BMJ Open

Positive psychological profiles based on perceived health clustering in patients with cardiovascular disease: a longitudinal study

Rosario Castillo-Mayén [1,2] Bárbara Luque,[1,2] Sebastián Jesús Rubio,[1,3] Esther Cuadrado,[1,2] Tamara Gutiérrez-Domingo,[1,2] Alicia Arenas,[1,4] Javier Delgado-Lista,[1,5] Pablo Pérez-Martínez,[1,5] Carmen Tabernero[1,6]

Correspondence to
Dr Rosario Castillo-Mayén;
rcmayen@uco.es

Strengths and limitations of this study

► A cluster analysis of perceived mental and physical-health levels of patients with cardiovascular disease led to classify these patients according to their self-reported health status.
► Profiles of positive psychological well-being were tested over an 18-month period based on the perceived health classification.
► This methodology allowed us to further explore the link between perceived health status and positive psychological well-being.
► Patients were recruited from a single hospital covering only one province in the south of Spain.
► The study sample was unbalanced in certain sociodemographic characteristics.

ABSTRACT

Objectives Psychological well-being and sociodemographic factors have been associated with cardiovascular health. Positive psychological well-being research is limited in the literature; as such, this study aimed to investigate how patients with cardiovascular disease could be classified according to their perceived mental and physical health, and to identify positive psychological profiles based on this classification and test their stability over time.

Design and setting Longitudinal study with patients from a public hospital located in Córdoba (Spain).

Participants This study comprised 379 cardiovascular patients (87.3% men) tested at three measurement points.

Outcome measures Participants reported their sociodemographic variables (age, sex, educational level, employment and socioeconomic status) at phase 1, while their perceived health and variables relating to positive psychological well-being were tested at this and two subsequent time points (average interval time: 9 months).

Results The two-step cluster analysis classified participants into three groups according to their mental and physical health levels, p<0.001: high (n=76), moderate (n=113) and low (n=189) perceived health clusters. Low perceived health was the largest cluster, comprising almost half of patients. Clusters significantly differed according to sex, p=0.002, and socioeconomic level, p=0.004. The profile analysis indicated that participants in the high perceived health cluster showed high positive affect, positivity, life satisfaction, and self-efficacy in emotion regulation, and less negative affect and use of passive strategies over the three measurement points (95% CI, all ps<0.01). Moreover, psychological profile stability for each cluster was generally found over an 18-month period, all ps<0.05.

Conclusion Cardiovascular patients may differ in terms of their perceived health and, accordingly, in terms of other relevant variables. Perceived health clusters generated varying and generally stable psychological profiles based on positive psychological well-being variables. Psychological interventions should be adapted to patients' requirements.

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death worldwide.[1] Given the preventable nature of most CVD risk factors and the chronic condition of these patients, psychological research has been of great importance in recent decades. Many studies have shown that psychological factors, such as affective states and psychological well-being, may have an impact on cardiovascular health (CVH).[2] So far, most research has focused on the negative aspects of patients' psychological well-being,[3] such as depression, anxiety and stress.[4–7] For example, recent results from the European Survey of Cardiovascular Disease Prevention and Diabetes, the largest European CVD survey comprising 24 countries, indicate that feelings of depression are associated with increased cardiovascular risk in these patients.[4] Moreover, review studies have concluded that psychosocial stress may have a direct impact on other CVD risk factors, such as heart rate variability or hypertension, by increasing their prevalence and

severity.[8 9] Altogether, research on these psychological variables highlights the need to further investigate the association between psychological factors and CVH.

Despite the relevant contributions of this line of research to CVD and CVH promotion, there is a new trend to consider the other side of psychological well-being that calls for more prospective studies.[10] Thus, recent research has pointed out the relevance of positive psychological well-being, which has been proven to be an independent protective factor for CVD.[11 12] A recent review indicated that most prospective studies of clinical samples identified a relationship between positive psychological constructs, such as positive affect, optimism and life satisfaction, in relation to health outcomes.[13] For example, positive affect has been associated with better clinical outcomes[14 15] and better CVH across 20 years.[16]

Positivity, the common factor of self-esteem, life satisfaction and optimism,[17] is also linked to positive psychological well-being. Along with life satisfaction, positivity was a negative predictor of emotional instability (ie, neuroticism) in individuals with hypertension, while life satisfaction was the only predictor for healthy individuals.[18] Another form of subjective well-being is low negative affect,[19] for which emotion regulation is essential. As for strategies focused on regulating stress and anxiety, patients with CVD have shown a preference for using passive strategies over physical and intellectual ones.[20]

Patient-reported health status, frequently considered a measure of health-related quality of life (HRQOL),[21 22] is getting more attention in CVH research. Recent studies have reported an important association between these two factors in both healthy adults[23 24] and clinical samples.[25 26] A negative psychological profile, characterised by low perceived health, dysfunctional coping, and high depression and anxiety, identified in patients with a left ventricular assist device implant was associated with long-term mortality.[26] There is also evidence of a positive relationship between positive affect and life satisfaction with physical and psychological well-being in cardiac patients.[3 27] Along a similar vein, high positive affect and low negative affect have been associated with higher self-assessed health in these patients.[28]

Research has also established an association between CVH and sociodemographic factors such as age, sex and socioeconomic status (SES). While age is the most important factor for both women and men in developing CVD,[29] there are differences between them in disease presentation and outcomes that appear to be due to sex-specific patterns of cardiovascular ageing.[30 31] Furthermore, SES has a clear association with CVH, with disadvantaged individuals being at higher risk of developing CVD. Low-income, low-educational level and unemployment have been separately associated with a higher risk of CVD.[4 32 33] Sociodemographic factors have also been associated with self-reported health in patients with CVD. In a multi-country study,[22] women showed lower levels of perceived mental and physical health than those of men; while compared with young patients,

older patients showed higher levels of perceived mental health but lower levels of perceived physical health. Furthermore, patients from European countries with lower economic growth showed lower levels of perceived mental and physical health than patients from countries with higher economic growth.

In spite of the association between the numerous variables related to positive psychological well-being and HRQOL in patients with CVD, little is known about how these patients might be classified according to their self-reported health status or whether these emerging groups might be differentiated in terms of multiple psychological and sociodemographic factors. A partial exception is a recent study in which a small clinical sample was classified according to self-reported health, anxiety, depression and coping.[26] Thus, this study aimed to provide more evidence on this topic, with a focus on positive psychological well-being. Classifying individuals in accordance with the natural groups that emerge from their observed data is the essence of cluster analysis,[34] the analytical procedure used in this study. It allows the identification of homogeneous groups of individuals according to the variables used to define them, at the same time that maximises heterogeneity among the emerging groups.[35] In addition, this procedure allows the exploration of different profiles based on the differences between the clusters with other theoretically relevant related variables.[35] Moreover, this classification can assist in the identification of specific needs in each group of patients and develop psychological interventions accordingly.[36]

Present study

This study had four main objectives. First, it aimed to classify a large sample of patients with CVD according to their perceived mental and physical health by means of cluster analysis. Both variables were considered independently but jointly in the same analysis, so that different configurations of both perceived health variable levels could be tested. In accordance with previous studies performing similar procedures with other chronic conditions,[26 36 37] we expected that at least two patient classifications emerged, that is, one for lower and one for higher perceived health levels.

