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Reliability and validity of the Positive Mental Health Questionnaire in a sample of Spanish university students

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Accessible summary

What is known on the subject?

- In general, the current studies of positive mental health use questionnaires or parts thereof. However, while these questionnaires evaluate aspects of positive mental health, they fail to measure the construct itself.

What does this paper add to existing knowledge?

- The widespread use and the lack of specific questionnaires for evaluating the positive mental health construct justify the need to measure the robustness of the Positive Mental Health Questionnaire. Also six factors are proposed to measure positive mental health.

What are the implications for practice?

- The availability of a good questionnaire to measure positive mental health in university students is useful not only to promote mental health but also to strengthen the curricula of future professionals.

Abstract

Introduction: Nursing has a relevant role in managing mental health. It is important to identify and thereafter to enhance positive aspects of mental health among university nursing students. **Aim:** The aim of the present study was to analyse the psychometric properties of the Positive Mental Health Questionnaire (PMHQ) in terms of reliability and validity using confirmatory factor analysis in a sample of university

students. **Method:** A cross-sectional study was carried out in a sample of 1091 students at 4 nursing schools in Catalonia, Spain. The reliability of the PMHQ was measured by means of Cronbach's alpha coefficient, and the test-retest stability was measured with the intraclass correlation coefficient (ICC). Confirmatory factor analysis was used to determine the validity of the factorial structure. **Results:** Cronbach's alpha coefficient was satisfactory (>0.70) for four of the six subscales or dimensions and ranged from 0.54 to 0.79. ICC analysis was satisfactory for the six subscales or dimensions. The hypothesis was confirmed in the analysis of the correlations between subclasses and the overall scale, with the strongest correlations being found between the majority of the subscales and the overall scale. Confirmatory factor analysis showed that the model proposed for the factors fit the data satisfactorily. **Discussion:** This scale is a valid and reliable instrument for evaluating positive mental health in university students. **Implications for Practice:** A good questionnaire to measure positive mental health in university students is useful not only to promote mental health but also to strengthen the curricula of future professionals.

Background

In 2001, the World Health Organization (WHO) provided a specific definition of mental health that emphasized the positive perspective: [mental health is a] '*state of well-being in which the individual realizes his skills, copes with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his community*'. This definition has strongly reinforced the need to fully accept the original ideas put forward at the outset of the twentieth century that saw mental health as something more than the mere absence of illness. Indeed, this position has led to the formulation of explanatory models of health, and by extension mental health, as a continuum, with the promotion of mental health as a primary objective (Herman *et al.* 2005, Jané-Llopis 2007, Barry 2009, World Health Organization, 2015). It has also generated models with dimensions and separate but interrelated axes, based on positive concepts such as happiness, flourishing, satisfaction with life, positive affect, and meaning of life (Keyes 2002, Peterson *et al.* 2005, Kashdan *et al.* 2009, Westerhof & Keyes 2010, Lamers 2012, Huppert & So 2013).

A strong positive current on mental health has emerged from psychology emphasizing the need to exploit and develop the strengths of the human being (Peterson & Seligman 2004, Kobau *et al.* 2011, Bolier *et al.* 2013). As early as 1994, Bowling stated that although a high percentage of the population suffered or was in danger of suffering mental illness (up to 20% according to some reports), it was also necessary to attend the healthy population to prevent the appearance of mental health problems and to enhance positive mental health (Bowling 1994). Along parallel lines, from the perspective of mental health professionals, positive mental health would allow professionals to focus on the healthy aspects of the individual in terms of resilience (Vilete *et al.* 2014) and/or recovery (Provencher & Keyes 2011).

In order to be able to develop interventions aimed at promoting positive mental health, conceptual models are first needed to guide the actions to be taken. Furthermore, we also need instruments that can measure levels of positive mental health both before (to carry out health diagnosis) and after (to evaluate results in health) the intervention.

Following extensive review of the literature, Lluch found that the work of Jahoda (1958) on conceptual aspects of positive mental health had not been implemented. In his doctoral thesis, Lluch made three consecutive studies and structured positive mental health in a multifactor model made up of 6 factors to explain that positive mental health involves both theoretical and practical aspects which address concepts independently or with relationships between two and three concepts, e.g. personal satisfaction with autonomy or self-control (Barry *et al.* 2013, Min *et al.* 2013, Hofmann *et al.* 2014, Orpana *et al.* 2016). In addition, there are multicomponent intervention programmes in mental health that use techniques such as combined problem-solving and social skills (Forsman *et al.* 2011, Van der Stouwe *et al.* 2016). Indeed, no previous study has integrated the six factors within a conceptual framework to provide a model category highlighting the need to further explore its structure and configuration for future confirmation as a model.

