

## Validity and reliability of the Posttraumatic Growth Inventory among Japanese women with cesarean section

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### ABSTRACT

This study aimed to examine the validity and reliability of the expanded version of the Posttraumatic Growth Inventory-Japanese version (PTGI-X-J) among Japanese women who delivered by cesarean section. The study is a cross-sectional survey psychometric study. Participants were 517 Japanese women who were in the hospital after childbirth by cesarean section at six general hospitals and two obstetric clinics in Tokai Region, Japan. They completed a self-report questionnaire—which included sociodemographic and childbirth information and obstetric history, the PTGI-X-J, and the Postnatal Women Version of the Japanese-Language Version of the Impact of Event Scale-Revised (IES-R-J-PWV). We conducted an exploratory factor analysis to evaluate the factorial validity of the PTGI-X-J. We confirmed the internal consistency reliability of the Postpartum Women Version of PTGI-X-J (PTGI-X-J-PWV) using Cronbach's  $\alpha$  coefficients and examined Spearman's correlation coefficients between the PTGI-X-J-PWV and the IES-R-J-PWV. The exploratory factor analysis resulted in a 22-item measure that comprised four factors: strength as mothers, spiritual change as mothers, new possibilities as mothers and appreciation of life, and relating to others as mothers. The PTGI-X-J-PWV exhibited good internal consistency reliability (Cronbach's  $\alpha = 0.94$ ), and a weak significant positive correlation with the IES-R-J-PWV ( $r_s = 0.18$ ,  $p < 0.001$ ) was evident. The results of this study indicated that the PTGI-X-J-PWV was a valid and reliable tool for measuring postpartum posttraumatic growth among Japanese women who have delivered by cesarean section. By accurately measuring mothers' posttraumatic growth, midwives and nurses can provide the kind of care that encourages their growth as mothers.

Keywords: cesarean section, postpartum Japanese women, Posttraumatic Growth Inventory, reliability, validity

#### Abbreviations:

IES-R-J-PWV: Postnatal Women Version of the Japanese-Language Version of the Impact of Event Scale-Revised

PTG: posttraumatic growth

PTGI: Posttraumatic Growth Inventory

PTGI-J: Posttraumatic Growth Inventory-Japanese version

PTGI-X: expanded version of the Posttraumatic Growth Inventory

PTGI-X-J: expanded version of the Posttraumatic Growth Inventory-Japanese version

PTGI-X-J-PWV: Postpartum Women Version of the expanded version of the Posttraumatic Growth Inventory-Japanese version

PTSD: posttraumatic stress disorder

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## INTRODUCTION

Women who have delivered by cesarean section are at high risk for posttraumatic stress symptoms and posttraumatic stress disorder (PTSD). In a previous study, women who underwent an unplanned cesarean section were 3.3 times more likely to experience probable childbirth-related PTSD than women who had a natural delivery.<sup>1</sup> Hernández-Martínez et al<sup>2,3</sup> found that, among Spanish women, cesarean section was one of the risk factors of PTSD, being associated with 3.79–4.80 times more PTSD symptoms than normal vaginal delivery. Further, 14.3% of 890 postpartum Australian women experienced posttraumatic stress symptoms, which, when compared with normal vaginal delivery, was 2.15 times more likely when it was an elective cesarean section and 5.17 times more likely when it was an emergency cesarean section.<sup>4</sup> Japanese women who had an emergency cesarean section recognized the intense experiences that overwhelmed their own and their children's lives, characterizing their own experiences as traumatic.<sup>5</sup> These women lost confidence in childbirth and as mothers.<sup>6</sup> A qualitative study also reported that Australian mothers who underwent a cesarean section experienced trauma at delivery.<sup>7</sup>

Postpartum posttraumatic stress symptoms and PTSD contribute to the development of postpartum depression<sup>8</sup> and attachment disorders.<sup>9</sup> In a mixed-research synthesis, Beck and Casavant<sup>10</sup> reported that women's posttraumatic stress at childbirth adversely affected their relationships with their infants and partners. However, this is not the case for all postpartum women who experience posttraumatic stress symptoms and/or PTSD. For women who had a cesarean section, talking about childbirth helped them process the events that occurred and their feelings.<sup>11</sup> Hashimoto and Kobayashi<sup>6</sup> reported that Japanese women who had an emergency cesarean section found that they gained acceptance of their childbirth experiences by repeatedly talking about them. Therefore, it is possible that some women will experience personal growth, specifically as mothers, after enduring posttraumatic stress following a cesarean section.

