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ORIGINAL ARTICLE

The "bubbles"-study: validation of ultra-short scales for the assessment of positive mental health, life satisfaction, and perceived social support

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Abstract

Aim The positive dimension of mental health should be considered to assess the complete state of a person's mental health and to protect it. Very brief valid screening instruments implemented in general mental health programs and in therapeutic setting are supportive tools hereby. In the present work, we aimed to develop such tools.

Subject and methods In two studies (Study 1: $N = 1{,}004$; Study 2: $N = 1{,}000$) on representative German population samples, we developed and validated three ultra-short scales – the "bubbles" – that consist of only one item per construct based on Positive Mental Health Scale (PMH-Scale; Lukat et al. 2016), Satisfaction with Life Scale (SWLS; Diener et al. 1985), and Social Support Questionnaire (F-SozU K-6; Lin et al. 2019) for the assessment of the positive mental health dimension. The bubbles are designed in a graphical/visual format.

Results The results of Study 1 and Study 2 revealed that the bubbles are valid instruments that fit the original instruments on the factor level; the bubbles mostly replicated their association pattern with demographic variables, and with variables that belong to the negative and the positive dimension of mental health.

Conclusions The shortness of the bubbles prevents participants' fatigue and motivation decrease. Thus, due to their time- and cost-efficiency, the bubbles can be used as brief screening tools in research (e.g., large-scale studies, longitudinal studies, experience sampling paradigms) and in praxis (e.g., mental health programs). Future research should validate the bubbles in clinical context and cross-national.

Keywords Bubble · Positive mental health · Life satisfaction · Perceived social support · Validation

Introduction

Following dual-factor models (Suldo and Shaffer 2008), mental health consists of two distinct but interrelated dimensions: positive dimension and negative dimension (Keyes 2005). A status of complete mental health is described by a low level of the negative dimension and a high level of the positive dimension (Keyes 2007). To assess the overall level of a person's mental health, both dimensions should be likewise considered (Antaramian et al. 2010; Keyes et al. 2002). However, a lot of research in the past years focused only on the negative dimension neglecting the positive one which contributed to an incomplete understanding of mental health and of the steps required for its improvement (Teismann et al. 2018a; Trompetter et al. 2017).

Against this background, it is of great importance to provide researchers and practitioners with validated instruments for the assessment of the positive dimension in mental health screenings. The significance and urgency of such instruments is emphasized by the fact that one of every eight people in the world suffers from a low level of mental health (World Health Organization 2022). Therefore, persons at risk for a high level of the negative dimension of mental

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health and a low level of its positive dimension should be identified at an early stage to prevent a further deterioration of the mental health status. To efficiently achieve this, we need very brief and valid screening tools that can be implemented in general mental health programs and in the therapeutic setting.

While the negative dimension of mental health is often described as high levels of for example symptoms of depression, anxiety and stress, the positive dimension is typically characterized by well-being, life satisfaction, positive emotions, resilience, self-efficacy, optimism, and perception of social support (Keyes et al. 2012; Gamm et al. 2010). Several instruments were proposed for the assessment of the positive dimension. One of them is the Positive Mental Health Scale (PMH-Scale; Lukat et al. 2016). The PMH-Scale is a well-established instrument for the assessment of emotional, cognitive, social, and psychological well-being. Recent research validated this 9-item instrument in various countries and languages and reported its cross-cultural measurement invariance (Cai et al. 2017; Truskauskaite-Kuneviciene et al. 2020; Velten et al. 2022). Other studies assessed the positive dimension of mental health by an older instrument – the Satisfaction with Life Scale (SWLS; Diener et al. 1985). This instrument measures life satisfaction with five items. Its measurement invariance has been confirmed by quantitative and qualitative research (Bieda et al. 2017; Brailovskaia et al. 2022). Research that rather emphasized the social characteristic of the positive dimension, assessed it by social support scales such as the Social Support Questionnaire (F-SozU K-14; Fydrich et al. 2009) or its brief form (F-SozU K-6; Lin et al. 2019) that focus on anticipated or perceived support received from the social network. Both showed good cross-cultural validity and measurement invariance (Bieda et al. 2017; Brailovskaia et al. 2022). To assess the various factettes of the positive dimension of mental health, it has been recommended to include all these instruments in a data collection (Bieda et al. 2017; Lamers et al. 2015; Margraf et al. 2020b). Notably, the described instruments assess the positive mental health dimension by five to 14 items (20 to 28 items when using all instruments in the same data collection) that focus on PMH, life satisfaction and social support which is short – but not ultra-short.

Available literature emphasized that ultra-short instruments are single-item scales (Milton et al. 2011; Robins et al. 2001). Single-item scales have some shortcomings such as simplifying multidimensional topics and not being able to assess fine-grained differences between individuals (Nunnally and Bernstein 1994). However, there are also remarkable advantageous. The single-item instruments are extremally time-saving. Therefore, they prevent participants' fatigue and a decrease of motivation (Konrath et al. 2014). This is of advantage for brief screenings in clinical settings where patients often display a low attention span. Furthermore, longitudinal studies with several measurement points and large-scale representative research can benefit from the shortness of such time- and cost-efficient instruments. Available literature presented single-item scales that assess constructs such as narcissism (Konrath et al. 2014), self-esteem (Brailovskaia and Margraf 2020), risk-taking (Szrek et al. 2012), need to belong (Nichols and Webster 2013), fear of missing out (Riordan et al. 2018), and happiness (Abdel-Khalek 2006). Those scales have adequate psychometric properties and show similar valid results as the constructs' long-version measures.

Against this background, we aimed to develop and validate ultra-short scales that consist of only one item based on the PMH-Scale, SWLS, and F-SozU K-6 for a time-efficient assessment of PMH, life satisfaction, and perceived social support. Therefore, we conducted two studies with population representative samples in Germany as part of a large ongoing project that investigates mental health factors.

In Study 1, we developed three ultra-short scales termed as "PMH bubble", "life satisfaction bubble", and "social support bubble". Notably, it is complicated to formulate a single comprehensible sentence or question that encompasses as many facets of the assessed construct as possible. Therefore, single-item instruments that consist of only one sentence or question have been criticized to lose information of the assessed construct (Nunnally and Bernstein 1994). Furthermore, some people – due to health-related issues – cannot read, concentrate on, and understand complicated sentences. To address these challenges, we designed the bubbles in a graphical/visual format. This innovative format should allow the inclusion of as much content from the original instrument's items as possible, on the one hand. On the other hand, it should provide a presentation of the content that is easily accessible cognitively. Also in Study 1, we provided the first step for the assessment of the bubbles' validity. First, we investigated by exploratory factor analyses (EFAs) whether each bubble belongs to the same factor as the corresponding items of the original scale. Second, we investigated whether the bubbles exhibit a similar correlation pattern as the original scales with demographic variables (age, gender, social status), variables of the positive dimension of mental health (PMH, life satisfaction, perceived social support), those of the negative dimension (depression, anxiety, and stress symptoms), self-esteem and physical health.

