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Healthy, moderate, or distressed: identification of latent profiles of mental health of a Chilean older primary care user sample

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Abstract

Background In older adults, medium and high levels of life satisfaction can coexist with mental health symptoms. The combination of these variables continues to be a challenge for public mental health; even more so for middle-income countries where evidence is scarce. This study aimed to identify latent mental health profiles in a sample of older adults attending primary healthcare centres (PHC) in the Province of Concepción, Chile.

Methods A convenience sample of individuals aged 65 and older who sought care in 15 PHC centres was recruited. Perception of well-being and the presence of anxiety and depression symptoms, all of these in relation to variables such as age, sex, cohabitation, health history, alcohol use, social participation, social support, loneliness, stressful events, presence of previous major depressive episodes, and generalized anxiety disorders. The relationship between the variables was analysed using a latent profile model.

Results A total of 573 interviews were conducted, with 7.85% having a psychiatric diagnosis in the last year. Four latent profiles were identified: *healthy (15%); moderate mental health with lower anxiety (22%)*, *moderate mental health with higher anxiety (34%)*, *and distressed (29%)*. The multinomial regression model for predictor variables significantly predicted the class for each subject. Key predictors include loneliness, stressful events, satisfaction with health status, and sex.

Conclusions The combined assessment of mental distress variables (anxiety and depressive symptoms) and well-being forms a gradient ranging from positive (*healthy*) and negative (*distressed*) mental health, with anxiety playing a crucial role in its differentiation.

Keywords Depression, Anxiety, Elderly, Primary care, Geriatric psychiatry

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Background

Many older people experience successful aging and positive emotional well-being [1], even when physical and mental illnesses are present simultaneously. From a psychosocial perspective, aging is a dynamic process whose outcomes depend on various factors such as widowhood and retirement, which can lead to either fulfilment or feelings of hopelessness and marginalization [2, 3].

In Chile, rapid population aging is underway, with over 30% of the population projected to be over 60 years old by 2050 [4]. This demographic shift brings with it significant mental health challenges, particularly depressive symptoms, which affect between 13.4% and 36.4% of older adults, with higher prevalence among women. Risk factors include multimorbidity, chronic pain, disability, financial stress, and loneliness [5, 6]. However, only 17–43% of those with depressive symptoms report a medical diagnosis, reflecting gaps in healthcare system coverage [5, 7].

Clinically, older individuals often exhibit psychiatric, clinical, or subclinical symptoms that interfere with daily life and complicate prevention and treatment approaches [8, 9]. These symptoms, while aligning with conventional diagnostic categories, may not meet the full criteria for a formal diagnosis [10]. These problems are further compounded by low healthcare coverage and by reduced intervention effectiveness due to discrimination, multimorbidity, and barriers to accessing appropriate care in this population. Thus, addressing these difficulties is complex and demanding [11, 12].

The co-occurrence of anxious and depressive symptoms is common in older adults, posing diagnostic challenges and necessitating the exploration of shared and distinct risk factors [13]. Both conditions are linked to increased disability, self-reported functional impairment [8, 14], and a reduction in well-being and life satisfaction [15, 16]. Key predictors for both disorders include female sex and experiencing stressful life events, with traumatic events being more strongly linked to anxiety [17]. Age serves as a protective factor for anxiety but a risk factor for depression [18], while social support consistently emerges as the most protective factor for both conditions [19]. Recent studies also highlight the role of loneliness in both cases as a significant factor influencing psychological status in older adults [20]. Personality traits, inadequate coping strategies, previous psychological alterations, and qualitative aspects of social network for an individual are additional risk factors associated with the incidence and prevalence of anxiety [18, 21]. Untreated anxiety in men is associated with an increased risk of coronary heart disease and overuse of health services [22, 23]. Conversely, cognitive impairment, widowhood or separation, and a positive family history are risk factors for both clinical and subclinical forms of depressive disorders, but not for anxiety [13, 21].

Different perspectives exist in the examination of well-being in older individuals. One of the most studied is subjective well-being, which involves cognitive evaluations encompassing overall life satisfaction, realizing individuals' potentials (eudaimonic well-being), positive and negative emotions, and contentment in domains such as relationships, work, and leisure [24]. Keyes [25] expanded the well-being lens to encompass social well-being and capture how individuals experience their societal interactions. Factors such as economic and educational levels, health status, functional limitations, and social support significantly influence subjective well-being in older individuals [16, 26]. Recent studies have also highlighted the positive impact of neighbourhood social cohesion on well-being, particularly among women, while alcohol use has been linked to life satisfaction [27, 28]. Predictors of eudaimonic well-being include marital status, sociocultural context, and perceived physical health [29]. Quality social networks contribute to increase well-being and life satisfaction, emphasizing the importance of interactions beyond the spouse. Conversely, loneliness and social isolation are linked to functional and social difficulties that hinder in-person interactions and social engagement [30]. In Chile, the COVID-19 pandemic exacerbated these issues, with a 25% increase in depressive symptoms and a 40% rise in perceived loneliness, especially among those living alone [31]. Perceived social support, particularly from family and community, plays a crucial role in promoting well-being, as evidenced by a study in Chile showing that older adults with stronger support networks report lower levels of depressive symptoms and a higher quality of life [32].

