# The factor structure of the Posttraumatic Growth Inventory in parents of critically ill children

Rocío Rodríguez-Rey[1], Jesús Alonso-Tapia[1], Nancy Kassam-Adams[2] and Helena Garrido-Hernansaiz
[1] Universidad Autónoma de Madrid and [2] Centre for Injury Research and Prevention. The Children's Hospital of Philadelphia

## Abstract

**Background**: Posttraumatic growth (PTG) was conceptualized as consisting of changes in three broad dimensions; Self, interpersonal relationships, and philosophy of life. The aim of this study is to analyze the factor structure of the Posttraumatic Growth Inventory (PTGI) in a sample of parents whose children had survived a critical hospitalization in order to consider the structural validity of the PTGI scores for this population and to report our understanding of PTG as a construct. **Methods:** 143 parents completed the PTGI 6 months after their child's discharge from pediatric intensive care. The PTGI scores' factor structure was studied through confirmatory factor analyses (CFA) of different models supported in prior research, followed by an exploratory principal component analysis (PCA). **Results:** Prior models tested through CFA did not provide an acceptable fit for our data. Through exploratory PCA, three components emerged that explained 73.41% of the variance; personal growth, interpersonal growth and transpersonal growth. Subsequent CFAs on this three-factor model showed that a bifactor model had the best fit. **Conclusion:** Although the PTGI scores have shown slightly different factor structures among diverse populations, the three dimensions initially theorized appear to be robust, which supports the structural validity of its scores.

*Keywords:* Posttraumatic growth inventory, pediatric intensive care, parents, factor structure, structural validity.

## Resumen

*La estructura factorial del Inventario de Crecimiento Postraumático en padres de niños críticamente enfermos.* **Antecedentes:** el crecimiento postraumático (CPT) se definió originalmente como la ocurrencia de cambios en tres dimensiones: personal, relaciones interpersonales y filosofía de vida. El objetivo de este estudio es analizar la estructura factorial de las puntuaciones del Inventario de Crecimiento Postraumático (PTGI) en una muestra de padres cuyos hijos sobrevivieron a una hospitalización en cuidados intensivos pediátricos para explorar la validez estructural en esta población e incrementar nuestra comprensión de este fenómeno. **Método:** 143 padres completaron el PTGI 6 meses después del alta de su hijo de cuidados intensivos. La estructura factorial de las puntuaciones en el PTGI se estudió mediante análisis factoriales confirmatorios (AFC) de los diferentes modelos que habían emergido en estudios previos, seguido de un análisis exploratorio de componentes principales (ACP). **Resultados:** los modelos previos no proporcionaron un ajuste aceptable a nuestros datos. Mediante ACP emergieron tres componentes que explicaron el 73,41% de la varianza; crecimiento personal, crecimiento interpersonal y crecimiento transpersonal. Posteriores AFCs de este último modelo mostraron que un modelo bifactor obtuvo el mejor ajuste. **Conclusión:** aunque las puntuaciones del PTGI haya mostrado estructuras factoriales distintas en diferentes poblaciones, las tres dimensiones originalmente teorizadas son consistentes, lo que apoya su validez estructural.

*Palabras clave:* inventario de crecimiento postraumático, cuidados intensivos pediátricos, estructura factorial, validez estructural.

The hospitalization of a child in intensive care is a potentially traumatic experience for parents, which may result in negative psychological outcomes (Colville & Pierce, 2012). Little research has explored the occurrence of positive outcomes after this experience, such as posttraumatic growth (PTG), defined as positive psychological changes that occur as the result of one's struggle with a potentially traumatic event (Tedeschi & Calhoun, 1995).

A recent review identified 19 studies that explored PTG in parents of children with serious pediatric illness (Picoraro,

Womer, Kazak, & Feudtner, 2014), but only one of them (Colville & Cream, 2009) focused on exploring this phenomenon in parents of critically ill children, finding moderate levels. Examining the structural validity of the scores of a widely-used PTG measure in this population will enrich our theoretical understanding of the validity and utility of this construct and its domains, and will also have clinical implications, as it may help us to understand which aspects must be taken into account when trying to foster PTG among these families.

What changes in a person after dealing with a traumatic life event that may lead to PTG? Tedeschi and Calhoun (1995, 1996), based on an extensive review, suggested that the perceived positive changes experienced in the aftermath of trauma fall into three categories: 1) the perception of self, 2) interpersonal relationships and 3) philosophy of life. In each dimension, changes may occur at an affective, cognitive, and behavioral level.

Regarding *changes in self*, living through life's adverse experiences provides individuals with information about their own strengths, as they realize that they can overcome difficulties (Thomas, DiGiulio, & Sheehan, 1988). Regarding *changes in interpersonal relationships*, recognition of one's vulnerability can lead to more willingness to accept help, more expressiveness, and increased self-disclosure (Tedeschi & Calhoun, 1996). Regarding *changes in philosophy of life*, they are related to the process of "meaning-making" in the midst of trauma, which may lead to positive changes in one's basic assumptions about life (Janoff-Bulman, 1992).

