View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Constellation

Post-disaster health status of train derailment victims with posttraumatic growth

Danielle Maltais[1],
Anne-Lise Lansard[1],
Mathieu Roy[2],
Mélissa Généreux[2],
Geneviève Fortin[1],
Jacques Cherblanc[1],
Christiane Bergeron-Leclerc[1],
Eve Pouliot[1]

[1] Université du Québec à Chicoutimi

[2] Université de Sherbrooke

© The Author(s) 2020. (Copyright notice)

Author correspondence:
Danielle Maltais
Department of Human and Social science, UQAC,
555 Boulevard de l'Université, Saguenay,
QC, Canada, G7H2B1
Email: danielle_maltais@uqac.ca

URL: http://trauma.massey.ac.nz/issues/2020-1/AJDTS_24_1_Maltais.pdf

Abstract

In July 2013, a train derailment causing explosions and a fire in downtown Lac-Mégantic (Municipalité Régionale de Comté du Granit, Quebec, Canada) resulted in the death of 47 people and the destruction of many homes and other buildings. This article compares the physical and psychological health of 624 adults from the Granit area exposed to this disaster three years after the tragedy, comparing based on the presence or absence of posttraumatic growth. Women, people with high levels of social support, lower levels of education, and with lower incomes were more likely to show posttraumatic growth. For psychological health, the presence of post-traumatic stress symptoms and the use of antidepressants were positively related to posttraumatic growth. Our study demonstrates that, over time, many people managed to initiate a recovery process and to see benefits from this disaster.

Keywords: *technological disaster, train derailment, posttraumatic growth, post-traumatic stress disorder, post-disaster psychological health, positive effects of disaster*

On July 6, 2013, a train carrying crude oil exploded in downtown Lac-Mégantic (Québec, Canada). In a community of 6,000 inhabitants, this disaster caused the death of 47 people and the destruction of 44 buildings as well as a spill of over five million litres of crude oil into the environment. More than 2,000 individuals were relocated for a few days or weeks. Of these, 169 were never able to return to their homes (Petit & Gosselin, 2016). Three years after this disaster, physical and psychological health consequences were still felt not only by those who were exposed to the train derailment (i.e., were directly impacted), but also throughout the Lac-Mégantic community. This article focuses on the socio-demographic and health characteristics associated with posttraumatic growth only among those directly exposed to the train derailment.

The concept of posttraumatic growth, as measured with the Posttraumatic Growth Inventory (PTGI), is used to reflect the positive changes that may result from a disaster (Tedeschi & Calhoun, 1996, 2004). This article aims to: 1) document the characteristics of adults who show posttraumatic growth three years after being exposed to the derailment disaster and 2) examine the contribution of different elements (e.g., marital, family, personal, and social) to their posttraumatic growth.

Literature Review

According to Tedeschi and Calhoun (2004), posttraumatic growth, unlike recovery, is not a simple return to normal life; it is rather an enrichment of various aspects of one's life elements, referring to real transformations rather than ones that are illusory and transitory. According to these authors, this phenomenon stems from a potentially traumatic event associated with the destruction of fundamental patterns. In such a situation, people begin a cognitive process that can lead to the emergence of posttraumatic growth (Tedeschi & Calhoun, 2004). The presence of posttraumatic growth, as measured by Calhoun and Tedeschi (1999; see also Tedeschi & Calhoun, 2004), can be observed in five main areas: a) relationships with others, b) perception of new possibilities, c) personal strengths, d) appreciation of life, and e) spiritual changes. More specifically, relationships with others refers to closeness with members of one's social group and a greater ability to

demonstrate a compassionate attitude. Perceiving new opportunities can be the emergence of new interests or new career choices. Personal strengths reflect the (re)discovery of (un)suspected resources. Appreciation of life is characterized by higher levels of gratitude for life or changes in prioritising important aspects of life. Posttraumatic growth can also indicate a deeper spirituality and changes in the philosophical principles on which behaviours are based. As stated in Tedeschi and Calhoun (2004), posttraumatic growth occurs relatively late in the adaptation process and is stable over time (Marshall, Frazier, Frankfurt, & Kuijer, 2015). However, positive impacts may also occur soon after exposure to a disaster (Carra & Curtin, 2017; Fergusson, Boden, Horwood, & Mulder, 2015).