Despite the general trend of increasing well-being with age [33], older adults also face a higher prevalence of physical and psychiatric conditions, including subclinical symptoms coupled with increased multi-morbidity [12, 20]. While some studies suggest that older individuals may experience fewer mental health issues compared to younger adults, this does not necessarily translate to higher well-being [34]. In Chile, a study in Santiago with a representative sample of 1,431 people over 60 found that 38.1% reported having experienced at least one stressful event in the past year that negatively impacted well-being [35].

Although mental health is frequently discussed in public discourse, the combination of the presence of psychiatric symptoms or a common mental disorder and the assessment of subjective well-being is often not analysed. The dual continuum model of mental health [34, 36] provides a useful framework for understanding the interplay between mental disorders and well-being. This model posits that mental health and mental illness are distinct

but correlated dimensions, each with independent predictive value; therefore, a thorough examination of an individual's mental health should consider and evaluate both aspects. According to this model, individuals with high well-being and no mental disorder are in a state of "complete mental health", while those with low well-being and presence of mental disorder are considered in a state of "complete mental illness". Additionally, two other subgroups are classified under moderate mental health: those with low well-being and no mental disorder, and those with high well-being and presence of a mental disorder [34].

In a Danish general population study, lower socioeconomic status was linked to lower well-being and common mental disorders; however, a higher socioeconomic status did not predict elevated well-being; relational and recreational behaviours were associated with lower risks of poor well-being and common mental disorders and increased likelihood of high well-being [37]. In older individuals in China, factors such as being female, single, younger, and feeling unhealthy were tied to a higher probability of complete mental illness (CMI). Conversely, employment, education, and cognitive function emerged as significant protective factors for complete mental health (CMH). Age, income, urban or rural residence, and physical function limitations were also associated with these categories [26].

Promoting well-being and mental health in older individuals poses a challenge, especially in low- and middle-income countries, as limited evidence impedes a broad understanding of the relationship between aspects of well-being and psychiatric disorders. Furthermore, there is still an incomplete understanding of the factors influencing mental health across various dimensions and levels, including risk, protection, and promotion in these regions [38]. This article seeks to identify latent mental health profiles in older adults attending primary healthcare centres (PHCs), considering self-reported anxiety and depression symptoms, well-being perception, and predictive variables.

Examining the profiles of mental health symptoms and well-being is essential for advancing a comprehensive, person-centred understanding of mental health. It enables researchers to move beyond simplistic dichotomies and capture the complexity of older adults' experience, ultimately leading to more effective public health interventions, policies, and theoretical frameworks that address the unique characteristics of each group and meet their specific needs. This approach aligns with contemporary shifts in mental health research, which emphasize the importance of integrating both negative and positive aspects of psychological functioning.

Methods

This article uses baseline data from a sample of 15 PHC centers distributed in two communes in southern Chile (Concepción and Talcahuano) for the Vida Activa randomized controlled trial (ISRCTN32235611) [39]. Potential participants ($N = 1220$) were contacted and invited during a home visit; 638 refused to participate, 582 accepted, in which case an interview was coordinated for data collection, but only 573 interviews were conducted. Inclusion criteria considered (1) individuals aged 65 to 80 (2), self-dependent and (3) PHC users. Exclusion criteria were: (1) presence of a severe mental disorder (psychosis or bipolar disorder) in the last year (2), mental disability or dementia, and (3) a condition that impeded communication. Eligibility was assessed using a standardized instrument for PHC in Chile (EMPAM) [40]. Data collection was done in 1 month, with participants doing 40-min individual face-to-face interviews conducted by trained lay interviewers in the second semester of 2018. The survey included all outcome and predictor variables, and other measures not related to this study.

The study was approved by the Research Ethics Committee of the Health Services of Concepción and Talcahuano, Chile. Written informed consent was obtained from all participants was obtained before the first interview was conducted.

Measurements

Outcome variables

Depression symptoms, anxiety symptoms and well-being were assessed; the first two using the *Symptom Checklist* (SCL-90-R) [41, 42]; a 90-item questionnaire designed to evaluate psychopathological problems on a 5-point scale ranging from 0 (none) to 4 (extreme). Reliability was measured with Cronbach's coefficient (α) ranging from 0.78 to 0.90 and demonstrating factorial invariance in eight of the nine primary symptom dimensions. It also has shown adequate psychometric properties in Chile in younger cohorts, with CFA showing adequate fit indices ($\chi 2 = 50.08$, p. = 0.200; GFI = 0.99; RMR = 0.03; RMSEA = 0.01). The 23-item depression and anxiety subscales had reliability (α) values of 0.85 and 0.80, respectively. Well-being was evaluated using the 11-item remembered well-being subscale of the *Pemberton Happiness Index* [43, 44], which considers different well-being traditions: subjective, eudaimonic and social. It uses a scale from 0 to 10, with 0 being total disagreement and 10 being total agreement. The original Spanish validation showed $\alpha = 0.89$ reliability and inter-item correlations between 0.31 and 0.56 for this subscale, as well as adequate psychometric properties (single factor structure, convergent and incremental validity). In a younger Chilean sample, reliability for this subscale was $\alpha = 0.87$, with adequate CFA indices ($\chi 2 = 2275.39$, p. < 0.001; CFI = 0.93;

TLI = 0.91; RMSEA = 0.08 (90% CI [0.07, 0.09]). The reliability of this subscale in the present study was α = 0.89. The experienced well-being subscale was not used due to nature of the measure, which assesses momentary affective states in real time rather than relying on the memory of these states.

