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Journal of Affective Disorders 320 (2023) 148–160

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Review article

Associations between psychological inflexibility and mental health problems during the COVID-19 pandemic: A three-level meta-analytic review

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ARTICLE INFO

Keywords:
Psychological inflexibility
Depression
Anxiety
Stress
Meta-analytic review
COVID-19 pandemic

ABSTRACT

Background: An increasing number of research has documented the positive associations between psychological inflexibility (PI) and mental health problems (i.e., depressive, anxiety, and stress symptoms) during the COVID-19 pandemic. However, the documented associations have been inconsistent. This review thus aimed to quantitatively summarize primary research to gain better estimates of these associations.

Methods: A systematic literature review was conducted in six databases and three-level meta-analytic models were used to statistically synthesize effect sizes and to examine moderators of the associations between PI and depressive, anxiety, and stress symptoms.

Results: A total of 22 studies yielded 63 effect sizes on associations between PI and depressive, anxiety, or stress symptoms. The results of three separate meta-analyses revealed a large and significant association between PI and depressive ($r = 0.580$, 95 % CI [0.549; 0.775]), anxiety ($r = 0.548$, 95 % CI [0.468; 0.761]), and stress symptoms ($r = 0.548$, 95 % CI [0.506; 0.725]). The association between PI and depressive symptoms is stronger for males than for females, and the association between PI and stress symptoms varies by type of measure that primary studies use to assess PI and stress symptoms.

Limitations: Temporal or causal conclusions are not allowed due to cross-sectional nature of the associations included in meta-analyses. Clinical samples with high levels of stress were underrepresented.

Conclusions: PI seems an important risk factor for symptoms of depression, anxiety, and stress, and should therefore be targeted in interventions addressing mental health problems during the COVID-19 pandemic and beyond.

Introduction

The Coronavirus Disease 2019 (COVID-19) has infected over 500 million people and cost the lives of more than six million people worldwide as of June 20, 2022 (World Health Organization, 2020). Extensive studies have suggested that the COVID-19 pandemic has significantly increased the prevalence of mental health problems across populations and time periods (Chang et al., 2021; Chekole and Abate, 2021; Deng et al., 2021b). It has been reported that the average prevalence of depression, anxiety, and stress among the general population during the COVID-19 pandemic was 45 %, 47 %, and 53 %, respectively (Lakhan et al., 2020; Necho et al., 2021). Given the high prevalence rates of these mental health problems during the COVID-19 pandemic, it is necessary to examine critical malleable factors to alleviate these mental health problems.

In the past two years, psychological inflexibility (PI) has been recognized as a risk psychological factor in mental health problems. PI involves the rigidity in how people react to life events and it may occur when people attempt to avoid unwanted emotions and thoughts (Hayes et al., 2012). Numerous studies have documented that PI is positively associated with depressive symptoms (Landi et al., 2022; Pakenham et al., 2020), anxiety symptoms (Fuentes-García et al., 2020; Huang et al., 2021), and stress symptoms (Arslan et al., 2021; Bonilla-Sierra et al., 2021) during the COVID-19 pandemic, and both in cross-sectional

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https://doi.org/10.1016/j.jad.2022.09.116
Received 29 July 2022; Received in revised form 18 September 2022; Accepted 21 September 2022
Available online 28 September 2022

and prospective study designs (Landi et al., 2022). However, the documented associations between PI and mental health problems have been inconsistent. For example, Smith et al. (2020) found a large PI-depression association, whereas Pakenham et al. (2020) reported a nonsignificant PI-depression association; Huang et al. (2021) revealed a large PI-anxiety association, whereas Pakenham et al. (2020) suggested a nonsignificant PI-anxiety association; Chen et al. (2021) yielded a large PI-stress association, whereas Peltz et al.'s (2020) study indicated a small PI-stress association. Furthermore, until now no study has performed a systematic review or meta-analysis of associations between PI and mental health problems during the COVID-19 pandemic. To enhance knowledge on the extent to which PI is associated with different mental health problems during the COVID-19 pandemic, the present study aimed to conduct a meta-analytic review to statistically synthesize associations between PI and mental health problems. The results of this study provide knowledge for practitioners and policymakers to make more comprehensive preparations for prevention and intervention in mental health problems during the COVID-19 pandemic and beyond.

1.1. Psychological Inflexibility and Mental Health Problems

PI has been conceptualized as "the rigid dominance of psychological reactions over chosen values and contingencies in guiding action" (Bond et al., 2011, p. 678), that may become pathologic (Hayes et al., 2012). It is a transdiagnostic concept that forms the basis for acceptance and commitment therapy (ACT). PI encompasses six interrelated processes: experiential avoidance, cognitive fusion, attachment to the conceptualized self, inflexible attention, failures in clarity or pursuit of values, and inaction, impulsivity, or avoidant persistence (Bond et al., 2011; Hayes et al., 2006; Hayes et al., 2012). PI involves patterns of behavior that are regulated by these six processes and are linked to rigid and reactionary behavioral responses and negative experiences (Hayes et al., 2006; Hayes et al., 2013; Levin et al., 2014). When a person undergoes one or more of these six processes consistently or excessively, PI may develop into psychopathology (Hayes et al., 2012).

In the present study, we focused on three mental health problems (i.e., depressive, anxiety, and stress symptoms) for several reasons: (1) they are prevalent in the general population (Chang et al., 2021; Erbiçer et al., 2021); (2) a large number of studies on psychological distress and/or trauma during the COVID-19 pandemic assessed these outcomes; and (3) these three symptoms may serve as risk factors for other psychopathology such as suicidality, obsessive-compulsive symptoms, and sleep disorder (Carballo et al., 2020; Fang et al., 2019; Khosravani et al., 2021) and could be targeted in intervention efforts. A growing body of research has evidenced correlations between PI and various psychological problems, including depressive, anxiety, and stress symptoms, across different samples and during the COVID-19 pandemic (Bonilla-Sierra et al., 2021; Landi et al., 2022; Pakenham et al., 2020). For instance, Ferreira et al. (2021) analyzed data obtained from an online survey filled out by 586 Portuguese adults and found that PI had significantly large and positive associations with negative psychological problems (i.e., depressive, anxiety, and stress symptoms). Among Chinese school children and students aged 8–18 years, Chen et al. (2021) explored factors potentially influencing mental health symptoms and reported that PI is positively correlated with depressive, anxiety, and stress symptoms. Consistent with these lines of research, another study conducted in the United States by Smith et al. (2020) analyzed data obtained from online surveys and revealed that the relationship between PI and anxiety symptoms was significantly positive and large in magnitude. Similar findings were reported on the associations between PI and depressive and anxiety symptoms in Italy (Pakenham et al., 2020).