Second, this study aimed to test whether these emerging groups could be differentiated in terms of sociodemographic characteristics (age, sex, educational level, employment, SES and marital status). The third objective was to test whether these groups could be differentiated according to variables relevant to positive psychological well-being (positive and negative affect, positivity, life satisfaction, self-efficacy in regulating negative emotions, and passive strategies to regulate stress and anxiety) so that positive psychological profiles might be identified. In view of the aforementioned literature reviewed, we expected that compared with participants with lower perceived health, the profile analysis would reveal that participants with higher perceived health would be represented by more men, would be more highly educated, and

would have more favourable employment and SES. They would also report higher positive affect, positivity, satisfaction with life and self-efficacy in emotion regulation, but less negative affect and use of passive strategies, thus exhibiting a more favourable psychological profile. In relation to age, we expected individuals to be younger if a cluster with higher perceived physical health and lower perceived mental health appeared, or older if a cluster with the opposite pattern of combined physical and mental health measures emerged, due to the opposing relationship between age and mental and physical health.

Finally, we aimed to explore the stability of these emerging profiles over three measurement points. We hypothesised that the psychological profiles would be stable over an 18-month period for the various groups of participants as classified by their mental and physical perceived health at the first measurement point.

METHOD
Participants and procedure
This research was conducted within the framework of the CORonary Diet Intervention with Olive oil and cardiovascular PREVention (CORDIOPREV) study, the details of which have been published previously along with participant characteristics. CORDIOPREV study, the details of which have been published previously along with participant characteristics. [38] All participants were patients involved in the CORDIOPREV study; this primary study included a clinical population of 1002 patients with CVD (mean age=59.5 years, 83.5% men). Inclusion criteria included participants 20-76 years old and with established coronary heart disease (unstable coronary disease, acute myocardial infarction, unstable angina or chronic coronary disease at high risk for event) without clinical events in the last 6 months. Exclusion criteria included a life expectancy of less than 5 years or presenting chronic or severe disease such as psychiatric, uncontrolled diabetes mellitus or endocrine disorders. At baseline, participants presented a high body mass index (56.3% indicating obesity and 37.2% overweight), a median of low-density lipoprotein cholesterol of 88.5 mg/dL and a 58% prevalence of metabolic syndrome.

For the current study, data was collected until September 2019. Recruitment started in April 2016, after which two follow-up measures were taken (average time of 9 months between measurement time points). Data from participants who had participated at baseline and at the two follow-up measurement points was included in this study. The sample comprised 379 participants with an established coronary heart condition.

Participants were approached at a clinical room of a hospital in a city in Spain. They were informed about the objectives of the current research, ensuring voluntary and anonymous participation. After written informed consent was obtained at baseline, participants used a tablet computer connected to the internet to access the link provided and responded to a series of questionnaires

by means of the Unipark programme (V.10.9). The same procedure was used for the follow-up measurements. The psychological measures of this study were presented at the three phases. Sociodemographic factors at phase 1 were considered for analyses.

Measures
To facilitate participants' understanding, all but one scale used a 7-point Likert type or frequency scale as the response format, the exception being the perceived health measure.

Sociodemographic variables
Participants were asked to provide information about their age, sex, educational level, employment, SES and marital status.

Perceived mental and physical health
The Short-Form 12 (SF-12) health questionnaire[39] (Spanish version by Failde et al[40]) was used to assess participants' perceptions of their health. This 12-item short-form includes six items each for mental (eg, 'to what extent have you felt calm and peaceful?') and physical (eg, 'in general, how would you say your health is?') health. Eight items were presented on a 5-point Likert type scale and four in a yes/no format. Separate scores for participants' perceptions of their mental and physical health were obtained (scores ranged from 6 to 24), with higher scores indicating better health perceptions. This measure has been validated in cardiac patients and has shown good psychometric properties for assessing HRQOL in this population.[34]

Positive and negative affect
A brief, 10-item version of the Positive and Negative Affect Schedul (PANAS)[41] (brief Spanish version by Tabernero et al[42]) was used to evaluate positive affect (PA, 5 items; eg, enthusiastic) and negative affect (NA, 5 items; eg, afraid). Participants indicated the frequency of their experience of each affect. When previously used with cardiac patients, Cronbach's alpha was 0.79 for PA and 0.83 for NA.[27] Similarly, the internal consistency of the Spanish version was 0.83 for PA and 0.84 for NA.[42]

Positive orientation
We used the *Positivity Scale*[17] to assess participants' tendency to regard their life and experiences positively. This is an 8-item scale (eg, 'I feel I have many things to be proud of') that has shown adequate psychometric properties in various countries including Spain.[17] The internal consistency in a sample of patients with hypertension was 0.91.[18]

Life satisfaction
The *Satisfaction with Life Scale*[43] (Spanish adaptation by Vázquez et al[44]) was used to assess the extent to which participants feel satisfied with their life and experience subjective well-being. This is a widely used measure to assess general life satisfaction (eg, 'I am satisfied

with my life'), with Cronbach's alpha value of 0.82 in cardiac patients[3] and values of 0.79 or higher in various languages.[44]

Self-efficacy in regulating negative emotions

We used the eight items relating to the regulation of negative emotions from the *Regulatory Emotional Self-Efficacy Scale* (RESE)[45] (Spanish version by Caprara *et al*[46]) to evaluate participants' perceived self-efficacy in managing negative emotions (eg, 'how well can you keep from getting dejected when you are lonely?'). The scale has shown good psychometric values in various countries.[46]

Passive strategies to regulate stress

We selected the passive strategies subscale of the *Stress and Anxiety Regulation Strategies Scale*[20] to assess the use of passive strategies to manage stressful situations. This consists of eight items that ask participants to indicate how frequently they use passive strategies (eg, 'watch TV') to regulate feelings of stress or anxiety. This measure has shown adequate psychometric properties for assessing regulation strategies in patients with CVD.[20]

Patient and public involvement

Although patients were surveyed, no patients or members of the public were directly involved in its design, conduct, reporting or dissemination.

RESULTS

The demographic characteristics of the sample are described in table 1. Participants' average age was 62.94 years (SD=9.27, age range=34–82 years) at baseline, with most patients being men. The largest groups of participants were those who had completed their primary education, were retired, earned €10 800–€22 000 per year and were married.

Internal consistency (Cronbach's alpha) of the perceived health measure was 0.82 at phases 1 and 2 and 0.81 at phase 3. Descriptive analyses indicated that the mean value of perceived mental health was 18.94 (SD=3.25) at phase 1, 19.46 (SD=3.28) at phase 2 and 19.37 (SD=3.33) at phase 3. Similarly, the mean value of perceived physical health was 18.51 (SD=4.05) at phase 1, 19.06 (3.95) at phase 2 and 19.05 (SD=3.88) at phase 3. Reliability results and descriptive analyses of the positive psychological well-being measures are shown in table 2. All instruments showed adequate internal consistency. Additionally, Pearson's correlation analyses (see table 2) showed positive relationships between positive affect, positivity, life satisfaction and self-efficacy in emotion regulation, a negative relationship between these variables and negative affect, and a positive correlation between negative affect and the use of passive strategies to regulate stress. These results occurred across the three measurement points. The use of passive strategies also correlated negatively with self-efficacy in emotion regulation across the three phases. At

phase 3, passive strategies correlated negatively with positive affect and positivity.

