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Review

Cognitive biases in perceptions of posttraumatic growth: A systematic review and meta-analysis

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ABSTRACT

Posttraumatic growth (PTG) has captivated the attention of clinicians and researchers over the past three decades. However, accumulating evidence suggests that individuals' self-reports of PTG may be cognitively biased. In the current systematic review and meta-analysis, we aimed to investigate the relation between cognitive biases and perceived PTG. In line with existing theory on cognitive biases that may lead to illusory perceived PTG, we examined the following cognitive biases: defensiveness, memory bias, downward comparison bias, social desirability bias, positive attention bias, and growth beliefs. Forty-seven studies met criteria for inclusion in this review and 66 separate effects were coded for meta-analyses. Results indicated that cognitive biases were related to perceived PTG, with variation by type of cognitive bias. Moderator analyses revealed that downward comparison bias, positive attention bias, and growth beliefs exhibited stronger relations with perceived PTG than did defensiveness, memory bias, and social desirability bias. Further, subgroup analyses explored effects by type of cognitive bias and characteristics of cognitive bias measurements. The current study suggests that cognitive biases may have a role in individuals' perceptions of their PTG. This contributes to theory on the origins of illusory perceptions of PTG and provides direction for improvements to the measurement of PTG and clinical approaches to PTG.

1. Introduction

In the United States, approximately 90% of individuals experience a traumatic event in their lifetime, and a portion of these individuals will go on to develop significant psychological problems, such as Posttraumatic Stress Disorder (Kilpatrick et al., 2013). Traumatic or stressful events also have the potential to bring about positive changes in people's lives, which is referred to as posttraumatic growth (PTG). PTG can take different forms, such as increases in personal strengths, a deepened spirituality and understanding of existential matters, more meaningful relationships with others, a greater appreciation for life, and recognition of new possibilities or paths for their lives (Park, Cohen, & Murch, 1996; Tedeschi & Calhoun, 2004). Over the past three decades, PTG has captivated the attention of clinicians and researchers as a positive outcome of experiencing traumatic events and a potential protective factor against long-term psychological symptoms (Park et al., 1996; Tedeschi & Calhoun, 2004). Given the potential benefits of PTG, there are now manualized ways to facilitate PTG in therapy (Calhoun & Tedeschi, 1999; Roepke, Tsukayama, Tsukayama, Blackie, & Jayawickreme, 2018). However, some scholars have questioned the validity of existing research on PTG (Jayawickreme & Blackie, 2014, 2016; Maercker & Zöllner, 2004; Tennen & Affleck, 2009) and whether it can be trusted to inform our understanding of PTG. In this systematic review and meta-analysis, we examine the empirical evidence of a relation between several different types of cognitive biases and perceived PTG.

1.1. Measurement of perceived PTG

The majority of studies that have measured PTG after a stressful or traumatic event ask participants to report on the extent to which they have experienced positive changes as a result of the stressful or traumatic event (Park et al., 1996; Tedeschi & Calhoun, 2004). Such retrospective measures of PTG are referred to as *perceived* or *self-reported PTG*. In several systematic reviews of PTG, all of the reviewed articles utilized a measure of perceived PTG (Rzeszutek & Gruszczyńska, 2018; Shakespeare-Finch & Lurie-Beck, 2014; Shand, Cowlishaw, Brooker, Burney, & Ricciardelli, 2015), such as the Posttraumatic Growth Inventory

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(Tedeschi & Calhoun, 1996) or the Stress-Related Growth Scale (Park et al., 1996). These scales include positively-worded items (e.g., "I appreciate each day more") with response options ranging from *not at all* to *a great deal*. In order to accurately self-report perceived PTG using these measures, individuals must recall their past standing on an attribute, such as the extent to which they had meaningful relationships with others, evaluate their current standing on that attribute, estimate the difference between the two, and then determine what portion of that difference is attributable to the traumatic or stressful event (Tennen & Affleck, 2009). Individuals may not have the time, motivation, or ability to accurately complete this task, particularly if they are thinking about PTG for the first time.

Less common approaches to measuring PTG capture related constructs of *posttraumatic depreciation (PTD)* and *actual PTG*. PTD can be measured by administering positively-worded PTG items along with negatively-worded versions of those same items (e.g., "I appreciate each day more" and "I appreciate each day less"). PTD can also be measured by administering neutrally-worded items (e.g., "I experienced a change in how I treat others") with response options ranging from very negative changes to very positive changes. This latter approach has been used in several recently revised measures of PTG, including the Psychological Well-Being-Posttraumatic Changes Questionnaire (Joseph et al., 2011) and the Stress-Related Growth Scale-Revised (Boals & Schuler, 2017). Actual PTG involves pre- and post-measurements of participants' self-reported current standing on different attributes and then a change score is calculated between the two reports (e.g., Frazier et al., 2009). It has been suggested that measures of PTG and PTD or actual PTG may capture more accurate reports of PTG and thus should be used in lieu of the more common measures of retrospective, perceived PTG (Jayawickreme & Blackie, 2016; Tennen & Affleck, 2009). However, such recommendations may be premature and impractical, as evidence for the validity of these alternative measures is still accumulating, and the feasibility of measuring actual PTG is questionable. Thus, the current systematic review and meta-analysis focuses on the more prevalent measurement of perceived PTG to provide researchers and clinicians with direction for interpreting and improving upon existing literature on PTG.

1.2. Validity of perceived PTG

Original theory on PTG conceptualizes PTG as a possible positive outcome of traumatic events that results from one's struggle with the aftermath of trauma (Tedeschi & Calhoun, 1996, 2004). This theory designates personal strengths and environmental resources as central precipitants of one's processing of the traumatic experience and subsequent PTG (Tedeschi & Calhoun, 1996, 2004). Some studies suggest that commonly used self-reports of perceived PTG exhibit criterion validity, relating to theoretically relevant constructs, such as positive reappraisal and social support (Rzeszutek & Gruszczyńska, 2018; Shand et al., 2015), and positive outcomes, such as positive affect, self-esteem, and life satisfaction (Helgeson, Reynolds, & Tomich, 2006). There is also evidence of convergent validity, for instance, with free response essays on PTG (Weinrib, Rothrock, Johnsen, & Lutgendorf, 2006). However, evidence is also accumulating to the contrary, for instance, suggesting that self-reports of perceived PTG are not corroborated by family and friends (Helgeson, 2010). In addition, self-reports of perceived PTG exhibit null or weak relations with prospective measurements of actual PTG (Corman et al., 2021; Frazier et al., 2009; Ransom, 2006; Widows, Jacobsen, Booth-Jones, & Fields, 2005; Yanez, Stanton, Hoyt, Tennen, & Lechner, 2011). Whereas actual PTG has exhibited relations that are congruent with PTG theory, such as with decreased distress (Frazier et al., 2009), perceived PTG has exhibited positive relations with unexpected correlates, such as denial coping (Helgeson et al., 2006). These findings question the assumption that individuals' perceived PTG reflects real improvements (Tedeschi & Calhoun, 2004). If measures of perceived PTG are not capturing real PTG, we may not be able to use much of the existing PTG literature to inform our theoretical understanding of PTG. Moreover, we may not be able to trust much of the existing evidence that certain clinical techniques or interventions promote PTG (e.g., Roepke et al., 2018) if studies utilizing measures of perceived PTG are not capturing real PTG.