Predictor variables

Information was collected on each interviewee from several sources. The first source was the Preventive Medicine Examination of Older Adults (EMPAM) [40], an annual routine evaluation assessing comprehensive health, functionality, and key risk factors of older adults. The second was the Multidimensional Scale of Perceived Social Support (MSPSS) [45, 46], a 12-item measure of perceived social support, with adequate reliability and a solid factorial structure in older Chilean samples. The reliability in this study was 0.89. Third, the Alcohol Use Disorders Identification Test (AUDIT) [47], which evaluates alcohol consumption. In Chile, it has shown 80% sensitivity and 89% specificity for a cut-off score of nine for harmful consumption and risk of dependence [48]. The reliability in this study was α = 0.69. Fourth, the UCLA Loneliness Scale-3 (ULS-3) [49] which evaluates the subjective experience of loneliness with 20 items across three domains: intimate, relational and collective; validation in older Spanish samples have shown α = 0.95 reliability and adequate construct validity [50]. An abbreviated version of the scale has been used in an older Chilean sample with adequate construct validity and reliability α = 0.84 [51]. The reliability in this study was α = 0.89. The sociodemographic background questionnaire based on the PREDICT Chile questionnaire [52]. The *List of Threatening Experiences* (LTE) [53] was used to assess the absence or presence of 12 individual stressful events in the last 12 months, including those related with health, bereavement, marital and other relationships, work, financial problems, crime/legal and loss of possessions. The reliability test-retest intra-class correlation coefficient (ICC) was 0.86 in a Spanish primary care sample. To identify possible clinical cases; specifically diagnoses of depression and anxiety, the *International Neuropsychiatric Interview* (MINI) [54] was applied. This is a structured interview designed to evaluate the main ICD-10 and DSM-IV diagnostic criteria, which shows adequate levels of reliability and concurrent validity with the SCID and CIDI interviews. This study used modules evaluating anxiety disorder (300.21 and 300.01) and generalized anxiety disorder (300.02). Module E of the International Composite Diagnostic Interview (CIDI) [55] was applied to evaluate major depressive episodes (296.xx), with adequate validity and inter-rater and test-retest reliability [56].

Statistical analysis

A descriptive analysis of both predictor and criterion variables was performed, including an analysis by sex. The relationship between the criterion variables (depression, anxiety, and well-being) was analysed using a latent profile model. In this person-oriented model, the relationship between specific variables can be explained by a categorical, unobservable latent variable for which a finite latent mixture model was determined. For each case, the probability of being correctly assigned to a latent class category was estimated. This approach is particularly useful when it is not expected that all individuals fall on a continuum but rather that specific distributions are expected for variables that reflect the heterogeneity of the group. This heterogeneity is explained by the latent variable, which corresponds to a complex construct—in this case, the health profile—that allows, in a parsimonious way, the explanation of the relationship between the predictors and the criterion variables. This technique offers great flexibility compared to other person-oriented techniques, as it does not assume that the relationship between the criterion variables is the same for all participants, nor does it rigidly classify individuals into groups; instead, it assigns probabilities of belonging to each category [57].

To determine the specific covariance structure of the latent class profile model, the 14 covariance models proposed by Banfield and Raftery were analysed [58], testing solutions ranging from 1 to 9 categories. The model with the lowest BIC was selected, an indicator that balances the fit of the data to the model while penalizing model complexity [see table S1 for BIC models, supplementary material online].

To verify the validity of the solution, the first step was to ensure that the model with the lowest BIC could be clearly interpreted based on differences in the criterion variables. Secondly, to identify the relationship between latent profiles and depressive and anxiety diagnoses, the prevalence of each diagnosis within each latent profile was calculated. To confirm this relationship, logistic regression was performed for each disorder, using the BHS adjustment to account for the predictor being a latent class.

To analyse the relationship between predictors and latent profiles, a multinomial regression with bias reduction was performed using the log-linear Poisson model. A redundancy analysis of the variables was conducted to detect possible multicollinearity using the redun function from the Hmisc package. It was verified that no variable was predicted by the rest of the predictors with an R^2 greater than 90%. The Hosmer-Lemeshow test was used to evaluate the model's fit to the data. Additionally, the Nagelkerke pseudo-R^2 is presented as a numerical indicator of the degree of 'variation' explained by the model,

understood as the difference in the model's likelihood compared to a null model. All analyses were performed in R version 3.6, using the mclust and brglm2 packages.