A woman who experiences a significant amount of stress after a cesarean section can grow as a person during the recovery process. Posttraumatic growth (PTG) is defined as the positive psychological change that a person experiences as a result of a struggle with a major life crisis or traumatic event.<sup>12</sup> Although the word "traumatic" is included in the PTG definition, it is not necessarily limited to trauma that causes PTSD, but includes stressful, life, and even crisis events.<sup>13</sup> Therefore, by measuring PTG after a cesarean section, it is possible to visualize the growth as a mother. Several recent studies have examined PTG in mothers after childbirth. For example, British women who experienced a cesarean section had higher levels of PTG after childbirth than women who underwent a vaginal delivery.<sup>14</sup> In Israel, the PTG of parents with premature babies was higher than that of parents with full-term babies.<sup>15</sup> In two recent studies in Japan, postpartum primiparas with high social support had higher PTG<sup>16</sup>; furthermore, primiparas had a higher level of PTG than multiparous women, and higher resilience was associated with higher PTG.<sup>17</sup> In these studies, PTG was measured with the Posttraumatic Growth Inventory (PTGI).<sup>18</sup>

The PTGI consists of 21 items and five factors.<sup>18</sup> The PTGI has reported that differences in language, socio-cultural and religious backgrounds, and characteristics of the subjects affect the factor structure.<sup>19</sup> In Israel, the PTGI demonstrated reliability and validity in a sample of postpartum mothers.<sup>20</sup> In Japan, Suzuki et al<sup>21</sup> found support for the validity and reliability of their Posttraumatic Growth Inventory-Japanese version (PTGI-J) for postpartum women based on the original 21-item PTGI-J.<sup>22</sup> The PTGI-J for postpartum women's version consists of 17 items and three factors, and the Cronbach's  $\alpha$  was 0.93.<sup>21</sup> However, the spiritual domain of the

PTGI-J, which consists of two items from the original PTGI, was deleted in the PTGI-J for the postpartum women's version. The spiritual domain may have been deleted because the cultural and religious backgrounds of the Japanese differ from those of Americans. The expanded version of the Posttraumatic Growth Inventory (PTGI-X)<sup>23</sup> added more items to the original PTGI to assess the spiritual domain and could complement the PTGI-J for the postpartum women's version. The PTGI-X was developed for use in a wide range of samples in which traditional religious beliefs are less dominant; however, the PTGI-X had not previously been used with Japanese postpartum women. This study assessed PTG after childbirth using the Japanese version of the PTGI-X (henceforth, PTGI-X-J).<sup>23</sup> Therefore, the aim of this study was to evaluate the validity and reliability of the PTGI-X-J in women who delivered by cesarean section.

## MATERIALS AND METHODS

### *Study design and participants*

We conducted a cross-sectional study with postpartum Japanese women who had been admitted to maternity wards and had delivered by cesarean section. Inclusion criteria were women who had a gestation period of at least 22 weeks beyond the preterm birth period and were at least 20 years of age (ie, not minors). Women who had a mental disorder or experienced stillbirth were excluded.

### *Procedure and data collection*

This study was conducted using a self-report questionnaire that was distributed from May 2017 to March 2018 at six general hospitals and two obstetric clinics in the Tokai Region, Japan. The questionnaire was distributed to 648 postpartum women after cesarean section, and the women were requested to return the questionnaire during hospitalization. Five hundred thirty-nine women returned the questionnaire via mail or at a collection box in the maternity ward (response rate = 83.1%). Of the 539 questionnaires, 517 had complete usable data (95.9%).

### *Demographic data*

The sociodemographic information that was collected included age, education level, occupation, parity, elective or emergency cesarean section, number of children born, infant gestational age at birth, infant birth weight, and infant hospitalization in the neonatal intensive care unit.