1.3. Cognitive biases in perceived PTG

Validity issues of self-reports of perceived PTG may be explained by the susceptibility of these measures to cognitive biases. Cognitive biases are defined as sources of error, such as beliefs, expectations, motives, and desires, that color individuals' perceptions of objective reality (Tversky & Kahneman, 1974). Several scholars have theorized that, at least for some individuals, self-reports of perceived PTG might be distorted by cognitive biases, which is referred to as *illusory perceived PTG* (Jayawickreme & Blackie, 2014, 2016; Maercker & Zöllner, 2004; Tennen & Affleck, 2009). This theorizing is often referred to as the Janus-Face model of PTG (Maercker & Zöllner, 2004), which more specifically suggests that PTG may have a constructive, self-transcending side, in line with original theorizing (Tedeschi & Calhoun, 1996, 2004), as well as a self-deceptive, illusory side. Jayawickreme and Blackie (2014, 2016) have since synthesized this theorizing to outline cognitive biases that may give rise to illusory perceived PTG. These researchers suggest that defensive coping efforts may be one explanation for illusory perceived PTG, such that individuals may perceive growth to avoid facing the difficult truths of adversity. Jayawickreme and Blackie (2014, 2016) also posit that self-enhancing motivations may explain illusory perceived PTG, which can involve comparing oneself to others who are less fortunate, exaggerating positive aspects of one's self-concept, diminishing one's past self during recall, or re-focusing one's cognitions on positive rather than threatening aspects of the event. Lastly, Jayawickreme and Blackie (2014, 2016) suggest that culturally-driven expectations that one can grow from suffering may lead individuals to falsely perceive such growth. However, there has yet to be a thorough synthesis of empirical evidence for the role of different types of cognitive biases in perceived PTG. This would enable researchers and clinicians to more effectively assess cognitive biases when studying illusory perceived PTG. The current study utilized the framework provided by Jayawickreme and Blackie (2014, 2016) to examine six different types of cognitive biases, described below, that may be associated with perceived PTG.

1.3.1. Defensiveness

Self-deceptive, defensive denial is one cognitive bias that has been theorized to affect perceptions of PTG (Maercker & Zöllner, 2004). Individuals who are high in defensiveness may block negative experiences out of their awareness through neurotic tendencies, which include strategies to distort one's internal reality through acting or thinking in an opposite manner. For instance, one may respond to negative self-perceptions with exaggerated positive self-perceptions. Defensiveness may also include immature tendencies, which involve attempts to suppress awareness of emotions engendered by threatening stimuli (Boerner, Joseph, & Murphy, 2020). These tendencies may become prominent in response to sudden, earth-shattering experiences, due to their short-term coping benefits (Maercker & Zöllner, 2004). Defensiveness may interfere with individuals' awareness of their negative trauma-related cognitions and affect, making them more likely to overestimate PTG. For instance, individuals who are in denial of their negative trauma-related affect may falsely perceive that the traumatic or stressful event has enhanced their ability to regulate their affect.

1.3.2. Memory bias

Memory biases have also been linked to perceived PTG (Jayawickreme & Blackie, 2014; Tennen & Affleck, 2009). Memory biases involve systematic distortions or impairments in the retrieval of autobiographical events (Blome & Augustin, 2015) and are commonly identified

when individuals' retrospective reports differ from their earlier, contemporaneous reports (Blome & Augustin, 2015). Memory biases are found to be present across individuals and contexts as memories naturally decay over time (Drasch & Matthes, 2013; Reimer & Matthes, 2007). Memory biases may be augmented following traumatic or stressful events in several ways. First, traumatic events may lead to autobiographical memory overgenerality, which involves the reduced specificity of autobiographical details (Moore & Zoellner, 2007). Overgenerality is theorized to be a protective mechanism against psychological distress related to negative memories (Moore & Zoellner, 2007). Overgenerality may bias individuals' reports of PTG, such that their timeline of memories may be imprecise or they may not be able to recall their functioning prior to the trauma with specificity.

Second, following traumatic or stressful events, individuals may have memory biases for valenced stimuli or events. For instance, individuals may be motivated to recall their past functioning as worse than it actually was, in order to perceive their present functioning more positively (McFarland & Alvaro, 2000; Wilson & Ross, 2001). Individuals may derogate their past attributes in response to traumatic or stressful events to cope with threat, maintain their self-esteem, and reduce distress (McFarland & Alvaro, 2000). For instance, by derogating recalled levels of religiosity/spirituality, any struggles with religiosity/spirituality prompted by trauma can be positively reframed as an improvement from what existed before, which may reduce distress while also leading to illusory perceptions of PTG. Measurements of perceived PTG may be more prone to these memory biases than measurements that reference specific behaviors, contextual features, or landmark events (Norman, 2003).

1.3.3. Downward comparison bias

Individuals may be positively biased in their perceptions of PTG by making downward comparisons, such that they may compare themselves to individuals that are worse off than them in order to enhance their own self-evaluations (Taylor, 1983). Previous studies indicate that when individuals are presented with threatening stimuli (e.g., criticism), they are more likely to utilize downward comparisons, compared to those presented with non-threatening stimuli (Wills, 1981). This aligns with findings that individuals with cancer self-reported that they were more likely to compare themselves to worse off individuals than to individuals who were doing similar or better (Wood, Taylor, & Lichtman, 1985). Similarly, individuals with downward comparison bias may experience exaggerated perceptions of their own PTG by comparing themselves to others who experienced more detriment or fewer benefits following traumatic or stressful events.

1.3.4. Social desirability bias

Social desirability bias is an additional type of positivity bias that has been theorized to contribute to perceived PTG (Boals & Schuler, 2017). Social desirability bias is commonly identified when individuals endorse more favorable responses in order to enhance their own self-presentation (Blome & Augustin, 2015). Social desirability bias can include self-deceptive enhancement, which reflects the tendency to give positively biased self-reports, as well as impression management, which reflects the tendency to intentionally falsify responses to create a socially desirable image (Paulhus, 1991). Commonly used measures of perceived PTG may insinuate to participants that growth is expected and preferable, thus increasing their social desirability biases and their reports of PTG (Boals & Schuler, 2017). Individuals may be all the more likely to experience social desirability biases when faced with threat and uncertainty (Renkema, Stapel, & Van Yperen, 2008) and to maintain appearances that they are coping well in order to appease or impress social network members (Frazier & Kaler, 2006; Helgeson, 2010).

1.3.5. Positive attention bias

Positive attention bias is another bias that may be associated with perceived PTG (Jayawickreme & Blackie, 2014; Taylor, 1983). Positive attention bias reflects the tendency to selectively attend to the positive aspects of events or information. In the broader literature, positive attention bias has been measured in different ways: using participants' self-reports of the extent to which they attend to positive or negative information (e.g., Noguchi, Gohm, & Dalsky, 2006), or measuring their reactions to positive versus negative stimuli (e.g., Matthews & Antes, 1992). Previous studies suggest that some individuals preferentially attend to positive information even in the absence of traumatic or stressful events (Matthews & Antes, 1992). However, individuals may have greater positive attention biases following a traumatic or stressful event as a protective strategy to promote positive and reduce negative mood (Ellis, Beevers, & Wells, 2011). Individuals with positive attention bias may overestimate PTG by focusing on positive changes they have made to their lives and overlooking negative changes.

1.3.6. Growth beliefs

Individuals may expect that personal growth is likely to occur following traumatic or stressful events, which may bias perceived PTG (Frazier & Kaler, 2006; Jayawickreme & Blackie, 2016). Individuals may alter their memories of their past selves or their perceptions of their current selves in order to align with their assumptions about how they have probably changed (Blome & Augustin, 2015; Ross, 1989). Previous studies have found that individuals who self-reported beliefs that certain attributes are likely to change over the lifespan were more likely to retrospectively perceive change in those attributes (McFarland, Ross, & Giltrow, 1992). Growth beliefs may impact assessments of change following traumatic or stressful events as a way to restore positive worldviews (Ross, 1989; Wood et al., 1985). Individuals with growth beliefs may assume PTG rather than effortfully evaluate their pre-event and post-event functioning or considering disconfirming information. Individuals may also rely on their growth beliefs when assessing PTG to compensate for gaps in their memories.