It is worth noting that previous research has reported inconclusive findings regarding the relationship between the positive dimension of mental health and age. Considering PMH, some studies described higher levels in older people than in younger ones (Lukat et al. 2016; Velten et al. 2018); other found no significant associations between PMH and age (Askari et al. 2021; Chuang et al. 2021); and some studies reported a negative link (Lavallee et al. 2019; Margraf

et al. 2016). Life satisfaction was not significantly associated with age in some research (Glaesmer et al. 2011); other studies showed an u-shaped association between life satisfaction and age (De Ree and Alessie 2011). Some research described that perceived social support decreased with increasing age (Prezza and Giuseppina Pacilli 2002); other research showed no significant age-related differences (Sarriera et al. 2012). Also, inconclusive findings were reported for the association between the positive mental health dimension and gender. Some studies reported higher PMH levels in male persons (Chow and Choi 2019; Lukat et al. 2016); others found higher levels in female persons (Asiamah et al. 2021; Chuang et al. 2021); and yet other studies reported no significant relationship between PMH and gender (Bekalu et al. 2019; Çeçen and Vatandaşlar 2021; Crisci et al. 2021; Margraf et al. 2020b). Considering life satisfaction, no significant gender differences were found in some research (Glaesmer et al. 2011); others reported higher life satisfaction in female persons (Joshanloo and Jovanović 2020). Female persons perceived more social support than male persons (Talwar et al. 2013; De la Iglesia et al. 2014). Furthermore, PMH, life satisfaction, and perceived social support were positively associated with social status (Daraei and Mohajery 2013; Businelle et al. 2014; Wang et al. 2023). Previous research described a positive association between PMH, life satisfaction, and perceived social support (Bieda et al. 2017); people with a high self-esteem showed high levels of PMH, life satisfaction and perceived social support (Lukat et al. 2016; Brailovskaia and Margraf 2016); there was a positive link between physical health and the three positive variables (Siahpush et al. 2008; Brouwer et al. 2010); and all three positive variables were negatively related to depression, anxiety and stress symptoms that represent the negative dimension of mental health (Brailovskaia et al. 2018; Lin et al. 2019; Precht et al. 2021; Teismann et al. 2018b).

Study 2 replicated and extended the findings of Study 1. Notably, an EFA and a confirmatory factor analysis (CFA) should not be calculated with the same sample (Field 2013; Schmitt 2011). Against this background, we used the sample of Study 2 to replicate the unidimensional factor structure of the original instruments including the corresponding bubble by the calculation of CFAs. Then, we focused again on the associations of the bubbles in comparison to the original instruments. Hereby, we extended the examination of the validity of the bubbles by the inclusion of the variables sense of control and loneliness. Sense of control is an important human need (Southwick and Southwick 2018). High levels of the control are often accompanied by high levels of PMH, life satisfaction and perceived social support (Precht et al. 2021; Skaff 2007). In contrast, loneliness is negatively associated with the three positive variables (Mellor et al. 2008; Wang et al. 2018).

Methods

For both studies, data were collected in June and July 2023 by an independent social marketing and research institute (Study 1: Talk Online, www.talkonlinepanel.com/de; Study 2: INSA, https://www.insa-consulere.de/) via a population-based online-panel survey. The institutes recruited the participants from the German residential population aged 18 years and above. Representativeness was achieved by the implementation of age, gender, and region/federal state stratification. Participation was compensated by panel-specific tokens. They can be converted in voucher or monetary payment. There were no specific requirements for participation. All participants were properly instructed and gave online their informed consent to participate. The present study's implementation has been approved by the Ethics Committee of the Faculty of Psychology of the Ruhr-Universität Bochum, Germany (application number: 20110512). The study was pre-registered with AsPredicted.org on May 03, 2023 (Pre-registration Number: #130926). All national regulations and laws regarding human subjects research were followed. The study was conducted in accordance with the Declaration of Helsinki. All data sets used in the present study were complete.

Procedure and participants

In Study 1, 1,166 persons started the survey and 162 (13.9%) dropped out. Thus, the sample of Study 1 included 1,004 participants from Germany. In Study 2, 1,870 persons started the survey and 870 (46.5%) dropped out. Thus, the sample of Study 2 consisted of 1,000 participants from Germany. Table 1 shows both samples' demographics.

Measures

Demographics Participants indicated their gender, age, marital status, occupation, living environment, and social status (see Table 1).

Positive Mental Health (PMH) The unidimensional Positive Mental Health Scale (PMH-Scale; original German language version: Lukat et al. 2016) assessed the level of PMH. The nine items are rated on a 4-point Likert-type scale (e.g., "I enjoy my life"; 0 = *do not agree*, 3 = *agree*). Higher sum scores indicate higher levels of PMH. The total sum score can range from zero to 27. In both studies, current scale reliability was, respectively, Cronbach's $\alpha = .932$.

Life satisfaction We used the unidimensional Satisfaction with Life Scale to measure life satisfaction (SWLS; original

Table 1 Demographic variables of Study 1 and Study 2

	Study 1 ($N=1{,}004$)	Study 2 ($N=1{,}000$)
Age (years)		
M (*SD*; Min–Max)	49.45 (17.10; 18–87)	49.04 (16.75; 18–87)
Gender, n (%)		
Women	512 (51.0)	519 (51.9)
Men	492 (49.0)	481 (48.1)
Marital Status, n (%)		
Single	269 (26.8)	243 (24.3)
Romantic relationship, not married	160 (15.9)	142 (14.2)
Married	429 (42.7)	460 (46.0)
Widowed, divorced	146 (14.5)	155 (15.5)
Occupation, n (%)		
Student	91 (9.1)	49 (4.9)
Employee	582 (58.0)	604 (60.4)
Unemployment	55 (5.5)	68 (6.8)
Retire	276 (27.5)	279 (27.9)
Living Environment, n (%)		
Large city	351 (35.0)	384 (38.4)
Small city	409 (40.7)	394 (39.4)
Rural community	244 (24.3	222 (22.2)
Social Status, n (%)		
Lower class	77 (7.7)	70 (7.0)
Working class	166 (16.5)	176 (17.6)
Lower middle class	241 (24.0)	239 (23.9)
Middle middle class	413 (41.1)	386 (38.6)
Upper middle class	99 (9.9)	117 (11.7)
Upper class	8 (0.8)	12 (1.2)

Study 1 and Study 2: There were no "gender divers" participants; due to rounding, the sum of the frequencies is not always 100%

version: Diener et al. 1985; German version: Glaesmer et al. 2011). The five items of this unidimensional instrument are rated on a 7-point Likert-type scale (e.g., "In most ways, my life is close to my ideal"; 1 = *strongly disagree*, 7 = *strongly agree*). Current scale reliability was $\alpha_{Study1} = .945$ and $\alpha_{Study2} = .919$. The higher the sum score, the higher the level of life satisfaction. The total sum score can range from five to 35.