Results

Five hundred and seventy-three (573) interviews were conducted, with no missing data. The sample was predominantly female (65.4%) and married (52.2%). Marital status differences were observed by gender (χ^2 = 89.643, $p = 0.001$), with a higher percentage of married men (52.2% versus 38.1% among women) and widowed women (32% versus 24% of widowed men). Regarding cohabitation with a partner (χ^2 = 70.461, $p = 0.001$), 80% of men lived as a couple compared to 43.7% of women. 20% of women and 11.6% of men reported sharing housing with grandchildren or great-grandchildren. Women showed higher participation in church and community groups and greater involvement in caregiving for other relatives. The most reported stressful events were a family member's illness (34.7%) and the death of a friend (33.3%), with men experiencing the latter more frequently (39.4%) than women (30.1%) (Table 1).

Men who worked more months in the past year had higher educational levels and reported higher levels of relational and collective loneliness. Meanwhile, women scored higher in perceived social support from others and friends (Table 2).

From the clinical variables, 528 subjects (92.15%) showed no psychiatric diagnosis based on CIDI and MINI evaluations. Forty people had a single diagnosis, mostly GAD (300.02) ($n = 21$; 3.66%, 95% CI: [2.4%; 5.5%]), followed by an MDE (296.2x) ($n = 16$; 2.79%, 95% CI: [1.7%; 4.5%]) and panic disorder (300.01) ($n = 3$; 0.52%, 95% CI: [0.18%; 1.5%]). Comorbidity was observed

Table 1 Categorical predictor variables, by sex and total

Variables	Men		Women		Total		X^2	
	n	%	*n*	%	*n*	%		
Sociodemographic:								
Sex	198	34.6	375	65.4	573	100		
Marital status:								
Widower	17	8.6	120	32.0	137	23.9	X^2=89.289, p=0.001	**
Married	156	78.8	143	38.1	299	52.2		
Never married	7	3.5	55	14.7	62	10.8		
Divorced	18	9.1	57	15.2	75	82.5		
Type of cohabitation (Who do you live with?):								
Couple †	159	80.3	164	43.7	323	56.4	X^2=70.461, p=0.001	**
Children	94	47.5	170	45.3	264	46.1	X^2=0.239, p=0.686	
Parents	4	2.0	7	1.9	11	1.9	X^2=0.016, p=1.000	
Siblings	6	3.0	26	6.9	32	5.6	X^2=3.744, p=0.056	
(Great)grandson	23	11.6	75	20.0	98	17.1	X^2=6.424, p=0.013	*
Other	31	15.7	87	23.2	118	20.6	X^2=4.060, p=0.0439	*
Social participation:								
church	91	46.0	244	65.1	335	58.5	X^2=19.481, p=0.001	**
peer group (MAS program)	25	12.6	73	19.5	98	17.1	X^2=4.277, p=0.063	
In community group	74	37.4	205	54.7	279	48.7	X^2=15.511, p=0.001	**
Caregiver of a family member	21	10.6	87	23.2	108	18.8	X^2=13.437, p=0.001	**
Exposure to stressful events:								
1. Own illness	51	25.8	104	27.7	155	27.1	X^2=0.256, p=0.623	
2. Illness of a family member	66	33.3	133	35.5	199	34.7	X^2=0.260, p=0.647	
3. Death of a loved one	8	4.0	16	4.3	24	4.2	X^2=0.017, p=1.000	
4. Death of a close friend	78	39.4	113	30.1	191	33.3	X^2=5.001, p=0.027	*
5. Separation of the couple	7	3.5	11	2.9	18	3.1	X^2=0.154, p=0.800	
6. Breakup of a stable relationship	5	2.5	6	1.6	11	1.9	X^2=0.589, p=0.566	
7. Serious problem with a friend or close friend	14	7.1	29	7.7	43	7.5	X^2=0.082, p=0.861	
8. Unemployment or unsuccessful job search	8	4.0	7	1.9	15	2.6	X^2=2.402, p=0.182	
9. You have been fired from your job †	-	-	2	0.5	2	0.3	X^2=1.060, p=0.544	
10. Serious economic crisis	24	12.1	51	13.6	75	13.1	X^2=0.249, p=0.708	
11. Problems with the police or justice	4	2.0	8	2.1	12	2.1	X^2=0.008, p=1.000	
12. Victim of theft	18	9.1	39	10.4	57	9.9	X^2=0.248, p=0.666	
13. Another type of problem	6	3.0	26	6.9	32	5.6	X^2=3.744, p=0.049	*

Notes. * $p < 0.05$ ** $p < 0.01$. Chi-square test calculated using Monte-Carlo simulation, for 2000 samples. † Not used in subsequent analyses