1.4. The current study

In the current systematic review and meta-analysis, we synthesize empirical evidence for the quantitative relation between measurements of cognitive biases and perceived PTG. We focus on adult populations to align with studies in literature on illusory perceived PTG (e.g., Corman et al., 2021; Frazier et al., 2009; Ransom, 2006; Widows et al., 2005; Yanez et al., 2011). Given the nascence of empirical literature on the relation between cognitive biases and perceived PTG, we aimed to narratively synthesize methodologies in the reviewed studies. To inform literature on the validity of measurements of perceived PTG, we additionally aimed to quantitatively synthesize empirical evidence for the relation between perceived PTG and the following cognitive biases: (1) defensiveness, (2) memory bias, (3) downward comparison bias, (4) social desirability bias, (5) positive attention bias, and (6) growth beliefs. We hypothesized that cognitive biases would be related to perceived PTG. We aimed to explore the effects of specific types of cognitive biases using moderator and subgroup analyses.

2. Method

The first author developed a protocol for the objectives, search criteria, and strategy for data extraction prior to conducting the review, in line with guidelines for systematic reviews (Centre for Review and Dissemination, 2008).

2.1. Search strategy

In October 2021, the following electronic databases were searched: Psychology & Behavioral Sciences Collection, APA PsycArticles, APA PsycInfo, MEDLINE, OpenDissertations, ERIC, and SocINDEX with Full Text. To be as inclusive as possible and to reduce potential bias, limits were not placed on the years searched or the resource type; unpublished

studies (e.g., dissertations) were included. An initial exploratory review identified the following search terms and protocols: ("posttraumatic growth" OR "post traumatic growth" OR PTG OR (grow* N5 stress*) OR (grow* N5 trauma*)) AND (bias* OR illus* OR error OR heuristic OR distort* OR cognit* OR defens* OR recall OR recollect* OR memor* OR remember* OR self-enhanc* OR self-serv* OR self-inflat* OR self-decept* OR "positive self-evaluations" OR "downward comparison" OR "social* desir*" OR "impression management" OR "demand characteristics" OR attention OR "implicit theor*" OR "incremental theor*" OR "growth beliefs" OR "growth expectations")).

2.2. Selection strategy

To be included in the systematic review, articles must have: (a) evaluated PTG as retrospective, self-reported, perceived growth in psychological well-being due to a traumatic event or stressor, (b) examined the relation between defensiveness, memory bias, downward comparison bias, social desirability bias, positive attention bias, and/or growth beliefs and perceived PTG, (c) examined adult populations aged 18 years and older, (d) utilized quantitative analyses (e) were available online prior to October 2021. Studies were screened for inclusion in two steps; first, using both study titles and study abstracts, and second, using the full text. Studies identified as having ambiguous terms, such as "cognitive functioning" or "validity," in the first step were included for full text screening to reduce potential coding errors and bias. To further reduce potential bias and coding errors, all articles were screened for inclusion by two independent raters. There was 98% inter-rater agreement on study inclusion; discrepancies were handled by discussion.

The literature search and selection process is presented in the PRISMA flow diagram (Fig. 1; Moher, Liberati, Tetzlaff, & Altman, 2009). Reasons for rejection were: 58% (1651/2838) articles did not assess perceived PTG, 23% (642/2838) did not assess cognitive biases, 10% (271/2838) did not produce original empirical research, 5% (152/2838) did not utilize quantitative data, 3% (75/2838) did not utilize an adult sample, and < 1% (3/2838) did not examine the direct relation between cognitive bias and PTG. The literature search yielded 44 articles. However, one article included two samples (Marshall, 2010), and another article included three studies (Börner, 2016) that met inclusion criteria for this review. Thus, our final sample for review included 47 studies.

2.3. Data extraction

The first author coded articles for the following: sample size, number of timepoints included in the study design, publication status, gender distribution of the sample, mean and standard deviation of participants' age at the time of measurement, racial composition of the sample, nature of the event, mean and standard deviation of the years since the event, and the effect size and *p*-value of bivariate correlations between cognitive biases and total scores of perceived PTG. A second, independent rater coded study demographics and effect sizes with 98% inter-rater agreement; discrepancies were handled by discussion.

If effect sizes were provided for subscale rather than total scores of perceived PTG, effect sizes were averaged across subscales. Whenever possible, unadjusted effects (i.e., bivariate correlations) were extracted. If bivariate correlations were not provided, the corresponding author was contacted with a request for this information. Six authors were contacted at least twice for the information, and only one author provided missing data. In the absence of data from the corresponding author, any other available statistics on the relation between cognitive biases and perceived PTG were extracted from the studies and converted into bivariate correlations. For two studies, effects were reported as

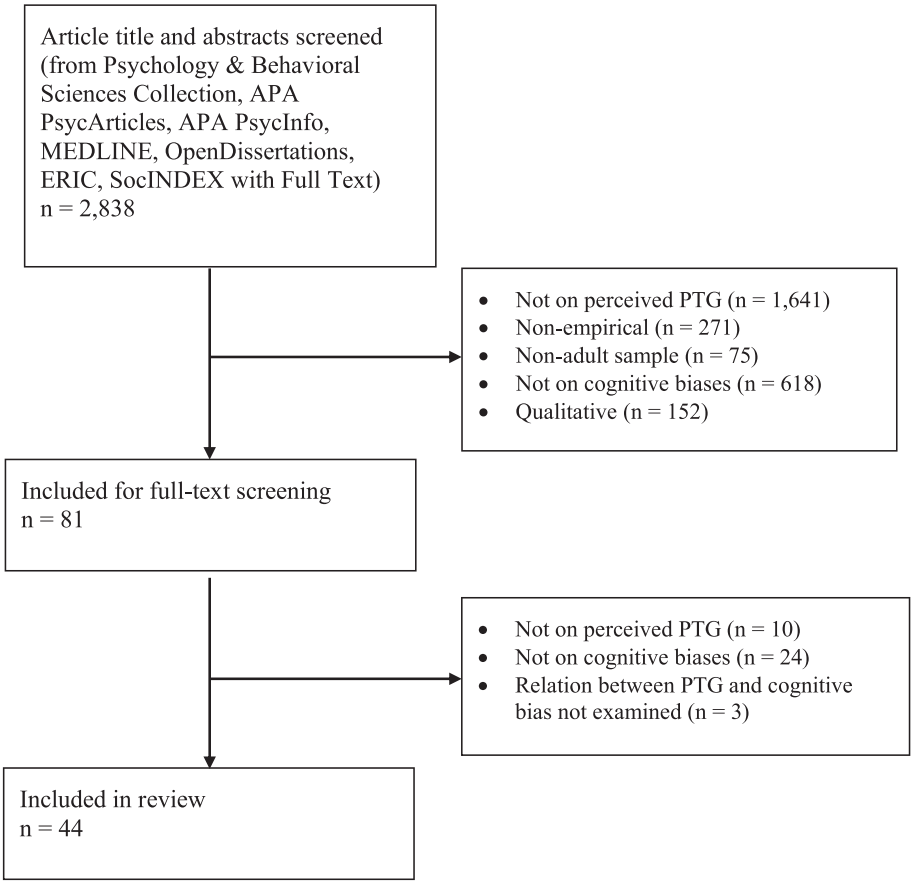

Fig. 1. Flow diagram of systematic review procedures.