Several sociodemographic factors are linked to the presence of posttraumatic growth in victims of disasters with natural or technological causes. For example, women usually have higher posttraumatic growth after such events than men (Achterhof et al., 2017; Marshall et al., 2015; Smith et al., 2016). However, other researchers have found that gender is not predictive of posttraumatic growth (Mordeno, Nalipay, Alfonso, & Cue, 2016). Those who are 50 years old or younger also more often demonstrate posttraumatic growth than those who are older (Achterhof et al., 2017; Guo, Fu, Xing, Qu, & Wang, 2017). Higher education is also linked to the presence of more post-disaster benefits (Kaijun, Yuqing, Zhengkui, Peiling, & Chuguang, 2015) although no correlations with post-disaster benefits were found among economic levels (Jin, Xu, Liu, & Liu, 2014). However, other researchers have shown that the lower the income, the higher the posttraumatic growth (Achterhof et al., 2017). As for family characteristics, marital status has been shown to not relate to posttraumatic growth (Helgeson, Reynolds, & Tomich, 2006).

The level of disaster exposure and associated traumatic experiences is also important when examining post-disaster benefits (Jin et al., 2014; Tang, 2007; Xu & Liao, 2011), while relocation is associated with the perception of benefits (Wu, Xu, & Sui, 2016), especially concerning personal safety (Maltais & Gauthier, 2009). In addition, individuals who have experienced other traumatic events prior to their exposure to a disaster are more likely to experience posttraumatic growth than those who have never experienced such events (Bonanno, Brewin, Kaniasty, & La Greca, 2010). With regard to social support, the higher the level of satisfaction with social support among those exposed to a disaster, the more those people are able to experience posttraumatic growth (Bonanno et al., 2010; Lowe, Rhodes, & Waters, 2015) and the less likely they are to present post-disaster psychological health problems (Maltais & Côté, 2007; Maltais, Lachance, Brassard, & Dubois, 2005).

Finally, several studies have shown that people with post-traumatic stress disorder experience higher levels of posttraumatic growth (Achterhof et al., 2017; Dursun, Steger, Bentele, & Schulenberg, 2016). However, a similar connection is not apparent between depression or anxiety and posttraumatic growth (Chan & Rhodes, 2013). Depression is more likely to be a barrier to the development of posttraumatic growth (Guo et al., 2017). In fact, individuals with fewer depressive symptoms demonstrate more posttraumatic growth, discovery of post-disaster benefits, and overall well-being (Helgeson et al., 2006).

Despite the growing interest of researchers in identifying the positive impacts of disaster exposure, this field of research is less developed compared to studies of the dysfunctional responses that victims of such events may experience (Bonanno et al., 2010). In addition, previous studies lack information about variables that may contribute to posttraumatic growth (Linley & Joseph, 2004). This study therefore had the following two objectives: 1) to identify socio-demographic characteristics (gender, age, education, income, etc.), contextual factors (loss and damage suffered, fears for one's own life and that of a loved one, relocation), and personal factors (perception of one's physical and psychological health) that are associated with posttraumatic growth among adults who have been exposed to a rail disaster; and 2) document the changes observed by respondents in different areas of their lives as a result of this event.

Method

Recruitment Procedure

During October and November 2016, 800 adults living in the Granit area, nearly half of which lived in the city of Lac-Mégantic, were recruited from a randomly generated telephone number list. Selected individuals were invited to answer a questionnaire, either by telephone or online. The duration of the telephone interviews was 30 minutes.

Participant Characteristics

The questions to identify exposed individuals from those not exposed to the train derailment related to various

events and losses experienced during the disaster. Participants were asked whether they had experienced the following situations during the train derailment: fear for their own lives or that of a loved one (immediate or extended family member or friend), have no news of a loved one for a few hours or days, suffer personal injury or find that a relative has been injured, experience the loss of a loved one, and suffer damage or the total loss of one's home and be temporarily or permanently relocated. Participants who answered yes to any of these questions were classified as exposed to the train derailment, while others were considered unexposed. Based on the participants' responses on stress and the various losses, it was possible to classify them in two categories: those exposed (n = 624) and unexposed to the tragedy (n = 176). Given that, according to Tedeschi and Calhoun (2004), posttraumatic growth can only emerge as a result of a potentially traumatic experience in which individuals have struggled to rebuild their basic patterns, it was decided that, for this study, only those exposed directly to the train derailment would be analysed. In addition, given that three years elapsed between the tragedy and the data collection, excluding those not exposed allowed us to limit the risk that the presence of posttraumatic growth is related to other potentially traumatic events such as an accident or a health problem. For this study, therefore, only the 624 exposed respondents were selected to identify the characteristics of the train derailment victims who show posttraumatic growth three years after the tragedy.