### *PTGI-X-J*

We assessed PTG in Japanese women who have undergone a cesarean section using the PTGI-X-J to confirm its validity and reliability. The PTGI-X is an expanded version of the PTGI in which four new items were added to the original two items in the spiritual change domain—a domain in which cultural differences have been reported in comparison to the other four domains. The original two items were “I have a better understanding of spiritual matters” and “I have a stronger religious faith.” The four items that were added included “I have greater clarity about life's meaning,” “I feel better able to face questions about life and death,” “I feel more connected with all of existence,” and “I have a greater sense of harmony with the world.” Support for the validity and reliability of the PTGI-X was found in studies with American, Turkish, and Japanese university students (Cronbach's  $\alpha = 0.95\text{--}0.97$ ).<sup>23</sup>

Tedeschi et al<sup>23</sup> and Taku et al<sup>22</sup> created the PTGI-X-J by adding the four spiritual domain items to the PTGI-J.<sup>22</sup> Prior to conducting the study, we obtained permission to use the PTGI-X-J from Dr. Taku. We confirmed with Dr. Taku that the translation process of the PTGI-X-J into Japanese was the same as that of the PTGI-J.<sup>22</sup> The original PTGI-X-J was given to us directly

by Dr. Taku. In this study, we define PTG as the “positive psychological change experienced as the result of a struggle with a challenging life crisis or traumatic event (stressful experience), specifically childbirth, which was a life-threatening experience for both mother and child.”

The PTGI-X-J consists of 25 items and five subscales: Relating to Others (seven items), New Possibilities (five items), Personal Strength (four items), Spiritual Change (six items), and Appreciation of Life (three items). Items are responded to on a 6-point Likert scale ranging from 0 (“not at all”) to 5 (“a very great degree”). Total scores range from 0 to 125, where higher scores indicate a greater degree of PTG. To evaluate PTG for women who had a cesarean section, we revised the instructions of the PTGI-X-J as follows: “For each of the statements below, indicate the degree to which this change occurred in your life as a result of the childbirth you experienced.” The content validity of the PTGI-X-J for women who had a cesarean section was evaluated by four experts with midwifery experience. Ichikawa<sup>24</sup> reported on the mysterious birth as follows: “mothers found a relationship between the birth of their children and the death of their family or of their relatives. By recognizing the importance of this soul linking, we come to the understanding that we are able only to live through our relationships with other people.” Therefore, we considered the four additional items as appropriate.

#### *Postnatal Women Version of the Japanese-language Version of the Impact of Event Scale-Revised*

We used the Postnatal Women Version of the Japanese-language Version of the Impact of Event Scale-Revised (IES-R-J-PWV)<sup>25</sup> to measure childbirth-related postnatal posttraumatic stress symptoms. There are 22 items to which participants respond on a 5-point scale, where 0 = “not at all” and 4 = “extremely.” A sample item is “I had waves of strong feelings about childbirth.” Total scores range from 0 to 88, with higher scores indicating more severe stress related to childbirth. The measure consists of four subscales: Difficulty Controlling Feelings for Childbirth Experience, Intrusion Symptoms of Childbirth Experience, Avoidance and Dissociative Symptoms for Childbirth Experience, and Escape Behavior from Childbirth Experience. The IES-R-J-PWV is a reliable and valid tool for assessing posttraumatic stress symptoms in postpartum Japanese women (Cronbach’s  $\alpha = 0.92$ ).<sup>25</sup> We adopted the IES-R-J-PWV to examine criterion-related validity because previous studies reported that there were significant positive correlations between posttraumatic growth and posttraumatic stress symptoms.<sup>14,22,26</sup> In our study, the Cronbach’s  $\alpha$  was 0.92.

