The relationship between self-reflection and mental health: a meta-analysis review

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Abstract

Self-reflection, centered on the introspection and evaluation of one's thoughts, feelings, and behaviors in relation to self-concerns, occupies a central place in understanding the dynamics of mental health. The dual-factor model of mental health suggests that mental health has both positive and negative dimensions. Nonetheless, the relationship between self-reflection and mental health is a source of continuous controversy. This study is dedicated to thoroughly examining the connection between self-reflection and various mental health indicators and exploring the moderating effects of cultural background and self-reflection measurement tools. A meta-analysis of 39 studies including 12,496 subjects was conducted to determine the magnitude of the relationship between self-reflection and both positive and negative mental health. (1) The random-effect model showed no significant relationship between self-reflection and overall positive mental health or with individual positive indicators, including subjective well-being, life satisfaction, and self-esteem. In contrast, the model showed a significant positive relationship between self-reflection and overall negative mental health indicators, including depression and anxiety. (2) Cultural background moderates the relationship between self-reflection and positive mental health, while different measurements of self-reflection moderate the relationship between self-reflection and both positive and negative mental health. We found that self-reflection was significantly associated with negative mental health but not with positive mental health. Our findings suggest that focusing on self-reflection may offer potential for improving negative mental health outcomes, such as anxiety and depression, particularly when culturally sensitive approaches and appropriate measurement tools are used.

Introduction

Mental health has garnered widespread attention in recent years, particularly due to its dynamic and multifaceted nature (Barch et al., 2018). Positive indicators such as subjective well-being and negative indicators like anxiety and depression often fluctuate in response to environmental changes. These fluctuations, especially in negative emotions like anxiety and depression, highlight the need to identify stable psychological traits that may influence or predict such changes. Self-reflection (SR)—the act of turning inward to examine our own thoughts, memories, feelings,

and actions—represents a fundamental aspect of human cognition (Philippi & Koenigs, 2014). As an internal cognitive process and psychological mechanism, SR plays a crucial role in influencing mental health, which encompasses realizing one's potential, experiencing positive emotions, coping with stress, maintaining relationships, working productively, and contributing to the community (Herrman & Jané-Llopis, 2005). Given its profound impact, SR, as a form of deep self-awareness, has recently attracted significant interest and discussion in the field of mental health.

In recent years, several studies have demonstrated a strong relationship between SR and mental health. In particular, numerous empirical studies have found a positive correlation between SR and both anxiety and depression (Webster et al., 2022; Falon et al., 2021; Taylor-Swanson et al., 2019; Nakajima et al., 2017; Tanovic et al., 2017). Conversely, Stein and Grant (2014) reported a negative correlation between SR and self-esteem, while some research

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has found either a negative correlation or no statistically significant correlation between SR and subjective well-being (Lyke, 2009; Elliott & Coker, 2008). However, when taken as a whole, the conclusions of previous studies are not consistent. A few studies have identified a negative correlation between SR and both anxiety and depression (Mori et al., 2015; Pai et al., 2017; Van Patten et al., 2019), whereas other researchers have observed a positive correlation with subjective well-being (Bucknell et al., 2022; Jeste et al., 2021; Ardelt & Jeste, 2016), life satisfaction (Van Patten et al., 2019; Ardelt & Jeste, 2016; Boyraz & Kuhl, 2015), and self-esteem (Joireman et al., 2002). Additionally, some studies have reported no statistically significant correlation between SR and depression (Martinon et al., 2019). These inconsistent findings complicate our understanding of the relationship between SR and mental health. Therefore, a systematic analysis of previous research is necessary to clarify the role of SR in mental health and to provide insights for the prevention and treatment of mental health problems.

Mental health is a complex concept widely recognized as a crucial aspect of individual adaptation and development. With advancements in mental illness research and the discipline of positive psychology gaining prominence, fresh perspectives on this structure have emerged. The introduction of the dual-factor model of mental health (Greenspoon & Saklofske, 2001) has emerged as a robust analytical lens, facilitating a more holistic and precise evaluation of an individual's mental health. This model posits that mental health should encompass both negative (e.g., depression) and positive dimensions (e.g., subjective well-being and self-esteem). Furthermore, this model has been fruitfully applied in research examining the interplay between mental health, resilience, and domain-specific physical activity (Hu et al., 2015; White et al., 2017). Accordingly, this study explores the relationship between SR and mental health across both positive and negative dimensions.

As a key process in internal mental cognition, SR has attracted attention from researchers across various disciplines, including education, psychology, psychopathology, and even cognitive neuroscience. The measurement of SR varies across these fields, with different instruments emphasizing different aspects. For example, the SR subscale of the Beck Cognitive Insight Scale (BCIS; Beck, 2004) in psychopathology focuses on patients' ability to evaluate their own experiences in an objective, reflective, and open manner, which contributes to a more accurate understanding of their condition. Some studies have found a positive correlation between SR and depression using this measure (Warman et al., 2007; Webster et al., 2022). Conversely, other studies have reported a negative correlation between SR and depression (Van Patten et al., 2019; Jeste et al., 2021) using the reflection subscale of the

Three-Dimensional Wisdom Scale (3D-WS; Ardelt, 2003), which emphasizes reflection on one's behaviors, thoughts, and feelings to gain new insights. However, while the SR subscale of the Private Self-Consciousness Scale (PrSCS, Fenigstein et al., 1975) was found to negatively correlate with anxiety, Grant et al. (2002) found a positive correlation using the Self-Reflection and Insight Scale (SRIS), which was developed from the PrSCS and highlights SR as a need to reflect on one's thoughts, feelings, and behaviors. These differences in SR measurement tools may contribute to the variations in findings regarding the relationship between SR and mental health.