Although seven measures assessing PTG have been published (Linley, Andrews, & Joseph, 2007), the most widely-used is the Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996). It comprises 21 items assessing positive changes reported by persons who have experienced traumatic events, each rated on a 6-point-Likert scale regarding how much this change was experienced "as a result of my crisis". Internal consistency was high in the original version (α = .90) (Tedeschi & Calhoun, 1996), and the Spanish version (α = .92) (Weiss & Berger, 2006).

Even though the PTGI was originally developed to account for three dimensions (self, interpersonal relationships and philosophy of life), an initial principal component analysis (PCA) on data from 604 college students showed five factors (New Possibilities, Relating to Others, Personal Strength, Spiritual Change and Appreciation for Life), which were interpreted and named a posteriori. From a theoretical perspective, these five dimensions could be considered as a re-grouping of the three hypothesized dimensions as initially defined, such that "personal strength" and "new possibilities" reflect changes in self, "relating to others" reflects changes in interpersonal relationships, and "appreciation of life" and "spiritual change" reflect changes in philosophy of life.

This posited five-dimensional factor structure has implications for research. Because these components undergird the scoring of the PTGI and its subscales, they are often used to guide interpretation of PTGI scores in the context of research hypotheses without conducting further analyses on factor structure (Morris, Shakespeare-Finch, Rieck, & Newbery, 2005). Thus, given the wide use of the PTGI, it is important to establish whether this structure is optimal and can be replicated across different populations.

Prior studies have found three basic variants on the construct of PTG that either: (1) consider growth as a unitary construct (monofactorial), (2) indicate that growth has one personal, one interpersonal, and one transpersonal dimension, which is consistent with the initial PTGI theory, or (3) support the five-factor structure of the PTGI scores, which can be seen as a variation on (2) above. Table 1 summarizes studies of the factor structure of the PTGI, noting the participants, method of analysis, and the number of factors that emerged (or were tested in a confirmatory analysis). Table 2 lists the 21 items of the PTGI and shows, for the different models that have emerged from literature, to which factor each item belongs.

As Table 1 shows, the idea that PTG is best understood as a unitary construct was supported in several studies. Three-factor solutions have been also common. Although specific items may load on slightly different dimensions (see Table 2), all of the three-factor solutions are consistent with the three elements of growth theorized by Tedeschi and Calhoun. However, as Table 2 shows, these factors have received slightly different names, even when they refer to the same underlying construct. Similarly, four-factor models are generally consistent with the three original elements of growth, but with slight variations, and are very similar to the five-factor model. Finally, the five-factor structure has been replicated in several samples. Konkolÿ Thege, Kovács, & Balog (2014) found the best fit in a bifactor model, in which all items load onto a general dimension and onto one of the five factors of PTG at the same time.

*Table 1*
Factor Structure, participants and language of the PTGI in previous studies.

| | Authors | Participants | N | Language | Analysis method |
|---|---|---|---|---|---|
| One-Factor | Joseph, Linley, and Harris (2005) | University students, and family and friends | 176 | English | EFA |
| | Sheikh and Marotta (2005) | Adults with a history of cardiovascular disease | 124 | English | PCA |
| | Costa-Requena and Gil (2007) | Cancer outpatients | 130 | Spanish | PCA |
| Three-factor | Powell, Rosner, Butollo, Tedeschi, and Calhoun (2003) | Refugees and displaced people | 136 | Bosnian | PCA |
| | Weiss and Berger (2006) | Latino immigrants | 100 | Spanish | PCA |
| | Anderson and Lopez-Baez (2008) | University students | 345 | English | PCA |
| Four-factor | Ho, Chan, and Ho (2004) | Cancer survivors | 188 | Chinese | EFA |
| | Taku et al. (2007) | University students | 312 | Japanese | EFA |
| Five-Factor | Tedeschi and Calhoun (1996) | Undergraduate psychology students | 604 | English | PCA |
| | Morris, Shakespeare-Finch, Rieck, and Newbery (2005) | Undergraduate students | 219 | English | EFA |
| | Linley, Andrews, and Joseph (2007) | Adults who had experienced adverse life events | 372 | English | CFA |
| | Taku, Cann, Calhoun, and Tedeschi (2008) | Adults experiencing a variety of traumatic events | 926 | English | CFA |
| | Lee, Luxton, Reger, and Gahm (2010) | Active duty soldiers | 3537 | English | CFA |
| | Palmer, Graca, and Occhieti (2012) | Veterans with PTSD | 221 | English | CFA |
| | Konkolÿ Thege, Kovács, and Balog (2014)* | People who had experienced a trauma or loss | 691 | Hungarian | CFA |