Table 2 Numerical predictor variables, by sex and total

Variable	Men ($n=198$)		Women ($n=375$)		Total ($n=573$)		U Mann-Whitney			d
	M	DE	M	DE	M	DE	U	*p*		
Age	72.18	4.17	71.61	4.16	71.8	4.17	40147.50	0.108		0.14
Number of children	3.13	1.77	2.98	1.85	3.03	1.82	39484.00	0.203		0.08
Months worked last year	2.88	4.91	1.51	3.84	1.99	4.28	42422.00	< 0.001	**	0.32
Years of study	10.26	4.38	8.68	4.44	9.23	4.48	44483.00	< 0.001	**	0.36
Satisfaction variables:										
With coexistence[a]	4.23	0.82	4.07	1.01	4.12	0.95	34622.50	0.156		0.17
With partner[b]	4.17	1.12	3.99	1.33	4.08	1.28	14938.5	0.21		0.18
With income[c]	2.75	0.62	2.74	0.64	2.75	0.63	37822.00	0.667		0.01
Perceive general health[a]	3.56	0.74	3.43	0.78	3.47	0.77	40143.50	0.081		0.17
Perceived social support[d]:										
Support from family and significant other	3.17	0.78	3.30	0.81	3.25	0.80	32198.0	0.008	**	0.17
Support from Friends	2.22	1.12	2.64	1.21	2.49	1.19	29956.00	< 0.001	**	0.36
Loneliness[e]										
Intimate	1,77	0,56	1,79	0,65	1.78	0.62	38002.00	0.64		0,02
Relational	1,60	0,54	1,46	0,54	1.51	0.54	43616.50	< 0.001	**	0,25
Collective	1,72	0,56	1,57	0,56	1.62	0.57	43115.00	< 0.001	**	0,27

Notes. [a]: Scale from 1 to 5, where 1. Very dissatisfied and 5. Very satisfied. [b]: Men $n=169$, Women $n=165$. [c]: Scale from 1 to 4, where 1: Very bad and 4: Very good. [d]: Scale from 1 to 4, where 1: Almost never and 4: Always or almost always. [e]: Scale from 1 to 4, where 1: Never and 4: Many times. * $p<0.05$ ** $p<0.01$

Table 3 Model fit indices by latent profiles

Profile	Probability		A Posteriori probability mean			
	Expected	Observed	G1	G2	G3	G4
G1: Healthy	0.15	0.16	**0.89**	0.07	0.02	0.02
G2: MMH– Anx	0.22	0.24	0.02	**0.74**	0.16	0.08
G3: MMH + Anx	0.34	0.32	0	0.06	**0.83**	0.11
G4: Distress	0.29	0.28	0	0.04	0.12	**0.84**

Notes. MMH - Anx: Moderate mental health with lower anxiety. MMH + Anx: Moderate mental health with higher anxiety. GAD: Generalized anxiety disorder

in five cases, specifically MDE and GAD ($n=4$; 0.69%, 95% CI: [0.27%; 1.78%]) as well as one case of MDE and panic disorder ($n=1$; 0.18%, 95% CI: [0.03%; 0.98%]).

When analysing the criterion variables, well-being had an average of M = 8.45 (SD = 1.40). Using the categories of Hervás and Vázquez [43], a high proportion of participants ($n=364$, 63.5%) reported high levels of well-being, while medium ($n=111$, 19.4%) and low ($n=98$, 17.1%) levels were observed in similar proportions. Regarding the symptom scales, the mean of the SCL-Anxiety scale was M = 1.60 (SD = 0.63), while the SCL-Depression scale reached M = 1.79 (SD = 0.68). When analysing the differences by sex, the average well-being was higher in women (M = 8.47, SD = 1.37) versus (M = 8.4, SD = 1.37); however, this difference was not statistically significant (t (411.1) = 0.57, $p=0.57$, d = 0.05). On the symptom scales, there was a statistically significant difference (t(466.2) = 4.19, $p<0.001$, d = 0.35) in the mean anxiety scores which were higher in women (M = 1.67; SD = 0.66) than in men (M = 1.46; SD = 0.55), and although more depressive symptomatology was observed in women (M = 1.83; SD = 0.70) versus (M = 1.72; SD = 0.64), this difference was not significant (t(433.4) = 1.84, $p=0.07$, d = 0.16).

Identification of latent profiles. Analysis of groups

After selecting the number of groups and the model type using BIC, four profiles were identified. Table 3 displays the theoretical and observed probabilities of belonging to each group, thereby considering an integrated mental health profile. It also shows the average posterior probability of cases belonging to their assigned group. Notably, the model exhibits the highest discrimination for Group 1 (89%), followed by Group 4 (84%) and Group 3 (83%). Group 2 (74%) has the lowest discriminative capacity, with cases assigned to this group having a 16% probability of belonging to Group 3.

Describing the four identified profiles based on mean scores of well-being, depressive symptoms, and anxiety symptoms (Table 4), Group 1 (15%) termed *healthy* exhibited positive mental health indicators with higher well-being and lower depressive and anxiety symptoms. No participant in this group presented with a psychiatric diagnosis. Group 2 (22%), termed *moderate mental health with lower anxiety*, had the second-highest mean well-being score, lower anxiety than Group 3 and 4, but similar depressive symptoms to Group 3. This group had one case of MDE and GAD. Group 3 (34%), termed *moderate mental health with higher anxiety*, was the largest

Table 4 Four-latent-profile model of mental health: mean and standard deviation for items of depression and anxiety symptoms and remember well-being, by profile

