

## BRIEF REPORT

# Posttraumatic Growth in Adolescence: Examining Its Components and Relationship With PTSD

Stephen Z. Levine

*Department of Criminology, Bar Ilan University, Ramat Gan, Israel*

Avital Laufer

*School of Behavioral Sciences, Netanya Academic College, Netanya, Israel*

Yaira Hamama-Raz

*Ariel University Center of Samaria, Ariel, Israel*

Einat Stein

*Department of Psychology, Bar Ilan University, Ramat Gan, Israel*

Zahava Solomon

*School of Social Work, Tel Aviv University, Tel Aviv, Israel*

*To address gaps in the literature, this study examined the components of posttraumatic growth, and the relationship between growth and posttraumatic stress disorder (PTSD). Participants were from a pooled sample of 4,054 Israeli adolescents exposed to terror of whom 210 (5.5%) met criteria for PTSD. Measures included the Child Post-Traumatic Stress Reaction Index and Posttraumatic Growth Inventory. Principal components analysis showed two correlated components of outward and intrapersonal growth. Regression modeling showed that the relationship between the growth and PTSD measures was linear and curvilinear (inverted-U). These results replicated accounting for heterogeneity in PTSD, exposure and subsamples. Collectively, the results imply that posttraumatic growth in adolescence is characterized by two robust components, and is greatest at moderate posttraumatic stress levels.*

Posttraumatic growth, the experience of positive psychological change following highly challenging and traumatic life circumstances, receives considerable attention (Tedeschi & Calhoun, 1996, 2004). Growth research shows, for example, that even the survivors of life-threatening trauma experience positive psychological changes (Solomon & Dekel, 2007). To measure growth the Posttraumatic Growth Inventory (PGI; Tedeschi & Calhoun, 1996) is often used. The number of PGI factors and its relationship with posttraumatic stress disorder (PTSD) are unclear. Accordingly, we examine (a) the number of growth factors, and (b) the relationship between PTSD and growth.

Growth theory and research follow the positivist philosophical tradition that emphasizes positive rather than negative outcomes following trauma (Tedeschi & Calhoun, 1996, 2004). The initial three theoretical growth components have been expanded to five and include relating to others, new possibilities, personal strength, spiritual change, and appreciation for life (Tedeschi & Calhoun, 2004). To examine the number of PGI factors, nine data reduc-

tion studies have been conducted from which six points emerge (Ho, Chan, & Ho, 2004; Jaarsma, Pool, Sanderman, & Ranchor, 2006; Linley, Andrews, & Joseph, 2007; Morris, Shakespeare-Finch, Rieck, & Newbery, 2005; Powell, Rosner, Butollo, Tedeschi, & Calhoun, 2003; Sheikh & Marotta, 2005; Taku et al., 2007; Tedeschi & Calhoun, 1996; Weiss & Berger, 2006). First, sample size adequacy varies from poor to very good (Comrey & Lee, 1992). Second, correlations among the growth factors are unclear. Third, the study locations are international and thus heterogeneous. Fourth, most participants are students, who generally suffer from upsetting yet natural rather than life-threatening trauma. Fifth, generally five growth components emerge among students, three components emerge from immigrants and refugees, and two components emerge from survivors of severe illnesses. Sixth, the age range of the samples studied is broad, but adolescence is not studied systematically. Adolescence may be characterized by acquiring the abstract thinking skills necessary to experience growth and so contribute to understanding growth (Helgeson, Reynolds, &

Correspondence concerning this article should be addressed to:

© 2008 International Society for Traumatic Stress Studies. Published online in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/jts.20361

Tomich, 2006, p. 799). Such disparate results based on the same growth measure may be due to differences in culture, methodology, exposure, or a combination of these factors. Accordingly, the first study aim is to examine the number of PGI components.

Theoretically, the relationship between PTSD and growth may take four forms: (a) experiencing PTSD symptoms disturbs human functioning and quality of life, and so relates negatively to growth (Johnson et al., 2007); (b) experiencing growth is only possible if PTSD occurs and so a positive relationship is hypothesized (Tedeschi & Calhoun, 1996, 2004); (c) PTSD and growth are separate outcomes that may coexist independently (Linley & Joseph, 2004); and (d) the relationship between PTSD and growth follows an inverted-U (i.e., a quadratic curve; Powell et al., 2003). Low and high PTSD levels increase growth less than moderate levels of PTSD that correspond to the greatest growth (Solomon & Dekel, 2007). Collectively, competing theoretical explanations and mixed findings characterize the relationship between PTSD and growth. Therefore, the second study aim is to examine competing models of the relationship between PTSD and growth.