The study on positive mental health (PMH) performed by Luch in 1999 had two complementary objectives: to define a conceptual model of positive mental health and to construct an instrument to make the conceptual model

operative to evaluate positive mental health. The result of this effort was the creation of the multifactor model of positive mental health (MM-PMH). This model is made up of 6 factors that define the construct of positive mental health (Lluch 1999, 2003): Personal Satisfaction (F1), Prosocial Attitude (F2), Self-control (F3), Autonomy (F4), Problem-Solving and Self-actualization (F5) and Interpersonal Relationship Skills (F6) (Table 1).

On the basis of MM-PMH, the Positive Mental Health Questionnaire (PMHQ) was created to make the model operative and to measure positive mental health. The PMHQ comprises 39 items which are unevenly distributed across the six factors that define the construct. The distribution of the items of each factor is described in Methods. Initial validation of the PMHQ was carried out in a sample of students from the nursing school of the University of Barcelona (Lluch 2003). Gold standard assessments were followed to establish the reliability and validity of the new instrument (Nunnally & Bernstein 1994). In the exploratory factor analysis, the six factors extracted accounted for 46.8% of the total variance of the questionnaire. In the resulting factor matrix, the weights of each item with respect to the factor extracted were above 0.40 in all cases (Hair *et al.* 1998). Overall, the psychometric results were favourable, but the sample size of this initial study was small and confirmatory factor analysis was not performed.

The PMHQ has been used by various research teams, especially in Spain, Portugal and Latin America (Amar *et al.* 2008, Lluch-Canut *et al.* 2013, Sequeira *et al.* 2014). However, very few studies have analysed its psychometric properties (Lluch-Canut *et al.* 2013, Sequeira *et al.* 2014) and, to our knowledge, this is the first confirmatory factor analysis of the questionnaire.

The widespread use and the lack of specific questionnaires for evaluating the positive mental health construct justify the need to measure the robustness of the Positive Mental Health Questionnaire, as has been pointed out by the EUROHIS group (Meltzer 2003).The only specific instrument for evaluating positive mental health as a construct was described in a recent study carried out in an Asian population on the relevance of religious and spiritual practices in mental health (Vaingankar *et al.* 2014). In general, the current studies of positive mental health use questionnaires such as the Warwick–Edinburgh Mental Well-being Scale – WEMWBS (Tennant *et al.* 2007), the Sense of Coherence Scale – SOC (Antonovsky 1993), the Mental Health Continuum – Short Form – MHC – SF (Keyes 2002), the WHO-Five Well-being Index (Bech2004) or the Affectometer 2 (Kamman & Flett 1983) that evaluate aspects of mental well-being, but they fail to measure the construct 'positive mental health' itself (Lamers 2012, Dreger *et al.* 2014). According to Cronbach & Meehl (1955), the main difficulty of a construct is that it is 'a concept for which there is not a single observable referent, which cannot be directly observed, and for which there exist multiple referents, but none all-inclusive'.

The question is, however, how many factors or criteria are required to define mental health? Researchers in Canada have used the definition of mental health formulated by the PHAC (Public Health Agency of Canada) to operationalize the positive mental health construct into

Table 1
Multifactor model of positive mental health (Lluch 1999) and distribution of items of each factor

Positive mental health factors	Definition	Items
F1: Personal Satisfaction	Self-concept/Self-esteem Satisfaction with personal life Optimistic outlook on the future	4, 6, 7, 12, 14, 31, 38, 39
F2: Prosocial Attitude	Active predisposition towards society Altruistic social attitude; attitude of helping/supporting others Acceptance of others and of differential social characteristics	1, 3, 23, 25, 37
F3: Self-control	Ability to cope with stress/situations of conflict Emotional balance/emotional control Tolerance of frustration, anxiety and stress	2, 5, 21, 22, 26
F4: Autonomy	Able to have one's own standards Independence Self-regulation of one's behaviour Sense of personal security/self-confidence	10, 13, 19, 33, 34
F5: Problem-solving and Self-actualization	Analytical capacity Ability to make decisions Flexibility/ability to adapt to change Attitude of continuous growth and personal development	15, 16, 17, 27, 28, 29, 32, 35,36
F6: Interpersonal Relationship Skills	Ability to establish interpersonal relationships Empathy/ability to understand the feelings of others Ability to give emotional support Ability to establish and maintain close interpersonal relationships	8, 9, 11, 18, 20, 24, 30

five components (Canadian Institute for Health Information, 2009, 2011). In our work, we took the conceptualization of positive mental health described by Jahoda (1958) as the initial reference point followed by the formulation of the MM-PMH, which as noted above defines the construct in terms of six factors.