Data Collection Tools and Variables Under Study

For the survey, a questionnaire was developed based on tests with good psychometric qualities and questions related to consequences of technological disasters previously validated in various studies.

The Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) was selected as the measure of posttraumatic growth. This test contains 21 questions aimed at defining the positive impacts of exposure to traumatic events in five areas: a) relationships with others (7 items; Cronbach's alpha α = .91); b) new possibilities (5 items; α = .88); c) personal strengths (4 items; α = .86); d) appreciation of life (3 items; α = .83); and e) spiritual changes (2 items; α = .66). This tool offers six answer choices ranging from 0 ("I never experienced this change") to 5 ("I experienced this change very strongly"). Individuals showing positive effects of their exposure to a potentially traumatic event typically receive 23 points or more for the sub-scale relationship with others (out of a possible 35 points), 18 for new opportunities (out of a possible 25 points), 15 for personal strengths (out of a possible 20 points), five for spiritual changes (out of a possible 10 points), and 11 for appreciation of life (out of a possible 15 points). A score greater or equal to 57 (out of a possible 105 points) indicates the presence of posttraumatic growth (Bianchini et al., 2017). The PTGI remains one of the most used tools among the seven existing measuring instruments for measuring the presence or absence of posttraumatic growth (Linley & Joseph, 2004). In addition, this measuring scale was considered a relevant model to best represent the long-term experiences of survivors of a disaster (Mordeno, Nalipay, & Cue, 2015). In this study, the Cronbach's alpha coefficient was .95 for the overall score indicating very good internal reliability.

To identify positive or negative impacts on various aspects of their lives, respondents also had to consider if there had been any changes in their personal, professional, and social life over the past three years prior to the data collection but after the train derailment. Depending on the items investigated, respondents could answer that their situation had improved, deteriorated, or remained stable, as well as whether the number and frequency of their contacts increased, decreased, or remained stable over time.

To measure respondents' level of resilience in coping with day-to-day difficulties, this study used the 10-item Connor-Davidson Resilience Scale (CD-RISC: Connor & Davidson, 2003). Resilience is the individual's or community's capacity to adapt positively when faced with stressful or traumatic events (Luthar, Ciccetti, & Becker, 2000). This scale contains 10 questions used to assess the extent to which a respondent has felt able to handle various aspects of life during the last month (Campbell-Sills & Stein, 2007; Connor & Davidson, 2003). Items refer to being able to adapt to change, dealing with whatever comes, seeing the humorous side of problems, coping with stress and strengthening oneself, tendency to bounce back after illness or hardship, achieving goals despite obstacles, staying focused under pressure, not being easily discouraged by failure, thinking of self as a strong person, and being able to handle unpleasant feelings. Every question provides five possible answers (i.e., "not true at all", "rarely true", "sometimes true", "often true", "true nearly all the time") which correspond to values of 0 to 4. The scale provides a composite score of 0 to 40 (the sum of the score of the 10 questions). A higher score indicates higher resilience. This measure

has been used in large studies elsewhere (Antunez, Navarro, Adam, 2015; Jeste et al., 2013) and had good internal consistency (Cronbach's α = .88) in this study.

The Inventory of Complicated Grief (Prigerson et al., 1995) was used to assess the presence or absence of complicated grief among respondents who reported the loss of a loved one. Only the bereaved, who lost a member of their immediate family (child, spouse, brother, sister, parent or grandparents), a member of their extended family (cousin, brother-in-law, sister, uncle or aunt), or someone significant (friend, neighbour, or work colleague) completed this scale. This tool focuses on two elements: symptoms of separation distress (e.g., nostalgia) and traumatic distress (e.g., bitterness, avoidance). It includes 19 items and respondents must indicate how often each of the 19 feelings has been experienced since the death of a loved one. The answer choices range from 0 ("never") to 4 ("always"). A score of 26 or higher corresponds to complicated or pathological grief (Prigerson et al., 1995). Of the 624 respondents who were exposed to the train derailment, 268 people were bereaved (42.9%), of whom 71 had complicated grief (26.5%). The Cronbach's alpha coefficient was .90 for the overall score, indicating good internal reliability.