Previous research has highlighted the significant cultural influences on both self-related processes and mental health. Cultural psychology suggests fundamental disparities are posited between Eastern and Western conceptions of the self among individuals from different cultural backgrounds (Markus & Kitayama, 2010). These differences extend to positive and negative psychological processes across cultures. A small number of studies have begun to explore whether the relationship with self and mental health is influenced by cultural factors. For instance, research indicates that Easterners exhibit a heightened threshold for accepting positive self-evaluations, whereas Westerners require greater justification for accepting negative feedback as valid (Boucher, 2010). Studies, such as those by Jones et al. (2014) in the USA and Mori et al. (2015) in Japan, show varying degrees of correlation between SR and mental health indicators like depression. Additionally, Asian Americans tend to score higher on measures of SR compared to European Americans, yet SR is less predictive of dysphoria among Asian Americans (Chang et al., 2010). However, no research has systematically explored whether regional cultural differences impact the relationship between SR and mental health or how these differences may influence the effect of SR on mental health.

While numerous qualitative studies have highlighted the benefits of SR for mental health, quantitative research findings are less consistent. This inconsistency may arise from varying definitions and measurement tools for SR, as well as a lack of exploration into its role as a stable psychological trait that interacts with dynamic mental health states. Understanding whether SR has a positive or negative impact on mental health is critical for both theoretical and practical reasons. As a relatively stable psychological trait, it is particularly important to investigate whether and how SR interacts with and predicts dynamically fluctuating mental health states. This study aims to address this gap by examining the relationship between SR and mental health and providing a theoretical foundation for developing predictive models based on SR levels. Given the potential influence of SR measurement tools and cultural background on this relationship,

we also examined the moderating effects of these factors. We propose three hypotheses: (1) SR is significantly correlated with both positive and negative mental health, with distinct differences in these associations; (2) cultural background moderates the relationship between SR and these mental health indicators; and (3) the SR measurement tool also moderates the relationship between SR and mental health indicators. Through this study, we hope to deepen the understanding of SR as a metacognitive approach in mental health, offering insights into enhancing positive mental health, reducing negative mental health, and providing a theoretical basis for cognitive therapies in mental health.

Methods

Literature search

The scope of our literature search was designed to encompass all published papers pertaining to the subject matter, with the limitation of including English-language articles. We conducted electronic database searches using PubMed, PsycInfo, and PsycArticles for articles published from inception to March 2023. Selected articles' references were also utilized, and Google Scholar was searched for more articles. The subject headings guided the literature search. The following set of search phrases made up the search strategy used for each database: (self-reflect*) AND ("mental health" OR "psychological well-being" OR "anxiety" OR "depression" OR "depression symptom" OR "subjective well-being" OR "self-esteem" OR "well-being" OR "subjective happiness" OR "life satisfaction"). The first and second authors began their search on March 22, 2023. To extend the search for relevant papers, we delved into the reference sections of the most recent studies to look for additional clues. Figure 1 provides comprehensive details regarding the process of choosing literature. Five thousand one hundred and eighty-nine articles were identified and subjected to a rigorous screening process.

During this first phase, 4,837 articles were dismissed due to the absence of quantitative data, a lack of measurement for SR, or the non-mention of mental health indicators. Subsequently, the remaining 352 articles underwent a meticulous review in the second step, resulting in the exclusion of 313 articles that did not align with the remaining inclusion criteria (see the "Inclusion and Exclusion Criteria" section). Finally, 39 articles were selected for inclusion in the quantitative synthesis, comprising 43 samples.

Inclusion and exclusion criteria

Among the 5189 articles initially identified, 43 samples were found to contain viable data, contributing a total of 63 effect sizes to the analysis. The inclusion criteria applied were as follows:

1. *Quantitative data*: Only studies that presented quantitative data were eligible for inclusion. Publications that solely featured qualitative data, reviews, or theoretical papers were excluded from consideration.
2. *Measurement of SR*: the SR scale of the Self-reflection and Insight Scale [SRIS-SR], the SR scale of the Beck Cognitive Insight Scale [BCIS-SR], the reflection scale of the Rumination-Reflection Questionnaire [RRQ-RF], the reflection scale of the Three-Dimensional Wisdom Scale [3D-WS-RF], the reflection scale of the Ruminative Response Scale [RRS-RF], and the SR scale of the Private Self-Consciousness Scale [PrSCS-SR] (details seen in Supplement-Table 5). The absence of information on individual subscales of SR served as a basis for exclusion.
3. *Mental Health indicators*: Studies must report at least one indicator of mental health, encompassing depression, anxiety, subjective well-being, life satisfaction, and self-esteem. The measurement of mental health indicators is outlined in Supplement-Table 5.
4. *Study design*: No specific study design was deemed ineligible. Nevertheless, for the main analysis, only baseline data from the studies were utilized.
5. *Statistical requirements*: Only studies that reported correlation coefficients between SR and at least one measure of a mental health indicator (depression, anxiety, subjective well-being, life satisfaction, and self-esteem) were included in the analyses.
6. *Subject*: The study samples must be separate from each another; the more comprehensive or larger samples were used when the samples from several studies were duplicated or overlapped. The subjects were normal subjects of adults and professionals, excluding patients with physiological diseases and mental disorders.
7. *Moderators*: For the construction of cultural background, the criterion for incorporating regulatory factor analysis is that the original article must report its sample source region. For the construction of SR measurement tools, the criterion for incorporating regulatory factor analysis is that SR must be measured using the six self-report questionnaires mentioned above (SRIS-SR, BCIS-SR, RRQ-RF, 3D-WS-RF, RRS-RF, and PrSCS-SR).
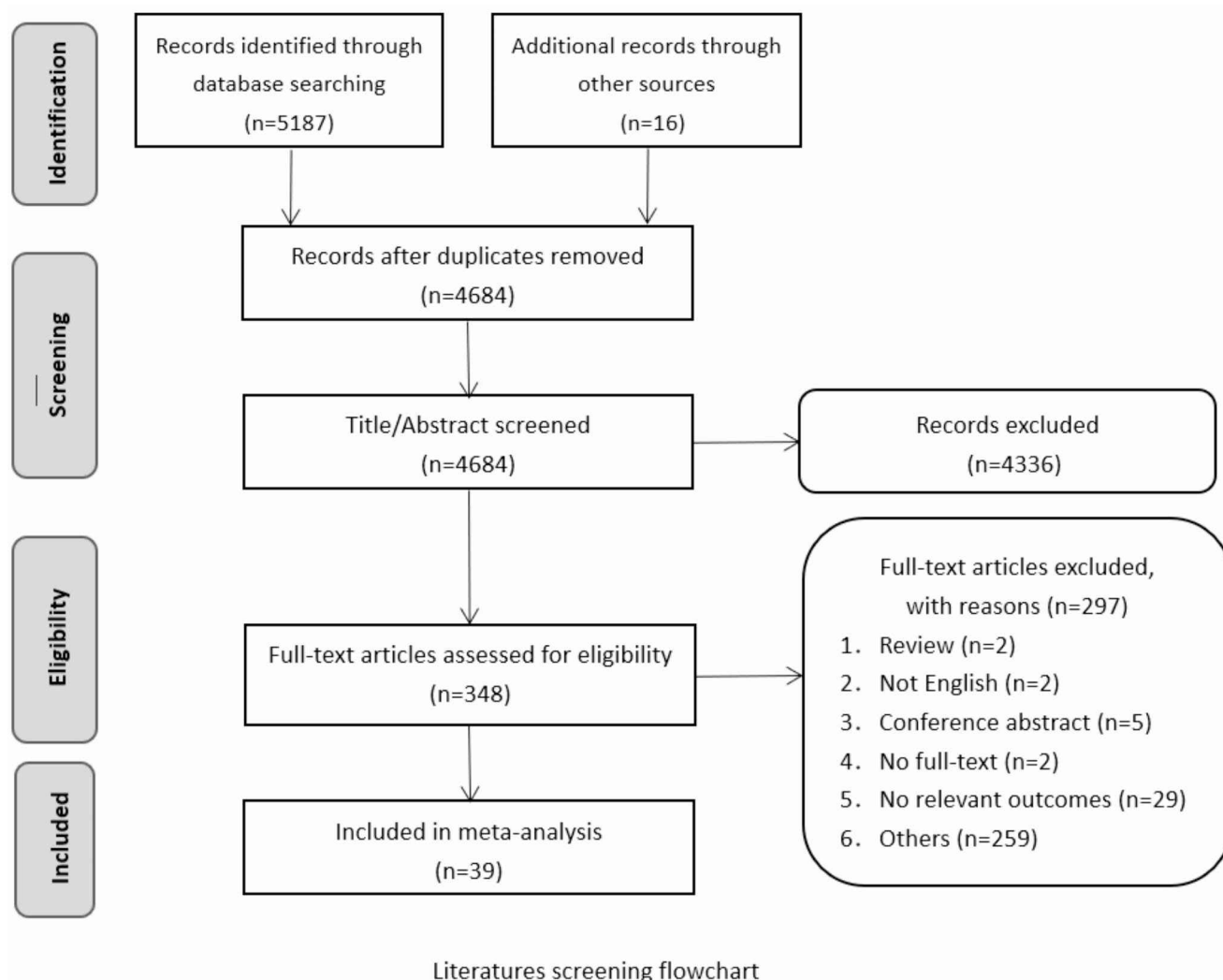
Fig. 1 Literatures screening flowchart

Coding variables

In our study, we systematically coded a multitude of characteristics and variables. First, the *study characteristics*: author information and publication date. Second, several *sample characteristics*: gender, sample size, age of participants, and geographical region of the sample. Third, the *measurement characteristics* were coded. These included the SR questionnaires and mental health indicators (subjective well-being, life satisfaction, self-esteem, depression, and anxiety measurements). Specifically, based on the theoretical description and measurement properties of each questionnaire, we combined reflection and self-reflection into a SR dimension, happiness, general well-being, and subjective well-being into a subjective well-being dimension, and social anxiety and anxiety symptoms into an anxiety dimension. In addition, life satisfaction, self-esteem, and depression in this study did not include similar conceptual

mergers. In the data analysis section, they are combined as total positive mental health (including subjective well-being, life satisfaction, and self-esteem) and total negative mental health (depression and anxiety) to explain and discuss the findings. Fourth, in terms of the effect size coding process, the Pearson correlation coefficient (r) between SR and positive negative indicators of mental health was coded (see Table 1 for details). Fifthly, if a study included multiple samples, these were combined with the correlation coefficients. When a study presented effect sizes (r) pertaining to sample characteristics, like gender, the respective results for both genders were amalgamated using correlation coefficients. Sixth, if studies reported on multiple outcomes (such as depression and life satisfaction), each of these outcomes was individually coded with its corresponding effect size. Finally, for studies that involved both clinical (e.g.,