Perceived social support The brief version of the Social Support Questionnaire (F-SozU K-6; original German language version: Lin et al. 2019) measured anticipated or perceived support received from the social network. The six items of this unidimensional instrument (e.g., "I experience a lot of understanding and security from others") are rated on a 5-point Likert-type scale (1 = *not true*, 5 = *true*). Higher sum scores indicate higher levels of social support. The total sum score can range from 5 to 30. Current scale reliability was $\alpha_{Study1} = .920$ and $\alpha_{Study2} = .900$.

Bubbles: positive mental health, life satisfaction, social support We developed, the PMH bubble based on the items of the PMH-Scale (Lukat et al. 2016), the life satisfaction bubble based on the SWLS (Glaesmer et al. 2011), and the social support bubble based on the F-SozU K-6 (Lin et al. 2019) in Study 1. By the implementation of expert reviews by two psychology trained professionals, who evaluated the appropriateness of context, conciseness and wording, each item of the PMH-Scale, the SLWS and the F-SozU K-6 was shortened to one word or a brief phrase consisting of several words (e.g., PMH bubble: "carefree", "joy", "calm and balance"; life satisfaction bubble: "satisfaction", "excellent life conditions", "almost perfect"; social support bubble: "understanding and security", "person of trust", "support-on-demand"; see Table 2). Due to the very similar content, Items 3, 5, and 6 of the PMH-Scale were summed up to one bubble term; Item 2 and 6 of the F-SozU K-6 were summed up to one bubble term; for Item 5 of the F-SozU K-6, two words were assigned – the first word was the same as the

Table 2 Content of the Positive Mental Health Bubble, Life Satisfaction Bubble, and Social Support Bubble in relationship with the original items of the Positive Mental Health Scale (PMH-Scale; Lukat et al. 2016), the Satisfaction with Life Scale (SWLS; original version: Diener et al. 1985; German version: Glaesmer et al. 2011), and the Social Support Questionnaire (F-SozU K-6; original German language version: Lin et al. 2019)

Original Item	Wording of the Bubble
Positive Mental Health Scale (PMH-Scale)	*PMH Bubble*
Item 1	carefree [Item 1]
Item 2	pleasure of life[Item 2]
Item 3	life satisfaction [Item 3, 5, 6]
Item 4	confidence[Item 4]
Item 5	
Item 6	
Item 7	management of difficulties[Item 7]
Item 8	joy[Item 8]
Item 9	calm and balance[Item 9]
Satisfaction with Life Scale (SWLS)	*Life Satisfaction Bubble*
Item 1	satisfaction[Item 1]
Item 2	excellent life conditions[Item 2]
Item 3	almost perfect[Item 3]
Item 4	get the important things [Item 4]
Item 5	would change almost nothing[Item 5]
Social Support Questionnaire (F-SozU K-6)	*Social Support Bubble*
Item 1	understanding and security[Item 1]
Item 2	person of trust [Item 2, 6]
Item 3	support on-demand [Item 3, 5]
Item 4	acquaintances[Item 4]
Item 5	friends[Item 5]
Item 6	

one for Item 3, the second word was for Item 5 only. Then, the words/phrases that belong to a scale were included in a visual bubble (see Fig. 1 for the original German language bubbles and Fig. 2 for the English language bubbles). The positioning of the words/phrases in a bubble followed mostly the order of the items in the original instrument. For the PMH bubble, participants had to rate how much/how often the overall content of the bubble applies to them in general. For the life satisfaction bubble, participants had to rate how much/how often the overall content of the bubble applies to their life in general. For the social support bubble, participants had to rate how much/how often the overall content of the bubble applies to their relationship to other people. Each bubble was rated on a horizontally arranged 4-point Likert-type scale (1 = *not at all*, 2 = *a little bit / sometimes*, 3 = *substantial / often*, 4 = *very strong / mostly*). The higher the rating, the higher PMH, life satisfaction, or social support.

Self-esteem We used the Germen version of the Single-Item Self-Esteem Scale (SISE; original version: Robins et al. 2001; German language version: Brailovskaia and Margraf 2020) to assess self-esteem. Participants are asked to rate how much the item "I have a high self-esteem" applies to them on a 5-point Likert-type scale (1 = *not very true of me*, 5 = *very true of me*). The higher the rating, the higher the self-esteem.

Depression, anxiety, and stress symptoms The Depression Anxiety Stress Scales 21 (DASS-21; original version: Lovibond and Lovibond 1995; German language version: Nilges and Essau 2015) measured symptoms of depression, anxiety and stress with respectively seven items per subscale (e.g., depression subscale: "I felt that life was meaningless"; anxiety subscale: "I felt scared without any good reason"; stress subscale: "I found it hard to wind down"). Items are rated on a 4-point Likert-type scale (0 = *did not apply to me at all*, 3 = *applies to me very much or most of the time*). The higher the sum scores, the higher the symptoms. The total sum score of each subscale can range from zero to 21. The scale reliability was $\alpha_{Study1} = .936$ and $\alpha_{Study2} = .943$ (depression subscale), $\alpha_{Study1} = .918$ and $\alpha_{Study2} = .921$ (anxiety subscale), and $\alpha_{Study1} = .918$ and $\alpha_{Study2} = .932$ (stress subscale).

Physical health state The EuroQuol Visual Analogue Scale (original version: The Euroqol Group 2013; EQ VAS; German language version: Margraf et al. 2020a) assessed the overall current physical health state. The EQ VAS is a visual analogue scale ranging from 0 (= *worst imaginable physical health state*) to 100 (= *best imaginable physical health state*). Higher ratings indicate a better physical health state.