Furthermore, prospective associations between PI and mental health problems have also been documented in research. For example, a longitudinal study conducted among adults in Italy from 2020 to 2021 evidenced that high PI is positively associated with depressive and anxiety symptoms (Landi et al., 2022). In addition, a recent meta-analysis revealed a moderate-to-large association of experiential avoidance (i.e., a sub-process of PI) with depressive and anxiety symptoms (Akbari et al., 2022). These empirical findings indicate that individuals with high levels of PI may be unable to effectively manage and align their feelings and thoughts in a psychologically adaptive way. Hence, PI may be a vital mechanism in alleviating psychological problems, such as depressive, anxiety, and stress symptoms, by reducing the adverse effects of coronavirus stress on these constructs.

With the theoretical insights and empirical evidence discussed above, the primary aim of this meta-analytic review was to reveal a better estimate of true association between PI and different mental health problems (i.e., depressive, anxiety, and stress symptoms). The secondary aim was to investigate whether the overall association between PI and each of these three mental health problems (i.e., depressive, anxiety, and stress symptoms) varies by sample characteristics (i.e., gender, age, and sample type), research design characteristics (i.e., measurements of study variables), and other characteristics (i.e., country where the primary study was conducted and publication year). An overall effect was estimated for each association, after which several variables were examined as potential moderators. From previous theory and research, we hypothesized that PI is significantly and positively correlated with depressive, anxiety, and stress symptoms. We did not formulate hypotheses on moderating variables, and tested these variables exploratively.

2. Methods

In line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021), three separate meta-analyses were conducted to estimate the associations between PI and the three mental health outcomes (i.e., depressive, anxiety, and stress symptoms) during the COVID-19 pandemic.

2.1. Search strategy

The following six databases were searched in this review: PsycINFO, Web of Science, PubMed, MEDLINE, ScienceDirect, and China National Knowledge Infrastructure (CNKI). We conducted electronic searches to identify relevant literature using the following keywords and syntax: ("psychological inflexibility") AND ("depression" or "depressive symptoms" or "anxiety" or "stress" or "mental health"). The search was restricted to keywords, titles, and abstracts of primary studies. Further, the reference lists of review articles and primary studies eligible for inclusion were manually screened to retrieve additional relevant studies. When the full text of a potentially relevant study was not available, we sent emails to the primary study authors and requested the full text. The results from each electronic search were combined after which and duplicates were removed. Our latest search finished on May 31, 2022.

2.2. Eligibility criteria

A study that fulfilled the following criteria was included in this review: (1) the study was empirical and quantitative in nature, (2) the study used a cross-sectional, or longitudinal design, (3) the study tested at least one association between PI and one or more of the mental health outcomes, (4) the study was published in English or Chinese, (5) the study reported at least one correlation coefficient that could be extracted, (6) the study was published after January 1, 2020 when the COVID-19 pandemic started, and (7) primary study data were collected during the COVID-19 pandemic.

2.3. Data extraction and coding

Each study was coded and extracted for the following characteristics:

(a) the first author's name, (b) publication year, (c) country (categorized into four continents: North-America, Europe, Asia, and South-America), (d) research design (i.e., cross-sectional or longitudinal), (e) sample type (sample was coded as "community" if participants were recruited from general community contexts, and "clinical" if participants were recruited from clinical settings), (f) sample size, (g) percentage of females, (h) mean age of the sample, (i) type of PI measure, (j) type of measure that was used for assessing an outcome (i.e., depressive, anxiety, and stress symptoms; different versions of one scale were coded as the same type of measure), and (k) effect size (i.e., the zero-order correlation coefficient).

As for longitudinal studies, we extracted only cross-sectional correlations that were measured on a single time point. All extracted effect sizes were unadjusted, implying that they were not controlled for demographic variables (e.g., gender, age) and/or other variables. In the coding procedure, the full text of each included study was thoroughly read, and each primary study was coded independently by the 1st and 2nd author. In case of disagreements, the two authors discussed until consensus was achieved, or consulted other authors or experts in the fields of PI and mental health to make a final decision.

2.4. Quality assessment

Each of the included studies was assessed for quality according to the "Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies" (National Heart, Lung, and Blood Institute, 2013), and rated on 14 criteria. Each of these criteria was assessed with a 3-point scale (good, fair, and poor). Quality assessment was performed independently by the two authors.

2.5. Publication bias

For assessing publication bias, we visually examined the funnel plots of the effect sizes and applied Duval and Tweedie's (2000) trim-and-fill procedure, which allowed us to evaluate an adjusted overall effect in case the trim-and-fill algorithm indicated that effect sizes had to be imputed to restore the symmetry of the effect size distribution. In case no effect sizes had to be imputed according to the algorithm, the effect size distribution was deemed to be symmetric.

2.6. Statistical analyses

The correlation coefficient was used as the common effect size in this meta-analysis. We directly extracted effect sizes (Pearson's r) from every included study. Before performing the meta-analysis, we converted each correlation into a Fisher's z value (Z_r), as correlations are not normally distributed. After conducting the statistical analyses, the Fisher's z values were retransformed into Pearson's r for easier interpretation.

We built three-level meta-analytic models to synthesize effect sizes and to perform moderator analyses. In this model, three sources of variance were modeled to deal with effect size dependency that occurred because from most studies multiple effect sizes could be extracted: the sampling variance of the observed effect sizes (Level 1), the variance in effect sizes extracted from the same study (Level 2), and the variance between studies (Level 3; Cheung, 2014; Van den Noortgate et al., 2013, 2015). With such a three-level model, it is possible to retain all relevant information as reported in the included studies, so that a maximum power in the statistical analyses could be achieved.

In the analyses, we first estimated an overall correlation between (1) PI and depressive symptoms, (2) PI and anxiety symptoms, and (3) PI and stress symptoms by building three separate meta-analytic intercept-only models in which only cross-sectional correlations were synthesized. For interpretation of these overall correlations, we adhered to the guidelines of Cohen (1992), in which an effect size of 0.10 was considered to be small, 0.30 medium, and 0.50 large, respectively. Second, we performed bivariate moderator analyses by building mixed-effect models to investigate potential moderators of the associations between PI and depressive, anxiety, and stress symptoms. We examined effect size heterogeneity by performing a one-sided loglikelihood-ratio test (Assink and Wibbelink, 2016), and in case of significant heterogeneity, we performed moderator analyses to search for (coded) variables that may explain within- and/or between-study variance.

We conducted all analyses in R version 4.1.2 (R Core Team, 2021; Viechtbauer, 2010) using the metafor package. The R syntax was written based on the tutorial of Assink and Wibbelink (2016). All model parameters were calculated using the restricted maximum likelihood method (Viechtbauer, 2005), and a two-tailed p-value smaller than 0.05 was considered to be statistically significant.

3. Results

3.1. Literature search and study characteristics

The flow chart of the study selection process is shown in Fig. 1. Twenty-two studies analyzing 25,571 participants in total were included in the present review (i.e., 15 studies on depressive symptoms, 14 studies on anxiety symptoms, and 14 studies on stress symptoms). Table 1 presents the included studies and several characteristics. The included studies were published from January 1, 2020 to May 31, 2022 in peer-reviewed journals, with sample sizes ranging from 75 to 15,993. Except for one study (Landi et al., 2022) that employed a longitudinal design, all included studies used a cross-sectional design. Altogether, 63 correlations (61 cross-sectional and 2 longitudinal correlations) were extracted. The quality of the studies was assessed as fair or good according to our quality assessment procedure (see Table 1).