Table 1 Characteristics of the studies included in the meta-analysis

No.	Study	Nationality	N	SR measure used	MH measure used	Finding on SR-MH Relationships				
						Anxiety	Depression	Self-esteem	Subjective Well-being	Life sat-isfaction
1	Cramer (2000)	Canada	329	PrSCS	SCS-SC	0.31	x	x	x	x
2	Joireman et al. (2002)	USA	184	RRQ	RSEI	x	x	N/A	x	x
3	Grant et al. (2002)	Australia	121	SRIS	DASS-DEP DASS-ANX	0.32	N/A	x	x	x
4	Lindwall (2004)	Sweden	510	PrSCS	SCS-SC	0.29	x	x	x	x
5	Verhae-ghen et al. (2005)	USA	99	RRS	CESD	x	0.28	x	x	x
6	Warman et al. (2007)	USA	60	BCIS	BDI-II	x	0.19	x	x	x
7	Luyckx et al. (2007)	USA	263	RRQ	RSEI CESD	x	N/A	N/A	x	x
8	Haga et al. (2007)	Norway	489	SRIS	CESD	x	N/A	x	x	x
9	Elliott and Coker (2008)	Australia	123	RRQ	SHS	x	x	x	N/A	x
10	Takano and Tanno (2009)	Japan	111	RRQ	SDS	x	N/A	x	x	x
11	Jones et al. (2009)	USA	121	RRQ	BDI STAI	N/A	N/A	x	x	x
12	Lyke et al. (2009)	USA	208	SRIS	SWLS SHS	x	x	x	N/A	N/A
13	Chang et al. (2010)	USA	422	RRS	BDI BAI SWLS	0.57	0.61	x	x	−0.49
14	Har-rington & Loffredo (2010)	USA	121	SRIS&RRQ	SWLS SCS-SC	N/A	x	x	x	N/A
15	Hervas & Vazquez (2011)	Spain	80	RRS	BDI-II	x	0.47	x	x	x
16	Silvia & Phillips (2011)	USA	223	SRIS&RRQ	BDI BAI RSEI	0.17	0.17	−0.18	x	x
17	Zacher et al. (2012)	Australia	575	3D-WS-SR	SWLS	x	x	x	x	0.49
18	Simsek et al. (2013)	Turkey	459	RRQ	RSEI BSI-DEP BAI	0.29	0.30	N/A	x	x
19	Eisma et al. (2013)	Netherlands	282	RRQ	HADS-DEP	x	0.26	x	x	x
20	Stein and Grant (2014)	Australia	227	SRIS	SHS CSES-SE	x	x	−0.14	−0.18	x
21	Adrian et al. (2014)	USA	852	RRS	MFQ	x	0.20	x	x	x
22	Jones et al. (2014)	USA	71	RRS	CESD	x	0.40	x	x	x

Table 1 (continued)

No.	Study	Nationality	N	SR measure used	MH measure used	Finding on SR-MH Relationships				
						Anxiety	Depression	Self-esteem	Subjective Well-being	Life sat-isfaction
23	Verhae-ghen et al. (2014)	USA	244	RRS	CESD	x	0.16	x	x	x
24	DaSilveir et al. (2015)	Brazil	602	SRIS&RRQ	SCS-SC	N/A	x	x	x	x
25	Boyraz and Kuhl (2015)	USA	619	RRQ	SWLS DASS-ANX	−0.08	x	x	x	0.13
26	Mori et al. (2015)	Japan	39	RRQ	POMS-BF	x	N/A	x	x	x
27	Ardelt & Jeste (2016)	USA	994	3D-WS-SR	CESD-4 SWLS	x	x	x	0.41	0.38
28	Nakajima et al. (2017)	Japan	108	SRIS	HSCL-DEP HSCL-ANX	0.17	0.27	x	x	x
29	Pai et al. (2017)	China	293	SRIS	STAI	−0.45	x	x	x	x
30	Tanovic et al. (2017)	USA	45	RRS	PAI-ANX PAI-DEP	N/A	N/A	x	x	x
31	Taylor-Swanson et al. (2019)	USA	232	PrSCS	A single question	0.27	x	x	x	x
32	Muranaka and Sasaki (2018)	Japan	146	RRQ	STAI	N/A	x	x	x	x
33	Martinon et al. (2019)	UK	453	RRQ	BDI-II	x	N/A	x	x	x
34	Van Pat-ten et al. (2019)	USA	96	3D-WS-SR	BSI-ANX CESD SWLS CESD-4	−0.48	−0.44	x	0.62	0.61
35	Stefan and Cheie (2020)	USA	180	SRIS	LSAS	N/A	x	x	x	x
36	Jeste et al. (2021)	USA	1786	3D-WS-SR	PHQ CESD-4 GAD	−0.06	−0.13	x	0.17	x
37	Falon et al. (2021)	Australia	108	RRS	PHQ GAD	0.43	0.32	x	x	x

Table 1 (continued)

No.	Study	Nationality	N	SR measure used	MH measure used	Finding on SR-MH Relationships				
						Anxiety	Depression	Self-esteem	Subjective Well-being	Life satisfaction
38	Bucknell et al. (2022)	Australia	277	SRIS	GWB	x	x	x	0.17	x
39	Webster et al. (2022)	UK	344	BCIS	BDI BAI	0.41	0.30	x	x	x