Cluster analysis

To classify participants according to the scores of their perceived mental and physical health, a two-step cluster analysis was executed considering both variables together at phase 1. The distance measure was calculated using the log-likelihood criterion and the optimal number of clusters was determined automatically based on the Bayesian information criterion (BIC) as the index of fit and the BIC change. The default value of 15 was kept as the maximum number of clusters requested. With the aim of ensuring the best possible fit among cases, outlier treatment (20%) was selected. The two-step cluster analysis resulted in two profiles of perceived mental and physical health. The silhouette coefficient was 0.05, indicating fair cluster quality. Fair or higher quality is considered acceptable clustering.[47] The importance of each predictor for clustering formation was 1.00 for mental health and 0.55 for physical health. According to the mean scores in each cluster, cluster 1 (n=271, 71.5%) was named 'low perceived mental and physical health' (mental health: M=18.14, SD=2.42; physical health: M=17.79, SD=3.52) and cluster 2 (n=89, 23.5%) 'high perceived mental and physical health' (mental health: M=22.72, SD=0.91; physical health: M=22.36, SD=1.49). Five per cent of participants (n=19) were identified as having an atypical value (mental health: M=12.50, SD=2.21; physical health: M=10.75, SD=1.65).

The stability of this cluster solution was first tested by repeating the cluster analysis this time using the Akaike information criterion (AIC) as the index of fit to determine the optimal number of clusters.[48] The result showed a cluster solution of three profiles of perceived mental and physical health. The silhouette coefficient was 0.05 as in the previous analysis. The importance of the predictors was 1.00 for physical health and 0.71 for mental health. Consistent with the mean scores in each cluster, cluster 1 (n=189, 49.9%) was named 'low perceived mental and physical health' (mental health: M=16.83, SD=2.77; physical health: M=15.23, SD=2.78), cluster 2 (n=113, 29.8%) 'moderate perceived mental and physical health' (mental health: M=19.84, SD=1.48; physical health: M=21.49, SD=1.71) and cluster 3 (n=76, 20.1%) 'high perceived mental and physical health' (mental health: M=22.95, SD=0.77; physical health: M=22.34, SD=1.58). Only 0.3% of participants (n=1) were identified as having an atypical value (mental health: M=9.35; physical health: M=10.01).

Considering the different results when using several indexes of fit, results from the first cluster analysis were further explored, revealing that the three profile solution was the second best cluster solution when compared with the two cluster solution, as indicated by close BIC values (BIC=73.04 and BIC=68.78, respectively), with the score for the three cluster solution being the second lowest BIC value, and the size of the BIC change (BIC change=4.25 and BIC change=−7.11, respectively), being the second

Table 1 Sociodemographic characteristics of the sample and profile analysis results of perceived health clusters: percentages and adjusted residuals

Variables	Total sample N=379	Perceived mental and physical health clusters			χ²	P value
		High n=76	Moderate n=113	Low n=189		
	n (%)	% (Adj)	% (Adj)	% (Adj)		
Sex					12.16	0.002
Women	48 (12.7)	0.5 (–2.9)	3.2 (–0.8)	9.0 (3.1)		
Men	331 (87.3)	19.6 (2.9)	26.7 (0.8)	41.0 (–3.1)		
Educational level					14.13	0.078
Without formal education	49 (12.9)	2.9 (0.4)	2.7 (–1.6)	7.4 (1.1)		
Primary education	181 (47.8)	9.8 (0.2)	11.7 (–2.2)	26.3 (1.9)		
Secondary education	57 (15.0)	2.7 (–0.5)	5.3 (0.9)	7.2 (–0.4)		
Vocational school	42 (11.1)	1.9 (–0.6)	4.8 (1.9)	4.5 (–1.3)		
College/university	49 (12.9)	2.9 (0.4)	5.6 (2.1)	4.5 (–2.3)		
Employment status					10.79	0.095
Unemployed	34 (9.0)	1.3 (–0.8)	1.9 (–1.2)	5.8 (1.8)		
Part-time worker	14 (3.7)	0.8 (0.1)	1.6 (1.1)	1.3 (–1.1)		
Full-time worker	97 (25.6)	5.3 (0.2)	10.1 (2.4)	10.1 (–2.4)		
Retired	234 (61.7)	12.7 (0.3)	16.4 (–1.8)	32.8 (1.5)		
Socioeconomic status (annual income (€))					19.38	0.004
<10 800	108 (28.5)	4.4 (–1.8)	7.3 (–2.0)	19.8 (3.3)		
10 800–22 000	146 (38.5)	9.6 (1.3)	11.9 (–0.8)	20.6 (–0.3)		
22 000–43 000	76 (20.1)	5.2 (1.0)	9.6 (2.8)	7.3 (–3.4)		
More than 43 000	15 (4.0)	0.3 (–1.3)	1.7 (0.8)	2.3 (0.3)		
Marital status					13.48	0.198
Single	14 (3.7)	0 (–1.9)	1.1 (–0.1)	2.7 (1.6)		
Common-law partner	3 (0.8)	0.3 (0.6)	0 (–1.1)	0.5 (0.6)		
Married	323 (85.4)	18.8 (2.2)	24.7 (–1.1)	41.9 (–0.8)		
Separated	9 (2.4)	0.5 (0.2)	1.3 (1.7)	0.5 (–1.7)		
Divorced	9 (2.4)	0.3 (–0.7)	1.1 (1.0)	1.1 (–0.3)		
Widow/er	20 (5.3)	0.3 (–1.7)	1.9 (0.5)	3.2 (0.9)		

Participants who chose the option 'I prefer not to answer' when reporting their socioeconomic status were excluded from analyses involving this variable (n=32, 8.4%). % denotes percentages computed on total. Adj denotes adjusted residuals.

highest BIC change value for the three cluster solution. Thus, considering that three profiles of perceived health provided more practical interest and interpretability potential than a two-cluster solution,[35] this result was selected as the preferred solution and was further analysed for stability. Specifically, the stability of the result based on AIC was later tested by randomising the order of cases 20 times and running the same analysis for each new sequence. The results showed that 80% of reruns had the same three-cluster solution, and only 20% showed a two-cluster solution. Subsequent analyses with a fixed number of clusters (two, four, five and six) showed a silhouette coefficient of 0.5 or lower.