Nursing professionals need validated instruments that may be used in daily practice.

Thus, the model of positive mental health as expressed in this study may be of great importance for both the prevention and promotion of mental health.

The aim of this study was to analyse the psychometric properties of the PMHQ in terms of reliability and validity by means of confirmatory factor analysis in a sample of university students.

Methods

Design

We performed a cross-sectional study to validate the psychometric properties of the PMHQ in a sample of 1091 nursing students at four university nursing schools in Catalonia, Spain.

Participants and setting

Data were collected from first-year nursing students during the years 2012-2014. The inclusion criteria were registration in the programme and voluntary participation in the study. The 4 university schools of nursing included Bellvitge and Sant Joan de Dèu, both affiliated with the University of Barcelona, and Blanquerna and Rovira i Virgili, the latter two being private institutions. The total student population during the study period was of approximately 1500 students.

Instruments

The following demographic data of the participants were collected: age, sex, nursing school, physical and mental problems in the preceding month and visits to a physician, psychologist or psychiatrist in the preceding month.

The PMHQ (Positive Mental Health Questionnaire), Lluch (1999, 2003): this questionnaire comprises 39 items which are unevenly distributed across the six factors that define the construct: F1. Personal Satisfaction (8 items), F2. Prosocial Attitude (5 items), F3. Self-control (5 items), F4. Autonomy (5 items), F5. Problem-solving and Self-actualization (9 items) and F6. Interpersonal Relationship Skills (7 items). The items are expressed as positive or negative statements which are responded to using a scale ranging from 1 to 4, according to how frequently they occur: always or almost always, quite often, sometimes, never or rarely. The distribution of the 39 items of the PMHQ among the six factors is shown in Table 1. The PMHQ was constructed in Spanish and has been translated and adapted to Portuguese (Sequeira *et al.* 2014).

Ethical considerations

This study was approved by the Ethics and Research Committee of the University of Barcelona. All participants were informed of the purpose of the study and provided oral informed consent to participate. The study was anonymous and confidential.

Data collection procedures

The questionnaire was administered on one day at each school to all students attending classes on that day and who voluntarily agreed to participate.

Four weeks later, the PMHQ was again administered to the same 380 participants at the Bellvitge School of Nursing (University of Barcelona) during the academic year 2013–2104 to determine test-retest reliability.

Statistical analysis

Data analysis was performed using SPSS for Windows 17.0 (SPSS, Chicago, IL, USA). One-sample Kolmogorov–Smirnov Z tests were used to assess normality, and descriptive statistics were used to summarize the scale.

Item analyses included calculation of item means, standard deviations, percentage ceiling and floor effects, and corrected item-total correlation. Ceiling and floor effects are the percentage of people with the highest score and with the lower score, respectively. The item-total correlation is the correlation between the score of one item and the sum of the scores of the remaining items. Internal consistency reliability was evaluated using Cronbach's alpha coefficient for the total and each of the subscales (Nunnally & Bernstein 1994).

A coefficient alpha value of 0.70 (Nunnally & Bernstein 1994) or above was considered acceptable for this scale. Test-retest reliability was examined within a 4-week time frame using the intraclass correlation coefficient (ICC) criteria (two-factor and mixed-effects model).

A correlation analysis was performed using the Spearman correlation between the scales in PMHQ to evaluate convergent and discriminant validity based on the hypothesis that the correlation between each subscale and the overall scale should be higher than the correlations among the subscales (Fayers & Machin 2000). The discriminant

validity was also evaluated by comparing the means of the Positive Mental Health Questionnaire in the two groups of students according to whether they had reported having a mental health problem and whether they had visited a psychologist/psychiatrist on at least one occasion. The Student's *t*-test was used for this analysis.