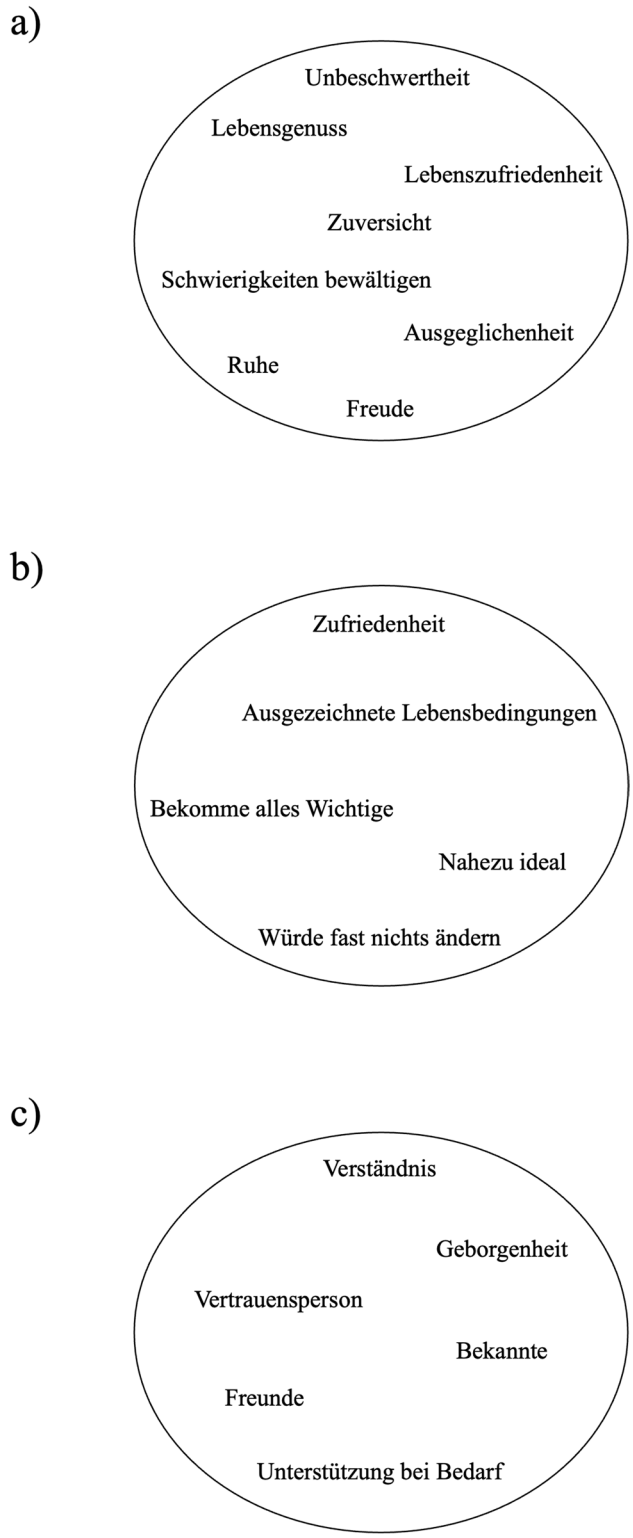

Fig. 1 Original German language Bubbles: **a**) Positive Mental Health Bubble; **b**) Life Satisfaction Bubble; **c**) Social Support Bubble

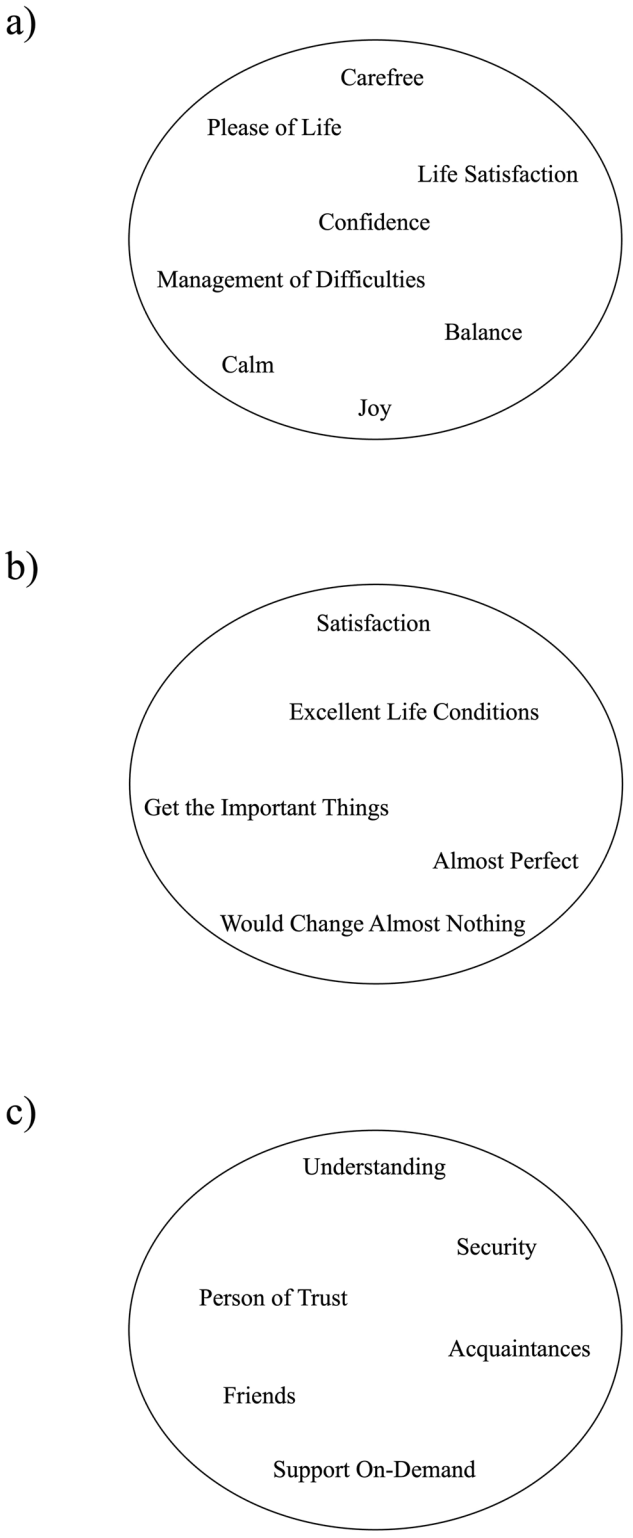

Fig. 2 English language Bubbles: **a**) Positive Mental Health Bubble; **b**) Life Satisfaction Bubble; **c**) Social Support Bubble

Sense of control We measured sense of control by the Sense of Control Scale (SoC-Scale; original German language version: Niemeyer et al. 2019). The two items "Do you experience important areas of your life (i.e., work, free-time, family, etc.) to be uncontrollable, meaning that you cannot, or barely can, influence them?" and "Do you experience these important areas of your life as unpredictable or inscrutable?" are rated on a 5-point Likert-type scale (0 = *not at all*, 4 = *very strong*). We recoded both items for the statistical analyses. Thus, the higher the sum score, the higher the sense of control. The total sum score can range from 0 to 8. Current scale reliability was $\alpha_{Study2} = .886$.

Loneliness To assess loneliness participants responded to the question "How often did you feel lonely in the past two weeks?" on a 6-point Likert-type scale (1 = *all the time*; 6 = *at no time*) (European Foundation for the Improvement of Living and Working Conditions 2016). We recoded the item for the statistical analyses. Thus, the higher the rating, the higher the level of loneliness.

In both studies, the questions on demographics, the three bubbles, PMH-Scale, SWLS, F-SozU K-6, and the DASS-21 were included. Furthermore, SISE and EQ VAS were included in Study 1; SoC-Scale and the loneliness item were included in Study 2.

Statistical analyses

In Study 1 and Study 2, statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS 28; IBM Corp 2021). In addition, the open statistical software jamovi (version 2.3.26.0; www.jamovi.org) was used in Study 2. In both studies, all investigated psychological variables were close to normally distributed (indicated by analyses of skewness, < 3.00, and kurtosis, < 8.00; see Table 2).