Note: * Bifactor model with a 5 + 1 factor structure

*Table 2*
Items of the PTGI and its belonging to different dimensions among different factor models

| | 1F | 5F | 3F (Po-well et al., 2003) | 3F (Weiss & Berger, 2006) | 3F (Ander-son & Lopez-Baez, 2008) | 4F (Ho et al., 2004) | 4F (Taku et al., (2007) |
|---|---|---|---|---|---|---|---|
| 4. I have a greater feeling of self-reliance | PTG | PS | CS | SPA | SP | SC | PS |
| 10. I know better that I can handle difficulties | PTG | PS | CS | SPA | SP | CS | PS |
| 12. I am better able to accept the way things work out | PTG | PS | CS | | SP | CS | PS |
| 19. I discovered that I'm stronger than I thought I was | PTG | PS | CS | PL | SP | | PS |
| 3. I developed new interests | PTG | NP | PL | SPA | SP | CS | NP |
| 7. I established a new path for my life | PTG | NP | CS | SPA | SP | CS | NP |
| 11 I am able to do better things with my life | PTG | NP | CS | SPA | SP | CS | NP |
| 14. I have new opportunities which wouldn't have been available otherwise | PTG | NP | CS | SPA | SP | | NP |
| 17. I am more likely to try to change things which need changing | PTG | NP | PL | | SP | LO | NP |
| 6. I more clearly see that I can count on people in times of trouble | PTG | RO | PL | RO | RO | RO | RO |
| 8. I have a greater sense of closeness with others | PTG | RO | RO | | RO | RO | RO |
| 9. I am more willing to express my emotions | PTG | RO | CS | RO | RO | CS | RO |
| 15 I have more compassion for others | PTG | RO | PL | | RO | RO | RO |
| 16. I put more effort into my relationships | PTG | RO | PL | PL | RO | | RO |
| 20. I learned a great deal about how wonderful people are | PTG | RO | RO | | RO | | SC/ AL |
| 21. I better accept needing others | PTG | RO | RO | | RO | | RO |
| 1. I changed my priorities about what is important in life | PTG | AL | | PL | SP | LO | NP |
| 2. I have a greater appreciation for the value of my own life | PTG | AL | PL | | SP | | SC/ AL |
| 13. I can better appreciate each day | PTG | AL | PL | PL | SP | CS | SC/ AL |
| 5. I have a better understanding of spiritual matters | PTG | SC | CS | | SC | SC | SC/ AL |
| 18. I have a stronger religious faith | PTG | SC | RO | PL | SC | SC | SC/ AL |

Note: F = factor; AL = appreciation of life, CS = changes in self, LO = life orientation, NP = new possibilities, PL= philosophy of life, PS = personal strength; RO = relating to others, and SC = spiritual change, SPA= self-positive attitude, SP= self-perception.

Most studies have used exploratory techniques (exploratory factor analysis [EFA] or PCA), which may lead to variations in findings when analyses optimize a solution for each particular sample. However, even confirmatory factor analyses (CFA) have varied in whether they are able to confirm the fit of the PTGI scores' five-factor structure (Taku, Cann, Calhoun, & Tedeschi, 2008; Linley et al., 2007; Lee, Luxton, Reger, & Gahm, 2010; Palmer, Graca, & Occhietti, 2012; Ho, Chan, & Ho, 2004). Therefore, it does not seem justifiable to assume the five-factor structure of the PTGI scores when it is used in a new population.

In summary, the aim of this study was to examine the PTGI scores' factor structure in parents of critically ill children. We tested factor structures supported in prior studies that may shed light on the optimal way to understand PTG (and administer/score the PTGI) in this population expecting that that either a five- or a three-factor solution would demonstrate a good fit to the data. By comparing the fit of single and multiple factor solutions, this study also examines the idea that PTG would be best understood as a multi-factorial construct. Additionally, we will explore the internal consistency of the PTGI in our sample of parents of critically ill children.

Method

*Participants*

Participants in the present study were the parents ($N$ = 143) of children who had been admitted for more than 12 hours to a sixteen-bed PICU in Spain six months before, and whose child survived the hospitalization. All of them were Spanish-speakers. The mean age was 38.24 years ($SD$= 6.31); and 63.6% were women. The primary reasons for their child's admission to the PICU were planned surgery (70.6%), emergency medical treatment (15.4%), accidental injury/emergency surgery (11.2%) and relapse of a chronic disease (2.8%).

*Instruments*

– A *sociodemographic and medical questionnaire* included age and gender of the parent, and primary reasons for admission.
– The *Posttraumatic Growth Inventory (PTGI)* (Tedeschi & Calhoun, 1996) is the best-known measure to assess PTG, and contains 21 items with a 6-point Likert response format ranging from 0 ("I did not experience this change as a result of my crisis") to 5 ("I experienced this change to a very great degree as a result of my crisis"). Internal consistency was high in the original study (α = .95) (Tedeschi & Calhoun, 1996), as well as in the Spanish version validation study (α = .95) (Weiss & Berger, 2006), and in a subsequent study conducted with oncological patients in Spain (α = .95) (Costa-Requena & Gil, 2007). The Spanish version used in this study was developed to retain semantic and content equivalence, and has demonstrated conceptual and technical equivalence (Weiss & Berger, 2006). In order to ensure that parents' responses referred to the experience

of their child's critical hospitalization, the wording "as a result of my crisis" was changed to "as a result of my child's admission to the PICU".