Given the higher stability and equal or higher value of the silhouette coefficient, as well as its parsimony when

compared with solutions with a higher number of clusters and its greater theoretical and practical relevance when compared with the two profiles result, the three-cluster solution based on perceived mental and physical health was selected for further analyses aimed to determine the psychological profile of patients with CVD. The outlier cluster was excluded where appropriate in subsequent analyses. The stability of this solution was also tested by repeating the cluster analyses at phases 2 and 3. The results indicated fair quality of the solution when the number of clusters was fixed at three. Significant differences among the clusters in perceived mental health, $F(2, 375)=233.43$, $p<0.001$, and perceived physical health $F(2, 375)=395.24$, $p<0.001$, further validated this solution. As Levene's tests were significant ($ps<0.001$), post hoc comparisons were

Table 2 Means (M), SD, Cronbach's alpha values (α) and Pearson's correlations of the positive psychological well-being variables at the three measurement points

Variables	M	SD	α	1. PA	2. NA	3. POS	4. SWL	5. RESE	6. P-ST
Phase 1									
1	5.17	1.14	0.88	–					
2	2.66	1.23	0.80	−0.23***	–				
3	5.30	0.97	0.78	0.57***	−0.27***	–			
4	5.23	1.26	0.86	0.43***	−0.23***	0.53***	–		
5	5.14	1.19	0.90	0.43***	−0.25***	0.49***	0.35***	–	
6	3.18	1.27	0.80	−0.07	0.20***	−0.09#	−0.01	−0.17**	–
Phase 2									
1	5.21	1.08	0.88	–					
2	2.36	1.17	0.81	−0.35***	–				
3	5.30	0.90	0.75	0.63***	−0.46***	–			
4	5.33	1.26	0.85	0.46***	−0.35***	0.56***	–		
5	5.40	1.17	0.90	0.40***	−0.40***	0.45***	0.37***	–	
6	3.02	1.30	0.79	−0.03	0.22***	0.00	0.00	−0.17**	–
Phase 3									
1	5.17	1.25	0.91	–					
2	2.28	1.27	0.86	−0.28***	–				
3	5.30	1.01	0.78	0.52***	−0.35***	–			
4	5.45	1.27	0.85	0.40***	−0.30***	0.54***	–		
5	5.40	1.17	0.91	0.43***	−0.41***	0.48***	0.38***	–	
6	2.91	1.28	0.78	−0.13*	0.28***	−0.20***	−0.08	−0.23***	–

***$p<0.001$; **$p<0.01$; *$p<0.05$; #$p<0.10$.
NA, negative affect; PA, positive affect; POS, positivity; P-ST, passive strategies; RESE, Regulatory Emotional Self-Efficacy; SWL, satisfaction with life.

based on Games-Howell's test, with all pairs being significant (all ps<0.01).

Demographic characteristics between clusters

The first step of the profile analysis was to compare perceived health clusters according to their sociodemographic characteristics. Regarding age, results from a one-way Analysis of variance (ANOVA) showed that participants only differed marginally, F(2, 375)=2.86, p=0.059. Additionally, Bonferroni post hoc testing indicated that participants in the 'moderate perceived health cluster' tended to be younger (M=61.42) than participants in the 'high perceived health' cluster (M=64.61), p=0.061. No differences were found between participants in the 'low perceived health' (M=63.21) and other clusters, ps>0.05.

χ^2 analyses were performed for the remaining variables because they were categorical (table 1). The results revealed significant differences in sex between the three clusters for perceived mental and physical health, with women being over-represented in the group with lower scores on these variables. Significant differences were also found for socioeconomic level, observing a higher frequency of participants earning less than €10 800 per year in the 'low perceived health' cluster and a higher

representation of participants earning between €20 000 and €43 000 per year in the 'moderate perceived health cluster'. Only marginal differences were found among clusters for educational level and employment status and no differences were found for marital status. Thus, the sociodemographic profile of patients with CVD based on perceived health clustering indicated that participants with higher perceived mental and physical health were more likely to be men earning at least between €10 800 and €22 000 per year. As for the 'moderate perceived mental and physical health' cluster, these participants were more likely to be men earning at least between €22 000 and €43 000 per year, with a tendency to have received at least secondary education and be part-time or full-time workers; while participants with lower perceived mental and physical health were more likely to be women earning less than €18 000 per year, with a tendency to be educated to primary-school level or lower and be unemployed or retired.

Psychological characteristics among clusters

The next step in the profile analysis was to explore the differences in positive psychological well-being among the clusters.

Table 3 One-way ANOVA results of perceived mental and physical health clusters for psychological variables (N=379)

Variables	Phase 1 F	Phase 2 F	Phase 3 F
Positive affect	39.29***	16.07***	13.50***
Negative affect	11.72***	8.73***	7.49**
Positivity	38.25***	14.19***	15.08***
Life satisfaction	23.51***	10.61***	15.43***
RESE	28.80***	11.37***	9.87***
Passive strategies	31.66***	17.99***	17.46***

***p<0.001; **p<0.01.
RESE, Regulatory Emotional Self-Efficacy.

Thus, we examined whether the three clusters for perceived mental and physical health differed in positive and negative affect, positivity, life satisfaction, self-efficacy in regulating negative emotions and passive strategies with a series of one-way ANOVAs. The results presented significant differences for all study variables at each of the three measurement points (table 3). In general, the results indicated that in each phase, levels of positive affect, positivity, life satisfaction and self-efficacy in emotion regulation were higher for participants in the high perceived health cluster than for those in the moderate and low clusters, while levels of negative affect and use of passive strategies were lower in the high perceived health cluster than in the moderate and low clusters.

We also performed post hoc analyses by means of Bonferroni tests. When Levene's test was significant, the Games-Howell's test was considered instead. Comparisons of the perceived health clusters on the psychological variables at phase 1 showed significant results (all ps<0.05) between all the pairs examined, except for negative affect between moderate and low clusters. Thus, the results indicated higher levels of positive affect, positivity, self-efficacy in emotion regulation and life satisfaction and lower use of passive strategies in the high-cluster participants compared with those in the moderate and low clusters. In accordance with this pattern, participants in the moderate cluster also differed significantly from those in the low cluster. High-cluster participants also showed lower levels of negative affect than participants in the moderate and low clusters. At phases 2 and 3, the same pattern was found with some exceptions: for levels of negative affect, life satisfaction and self-efficacy in emotion regulation at phase 2, participants in the moderate and low clusters showed similar levels to each other while differing significantly from the levels shown by the high-cluster participants. Additionally, participants in the high and moderate clusters reported a similar use of passive strategies while differing significantly from the frequency reported by the low-cluster participants. Concerning phase 3, participants in the moderate and low clusters showed similar levels to each other in negative affect, positivity and self-efficacy in emotion regulation while differing significantly from the levels shown by the high-cluster participants. Finally, levels of positive affect were similar in participants in the high and moderate

clusters but significantly higher when compared with those in the low cluster.

Psychological profile over time

As a final step for the profile analysis, a series of repeated measures ANOVAs was performed to determine whether the psychological profiles of patients with CVD derived from perceived mental and physical health clusters varied over time or were similar (table 4). As shown in figure 1, the pattern found in the previous analysis was also observed over time.

Results from the within-subjects effect tests showed that for the perceived health clusters there was a significant main effect of time on negative affect, life satisfaction, self-efficacy in emotion regulation, and passive strategies, and a significant interaction between time and the cluster variable on positive affect and positivity. This interaction effect was marginally significant for self-efficacy in emotion regulation. All remaining variables showed stable values over time and/or non-significant interactions with the clusters (table 4). Bonferroni post hoc testing of the cluster variable indicated that all possible pairs showed significant differences in all the psychological measures (all ps<0.05), except for negative affect levels in participants from moderate and low clusters.