SR self-reflection, *MH* mental health, *PrSCS-SR* The Private Self-Consciousness Scale, *RRQ* The Rumination–Reflection Questionnaire, *SRIS* The Self-Reflection and Insight Scale, *RRS* The Ruminative Responses Scale, *BCIS* The Beck Cognitive Insight Scale, *3D-WS-SR* The 3-Dimensional Wisdom Scale, *BDI* The Beck Depression Inventory; The Beck Depression Inventory, Second Edition; *CESD* The Center for Epidemiological Studies Depression Scale, *HADS-DEP* The depression scale of Hospital Anxiety and Depression Scale, *SDS* The Zung Self-rating Depression Scale, *PAI-DEP* The depression scale of Personality Assessment Inventory, *DASS-DEP* The depression scale of Depression Anxiety Stress Scale, *HSCL-DEP* The depression scale of Hopkins Symptom Checklist, *BSI-DEP* The depression scale of the Brief Symptom Inventory, *PHQ* The Patient Health Questionnaire, *MFQ* The Mood and Feelings Questionnaire, *STAI-SAI* The state anxiety scale of the State-Trait Anxiety Inventory, *BAI* The Beck Anxiety Inventory, *DASS-ANX* The anxiety scale of Depression Anxiety Stress Scale, *PAI-ANX* The anxiety scale of Personality Assessment Inventory, *LSAS* The Liebowitz Social Anxiety Scale, *HSCL-ANX* The anxiety scale of Hopkins Symptom Checklist, *BSI-ANX* The anxiety scale of Brief Symptom Inventory, A single question = "Think back over the past 2 days and rate overall how severe each symptom was listed below", *SCS-SC* The Social Anxiety Scale of Self-Consciousness Scale, *GAD* The Generalized Anxiety Disorder Scale, *SHS* The Subjective Happiness Scale, *CESD-4* The 4-items of Center for Epidemiological Studies Depression Scale, *GWB* The 14-items Scales of General Well-being, *SWLS* The Satisfaction With Life Scale, *RSEI* The Rosenberg Self-Esteem Scale, *SES-2* The 2-items of Core Self-evaluations Scale, "N/A" indicates no correlation; and "x" indicates the indicator was not mentioned in the study

patients with depressive disorders) and non-clinical participants, only the non-clinical data was incorporated into our analysis.

Data processing and analysis

Analyses were conducted using R, version 4.3.0. The effect size of interest was Pearson's r between SR and various mental health indicators (e.g., depression, self-esteem). All correlation coefficients were transformed using Fisher's r-to-z transformation before calculations and then back-transformed for interpretation (Hedges & Olkin, 1985). Recognizing the inherent and statistically verified heterogeneity across studies (see the "Results" section; Borenstein et al., 2010), a random-effects model was employed to synthesize the effect sizes.

First, correlation coefficients were calculated between SR and overall positive and negative mental health, as well as between SR and specific mental health indicators (e.g., depression, self-esteem), using random-effects models. These analyses were performed using the metacor function from the meta package in the R statistical environment (Hunter & Schmidt, 2004; R Core Team, 2016).

Second, heterogeneity was assessed using the Q-test and the I^2-test (Borenstein et al., 2010). The I^2 statistic, which ranges from 0 to 100%, was interpreted as low, medium, or high heterogeneity at thresholds of 25%, 50%, and 75%, respectively, with a p-value < 0.05 indicating significant heterogeneity (Higgins & Thompson, 2002). Regression analysis was performed to identify potential sources of heterogeneity using the rma function of the metafor package (Viechtbauer, 2010). When significant heterogeneity

was detected, sensitivity analyses were performed for all studies to further investigate variability using the metacor and metainf functions from the meta package (Hunter & Schmidt, 2004).

To further investigate the influence of cultural background and SR measurement methods on the association between SR and specific mental health indicators, subgroup analyses were conducted. These random-effect subgroup analyses were conducted using the metacor function from the meta package (Andrade, 2020).

Finally, publication bias was assessed using Egger's repression test (Egger et al., 1997), Begg's rank correlation test (Ioannidis, 2008), and Duval and Tweedie's trim and fill analysis (Aitkin, 1999), using the metabias and trimfill functions from the meta package.

Results

Characteristics of included studies

Following a comprehensive review of the literature, 39 published studies that satisfied the inclusion criteria were found. Of these, 39 comprised independent samples, from which 63 effect sizes were calculated or estimated. The mental health indicators included in the current study were subjective well-being, self-esteem, life satisfaction, anxiety, and depression. The combined sample size of these studies was 12,496 (subjective well-being: k=8; n=4200; life satisfaction: k=7; n=3034; self-esteem: k=5; n=1356; anxiety: k=20; n=6795; depression: k=23; n=6876). All the research comes from 4 regions (Anglo-American: n=28;

Table 2 Meta-analysis of studies examining the association of self-reflection and positive indicators of mental health

Index	K	N	Effect Size			
			COR	95%CI		P
Positive-total	20	8590	0.118	−0.018	0.254	0.089
Subjective well-being	8	4200	0.179	−0.004	0.362	0.055
Self-esteem	5	1356	−0.044	−0.138	0.050	0.362
Life satisfaction	7	3034	0.164	−0.154	0.482	0.312

K numbers of independent sample, *N* number of total participants, *Cor* the average true population effect sizes of the insight and cognition associations

Table 3 Meta-analysis of studies examining the association of self-reflection and negative indicators of mental health

Index	K	N	Effect Size			
			COR	95%CI		P
Negative-total	43	13,671	0.155	0.076	0.233	<0.001
Anxiety	20	6795	0.130	0.002	0.257	0.046
Depression	23	6876	0.176	0.079	0.273	<0.001

K numbers of independent sample, *N* number of total participants, *Cor* the average true population effect sizes of the insight and cognition associations

Asia: $n=6$; Europe: $n=4$; South America: $n=1$). All studies used 6 SR scales (SRIS & RRQ: $n=22$; RRS: $n=8$; 3D-WS-SR: $n=4$; SCS: $n=3$; BCIS: $n=2$). The 8 studies did not report the mean age, and 5 studies did not report the gender ratio. The mean age across the 31 studies was 27.29, and the mean number of females was approximately 64.95%. Details of all included studies were provided in Table 1.

Self-reflection and positive indicators of mental health

The random-effect model showed no significant correlation between SR and overall positive mental health (0.118; 95% CI: −0.018 to 0.254; $p>0.05$), as well as with each individual positive indicator of mental health (details seen in Table 2). The Q test and I^2 statistics indicated significant heterogeneity between samples (all $I^2>60\%$) (details seen in Supplement-Table 1).