*Procedure*

This study was part of a larger longitudinal study evaluating the impact of a children's PICU admission on parents' psychological well-being, for which ethical approval was obtained at the first author's University and at the relevant hospital, and written informed consent was required as well. Inclusion criteria for the main study were being a parent of a child admitted to the PICU for more than 12 hours, being able to speak Spanish well enough to complete the questionnaires, and that the child survives the critical hospitalization.

In the main study, parents were assessed at three time-points; in the first 48 hours after their child's discharge from the PICU (T0), three months post-discharge (T1) and six months post-discharge (T2). In total, 273 parents who met the inclusion criteria were initially approached. Of these, 196 (71.79%) parents gave their consent and completed the T0 assessment. Three and six months post-discharge, 158 parents (80.61%) and 143 parents (72.96%), respectively, fully completed the T1 and T2 questionnaires by email or post. Participants completed the assessments at a time and place of their choosing. The 143 parents who completed the T2 assessment constitute the participants of the present study. All of them completed the 21 items of the PTGI, so there were no missing data. Participants did not receive any compensation for their participation. Data were collected between January 2013 and April 2014.

*Data analysis*

In order to study PTGI scores' factor structure, seven models were tested via CFA using Mplus version 7.31 (Muthén & Muthén, 2013). A one-factor model was tested, as well as hierarchical and bifactor solutions for three-, four- and five-factor models. The tested models correspond to those shown in Table 2 and reflect the models found in previous literature. In order to evaluate the fit of the model, it was estimated with the MLM method (maximum likelihood parameter estimates with standard errors and a mean-adjusted chi-square test statistic), which is robust to non-normality (Muthén & Muthén, 2013). For comparing the fit of the tested models, we first used the chi-square statistic ($\chi^2$) to assess the overall fit; however, it is sensitive to the sample size and may be unreliable given the current size sample ($N$ = 143), and alternative methods are commonly used (Urra Portillo, Escorial Martín, & Martínez Arias, 2014). Therefore, as suggested by Hu and Bentler (1999), we employed a combination approach to evaluate model fit, including the $\chi^2$, the $\chi^2/df$, two baseline close-fit indices –the maximum likelihood based standardized root mean squared residual (SRMR) and the root mean square error of approximation (RMSEA)–, and two incremental close-fit indices –the comparative fit index (CFI) and the Tucker-Lewis index (TLI). As for the baseline fit indices, $\chi^2$ non-significant values indicate good fit, $\chi^2/df$ < 2 indicates a good fit, the SRMR values of .08 or less and the RMSEA values of .06 or less are generally taken to indicate reasonable model fit (Hu & Bentler, 1999; Thompson, 2004). The incremental fit indices (CFI and

TLI) with a value of .95 or greater indicate acceptable fit (Hu & Bentler, 1999; Schreiber, Stage, King, Nora, & Barlow, 2006). In each model, it was expected that each observable variable would load only on the factor it was intended to measure, that measurement errors associated with these variables would be uncorrelated, and that all covariance between each of the first order factors would be explained either by a higher-order factor (hierarchical model), or by a general dimension on which all items would load at the same as on the factors (bifactor model) as suggested by Konkolÿ Thege et al. (2014).

Subsequently, based on the results of previous analyses, we conducted a principal component analysis (PCA) using SPSS v.22 (IBM Corporation, 2013). We conducted PCA to replicate the original study of Tedeschi and Calhoun (1996), the Spanish adaptation of the PTGI (Weiss & Berger, 2006), and its validation with Spanish cancer patients (Costa-Requena & Gil, 2007). Moreover, PCA is distinctive in that it accounts for all the variability, and this is especially important in summarizing the structure of the present data. The model that emerged from this analysis was tested through two CFAs (hierarchical and bifactor) using the same method and criteria as in the previous CFAs. Once the best factor solution for the PTGI scores in our sample was found, the internal consistency of the scores of the PTGI and its factors was calculated by means of McDonald's omega (ω) coefficient (McDonald, 1999; Elosua Oliden & Zumbo, 2008).

Results

*Evidence of Structural Validity of the PTGI*

We first tested the monofactorial model, and secondly, the original five-factor model. Next, we examined a three-factor model with a factor named "Self" (including items 1, 2, 3, 4, 7, 10, 11, 12, 13, 14, 17, and 19), a factor named "Relationship with others" (items 6, 8, 9, 15, 16, 20 and 21), and a factor called "Spiritual change" (items 5 and 18). That model was created from the conjunction of the three three-factor models that appear in Table 2. We assigned each item to each of the three dimensions when it belonged to that dimension in at least two of the three-factor models presented in Table 2, and also when the content of the item was coherent with this assignment. Finally, we examined a four-factor model based on the same criteria described for the three-factor model, and adding the dimension "New possibilities/Life orientation", which included items 1, 2, 3, 7, 14, and 17. Two models were tested for the three-, the four- and the five-factor models, first a hierarchical model and second a bifactor model.