With regard to the continent in which the primary studies were performed, four (18.18 %) studies were performed in North America, seven (31.82 %) in Europe, nine (40.91 %) in Asia, and one (4.55 %) in South America. All studies used community samples except three studies that analyzed clinical samples (i.e., Ecija et al., 2022; Huang et al., 2021; Pang et al., 2021a). The mean age of participants was 33.06 years (SD = 9.75, ranging from 12.26 to 56.91 years).

3.2. Overall effect sizes

The results of our three-level meta-analyses for the overall correlation between PI and each of the three mental health outcomes (i.e., depressive, anxiety, and stress symptoms) are summarized in Table 2. The overall correlations between PI and depressive symptoms (r = 0.580, 95 % CI [0.549; 0.775]), anxiety symptoms (r = 0.548, 95 % CI [0.468; 0.761]), and stress symptoms (r = 0.548, 95 % CI [0.506; 0.725]) were all significant (p < .001) and positive in direction. Following Cohen's (1992) criteria, the overall effect sizes are large in magnitude.

The results of the likelihood-ratio tests indicated significant variance in effect sizes extracted from the same studies (i.e., significant Level 2 variance or within-study-variance) for all three meta-analyses (i.e., PI-depressive symptoms, PI-anxiety symptoms, and PI-stress symptoms). However, variances in effect sizes extracted from different studies (i.e., Level 3 variance or between-study variance) were nonsignificant for all three outcomes (see Table 2). Significant variances at level 2 did imply heterogeneity in effect sizes, and we therefore proceeded with performing moderator analyses in the PI-depressive symptoms, PI-anxiety symptoms, and PI-stress symptoms meta-analysis in an attempt to identify moderator variables that can account for the significant Level 2 variance.

3.3. Publication bias

The trim-and-fill analysis indicated that the distribution of effect sizes was asymmetric in all three meta-analyses, implying that the results of each of these meta-analyses may have been biased (see Figs. 2, 3,

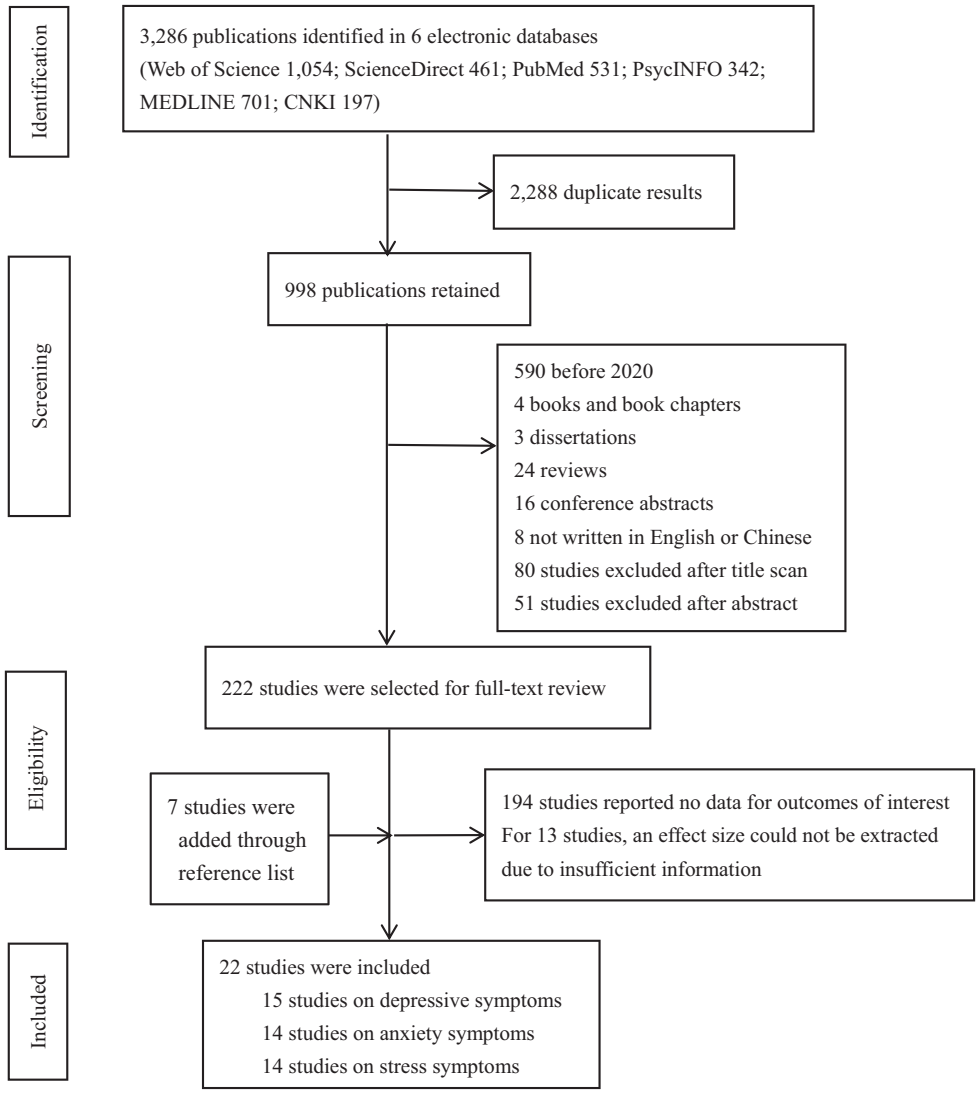

Fig. 1. PRISMA flow chart of the selection process of included studies.

and 4). After conducting trim-and-fill analyses that imputed effect sizes to restore the symmetry of each of the three plots, an "adjusted" overall effect size was calculated for all three outcome variables (Table 2). The associations between PI and depressive symptoms (mean $r = 0.521$, $p < .001$) as well as PI and anxiety symptoms (mean $r = 0.515$, $p < .001$) both became smaller in magnitude, but were still significant and large in magnitude according to Cohen's (1992) criteria. As for stress symptoms (mean $r = 0.578$, $p < .001$), the adjusted overall effect size was significant and slightly higher than the initially estimated effect. Figs. 2, 3, and 4 show the funnel plot of effect sizes plotted against their standard errors for the PI-depressive symptoms, PI-anxiety symptoms, and PI-stress symptoms meta-analyses, respectively.

3.4. Moderator analyses

Table 3 displays the results of the moderator analysis conducted in the PI-depressive symptoms association. We found a significant moderating effect of the percentage of females, $F(1, 21) = 4.346$, $p < .05$ (i.e., $p = .0495$), which indicated that as the percentage of females in primary study samples increases, the strength of the overall association between PI and depressive symptoms decreases.

For the PI-anxiety symptoms association, the moderator analyses showed a significant moderating effect of publication year, $F(1, 17) = 5.180$, $p < .05$ (see Table 4), indicating that more recently published studies report stronger PI and anxiety symptoms associations.