For both subjective well-being ($p=0.007$, which explained 50.46% of the heterogeneity) and total positive indicators ($p<0.001$, which explained 44.41% of the heterogeneity), the moderator of SR measurements was statistically significant. There was no statistically significant difference in the heterogeneity of self-esteem and life satisfaction between regions or SR measures (all $p>0.05$).

Sensitivity analysis results indicated that the source of heterogeneity in total positive indicators was one pertinent study (Chang et al., 2010). The effect size of the 19 studies that remained after removing it was significant (0.153; 95%CI: 0.031 to 0.276; $p=0.014$; $I^2=95.2\%$). Sensitivity analyses revealed that the sources of the variability in subjective well-being were two pertinent studies (Lyke, 2009; Stein & Grant, 2014). The effect size of the six studies that remained after these were eliminated was substantial (0.27;

95%CI: 0.085 to 0.455; $p=0.004$; $I^2=93.2\%$). Sensitivity analysis results indicated that the variability in life satisfaction was due to one pertinent study (Chang et al., 2010). The effect sizes of the six remaining studies were significant (0.28; 95%CI: 0.031 to 0.536; $p=0.028$) after the study was removed.

Self-reflection and negative indicators of mental health

The random-effect model showed a significant positive relationship between SR and overall negative mental health indicators (0.155; 95% CI: 0.076 to 0.233; $p<0.001$). Further correlation analysis revealed that SR was significantly associated with each individual negative indicator of mental health, including depression and anxiety (details in Table 3). The Q test and I^2 statistics indicated significant heterogeneity between samples (all $I^2>90\%$) (details seen in Supplement-Table 1).

Only the heterogeneity in the total negative indicators ($p=0.001$, explaining 18.95% of the variability) was statistically significant for the moderator of SR measurements. For anxiety and depression heterogeneity, neither SR measurements nor region showed statistical significance (all $p>0.05$).

Self-reflection measurement tool moderator analysis

Correlational coefficients of SR and positive mental health domains were 0.001 to 0.033 in SRIS & RRQ, 0.419 to 0.534 in 3D-WS-SR, and −0.545 in RRS (details seen in Supplement-Table 2). Correlational coefficients of SR and negative indicators of mental health domains were 0.045 to

0.131 in SRIS & RRQ, −0.285 to −0.277 in 3D-WS-SR, 0.293 to 0.436 in BCIS, 0.35 to 0.459 in RRS, and 0.299 in PRSCS (details seen in Supplement-Table 2). A significant difference was found in positive mental health (k=20, Q=140.4, df=2, p<0.001) and negative mental health (k=43, Q=45.28, df=4, p<0.001) (details seen in Supplement-Table 2).

Cultural background moderator analysis

Correlational coefficients of SR and positive mental health domains were −0.054 to 0.197 in Anglo-American, −0.010 in Asia, and 0.06 in Europe (details seen in Supplement-Table 3). Correlational coefficients of SR and negative mental health domains were 0.1578 to 0.163 in Anglo-American, 0.002 to 0.201 in Asia, 0.256 to 0.297 in Europe, and 0.012 in South America (details seen in Supplement-Table 3). A significant difference was found in negative mental health (k=43, Q=9.28, df=3, p=0.026) (details seen in Supplement-Table 3).

Publishing bias

The results of Begg's rank correlation test and Egger's regression test indicate that none of them are statistically significant. For every analysis, estimated unbiased effect sizes (r) are obtained using the trim-and-fill method developed by Duval and Tweedie (details seen in Supplement-Table 4).

Discussion

This study represents the first meta-analysis to systematically investigate the relationship between SR and mental health within the dual-factor model framework. Additionally, it examines the potential roles of SR measurement tools and cultural background in this relationship. The following sections provide specific discussions on these topics:

Relation between self-reflection and mental health Current research reveals a significant positive correlation between SR and negative mental health indicators, including a marked association with individual indicators such as depression and anxiety. This finding aligns with earlier studies (Webster et al., 2022; Falon et al., 2021; Tanovic et al., 2017; Nakajima et al., 2017; Şimşek et al., 2013; Silvia & Phillips, 2011) and underscores that high levels of SR are often linked with various mental health challenges (Ingram, 1990; Van Camp et al., 2017; Nolen-Hoeksema et al., 2008). These research findings suggest that SR may play a crucial role in mental health, particularly in the onset and development of negative mental health. A longitudinal survey study conducted by Van Camp et al. (2018) found that the correlation between SR and depression was evident at baseline but did not persist over time. They propose that SR may represent a trait-like ability that is not influenced by emotional states, yet it has an impact on emotional fluctuations (Van Camp et al., 2018). Furthermore, in clinical treatment, when individuals enhance their SR abilities, they often become aware of previously unnoticed emotions, such as sadness (Lysaker et al., 2013). This can lead to depressive mood and distress, and research suggests that this enhancement of SR ability is the first critical process in patient recovery (Buck et al., 2020). Additionally, as SR abilities continue to increase, individuals become more aware of their emotions, can describe them, and attribute them correctly, which helps to better regulate emotions (Vohs et al., 2018).