The construct validity of the PMHQ was determined using confirmatory factor analysis (CFA). CFA models were estimated using structural equation modelling (EQS 6.1 for Windows, Multivariate Software, Inc., Encino, CA, USA). The generalized least-squares parameter estimation method of a polychoric correlation matrix was used. This method has the same properties as the maximum likelihood method, although with less stringent criteria of normality, and it is mainly used for measuring ordinal items (Batista-Foguet *et al.* 2004). Model fit was determined with several methods as several authors have suggested using a number of indicators to determine the fit of the models (Bollen & Long 1993). The statistics provided were the χ^2 test, the ratio between χ^2 and the degrees of freedom (χ^2/d.f.), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the Bentler-Bonett normed fit index (BBNFI), and the Bentler & Bonett (1980)non-normed fit index (BBNNFI). The BBNFI and BBNNFI indexes can vary from 0 (poor fit) to 1 (perfect fit). The RMSEA reflects the extent to which the model approximates a reasonable fit, and values close to or below 0.07 are generally recommended (Steiger 2007). Using a two-index presentation strategy, Hu & Bentler (1999) proposed a cut-off of 0.09 for SRMR and 0.06 for RMSEA (values close to or below). According to Hinkin (1995), χ^2/d.f. may be used when there is a ratio of 5:1 or less.

Statistical significance was set at a *P* value 0.05.

Results

The questionnaires were completed by 1091 participants. The sociodemographic data and clinical characteristics of the participants are shown in Table 2. The average age of the participants was 21 years, and most of the participants were female (87.5%). The majority of students stated that they had no physical or mental health problems and also declared that they had not seen a doctor, psychologist or psychiatrist in the previous month.

Item analysis

The mean item value ranged from 2.47 (item 18) to 3.79 (item 3), and the standard deviation ranged from 0.51 (item 3) to 0.90 (item 35). The item with the greatest ceiling effect was item 3 (*I find it particularly difficult to listen to people telling me their problems*) (82.7%), and the items with the greatest floor effect were item 10 (*I worry a lot about what others think of me*) (12.6%), item 18 (*I consider myself to be a good psychologist*) (12.6%) and item 19 (*It troubles me when people criticize me*) (13.0%) (Table 3).

Table 2
Sociodemographic and clinical characteristics of the study sample (n = 1091)

	21.37 (Standard deviation: 4.8)	
Mean age (years) min. 18 max 56	*n*	%
Sex		
Male	129	11.8
Female	962	88.2
School/programme		
Bellvitge – University of Barcelona	821	75.2
University Rovira i Virgili	74	6.8
Sant Joan de Dèu – University of Barcelona	124	11.4
Blanquerna	72	6.6
Physical health problems		
Yes	97	8.9
No	601	86.1
Mental health problems		
Yes	28	4.0
No	669	96.0
Visits to doctor		
Yes	234	33.6
No	463	66.4
Visits to psychologist/psychiatrist		
Yes	125	17.9
No	573	82.1

Reliability

Cronbach's alpha coefficient was satisfactory (>0.70) for four of the six subscales or dimensions and ranged from 0.54 to 0.79 (Table 4).

The internal consistency of the total PMHQ yielded an alpha of 0.89, indicating good internal consistency for the 39-item PMHQ.

Most of the 39-item PMHQ had item-total correlations >0.20. Only two items had corrected item-total scale correlation coefficients <0.20 (items 1 and 3). These items were as follows: *I find it especially difficult to accept others when their attitudes are different from mine*(item 1) and *I find it particularly difficult to listen to people telling me their problems* (item 3) (Table 3).

ICC analysis demonstrated that the 4-week test-retest reliability was 0.92 (95% confidence interval 0.91–0.93, n = 380) and was satisfactory for the six subscales or dimensions (Table 4).

Convergent and discriminant validity

The hypothesis was confirmed in the analysis of the correlations between the subclasses and the overall scale, with

Table 3
Descriptive statistics of the items of the scale (PMHQ) Item mean, standard deviations, % ceiling, % floor and corrected item–total correlation