DISCUSSION

This study aimed, first, to explore how patients with CVD could be classified according to different combinations of perceived mental and physical health. Second, it sought to identify the sociodemographic and psychological characteristics that described each group, in order to obtain psychological profiles of patients with CVD based on their self-reported health status. Finally, this study tested the stability of the emerging profiles based on positive psychological well-being variables over an 18-month period at three measurement points.

In relation to the first objective, we expected that at least two groups would be needed to classify the participants. After testing the results with different indexes of fit, a three-cluster solution was selected due to its greater theoretical interest and practical implications.[35] This result revealed a three-group classification of patients with CVD based on their perceived mental and physical health, reflecting high, moderate and low self-reported health. The results indicated that, when combining both perceived health variables, these patient classifications reflected similar values of both measures in each cluster, suggesting a direct association between the variables. The three clusters significantly differed in both self-reported health variables; additional tests confirmed the stability of these results. The highest proportion of patients (49.9%) was found in cluster 1, which represented participants with 'low perceived mental and physical health'. Cluster 2 was represented by 29.8% of patients with moderate mental and physical health. Finally, cluster 3 was characterised

Table 4 Multivariate and within-subject effects of the repeated measures ANOVA (N=379)

Variable(s)	Multivariate effects		Within-subjects effects			
	Pillai's trace	F	Mean square	F	η_p^2	Power
Positive affect	0.00	0.44	0.32	0.52	0.00	0.13
Positive affect×cluster	0.03	3.23*	2.03	3.30*	0.02	0.83
Error			0.62			
Negative affect	0.06	12.43***	11.32	13.69***	0.04	1.00
Negative affect×cluster	0.01	0.50	0.46	0.55	0.00	0.19
Error			0.83			
Positivity	0.01	1.27	0.47	1.15	0.00	0.25
Positivity×cluster	0.04	3.92**	1.49	3.65**	0.02	0.87
Error			0.41			
Life satisfaction	0.03	4.64*	2.83	4.54*	0.01	0.77
Life satisfaction×cluster	0.01	1.26	0.83	1.33	0.01	0.42
Error			0.63			
RESE	0.03	5.21**	4.22	5.26**	0.01	0.83
RESE×cluster	0.02	2.12#	1.71	2.13#	0.01	0.63
Error			0.80			
Passive strategies	0.04	6.39**	5.02	6.62**	.02	0.91
Passive strategies×cluster	0.01	1.20	0.94	1.23	0.01	0.39
Error			0.76			

When Mauchly's test was significant, Huynh-Feldt correction was used since Greenhouse-Geisser's was ε>0.75.[60] This correction was used for the following variables (corrected df): positive affect (1.95, 729.71), positive affect×cluster (3.89, 729.71), positivity (1.93, 724.19) and positivity×cluster (3.86, 724.19). ***p<0.001; **p<0.01; *p<0.05; #p<0.10.
ANOVA, Analysis of variance; RESE, Regulatory Emotional Self-Efficacy.

by high mental and physical health, being represented by only 20.1% of the sample.

With recent research indicating that the HRQOL may be an independent predictor of CVD events among non-clinical adults,[24] the higher proportion of participants in the low health cluster suggests that more attention should be paid to the self-reported health status of patients with CVD. Therefore, future research would benefit from further exploration of the association between perceived health and CVD events in clinical populations. This need to focus on the patients' health perceptions is reinforced by results in non-clinical samples from other European country that revealed a low perception and knowledge of some CVD risk factors in medical students[49] and low awareness of their actual presence in older adults with or without CVD risk factors.[50] Together, the results of this and previous studies[49 50] claim more extensive actions, from professionals, but specially from health and educational authorities, that highlight the preventability of CVD and favour a culture of health promotion. Hence, we consider that our results underline the value of classifying patients with CVD by means of cluster analysis, since this analytical procedure facilitated the identification of meaningful and mutually exclusive subgroups of individuals[34] according to perceived health measures that might be relevant for the disease course. Additionally, this

analysis revealed an important proportion of patients with CVD with low perceived health that may need more attention from physical and psychological health professionals.

To the best of our knowledge, only one recent study has explored classifications of patients with CVD according to their self-reported health status.[26] This issue has previously been investigated in other clinical populations. Using the total score of the Health Survey SF-36 with transplant patients, Goetzmann et al found two clusters,[37] accounting for high and low perceived health. In a sample of patients with common variable immunodeficiency, Bayrhuber et al found a four-group classification after clustering participants' combined perceived mental and physical health scores on the SF-12.[36] Although a similar design to that used by Bayrhuber et al for clustering perceived health variables was followed in this study, the two-step cluster analysis used in the current study is considered to be a more advantageous procedure compared with hierarchical approaches.[48] In these previous studies, clusters representing better self-reported health status were positively associated with a better psychosocial outcome[37] and other relevant variables such as work ability and health literacy,[36] while the negative psychological profile identified in patients with CVD was associated with mortality.[26] In the present study, the cluster representing higher self-reported mental and physical health was also associated

Figure 1. *CVD patients' positive psychosocial profile based on perceived mental and physical health clusters*
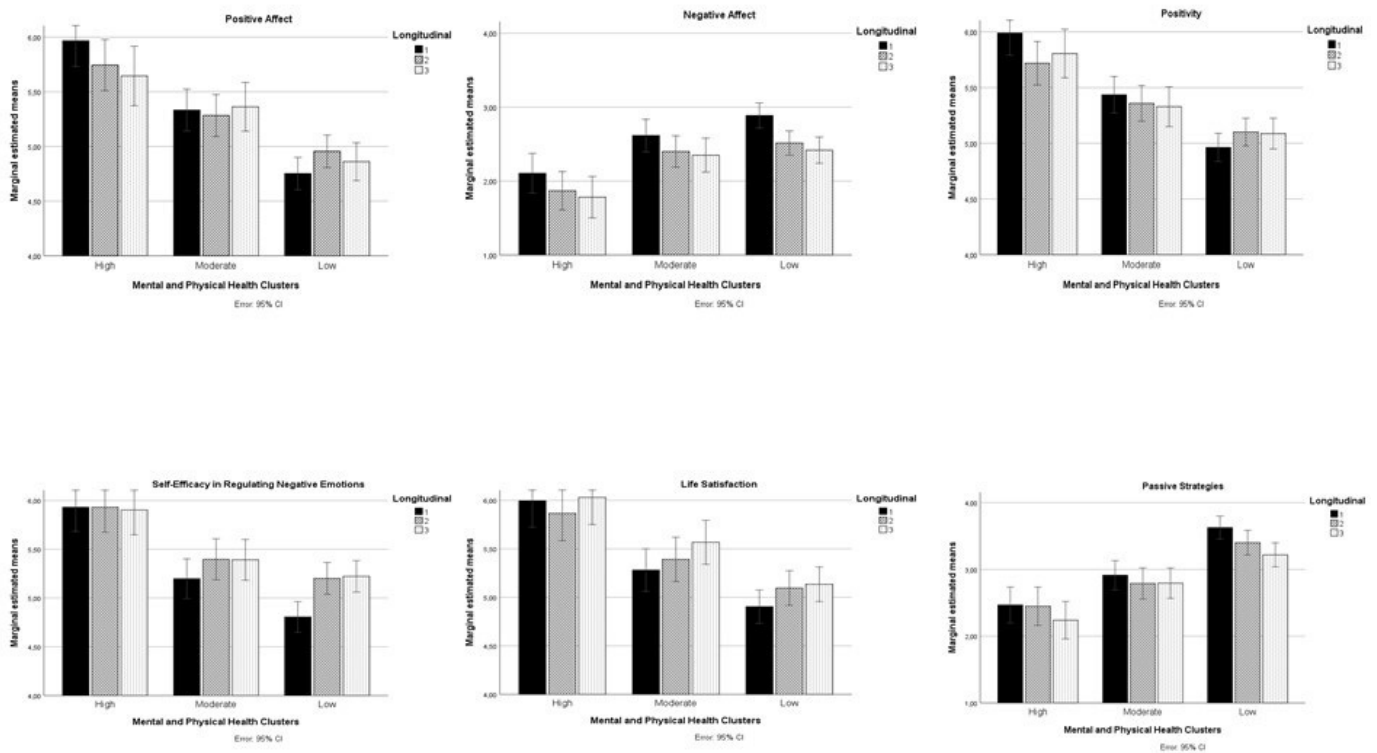