Consistent with the observations of Philippi and Koenigs (2014), which suggest that while moderate SR supports normal social and emotional functioning, significant deviations in SR may be associated with various psychopathology. These findings have practical implications for developing predictive models of mental health states. By quantifying the relationship between SR and negative emotional states, this study provides a foundation for early identification and intervention strategies targeting individuals at risk for anxiety and depression. For instance, effective interventions for depression often involve teaching patients' positive strategies to manage stressors and transforming reflective practices into adaptive tools that promote mental health rather than exacerbating negative emotions (Dunn & Luckner, 2022). Previous metacognitive therapy for clinical patients, through destigmatization/normalization, adjusted patients' SR abilities and improved their depressive symptoms (Moritz et al., 2018; Vohs et al., 2018). These findings suggest that recognizing disease-related experiences without internalizing the negative consequences of the disease into the self can lead to positive subjective outcomes (García-Mieres et al., 2020). Therefore, future research should focus on exploring how to encourage individuals to engage in positive and constructive SR, helping them recognize and manage potential negative emotions and mental health challenges.

Current research shows no statistically significant correlation between SR and positive mental health indicators. This finding is consistent with most previous studies, which similarly report a lack of association between SR and positive indicators, such as subjective well-being, life satisfaction, and self-esteem (Şimşek et al., 2013; Harrington & Loffredo, 2010; Lyke, 2009; Haga et al., 2007; Luyckx et al., 2007). While some research has suggested both positive

and negative correlations between SR and positive mental health indicators (Jeste et al., 2021; Boyraz & Kuhl, 2015; Silvia & Phillips, 2011), these variations may be explained by the focus of SR itself. Specifically, engaging in SR that emphasizes positive, meaningful experiences could foster an enhanced view of the self, thereby improving positive mental health, e.g., SR allows both teachers and students to identify their strengths and weaknesses, improve methods, and optimize teaching practices (Lim et al., 2022). Thus, SR in education is almost universally associated with positive outcomes. whereas dwelling on personal problems or dysfunctional attitudes may lead to increased negative emotions and diminished positive mental health, e.g. emotion-centered thinking patterns (Stein & Grant, 2014; Bucknell et al., 2022).

It is worth noting that positive indicators like subjective well-being and life satisfaction largely depend on individuals' perceptions of their external environment, while self-esteem reflects an individual's assessment of their own worth, which is dynamic and situation dependent. In contrast, SR is a more stable cognitive process centered on self-thoughts, memories, feelings, and behaviors (Lyke, 2009; Luyckx et al., 2007; Joireman et al., 2002). This suggests that SR may have an indirect influence on positive mental health by shaping the cognitive frameworks through which external experiences are interpreted. However, its impact appears to be subtler and less direct compared to its role in negative mental health.

Future research should delve deeper into the complex role of SR in promoting mental health, particularly by exploring its potential as an indirect factor in enhancing positive mental health. Given its nuanced relationship with both positive and negative indicators, future studies could benefit from incorporating more diverse research methods, such as longitudinal and intervention studies, to better capture the dynamic interplay between SR and mental health outcomes. Additionally, practical applications that encourage constructive SR should be prioritized to support mental health interventions, particularly guiding individuals to reflect in ways that mitigate negative emotions and enhance well-being. By adopting a more comprehensive approach, future research could contribute to a more thorough understanding of SR's potential in both preventing mental health challenges and fostering psychological resilience.

Moderating effects The present study revealed that the choice of SR measurement tool moderated the relationship between SR and mental health. As a complex and multidimensional construct, SR is interpreted and measured from diverse perspectives across different studies. This divergence leads to a multiplicity of scales and inconsistent results, thereby obscuring and complicating the relationship

between SR and mental health. Specifically, the SR subscale of the Rumination Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991) was associated with higher levels of negative mental health and lower levels of positive mental health. In contrast, the SR subscale of the 3D-WS was linked to lower levels of negative mental health and higher levels of positive mental health. The SR subscale of the RRS has consistently shown a positive correlation between SR and depression (Falon et al., 2021; Tanovic et al., 2017; Verhaeghen et al., 2014; Adrian et al., 2014) and has been found to predict depressive symptoms and suicidal ideation (Kwon & Olson, 2007; Miranda & Nolen-Hoeksema, 2007). One possible explanation for these findings is the strong positive correlation between the reflective and brooding subscales of the RRS (Falon et al., 2021; Tanovic et al., 2017; Verhaeghen et al., 2014), where "brooding contamination" can skew results related to reflection (Joormann et al., 2006).

In this study, we found that cultural background moderated the relationship between SR and negative indicators of mental health. Specifically, the correlation between SR and negative indicators, particularly anxiety, differed significantly across Asia, South America, Anglo-American, and European regions, with the strength of the correlation increasing sequentially. We discovered that individuals in European and American countries are more prone to internalize negative emotions and experiences as personal responsibility during SR, thereby exacerbating negative mental health issues. This tendency may be related to a cultural dimension pertinent to mental health (individualism versus collectivism, IDV–COLL) (Hofstede, 2011). IDV-COLL, as a cultural dimension, represents the extent to which people in a society integrate into groups. European and American cultures, being individualistic, prioritize rights over obligations, emphasize values of personal independence, self-expression, pursuit of individuality, and achievement orientation, and are content with loose social networks (Hofstede, 2011). Within this cultural context, individuals are often encouraged to actively pursue personal goals and take personal responsibility for failures and setbacks, which can lead to increased SR and subsequent negative emotions. In contrast, in Asian countries, we found that the relationship between SR and negative mental health is relatively weaker. As collectivist cultures, they focus on the group, value the group over the individual, and prefer to integrate into tightly knit social networks (Beller & Wagner, 2020). In the Asian cultural context, individuals tend to prioritize group harmony and are inclined to seek social support and help when encountering difficulties, rather than bearing the burden alone (Germani et al., 2021). Collectivism instills from an early age the importance of self-control, encouraging the suppression of one's own interests and personal

desires, as well as the regulation of emotions, particularly negative ones (Li et al., 2018). In the long run, frequent practice of self-control ultimately enhances an individual's self-regulatory capacity (Muraven et al., 1999). This cultural characteristic may mitigate the negative impact of SR on mental health.