The original version of Horowitz, Wilner, and Alvarez's (1979) Impact of Event Scale (IES) was used to measure the presence of post-traumatic stress disorder. This tool includes 15 items for which respondents are asked to indicate the frequency of occurrence of the symptoms during the last week (Alexander & Klein, 2001) from 0 to 5, to give a total scale score between 0 and 75 points. The higher the score, the more post-traumatic stress symptoms respondents show. A score greater than 25 indicates the presence of a post-traumatic stress disorder (Ticehurst, Webster, Carr, & Lewin, 1996). The alpha coefficient was .93 for the overall score.

The six-item Kessler Psychological Distress Scale (K6) was used to assess the psychological distress of respondents (Kessler et al., 2002). This scale, validated in many American, Australian, and Canadian population surveys, deals with feelings of nervousness, hopelessness, agitation, depression, discouragement, and uselessness experienced during the last month. Each of the six items is evaluated on a 4-point scale, for a total score ranging from 0 to 24. The higher the score, the greater the psychological distress. People who score seven or higher are classed as suffering from psychological distress (Camirand, Traoré, Baulne, & Courtemanche, 2016). The alpha coefficient was .85 for the overall score.

The presence of depressive symptoms was assessed with two questions determining whether, for a consecutive period of two weeks or more in the past 12 months, respondents felt sad, melancholic, or depressed and had experienced a loss of interest in the things they usually liked. Respondents also had to answer two questions asking them if they had been diagnosed by a doctor regarding: a) the presence of a mood disorder, such as depression, bipolar disorder, mania, or dysthymia; and b) the presence of an anxiety disorder, such as a phobia, obsessive-compulsive disorder, or panic disorder. These questions were previously used in two population surveys conducted in 2014 and 2015 (Généreux, Perreault, & Petit, 2016).

Positive mental health was captured with the 14-item Mental Health Continuum-Short Form questionnaire (MHC-SF) which provides a mental health assessment based on hedonic (three items) and eudemonic (11 items) approaches to well-being (Keyes, 2002, 2005). This measure acknowledges that mental health is more than the absence of mental disorders; people with such disorders are able to experience well-being and quality of life while people without such disorders can experience low levels of mental health (Keyes, 2007). Participants indicated how often during the last month they had experienced each item (e.g., happy, interested in life) using a 6-point Likert-type scale (i.e., "never", "rarely", "a few times", "often", "most of the time", "always"). In this study, the alpha coefficient was .89, again indicating good internal reliability.

The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988; Zimet, Powell, Farley, Werkman, & Berkoff, 1990) was used to assess respondents' social support. This tool uses 12 questions to measure three dimensions of social support: 1) support received from family members (four questions); 2) support received from friends (four questions); and 3) support received from other people, those who are present when needed, people with whom they can share their joys or sorrows, who care about their feelings, or who are sources of comfort (four questions). Responses used a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). The lower the score, the weaker the social support network. A score of 69 points or more shows that respondents have a high level of social support, while a score of 49 to 68 points represents an average level of social support.

Respondents scoring 12 to 48 points have access to low social support (Bergeron & Hébert, 2004). In this study, the alpha coefficient was .92 for the overall score.

Finally, the use of prescribed medication was identified based on two questions about the use or not of tranquillizers, sedatives, or antidepressants prescribed by a physician in the last 12 months preceding the survey. The respondents had to answer the following questions with "yes", "no", or "do not know": "In the past 12 months, did you use doctor-prescribed sedatives or tranquillizers?" and "In the past 12 months, did you use doctor-prescribed antidepressants?"