Figure 1 CVD patients' positive psychological profile based on perceived mental and physical health clusters.

with better SES and psychological outcomes, reinforcing the relevance of considering clusters derived from self-reported health status in patients with a chronic condition. Thus, concerning the second objective, the study hypotheses with reference to sociodemographic factors were partially confirmed.

Regarding age, only marginally significant differences were found between the clusters. This might be due to the fact that age is oppositely related to perceived mental and perceived physical health[22]; this means that, given that clusters were formed by similar levels in both variables, it is reasonable that not significant differences in age appeared. With regard to sex, women were represented significantly more in the clusters of low perceived health, while higher proportions of men were found in the clusters of moderate and high perceived health. This result supports previous findings showing lower levels of self-reported mental and physical health in female than in male patients with CVD.[22]

With the SES-related variables, significant differences were only found between the clusters for socioeconomic level, with the group that reported lower physical health containing more patients with a lower annual salary. Thus, sex and socioeconomic level (annual income) were the two sociodemographic factors that were most relevant for characterising patients with CVD' profiles based on perceived health. Overall, these results suggest that attention should be paid to the reported health status of patients with CVD along

with, at least, certain sociodemographic characteristics, since research has indicated that women are more likely to present poorer CVD outcomes than men.[51] Similarly, a low income is associated with higher CVD risk.[32] Regarding marital status, not significant differences were found between the clusters, in spite of the influence of social and familial support for patients with CVD.[52]

In relation to psychological characteristics, the results from the profile analysis showed higher levels of positive psychological well-being related variables in the cluster with higher self-reported health than in the clusters with moderate or low health; moreover, this last cluster showed the poorest psychological well-being outcomes, which is in line with previous research on self-perceived health clustering in chronic disease populations.[26 37] The most positive psychological well-being profile—the one that appeared for the high perceived health cluster—involved individuals with higher levels of positive affect, positivity, self-efficacy in regulating negative emotions, and life satisfaction, and lower levels of negative affect and use of passive strategies to regulate stress and anxiety. Moreover, this pattern was virtually the same at all three measurement points. The way in which the variables were grouped in the profiles was also in accordance with correlation results, where most variables were associated in the expected manner. In general, post hoc analyses more consistently indicated different levels in psychological variables between the clusters of high and moderate or low self-reported health, while the cluster of moderate and low

perceived health were similar in certain psychological variables, such as negative affect across the three measurement points or self-efficacy in emotion regulation at phases 2 and 3. Furthermore, repeated measures analyses showed that the psychological profile of patients with CVD was generally stable throughout the three measurement points. In other words, patients with CVD belonging to the cluster with both high perceived mental and physical health displayed a better psychological well-being profile than that of participants in the clusters reflecting lower perceived health. This result persisted not only when all the variables were measured at the same time, but also when they were measured again 9 and 18 months after measuring the self-reported health variables. The results suggest that this pattern was sustained over time, in spite of variations in levels of life satisfaction and self-efficacy in emotion regulation, which appeared to increase over time, and variations in the levels of negative affect and use of passive strategies, which appeared to decrease over time.

Overall, this study's results are in accordance with previous research indicating an association between self-reported health in patients with CVD and positive psychological well-being-related variables such as positive affect,[27 28] low negative affect[28] and life satisfaction.[3] With evidence on the protective role of positive well-being for CVD,[12 13] this and previous research emphasise the need for further investigation into the positive vs negative constructs of psychological well-being in this clinical population with the aim to contribute to the improvement of patients' physical and psychological health. This growing evidence highlighting the relevance of positive well-being on patients with CVD also motivates the development of psychological interventions focused on positive aspects of well-being that might have an effect both on patients' levels of perceived health and adherence to health behaviours.[53] In fact, some authors claim the need for interdisciplinary interventions to improve the quality of life of patients with CVD.[7 54]

This study extends previous research by analysing together a variety of variables, including those that have received little attention in CVD populations that are related to patients' psychological well-being such as positivity, self-efficacy in emotion regulation and the use of passive strategies for regulating stress. Recent results indicating the importance of positivity for healthier functioning in old age[55] and its negative association with negative affectivity in patients with CVD[56] underscore the relevance of giving more consideration to this psychological factor in future studies with this population. Furthermore, emotion regulation, and especially stress management, is crucial for reducing CVD recurrence, as recommended in the European Guidelines for CVD prevention.[57] The fact that individuals in the high, compared with the low, perceived health cluster also reported higher levels of self-efficacy in regulating negative emotions and lower use of passive strategies for regulating stress, reinforces the importance of including interventions with a focus on emotion regulation for these patients. Additionally,

observing the association of these cluster results with positive psychological well-being, not only cross-sectionally but also longitudinally, indicates that assessing and classifying patients according to their self-reported mental and physical health may serve to extend the use of the person-centred approach in both CVD research and practice[24 56] by identifying groups of individuals with different needs. Future research should also evaluate the relevance of considering self-reported health status to improve the course of CVD in patients with this chronic condition.[58]

This study has a number of limitations. First, the study sample was unbalanced in certain characteristics, such as sex and employment status. In addition, participants were recruited from a single hospital covering only one province in the south of Spain. Furthermore, although other studies have shown similar samples in terms of their average age values,[4 22 27] the average age of this sample was younger than typical CVD populations, likely due to the wide age range of this study. Thus, any generalisation of the results should be made with caution because of the sociodemographic characteristics of patients in this study. For example, that the majority of the sample was retired may have influenced the lack of differences among clusters according to participants' employment status. Moreover, although the proportion of men in this study (87.3%) was similar to that of the primary study (83.5%), the scarce number of women does not reflect the actual sex differences in CVD prevalence and, thus, prevents the assessment of the influence of the results on how CVD is differently manifested in women and men.[31] In addition, since the adoption of gender stereotypes may influence emotion regulation,[59] the low number of women limits the assessment of gender socialisation. Therefore, future studies should include more balanced subgroups in terms of sociodemographic characteristics to ensure the robustness and generalisation of these results. Second, although the use of self-report measures is extensive in psychological research, our participants' responses may have been influenced by socially desirable response bias, in that participants may have reported their health status and levels of psychological variables to be more positive than they actually were. Thus, future research would benefit from combining more objective measures of health status (eg, biological markers) with other approaches to assess psychological well-being (eg, diary studies) and self-report measures.