The results of our moderator analyses performed for the PI-stress symptoms association are reported in Table 5. Our findings revealed a significant moderating effect of measurement tool that was used to assess PI, $F(4, 15) = 4.263$, $p < .05$. The most widely used measurements of PI in the stress field are the Acceptance and Action Questionnaire-II (AAQ-II, $n = 10$). The strength of the PI-stress symptoms association was stronger when using AFQ-Y ($r = 0.760$) was used to assess PI than when AAQ-II ($r = 0.548$) was used. On the other hand, the strength of the PI-stress symptoms association was weaker when the MPFI ($r = 0.310$) was used relative to the AAQ-II.

For the PI-stress symptoms association, we also found a moderating effect of the measurement of stress symptoms, $F(5, 12) = 5.329$, $p < .05$ (see Table 5). The most commonly used measure of stress symptoms was the Depression Anxiety and Stress Scale (DASS, $n = 6$). The strength of the PI-stress symptoms association was stronger when the DASS ($r = 0.661$) was used to measure stress symptoms than when the Coronavirus Stress Measure (CSM, $r = 0.319$) was used.

4. Discussion

Using a three-level approach to meta-analysis, this is the first quantitative review to summarize primary studies to obtain more insight into the associations between PI and mental health problems.

Table 1
Overview of studies included in the meta-analytic review.

Study name	Country	Study design	Sample type	Sample	N	Sex (% female)	Mean age	Measurement of PI	Outcomes	Measurement of outcomes	Study quality
Arslan et al. (2021)	Turkey	cross-sectional	community	adults	451	55.00	23.30	AAQ-II	DEP	BSI	Good
									ANX	BSI	
									Stress	CSM	
Bonilla-Sierra et al. (2021)	Ecuador	cross-sectional	community	healthcare professionals	191	70.20	26.29	AAQ-II	DEP	PHQ	Good
									ANX	PHQ	
									Stress	PSS	
Chen et al. (2021)	China	cross-sectional	community	students aged 8–18	15,993	49.40	12.26	AFQ-Y	DEP	DASS	Good
									ANX	DASS	
									Stress	DASS	
Clemente-Suarez et al. (2020)	Spain	cross-sectional	community	Olympic and Paralympic athletes	175	58.90	27.62	AAQ-II	ANX	STAI	Good
Daks et al. (2020)	USA	cross-sectional	community	adults	742	71.00	40.70	MPFI	DEP	PHQ	Good
Ecija et al. (2022)	Spain	cross-sectional	clinical	women with fibromyalgia	231	100.00	56.91	POAM-P, CFQ	DEP	HADS	Fair
Ferreira et al. (2021)	Portugal	cross-sectional	community	adults	586	72.90	38.96	AAQ-II	DEP	DASS	Good
									ANX	DASS	
									Stress	DASS	
Fuentes-García et al. (2020)	mixed	cross-sectional	community	chess players	450	11.10	38.12	AAQ-II	ANX	STAI	Good
Hu and Chen (2020)	China	cross-sectional	community	college students	614	69.70	19.56	AAQ-II	DEP	SDS	Good
									Stress	SSPQ	
Huang et al. (2021)	China	cross-sectional	clinical	suspected patients of COVID-19	180	40.60	NR	AAQ-II, CFQ	DEP	PHQ	Fair
									ANX	GAD	
									Stress	PSS	
Landi et al. (2022)	Italy	longitudinal	community	adults	569	78.21	39.77	MPFI	DEP	PHQ	Good
									ANX	GAD	
Mandarano et al. (2021)	Italy	cross-sectional	community	medical students, doctors et al.	37	54.10	26.89	AAQ-II, CFQ	Stress	PSS	Fair
	Italy	cross-sectional	community	medical students, doctors et al.	38	65.80	24.82	AAQ-II, CFQ	Stress	PSS	
Mazumdar et al. (2021)	India	cross-sectional	community	urban Indian mothers	242	100.00	35.50	AAQ-II	Stress	PSS	Good
McCracken et al. (2021)	Sweden	cross-sectional	community	adults	1102	75.20	36.90	AAQ-II	DEP	PHQ	Good
									ANX	GAD	
O'Brien et al. (2021)	USA	cross-sectional	community	Turk workers	450	38.00	36.68	FFMQ	Stress	PHQ	Good
Öcal Demir et al. (2021)	Turkey	cross-sectional	community	health care workers	261	78.90	29.00	AAQ-II	DEP	DASS	Fair
									ANX	DASS	
									Stress	DASS	
Pakenham et al. (2020)	Italy	cross-sectional	community	adults	1035	79.10	37.51	MPFI	DEP	PHQ	Good
									ANX	GAD	
Pang et al. (2021b)	Malaysia	cross-sectional	community	university students	515	68.90	NR	AAQ-II	ANX	DASS	Fair
									Stress	DASS	
Pang et al. (2021a)	Malaysia	cross-sectional	clinical	frontline worker population	181	51.40	30.00	AAQ-II	DEP	DASS	Fair
									ANX	DASS	
									Stress	CSM, DASS	
Peltz et al. (2020)	USA	cross-sectional	community	parents	1003	73.6	40.9	MPFI	Stress	NA	Good
Smith et al. (2020)	USA	cross-sectional	community	undergraduates et al.	278	80.60	39.60	AAQ-II	DEP	DASS	Good
									ANX	DASS	
									Stress	DASS	
Su et al. (2021)	China	cross-sectional	community	adults	247	60.73	NR	AAQ-II, CFQ	DEP	CCMD	Fair

Note. NR = Not Reported; NA = Not Applicable; AAQ-II = Acceptance and Action Questionnaire-II; AFQ-Y = Avoidance and Fusion Questionnaire for Youth; MPFI = Multidimensional Psychological Flexibility Inventory; POAM-P = Subscales from Patterns of Activity to Measure Pain; CFQ = Cognitive Fusion Questionnaire; FFMQ = Five Factor Mindfulness Questionnaire; DEP = Depressive symptoms; ANX = Anxiety symptoms; BSI = Brief Symptom Inventory; CSM = Coronavirus Stress Measure; PHQ = Patient Health Questionnaire of Depression and Anxiety; PSS = Perceived Stress Scale; DASS = Depression Anxiety and Stress Scale; STAI = State-Trait Anxiety

Inventory; HADS = Hospital Anxiety and Depression Scale; DASS = Depression Anxiety and Stress Scale; SDS = Self-rating Depression Scale; SSPQ = SARS Stress Perception Questionnaire; GAD = General Anxiety Disorder; CCMD = Chinese classification of mental disorders.

Table 2
Results for the overall mean effect sizes of the depressive symptoms, anxiety, and stress outcomes.