Profile	Remembered Well-Being		Anxiety		Depression		Clinical Diagnosis		
	M	SD	M	SD	M	SD	Depression	GAD	Panic Disorder
G1: Healthy	9.68[a]	0.31	1.02[a]	0.04	1.17[a]	0.17	-	-	-
G2: MMH– Anx	8.94[b]	0.79	1.20[b]	0.14	1.48[b]	0.30	1(0.7%)	1(0.7%)	-
G3: MMH + Anx	8.36[c]	1.25	1.71[c]	0.39	1.58[b]	0.33	1(0.5%)	5(2.7%)	1(0.5%)
G4: Distress	7.41[d]	1.58	2.15[d]	0.78	2.68[c]	0.57	19 (12.0%)	19(12%)	3(1.9%)
ANOVA	$F(3,569) = 84.78$ **		$F(3,569) = 156.8$**		$F(3,569) = 407.0$ **				

Notes. MMH - Anx: Moderate mental health with lower anxiety. MMH + Anx: Moderate mental health with higher anxiety. GAD: Generalized anxiety disorder. Different lowercase letters indicate significant difference at the 5% level using Tukey's HSD method. ** $p < 0.05$

Table 5 Mutinomial regression model: explained variance and significance of predictors set

Predictors set	Nagelkerke's R^2	d R^2 total	AIC	BIC	LRT	
Total	0.58	--	1381.52	2086.36	$X^2(159) = 498.48$	$p < 0.001$
Loneliness	0.48	0.18	1492.35	2158.03	$X^2(9) = 128.831$	$p < 0.001$
Stressful events	0.53	0.08	1373.31	1921.52	$X^2(36) = 63.791$	$p = 0.003$
Satisfaction with family life	0.55	0.05	1366.24	1953.61	$X^2(27) = 38.724$	$p = 0.067$
Other Demographics	0.56	0.04	1359.40	1946.77	$X^2(27) = 31.883$	$p = 0.236$
Satisfaction with health status	0.56	0.03	1385.55	2051.24	$X^2(9) = 22.039$	$p = 0.009$
Sex	0.57	0.02	1394.47	2086.26	$X^2(3) = 18.955$	$p < 0.001$
Household members	0.57	0.02	1365.72	2005.30	$X^2(15) = 14.2$	$p = 0.510$
Economics status	0.57	0.01	1368.96	2021.59	$X^2(12) = 11.44$	$p = 0.492$
Social participation	0.57	0.01	1366.93	2019.56	$X^2(12) = 9.409$	$p = 0.668$
Age	0.58	0.01	1381.88	2073.67	$X^2(3) = 6.368$	$p = 0.095$
Social Support	0.58	0.01	1375.68	2054.41	$X^2(6) = 6.159$	$p = 0.406$

Notes. AIC: Akaike Information Criterion. BIC: Bayesian Information Criterion. LRT: Likelihood Ratio Test. Other Demographics include: Marital status, number of children, years of study, and months worked in the last year

and had lower well-being and higher anxiety symptoms than the previous groups, sharing similar depressive symptoms with Group 2. Diagnoses in this group included one case of MDE, one case of panic disorder, and five cases of GADs. Group 4 (29%), termed *distress*, displayed the poorest mental health indicators with the lowest well-being and the highest anxiety and depression symptoms. This group comprised most diagnosed individuals, with 19 cases of MDE, 19 GAD, and three cases of anxiety disorder. Figure S1 shows the relationship between the presence of anxiety and depression symptoms, latent profiles, and cases with a positive psychiatric diagnosis. All profiles, except for *distress*, exhibited average levels of well-being within the range considered indicative of high well-being [44]. The *distress* profile showed an average well-being value within the moderate range. Regarding anxiety and depression, only the *distress* profile had an average per-item score exceeding 2.

Considering 38 predictor variables classified into 11 groups (age, sex, other demographics, loneliness, stressful events, satisfaction with family life, satisfaction with health status, household members, economic status, social participation, and social support), Table 5 shows the results from a multinomial regression model for the observed latent profiles. It should be noted that the model is considered appropriate because, first, it significantly predicts the latent profile, X^2 (159) = 498.48, $p < 0.001$, with a Nagelkerke pseudo- R^2 of 0.58, and second, it adequately fits the data, as indicated by the Hosmer-Lemeshow test, X^2 (24) = 28.271, $p = 0.2488$. Significant predictor groups include loneliness (X^2 (9) = 128.831, $p < 0.001$), stressful events (X^2 (36) = 63.791, $p = 0.003$), satisfaction with health status (X^2 (9) = 22.039, $p = 0.009$), and sex (X^2 (3) = 18.955, $p < 0.001$). [see table S2 for odds ratios from the multinomial regression model, supplementary material online]. Taking *distress* group as a reference, greater intimate loneliness decreases the odds of belonging to the *healthy* group (OR = 0.02), as well to *moderate mental health with lower anxiety* (OR = 0.16) and *moderate mental health with higher anxiety* (OR = 0.22). The presence of stressful events, such as one's own illness, decreases the probability of belonging to *moderate mental health with higher anxiety* (OR = 0.49) and *healthy* (OR = 0.25), while an economic crisis reduces the probability of belonging to the *healthy* group (OR = 0.04). Higher satisfaction with health status increases the odds of being in non-distress categories, especially in *moderate mental health with lower anxiety* (OR = 4.96). Regarding gender, women have lower odds of being in the *healthy* group (OR = 0.27).