Summary of the contents of the items	Mean	Standard deviation	% Floor	% Ceiling	Corrected item-total correlation
Item 1: I find it especially difficult to accept others when their attitudes are different from mine.	3.26	0.68	1.8	38.0	0.198
Item 2: Problems often cause me to feel blocked.	2.86	0.74	4.9	16.7	0.480
Item 3: I find it particularly difficult to listen to people telling me their problems.	3.79	0.51	0.7	82.7	0.153
Item 4: I like myself as I am.	2.86	0.82	4.1	24.3	0.492
Item 5: I am able to control myself when I feel negative emotions.	2.54	0.80	7.6	11.9	0.397
Item 6: I feel like I am about to explode.	3.08	0.65	2.0	23.9	0.363
Item 7: I find life to be boring and monotonous.	3.49	0.64	1.1	55.7	0.417
Item 8: I find it particularly difficult to provide emotional support to others.	3.45	0.70	1.9	55.8	0.308
Item 9: I find it hard to establish deep and satisfying interpersonal relationships with some people.	3.32	0.75	2.6	47.2	0.308
Item 10: I worry a lot about what others think of me.	2.63	0.86	12.6	13.2	0.384
Item 11: I feel that I have a strong ability to put myself in the shoes of others and to understand their responses.	3.11	0.77	1.6	34.4	0.366
Item 12: I see the future with pessimism.	3.39	0.68	1.7	49.2	0.442
Item 13: The opinions of others have a strong influence on me when I have to make decisions.	2.91	0.76	4.9	19.8	0.422
Item 14: I see myself as less important than those around me.	3.44	0.75	2.7	57.5	0.500
Item 15: I am able to make decisions on my own.	3.44	0.72	1.3	56.6	0.520
Item 16: I try to look for the positive side when bad things happen to me.	2.90	0.88	5.1	29.5	0.497
Item 17: I try to improve myself as a person.	3.49	0.69	0.7	59.2	0.388
Item 18: I consider myself to be a good psychologist.	2.47	0.86	12.6	12.5	0.216
Item 19: It troubles me when people criticize me.	2.68	0.89	13.0	16.4	0.372
Item 20: I think that I am a sociable person.	3.29	0.76	1.8	45.9	0.412
Item 21: I am able to control myself when I have negative thoughts.	2.74	0.80	3.8	18.9	0.433
Item 22: I am able to maintain a high level of self-control in conflictive situations in my life.	2.75	0.75	2.8	15.9	0.504
Item 23: I feel that I am someone to be trusted.	3.67	0.54	0.3	70.6	0.332
Item 24: I find it particularly hard to understand the feelings of others.	3.53	0.61	0.9	58.5	0.267
Item 25: I consider the needs of others.	3.15	0.72	0.9	34.3	0.232
Item 26: When I experience unpleasant external pressure I am able to maintain my personal balance.	2.56	0.77	7.1	10.6	0.481
Item 27: When there are changes in my surroundings I try to adapt to them.	3.33	0.69	0.4	46.0	0.520
Item 28: In the face of a problem I am able to ask for information.	3.04	0.80	2.6	31.9	0.363
Item 29: I find changes in my daily routine to be stimulating.	2.86	0.78	2.5	22.2	0.334
Item 30: I find it hard to relate openly with my teachers/bosses.	3.20	0.79	4.2	39.2	0.336
Item 31: I feel inept and useless.	3.71	0.54	0.3	75.1	0.529
Item 32: I try to develop my abilities to the maximum.	3.27	0.70	1.0	41.2	0.503
Item 33: I find it hard to hold my own opinions.	3.59	0.64	1.3	67.0	0.395
Item 34: When I have to make big decisions I feel very unsure of myself.	2.75	0.88	11.9	17.9	0.497
Item 35: I am able to say no when I want to.	3.08	0.90	4.1	40.5	0.332
Item 36: When I am faced with a problem I try to find possible solutions.	3.48	0.64	0.5	55.6	0.538
Item 37: I like to help others.	3.67	0.57	0.3	71.7	0.206
Item 38: I feel unsatisfied with myself.	3.22	0.78	4.5	39.7	0.434
Item 39: I feel unsatisfied with the way I look.	3.06	0.81	5.2	31.0	0.409

Table 4
Cronbach's alpha coefficient and intraclass correlation coefficient test-retest

	Cronbach's α	Intraclass correlation coefficient	Confidence interval 95%
Personal satisfaction	0.794	0.890	0.865–0.910
Prosocial attitude	0.543	0.760	0.707–0.804
Self-control	0.772	0.767	0.715–0810
Autonomy	0.752	0.890	0.865–0.910
Problem-solving	0.778	0.874	0.846–0.897
Interpersonal Relationship Skills	0.636	0.840	0.804–0.869
Total	0.890	0.925	0.907–0.939

the strongest correlations being found between the majority of the subscales and the overall scale. Subscale F5 (Problem-solving and Self-Actualization) most strongly correlated with the overall scale (rho = 0.80), while subscale F2 (Prosocial Attitude) showed the weakest correlation with the overall scale (rho = 0.42).