Type of narcissism	# Studies	# ES	Mean *z* (SE)	95 % CI	*t* value (Sig)	Mean *r*	% var. at level 1	Level 2 variance	% Var. at level 2	Level 3 variance	% Var. at level 3
Before trim-and-fill											
Depressive symptoms	15	23	0.662 (0.054)	0.549; 0.775	12.168***	0.580	2.08	0.045***	80.64	0.010	17.28
Anxiety symptoms	14	19	0.615 (0.070)	0.468; 0.761	8.841***	0.548	1.22	0.080***	94.27	0.004	4.50
Stress symptoms	14	21	0.615 (0.052)	0.506; 0.725	11.753***	0.548	3.88	0.017**	42.33	0.022	53.79
After trim-and-fill											
Depressive symptoms	19	27	0.578 (0.049)	0.478; 0.679	11.804***	0.521	1.23	0.062***	98.77	0.000	0.00
Anxiety symptoms	16	21	0.569 (0.066)	0.431; 0.707	8.597***	0.515	1.23	0.089***	98.77	0.000	0.00
Stress symptoms	16	25	0.659 (0.054)	0.548; 0.770	12.268***	0.578	3.09	0.010**	21.78	0.035**	75.13

Note. # Studies = number of studies; # ES = number of effect sizes; Mean *z* = Mean effect size (Fisher's *z*); SE = standard error; CI = confidence interval; Sig = significance; Mean *r* = Mean effect size expressed as a Pearson's correlation; Var = variance; Level 1 variance = sampling variance of observed effect sizes; Level 2 variance = variance between effect sizes extracted from the same study; Level 3 variance = variance between studies.
** $p < .01$.
*** $p < .001$.

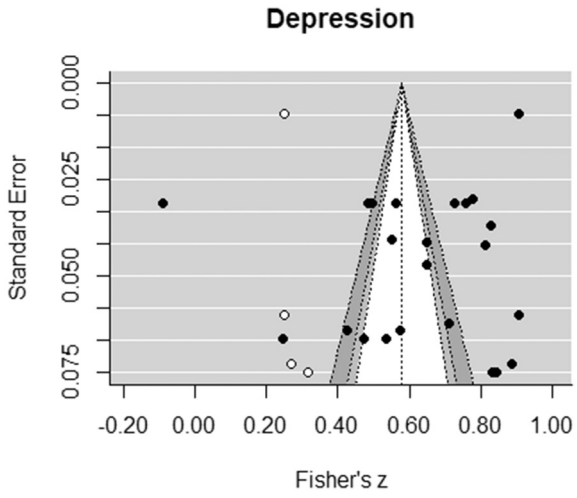

Fig. 2. Trim-and-fill plot for the association between psychological inflexibility and depressive symptoms.

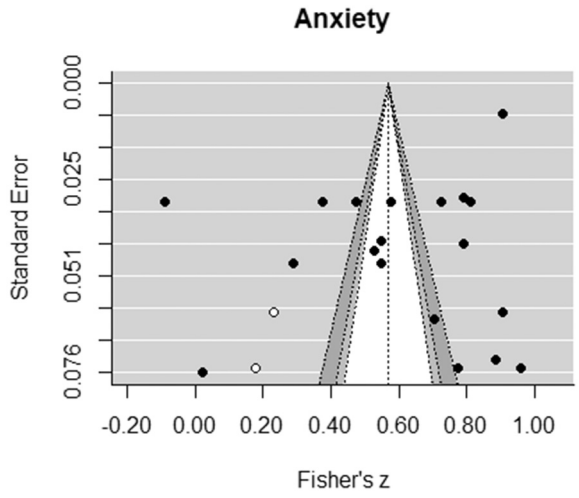

Fig. 3. Trim-and-fill plot for the association between psychological inflexibility and anxiety symptoms.

Specifically, this review quantitatively synthesized results of existing primary research that explored associations between PI and (1) depressive symptoms, (2) anxiety symptoms, and (3) stress symptoms during the COVID-19 pandemic. Twenty-two studies analyzing a total sample of 25,571 participants were included in three separate meta-analyses, yielding 63 effect sizes in total. The findings demonstrated significant and large associations between PI and mental health problems (i.e., depressive ($r = 0.580$), anxiety ($r = 0.548$), and stress ($r = 0.548$) symptoms), which supported our hypothesis.

4.1. Overall associations and bias assessment

In general, this review revealed a significant and large correlation between PI and depressive, anxiety, and stress symptoms, respectively. The association between PI and depressive symptoms was found to be stronger than the association between PI and anxiety symptoms and between PI and stress symptoms. These findings build on existing research in the field of psychological inflexibility and mental health. Prior research has found that certain personality traits are more susceptible to depressive, anxiety, and stress symptoms than others such as fear (Erbiçer et al., 2021) and loneliness (Bonilla-Sierra et al., 2021). Our results imply that PI may be another personality profile that renders individuals vulnerable to depressive, anxiety, and stress symptoms. The findings indicate that individuals with high PI levels are predisposed to develop these mental health problems, and are in line with prior research (Eisenbeck et al., 2019; Gilbert et al., 2019; Lonfeldt et al., 2017) suggesting that people with higher PI levels are more likely to experience higher levels of depressive, anxiety, and stress symptoms.

The trim-and-fill analysis revealed indications for bias in all three meta-analyses. Specifically, there were indications of an overestimated association in the PI-depressive symptoms and PI-anxiety symptoms meta-analysis, whereas there were indications of an underestimated association in the PI-stress symptoms meta-analysis. However, significant and large overall correlations between PI and depressive, anxiety,

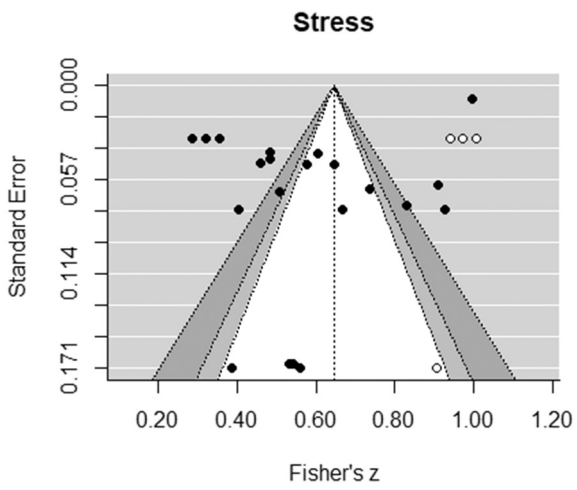

Fig. 4. Trim-and-fill plot for the association between psychological inflexibility and stress symptoms.

and stress symptoms were obtained when the "missing" effect sizes were taken into account. These findings suggested that even when we adjusted for publication bias, PI still serves as a salient risk factor for individual's depressive, anxiety, and stress symptoms during the COVID-19 pandemic.

4.2. Moderating variables

As for moderating effects of sample characteristics, we detected a significant moderating effect of the percentage of females in the PI-depressive symptoms association. Specifically, the association between PI and depressive symptoms seems stronger for males than for females. This finding adds new evidence to the PI and mental health literature, which was relatively deficient in finding gender differences in the association between PI and depressive symptoms (Balazsi et al., 2019; Bermejo-Franco et al., 2022). It may be that men more easily develop depressive symptoms because they may experience higher levels of pressure in case of financial hardship or social isolation during the COVID-19 pandemic. After all, in most contemporary societies higher expectations are still put on men to carry the financial burden of the family. If they are more psychologically inflexible in coping with the challenges caused by the COVID-19 pandemic, they may experience higher levels of mental health problems, such as symptoms of depression, anxiety, and stress.