Data Analysis

This study aimed to compare respondents split by the presence of posttraumatic growth on all variables under study. Chi-square tests were used for nominal or ordinal data. When significant differences were identified through these analyses, post hoc comparative tests were conducted using the Bonferroni correction. For the presence of post-traumatic stress, psychological distress, complicated grief, resilience, and positive mental health, the Student's *t*-test or the Mann-Whitney U test was used to compare the averages of these five variables between respondents with and without posttraumatic growth. The significance threshold was established at $p < .05$ for all analyses. Due to an over-representation of women and people aged 65 or over who agreed to participate in this study according to their actual distribution in the population, all data were weighted for age and gender according to the method of Weighting Factors (NIST, 2019). Analyses were carried out using IBM SPSS version 24 software.

Results

Sociodemographic characteristics, social support, and posttraumatic growth of respondents.

Significant differences exist between respondents exposed to adversity showing signs of posttraumatic growth ($n = 269$) and those who are not in this situation ($n = 355$) in terms of their gender, level of education, income, and level of social support (Table 1). There was a significantly higher proportion of women than men who scored above 57 on the PTGI. There were also more people with lower income who showed posttraumatic growth three years after the train tragedy than among those who did not show posttraumatic growth. People with posttraumatic growth were also more likely to have a high level of social support than those who did not have such growth.

Table 1
Sociodemographic characteristics of respondents split by the presence or not of posttraumatic growth (%).

Variables	Posttraumatic Growth		X^2	*p*
	Yes ($n = 269$)	No ($n = 355$)		
Gender			6.24	.014*
Man	29.0	38.6		
Woman	71.0	61.4		
Age			4.07	.130
18-49 years old	29.5	30.9		
50-64 years old	34.5	40.5		
65 years +	36.0	28.6		
Live alone			0.079	.853
Yes	25.3	26.3		
No	74.7	73.7		
Marital status			1.83	.608
Married / Free union	65.4	65.6		
Single	13.0	14.6		
Separated / divorced	14.1	11.0		
Widowed	7.4	8.7		
Children of 18 years old and under			0.64	.449
Yes	22.3	25.1		
No	77.7	74.9		
Source of income			1.02	.796
Full-time worker	38.4	41.5		
Part-time worker	10.1	10.7		
Retired	39.6	37.6		
Others	11.9	0.2		
Last level of education completed			4.07	.130
High school or less	64.3	51.6		
College or more	35.7	48.4		
Family annual income			10.45	.005**
Under 30 000$	37.1	25.8		
Between 30 000 and 79 999$	49.6	54.2		
Over 80 000$	13.3	20.0		
Social support			10.50	.005**
Low	3.3	6.5		
Average	27.5	36.6		
High	69.1	56.9		

*$p < .05$, **$p < .01$

Women were more likely than men to show posttraumatic growth in the areas of relation with others (Women = 80.7%, Men = 67.4%) and spiritual changes (Women = 75.5%, Men = 69.8%). However, there were no significant differences between genders among those who showed posttraumatic growth in the areas of discovering new opportunities (Women = 36.3%, Men = 39.5%), personal strengths (Women = 29.7%, Men = 31.4%), or appreciation of life (Women = 64.2%, Men = 65.1%).

Posttraumatic growth and loss during the train derailment.

Survivors with posttraumatic growth were significantly more likely to have suffered the death of one of their relatives and to have been forced to relocate temporarily or permanently (see Table 2). However, those with and without posttraumatic growth did not differ on any of the other exposure factors (fear for their own or a close other's life, damage to property, loss of employment, or exposure to the damaged city centre).

Table 2
Exposure to and effect of the disaster split by the presence or not of posttraumatic growth (%).

Variables	Posttraumatic Growth		χ^2	*p*
	Yes (*n* = 269)	No (*n* = 355)		
Fear for the life for oneself			2.43	.121
Yes	41.8	34.7		
No	58.2	65.3		
Fear for the life of a loved one			3.42	.068
Yes	78.6	70.9		
No	21.4	29.1		
Death of a loved one			5.07	.027*
Yes	48.5	39.4		
No	51.5	60.6		
Loss of or damages to one's home			3.03	.090
Yes	13.3	8.9		
No	86.7	91.1		
Loss of employment			0.66	.436
Yes	17.2	14.8		
No	82.8	85.2		
Relocation			4.64	.036*
Yes	42.0	33.6		
No	58.0	66.4		
Exposure to the destroyed city centre			1.11	.324
Yes	60.6	56.4		
No	39.4	43.6		

*$p < .05$

Post-disaster physical and psychological health status and posttraumatic growth.