The strongest correlation among the subscales was that of F3 (Self-control) and F5 (Problem-solving and Self-Actualization) (rho = 0.50), while the weakest was between F2 (Prosocial Attitude) and F4 (Autonomy) (rho = 0.06) (Table 5). All of the correlations were

Table 5
Correlations among the subscales of the PMHQ Scale

	Personal satisfaction	Prosocial attitude	Self-control	Autonomy	Problem-solving	Interpersonal Relationship Skills
Personal satisfaction	1					
Prosocial attitude	0.15	1				
Self-control	0.45	0.18	1			
Autonomy	0.44	0.06	0.34	1		
Problem-solving	0.46	0.34	0.50	0.39	1	
Interpersonal Relationship Skills	0.34	0.34	0.28	0.25	0.41	1
Total positive mental health	0.74	0.42	0.68	0.62	0.80	0.62

n = 1091; All correlation coefficients are significant at $P < 0.001$.

significant ($P < 0.001$). The mean total scores of the scale were greater in students declaring not having had mental health problems (t (28.52) = 3.90, $P = 0.001$) and in those stating that they had not visited a psychologist/psychiatrist (t (157.20) = 3.45, $P = 0.001$).

Construct validity

The result of the χ^2 test was significant ($\chi^2 = 2930.07$; $P < 0.001$), indicating that the hypothesis of a perfect fit model should be rejected. It was considered that other statistics were needed to assess the model due to the sensitivity of the χ^2 test to sample size. The value for RMSEA was 0.05 and the SRMR was 0.05 which are below the recommended critical limits of 0.06 and 0.09, respectively. The χ^2/d.f. ratio was equal to 4.26, which is within the acceptable value for this ratio of up to a maximum of 5. The value for BBNFI was 0.77, being 0.81 for BBNNFI. According to the results presented above, the model proposed for the factors satisfactorily fit the data.

The parameters estimated by the model were all significantly different from zero (Figure 1). No items had loads under 0.30 in the factor analysis (Kline 2011).

Discussion

The results obtained using several different analyses have shown that the PMHQ has good psychometric properties. The scale was developed with the aim of evaluating the positive mental health construct considering 6 dimensions or factors for the definition of the construct: Personal Satisfaction (F1), Prosocial Attitude (F2), Self-control (F3), Autonomy (F4), Problem-solving and Self-actualization (F5), and Interpersonal Relationship Skills (F6).

In relation to the analysis of the items, it was of note that item 3 presented an elevated ceiling effect (82.7%) which may simply be due to nursing students having a greater predisposition to listen to people with problems. Regarding reliability, four of the six factors proposed (F1, F3, F4, F5 and F6) scored good levels of reliability in terms of internal consistency. In the present study, Factor F2 (Prosocial Attitude) scored the lowest Cronbach's alpha coefficient. This result is similar to that of other studies in which the results ranged from a maximum score of 0.60 in the study by Lluch-Canut *et al.* (2013) in a sample of people with chronic physical health disorders to a score of 0.51 reported by Sequeira *et al.* (2014) in a sample of Portuguese university students.

In regard to the stability over time of the PMHQ, our test-retest correlations were high as in other studies, ranging from 0.98 in the study by Sequeira *et al.* (2014) to 0.92 for the overall scale in our study. In previous studies including analysis of stability over time, test-retest evaluation was performed within time periods ranging from 30 days, as in the present study, to 60 days as in the study by Sequeira *et al.* (2014).

In view of all these results, we can therefore conclude that the PMHQ possesses a good level of reliability for measuring the construct of positive mental health.

In the present study, the results obtained from analysis of the PMHQ items were higher (range of 2.47 for item 18–3.79 for item 3) than those obtained in a previous study (Albacar-Ribóo *et al.* 2015), (range of 1.22 for item 23–2.31 for item 18). These results may be due to our population being made up of university students while that of Albacar-Ribóo *et al.* (2015) included caregivers of patients diagnosed with schizophrenia whose response may have been influenced by tiredness. Furthermore, the range of the standard deviation in the present study was slightly narrower than that of Albacar-Ribóo *et al.* (2015), ranging from 0.51 (item 3) to 0.90 (item 35) in our study and from 0.53 (item 23) and 1.13 (item 35) in the latter. In both studies, the item showing the greatest deviation was number 35, *'I am able to say no when I want to'*.

On comparing the correlation among factors and subscales of the PMHQ of the present study with that of the studies by Lluch (1999, 2003), Lluch-Canut *et al.* (2013), and Sequeira *et al.* (2014), the scores were similar for the three studies, and in all three cases, the six factors or subscales showed statistically significant correlations below 0.70.

