Review

A meta-analytic clarification of the relationship between posttraumatic growth and symptoms of posttraumatic distress disorder

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ABSTRACT

Traumatic experiences can have a powerful impact on individuals and communities but the relationship between perceptions of beneficial and pathological outcomes are not known. Therefore, this meta-analysis examined both the strength and the linearity of the relationship between symptoms of posttraumatic stress disorder (PTSD) and perceptions of posttraumatic growth (PTG) as well as identifying the potential moderating roles of trauma type and age. Literature searches of all languages were conducted using the ProQuest, Wiley Interscience, ScienceDirect, Informaworld and Web of Science databases. Linear and quadratic (curvilinear) rs as well as βs were analysed. Forty-two studies ($N = 11,469$) that examined both PTG and symptoms of PTSD were included in meta-analytic calculations. The combined studies yielded a significant linear relationship between PTG and PTSD symptoms ($r = 0.315$, CI = 0.299, 0.331), but also a significantly stronger (as tested by Fisher's transformation) curvilinear relationship ($r = 0.372$, CI = 0.353, 0.391). The strength and linearity of these relationships differed according to trauma type and age. The results remind those working with traumatised people that positive and negative post-trauma outcomes can co-occur. A focus only on PTSD symptoms may limit or slow recovery and mask the potential for growth.

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1. Introduction

Positive post-trauma changes have been increasingly researched since the mid 1990s and there is now a substantial body of literature that attests to the prevalence of such changes (e.g., Calhoun, Cann, & Tedeschi, 2010; Kleim and Ehlers, 2009; Shakespeare-Finch & Barrington, 2012; Solomon & Dekel, 2007; Tedeschi & Calhoun, 1996). Most commonly, such changes are referred to as posttraumatic growth or PTG (Linley, Andrews, & Joseph, 2007); a term coined by Tedeschi and Calhoun (1995). Of course there is also a large body of literature that examines negative post-trauma changes and interventions that are developed to alleviate associated symptoms (e.g., Bryant, Harvey, Guthrie, & Moulds, 2000; O'Donnell, Elliot, Lau, & Creamer, 2007; Vranceanu, Hobfoll, & Johnson, 2007). Over the past 16 years of published research examining positive post-trauma changes, the relationship between growth and distress has also been discussed. Yet to date, there has been no consensus about the nature of this relationship

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and therefore, it is that relationship that is the central focus of this paper.

The inconsistent findings in the literature around this topic do not appear to be attributable to the type of trauma experienced or the cultural context. For example, studying a group of bereaved Japanese students, Taku, Calhoun, Cann, and Tedeschi (2008), found evidence of a significant positive relationship between posttraumatic growth inventory (PTGI; Tedeschi & Calhoun, 1996) scores and posttraumatic stress symptoms. Similar results have been obtained in US samples (e.g., Kilmer et al., 2009) and in Israeli adolescents (Laufer & Solomon, 2006). Other researchers have found no relationship between PTG and maladaptive outcomes for example, examining cancer survivors in the US (Cordova, Cunningham, Carlson, & Andrykowski, 2001) or in SARS survivors in China (Ho, Kwong-Lo, Mak, & Wong, 2005). Others have found a negative relationship in populations as culturally diverse as the US and Turkey (e.g., Frazier, Conlon, & Glaser, 2001; Kilic & Ulsoy, 2003). Although most papers do not report testing for a non-linear relationship, some authors suggest that the relationship between growth and symptoms of PTSD is better explained as curvilinear (e.g., Butler et al., 2005; Lechner, Carver, Antoni, Weaver, & Phillips, 2006).

There are a number of ways in which the nature of the relationship between variables can be tested. Powell, Rosner, Butollo, Tedeschi, and Calhoun (2003) suggest there is a curvilinear relationship between growth and PTSD symptoms but like many others, only appear to test for this via visual inspection of scatterplots. The question arises as to the most reliable way to test for a curvilinear relationship. The most ideal way is with hierarchical regression where the test is for the additional variance explained by the curve over and above the linear assessment (Field, 2009, p. 791). Reporting on quadratic tests is another approach but its short coming is that it does not provide a test that explains if the curvilinear relationship is significantly more reliable than the linear estimate. Perhaps the weakest way is to use Analysis of Variance (ANOVA), for example, by grouping people scoring low, medium and high symptom severity and comparing groups on growth level. A curvilinear relationship would be implied if medium grouping scores were highest on growth scores.