#### *Statistical analyses*

Demographic data were analyzed to describe the sample’s characteristics regarding median and interquartile ranges, frequencies, and percentages. We conducted an exploratory factor analysis to evaluate the factorial validity of the PTGI-X-J. We used principal factor analysis with Promax rotation. Factors with eigenvalues greater than 1.0 were extracted, and items with factor loadings greater than 0.35 were selected. Normally, factor loadings of about 0.40 or 0.30 are used as the cutoff value.<sup>27</sup> Furthermore, we examined the overall content of the questionnaire and used a factor loading of 0.35 as the standard. We named the obtained scale the Postpartum Women Version of the Expanded Version of the Posttraumatic Growth Inventory-Japanese Version (PTGI-X-J-PWV). The internal consistency reliability of the PTGI-X-J-PWV was examined using Cronbach’s  $\alpha$  coefficients. In addition, item-total correlation analysis was used to confirm the reliability. Criterion-related validity was assessed by examining Spearman’s correlation coefficients ( $r_s$ ) between the PTGI-X-J-PWV and IES-R-J-PWV. For statistical analysis, we used SPSS version 22 (IBM SPSS Inc), and the minimum level of statistical significance was set at 0.05.

*Ethical considerations*

Prior to presenting the questionnaire items, participants were provided a written statement explaining the study objectives and contents of the questionnaire. Completing and returning the questionnaire was regarded as consent to participate. This study was approved by the research ethics committee of Nagoya University Graduate School of Medicine (No. 16-139) and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. In addition, we obtained permission from the ethics committee or directors at six general hospitals and two obstetrics clinics.

## RESULTS

*Demographic characteristics*

The median age was 34.0 years old, with an interquartile range of 31.0–38.0 (Table 1).

**Table 1** Sociodemographic characteristics of participants (N=517)

Characteristics	<i>n</i> (%)	Median (IQR)
<b>Age (years)</b>		34.0 (31.0–38.0)
<b>Academic background<sup>a</sup></b>		
Junior high school	18 (3.5)	
High school	102 (19.7)	
Technical school	107 (20.7)	
Junior college	77 (14.9)	
University	189 (36.6)	
Graduate school	23 (4.4)	
<b>Occupation</b>		
Worker	271 (52.4)	
Housewife	246 (47.6)	
<b>Parity</b>		
Primipara	226 (43.7)	
Multipara	291 (56.3)	
<b>Cesarean section</b>		
Elective cesarean section	336 (65.0)	
Emergency cesarean section	181 (35.0)	
<b>Number of children</b>		
Singleton	460 (89.0)	
Twin	57 (11.0)	
<b>Gestational age at birth (weeks)</b>		37 (36–38)
<b>Infant birth weight (g)</b>		2748.0 (2394.0–3065.0)
<b>Hospitalization in neonatal intensive care unit</b>		
Hospitalized newborn	265 (51.3)	
No hospitalization	252 (48.7)	

<sup>a</sup>Missing data = 1

IQR: interquartile range

Women with a college degree were 36.6% of the sample, which was the highest percentage. The percentage of first-time mothers (primiparas) was 43.7%. The range of gestational age at birth ranged from 26 to 41 weeks with a median of 37 weeks (interquartile range: 36–38). One hundred eighty-one women (35%) had an emergency cesarean section. The main reasons for the emergency cesarean section were the decreased fetal heartbeat (Non-Reassuring Fetal Status) and arrested labor. Furthermore, one hundred eighty-three women (36.2%) had a repeat cesarean section.

#### Factorial validity

The exploratory factor analysis of the PTGI-X-J resulted in 22 items and four factors (Table 2).

**Table 2** Exploratory factor analysis of the PTGI-X-J-PWV among Japanese women after a cesarean section ( $\alpha=0.94$ ) (N=517)