## METHOD

### Participants and Procedure

To maximize statistical power, data were pooled from two adolescent samples all with various terror exposure levels who responded to the same questionnaires. The first sample ( $n = 2,999$ ) consisted of adolescents in grades 7–9 from 11 schools (see Laufer & Solomon, 2006; Solomon & Laufer, 2005). The second sample consisted of 16-year-old ( $n = 1,745$ ) Israelis (Hamama-Raz, Solomon, Cohen, & Laufer, 2008).

### Measures

The Child Post-Traumatic Stress Reaction Index (CPTS-RI; Frederick & Pynoos, 1988) was used to measure PTSD symptom severity and the presence or absence of PTSD according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV*; American Psychiatric Association, 1994) criteria (Solomon & Dekel, 2007). This validated self-report questionnaire contained 20 statements, each with four response options, belonging to either the intrusion, avoidance, or hyperarousal syndrome (see Schwarzwald, Weisenberg, Waysman, Solomon, & Klingman, 1993).

The PGI was used to measure growth (Tedeschi & Calhoun, 1996). Based on pilot interviews the PGI response options were reduced from 6 to 4 to ease respondent understanding (see also, Powell et al., 2003). The original 21-item questionnaire was reordered and back translated into Hebrew (see Laufer & Solomon, 2006; Solomon & Laufer, 2005).

### Data Analysis

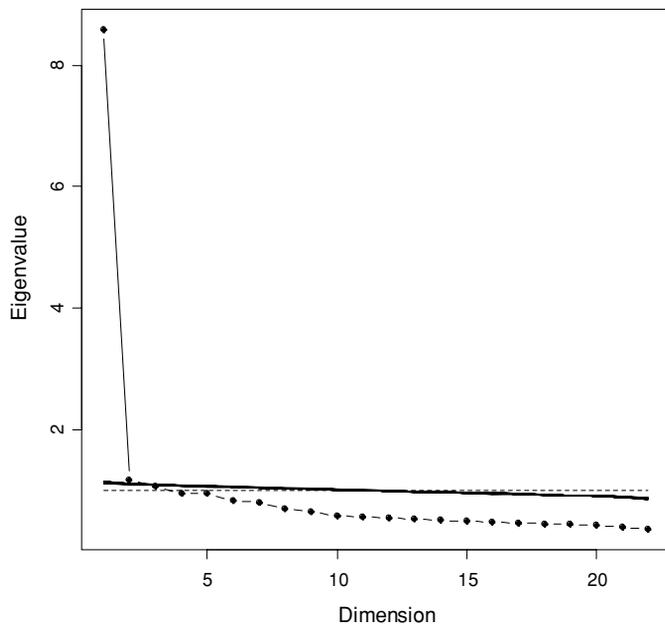
Data assumptions were tested by examining univariate and multivariate outliers, skew, kurtosis, multivariate normality, and multicollinearity. Although alternatives exist, principal components analysis was used because it maximizes the variance explained and makes few data assumptions (Gorsuch, 1993). To identify the number of components, scree plots of the data eigenvalues were superimposed on 20 parallel simulations of equally sized random data and examined (Zwick & Velicer, 1986). Promax rotation was used because it is an efficient procedure that gives good solution (Gorsuch, 1993, p. 204). Resultant loadings were used to interpret the components. To examine the relationship between PTSD and growth, curvilinear modeling was conducted. To account for heterogeneity, however, subanalyses (not reported) were conducted by level of exposure (all, direct, and indirect), PTSD (presence and absence), and subsample (because more terror attacks occurred in the 2005 than 2008 study). Presented data were analyzed listwise.

## RESULTS

Listwise deletion of all missing PGI cases left data on 4,054 participants who were mostly young women ( $n = 2,375$ , 58.6%), and few had CPTS-RI based PTSD ( $n = 210$ , 5.5%). Scale reliabilities ( $\alpha$ ) of the CPTS-RI (.92) and the PGI were good. Data screening of univariate outliers, skew, kurtosis, variance inflation factors for multicollinearity, multivariate normality using PRELIS showed that these data were better suited to principal components than to confirmatory factor analysis.