"non-significant," but no other statistics were provided. Excluding non-significant, unreported effects from meta-analyses could bias effects upwards. Thus, in line with previous meta-analyses (e.g., Helgeson et al., 2006), we assumed an effect size of zero for these two studies. The directionality of effects was coded so that all positive effect sizes indicated that higher levels of bias were related to higher levels of perceived PTG. The directionality of the relation between memory ability/specificity and perceived PTG was reversed during coding. That is, positive effects (i.e., lower memory ability/specificity predicted lower perceived PTG) were coded as negative effects (i.e., higher memory bias predicted lower perceived PTG) for the purposes of the current review.

2.4. Study quality

Study quality was assessed by two independent raters using the Quality Assessment Tool for Observational Cohort and Cross-sectional Studies (NIH, 2020). The Quality Assessment Tool includes criteria on selection bias, information bias, measurement, or confounding variables, where higher quality scores indicate lower risk of bias. Thirteen of the 14 criteria in the Quality Assessment Tool were used in the current study. Criterion 14 of the Quality Assessment Tool (i.e., whether confounding variables were controlled in analyses) was not applicable to the correlational nature of effect sizes included in the current review. Each criterion was rated as 0 = *no* and 1 = *yes* and then the 13 ratings were summed to create a total quality score. In line with previous work (e.g., Schuman et al., 2019), studies in the current review were placed into three categories based on their total quality scores: 'good' (9–13), 'fair' (4–8) or 'poor' (0–3). There was 94% inter-rater agreement on quality ratings; discrepancies were handled by discussion.

3. Results

Study demographics and characteristics of the stressor for each study are presented in Appendix A. The combined sample included 7748 adults (M_{age} = 40.98). The earliest study was published in 1996, and 68% (32/47) of studies were published in the past 10 years. Additionally, 62% (29/47) of studies were published in peer-reviewed journals and 38% (18/47) were theses/dissertations. The sample sizes ranged from 30 to 651, and only 8 out of 47 studies (17%) had sample sizes above 250, which is a recommended sample size for stability of coefficients (Schönbrodt & Perugini, 2013). Among studies reporting particular types of demographic information, 76% (35/46) utilized samples in which majority of participants were female, and 90% (26/29) utilized samples in which majority of participants were White. Additionally, 57% (27/47) were exposed to DSM-5 criterion-A potentially traumatic events, and 40% (19/47) of the samples were exposed to various or unreported stressful events. The time between the occurrence of the traumatic or stressful event and the measurement of perceived PTG ranged from 6 months to 19 years, with an average of 4.68 years. The Posttraumatic Growth Inventory was used as a measure of perceived PTG in 89% (42/47) of studies.

3.1. Methodological characteristics of included studies

Although majority of studies (42/47) measured cognitive biases using participant self-report measures, experimental paradigms were also used (memory bias: n = 1; positive attention bias: n = 4). Additionally, 1–5 different measures were used both within and across studies to examine a given type of cognitive bias, resulting in a total of 18 different measures of cognitive bias used across studies included in the current review. The majority of measures (67%; 12/18) were reported with some evidence of validity. More specific methodological characteristics are reviewed below by type of cognitive bias.

3.1.1. Defensiveness

All four studies on defensiveness utilized the Defense Style Questionnaire-40, which has been found to be valid and reliable (Andrews et al., 1989). The Defense Style Questionnaire-40 assesses participants' self-reports of their neurotic and immature defense tendencies, which are captured across two subscales.

3.1.2. Memory bias

Out of six studies that examined memory bias, three examined individuals' memory specificity or ability using neuropsychological assessments. MoshirPanahi, Moradi, Ghaderi, McEwen, and Jobson (2020) asked individuals to retrieve memories in response to cue words, using the psychometrically validated Autobiographical Memory Test (Williams & Broadbent, 1986), and then coded these memories for their specificity (e.g., whether they had a distinct time and place). Additionally, two studies utilized psychometrically validated assessments (e.g., Letter-Number Sequencing on the Wechsler Adult Intelligence Scale) to examine individuals' ability to recall verbal and pictorial cues over immediate and delayed timeframes (Eren-Koçak & Kiliç, 2014; Schuettler & Boals, 2011). For the purposes of the current study, effects of memory ability/specificity were reverse-coded to reflect effects of memory deficits/biases.

Three additional studies examined memory biases for valenced content using difference scores. More specifically, two studies examined valenced memory bias by asking participants to report on their current psychological distress (Widows et al., 2005) or personal attributes and meaning in life (Ransom, 2006) prior to a stressor using psychometrically validated measures, and then to recall their pre-event standing in these domains, approximately 6 months (Widows et al., 2005) or 6 weeks (Ransom, 2006) following the stressor. Biased recall was calculated by subtracting pre-stressor reports from recalled reports of pre-stressor standing. Additionally, Hayward (2013) examined valenced memory bias using an experimental procedure drawn from existing literature but did not report on its psychometric evidence. Individuals were first shown positive and negative emotional faces from the International Affective Picture System, which had been previously standardized in a normative sample. After 15 min, participants had to identify the faces from the first trial among a series of images. Hayward (2013) calculated a memory bias score by subtracting the number of correctly recognized positive images from the number of correctly recognized negative images.

3.1.3. Downward comparison bias

All seven studies on downward comparison bias examined participants' self-reported use of downward comparisons, with some variations in measurement. Six out of the seven studies (Arandia, Mordeno, & Nalipay, 2018; Eichenbaum, 2014; Gangstad, Norman, & Barton, 2009; Ogińska-Bulik, Gurowiec, Michalska, & Kędra, 2021; Ogińska-Bulik & Michalska, 2020; Williams, Davis, & Millsap, 2002) used the psychometrically validated downward comparison subscale of the Cognitive Processing of Trauma Scale (Williams et al., 2002). The downward comparison subscale prompts individuals to consider the extent to which they agree with downward comparisons about the most upsetting, stressful, or traumatic experience of their lifetime (e.g., *Other people have had worse experiences than mine*). The seventh study utilized a social comparison measure that was developed for the purpose of the study without prior psychometric evaluation (Walter, 2016). This measure asks participants to think of a time before their traumatic event when life was fairly stable and to report the frequency in which they compared themselves to others who were doing worse than them in personal strength, spirituality, new possibilities, and appreciation of life.

3.1.4. Social desirability bias

All 21 studies on social desirability bias utilized psychometrically validated self-report measures that assessed the extent to which individuals endorse socially desirable or unrealistically favorable attributes. More specifically, 15 of the studies examined general social desirability (Bennett, 2010; Grubaugh, 2003; Lebel et al., 2013; Marcus,

2015; Marshall, 2010, Sample 1, 2; Pakenham & Cox, 2008; Park et al., 1996; Russon, 2011; Salsman, Segerstrom, Brechting, Carlson, & Andrykowski, 2009; Sodergren, Hyland, Crawford, & Partridge, 2004; Tedeschi & Calhoun, 2004; Weinrib et al., 2006; Wild & Paivio, 2003; Zeligman, 2014). General social desirability was assessed with the psychometrically validated Balanced Inventory of Desirable Responding (Paulhus, 1991), Marlowe-Crowne Social Desirability Scale (Reynolds, 1982), or the Lie Scale of the Eysenck Personality Questionnaire-Revised (Eysenck, Barret, & Eysenck, 1984). Additionally, four studies examined self-deceptive enhancement and/or impression management (Börner, 2016, Chapter 6; Goorin, 2011; Vaughan & Waehler, 2010; Winters, 2003) using the Balanced Inventory of Desirable Responding (Paulhus, 1991). Two additional studies used the Balanced Inventory of Desirable Responding to examine general social desirability as well as self-deceptive enhancement and/or impression management (Bossick, 2008; Levi & Bachar, 2019).