PTGI-X-J-PWV items and factors	F1	F2	F3	F4	Original factor <sup>a</sup>
<b>Factor 1 (7 items): Strength as Mothers (<math>\alpha=0.86</math>)</b>					
10 I know better that I can handle difficulties.	0.88	-0.02	-0.11	0.06	III
19 I discovered that I'm stronger than I thought I was.	0.70	0.15	-0.17	-0.12	III
4 I have a greater feeling of self-reliance.	0.63	0.05	0.29	-0.18	III
12 I am better able to accept the way things work out.	0.58	0.06	-0.05	0.27	III
11 I am able to do better things with my life.	0.57	-0.13	0.26	0.17	II
25 I have a greater sense of harmony with the world.	0.38	0.32	-0.12	0.07	IV
9 I am more willing to express my emotions.	0.37	0.24	-0.09	0.26	I
<b>Factor 2 (5 items): Spiritual Change as Mothers (<math>\alpha=0.87</math>)</b>					
23 I feel better able to face questions about life and death.	-0.01	0.68	0.15	0.00	IV
22 I have greater clarity about life's meaning.	0.11	0.65	0.08	0.05	IV
20 I learned a great deal about how wonderful people are.	0.18	0.61	0.01	0.04	I
24 I feel more connected with all of existence.	0.02	0.60	0.02	0.20	IV
21 I better accept needing others.	-0.16	0.57	-0.13	0.49	IV
<b>Factor 3 (5 items): New possibilities as Mothers and Appreciation of Life (<math>\alpha=0.81</math>)</b>					
3 I developed new interests.	-0.11	-0.02	0.84	0.01	II
7 I established a new path for my life.	-0.06	0.05	0.64	0.19	II
1 I changed my priorities about what is important in life.	-0.14	0.12	0.63	0.11	V
14 New opportunities are available which wouldn't have been otherwise.	0.17	-0.05	0.47	0.20	II
2 I have a greater appreciation for the value of my own life.	0.07	0.44	0.46	-0.31	V
<b>Factor 4 (5 items): Relating to Others as Mothers (<math>\alpha=0.82</math>)</b>					
16 I put more effort into my relationships.	0.02	0.02	0.00	0.77	I
15 I have more compassion for others.	-0.02	0.23	0.05	0.55	I
17 I am more likely to try to change things that need changing.	0.23	-0.07	0.19	0.50	II

8	I have a greater sense of closeness with others.	0.05	0.14	0.12	0.50	I
6	I more clearly see that I can count on people in times of trouble.	-0.05	0.31	0.04	0.35	I

Note. Exploratory factor analysis: principal factor method, Promax rotation.

<sup>a</sup>Original factors: I. Relating to Others; II. New Possibilities; III. Personal Strength; IV. Spiritual Change; V. Appreciation of Life.

PTGI-X-J-PWV: Postpartum Women Version of the Expanded Version of the Posttraumatic Growth Inventory-Japanese Version

We excluded three items with a factor loading of less than 0.35 in the first factor analysis. The three excluded items of the PTGI-X-J were “I have a better understanding of spiritual matters,” “I can better appreciate each day,” and “I have a stronger religious faith.” We reran the factor analysis, which resulted in the four subscales and 22 items. Factor 1 was named Strength as Mothers and comprised 7 items with factor loadings ranging from 0.37–0.88. Factor 2 was named Spiritual Change as Mothers and comprised 5 items with factor loadings ranging from 0.57–0.68. Factor 3 was named New Possibilities as Mothers and Appreciation of Life, which comprised 5 items with factor loadings ranging from 0.46–0.84. Factor 4 was named Relating to Others as Mothers, which comprised 5 items with factor loadings ranging from 0.35–0.77. Furthermore, the inter-factor correlations of the PTGI-X-J-PWV were 0.57–0.64.

*Criterion-related validity*

Table 3 indicates that the PTGI-X-J-PWV total scores had a significant very weak positive correlation with the total score of the IES-R-J-PWV ( $r_s = 0.18, p < 0.001$ ).

**Table 3** Spearman’s correlations of relationships between the IES-R-J-PWV and the PTGI-X-J-PWV

PTGI-X-J-PWV	IES-R-J-PWV									
	Total		F1: Difficulty controlling feelings for childbirth experience		F2: Intrusion symptoms of childbirth experience		F3: Avoidance and dissociative symptoms for childbirth experience		F4: Escape behavior from childbirth experience	
	<i>r<sub>s</sub></i>	<i>p</i>	<i>r<sub>s</sub></i>	<i>p</i>	<i>r<sub>s</sub></i>	<i>p</i>	<i>r<sub>s</sub></i>	<i>p</i>	<i>r<sub>s</sub></i>	<i>p</i>
Total (22-item)	0.18	<0.001	0.16	<0.001	0.22	<0.001	0.03	0.502	-0.01	0.870
F1: Strength as mothers	0.12	0.006	0.10	0.028	0.16	<0.001	0.02	0.664	0.00	0.938
F2: Spiritual change as mothers	0.25	<0.001	0.19	<0.001	0.28	<0.001	0.05	0.299	0.01	0.796
F3: New possibilities as mothers and appreciation of life	0.16	<0.001	0.16	<0.001	0.18	<0.001	0.05	0.310	-0.03	0.458
F4: Relating to others as mothers	0.12	0.009	0.09	0.035	0.15	0.001	-0.01	0.821	-0.03	0.564