### Principal Components Analysis

The data were appropriate for principal components analysis: The Kaiser-Meyer-Olkin sampling adequacy measure was .96. A parallel scree plot to identify the number of growth components showed that the first two data eigenvalues exceeded those simulated (Figure 1), supporting a two component solution. Principal components analysis with promax rotation was conducted to interpret the two components. These two components were significantly correlated ( $r = .67$ ), had good reliability (Cronbach's  $\alpha$  were .90 and .80, respectively), and cumulatively explained 46.18% of the variance. Our components were broader in nature than those in the literature (e.g., Powell et al., 2003). The first and second growth components were labeled outward bound growth and intrapersonal growth, respectively. Additional analysis (not reported) of the PTSD and exposure subgroups showed two components with similar meanings, but not exactly the same loadings. The scales were moderately highly correlated. The magnitude of the correlation is sufficiently strong to suggest that a higher order general growth factor exists, but insufficiently strong to preclude the



**Figure 1.** Parallel scree plot of the simulated and actual data to identify the number of growth components. The dotted line represents the growth data eigenvalues, whereas the dark line represents the eigenvalues from 20 simulated data sets ( $n = 4,054$ ).

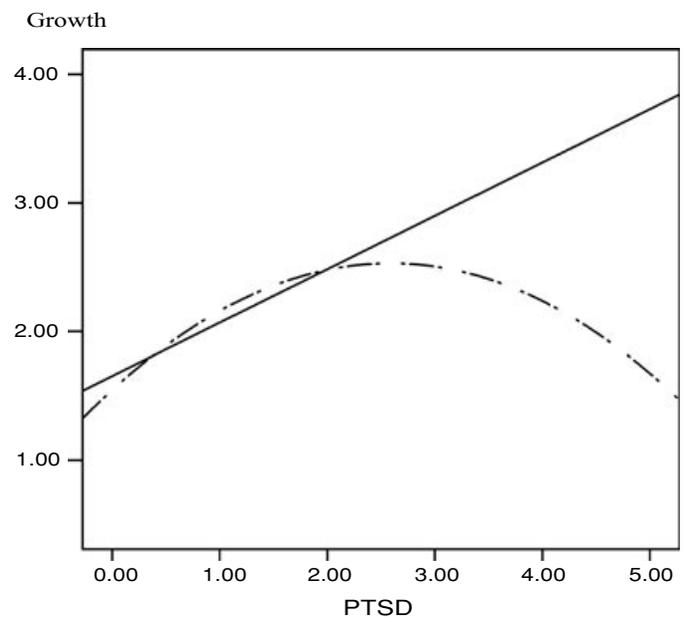
two components explanation, as other research domains suggest (Johnson, Nijenhuis, & Bouchard Jr, 2008).

### Regression Modeling: The Relationship Between PTSD and Growth

To examine the relationship between PTSD severity and growth curvilinear modeling was conducted. Significant linear and quadratic effects of PTSD severity on growth were observed ( $\beta = .42$ ,  $R^2 = .17$ ,  $p < .01$ ; and  $\beta = .76$ ,  $R^2 = .19$ ,  $p < .01$ , respectively). The relationship in Figure 2 followed an inverted-U. Supplementary analysis, not reported here, showed a similar trend of statistical significance irrespective of growth scale (total and summed components), level of exposure, PTSD, and subsample. Accordingly, these results replicated irrespective of heterogeneity and supported the curvilinear hypothesis (Solomon & Dekel, 2007).

## DISCUSSION

This study, using the largest sample in the literature identifies (a) two facets of outward and intrapersonal posttraumatic growth, and (b) the relationship between PTSD and growth as curvilinear. The results replicate irrespective of PTSD and exposure indicating their robustness.