In Study 1, we first ran an EFA for each original positive scale with the corresponding bubble using the Maximum Likelihood method (ML; rotation method: promax) (Field 2013; Schmitt 2011). This step revealed whether the bubbles belong to the unidimensional structure of the original scales. Next, to investigate the association pattern and the convergent validity of the bubbles, we assessed their association with age, gender, social status, PMH, life satisfaction, social support, self-esteem, physical health, and symptoms of depression, anxiety and stress by the calculation of Pearson's zero-order bivariate correlations and Spearman's rank order correlations (Bühner 2011).

In Study 2, we first ran three CFAs to test whether the unidimensional structure of the positive scales remains after the inclusion of the corresponding bubble. Then, to further investigate the validity of the bubbles, we assessed their association with age, gender, social status, the PMH-Scale, SWLS, F-SozU K-6, SoC-Scale, the DASS-21, and the loneliness item by the calculation of Pearson's zero-order bivariate correlations and Spearman's rank order correlations.

In Both studies, we also compared the associations of each bubble with the associations of the corresponding original scale. Following Cohen (1988), we used the effect size q (small effect: $.10 \leq q < .30$; medium effect: $.30 \leq q \leq .50$; large effect: $q > .50$) for the comparison of the correlations (bubble vs. original scale).

Results Study 1

Factor structure of the bubbles in relationship with the original scales: Exploratory Factor Analyses (EFAs)

Previous research described the unidimensional factor structure of the PMH-Scale (Lukat et al. 2016), SWLS (Glaesmer et al. 2011), and F-SozU K-6 (Lin et al. 2019).

Positive mental health The EFA that included the nine PMH-Scale items and the PMH bubble (Kaiser–Meyer–Olkin: KMO = .956; Barlett's test of sphericity: $\chi^2 = 6313.171$, df = 45, $p < .001$) revealed a unidimensional factor structure. The eigenvalue of the factor was 5.788, and it explained 57.9% of the variance which is sufficient for a one-factor structure (Kline 2013). Table 3 shows the factor loadings of the 10-item version.

Life satisfaction The EFA that included the five SWLS items and the life satisfaction bubbles (KMO = .920; Barlett's test of sphericity: $\chi^2 = 5076.442$, df = 15, $p < .001$) revealed a unidimensional factor structure. The eigenvalue of the factor was 4.133 and it explained 68.9% of the variance (see Table 3 for factor loadings).

Social support The EFA that included the six FozU K-6 items and the social support bubble (KMO = .917; Barlett's test of sphericity: $\chi^2 = 4267.000$, df = 21, $p < .001$) revealed a unidimensional factor structure. The eigenvalue of the factor was 4.156 and it explained 59.4% of the variance (see Table 3 for factor loadings).

Thus, the EFAs showed the correspondence of the bubbles and the original scales on the factor level. The PMH bubble belongs to the same factor as the nine PMH-Scale items; the life satisfaction bubble belongs to the same factor as the five SWLS items; and the social support bubble belongs to the same factor as the six F-SozU K-6 items.

Table 3 Factor loadings of the exploratory factor analyses (Positive Mental Health Scale, Satisfaction with Life Scale, Social Support Questionnaire, and Bubbles; Study 1)

Exploratory Factor Analyses	Factor Loading of Factor 1
1. EFA: Positive Mental Health	
PMH-Scale: Item 1	.792
PMH-Scale: Item 2	.814
PMH-Scale: Item 3	.810
PMH-Scale: Item 4	.801
PMH-Scale: Item 5	.781
PMH-Scale: Item 6	.702
PMH-Scale: Item 7	.815
PMH-Scale: Item 8	.801
PMH-Scale; Item 9	.686
PMH Bubble	.568
2. EFA: Satisfaction with Life	
SWLS: Item 1	.892
SWLS: Item 2	.903
SWLS: Item 3	.935
SWLS: Item 4	.884
SWLS: Item 5	.791
Life Satisfaction Bubble	.489
3. EFA: Perceived Social Support	
F-SozU K-6: Item 1	.794
F-SozU K-6: Item 2	.846
F-SozU K-6: Item 3	.793
F-SozU K-6: Item 4	.777
F-SozU K-6: Item 5	.822
F-SozU K-6: Item 6	.833
Social Support Bubble	.456

$N = 1{,}004$; EFA = Exploratory Factor Analysis; PMH-Scale = Positive Mental Health-Scale; SWLS = Satisfaction with Life Scale; F-SozU K-6 = Social Support Questionnaire

Association pattern of the bubbles and convergent validity

The descriptive statistics of the bubbles and the other assessed variables are presented in Table 4. Table 5 displays the correlations between the investigated variables. Notably, the bubbles and the corresponding original scales showed similar correlation pattern.

Correlations with demographic variables Table 5 shows that there was no significant correlation between the three bubbles and age. In contrast, the three original scales were significantly positively correlated with age revealing higher levels of PMH, life satisfaction and social support in older people. The correlations of the original scales were slightly stronger than those of the bubbles (PMH bubble vs. PMH-Scale: effect size q = .112, life satisfaction bubble vs. SWLS: q = .119, social support bubble vs. F-SozU K-6: q = .152; all: small effect). The inconclusive finding between the bubbles and the original scales on the association with age corresponds to previous research that also did not show a uniform result pattern (Chuang et al. 2021; Glaesmer et al. 2011; Lukat et al. 2016).

Furthermore, the three bubbles and the F-SozU K-6 were not significantly correlated with gender. In contrast, the PMH-Scale and the SWLS were significantly positively correlated with gender revealing higher levels of PMH and life satisfaction in male persons than in female persons. There were no significant differences between the correlations of the bubbles and the original scales (PMH bubble vs. PMH-Scale: q = .059, life satisfaction bubble vs. SWLS: q = .037, social support bubble vs. F-SozU K-6: q = .016; all: no effect). Similar to age, findings on the association between gender and the positive variables were inconclusive in previous research (Chow and Choi 2019; Margraf et al. 2020b). This is also mirrored by present results.

In line with available literature (Businelle et al. 2014; Daraei and Mohajery 2013; Wang et al. 2023), the three bubbles and the original scales were significantly positively correlated with social status revealing higher PMH, life satisfaction and social support in people with a higher social status (see Table 5) (PMH bubble vs. PMH-Scale: q = .096, life satisfaction bubble vs. SWLS: q = .034, social support bubble vs. F-SozU K-6: q = 0.025, all: no effect).