PTGI-X-J-PWV: Postpartum Women Version of the Expanded Version of the Posttraumatic Growth Inventory-Japanese Version

IES-R-J-PWV: Postnatal Women Version of the Japanese-language Version of the Impact of Event Scale-Revised

The power ( $1-\beta$ ) was 0.984 when the number of samples was 517,  $r_s = 0.18$ , and the significance probability was 0.05.

Additionally, two of the subscales of the IES-R-J-PWV were significantly positively correlated with the PTGI-X-J-PWV total score and all subscale scores: Intrusion Symptoms of Childbirth Experience ( $r_s = 0.15-0.28$ ,  $p \leq 0.001$ ) and Difficulty Controlling Feelings for Childbirth Experience ( $r_s = 0.09-0.19$ ,  $p = 0.035- < 0.001$ ).

#### *Internal consistency reliability*

Cronbach's  $\alpha$  for the total scale of the PTGI-X-J-PWV was 0.94. The Cronbach's  $\alpha$  for each subscale was as follows: 0.86 for Strength as Mothers, 0.87 for Spiritual Change as Mothers, 0.81 for New Possibilities as Mothers and Appreciation of Life, and 0.82 for Relating to Others as Mothers. Furthermore, item-total correlation analysis demonstrated significant positive correlations ( $r_s = 0.50-0.75$ ,  $p < 0.001$ ).

#### *Mean scores for the total scale of the PTGI-X-J-PWV*

The mean for the total scale was 59.40 (standard deviation [SD] = 22.00). Table 4 indicates the mean scores for the total scale of the PTGI-X-J-PWV.

**Table 4** Mean scores for the total scale of the PTGI-X-J-PWV (N=517)

Characteristics	Mean	SD	<i>p</i>
<b>Age (years)</b>			
Under 34 years old	61.1	(22.9)	0.135
34 years old and above	58.1	(20.6)	
<b>Academic background<sup>a</sup></b>			
University and Graduate school	55.6	(20.3)	0.001
Without a degree	62.1	(22.8)	
<b>Occupation</b>			
Worker	59.2	(21.8)	0.848
Housewife	59.6	(22.2)	
<b>Parity</b>			
Primipara	63.0	(20.8)	0.001
Multipara	56.6	(22.5)	
<b>Cesarean section</b>			
Elective cesarean section	59.2	(22.0)	0.780
Emergency cesarean section	59.8	(22.0)	
<b>Number of children</b>			
Singleton	58.7	(22.0)	0.048
Twin	64.8	(21.4)	
<b>Gestational age at birth</b>			
Term (37 weeks or more gestation)	58.1	(21.5)	0.033
Preterm (Less than 37 weeks gestation)	62.7	(22.9)	
<b>Infant birth weight (g)</b>			
2500 g or more	58.7	(21.9)	0.324
Less than 2500 g	60.8	(22.2)	



**Hospitalization in neonatal intensive care unit**

Hospitalized newborn	61.9	(21.9)	0.009
No hospitalization	56.8	(21.9)	

<sup>a</sup>Missing data = 1

PTGI-X-J-PWV: Postpartum Women Version of the Expanded Version of the Post-traumatic Growth Inventory-Japanese Version

SD: standard deviation

In obstetric characteristics, the PTG of primiparas was significantly higher than the PTG of multiparous women ( $p = 0.001$ ). The PTG of mothers in the neonatal intensive care unit with hospitalized newborns was significantly higher than that of mothers with not hospitalized newborns ( $p = 0.009$ ). The PTG of mothers with preterm delivery was significantly higher than that of mothers with full-term delivery ( $p = 0.033$ ); moreover, the PTG of mothers with twins was significantly higher than that of mothers with a singleton baby ( $p = 0.048$ ). However, there was no significant difference in PTG between planned and emergency cesarean sections ( $p = 0.780$ ).