Table 3 shows the fit indices for the tested models. The models with the best adjustment were the three- and the four-factor bifactor models. The chi-square statistic was significant for both models probably due to the sample size. The $\chi^2/df$ and the SRMR were inside the limits of acceptance. However, the CFI and the TLI were all below .95, and the RMSEA was higher than .05.

*Principal Component Analysis (PCA)*

As none of previous factor structures showed a good fit to our data, we conducted a PCA in order to study the factor structure of the PTGI scores in an exploratory approach. The term "factor" was

used to refer to the results of the rotation of the extracted principal components, following the practice of Tedeschi and Calhoun (1996). As in previous studies, we used PCA with criterion for extraction = eigenvalue > 1, followed by a Varimax rotation. Three factors emerged that accounted for 68.95% of the total variance. For the sake of interpretation, congruent with criteria used in previous studies (Costa-Requena & Gil, 2007; Tedeschi & Calhoun, 1996; Weiss & Berger, 2006), we allocated an item to a factor only if its loading was greater than .5 and if it loaded less than .4 on other factors. The items that failed to load differentially were removed from the questionnaire in order to assess the different components of PTG as clearly as possible. After doing so, 12 items stayed in the questionnaire, which accounted for 73.41% of the total variance. This level is comparable to the percentage of variance explained in previous studies using PCA (Powell, Rosner, Butollo, Tedeschi, & Calhoun, 2003; Tedeschi & Calhoun, 1996; Weiss & Berger, 2006), and the number of items retained is the same as the 12 items retained in the Bosnian translation (Powell et al., 2003), and similar to the 15 items in the Chinese translation (Ho et al., 2004) and the 13 items in the Spanish translation (Weiss & Berger, 2006).

Table 4 presents the resulting solution. Items included in the first factor, named *"Personal growth"*, stemmed from three different original factors. The item with the highest loading comes from the original *appreciation for life* and indicates a greater appreciation for the value of one's own life (2). This factor also included one item from the scale *new possibilities*, indicating the development of new interests (3). The remaining items refer to the original factor *personal strength* and captures changes in self-reliance (4), coping self-efficacy (10, 19), and acceptance (12). The second factor, labeled *"Interpersonal growth"* included three items from the original *relating to others* scale, and denotes changes in learning about how wonderful people are (20), better accepting needing others (21), and counting on others (6). Items in the third factor, titled *"Transpersonal growth"*, came from two original factors, *spiritual change* and *new possibilities*. It captures a strengthening of religious faith (5), a better understanding of spiritual matters (18), and the occurrence of new possibilities (14).

As Pearson correlation between total score based on the 21-item version of the PTGI and the total score based on the 12 items version was .98, no significant loss of information was produced by reducing the number of items.

## CFA of the Three-factor Structure that Emerged from the PCA

To better understand the factor structure of the PTGI scores in our sample, the solution that emerged from the PCA was further examined through CFA, using the same methods, estimators and criteria as in the previous CFAs. Two models were tested; hierarchical and bifactor. Model fit statistics for these two models are included on Table 3. Figures 1 and 2, show the initial confirmatory standardized solution for the two models. The bifactor model demonstrated the best fit: the chi-square statistic was again significant probably due to the sample size, but higher than for the rest of models ($p = .006$). However, the CFI, the TLI, the SRMR, and the RMSEA were inside the limits of acceptance. The AIC showed the lowest value for this model.

## Internal Consistency of the PTGI in parents of critically ill children

The internal consistency (McDonald's ω) of the 21-item PTGI was .99, which indicates that the items of the original 21-item PTGI may be redundant (Streiner, 2003). The internal consistency of the final scale considering only the 12 items that were kept in the questionnaire was .97. McDonald´s ω of the Personal Growth factor (ω = .96), the Interpersonal growth factor (ω = .89) and the Transpersonal Growth factor (ω = .91) were also adequate.

## Discussion

Although PTG is a common phenomenon after highly challenging life crises, psychometric analyses of the scores of the most widely used instrument –the PTGI– have revealed differences across samples concerning its scores' factor structure. This is the first study to report the dimensionality of the PTGI scores in parents after their child's critical illness and medical treatment.

In confirmatory analyses, none of the tested models showed a good fit to our data. However, the three PTG dimensions that emerged through exploratory PCA, and which were confirmed in the CFA, are congruent with the three broad categories of PTG originally identified by Tedeschi and Calhoun (1995). The first dimension refers to *personal growth* (self-perceived growth), the second to *interpersonal growth* (relationships with others), and the third to *transpersonal growth* (spiritual beliefs and life-possibilities).