**Figure 2.** Regression of posttraumatic stress disorder onto growth.

The findings suggest that growth may be best represented by a general factor at the apex and different, more specialized expressions of growth arrayed below it, complementing a hierarchical growth conceptualization (Taku, Cann, Calhoun, & Tedeschi, 2008). The outward growth component we identified maps onto interpersonal relationships, whereas the intrapersonal component maps onto self-perception and philosophy of life in growth theory (Tedeschi & Calhoun, 1996). The two components are more parsimonious and encompassing than other growth conceptualizations because fewer valid domains are identified. A reason for this may be that adolescents have insufficient abstract reasoning ability to achieve three growth factors (Helgeson et al., 2006). Our results, however, may extrapolate to nonadolescent samples because our sample size is large and the themes that we identify resemble those in the literature. Also, unlike most PGI data reduction research, exposure in this study is extreme and life threatening and so may cumulate in two components (see also Ho et al., 2004; Sheikh & Marotta, 2005). Alternatively, extrapolation may be inappropriate between differently aged samples.

The notions that experiencing PTSD disturbs human functioning and so is inversely related to growth (Johnson et al., 2007), and that PTSD and growth are separate outcomes that coexist independently (Linley & Joseph, 2004) do not receive support. The results indicate that PTSD increases linearly with the growth experience (Tedeschi & Calhoun, 1996, 2004). More parsimoniously, however, a quadratic relationship between growth and PTSD symptom severity emerges. Specifically, the highest levels of growth are achieved by those with average PTSD levels (see also

**Table 1.** PCA Loadings of the Growth Items With Promax Rotation

	I	II
Established a new path	<i>.84</i>	-.19
Developed new interests	<i>.81</i>	-.18
Available new opportunities	<i>.70</i>	-.02
Stronger than thought was	<i>.67</i>	.05
Learned how wonderful people are	<i>.65</i>	.06
Able to do better things	<i>.64</i>	.11
Accepts needing others	<i>.64</i>	.07
Handles difficulties	<i>.64</i>	.08
Effort into relationships	<i>.63</i>	.14
Express emotions	<i>.59</i>	.12
Sense of closeness with others	<i>.51</i>	.19
Can count on people	<i>.44</i>	.21
Accept the way things work out	.33	.31
Appreciation for the value of life	-.16	<i>.92</i>
Priorities about what is important	-.21	<i>.84</i>
Appreciating each day	.06	<i>.70</i>
Having compassion for others	.14	<i>.55</i>
Understanding spiritual matters	.25	<i>.42</i>
Has stronger religious faith	.25	<i>.41</i>
Feeling of self-reliance	.32	.39
Try to change things	.20	.39

Note. PCA = Principal components analysis. Loadings exceeding .40 are italicized to aid interpretability, and items abbreviated.

Solomon & Dekel, 2007). A quadratic relationship may partly explain the mixed findings regarding the relationship between PTSD and growth (Maercker & Langner, 2001).

Unlike the original PGI (Tedeschi & Calhoun, 1996), this study uses a back-translated Hebrew version and fewer response options based on the psychometric literature (Chang, 1994). Most PGI research uses convenience samples (i.e., students), requiring epidemiological samples to study growth comprehensively. Methodologically, longitudinal and multiple method (e.g., self- and peer report) studies are lacking and are an appropriate future research direction.

In conclusion, based on the largest growth study of adolescents to date, contrary to theory growth is represented as two components, although as theory suggests, growth is organized hierarchically (Tedeschi & Calhoun, 1996, 2004). This suggests that adolescents are worthy of special theoretical and clinical consideration. Clinically, this it is informative to note that moderate levels of PTSD facilitate the most growth. Future research into both positive and negative outcomes concurrently is appropriate.

## REFERENCES

American Psychiatric Association. (1994). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.