Three years after the tragedy, most respondents with or without posttraumatic growth rated their physical health as excellent or very good (see Table 3). However, more people with posttraumatic growth than people without

Table 3
Physical and psychological health categorical variables of persons exposed to train derailment split by the presence or absence of posttraumatic growth (%).

Variables	Posttraumatic Growth		χ^2	*p*
	Yes (*n* = 269)	No (*n* = 355)		
Physical health status				
Perception of health status			3.67	.057
Excellent and very good	85.6	79.7		
Fair to poor	14.4	20.3		
Health level			31.47	.000***
Has improved	18.2	4.5		
Remained stable	55.3	62.1		
Has deteriorated	26.5	33.4		
Psychological health status				
Presence of mood disorder			0.089	.805
Yes	11.7	12.5		
No	88.3	87.5		
Presence of anxiety disorder			0.73	.399
Yes	19.3	16.7		
No	80.7	83.3		
Depressive episode			2.12	.148
Yes	31.1	36.7		
No	68.9	63.3		
Use of anxiolytics			2.86	.093
Yes	24.6	19.0		
No	75.4	81.0		
Use of antidepressants			4.64	.040*
Yes	18.6	12.3		
No	81.4	87.7		

*$p < .05$, *** $p < .001$

it felt that their health status had improved over the last three years. Regarding the psychological health status of respondents (Tables 3 and 4), the presence of post-traumatic stress symptoms, complicated grief, positive mental health, and antidepressant use were positively associated with posttraumatic growth. However, presence of mood disorder, anxiety disorder, depressive episodes, high psychological distress, level of resilience, and the use of anxiolytics were not associated with posttraumatic growth.

Table 4
Averages, median, and standard deviation of psychological health continuous variables exposed to train derailment according to the presence or absence of posttraumatic growth.

Variables	Posttraumatic Growth		χ^2	*p*
	Yes (*n* = 269)	No (*n* = 355)		
Posttraumatic stress status				
Average	32.42	24.72	8.20	.000***
Median	31.00	21.20		
Standard Deviation	19.50	19.58		
High psychological distress				
Average	5.30	5.48	1.09	.276
Median	5.00	4.00		
Standard Deviation	3.93	4.65		
Complicated grief				
Average	20.69	17.46	2.28	.023*
Median	20.00	15.07		
Standard Deviation	11.58	11.63		
Resilience				
Average	28.86	28.84	-0.58	.564
Median	30.00	30.00		
Standard Deviation	6.16	7.20		
Positive mental health				
Average	47.58	44.08	-3.13	.002**
Median	47.00	45.00		
Standard Deviation	9.59	11.70		

Note. The test values for resilience and positive mental health are z-scores from Mann-Whitney U tests, conducted due to significant Levene's tests.

*$p < .05$, ** $p < .01$, *** $p < .001$

Positive changes in various aspects of respondents' lives based on the presence or absence of posttraumatic growth.

Reports of changes since the train derailment in various aspects of personal, marital, family, social, and professional aspects of life identified several significant differences between the two groups of respondents. Table 5 shows, for example, that people with posttraumatic growth were more likely than survivors without it to have noticed improvements since the derailment in their relationships with their spouses, relationships with their children, and in the quality of life in their neighbourhood. These respondents also had a more positive perception of the future and of life in general than those who did not demonstrate posttraumatic growth. Those who demonstrated growth were also significantly more likely to report an improvement in their work performance as well as an increase in work motivation. In terms of their social life, people with posttraumatic growth were significantly more likely to have noticed an increase in the quality of their relationships with members of their entourage and an increase in the frequency of their leisure activities and of their outings. These respondents with posttraumatic growth also had a stronger sense of belonging to their community but were more likely to have noticed that their stress level at work had increased since the train derailment.