*Table 3*
Goodness of fit statistics for CFAs

| Model | χ² | df | p | χ²/df | CFI | TLI | RMSEA | SRMR | AIC |
|---|---|---|---|---|---|---|---|---|---|
| Of the factor structures found in previous studies | | | | | | | | | |
| One-factor | 500.61 | 189 | .000 | 2.64 | .84 | .82 | .11 | .07 | 9862.21 |
| Three-factor hierarchical | 394.65 | 185 | .000 | 2.13 | .89 | .88 | .09 | .06 | 9735.42 |
| Three-factor bifactor | 309.71 | 168 | .000 | 1.84 | .93 | .91 | .08 | .05 | 9664.83 |
| Four-factor hierarchical | 451.61 | 187 | .000 | 2.42 | .86 | .85 | .10 | .10 | 9801.27 |
| Four-factor bifactor | 304.13 | 169 | .000 | 1.80 | .93 | .91 | .07 | .05 | 9651.01 |
| Five-factor hierarchical | 451.76 | 186 | .000 | 2.42 | .86 | .85 | .10 | .09 | 9798.28 |
| Five-factor bifactor | 325.32 | 171 | .000 | 1.90 | .92 | .90 | .08 | .05 | 9670.20 |
| Of the Factor structure that emerged after the PCA (PTGI-12 items) | | | | | | | | | |
| Three-factor hierarchical | 93.44 | 51 | .000 | 1.83 | .95 | .94 | .08 | .06 | 5744.70 |
| Three-factor bifactor | 68.09 | 42 | .007 | 1.62 | .97 | .95 | .06 | .05 | 5730.24 |

This structure is consistent with literature in this area, and supports the idea that a common underlying theoretical model may explain PTG in different populations (Powell et al., 2003; Weiss & Berger, 2006). Based on these findings, we propose that a reduced 12-item version of the questionnaire may be useful to assess PTG in parents of children with severe illnesses. As the three main dimensions of growth hypothesized by Tedeschi and Calhoun are well represented in the reduced version of the questionnaire, we consider that no clinically significant content has been removed. Additionally, the scores of the 12-item version of the PTGI and each of its three subscales showed adequate internal consistency, while the internal consistency for the 21-item PTGI scores was over .95, which indicates that the items may be redundant (Streiner, 2003), and supports the idea of a reduced version of the instrument.

The fact that a bifactor model such as the one proposed by Konkolÿ Thege et al. (2014) fit our data better than a hierarchical model implies that a person who grows after trauma at the personal level, tends to grow also at the interpersonal and transpersonal level –the three facets of the PTG construct– and also supports the idea of calculating a single overall PTG score in addition to subscales for each of its dimensions.

The main strength of this work is that it provides a theoretically grounded evaluation of previous factor models through CFA before exploring the factor structure of the PTGI through PCA. Heterogeneity of samples in prior studies may have adversely affected the consistency of factor structures observed for the PTGI. However, the fact that many studies (including this one) find a structure that is congruent with the original three dimensions proposed by Tedeschi and Calhoun supports the basic structural validity of this three-dimensional model of PTG.

This study also presents some limitations. First, participants were parents of children admitted to a single PICU, which may limit the generalizability of the results to other PICUs and other populations. The sample size did not allow us to explore the influence of the age and sex of the parent in the PTGI scores' factor structure, or to conduct multiple group analyses using randomized subsamples to study the invariance of the factor structure of the PTGI scores. It would be useful to conduct multi-center studies including larger samples of parents of critically ill children to address these aspects in future research. Our study relies exclusively on self-report data to assess PTG and its dimensions, a method which has raised some concerns (Sumalla, Ochoa, & Blanco, 2009). Future research could overcome this limitation by incorporating objective behavioral changes and confirmation of close persons (e.g., family) to the evaluation, as well as a social desirability scale as Tedeschi and Cahoun (1996) did. In terms of

*Table 4*
Loadings on the Three New Factors of the Spanish PTGI

| Item Number, Text, and New Factor PTGI | Factor in Original PTGI | New Factor Loadings | | |
|---|---|---|---|---|
| | | I | II | III |
| New Factor I: *Personal growth* (32.64% of variance) | | | | |
| 2. I have a greater appreciation for the value of my own life. | AL | .816 | | |
| 3. I developed new interests | NP | .786 | | |
| 4. I have a greater feeling of self-reliance | PS | .782 | | .380 |
| 10. I know better that I can handle difficulties | PS | .757 | | .332 |
| 12. I am better able to accept the way things work out. | PS | .687 | .321 | .334 |
| 19. I discovered that I'm stronger than I thought I was | PS | .634 | .337 | |
| New Factor II: *Interpersonal growth* (20.68% of variance) | | | | |
| 6. I more clearly see that I can count on people in times of trouble. | RO | .353 | .659 | |
| 20. I learned a great deal about how wonderful people are. | RO | | .800 | |
| 21. I better accept needing others. | RO | .311 | .734 | .346 |
| New Factor III: *Transpersonal growth* (20.10% of variance) | | | | |
| 5. I have a better understanding of spiritual matters. | SC | .307 | | .798 |
| 14. I have new opportunities which wouldn't have been available otherwise. | NP | | | .690 |
| 18. I have a stronger religious faith | SC | | | .825 |
| Items failing to load differentially | | | | |
| 1. I changed my priorities about what is important in life. | AL | .628 | .470 | |
| 7. I established a new path for my life. | NP | .567 | | .466 |
| 8. I have a greater sense of closeness with others. | RO | .596 | .380 | .493 |
| 9. I am more willing to express my emotions. | RO | .472 | .387 | .565 |
| 11 I am able to do better things with my life. | NP | .714 | | .410 |
| 13. I can better appreciate each day. | AL | .661 | .413 | |
| 15. I have more compassion for others. | RO | | .711 | .418 |
| 16. I put more effort into my relationships. | RO | .442 | .539 | .415 |
| 17. I am more likely to try to change things which need changing. | NP | .464 | .500 | .469 |