However, our findings don't align with Chang et al. (2010), who reported a stronger correlation between SR and anxiety-depression in Asian Americans compared to European Americans. The reason for the inconsistency with previous research findings may be that we divided the study regions into four major geographical areas: Asia, South America, Anglo-American countries, and Europe. This approach may not have adequately considered the cultural diversity within these regions, such as the varying cultural backgrounds among Asian countries, which could potentially affect our research results. Additionally, the uneven distribution of the number of studies included from each region may also introduce bias into the overall analysis, impacting the accuracy and reliability of the results. Apart from the limitations of our study, there are two other possibilities: firstly, the small sample size used by Chang et al. (238 European Americans and 184 Asian Americans), which may have limited the representativeness of their findings. Secondly, Chang et al.'s study was based on data collected before 2010, whereas our meta-analysis includes more recent studies. Over time, cultural, social, and psychological factors may change (Wickrama et al., 2002). Previous research has demonstrated that the cultural dimension of individualism-collectivism influences an individual's cognition (i.e., attitudes) and self-exertion (i.e., behavior) (Li et al., 2018). These temporal changes could account for the differences in how SR relates to negative mental health indicators in different cultural contexts.

In contrast, our study categorized cultural backgrounds into more specific geographic regions rather than broadly dividing them into Easten and Westen categories. We observed that the relationship between SR and anxiety was indeed influenced by cultural differences, while the relationship between SR and depression did not vary significantly across cultures. An interesting aspect of our results was that despite the varying number of studies focusing on SR's relationship with anxiety and depression across different regions (Anglo-American, Europe, and Asia), only the correlation between SR and anxiety demonstrated cultural variation. This suggests that cultural factors may have a greater influence on cognitive processes related to anxiety, while the impact of SR on depression appears to be more consistent globally. It seems that the intrinsic cognitive mechanisms of SR may interact with cultural contexts in ways that amplify or mitigate anxiety, whereas SR's influence on depression

may be more universally experienced, independent of cultural background.

Additionally, we did not find evidence that cultural differences influenced the relationship between SR and positive mental health indicators. This result may be limited by the available research, as most studies on SR and positive mental health have been concentrated in Anglo-America (19 studies), with far fewer studies conducted in Asian (1) and South American (1) countries. However, the data indicate that the correlation between SR and positive mental health was weaker in Asian populations compared to Anglo-American populations. We also observed that the link between SR and mental health may be stronger in regions with more extensive research on the subject. Thus, we speculate that cultural factors may shape the content and purpose of SR, influencing its relationship with mental health across different regions. To fully understand this dynamic, future research should explore SR and its connection to mental health within broader cultural contexts. By considering how culturally specific mental health practices impact the role and effectiveness of SR, researchers can offer more nuanced insights and provide more targeted recommendations for mental health interventions in various cultural settings.

Limitations and future prospects

This study has several limitations. First, while we explored the relationship between SR and both positive and negative mental health indicators based on the dual-factor model of mental health, there was a significant imbalance in the number of studies on SR and positive (18) versus negative (30) mental health outcomes. The large number of studies focusing on cognition, anxiety, and depression from a mental disorder perspective likely inflated the number of studies on SR and negative indicators. Additionally, the lack of statistically significant findings between SR and positive mental health indicators may have led to fewer publications in this area, as null results are less likely to be published. Second, the relationship between SR and mental health may not be linear. Unfortunately, due to limitations in the available data and statistical methods, this meta-analysis could not thoroughly examine these nonlinear dynamics. Third, a limitation of this study is the SR measurement instruments used, particularly the reliance on the rumination subscale, and the fact that these instruments may not be fully aligned with the core concepts of SR, which could lead to results that diverge from the intended benefits of SR. Fourth, although we attempted to examine the influence of cultural background on the relationship between SR and mental health, we only categorized regions geographically into four broad areas: Asia, South America, Anglo-American, and Europe. This approach did not account for the cultural diversity within

these regions, which may have limited the granularity of our analysis. Furthermore, the disparity in the number of studies from each region posed challenges to the robustness of our findings. Fifth, while we identified cultural background and SR measurement scales as sources of heterogeneity, they did not fully explain the variability in the results. Other potential moderating factors, such as gender or education level, were not explored in depth and may contribute to the observed differences. Finally, though our findings suggest a potential nonlinear relationship between SR and mental health, the constraints of the available meta-analysis data prevented a thorough investigation of this possibility. This presents an avenue for further research.

This study highlights several areas for future inquiry. First, there is a need to develop more comprehensive and domain-specific measurement tools to fully capture the multidimensional nature of SR. Second, exploring nonlinear relationships between SR and mental health, using advanced modeling techniques like structural equation modeling and machine learning, could provide deeper insights into the complexities involved. Third, longitudinal and intervention studies are essential to understand the causal pathways linking SR and mental health outcomes. Context-specific research across different populations and cultural contexts will enhance the generalizability of findings. Lastly, integrating qualitative and quantitative approaches, leveraging technologies such as natural language processing, will offer a richer and more nuanced understanding of SR and its mechanisms. These future directions will advance the field and deepen our understanding of the role of SR in mental health.

Conclusion

This meta-analysis reveals a significant positive correlation between SR and negative mental health indicators, while underscoring the lack of a similar association with positive mental health. The findings highlight the crucial role of SR measurement tools, demonstrating that the design and interpretation of these scales greatly influence their relationship with mental health outcomes. Moreover, the analysis sheds light on the pivotal role of cultural background in shaping the connection between SR and negative mental health, further complicating this dynamic interplay. These insights not only enhance our understanding of the intricate link between SR and mental health but also underscore the importance of adopting culturally sensitive and methodologically diverse approaches in future research.

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