3.1.5. Positive attention bias

Out of eight studies that examined positive attention bias, four studies examined positive attention bias using a self-report questionnaire of trait-like individual differences in the tendency to attend to, think about, and focus on positive information (Chan, Ho, Tedeschi, & Leung, 2011; Geng et al., 2020; MoshirPanahi et al., 2020; Xin et al., 2015). All four of these studies utilized the psychometrically validated Attention to Positive and Negative Information Scale (Noguchi et al., 2006). Four additional studies utilized experimental paradigms. One utilized an emotional Stroop task, in which participants were asked to identify the color of valenced words as quickly as possible; positive attention bias was identified by comparing response times to identify the color of positive words versus negative words (Gonzalez-Mendez, Yagual, & Marrero, 2020). Gonzalez-Mendez et al. (2020) conducted an initial normative study to identify lists of cue words, yet additional psychometric evidence for their emotional Stroop task was not provided. The other three studies (Liang, Dong, Liu, & Gong, 2016; Liu et al., 2018; Noh, Han, & Shim, 2018) utilized dot probe tasks, during which a probe appeared on the screen in the location of a neutral, positive, or negative image (e.g., facial expressions) and participants had to identify the location of the probe as quickly as possible. Positive attention bias was identified if individuals had quicker response times when the probe appeared in the location of the positive image, compared to negative or neutral images. All three dot probe studies included sets of images that had been normed in previous studies, yet additional psychometric evidence for the dot probe tasks was not provided.

3.1.6. Growth beliefs

All four studies on growth beliefs examined individuals' self-reported beliefs that suffering or traumatic events can bring about growth, but measurement varied across the studies. Ransom (2006) derived the Implicit Theories of Change Scale from Winters (2003), but did not report validity evidence. This scale assessed individuals' expectations regarding the amount of change patients typically experience as a result of cancer. Shiri, Wexler, and Kreitler (2010) used the benefits of suffering subscale of Cognitive Orientation of Growth Questionnaire, which assesses individuals' beliefs that suffering has benefits (e.g., *suffering and pain ultimately benefit the individual*). Shiri et al. (2010) derived the Cognitive Orientation of Growth Questionnaire from a previously developed questionnaire and assessed the validity of the Cognitive Orientation of Growth Questionnaire for the purposes for their study. Tallman (2011) adapted the Posttraumatic Growth Inventory to assess participants' expectations prior to starting cancer treatment to evaluate whether they would experience PTG as a result. Tallman (2011) did not evaluate their modified measure of Anticipated Posttraumatic Growth Inventory for its psychometric properties prior to its use.

3.2. Study quality

The results of the study quality assessment are presented in Appendix A. Of the 47 studies included in this review, 94% (44/47) were deemed to be of fair or good quality. Therefore, findings from meta-analyses conducted in the current study can be interpreted with some confidence.

3.3. Meta-analysis plan

From the 47 distinct samples included in this review, we extracted 66 effect sizes. The additional effect sizes resulted from studies examining multiple cognitive biases ($n = 3$), using multiple measures of PTG ($n = 1$), or examining a given cognitive bias with multiple measures ($n = 11$) or across multiple timepoints (n = 3). Multiple effects within the same study are likely to be correlated and therefore violate the assumption of independence in meta-analytic modeling (Cheung, 2019). Previous studies have commonly handled non-independence by aggregating across the multiple effect sizes or selecting only one effect from a given study (e.g., Chang, Delgadillo, & Waller, 2021; Turk & Waller, 2020). However, these approaches have been critiqued for biasing effects and losing valuable information (Cheung, 2019). For this reason, we utilized a three-level random-effects model to handle multiple effect sizes nested within studies. By analyzing multivariate effects as a three-level model, we can handle non-independence even when the sampling covariances of the multiple effect sizes are unknown (Cheung, 2019). Three sources of variance are modeled in three-level models: sample variances of the retrieved effect sizes (level 1), variance between study effect sizes (level 2), and variance between studies (level 3). All analyses were conducted using this three-level model except where specifically noted below.

Analyses were conducted in R v. 3.5.1 using the metafor package (Viechtbauer, 2010). Correlation coefficients (Pearson's *r*) were used as effect sizes in all analyses. Prior to conducting analyses, we examined standardized residuals to assess the data for outliers. No data points had standardized residuals greater than one. We first calculated the overall effect of cognitive bias on perceived PTG using all 66 effect sizes. We then calculated subgroup meta-analyses to determine the correlation between PTG and each specific type of cognitive bias separately (i.e., defensiveness, memory bias, downward comparison bias, social desirability bias, positive attention bias, and growth beliefs). Subgroup analyses for downward comparison bias and growth beliefs did not contain multiple effect sizes within studies and thus were conducted using traditional univariate meta-analysis models. Next, we examined the moderating effects of a categorical variable that reflected the different types of cognitive bias (i.e., defensiveness, memory bias, downward comparison bias, social desirability bias, positive attention bias, and growth beliefs) to provide significance tests comparing the effect sizes of each type of cognitive bias (analyzing all 66 effect sizes). Finally, we examined various plausible moderators of the 66 effect sizes in separate analyses for each moderator. The moderators tested were: study quality (i.e., good, fair, or poor), participant age, race, and gender, time since event, and publication status.

In exploratory analyses, we again utilized separate subgroup meta-analyses to explore the effect sizes of specific types of cognitive bias measurements because different studies of a particular cognitive bias often used different measures. In these subgroup analyses, we examined the effect sizes for: immature defensiveness, neurotic defensiveness; valenced memory bias, neuropsychological memory bias; general social desirability, self-enhancement, impression management; self-reported positive attention bias, and experimental assessments of positive attention bias. Subgroup analyses for immature and neurotic defensiveness, impression management, and experimental positive attention bias did not contain multiple effect sizes within studies and thus were conducted using traditional univariate meta-analysis models. These analyses were not conducted for downward comparison bias or growth beliefs because these biases were examined with similar measures across studies.

We used the Q statistic to test the variation of the effect size between

studies (heterogeneity). We additionally used the I^2 statistic to assess the proportion of variance that is true effect size variability (not sampling error), where I^2 values of 50–74 indicate moderate heterogeneity and 75 or higher indicate high heterogeneity. In moderator analyses, we used the QE statistic to assess the extent of residual heterogeneity not accounted for by the "type of bias" moderator, beyond what one would expect based on sampling variability alone.

Based on previous research on the relation between cognitive processes and perceived PTG (e.g., Helgeson et al., 2006), we expected small to moderate effects. A power analysis using the metapower R package (Griffin, Bauer, & Scherf, 2021) indicated that with the ES = 0.15, sample size = 150, total number of studies = 47, I^2 = 0.75, the power to detect significant mean effect size and significant moderating effects in a random-effects model exceeded 0.90. For subgroup analyses examining relations between each type of cognitive biases and perceived PTG, power exceeded 0.80, with the exception of social desirability bias (power = 0.60).