We also found that the strength of correlations between PI and depressive, anxiety, and stress symptoms holds across people of different ages. However, this finding contradicts the previous literature (Mekhemar et al., 2021; Plys et al., 2022), showing that older adults generally present lower PI levels than younger adults. This difference may be explained by the relatively narrow age range (ranging from 12.26 to 56.91 years) of the samples of the included studies, which limits the generalizability of the current results to older people. It is reasonable to assume that the elderly are particularly more vulnerable to the COVID-19 pandemic, as it is more likely that they suffer from various physical and/or mental illnesses relative to younger people. Moreover, the relatively small number of included studies limits the statistical power in testing moderating effects, thus the findings should be interpreted cautiously. More research with a prospective design is needed to validate these findings.

Further, we found that sample type (i.e., community sample vs. clinical sample) did not moderate the associations between PI and depressive, anxiety, and stress symptoms. These results may be explained by the nature of the sample. In the current meta-analyses, clinical samples comprised cases under surveillance in a frontline worker population (Pang et al., 2021a), women with fibromyalgia (Ecija et al., 2022), and suspected patients of COVID-19 (Huang et al., 2021). These people generally are not under heavy pressure, unlike people who suffer from high levels of stress such as people with chronic and acute illness, which may have led to the insignificant results of testing sample type as a moderator. Future research using clinical samples that have to deal with more severe challenges is warranted to provide a more nuanced understanding of the association between PI and mental health problems.

Regarding the moderating effects of study design characteristics, we observed that the overall correlation between PI and stress symptoms was moderated by how PI was measured. We found that the strength of the correlation was remarkably larger when the AFQ-Y was used compared to the AAQ-II. On the other hand, we found that the association was smaller when the MPFI was used compared to the AAQ-II, indicating that type of PI measure influenced the strength of the overall association. Since previous studies have documented that MPFI gained the most favorable overall rating, followed by AAQ and AFQ-Y (Cherry et al., 2021), the validity of different PI measures need to be further explored. We also found that the magnitude of the overall association between PI and stress symptoms differed by how stress symptoms were measured. Specifically, smaller associations were found when the CSM was used compared to the DASS. The five-item CSM for assessing COVID-19 related stress symptoms was adapted from the Perceived Stress Scale (PSS, Cohen et al., 1983). It is likely that for most people coronavirus stress did not play a significant role in COVID-19 related stress, compared to stress resulted from job loss or financial hardship, or other sources of stress. Therefore, when interpreting the association between PI and stress symptoms, it is important to be aware of such validity issues in the measurements of PI and stress symptoms.

Surprisingly, we found no significant moderating effect of measurements in the PI-depressive symptoms and PI-anxiety symptoms associations. We believe that the measures that primary studies used for assessing depressive symptoms and anxiety symptoms are quite reliable and valid so that the findings do not change markedly across measures.

Regarding the moderating effects of other descriptors, we found that publication year moderated the association between PI and anxiety symptoms. Specifically, we found that the association between PI and anxiety symptoms became stronger over time. This finding may be unexpected, but not unexplainable. It may be that as the COVID-19 epidemic continues and intensifies, people's lives are more affected and people become more anxious, worried, and fearful about the future.

It is interesting that the moderating variable of continent failed to moderate the associations between PI and depressive, anxiety, and stress symptoms. These findings revealed that the associations between PI and depressive, anxiety, and stress symptoms hold across people from different continents/countries. Although different countries have taken different measures in response to the COVID-19 outbreak, our results revealed that PI is a psychological vulnerable factor influencing mental health problems (i.e., depressive, anxiety, and stress symptoms) among people across the world, implying that the COVID-19 pandemic is a great challenge affecting people worldwide.

4.3. Limitations

Several study limitations should be noted. First, our analyses merely focused on cross-sectional associations, which limited the ability to examine temporal associations between PI and depressive, anxiety, and stress symptoms. Future studies using longitudinal design are warranted to draw inferences on temporal associations between PI and mental health outcomes.

Second, community samples were disproportionately analyzed in the primary studies, and clinical samples with high levels of stress were underrepresented. As vulnerable populations may have a greater possibility of experiencing depressive, anxiety, and stress symptoms than other populations during the COVID-19 pandemic, such as healthcare workers (Marvaldi et al., 2021; Deng et al., 2021a) and patients with

Table 3
Results of categorical and continuous moderator analyses for depressive symptoms (bivariate models).

Moderator variables	# Studies	# ES	Intercept / Mean *z* (95 % CI)	β_1(95 % CI)	Mean *r*	*F* (df1, df2)[a]	*p*[b]	Level 2 variance	Level 3 variance
Sample descriptors									
Percentage of females	15	23	0.633 (0.536; 0.731)***	−0.007 (−0.013; −0.000)*	–	*F* (1, 21) = 4.346	0.050	0.046***	0.001
Mean age of the sample	13	20	0.647 (0.531; 0.763)***	−0.008 (−0.018; 0.002)	–	*F* (1, 18) = 2.858	0.108	0.049***	0.004
Type of sample						*F* (1, 21) = 0.217	0.646	0.046***	0.011
Community sample (RC)	12	18	0.678 (0.547; 0.809)***		0.590				
Clinical sample	3	5	0.615 (0.364; 0.866)***	−0.063 (−0.346; 0.220)	0.548				
Research design descriptors									
Measurement of PI						*F* (4, 17) = 1.897	0.157	0.047***	0.000
AAQ-II (RC)	9	9	0.725 (0.568; 0.882)***		0.620				
AFQ-Y	1	1	0.908 (0.451; 1.364)***	0.183 (−0.299; 0.666)	0.720				
MPFI	3	8	0.571 (0.408; 0.735)***	−0.153 (−0.380; 0.073)	0.516				
POAM-P	1	2	0.359 (0.021; 0.696)*	−0.366 (−0.738; 0.006)	0.492				
CFQ	2	2	0.480 (0.143; 0.816)**	−0.245 (−0.616; 0.127)	0.446				
Measurement of depression						*F* (5, 17) = 1.038	0.427	0.044***	0.010
DASS (RC)	5	5	0.803 (0.578; 1.028)***		0.666				
BSI	1	1	0.648 (0.147; 1.148)*	−0.155 (−0.704; 0.393)	0.570				
PHQ	6	11	0.693 (0.518; 0.869)***	−0.110 (−0.395; 0.176)	0.600				
HADS	1	3	0.418 (0.077; 0.759)*	−0.385 (−0.794; 0.023)	0.395				
SDS	1	1	0.549 (0.052; 1.047)*	−0.254 (−0.800; 0.292)	0.500				
CCMD	1	2	0.499 (0.109; 0.888)*	−0.304 (−0.754; 0.145)	0.461				
Other descriptors									
Publication year	15	23	0.669 (0.550; 0.787)***	−0.014 (−0.188; 0.159)	–	*F* (1, 21) = 0.030	0.864	0.045***	0.013
Continent						*F* (3, 19) = 2.052	0.141	0.047***	0.000
North America (RC)	2	2	0.868 (0.538; 1.197)***		0.700				
Europe	5	12	0.537 (0.403; 0.671)***	−0.331 (−0.686; 0.025)	0.491				
Asia	7	8	0.686 (0.520; 0.852)***	−0.182 (−0.551; 0.187)	0.595				
South America	1	1	0.887 (0.408; 1.366)**	0.020 (−0.562; 0.601)	0.710				