Of the five studies (of 42; see Section 2) identified as having tested for a curvilinear relationship, Kleim and Ehlers (2009) used hierarchical regression to test quadratic effect over and above linear. Three dimensions of PTG were significantly curvilinear but the 'spiritual change' and 'relating to others' dimensions were marginal ($p = 0.057$). Levine, Laufer, Hamama-Raz, Stein, and Solomon (2008) tested both linear and curvilinear relationships but seemingly separately. That is to say, Levine et al. reported R^2 but not R^2_{change} for the quadratic curve, and were therefore unable to state if the quadratic curve was a significantly better fit of the data than the linear relationship detected. Solomon and Dekel (2007) found significant linear and quadratic effects of PTSD severity and growth but examined a range of other variables in the hierarchical regression to test quadratic effect over and above linear effects. Results predicted PTGI scores from PTSD but step two only added the PTSD quadratic estimation. Colville and Cream (2009) stated their quadratic solution better fit the data. However, in this study the authors failed to test to see if the difference between linear and curvilinear coefficients was significant. Similarly, Dekel and Nuttman-Shwartz (2009) tested linear and quadratic fits separately via curve estimation, therefore there was no test of a significant increment between the linear and quadratic estimates.

Another study looking at the relationship between distress symptoms and PTG was interested in predicting PTSD from PTG (Shiri, Wexler, Alkalay, Meiner, & Kreitler, 2008). The quadratic test was entered in the one step with the linear estimate, so there was no test of incremental significance. Both quadratic and linear

coefficients were significant but Shiri and colleagues suggested a plateau effect rather than true inverted U shape. Using the ANOVA approach, Zoellner, Rabe, Karl, and Maercker (2008) divided their sample into full PTSD, "sub-syndromal" PTSD and no PTSD subgroups and compared these groups on PTGI scores. The differences between the three groups on the PTGI total score and subscales was not strongly suggestive of an inverted-U curvilinear relationship though a plateau was evident for the PTGI total score with an increase for the full PTSD group only. Using the preferred method of hierarchical regression entering the quadratic estimation at the second step, McCaslin et al. (2009) found evidence for an inverted U-shaped curvilinear relationship between PTGI scores and PTSD symptoms as measured by the Posttraumatic Stress Checklist with the linear R^2 accounting for 7.8% of the variance and the quadratic term accounting for an additional and statistically significant 10% of the variance.

An earlier meta-analysis of posttraumatic growth was conducted by Helgeson, Reynolds, and Tomich (2006), but did not address the question of a relationship between PTG and symptoms of PTSD. Further, the authors stated they did not include non-published studies. This potentially introduces an over-estimating bias of the effect sizes derived due to the generally accepted publication bias towards significant results.

An additional limitation of previous investigations is that the vast majority of published studies only report the magnitude and significance of tests of a linear relationship. This focus on linearity was also reflected in the meta-analysis by Helgeson et al. (2006) of the relationship between PTG and various physical and psychological health measures. Therefore the meta-analyses reported in this article redresses this gap in knowledge by aggregating both linear and curvilinear assessments and testing for significance between assessments, thereby shedding light on the relationship between PTG and PTSD symptoms.

2. Method

Literature searches were conducted using the ProQuest (incorporating Dissertations and Theses), Wiley Interscience, ScienceDirect, Informaworld and Web of Science databases. Separate searches using the terms "posttraumatic growth inventory", "PTGI", "Tedeschi", and "Calhoun" were conducted and cross-referenced. Searches were limited to research published from 1996 (the year that Tedeschi and Calhoun published their introductory paper on the posttraumatic growth inventory) to 2011. No language limitations were placed on database searches.

In addition to database searches, search efforts were supplemented by the perusal of reference lists of all articles obtained. All relevant studies included in Helgeson et al.'s (2006) meta-analyses, as well as reviews by Linley and Joseph (2004), Stanton, Bower, and Low (2006), and Zoellner and Maercker (2006) were perused for relevance. Further, a number of data sets from unpublished doctoral theses which included assessment of the variables of interest were included to more completely represent data from all reliable sources. Articles and theses were cross-referenced to ensure that data reported in multiple locations were not included more than once in the meta-analysis. In order to be included, studies had to use Tedeschi and Calhoun's (1996) posttraumatic growth inventory as a measure of posttraumatic growth and use a measure of posttraumatic stress disorder (PTSD) symptoms.

2.1. Analysis approach

For the purposes of the analyses conducted, posttraumatic growth was classified as the criterion variable and PTSD symptoms were classified as the predictor variable. The moderating role