Note: AL = appreciation of life, NP = new possibilities, PS = personal strength, RO = relating to others, and SC = spiritual change. Only loadings greater than .30 are shown

understanding the construct of PTG in this population, a limitation of this study is that we are not able to explore dimensions of PTG that are not currently reflected in the PTGI. Future studies –preferably using mixed methods– might explore whether other dimensions of growth may emerge after parents' experience of a child's critical illness. The possibility of cultural differences in PTG after this experience may warrant further investigation. Finally, our suggested 12-item version resulted from modifications after an exploratory PCA, and should be examined in new samples via a confirmatory approach.

Regarding implications for the parents of children with illnesses, the relative lack of literature on PTG after medical trauma makes it difficult to give specific recommendations to professionals seeking to promote PTG (Picoraro et al., 2014). However, our study suggests that it may be useful to foster PTG in this group along the next three dimensions: *personal* (i.e., how
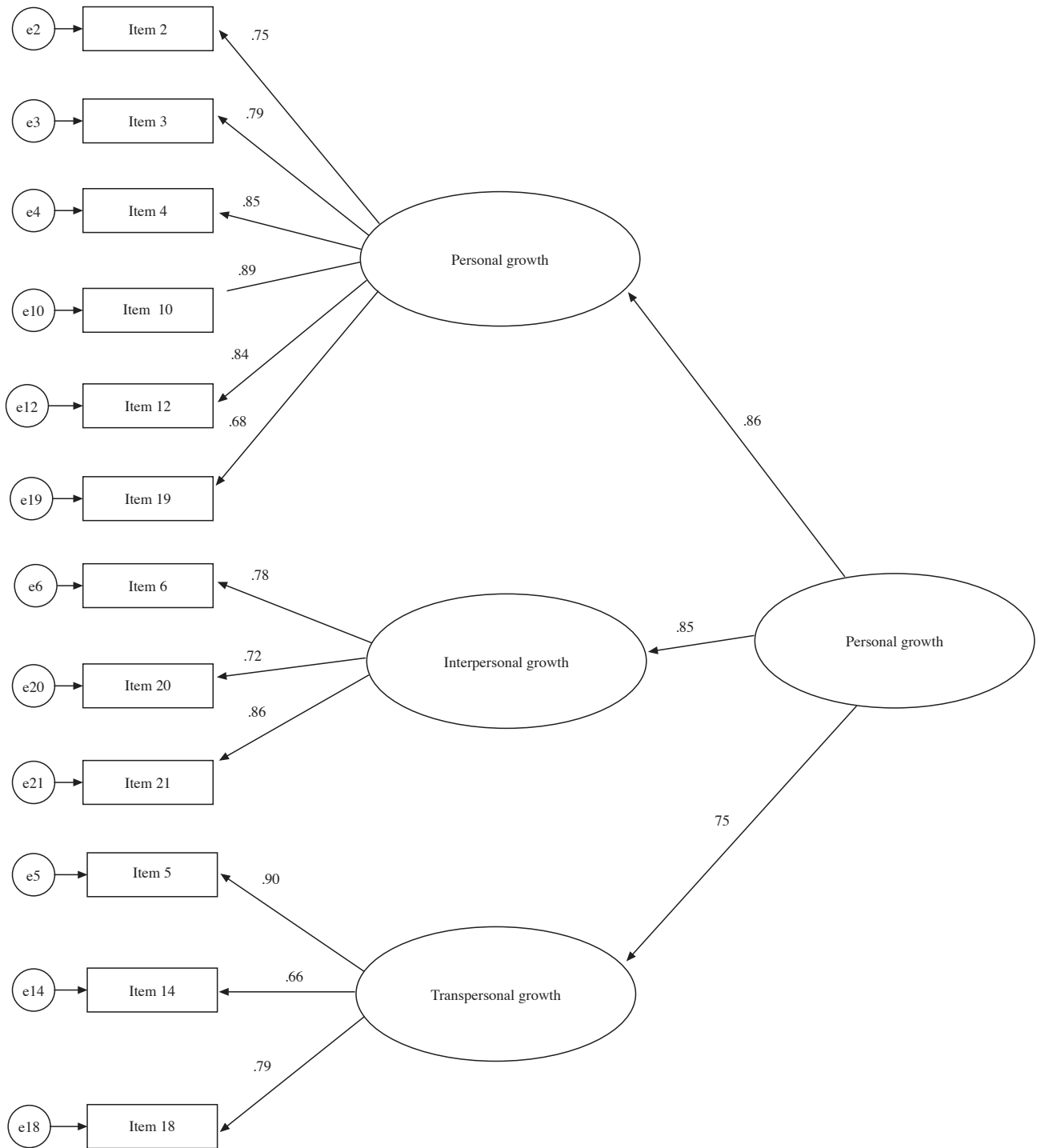