Note. # Studies = number of studies; # ES = number of effect sizes; mean *z* = mean effect size (Fisher's *z*); CI = confidence interval; β1 = estimated regression coefficient; *r* = mean effect size expressed as a Pearson's correlation; df = degrees of freedom; Level 2 variance = variance between effect sizes extracted from the same study; Level 3 variance = variance between studies; AAQ-II = Acceptance and Action Questionnaire-II; AFQ-Y = Avoidance and Fusion Questionnaire for Youth; MPFI = Multidimensional Psychological Flexibility Inventory; POAM-P = Patterns of Activity to Measure Pain; CFQ = Cognitive Fusion Questionnaire; DASS = Depression Anxiety and Stress Scale; BSI = Brief Symptom Inventory; PHQ = Patient Health Questionnaire; HADS = The Spanish version of the Hospital Anxiety and Depression Scale; SDS = Self-rating Depression Scale; CCMD = Chinese classification of mental disorders.

[a] Omnibus test of all regression coefficients in the model.

[b] *p*-Value of the omnibus test.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

chronic or acute medical situations and their caregivers (Tashakori-Miyanroudi et al., 2021), it is likely that these individuals may face an increased risk of mental health problems. Thus, future research efforts in disadvantaged populations are clearly required.

Third, we only examined three mental health problems in this study. Other mental health outcomes such as suicidality and obsessive-compulsive symptoms could not be examined due to a very limited number of available primary studies on such outcomes. Future empirical studies should explore more diverse psychological outcomes to deepen our understanding of the role of PI in mental health problems.

4.4. Implications

Our findings offer potentially valuable implications for the prevention and intervention of mental health problems in terms of research, practice, and policy. As for research, this study extends existing research on the associations between PI and mental health problems by synthesizing the current evidence systematically and quantitatively to obtain

Table 4
Results of categorical and continuous moderator analyses for anxiety symptoms (bivariate models).

Moderator variables	# Studies	# ES	Intercept / Mean *z* (95 % CI)	β_1(95 % CI)	Mean *r*	*F* (df1, df2)[a]	*p*[b]	Level 2 variance	Level 3 variance
Sample descriptors									
Percentage of females	14	19	0.628 (0.470; 0.785)***	0.002 (−0.007; 0.010)	–	*F* (1, 17) = 0.199	0.662	0.078***	0.011
Mean age of the sample	12	17	0.591 (0.435; 0.747)***	−0.008 (−0.029; 0.014)	–	*F* (1, 15) = 0.577	0.459	0.089***	0.000
Type of sample						*F* (1, 17) = 1.780	0.200	0.080***	0.000
Community sample (RC)	12	17	0.577 (0.430; 0.724)***		0.520				
Clinical sample	2	2	0.868 (0.431; 1.306)***	0.292 (−0.170; 0.753)	0.700				
Research design descriptors									
Measurement of PI						*F* (2, 15) = 0.797	0.469	0.083***	0.000
AAQ-II (RC)	10	10	0.601 (0.402; 0.799)***		0.538				
AFQ-Y	1	1	0.908 (0.292; 1.523)**	0.307 (−0.339; 0.954)	0.720				
MPFI	2	7	0.523 (0.289; 0.757)***	−0.078 (−0.384; 0.229)	0.480				
Measurement of anxiety						*F* (4, 14) = 1.948	0.158	0.064***	0.006
DASS (RC)	6	6	0.729 (0.492; 0.965)***		0.622				
BSI	1	1	0.549 (−0.027; 1.126)	−0.179 (−0.803; 0.444)	0.500				
PHQ	1	1	0.887 (0.298; 1.476)**	0.158 (−0.476; 0.793)	0.710				
STAI	2	2	0.157 (−0.256; 0.570)	−0.572 (−1.047; −0.096)*	0.156				
GAD	4	9	0.631 (0.416; 0.846)***	−0.098 (−0.417; 0.222)	0.559				
Other descriptors									
Publication year	14	19	0.607 (0.479; 0.735)***	0.233 (0.017; 0.450)*	–	*F* (1, 17) = 5.180	0.036	0.068***	0.000
Continent						*F* (3, 14) = 1.571	0.241	0.075***	0.000
North America (RC)	1	1	0.908 (0.307; 1.509)**		0.720				
Europe	5	10	0.505 (0.318; 0.693)***	−0.403 (−1.032; 0.227)	0.466				
Asia	6	6	0.737 (0.492; 0.982)***	−0.171 (−0.820; 0.478)	0.627				
South America	1	1	0.887 (0.280; 1.495)**	−0.021 (−0.875; 0.834)	0.710				

Note. # Studies = number of studies; # ES = number of effect sizes; mean *z* = mean effect size (Fisher's *z*); CI = confidence interval; β1 = estimated regression coefficient; *r* = mean effect size expressed as a Pearson's correlation; df = degrees of freedom; Level 2 variance = variance between effect sizes extracted from the same study; Level 3 variance = variance between studies; AAQ-II = Acceptance and Action Questionnaire-II; AFQ-Y = Avoidance and Fusion Questionnaire for Youth; MPFI = Multidimensional Psychological Flexibility Inventory; DASS = Depression Anxiety and Stress Scale; BSI = Brief Symptom Inventory; PHQ = Patient Health Questionnaire of Depression and Anxiety; STAI = State-Trait Anxiety Inventory; GAD = General Anxiety Disorder.

[a] Omnibus test of all regression coefficients in the model.

[b] *p*-Value of the omnibus test.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

better estimates of the associations. Future research could further explore the mediating and moderating mechanisms underlying the associations between PI and mental health problems. For example, future research may examine the interaction effect of cognitive-affective factors and personality factors, such as testing how neuroticism (Paulus et al., 2016) and PI affect mental health problems. Exploring neurobiological mechanisms of PI on mental health problems seems also promising (Ottaviani et al., 2016).

In terms of practice, this study reveals that individuals with high PI are more likely to develop depressive, anxiety, and stress symptoms during the COVID-19 pandemic. Therefore, intervention strategies targeting PI in an effort to reduce mental health problems (i.e., depressive, anxiety, and stress symptoms) seem promising. ACT has found to be an effective treatment to reduce PI and mental health problems, and has therefore potential in future intervention (Daks et al., 2020; Tarbox et al., 2022). Previous studies have demonstrated the benefits of ACT-based interventions for non-suicidal self-injury (Callahan et al., 2021), PTSD symptoms (Grau et al., 2020), and PI (Pakenham et al., 2020). Given the particular situation of the COVID-19 pandemic, ACT self-help books or online ACT interventions could be effectively employed (Huang et al., 2021), which have proved to be effective in prior studies (Probst et al., 2019; Levin et al., 2020). Evidence-based interventions using (online) ACT or other strategies to mitigate PI and improve mental health in different populations is also warranted. Since we found that

Table 5
Results of categorical and continuous moderator analyses for stress symptoms (bivariate models).