3.4. Meta-analytic results

3.4.1. Relations between cognitive biases and perceived PTG

The overall effect between cognitive bias and perceived PTG (across the 6 bias types comprised of all 66 effect sizes) was significant, but the effect size was small, $r = 0.15$, $SE = 0.03$, $z = 4.93$, $p < .001$ (Table 1; Appendix B, Fig. B.1-B.2). There was between-study heterogeneity in the overall relation between cognitive bias and perceived PTG, $Q(65) = 820.98$, $p < .001$, $I^2 = 89.91\%$.

To assess the relation of each type of cognitive bias to perceived PTG, we performed a subgroup analysis for each type of cognitive bias (Table 1; Appendix B.1-B.2). Downward comparison bias ($n = 7$ studies), $r = 0.23$, $SE = 0.05$, $z = 4.62$, $p < .001$, $I^2 = 59.74\%$, social desirability bias ($n = 21$ studies), $r = 0.06$, $SE = 0.02$, $z = 2.48$, $p = .01$, $I^2 = 50.68\%$, positive attention bias ($n = 8$ studies), $r = 0.45$, $SE = 0.11$, $z = 3.82$, $p < .001$, $I^2 = 91.90\%$, and growth beliefs ($n = 4$ studies), $r = 0.32$, $SE = 0.06$, $z = 5.42$, $p < .001$, $I^2 = 31.04\%$, were significantly related to perceived PTG. In contrast, defensiveness (n = 4 studies), $r = 0.17$, $SE = 0.12$, $z = 1.42$, $p = .16$, $I^2 = 86.16\%$, and memory bias ($n = 6$ studies), $r = 0.01$, $SE = 0.13$, $z = 0.08$, $p = .94$, $I^2 = 88.24\%$, were not related to perceived PTG.

Table 1
Bivariate models examining cognitive biases and perceived PTG.

Construct	*N* effects	*N* studies	Effect size *r*	*Z*-score	95% CI
Cognitive bias	66	47	0.15***	4.93	0.09, 0.22
Defensiveness	8	4	0.17	1.42	−0.07, 0.41
Immature	4	4	0.10	1.05	−0.09, 0.30
Neurotic	4	4	0.31**	2.66	0.08, 0.53
Memory bias	9	6	0.01	0.08	−0.24, 0.26
Neuropsychological[a]	5	3	−0.20	−1.28	−0.50, 0.11
Valenced	4	3	0.20*	2.03	0.01, 0.39
Downward comparison bias	7	7	0.23***	4.62	0.13, 0.32
Social desirability bias	29	21	0.06*	2.48	0.01, 0.10
General	18	17	0.07**	2.88	0.02, 0.12
Self-enhancement	6	5	0.05	1.12	−0.04, 0.15
Impression management	4	4	−0.01	−0.24	−0.08, 0.06
Positive attention bias	9	8	0.45***	3.82	0.22, 0.68
Self-report	5	4	0.58***	5.97	0.39, 0.77
Experimental	4	4	0.29	1.44	−0.11, 0.69
Growth beliefs	4	4	0.32***	5.42	0.21, 0.44

Note. [a]Effects of neuropsychological memory abilities were reverse-coded to represent effects of neuropsychological memory biases/deficits.
*$p < .05$, **$p < .01$, ***$p < .001$.

3.4.2. Moderators of the relation between cognitive bias and perceived PTG

3.4.2.1. Type of cognitive bias as a moderator. The overall effect between cognitive bias and perceived PTG (across the 6 bias types comprised of all 66 effect sizes) varied by type of cognitive bias, $QM(5) = 49.06$, $p < .001$, $I^2 = 80.89\%$. Downward comparison bias exhibited stronger relations with perceived PTG than did memory bias, $b = -0.25$, $SE = 0.10$, $z = -2.55$, $p = .01$, and social desirability bias, $b = -0.17$, $SE = 0.08$, $z = -2.21$, $p = .03$. Positive attention bias exhibited stronger relations with perceived PTG than did defensiveness, $b = -0.27$, $SE = 0.09$, $z = -2.93$, $p = .003$, memory bias, $b = -0.51$, $SE = 0.09$, $z = -5.54$, $p < .001$, downward comparison bias, $b = -0.25$, $SE = 0.09$, $z = -2.71$, $p < .001$, and social desirability bias, $b = -0.43$, $SE = 0.07$, $z = -6.11$, $p < .001$. Growth beliefs exhibited stronger relations with perceived PTG than did memory bias, $b = -0.35$, $SE = 0.12$, $z = -2.98$, $p = .003$, and social desirability bias, $b = -0.27$, $SE = 0.10$, $z = -2.68$, $p = .01$. No other differences were found between the effects of types of cognitive bias on perceived PTG. There was residual heterogeneity not accounted for by the bias type moderator, beyond what one would expect based on sampling variability alone, $QE(60) = 339.12$, $p < .001$.

3.4.2.2. Demographics or study characteristics as moderators. The overall effect between cognitive bias and perceived PTG (across the 6 bias types comprised of all 66 effect sizes) did not vary by age, race, gender, time since stressful event, publication status, or study quality (each analyzed in separate analyses).

3.4.3. Exploratory subgroup analyses

Separate subgroup analyses were conducted to examine the relation between each cognitive bias measurement characteristic and perceived PTG (Table 1). These analyses showed that immature defensiveness was not related to perceived PTG (n = 4 studies), $r = 0.10$, $SE = 0.10$, $z = 1.05$, $p = .30$, $I^2 = 71.17\%$, whereas neurotic defensiveness was related (n = 4 studies), $r = 0.31$, $SE = 0.12$, $z = 2.66$, $p = .008$, $I^2 = 78.11\%$. Memory bias measured with neuropsychological assessments was not related to perceived PTG ($n = 3$ studies), $r = -0.20$, $SE = 0.16$, $z = -1.28$, $p = .21$, $I^2 = 85.76\%$, whereas memory bias measured with valenced difference scores was related to perceived PTG (n = 3 studies), $r = 0.20$, $SE = 0.10$, $z = 2.03$, $p = .04$, $I^2 = 48.66\%$. General social desirability was related to perceived PTG ($n = 17$ studies), $r = 0.07$, $SE = 0.03$, $z = 2.88$, $p = .004$, $I^2 = 45.27\%$, whereas self-enhancement bias ($n = 5$ studies), $r = 0.05$, $SE = 0.05$, $z = 1.12$, $p = .26$, $I^2 = 31.61\%$, and impression management (n = 4 studies), $r = -0.01$, $SE = 0.04$, $z = -0.24$, $p = .81$, $I^2 = 27.95\%$, were not. Self-reported positive attention bias was related to perceived PTG (n = 4 studies), $r = 0.58$, $SE = 0.10$, $z = 5.97$, $p < .001$, $I^2 = 92.48\%$, whereas experimentally assessed positive attention bias was not (n = 4 studies), $r = 0.29$, $SE = 0.20$, $z = 1.44$, $p = .15$, $I^2 = 91.90\%$ (Table 1).