Discussion

This study found that women demonstrated more posttraumatic growth than men, which is consistent with most of the scientific literature. Several studies demonstrated gender differences in the specific areas of the posttraumatic growth index (PTGI); women are more likely to perceive positive changes in some areas, whereas men are more likely to do so in others (Anderson et al., 2016). However, in this study, men did not demonstrate significantly higher scores than women for any of the five areas of the PTGI. The fact that more women than men experienced posttraumatic growth after the train derailment may be due to their greater sensitivity and greater attentiveness to the feelings of the different members of their social groups. In addition, to cope with stressful events, women tend to use social support and express their feelings more often than men do (Simard, 2000), which promotes the emergence of posttraumatic growth (Tedechi & Calhoun, 2004). Further, the research conducted with men indicates

that many of them are often not very attentive to their own needs and feelings, whether they are positive or negative, and that they have difficulties in sharing them (Mahalik et al., 2003). Men typically also show little self-compassion (Reilly, Rochlen, & Awad, 2014), which may be detrimental to identifying changes in themselves, including benefits after exposure to a disaster.

The results for differences based on income are consistent with what is stated in the literature. In this study and in the literature, low income fosters the development of posttraumatic growth (Achterhof et al., 2017; Wu et al., 2016). This result could be explained by the fact that less economically vulnerable people seem to attach more importance to lost properties and goods than people who are more economically vulnerable (Saccinto, Prati, Pietrantoni, & Pérez-Testor, 2012). In addition, Platt, Lowe, Galea, Norris, and Koenen (2016) emphasized that disaster relief is primarily available to the poor and those with precarious health status. The fact that emergency assistance is available may have made it possible for the victims of the derailment to take a more positive look at different PTGI aspects, including relationships with others, appreciation for life, and the discovery of new opportunities. The current study also highlights that a high level of social support is positively associated with posttraumatic growth, which has already been observed in other studies (Lowe et al., 2015), as well as the fact that a high level

Table 5
Personal, family, social, and professional life of people exposed split by the presence or absence of posttraumatic growth (%).

Variables	Posttraumatic Growth		χ^2	Variables	Posttraumatic Growth		χ^2
	Yes (n = 269)	No (n = 355)			Yes (n = 269)	No (n = 355)	
Personal life				Family life			
Perception of the future			31.25***	Relationship with partner/spouse			14.21**
Is more positive	43.2	22.2		Has improved	20.1	8.7	
Remains the same	39.0	53.9		Remained stable	68.5	76.5	
Is more negative	17.8	23.9		Has deteriorated	11.4	14.9	
Outlook on life			41.80***	Relationship with children			23.56***
Is more positive	47.1	22.8		Have improved	30.3	13.1	
Remains the same	41.8	57.5		Remained stable	67.8	81.7	
Is more negative	11.0	19.7		Have deteriorated	1.9	5.2	
Professional life							
Quality of relationships			13.70**	Performance			18.56***
Has increased	27.3	17.0		Has improved	25.3	9.9	
Remained stable	65.2	68.8		Remained stable	64.4	74.6	
Has decreased	7.6	14.2		Has decreased	10.3	15.5	
Frequency of leisure activities			19.44**	Motivation			12.89**
Has increased	29.9	15.8		Has increased	26.2	14.5	
Remained stable	55.3	61.9		Remained stable	55.2	55.7	
Has decreased	14.8	22.2		Has decreased	18.6	29.8	
Number of outings			18.99***	Level of stress at work			5.78*ns*
Has increased	31.2	16.4		Has increased	26.2	21.7	
Remained stable	48.7	59.2		Remained stable	61.2	70.0	
Has decreased	20.2	24.4		Has decreased	12.5	8.3	
Quality of life in the neighbourhood			19.75***	Sense of belonging			3.81ns
Has improved	31.9	18.0		Strong	81.3	74.6	
Remained stable	7.6	14.6		Poor	18.7	25.4	
Has deteriorated	60.5	67.3					

ns $p > .05$, ** $p < .01$, *** $p < .001$

of perceived social support is beneficial to physical and mental health (Bruchon-Schweitzer, 2002). In addition, the fact that Lac-Mégantic is a small community may encourage access to support from informal and formal resources and may play a role in the development of posttraumatic growth of citizens, although this study did not produce firm evidence to support this idea. Future research could explore more closely the role of community connectedness and access to support in the development of posttraumatic growth.