Third, the fact that some of the self-report measures used in this study need further validation in patients with CVD also limits generalisation, at a time that stimulates carrying out future validation studies of these less commonly used instruments related to psychological well-being in these patients, such as emotion regulation measures and positivity. Fourth, given the significant impact of depression, anxiety and post-traumatic stress disorder on CVH,[4–9] future studies should include positive and negative aspect of psychological well-being to evaluate their joint contribution in the emerging profiles. Similarly, although clusters did not differ in terms of marital status, more direct assessments of social support should be included in further research, since this factor

might have an influence on patient recovery and well-being.[52] Finally, certain events could have happened between the measurement points that may have affected participants' responses concerning their perceived health status and psychological well-being; however, we did not consider their occurrence or influence on the results. Relevant events, such as acute stressors or new cardiac events, should be considered in future studies to identify their potential impact in the stability of the results.

CONCLUSIONS

This study identified three groups of patients with CVD based on different combinations of their levels of perceived mental and physical health. Virtually half of the patients pertained to the low perceived health cluster, who might be in more need of health professionals' attention. Finding the more favourable psychological profile for the high perceived health cluster reinforces the link between perceived health status and positive psychological well-being in this population. The stability of these profiles over an 18-month period supports the value of this patients' classification and should motivate well-suited psychological interventions.

Author affiliations
[1]Instituto Maimónides de Investigación Biomédica de Córdoba (IMIBIC), Córdoba, Spain
[2]Department of Psychology, University of Cordoba, Córdoba, Spain
[3]Department of Specific Didactics, University of Cordoba, Córdoba, Spain
[4]Department of Social Psychology, University of Seville, Sevilla, Spain
[5]Lipids and Atherosclerosis Unit, Department of Internal Medicine, Reina Sofia University Hospital, Córdoba, Spain
[6]Instituto de Neurociencias de Castilla y León, University of Salamanca, Salamanca, Spain

ORCID iD
Rosario Castillo-Mayén http://orcid.org/0000-0001-8599-2368

REFERENCES

1. World Health Organization. Cardiovascular diseases (CVDs), 2017. Available: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) [Accessed 11 Jan 2020].
2. Pedersen SS, von Känel R, Tully PJ, *et al*. Psychosocial perspectives in cardiovascular disease. *Eur J Prev Cardiol* 2017;24:108–15.
3. Steca P, Greco A, Monzani D, *et al*. How does illness severity influence depression, health satisfaction and life satisfaction in patients with cardiovascular disease? The mediating role of illness perception and self-efficacy beliefs. *Psychol Health* 2013;28:765–83.
4. De Bacquer D, De Smedt D, Kotseva K, *et al*. Incidence of cardiovascular events in patients with stabilized coronary heart disease: the EUROASPIRE IV follow-up study. *Eur J Epidemiol* 2019;34:247–58.
5. Prugger C, Wellmann J, Heidrich J, *et al*. Regular exercise behaviour and intention and symptoms of anxiety and depression in coronary heart disease patients across Europe: results from the EUROASPIRE III survey. *Eur J Prev Cardiol* 2017;24:84–91.
6. Viktorisson A, Sunnerhagen KS, Johansson D, *et al*. One-year longitudinal study of psychological distress and self-assessed health in survivors of out-of-hospital cardiac arrest. *BMJ Open* 2019;9:e029756.
7. Musey PI, Schultebraucks K, Chang BP. Stressing out about the heart: a narrative review of the role of psychological stress in acute cardiovascular events. *Acad Emerg Med* 2020;27:71–9.
8. Dar T, Radfar A, Abohashem S, *et al*. Psychosocial stress and cardiovascular disease. *Curr Treat Options Cardiovasc Med* 2019;21:23.
9. Osborne MT, Shin LM, Mehta NN, *et al*. Disentangling the links between psychosocial stress and cardiovascular disease. *Circ Cardiovasc Imaging* 2020;13:e010931.
10. Kubzansky LD, Huffman JC, Boehm JK, *et al*. Positive psychological well-being and cardiovascular disease: JACC health promotion series. *J Am Coll Cardiol* 2018;72:1382–96.
11. Boehm JK, Kubzansky LD. The heart's content: the association between positive psychological well-being and cardiovascular health. *Psycho Bull* 2012;138:655–91.
12. Sin NL. The protective role of positive well-being in cardiovascular disease: review of current evidence, mechanisms, and clinical implications. *Curr Cardiol Rep* 2016;18:1–10.
13. DuBois CM, Lopez OV, Beale EE, *et al*. Relationships between positive psychological constructs and health outcomes in patients with cardiovascular disease: a systematic review. *Int J Cardiol* 2015;195:265–80.
14. Hoen PW, Denollet J, de Jonge P, *et al*. Positive affect and survival in patients with stable coronary heart disease: findings from the heart and soul study. *J Clin Psychiatry* 2013;74:716–22.
15. Bekendam MT, Kop WJ, Barzilay S, *et al*. The predictive value of positive affect and type D personality for adverse cardiovascular clinical outcomes in patients with non-obstructive coronary artery disease. *J Psychosom Res* 2018;104:108–14.
16. Boehm JK, Chen Y, Qureshi F, *et al*. Positive emotions and favorable cardiovascular health: a 20-year longitudinal study. *Prev Med* 2020;136:106103.
17. Caprara GV, Alessandri G, Eisenberg N, *et al*. The positivity scale. *Psychol Assess* 2012;24:701–12.
18. Szcześniak M, Furmańska J, Konieczny K, *et al*. Dimensions of neurotic personality and its selected predictors in individuals with arterial hypertension. *Psychiatr Pol* 2019;53:901–14.
19. Diener E, Pressman SD, Hunter J, *et al*. If, why, and when subjective well-being influences health, and future needed research. *Appl Psychol Health Well Being* 2017;9:133–67.
20. Castillo-Mayén R, Luque B, Gutiérrez-Domingo T, *et al*. Emotion regulation in patients with cardiovascular disease: development and validation of the stress and anxiety regulation strategies scale (starts). *Anxiety Stress Coping* 2021;34:349–64.
21. Anker SD, Agewall S, Borggrefe M, *et al*. The importance of patient-reported outcomes: a call for their comprehensive integration in cardiovascular clinical trials. *Eur Heart J* 2014;35:2001–9.

22 Huber A, Oldridge N, Höfer S. International SF-36 reference values in patients with ischemic heart disease. *Qual Life Res* 2016;25:2787–98.

23 Pool LR, Ning H, Huffman MD, *et al*. Association of cardiovascular health through early adulthood and health-related quality of life in middle age: the coronary artery risk development in young adults (cardia) study. *Prev Med* 2019;126:105772.