3.4.4. Publication bias

Publication bias was examined with analysis of a funnel plot, where effects sizes were plotted against standard error as indication of precision (Fig. 2). Visual inspection of the funnel plot indicated some asymmetry of correlation coefficients, which suggests that publication bias may be distorting our findings. Additionally, Egger's regression test indicated a statistically significant level of publication bias, $b = -8.69$,

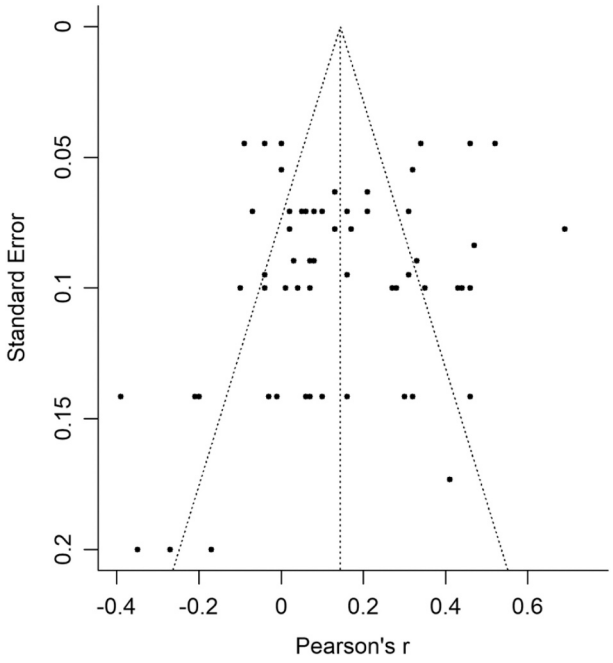

Fig. 2. Funnel plot of correlation coefficients of cognitive bias and perceived PTG.

$SE = 3.85$, $z = -2.26$, $p = .03$.

4. Discussion

We provide a systematic review and meta-analysis on the relation between cognitive bias and perceived PTG. Several scholars have described potential validity issues in measurements of perceived PTG and have theorized that individuals' reports of PTG may be cognitively biased and illusory (Jayawickreme & Blackie, 2014, 2016; Maercker & Zöllner, 2004; Tennen & Affleck, 2009). The current review identified 47 studies that have examined the relation between cognitive biases and perceived PTG. We found empirical support for our hypothesis that cognitive biases would be positively associated with perceived PTG, albeit with small effects ($r = 0.15$), which aligns with theory that cognitive biases may be contributing to illusory perceived PTG (Jayawickreme & Blackie, 2014, 2016; Maercker & Zöllner, 2004; Tennen & Affleck, 2009). Notably, our moderator analyses indicated downward comparison bias, positive attention bias, and growth beliefs were more strongly related to perceived PTG than were the other types of cognitive biases, including defensiveness, memory bias, and social desirability bias. Although further investigation is warranted for the interpretation of this pattern of findings, one could speculate that cognitive biases involving emotional processes have a stronger role in perceived PTG than those involving memory processes or social cognition. Alternatively, cognitive processes involving the exaggeration of positive perceptions may augment perceived PTG to a greater extent than cognitions involving the suppression of negative perceptions. It is also possible that perceived PTG stems more from self-deceptive cognitions than other-deceptive cognitions.

The current study suggests that cognitive biases should be considered in theoretical frameworks concerning perceived PTG. Theory on illusory perceived PTG has noted a multitude of cognitive biases that may influence perceived PTG. The current study advances this theorizing by synthesizing empirical evidence on which cognitive biases may be particularly relevant to illusory perceived PTG. Our findings suggest that individuals who enhance their own self-evaluations through downward comparison bias, or who attend to the positive in themselves or in their environment, may be more likely to perceive that they have experienced positive changes in result of the traumatic or stressful event (Jayawickreme & Blackie, 2014; Maercker & Zöllner, 2004; Tennen & Affleck, 2009). Likewise, individuals who expect that self-growth is likely to occur following traumatic or stressful events may be more likely to assume that has happened in their own lives. Of note, the directionality of this latter relation should be further investigated, given that experiences of PTG may also lead individuals to in turn develop growth beliefs. It should also be considered that cognitive biases may intersect with one another in processes of memory retrieval. For instance, individuals may be motivated to avoid trauma-related memories, or their memories may simply decay over time, which may leave room for individuals to favorably reconstruct gaps in their memories in ways that augment their perceptions of PTG.

The incorporation of cognitive biases in frameworks on the development of perceived PTG diverges from original theory on PTG (Tedeschi & Calhoun, 1996, 2004) and related empirical research (see Rzeszutek & Gruszczyńska, 2018; Shand et al., 2015, for review). Notably, cognitive biases had only small to moderate effects on perceived PTG in the current study, which has several implications. First, these small to moderate effects suggest that cognitive biases and perceived PTG are related, but not synonymous, constructs. However, it should be noted that, if several types of cognitive biases act jointly to each uniquely influence perceived PTG, these cognitive biases may additively have much larger effects on perceived PTG than those found in the current study. Second, cognitive biases have exhibited small to moderate effects on a number of psychological constructs, including depression and post-traumatic stress disorder (Klanecky Earl, Robinson, Mills, Khanna, & Badura-Brack, 2020). In this broader literature, best practices have included carefully considering the implications of cognitive biases for theory, improved measurement, and study conclusions (e.g., Hardt & Rutter, 2004). Of note, best practices have not included relinquishing the construct entirely. Third, the small to moderate effects of cognitive biases leave variance that might be better accounted for by originally theorized precipitants of PTG, such as personal strengths and environmental resources (Tedeschi & Calhoun, 1996, 2004). This aligns with the Janus-Face model that suggests that perceived PTG may have real and illusory components (Maercker & Zöllner, 2004). Perceived PTG may still represent a real, positive outcome of traumatic or stressful events when it is strongly and positively related to originally theorized precipitants of PTG and weakly (and/or negatively) related to cognitive biases.

4.1. Methodological considerations

Our subgroup analyses point to several methodological boundary conditions on our overall study findings. That is, positive attention bias ($r = 0.45$), growth beliefs ($r = 0.32$), downward comparison bias ($r = 0.23$), and (to a much lesser extent) social desirability bias ($r = 0.06$), were significantly related to perceived PTG, among the six types of cognitive biases examined. However, further subgroup findings indicated that the effects of a given type of cognitive bias on perceived PTG were inconsistent across measurement characteristics. That is, neurotic (but not immature) defensiveness, valenced (but not neuropsychological) memory bias, general social desirability bias (but not self-enhancement and impression management), and self-reported (but not experimental) positive attention bias were related to perceived PTG. Thus, future studies on illusory perceived PTG may benefit from precision in their operationalizations of cognitive biases.

Indeed, the current review indicated substantial heterogeneity across studies, which may be explained by the state of methodologies used in literature on PTG. A majority of studies assessed cognitive biases with participant self-report, using a variety of different self-report measures, some of which (23%) lacked psychometric support. Future studies on the relation between cognitive biases and perceived PTG may benefit from utilizing a standard, psychometrically validated measure of cognitive bias to establish consistent, rigorous methodology in this body of

literature. Additionally, majority of studies had small samples with less than 250 participants (83%) and homogeneous samples (76% Female, 90% White). Future studies should consider utilizing methodologies that can generalize and replicate existing research. In the current study, sample demographics and study quality did not moderate the effect size of cognitive bias on perceived PTG, which may indicate that this effect is not greatly dependent on the strengths and limitations of existing study methodologies. However, power to detect significant effects for moderator analyses in the current study was below the recommended level (Cohen, 1988). Thus, it remains possible that enhancements to study quality in the future studies could advance empirical understanding of illusory perceived PTG.

4.2. Measurement implications

The current study adds to literature suggesting that existing measures of perceived PTG may be susceptible to capturing illusory PTG (Jayawickreme & Blackie, 2014, 2016; Maercker & Zöllner, 2004; Tennen & Affleck, 2009). Relations between cognitive biases and perceived PTG may explain why self-reports of perceived PTG have previously exhibited poor convergence with actual PTG or with the reports of friends and family (e.g., Frazier et al., 2009; Helgeson, 2010). This accumulating evidence for the poor validity of self-reports of perceived PTG questions whether much of the literature on perceived PTG can be trusted. The relation between cognitive biases and perceived PTG may be an unmeasured confound in much of the existing empirical literature on the processes that precipitate perceived PTG.