## DISCUSSION

The current study aimed to evaluate the validity and reliability of the PTGI-X among Japanese women who delivered by cesarean section. Its Japanese-translated version (PTGI-X-J) was factor analyzed, and the results were used to develop the PTGI-X-J-PWV. Validity and reliability were examined, providing support for the PTGI-X-J-PWV as a measure that can be used to assess PTG among postpartum Japanese women.

### *Factorial validity*

The exploratory factor analysis of the 25-item PTGI-X-J with five factors resulted in a four-factor solution with 22 items. Support for the validity of the scale was demonstrated in the high levels of inter-factor correlations of the PTGI-X-J-PWV.

The three items of the PTGI-X-J deleted to form the PTGI-X-J-PWV were “I have a better understanding of spiritual matters,” “I can better appreciate each day,” and “I have a stronger religious faith.” These three items were considered less relevant to or representative of the experience of PTG in postpartum Japanese women because the same items were deleted to form the PTGI-J for the postpartum women’s version, which is also used to assess PTG in Japanese postpartum women.<sup>21</sup>

The reason why the items “better understanding of spiritual matters” and “stronger religious faith” had low factor loadings and, therefore, were deleted may be due to the influence of a different view of religion/spirituality in Japanese postpartum women. Perhaps, the PTG of Japanese postpartum women is not affected as much by changes in their religious and spiritual feelings in terms of strength and understanding.<sup>28</sup> Another possible explanation is that the terms “spiritual” and “religious faith” may not be understood the same way in Japanese culture as compared to Western culture. Characteristics of Japanese spirituality are strongly influenced by nature, customs, culture, and human relations, and Japanese religious faith is greatly influenced by Buddhism and Shintoism.<sup>29</sup> Furthermore, in the study by Tedeschi et al.,<sup>23</sup> the Japanese sample had the lowest mean for these two items of the six items in the spirituality domain across all three samples (Japanese, Turkish, and American). Moreover, the four added items in the spirituality domain of the PTGI-X-J (“life’s meaning,” “questions about life/death,” etc) were not deleted in the PTGI-

X-J-PWV. Japanese spirituality supports people in the face of crisis and gives them meaning to live.<sup>29</sup> As such, these four items were not about “religious” or “spiritual” growth experiences but were expressions that fit more so with the Japanese philosophy of life.

The factor structure of the PTGI-X-J-PWV was different from that of the original PTGI-X-J because the original PTGI-X was developed with university students, while the PTGI-X-J-PWV was developed with a sample population of postpartum women. Negative aspects related to childbirth by cesarean section have been reported in postpartum women, such as “loss of confidence in childbirth,” “sense of failure,” “anxiety,” “pain,” “guilt,” “unavoidable fear and responsibility,” and “self-doubt as a mother.”<sup>5,6,30</sup> In other words, postpartum women who have had a cesarean section recognize both the positive experience of giving birth to a healthy baby and the stress associated with putting themselves and their baby at risk of life by the surgery. Therefore, the factor structure of the PTGI-X-J-PWV could be different from the original PTGI-X-J due to the conflicting emotions that postpartum women experience after delivery by cesarean section.

#### *Criterion-related validity*

Support for criterion-related validity of the PTGI-X-J-PWV was demonstrated by the significant weak positive correlation with the IES-R-J-PWV. Our results are consistent with previous research that has shown a similar positive correlation in postnatal British women,<sup>14</sup> Japanese college students,<sup>22</sup> and parents of patients with osteosarcoma.<sup>26</sup> We also examined the relationship between PTSD symptoms and PTG; consistent with our results, a meta-analysis of 42 studies<sup>31</sup> revealed that PTG increases as PTSD symptoms increase. The relationship between PTG and posttraumatic stress is supported by theory, as Tedeschi and Calhoun<sup>13</sup> have stated that PTG and psychological distress coexist. We attribute the weak positive correlation to how a cesarean section is a life-threatening event for mothers and babies, even as a new life is born. However, this result provides support for the idea that emotional distress and PTG can coexist.<sup>22,32</sup>