As the present study is the first confirmatory factor analysis of the PMHQ, our results cannot be compared

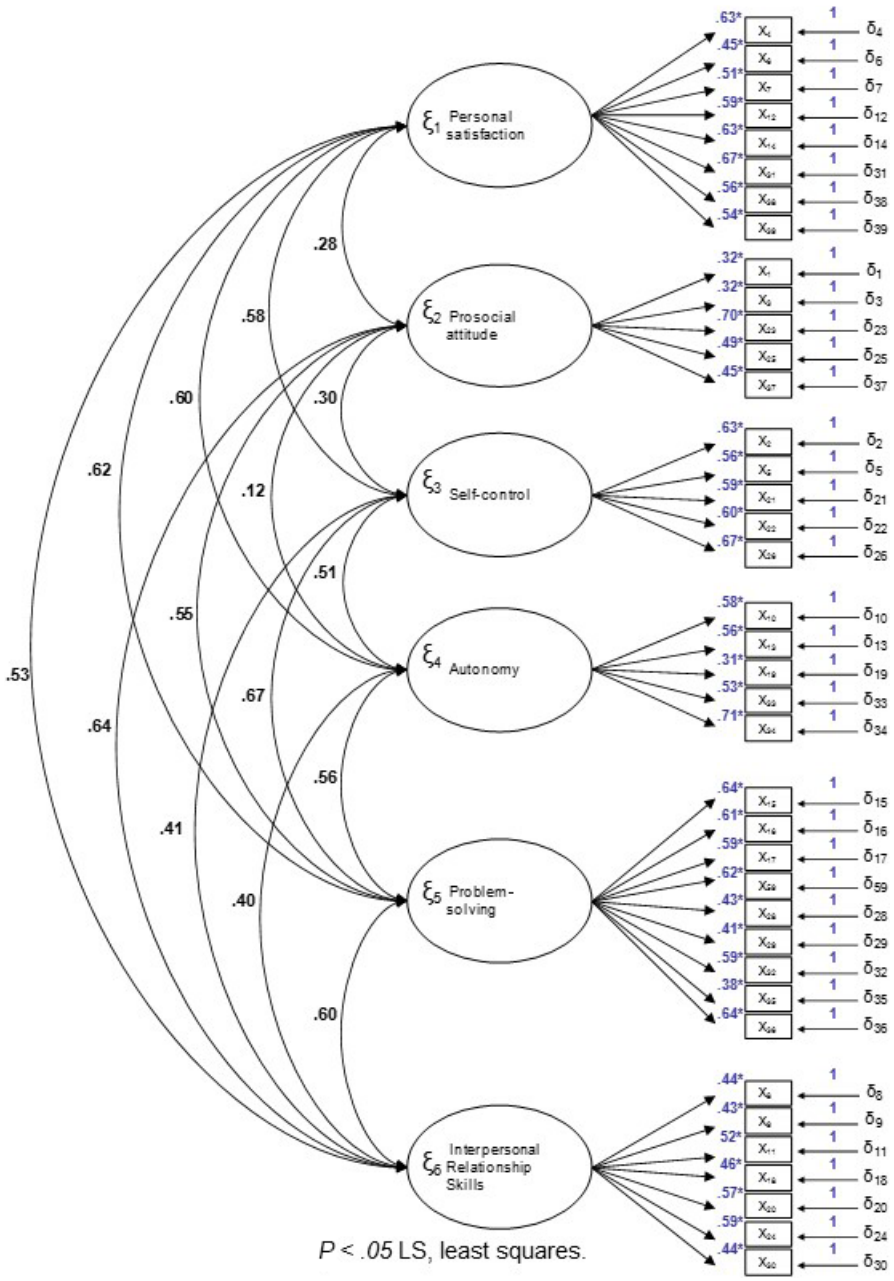

Figure 1
Factor loadings derived from the LS estimation (least squares) confirmatory factor analysis (λij).

with others. As shown in results, the model proposed for the factors satisfactorily fit the data and the parameters estimated by the model were all significantly different from zero. No items had loads under 0.30 in the factor analysis. The results obtained are in agreement with the initial factorial data for PMHQ obtained in the exploratory factor analysis by Lluch (1999, 2003). All of the items on the questionnaire scored factor loads greater than 0.30 (ranging from 0.42 to 0.78). Similar results were obtained in the exploratory factor analysis carried out by Sequeira *et al.* (2014) in which the item saturation ranged from 0.38 to 0.84. The results of the confirmatory factor analysis of the present study confirm the distribution of the items in the factors as well as the multifactorial structure of the PMHQ according to the model proposed in support of the instrument.