24 Pinheiro LC, Reshetnyak E, Sterling MR, *et al*. Using health-related quality of life to predict cardiovascular disease events. *Qual Life Res* 2019;28:1465–75.

25 Reiner Željko, De Sutter J, Ryden L, *et al*. Peripheral arterial disease and intermittent claudication in coronary heart disease patients. *Int J Cardiol* 2021;322:227–32.

26 Modica M, Minotti A, De Maria R, *et al*. Coping, mood, quality of life, and outcomes in recipients of left ventricular assist devices: a cluster analysis. *Psychosom Med* 2019;81:192–9.

27 Karademas EC, Barouxi E, Mavroeides G. Positive and negative affect and well-being in cardiac patients and their spouses: the mediating role of illness representations. *Psychol Health* 2019;34:289–305.

28 Peleg S, Drori E, Banai S, *et al*. The dynamic nature of self-assessed health (SAH) as a function of negative and positive affects among cardiac patients. *Appl Psychol Health Well Being* 2017;9:370–86.

29 Mikkola TS, Gissler M, Merikukka M, *et al*. Sex differences in age-related cardiovascular mortality. *PLoS One* 2013;8:1–6.

30 Bots SH, Peters SAE, Woodward M. Sex differences in coronary heart disease and stroke mortality: a global assessment of the effect of ageing between 1980 and 2010. *BMJ Glob Health* 2017;2:e000298.

31 Merz AA, Cheng S. Sex differences in cardiovascular ageing. *Heart* 2016;102:825–31.

32 Schultz WM, Kelli HM, Lisko JC, *et al*. Socioeconomic status and cardiovascular outcomes: challenges and interventions. *Circulation* 2018;137:2166–78.

33 Al-Zakwani I, M Mabry R, Zubaid M, *et al*. Association between education and major adverse cardiac events among patients with acute coronary syndrome in the Arabian Gulf. *BMJ Glob Health* 2019;4:e001278.

34 Black WC, Babin BJ, Hair JF. *Multivariate data analysis*. 7th edn. Pearson, 2014.

35 Mooi E, Sarstedt M. *A concise guide to market research*. Berlin: Germany Springer, 2011.

36 Bayrhuber M, Tinsel I, Goldacker S, *et al*. Perceived health of patients with common variable immunodeficiency–a cluster analysis. *Clin Exp Immunol* 2019;196:76–85.

37 Goetzmann L, Ruegg L, Stamm M, *et al*. Psychosocial profiles after transplantation: a 24-month follow-up of heart, lung, liver, kidney and allogeneic bone-marrow patients. *Transplantation* 2008;86:662–8.

38 Delgado-Lista J, Perez-Martinez P, Garcia-Rios A, *et al*. Coronary diet intervention with olive oil and cardiovascular prevention study (the CORDIOPREV study): rationale, methods, and baseline characteristics: a clinical trial comparing the efficacy of a Mediterranean diet rich in olive oil versus a low-fat diet on cardiovascular disease in coronary patients. *Am Heart J* 2016;177:42–50.

39 Ware JE, Kosinski M, Keller SD. *SF-12: how to score the SF-12 physical and mental health summary scales*. 3rd edn. Lincoln, RI: QualityMetric Incorporated, 1998.

40 Failde I, Medina P, Ramirez C, *et al*. Construct and criterion validity of the SF-12 health questionnaire in patients with acute myocardial infarction and unstable angina. *J Eval Clin Pract* 2010;16:569–73.

41 Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *J Pers Soc Psychol* 1988;54:1063–70.

42 Tabernero C, Chambel MJ, Curral L. The role of task-oriented versus relationship-oriented leadership on normative contract and group performance. *Soc Behav Pers* 2009;37:1391–404.

43 Diener E, Emmons RA, Larsen RJ, *et al*. The satisfaction with life scale. *J Pers Assess* 1985;49:71–5.

44 Vázquez C, Duque A, Hervás G. Satisfaction with life scale in a representative sample of Spanish adults: validation and normative data. *Span J Psychol* 2013;16:1–15.

45 Caprara GV, Gerbino M. Affective perceived self-efficacy: the capacity to regulate negative affect and to express positive affect. In: Caprara GV, ed. *Self-efficacy assessment*. Trento, Italy: Erickson, 2001: 35–50.

46 Caprara GV, Di Giunta L, Eisenberg N, *et al*. Assessing regulatory emotional self-efficacy in three countries. *Psychol Assess* 2008;20:227–37.

47 Carbone EA, Pugliese V, Bruni A, *et al*. Adverse childhood experiences and clinical severity in bipolar disorder and schizophrenia: a transdiagnostic two-step cluster analysis. *J Affect Disord* 2019;259:104–11.

48 Benassi M, Garofalo S, Ambrosini F, *et al*. Using two-step cluster analysis and latent class cluster analysis to classify the cognitive heterogeneity of cross-diagnostic psychiatric inpatients. *Front Psychol* 2020;11:1085.

49 Reiner Željko, Sonicki Z, Tedeschi-Reiner E. The perception and knowledge of cardiovascular risk factors among medical students. *Croat Med J* 2012;53:278–84.

50 Mazalin Protulipac J, Sonicki Z, Reiner Željko. Cardiovascular disease (CVD) risk factors in older adults–perception and reality. *Arch Gerontol Geriatr* 2015;61:88–92.

51 McSweeney J, Pettey C, Lefler LL, *et al*. Disparities in heart failure and other cardiovascular diseases among women. *Womens Health* 2012;8:473–85.

52 Homma K, Chang B, Shaffer J, *et al*. Association of social support during emergency department evaluation for acute coronary syndrome with subsequent posttraumatic stress symptoms. *J Behav Med* 2016;39:823–31.

53 Bassett SM, Schuette SA, O'Dwyer LC, *et al*. Positive affect and medication adherence in chronic conditions: a systematic review. *Health Psychol* 2019;38:960–74.

54 Kotseva K, De Backer G, De Bacquer D, *et al*. Lifestyle and impact on cardiovascular risk factor control in coronary patients across 27 countries: results from the European Society of cardiology ESC-EORP EUROASPIRE V registry. *Eur J Prev Cardiol* 2019;26:824–35.

55 Caprara MG, Di Giunta L, Caprara GV. Association of positivity with health problems in old age: preliminary findings from Spanish middle class seniors. *J Happiness Stud* 2017;18:1339–58.

56 Steca P, D'Addario M, Magrin ME, *et al*. A type A and type D combined personality typology in essential hypertension and acute coronary syndrome patients: associations with demographic, psychological, clinical, and lifestyle indicators. *PLoS One* 2016;11:e0161840.

57 Piepoli MF, Hoes AW, Agewall S. European guidelines on cardiovascular disease prevention in clinical practice. *Eur Heart J* 2016;37:2315–81.

58 Freedland KE. The behavioral medicine Research Council: its origins, mission, and methods. *Health Psychol* 2019;38:277–89.

59 Nolen-Hoeksema S. Emotion regulation and psychopathology: the role of gender. *Annu Rev Clin Psychol* 2012;8:161–87.

60 Field AP. *Discovering statistics using SPSS: and sex and drugs and rock 'n' roll*. 4th edn. London, UK: Sage, 2013.