Discussion

The main objective of this study was to identify latent mental health profiles in elderly individuals at primary health care centres, considering self-reported anxiety and depression symptoms, perceived well-being, and predictive variables.

The results confirm the lower morbidity of common mental disorders in this population, a finding consistent with previous population studies in diverse countries, including Chile [59, 60]. At the same time, most participants reported high well-being, reflecting a stage of life where positive mental health can be experienced.

Four profiles of combined mental health were identified. Slightly more than one-third of the participants corresponded to the profile of *moderate mental health with higher anxiety*. A little less than one-third was characterized by a profile of *distress*, with the lowest well-being and the highest anxiety and depression symptoms. As expected, this profile concentrated the highest proportion of individuals experiencing a common mental disorder. A quarter of the participants corresponded to the *moderate mental health with lower anxiety* profile, and close to one-sixth were categorized as *healthy* with high well-being and minimal psychological symptoms.

Observing how individuals are grouped based on their levels of well-being and distress reveals a configuration where the dimensions of distress/mental disorder and mental health/well-being are not as independent as proposed by the Dual Continua Model [61, 62]. Rather, they show more association with higher levels of well-being accompanying lower levels of distress (symptoms and/or diagnoses) and vice versa. The observed configuration in this sample of older adults could be interpreted as a gradient of combined mental health, ranging from high symptom levels, and suffering to their absence, alongside high well-being.

The replicability of the Dual-Factor model of mental health depends on the specific indicators of mental health problems and positive mental health that are considered in studies, as well as the analytical strategy employed. Most studies are conducted using theoretically predefined groupings and dichotomize measures of well-being and distress for this purpose. However, there is a growing trend favouring latent analyses, such as the one used in this study [63]. This context makes comparisons across studies challenging. An interesting result is that our findings place most of the studied population in moderate mental health profiles, with high well-being levels but some degree of anxiety or depressive symptoms. One of the few identified studies that used latent profile analysis on an adult population rather than focusing solely on children or youth, also identified four profiles [64]. That study was conducted on a working-age population in China, identified three profiles analogous to ours in terms of characteristics and proportions: a complete mental health group (comparable to the *healthy* profile in this study), which encompassed slightly more than one-fifth of the population; a symptomatic but content group (comparable to our two *moderate mental health* profiles), and a troubled group (comparable to our *distress* profile). However, unlike our study, they also identified a vulnerable group, with low well-being and low symptomatology, comprising one-fifth of their sample. A recent systematic review concluded that among older adults, belonging to a moderate mental health group is more common than being either the complete mental health or complete mental illness groups [63]. In our study, the obtained model distinguishes individuals with moderate mental health, with anxious symptomatology emerging as a key differentiating factor.

Various factors were associated with the identified mental health profiles, including loneliness, perceived stress (economic and health-related), satisfaction with general health, and female sex. This highlights the role of close interpersonal relationships and primary ties in the life satisfaction of older adults. Regarding intimacy versus loneliness/isolation, the multivariate analysis does not provide evidence on the influence of common variables such as social support or major stressors such as caregiving responsibilities, illness, or death of a loved one in this group. Analysing the relationship between social support and loneliness is particularly intriguing. In bivariate analyses, social support was associated with belonging to high well-being groups. However, this impact diminished when the perception of loneliness is included. This suggests that the quality of intimate relationships may be more important than the functional aspects of social connections in this sample. Exploring risk and protective factors further could help clarify whether perceived isolation mediates the moderating effect of social support on stress, as indicated by some studies [65, 66]. This relationship is particularly relevant, as our study found no individuals who simultaneously experienced high loneliness, high well-being, and few symptoms. Thus, Programs for older individuals should not only promote social participation but also ensure the quality of intimate relationships.

The levels of perceived physical health in the participants were relatively high, although nearly one-third reported having a chronic disease. The presence of diseases itself did not show predictive capacity. Instead, consistent with previous research [37, 66, 67], the perception of general health and the impact of serious illness significantly influenced well-being in older adults. Although illness is common in this age group, protecting and enhancing aspects such as the perception of general health, vitality, and functionality remains essential. Special support should be provided to older adults with

serious illnesses, using effective prevention programs [68].

From the results of this study, some considerations can be drawn regarding the care of well-being and mental health in the older adult population. First, the need to prioritize attention to that third of individuals who belong to the *distress* profile. Many of these individuals experience significant symptoms of anxiety and depression, and approximately one-quarter meet the criteria for a depressive or anxiety disorder. For this group, indicated preventive actions, psychosocial interventions, and medical treatment (when necessary) should be considered. Psychotherapeutic interventions tailored for older adults have demonstrated effectiveness comparable to other age groups. Additionally, actively identifying those with unrecognized mental health needs and enhancing social support are other strategies that prove valuable [69].