Notably, the strongest correlations between the PTGI-X-J-PWV and its subscales and the IES-R-J-PWV and its subscales were with the subscale assessing intrusion symptoms of the childbirth experience. Thus, we deemed intrusion symptoms associated with the trauma of delivery by cesarean section as possibly having the most influence on PTG. These symptoms included the following: pictures about childbirth popping into their mind, having waves of strong feelings about childbirth, thinking about childbirth when they did not mean to, having dreams about childbirth, and cues bringing back feelings about childbirth. This is similar to “rumination,” which is a related factor of PTG in the PTG model.<sup>13</sup> In a previous study, there was a significant positive correlation between PTG and intrusive ruminations among bereaved families of cancer patients.<sup>33</sup>

#### *Reliability*

The Cronbach’s  $\alpha$  for the total score of the PTGI-X-J-PWV was 0.94, and the four subscale scores ranged from 0.81–0.87. We confirmed that the PTGI-X-J-PWV was an instrument with high internal consistency. A useful coefficient for assessing internal consistency is Cronbach’s  $\alpha$ .<sup>34</sup> Cronbach’s  $\alpha$  values of 0.7 to 0.8 are regarded as satisfactory. For a clinical application, a higher  $\alpha$  is required, with a minimum value of 0.90 and a desirable value reported as  $\alpha = 0.95$ .<sup>35</sup> We confirmed that the high alpha coefficient of the PTGI-X-J-PWV was similar to the original PTGI-X; that is,  $\alpha = 0.95$  for 314 Japanese subjects,  $\alpha = 0.97$  for 250 Americans, and  $\alpha = 0.96$  for 502 Turkish subjects.<sup>23</sup> Furthermore, the item-total correlations also provide support for internal consistency reliability, with significant positive correlations among all items.

### *Related factors of PTG*

In this study, PTG was significantly higher in primiparas, mothers with preterm deliveries, and mothers of twins. This result was similar to that of previous studies of PTG in Japan<sup>17</sup> and Israel.<sup>15</sup>

### *Limitations*

First, the present study took place only in the Tokai Region of Japan. Therefore, the results may not generalize to all postpartum Japanese women. The results can be applied to mothers who gave birth by cesarean section in similar cities. However, while our study specifically considered women in the Tokai Region of Japan, we think it can also lay some of the groundwork for future studies regarding how culture and/or religion may affect how postpartum women's PTG is measured and perceived.

Second, we did not investigate religiousness or spirituality in our study. The factor loadings of the two items on religion and spirituality of the PTGI-X-J may be influenced by the presence or absence of religious faith in our sample. However, we believe that the results of the exploratory factor analysis are most likely representative of the population because Japanese youth in their twenties and thirties generally have low levels of religious faith,<sup>28</sup> although Japan's indigenous spirituality is infused in the culture. Future research should examine the possible influence of religiousness and spirituality on PTG in Japanese postpartum women.

Third, the significant positive correlation between the PTGI-X-J-PWV and IES-R-J-PWV was weak. However, it is still important and relevant because it supports the idea that emotional distress and PTG can coexist.

Fourth, it is unclear how mothers after cesarean section perceived the four additional items of the PTGI-X-J, as this was a quantitative study. Therefore, future qualitative research on how mothers perceived the content of the PTGI-X-J-PWV items is needed.

### *Clinical implications*

The results of this study indicate that the PTGI-X-J-PWV is an appropriate and effective measure to evaluate the PTG of Japanese postpartum women who delivered by cesarean section. In Japan, the rate of cesarean section is 27.4% at general hospitals; this rate has increased by approximately three times in the last twenty years.<sup>36</sup> Thus, there is an increased need for a valid and reliable measure that can be used to evaluate PTG in this population.

The PTGI-X-J-PWV can be used to assess growth from the trauma or stressful situation of having delivered by cesarean section. Midwives and nurses can assess the degree of PTG and provide feedback depending on the situation and results of the inventory, which can lead to awareness and confidence of postpartum women's growth as mothers.

## CONCLUSION

The results of this study indicated that the PTGI-X-J-PWV is a valid and reliable tool for measuring postpartum PTG among Japanese women who have delivered by cesarean section.

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## CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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