year-old group and 47.7% in the $\geq$50-year-old group. SRH worsens with age until the age of 49, whereas 50 years onwards older report better health than the younger. The influence of lifestyle on the SRH varies by age group among adults as well: in the younger age groups, obesity, smoking and non-alcohol are associated with poor SRH; in contrast, physical exercise only in leisure time and enough sleeping hours are associated with positive SRH in the $\geq$50-year-old population. **Conclusions:** The factors associated with SRH differ across age groups, particularly for lifestyle. Understanding the differences between the factors associated with the positive SRH is highly relevant for the design of specific programmes aimed at improving public health.

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Introduction

In developed countries, self-rated health (SRH) has been a widely used health indicator in health inequalities research. In some countries like

Spain, research in the past 20 years has involved in describing the assessment of SRH, and its association with various health indicators (morbidity, disability, health behaviours and use of health services) and socio-demographic characteristics (sex, age, social class, educational level,