Convergent validity In line with previous results (Bieda et al. 2017; Hu et al. 2020), we found a significant positive association between PMH, life satisfaction and social support – assessed by the bubbles and by the original scales. The PMH bubble was significantly positively correlated with the life satisfaction bubble, $r = .574$, $p < .001$, and the social support bubble, $r = .427$, $p < .001$. The life satisfaction bubble was significantly positively correlated with the social support bubble, $r = .385$, $p < .001$. The positive association between the bubbles corresponds with the close positive relationship between the original scales (see Table 5). As shown in Table 5, the PMH bubble was significantly positively correlated with the PMH-Scale. Both measures were significantly positively correlated with the original measures of life satisfaction (original scale > bubble: q = .563, large effect), social support (original scale > bubble: q = .325, medium effect), self-esteem (original scale > bubble: q = .153, small effect), and physical health (original scale > bubble: q = .201, small effect) (see Table 5). The life satisfaction bubble was significantly positively correlated

Table 4 Descriptive statistics and properties of the investigated variables (Study 1, Study 2)

	Study 1, N = 1,004					*Study 2, N = 1,000*				
	Rating *n* (%)	*M (SD)*	*Min–Max*	*Skew*	*Kurt*	Rating *n* (%)	*M (SD)*	*Min–Max*	*Skew*	*Kurt*
PMH-Scale		16.92 (6.30)	0–27	-.432	-.260		17.59 (6.35)	0–27	-.470	-.201
PMH Bubble		2.78 (.78)	1–4	-.017	-.659		2.78 (.82)	1–4	-.069	-.718
1 = *not at all*	33 (3.3)					45 (4.5)				
2 = *a little bit / sometimes*	339 (33.8)					334 (33.4)				
3 = *substantial / often*	443 (44.1)					414 (41.4)				
4 = *very strong / mostly*	189 (18.8)					207 (20.7)				
SWLS		20.46 (8.04)	5–35	-.182	-1.010		22.27 (7.26)	5–35	-.365	-.453
Life Satisfaction Bubble		2.64 (.79)	1–4	-.126	-.411		2.60 (.85)	1–4	-.147	-.587
1 = *not at all*	71 (7.1)					104 (10.4)				
2 = *a little bit / sometimes*	347 (34.6)					330 (33.0)				
3 = *substantial / often*	459 (45.7)					427 (42.7)				
4 = *very strong / mostly*	127 (12.6)					139 (13.9)				
F-SozU K-6		21.00 (6.18)	6–30	-.408	-.604		21.46 (5.88)	6–30	-.506	-.284
Social Support Bubble		2.91 (.78)	1–4	-.264	-.466		2.93 (.83)	1–4	-.517	-.204
1 = *not at all*	33 (3.3)					62 (6.2)				
2 = *a little bit / sometimes*	254 (25.3)					197 (19.7)				
3 = *substantial / often*	483 (48.1)					488 (48.8)				
4 = *very strong / mostly*	234 (23.3)					253 (25.3)				
SISE		3.34 (1.05)	1–5	-.402	-.266					
DASS-21: Depression Subscale		5.36 (5.46)	0–21	.823	-.397		5.77 (5.82)	0–21	.769	-.534
DASS-21: Anxiety Subscale		4.58 (5.03)	70–21	.958	-.170		4.59 (5.19)	0–21	1.031	.031
DASS-21: Stress Subscale		5.83 (5.10)	0–21	.637	-.562		6.11 (5.53)	0–21	.630	-.607
EQ VAS		64.75 (23.37)	0–100	-.659	-.248					
SoC-Scale							5.42 (2.22)	0–8	-.520	-.587
Loneliness							2.34 (1.50)	1–6	.885	-.389

M = Mean; *SD* = Standard Deviation; *Min* = Minimum; *Max* = Maximum; *Skew* = Skewness; *Kurt* = Kurtosis; PMH-Scale = Positive Mental Health Scale; SWLS = Satisfaction with Life Scale; F-Soz-U K-6 = Social Support Questionnaire; SISE = Single-Item Self-Esteem Scale; DASS-21 = Depression Anxiety Stress Scales 21; EQ VAS = EuroQuol Visual Analogue Scale; SoC-Scale = Sense of Control Scale; due to rounding, the sum of the frequencies is not always 100%

with the SWLS. Both life satisfaction measures were significantly positively correlated with the original measures of PMH (original scale > bubble: q = .448, medium effect), social support (original scale > bubble: q = .438, medium effect), self-esteem (original scale > bubble: q = .140, small effect), and physical health (original scale vs. bubble: q = .048, no effect) (see Table 5). The social support bubble was significantly positively correlated with the F-SozU K-6. Both measures were significantly positively correlated with the original measures of PMH (original scale > bubble: q = .224, small effect), life satisfaction (original scale > bubble: q = .343, medium effect), self-esteem (original scale vs. bubble: q = .054, no effect), and physical health (original scale vs. bubble: q = .008, no effect) (see Table 5). Those findings correspond to previous research on the associations of the positive dimension of mental health (Brailovskaia and Margraf 2020; Robins et al. 2001).

In line with available literature (Brailovskaia et al. 2018; Mahmoud et al. 2012), the PMH bubble and the PMH-Scale were significantly negatively correlated with the DASS-21 subscales depression (original scale > bubble: q = .130, small effect), anxiety (original scale vs. bubble: q = .096, no effect), and stress (original scale > bubble: q = .117, small effect). The life satisfaction bubble and the SWLS were significantly negatively correlated with the DASS-21 subscales (original scale vs. bubble: depression: q = .055, anxiety: q = .058, stress: q = .034, all: no effect). Also, the social support bubble and the F-SozU K-6 were significantly negatively correlated with the DASS-21 subscales (original scale vs. bubble: depression: q = .043, anxiety: q = .044, stress: q = .055, all: no effect).

The findings revealed a good convergent validity of the three bubbles. Notably, their association with the measures that assessed positive constructs was weaker than the

Table 5 Correlations of the Bubbles and Positive Mental Health Scale, Satisfaction with Life Scale, Social Support Questionnaire (Study 1, Study 2)

	PMH Bubble	PMH-Scale	Life Satisfaction Bubble	SWLS	Social Support Bubble	F-SozU K-6
Study 1, N = 1,004						
Age	.023	.134**	.018	.136**	-.017	.134**
Gender	.020	.079*	.051	.088**	-.033	-.017
Social Status	.196**	.286**	.300**	.331**	.185**	.161**
PMH-Scale	.550**	1.000**	.524**	.774**	.424**	.589**
SWLS	.436**	.774**	.479**	1.000**	.345**	.606**
F-SozU K-6	.337**	.589**	.259**	.606**	.437**	1.000**
SISE	.419**	.537**	.361**	.476**	.328**	.375**
DASS-21: Depression	-.336**	-.446**	-.285**	-.335**	-.246**	-.286**
DASS-21: Anxiety	-.220**	-.309**	-.162**	-.218**	-.143**	-.186**
DASS-21: Stress	-.313**	-.414**	-.263**	-.294**	-.167**	-.220**
EQ VAS	.356**	.518**	.390**	.430**	.277**	.270**
Study 2, N = 1,000						
Age	-.007	.070*	-.019	-.003	.238**	.081*
Gender	.045	.065*	.042	.007	-.051	-.048
Social Status	.241**	.336**	.334**	.386**	.019	.244**
PMH-Scale	.586**	1.000**	.627**	.816**	.241**	.552**
SWLS	.494**	.816**	.632**	1.000**	.185**	.581**
F-SozU K-6	.371**	.552**	.389**	.581**	.357**	1.000**
SoC-Scale	.177**	.325**	.196**	.253**	.335**	.259**
DASS-21: Depression	-.287**	-.528**	-.324**	-.433**	-.397**	-.351**
DASS-21: Anxiety	-.152**	-.320**	-.149**	-.226**	-.378**	-.231**
DASS-21: Stress	-.236**	-.465**	-.267**	-.353**	-.367**	-.298**
Loneliness	-.238**	-.464**	-.269**	-.431**	-.364**	-.420**