Moderator variables	# Studies	# ES	Intercept / Mean *z* (95 % CI)	β_1(95 % CI)	Mean *r*	*F* (df1, df2)[a]	*p*[b]	Level 2 variance	Level 3 variance
Sample descriptors									
Percentage of females	14	21	0.618 (0.506; 0.730)***	−0.002 (−0.009; 0.005)	–	*F* (1, 19) = 0.260	0.616	0.018**	0.023
Mean age of the sample	12	19	0.617 (0.497; 0.737)***	−0.008 (−0.022; 0.006)	–	*F* (1, 17) = 1.529	0.233	0.019***	0.022
Type of sample						*F* (1, 19) = 0.149	0.704	0.018**	0.024
Community sample (RC)	12	18	0.608 (0.486; 0.729)***		0.542				
Clinical sample	2	3	0.667 (0.369; 0.965)***	0.059 (−0.262; 0.381)	0.583				
Research design descriptors									
Measurement of PI						*F* (4, 15) = 4.263	0.017	0.022***	0.000
AAQ-II (RC)	10	12	0.615 (0.511; 0.718)***		0.548				
AFQ-Y	1	1	0.996 (0.678; 1.315)***	0.382 (0.047; 0.717)*	0.760				
MPFI	1	3	0.321 (0.133; 0.509)**	−0.294 (−0.508; −0.080)*	0.310				
FFMQ	1	2	0.612 (0.376; 0.848)***	−0.003 (−0.260; 0.255)	0.546				
CFQ	1	2	0.546 (0.205; 0.887)**	−0.069 (−0.425; 0.288)	0.498				
Measurement of stress						*F* (5, 12) = 5.329	0.008	0.000	0.033
DASS (RC)	6	6	0.794 (0.633; 0.954)***		0.661				
PSS	3	6	0.670 (0.422; 0.918)***	−0.123 (−0.418; 0.172)	0.585				
PS	1	1	0.508 (0.088; 0.927)*	−0.286 (−0.735; 0.163)	0.468				
PHQ	1	2	0.612 (0.211; 1.013)**	−0.182 (−0.614; 0.251)	0.546				
SSPQ	1	1	0.485 (0.080; 0.889)*	−0.309 (−0.744; 0.126)	0.450				
CSM	2	2	0.330 (0.108; 0.552)**	−0.464 (−0.667; −0.261)***	0.319				
Other descriptors									
Publication year	14	21	0.613 (0.505; 0.721)***	0.112 (−0.145; 0.368)	–	*F* (1, 19) = 0.829	0.374	0.019***	0.019
Continent						*F* (3, 17) = 0.427	0.736	0.018**	0.026
North America (RC)	3	6	0.576 (0.340; 0.813)***		0.520				
Europe	2	5	0.550 (0.247; 0.853)**	−0.027 (−0.411; 0.358)	0.501				
Asia	8	9	0.628 (0.469; 0.787)***	0.052 (−0.233; 0.337)	0.557				
South America	1	1	0.829 (0.360; 1.298)**	0.253 (−0.272; 0.778)	0.680				

Note. # Studies = number of studies; # ES = number of effect sizes; mean *z* = mean effect size (Fisher's *z*); CI = confidence interval; β1 = estimated regression coefficient; *r* = mean effect size expressed as a Pearson's correlation; df = degrees of freedom; Level 2 variance = variance between effect sizes extracted from the same study; Level 3 variance = variance between studies; AAQ-II = Acceptance and Action Questionnaire-II; AFQ-Y = Avoidance and Fusion Questionnaire for Youth; MPFI = Multidimensional Psychological Flexibility Inventory; FFMQ = Five Factor Mindfulness Questionnaire; CFQ = Cognitive Fusion Questionnaire; DASS = Depression Anxiety and Stress Scale; PSS = Perceived Stress Scale; PS = Parental Stress Scale; PHQ = Depression Anxiety and Stress Scale; SSPQ = SARS Stress Perception Questionnaire; CSM = Coronavirus Stress Measure.

[a] Omnibus test of all regression coefficients in the model.

[b] *p*-Value of the omnibus test.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

sample type (i.e., community sample versus clinical sample) did not moderate the associations between PI and depressive, anxiety, and stress symptoms, clinical and practical practices should implement interventions in both the general population and individuals with pre-existing mental health problems during and after the COVID-19 pandemic (Kuzman et al., 2020; McDaid, 2021).

Since we found that the association between PI and depressive symptoms was stronger for males than for females, prevention and intervention programs should be at least to some extent be gender-specific, in such a way that different needs between males and females can be better addressed. As we found that the association between PI and stress symptoms varied significantly by the measures that are used for assessing PI and stress symptoms, practitioners should be aware that different assessment tools can produce different results. Therefore,

future research is needed to examine the psychometric quality of the assessment tools and to improve their validity and clinical utility. Additionally, both traditional and online services may be offered in an attempt to best reach all individuals that are in mental distress and in need of support to recover from the mental health consequences of the COVID-19 pandemic (McDaid, 2021).

Finally, as we found significant associations between PI and mental health problems during the COVID-19 pandemic, it is essential for governments and other policy makers to develop effective mid-to long-term policy plans. These plans are needed to enhance the mental health of the public during and after the COVID-19 pandemic so that individuals can progress properly and the community can get smoothly through these tough times.

5. Conclusions

This quantitative review using advanced three-level meta-analytic models is the first to synthesize existing empirical evidence on the associations between psychological inflexibility (PI) and depressive, anxiety, and stress symptoms during the COVID-19 pandemic. Our findings reveal that the associations between PI and depressive, anxiety, and stress symptoms are all significant, positive, and large in magnitude. Moderator analyses revealed that the association between PI and depressive symptoms is stronger for men than for women, and that the association between PI and stress symptoms varies by the type of measures that are used to assess PI and stress symptoms. Further, across general samples and clinical samples and across people of different ages the strength of the associations between PI and depressive, anxiety, and stress symptoms does not vary. The relevance of targeting PI in intervention programs to mitigate PI and improve mental health during the COVID-19 pandemic and beyond should be emphasized.

CRediT authorship contribution statement

Xiaoyu Yao participated in the design of the study, conducted literature search, coded all primary studies, and drafted the manuscript. Xinhan Xu participated in the design of the study, conducted literature search, and coded all primary studies. Ko Ling Chan contributed to the design of the study and critical review of the manuscript. Shimin Chen assisted in data analysis and critically reviewed the manuscript. Mark Assink guided in data analysis and critically reviewed the manuscript. Shuling Gao designed the study and conducted statistical analyses. All authors contributed to and have approved the final manuscript.

Funding

This work was supported by the Humanities and Social Sciences Youth Foundation, Ministry of Education of the People's Republic of China [grant number 20YJC840012].

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2022.09.116.

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