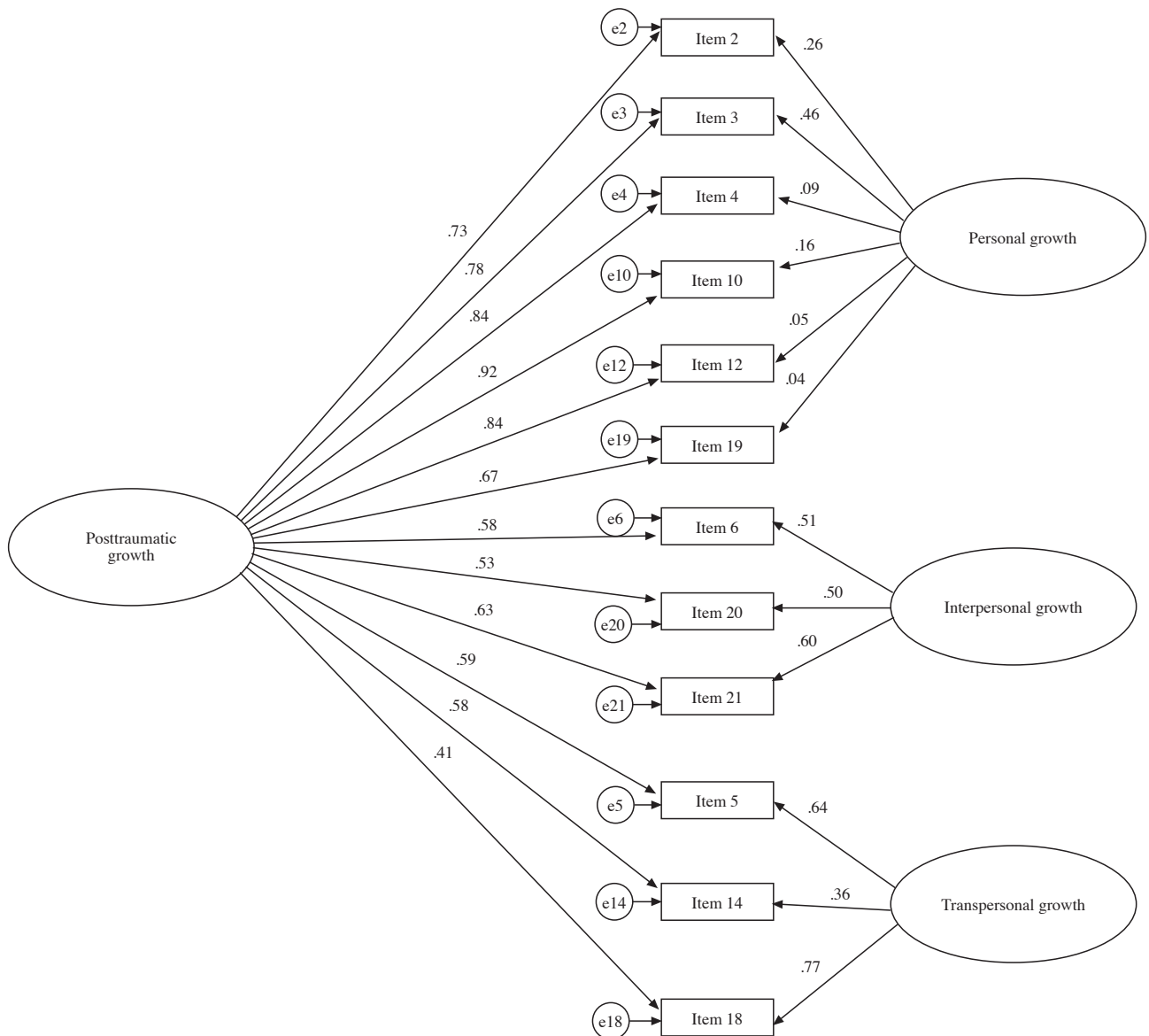*Figure 1.* Initial confirmatory standardized solution for the hierarchical model of the 12-item PTGI

*Figure 2. Initial confirmatory standardized solution for the bifactor model of the 12-item PTGI*

dealing with a child's critical illness may have provided parents with information about their own strengths), *interpersonal* (i.e., how it may have helped to deepen parents' relationships with others) and *transpersonal* (i.e., how it may have altered their view of the meaning or purpose of life).

With this as context, health and mental health professionals who work in pediatric health care settings may be able to help parents notice and reflect on ways in which their family's difficult experience of critical illness could lead not only to distress, but also to opportunities for growth.

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