Gender: coding 1 = women, 2 = men, point-biserial correlation; social status: Spearman's rank order correlation; PMH-Scale = Positive Mental Health Scale; SWLS = Satisfaction with Life Scale; F-Soz-U K-6 = Social Support Questionnaire; SISE = Single Item Self-Esteem Scale; DASS-21 = Depression Anxiety Stress Scales 21; EQ VAS = EuroQuol Visual Analogue Scale; SoC-Scale = Sense of Control Scale; $^{**}p < .001$, $^{*}p < .05$

relationships of the original scales with these measures. However, the association of the bubbles and the original scales with measures of the negative constructs was similarly strong. Considering the effect sizes, the two social support measures exhibited the most similar findings. The strength of their associations with other measures differed significantly only considering age, PMH and life satisfaction. The strength of the associations of the two PMH measures differed the most.

To sum up, the results of Study 1 provide the first evidence that the three bubbles are valid instruments for a rapid assessment of PMH, life satisfaction, and perceived social support. Their correlations are similar to those of the original scales. In comparison, the best fit shows the social support bubble, followed by the life satisfaction bubble, and the PMH bubble. Against this framework, it seems that the use of the positive bubbles as screening tools could be of advantage due to their time- and cost-efficiency especially in large-scale representative studies and longitudinal studies.

Results Study 2

Factor structure of the bubbles in relationship with the original scales: Confirmatory Factor Analyses (CFAs)

The CFA that included the PMH bubble and the PMH-Scale in a one-factor structure resulted in a significant chi-square value, $\chi^2 = 95.7$, degrees of freedom (df) = 35, $p < .001$. Because of the sample size sensitivity of the chi-square test (Oishi 2007), we took further fit indices into consideration (Schermelleh-Engel et al. 2003): The comparative fit index (CFI) reached a value of 0.990 indicating

an excellent fit, the root mean square error of approximation (RMSEA) was .042 (90% CI [.032, .052]), and the standardized root mean residual (SRMR) was 0.016, both indicating a good fit (Bentler 1990; Homburg and Baumgartner 1995; Hooper et al. 2008; Shi et al. 2019). Thus, the one-factor model fits the data well for PMH.

The CFA that included the life satisfaction bubble and the SWLS ($\chi^2 = 31.0$, df = 9, $p < .001$; CFI: .995, RMSEA: .049 (90% CI [.031, .069]), SRMR: .011), as well as the CFA that included the social support bubble and the F-SozU K-6 ($\chi^2 = 87.2$, df = 14, $p < .001$; CFI: .979, RMSEA: .072 (90% CI [.058, .087]), SRMR: .021) confirmed the hypothesized one-factor structure for life satisfaction and perceived social support.

Thus, the CFAs confirmed the findings of the EFAs in Study 1. Both emphasize the correspondence of the bubbles and the original scales on the factor level.

Association pattern of the bubbles and convergent validity

Table 4 shows the descriptive statistics of the bubbles and the other assessed variables. The correlation analyses replicated mostly the result pattern in Study 1 (see Table 5).

Correlations with demographic variables Considering age and gender, our results showed the same result pattern for PMH as in Study 1. The PMH bubble was not significantly correlated with both variables. In contrast, the PMH-Scale was significantly positively correlated with age and gender revealing higher levels of PMH in older and male persons (see Table 5). The correlations did not significantly differ between both PMH measures (original scale vs. bubble: age: q = .077, gender: q = .020, both: no effect). Both life satisfaction measures were not significantly correlated with age (original scale vs. bubble: q = .016, no effect) and gender (original scale vs. bubble: q = .035, no effect). Both social support measures were significantly positively correlated with age (original scale < bubble: q = .161, small effect), and both were not significantly correlated with gender (original scale vs. bubble: q = .003, no effect). Notably, the positive association between social support and age is in line with previous research (Prezza and Giuseppina Pacilli 2002). Also in line with previous research (Businelle et al. 2014; Daraei and Mohajery 2013) and with the results of Study 1, the PMH-Scale and the PMH bubble (original scale > bubble: q = .204, small effect), as well as the SWLS and the life satisfaction bubble (original scale vs. bubble: q = .060, no effect) were significantly positively correlated with social status. The F-SozU K-6 was also significantly positively correlated with social status; however, there was no significant association between the social support bubble and social status (original scale > bubble: q = .230, no effect) (see Table 5). Thus, the bubbles and the original scales showed partly similar correlations with demographic variables.

Convergent validity In line with Study 1 and earlier research (Bieda et al. 2017; Hu et al. 2020), there was a significant positive correlation between PMH, life satisfaction and social support (for the correlations between the original scales see Table 5). The three bubbles were significantly positively correlated with each other (PMH bubble and life satisfaction bubble: $r = .594$, $p < .001$; PMH bubble and social support bubble: $r = .148$, $p < .001$; life satisfaction bubble and social support bubble: $r = .100$, $p = .002$). Of note, the correlations of the social support bubble were remarkable weaker than in Study 1. Each bubble was significantly positively correlated with the corresponding original scale (see Table 5).

Furthermore, both PMH measures were significantly positively correlated with the SWLS (original scale > bubble: q = .603, large effect), the F-SozU K-6 (original scale > bubble: q = .232, small effect), and the SoC-Scale (original scale > bubble: q = .158, small effect). Both life satisfaction measures were significantly positively correlated with the PMH-Scale (original scale > bubble: q = .408, medium effect), the F-SozU K-6 (original scale > bubble: q = .253, small effect), and the SoC-Scale (original scale vs. bubble: q = .060, no effect). Both social support measures were significantly positively correlated with the PMH-Scale (original scale > bubble: q = .375, medium effect), the SWLS (original scale > bubble: q = .477, medium effect), and the SoC-Scale (original scale vs. bubble: q = .083, no effect). The findings correspond with available literature (Bieda et al. 2017; Precht et al. 2021).

Both PMH measures were significantly negatively correlated with the DASS-21 subscales (original scale > bubble: depression: q = .292, anxiety: q = .178, stress: q = .263, all: small effect) and the loneliness item (original scale > bubble: q = .260, small effect). Both life satisfaction measures were also significantly negatively correlated with the DASS-21 subscales (original scale > bubble: depression: q = .127, small effect; original scale vs. bubble: anxiety: q = 080, stress: q = 0.095, both: no effect) and the loneliness item (original scale > bubble: q = .185, small effect). Also, both social support measures were significantly negatively correlated with the DASS-21 subscales (original scale vs. bubble: depression: q = .053, stress: q = .078, both: no effect; original scale > bubble: anxiety: q = .162, small effect) and the loneliness item (original scale vs. bubble: q = 0.066, no effect) (see Table 5). The results are in line with earlier research (Totzeck et al. 2020; Wang et al. 2018).