- Chang, L. (1994). A psychometric evaluation of 4-point and 6-point Likert-type scales in relation to reliability and validity. *Applied Psychological Measurement*, 18, 205–215.
- Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Mahwah, NJ: Erlbaum.
- Frederick, C. J., & Pynoos, R. (1988). *The Child Post-traumatic Stress Disorder (PTSD) Reaction Index*. Los Angeles: University of California, Los Angeles.
- Gorsuch, R. L. (1993). *Factor analysis* (2 ed.). Mahwah, NJ: Erlbaum.
- Hamama-Raz, Y., Solomon, Z., Cohen, A., & Laufer, A. (2008). PTSD symptoms forgiveness and revenge among Israeli-Palestinian and Jewish Adolescents. *Journal of Traumatic Stress*.
- Helgeson, V. S., Reynolds, K. A., & Tomich, P. L. (2006). A meta-analytic review of benefit finding and growth. *Journal of Consulting and Clinical Psychology*, 74, 797–816.
- Ho, S. M., Chan, C. L., & Ho, R. T. (2004). Posttraumatic growth in Chinese cancer survivors. *Psychooncology*, 13, 377–389.
- Jaarsma, T. A., Pool, G., Sanderma, R., & Ranchor, A. V. (2006). Psychometric properties of the Dutch version of the Posttraumatic Growth Inventory among cancer patients. *Psychooncology*, 15, 911–920.
- Johnson, R. J., Hobfoll, S. E., Hall, B. J., Canetti-Nisim, D., Galea, S., & Palmieri, P. A. (2007). Posttraumatic growth: Action and reaction. *Applied Psychology*, 56, 428–436.
- Johnson, W., Nijenhuis, J. T., & Bouchard Jr, T. J. (2008). Still just 1 g: Consistent results from five test batteries. *Intelligence*, 36, 81–95.
- Laufer, A., & Solomon, Z. (2006). Posttraumatic symptoms and posttraumatic growth among Israeli youth exposed to terror incidents. *Journal of Social and Clinical Psychology*, 25, 429–448.
- Linley, P. A., Andrews, L., & Joseph, S. (2007). Confirmatory factor analysis of the posttraumatic growth inventory. *Journal of Loss & Trauma*, 12, 321–332.
- Linley, P. A., & Joseph, S. (2004). Positive change following trauma and adversity: A review. *Journal of Traumatic Stress*, 17, 11–21.
- Maercker, A., & Langner, R. (2001). Posttraumatic personal growth: Validation of German versions of two questionnaires. *Diagnostica*, 47, 153–162.
- Morris, B. A., Shakespeare-Finch, J., Rieck, M., & Newbery, J. (2005). Multidimensional nature of posttraumatic growth in an Australian population. *Journal of Traumatic Stress*, 18, 575–585.
- Powell, S., Rosner, R., Butollo, W., Tedeschi, R. G., & Calhoun, L. G. (2003). Posttraumatic growth after war: A study with former refugees and displaced people in Sarajevo. *Journal of Clinical Psychology*, 59, 71–83.
- Schwarzwald, J., Weisenberg, M., Waysman, M., Solomon, Z., & Klingman, A. (1993). Stress reaction of school-age children to the bombardment by SCUD missiles. *Journal of Abnormal Psychology*, 102, 404–410.
- Sheikh, A. I., & Marotta, S. A. (2005). A cross-validation study of the Posttraumatic Growth Inventory. *Measurement and Evaluation in Counseling and Development*, 38, 66–77.
- Solomon, Z., & Laufer, A. (2005). In the shadow of terror: Changes in world assumptions in Israeli youth. *Journal of Aggression, Maltreatment & Trauma*, 9, 353–364.
- Solomon, Z., & Dekel, R. (2007). Posttraumatic stress disorder and posttraumatic growth among Israeli ex-POWs. *Journal of Traumatic Stress*, 20, 303–312.
- Taku, K., Calhoun, L. G., Tedeschi, R. G., Gil-Rivas, V., Kilmer, R. P., & Cann, A. (2007). Examining posttraumatic growth among Japanese university students. *Anxiety Stress and Coping*, 20, 353–367.
- Taku, K., Cann, A., Calhoun, L. G., & Tedeschi, R. G. (2008). The factor structure of the Posttraumatic Growth Inventory: A comparison of five models using confirmatory factor analysis. *Journal of Traumatic Stress*, 21, 158–164.

- Tedeschi, R. G., & Calhoun, L. G. (1996). The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress, 9*, 455–471.
- Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*, 1–18.
- Weiss, T., & Berger, R. (2006). Reliability and validity of a Spanish version of the Posttraumatic Growth Inventory. *Research on Social Work Practice, 16*, 191–199.
- Zwick, W. R., & Velicer, W. F. (1986). Comparison of 5 rules for determining the number of components to retain. *Psychological Bulletin, 99*, 432–442.

Copyright of *Journal of Traumatic Stress* is the property of John Wiley & Sons, Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.