On comparing our results with those using the positive mental health instrument of Vaingankar *et al.* (2014), the psychometric reliability was similar to that of the PMHQ, with Cronbach's alpha values ranging between 0.73 and 0.91, and intraclass correlation coefficients (ICC) ranging between 0.74 and 0.96. Similarly, the load factors of the instrument and the fit indexes were also similar to those obtained with the PMHQ, ranging from 0.208 to 0.882.

The correlations among subscales of the PMHQ were smaller (range 0.07–0.51) than those of Vaingankar *et al.* (2014) (range 0.25–0.81) indicating that the factors or subscales of the PMHQ have good levels of discrimination. In both studies, the correlations among subscales or factors were statistically significant.

Finally, it was of note that the reliability and validity scores for the PMHQ were similar to the psychometric characteristics of other scales which also evaluate constructs or dimensions of a positive nature and are widely used in the field of mental health. These scales include the General Well-Being Schedule, GWBS (Dupuy 1984), the Warwick–Edinburgh Mental Well-being Scale – WEMWBS (Tennant *et al.* 2007), the Sense of Coherence Scale – SOC (Antonovsky 1993), the Mental Health Continuum – Short Form – MHC – SF (Keyes 2002), the WHO-Five Well-being Index (Bech2004) and the Affectometer 2 (Kamman & Flett 1983).

However, these scales do not assess the construct 'positive mental health'. Moreover as stated by Lehtinen *et al.* (2005), 'Happiness or life satisfaction are necessarily not the same as positive mental health, although they can be seen as essential components of the construct. More research on the epidemiology of positive mental health is evidently needed'.

Conceptual approaches and instruments are needed to encourage the development of the construct 'positive mental health'. Moreover, the PMHQ and its supporting conceptual model provide a new approach to the present international evidence to advance in the study of the positive aspects of mental health.

Limitations

Nevertheless, the present study has some limitations. First, the questionnaire was performed in a sample of students who voluntarily participated and thus may not be representative of the target student population. In addition, the students who accepted to participate may have had better positive mental health the day the questionnaire was given, thereby overestimating the results. The response rate was 73% (1091/1500) and, therefore, the influence of this bias would be minimal.

Secondly, in relation to the homogeneity of the sample, the results should be considered with caution. We agree with Bech (2012) that the validation of measuring instruments is an ongoing process that requires very large samples. Moreover, evaluation of the construct further enhances the complexity of the validation of measurement, and thus, additional studies with more heterogeneous samples should be performed. In this study, 88.2% of the sample was made up of women with possible differences in the perception of positive mental health compared to men.

On the other hand, it should be taken into account that the test-retest was undertaken in only teaching centre. However, the sociodemographic characteristics of the students from all the centres were similar and should not bias the results.

Finally, it would also be important to evaluate the predictive validity with longitudinal studies to analyse the correlation of this questionnaire with future measures of mental health.

Conclusions

The PMHQ has demonstrated good measuring properties both at the overall level and for the 6 factors with which it is constituted. Its internal consistency and stability over time were favourable for five of the six factors that comprise the questionnaire: (F1) Personal Satisfaction, (F2) Prosocial Attitude, (F3) Self-control, (F4) Autonomy, (F5) Problem-solving and Self-actualization and (F6) Interpersonal Relationship Skills. Factor 2 (Prosocial Attitude) showed more moderate results in terms of reliability and should be further evaluated in future studies. As to validity, the results of the confirmatory factor analysis support the multifactor model of positive mental health that underpins the questionnaire, yielding favourable data both for the 6 factors that make up the PMHQ and for the 39 questionnaire items distributed among the 6 factors.

Relevance for clinical practice

The availability of a good questionnaire to measure positive mental health in university students is useful not only to promote mental health but also to strengthen the curricula of future professionals.

In addition, an instrument such as this would be very useful for nurses to assess positive aspects of mental health of patients and develop care plans to reinforce positive mental health (Orem & Vardiman 1995).

In psychiatry, the construct of positive mental health is useful for the creation of programmes for the promotion of mental health and the prevention of mental illness as well as evaluating their effectiveness. This construct would also be of use in the approach to perspectives on the current understanding of therapeutic activity that includes aspects of resiliency and recovery.

Authors' contributions

JR, TLL, CS and IC designed the study and methodology. MP, MS, CF, DS and AF recruited the sample. The data

have been analyzed by JR and IC. All the authors have read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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