To sum up, the results replicated a good convergent validity of the three bubbles. Again, their associations with the positive variables (PMH, life satisfaction, social support, sense of control) were weaker than the associations

of the original scales. The association of the bubbles and the original scales with the negative variables (depression, anxiety, stress, loneliness) showed less differences. Interestingly, while in Study 1 the social support measures exhibited the most similar findings, the two life satisfaction measures exhibited the most similar findings in Study 2. The strength of their associations with other measures differed significantly only considering PMH, social support, depression symptoms, and loneliness. Again, the strength of the associations of the two PMH measures differed the most.

Overall, the findings of Study 2 confirmed the evidence gained in Study 1 that the three bubbles are valid time- and cost-efficient screening instruments for a brief assessment of PMH, life satisfaction and social support.

Discussion

A decrease in mental health negatively affects the persons themselves and the global economy (Fernando 2014). An early time-efficient identification of the complete status of a person's mental health could contribute to a targeted application of mental health programs and, thus, could protect both the individuals and the economics. Therefore, it is important to assess both dimensions of a person's mental health. However, the positive dimension is often not the focus of mental health research.

Against this background, we developed and validated three ultra-short scales for the assessment of the positive dimension of mental health in two population representative samples in Germany. Our "bubbles" assess PMH, life satisfaction, and perceived social support that are important factettes of the positive mental health dimension (Bieda et al. 2017). Each bubble includes a very shortened visual presentation of the corresponding original scale (i.e., PMH-Scale, SWLS, F-SozU K-6).

The results of both studies show that the three bubbles are valid, economical, and practical instruments for a very brief assessment of the positive mental health dimension. We mostly replicated the results gained by longer instruments in our own assessment and in earlier studies.

Study 1 and Study 2 provided evidence that the bubbles fit the original scales on the factor level. Moreover, the bubbles were sensitive enough to mostly replicate the association pattern of the original scales. However, it is worth noting that the original scales showed partly stronger associations with the other assessed constructs than the bubbles. This was conspicuous especially for the associations with facets of the positive dimension of mental health. For the facets of the negative dimension of mental health, the bubbles and the original scales showed mostly similar findings. The results allow the hypothesis that the positive bubbles are especially suitable for investigations of associations between the appropriate construct and representatives of the negative dimension of mental health. However, they also can be used in investigations that focus on representatives of the positive mental health dimension. The bubbles could be used for a short screening. For individuals who could be at risk for a low level of mental health and who, therefore, could especially benefit from mental health programs or therapeutic treatment, the bubbles could be complemented by the original scales.

Thus, similar to other single-item scales (Riordan et al. 2018), the bubbles are a valid economic instrument for a brief screening of PMH, life satisfaction and perceived social support. Due to their time- and cost-efficiency, the bubbles can be of specific benefit in large-scale surveys, in longitudinal studies in order not to overload participants, to prevent cognitive fatigue and attention deficits, and when a brief screening in mental health prevention programs or assessment centers is of benefit. Also, the bubbles can be of significant benefit in research using the experience sampling paradigm that aims to assess the association between specific daily experiences and the positive dimension of mental health. Furthermore, the bubbles could be used in addition to the original scales for example in experimental research. Specifically, in a study that includes longer interventions, the original scales could be used in the baseline measurement and the post-intervention measurement, the bubbles could assess the positive mental health dimension in a brief daily screening during the intervention period.

Limitations and future research

Our work has some limitations that should be considered when interpreting the current findings. First, we assessed the data only once in both studies. Therefore, no information on the test–retest reliability of the bubbles is available. And we cannot make conclusions on the time sensitivity of the bubbles – specifically, whether they can assess short- and longer-term changes of PMH, life satisfaction and perceived social support. Second, we focused only on the positive dimension of mental health in the present study. To a further speed up of a complete mental health screening, future research should validate additional bubbles for the assessment of the negative mental health dimension. Furthermore, bubbles for further positive variables such as optimism, resilience, and self-efficacy could be developed. Third, we included only a limited number of variables for the examination of the validity of the bubbles to prevent an overloading of the participants. Therefore, a further validation of the bubbles by more positive and negative scales is desirable. For example, the Psychological Well-Being Scale (PWBS) (Ryff 1989), the Beak's Depression Inventory (BDI) (Beck et al. 1961) and the Suicidal Behaviors

Questionnaire-Revised (SBQ-R) (Osman et al. 2001) could be used for further investigations of the bubbles' validity. Fourth, both investigations worked with healthy population representative samples. Therefore, no conclusions on the applicability and effectiveness of the bubbles in the clinical setting are possible. Future research should investigate the validity of the bubbles in clinical patients. In addition, future research should assess the validity of the bubbles in other countries than Germany and in people younger than 18 years. Fifth, the bubbles were rated on a 4-point Likert-type scale. Future research should examine whether another rating, for example a 5-point Likert-type scale, can improve their validity. Sixth, we recommend future research to discuss the content and visual presentation of the bubbles in focus groups (Brailovskaia et al. 2022). This could help to clarify whether the positioning of the words/phrases in the bubbles could influence their rating and to evaluate the advantages and disadvantages of the visual presentation of several words/phrases in a visual bubble vs. the presentation of one single sentence/question that summarizes a bubble's content. Seventh, all participants were free to decide whether to complete the survey or to terminate it at any stage without providing any reasons. Therefore, the reasons for the participants' dropout during the data collection that ranged between 13.9% (Study 1) and 46.5% (Study 2) are unclear. Eights, the samples were recruited online. Both institutes implemented age, gender, and region/federal state stratification to achieve their representativeness. However, it cannot be excluded that people who do not participate in online surveys or do not use the Internet in general – about 5% of the German population do not use the Internet (Federal Statistical Office of Germany 2024) – were underrepresented in the present samples which reduced the generalizability of the findings.

Conclusion

An assessment of the positive dimension of mental health is urgent to understand a person's complete mental health status. The positive mental health bubble, the life satisfaction bubble and the social support bubble are valid, cost- and time efficient instruments for a brief screening of the positive dimension. They can contribute to a rapid identification of persons at risk for a low level of mental health. The bubbles seem to be promising instruments that could be implemented in research and praxis to speed up the working processes and the mental health protection.

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Data availability The dataset and further material analysed during the current study will be available from the corresponding author on reasonable request.

Code availability (software application or custom code) Statistical analyses were conducted using SPSS 28 and the open statistical software jamovi. The used statistical codes will be available from the corresponding author on reasonable request.

Declarations

Ethical approval The responsible Ethics Committees approved the present study. All authors state their compliance with the Code of Ethics of the World Medical Association (the 1964 Declaration of Helsinki and its later amendments).

Consent to participate All participants were properly instructed and gave online their informed consent to participate.

Consent for publication All participants were properly instructed that data gained in the present study will be used for publication in an anonymous form and gave online their informed consent for publication.

Conflicts of interest/Competing interests On behalf of all authors, the corresponding author states that there are no conflicts of interest or competing interests.

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