In contrast, mental healthcare response for meeting the needs of profiles with *moderate mental health* is not very clear. While these individuals do not report elevated symptoms, not all can be classified as having good mental health. In particular, some participants in the *moderate mental health with higher anxiety*, where some participants exhibited high levels of anxiety, reaching clinical thresholds in a few cases, potentially impacting daily functioning [8]. Preventive actions and psychosocial interventions, and in some cases medical treatment, might be beneficial for some individuals within these profiles.

The promotion of well-being and mental health among older adults is a relevant objective that could potentially benefit this entire population group. Actions aimed at improving or enhancing living conditions, developing age-friendly environments, expanding education and recreation opportunities, encouraging physical activity, strengthening healthcare systems, and improving the quality of residential care programs are among the actions with the greatest potential impact [70]. Our results highlight the detrimental effects of loneliness, suggesting that policies and programs that strengthen and foster social integration are particularly important [71]. Although broad promotional efforts can have preventive effects, additional measures remain necessary.

Limitations and projections

This study is among the few in low- and middle-income Latin American countries examining older individuals by evaluating both depressive and anxious symptoms alongside well-being to form a comprehensive measure of mental health. Even though a convenience sampling method was used, participants who met the inclusion criteria were randomly selected before being contacted. Both characteristics could positively influence the representativeness of the sample. However, this study has the following limitations: The cross-sectional data of the study impedes any causality inference from the results, also, the data from the convenience sample excluded severe psychiatric cases. And, although it lacks an objective measure for the assessment of health status, such as clinical measures, does include data from the health registries on the most common diseases at this stage of life. Another limitation is the study was carried in a primary care population, which may limit the generalizability of the findings to other populations, despite the fact that 84,9% of older adults in Chile are primary care users [72]. Finally, another limitation regards the use of scales that have not been validated in Chile, while others have been validated in Chile but not specifically in older adults' samples. This may also reduce generalizability and complicate comparisons with other studies.

The role of intimate loneliness as a predictor of combined mental health in older individuals underscores the need to further investigation into its functions and impact on risk and protective mechanisms. This includes analysing its potential associations with social support and satisfaction with cohabiting relationships. A similar challenge arises in comprehending processes involving objective physical health data, the stressor 'living with a serious illness 'and overall health perception. This approach allows for a deeper exploration of processes beyond isolated diagnoses, whether related to physical health or mental conditions. It also facilitates a more holistic understanding of the processes and interactions associated with well-being, satisfaction with living conditions, and perceived loneliness. Moreover, this perspective supports the development of more effective interventions aimed at improving the health and well-being of older individuals. Future studies should also explore the role of spirituality in older adults in Latin American countries such as Chile, as it may serve as either a protective or risk factor for psychological distress [73].

Conclusions

This study identified four distinct profiles of combined mental health: *healthy*, *moderate mental health with lower anxiety*, *moderate mental health with higher anxiety*, and *distress*. The key predictors for these profiles included loneliness, stressful events, satisfaction with health status, and sex.

In PHC settings, these profiles provide valuable insights for customizing public mental health interventions to address the unique characteristics and specific needs of each group. The findings highlight the critical role of anxiety in distinguishing between healthy and distressed mental health among older adults. Mental health professionals in this field should prioritize the early detection

and effective treatment of anxiety symptoms to prevent more severe mental health outcomes in this population.

Abbreviations

PHC	Primary healthcare centres
CMI	Complete mental illness
CMH	Complete mental health
EMPAM	Annual Preventive Medicine Examination of Older Adults
SCL-90-R	Symptom Checklist
MSPSS	Multidimensional Scale of Perceived Social Support
AUDIT	Alcohol Use Disorders Identification Test
ULS-3	UCLA Loneliness Scale-3
LTE	List of Threatening Experiences
MINI	Mini International Neuropsychiatric Interview
ICD-10	The International Classification of Diseases, Tenth Revision
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders
SCID	Structured Clinical Interview for DSM
CIDI	Composite International Diagnostic Interview
MDE	Major Depression Episode
GAD	General Anxiety Disorder
BIC	Bayesian information criterion
ICC	Intra-class correlation coefficient

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12877-025-05903-y.

Supplementary Figure 1: Relationship between Latent Profiles (Well-being, Depressive Symptomatology, Anxious Symptomatology) and Psychiatric Diagnosis

Supplementary Table 1: Mental Health Profiles

Supplementary Table 2: Mental Health Profiles

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Author contributions
S. Saldivia and F. Cova designed the study, supported by C. Inostroza and C. Bustos. F. Cova and J. Aslan were involved in the selection of measurements; J. Aslan and A. Castillo-Carreño supervised data collection; C. Bustos and J.Aslan performed the statistical analysis, tables and figures; S. Saldivia drafted the manuscript; F. Cova, C. Inostroza, C. Bustos, J. Aslan, and A.Castillo-Carreño reviewed the draft.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Ethics Committee of Health Services of Concepción (CEC 17-09-53 in 04/03/2018) and Talcahuano (Act 66 from 07/04/2017), Chile. Written informed consent from all participants was obtained before the study began. All procedures performed in this study complied with the WMA Declaration of Helsinki.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

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