Several scholars have suggested that measures that examine PTG and PTD or actual PTG be used in lieu of retrospective, perceived PTG (Jayawickreme & Blackie, 2016; Tennen & Affleck, 2009). Indeed, there is some evidence that these alternative measurements of PTG exhibit null effects with cognitive biases, such as social desirability bias (Harper et al., 2007; Joseph et al., 2011), downward comparison bias (Morse-Karzen, 2016), or growth beliefs (Ransom, 2006). However, other studies using measures of PTG and PTD have found small to moderate effects between PTG and social desirability bias (Cheng, Wong, & Tsang, 2006) and growth beliefs (Lilgendahl, McLean, & Mansfield, 2013). Given this mixed and sparse literature, it may be premature to conclude that these alternative measures of PTG capture real PTG to a greater extent than measures of perceived PTG. Measures of PTG and PTD still require that individuals recall their pre-trauma functioning, compare it to their post-trauma functioning, and estimate the difference between the two that is attributable to the traumatic or stressful event. Likewise, measures of actual PTG may introduce new biases, such as response shift (Howard & Dailey, 1979). Finally, it may not be possible to predict the occurrence of traumatic events to prosectively measure actual PTG. The influence of cognitive biases on alternative PTG measures, and continued improvements to the measurement of PTG, should be explored. Real PTG may be better captured by prompting individuals to conduct effortful memory searches of specific life events (Ross, 1989), using such instruments/techniques as the Event History Calendar (EHC; Drasch & Matthes, 2013); the Life Story Interview (Adler et al., 2021); cognitive interviewing techniques, such as having participants think-aloud (Reimer & Matthes, 2007); and the use of photographs and diaries (Hodges et al., 2006). However, it remains to be established whether the relation between cognitive biases and PTG can be sufficiently diminished with even the best attempts at improved measurement. Instead, it may be necessary to control for the potentially confounding effects of cognitive biases when utilizing measures of PTG.

4.3. Clinical implications

Cognitive biases may be an unmeasured confound in existing evidence that certain clinical techniques or interventions promote perceived PTG (e.g., Roepke et al., 2018). It remains to be established whether clinical techniques, such as enhancing positive reappraisals, predict PTG after controlling for cognitive biases and/or utilizing improved measurements of real PTG. In the absence of such investigations, clinicians may consider approaching PTG with a nuanced perspective. It remains important for clinicians to listen to clients' trauma narratives for indications of growth and prompt clients to reflect on their PTG (Calhoun & Tedeschi, 1999). However, clinicians should also assess for indications of cognitive biases in clients' perceptions of PTG, for instance, by using measures of cognitive biases. The current study suggests that clincians may benefit from focusing their assessments on downward comparison bias, positive attention bias, and growth beliefs to effectively identify illusory perceived PTG. Clinicians may decide to tolerate and even encourage some biased perceptions of PTG if such illusory perceptions appear to have an adaptive function (Calhoun & Tedeschi, 1999). However, if illusory PTG impedes clients' adaptive functioning, clinicians should consider strategies to reduce biased perceptions of PTG, such as by prompting clients' effortful retrieval of autobiographical memories.

4.4. Limitations

Several limitations of the current systematic review and meta-analysis should be noted. First, there may be sources of cognitive bias in perceived PTG not covered in the current review. We examined six cognitive biases in the current study based on Jayawickreme and Blackie's (2014, 2016) framework because those authors provided a thorough synthesis of existing theory on PTG and identified several cognitive biases that have been empirically examined in relation to PTG. Other scholars, such as Taylor (1983), have identified additional potentially relevant cognitive biases, such as exaggerated perceptions of control or unrealistic optimism. However, for the role of these biases in perceived PTG to be clearly delineated, additional research is needed that specifically examines these cognitive biases (e.g., unrealistic optimism), rather than broader cognitive constructs (e.g., trait optimism), using measures such as the Positive Irrational Beliefs Scale (Collard & Fuller-Tyskiewicz, 2020). Second, it should be noted that many of the studies included in our review did not declare their use of cognitive bias measures in their study titles, or at times, in their abstracts. Thus, it is possible that we did not find some studies that studied cognitive biases, despite several precautions in our selection process to reduce such coding errors. Yet, this limitation also remains a notable strength of the current study because our extensive search criteria identified a number of studies for which cognitive bias was not a major factor of interest for that study. Third, all studies included in our review assessed cognitive biases and perceived PTG following the traumatic or stressful event. In the absence of pre-trauma measurement of cognitive biases, our understanding of the directionality and state-like nature of the relation between cognitive biases and perceptions of growth remains limited.

Several additional limitations should be noted pertaining to our meta-analytic findings. First, studies included in our meta-analysis had high heterogeneity, which we sought to address by utilizing a random-effects model and examining moderators that may explain such heterogeneity. High statistical heterogeneity suggests that there may be significant study level (e.g., measurement approach) and individual-participant level (e.g., gender) differences across studies in this body of literature, which could be ameliorated with more consistent, rigorous methodology across future studies. Second, our funnel plot and Egger's regression analyses suggest that our estimated effects may have been influenced by publication bias, despite our inclusion of both published and unpublished studies in our systematic review. Publication bias can arise because studies with low power, poor methodology, and/or null findings are less likely to be published. This can skew meta-analytic effects towards positive results (Thornton & Lee, 2000). Future studies should consider methods to ensure publication of null results, such as open science practices. Third, our investigation of the role of methodological factors in our findings was limited. Our measurement subgroup analyses were exploratory and likely did not capture all possible

measurement considerations. Related, few studies examined each cognitive bias, with as few as four studies examining growth beliefs in relation to perceived PTG, which may have limited our power to detect significant effects in measurement subgroup analyses. However, other scholars have argued that meta-analyses are preferrable to other data synthesis approaches even for literature with few available studies (Valentine, Pigott, & Rothstein, 2010). Fourth, 83% of studies had sample sizes below 250, which suggests that many of the coefficients included in this review are at risk of being unstable, and therefore not precisely representative of true population values (Schönbrodt & Perugini, 2013). Lastly, additional investigation is needed as to the generalizability of our findings. For example, while there is some indication that cognitive biases, such as memory bias (Huang & Gan, 2018) and positive attention bias (Alamdar, Lv, Guo, Lu, & Zhang, 2020), are related to perceived PTG in child and adolescent samples, as of yet there are few studies on this topic. It is also unclear whether the findings of the current review are applicable to all racial and ethnic groups. PTG is an internationally studied concept, and biases may differ depending on cultural scripts about growth from suffering. However, majority of participants identified their race/ethnicity as White in 90% of studies in the current review.

5. Conclusion

The current study provides a systematic review and meta-analysis of empirical literature on the relation between cognitive biases and perceived PTG. In this review, evidence was found for the relation between cognitive biases and perceived PTG, particularly for downward comparison bias, positive attention bias, and growth beliefs. Our findings suggest that existing literature on perceived PTG should be interpreted with caution, given that some individuals may have biased perceptions of PTG. Future research should consider cognitive biases as being potentially important in the development of PTG. The current study provides direction on which types of cognitive biases may be a particularly worthwhile focus for future investigations. These cognitive biases should also be considered to improve measures of perceived PTG and inform clinical practice.

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Contributors

Author A conducted the systematic review, statistical analyses, and wrote the first draft of this manuscript. Author B provided independent data coding for the systematic review. Author D provided statistical consultation. All authors substantially contributed to manuscript preparation.

Declaration of Competing Interest

There are no conflicts of interest by any author.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cpr.2022.102159.

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