In addition, the fact that people who lost a loved one, their home, or were relocated were more likely to experience posttraumatic growth can be explained by the fact that a high level of disaster exposure is positively related to posttraumatic growth (Jin et al., 2014). These situations, therefore, remain opportunities to experience a psychological process that leads individuals to give meaning to disruptive events as well as life in general (Park, 2016). Establishing the relationship between exposure to a disaster and posttraumatic growth can inform how such victims are supported after the event to increase the benefits they experience.

However, this study did not show that psychological distress is related to posttraumatic growth. This can possibly be explained by the fact that the measuring tool used (Kessler et al., 2002) specifically addresses feelings of depression rather than distress more broadly. In fact, depression is recognized as having no positive link with posttraumatic growth and is considered a potential constraint to it (Guo et al., 2017; Helgeson et al., 2006). Moreover, in this study, as the use of antidepressants is associated with posttraumatic growth, this may suggest that taking these medications can reverse any negative effects that depression may have on posttraumatic growth (Guo et al., 2017; Helgeson et al., 2006). In addition, the results also confirm the existence of a positive association between posttraumatic growth and post-traumatic stress manifestations (Achterhof et al., 2017; Dursun et al, 2016; Gibbs et al., 2016) such as: repetitive, involuntary, and pervasive memories of the traumatic event causing a feeling of distress; repetitive dreams related to the event also causing a feeling of distress; and dissociative reactions (e.g., flashbacks) in which the subject feels or acts as if the traumatic event(s) were to recur (American Psychiatry Association, 2015).

This study also found an association between posttraumatic growth and complicated grief as well as positive mental health, but no association with resilience. This result supports the suggestion that posttraumatic growth can coexist with resilience (Smith et al., 2016). However, further studies are needed to clarify the relationship between resilience and posttraumatic growth. The positive association between complicated grief and posttraumatic growth can be explained by the fact that people suffering complicated grief following a tragic event, such as natural or technological disaster, often also suffer from post-traumatic stress symptoms (Suar et al., 2015; Sveen et al., 2016) and that these reactions are themselves positively related to the presence of posttraumatic growth (Achterhof et al., 2017; Chan & Rhodes, 2013; Dursun et al., 2016; Gibbs et al., 2016; Guo et al., 2017; Jin et al., 2014; Linley & Joseph, 2004; Saccinto et al., 2012; Tang, 2007; Xu & Liao, 2011). It is not uncommon for people with complicated grief to ruminate and have intrusive thoughts (Shear, 2015). This rumination, related to the disruption of fundamental beliefs of life, can facilitate the posttraumatic growth process (Kaijun, Yuqing, Zhengkui, Peiling, & Chuguang, 2015; Tedeschi & Calhoun, 2004). Future research could test whether there is a mediating effect of rumination and post-traumatic stress disorder on the relationship between complicated grief and posttraumatic growth.

This study also shows that people with posttraumatic growth are more likely to notice various positive effects that are not measured by the PTGI in their lives. In this regard, people with posttraumatic growth were significantly more likely than those not in this situation to consider that their family and social relationships have improved in the three years following the derailment of the train. The studies of Shakespeare-Finch and Barrington (2012) and Bonanno et al. (2010) also highlighted these same findings. Indeed, they noted that many survivors of a traumatic event report spending more time with family members and friends and that this type of event brings them emotionally closer to those connections. In addition, Carra and Curtin (2017) recently demonstrated in their qualitative study that some flood victims in Australia reported having developed more links with their local community, which is also consistent with our finding that a large percentage of people with or without posttraumatic growth feel they have a high sense of belonging to their community. Without minimizing the negative impact that a disaster may have on survivors' lives, psychologists and social workers could not only focus on the reduction of post-traumatic symptoms but also take into account the potential for personal and social growth following such an event (Joseph, 2009;

Shakespeare-Finch & Lurie-Beck, 2014; Zoellner & Maercker, 2006). This would likely facilitate the recovery process of victims and their loved ones.

In addition to measuring the presence or absence of posttraumatic growth with a proven standardized tool, victims of disasters ought to be questioned on various other benefits that may result from their exposure to this type of event. Getting survivors to maintain hope, to seek the meaning of events, and to identify positive changes in other areas of their lives can guide them in their adaptation and recovery process. Again, since perceived social support is linked to posttraumatic growth, it is essential that before, during, and after a disaster, victims receive tangible and emotional support from various individuals and organizations to cope with their various stresses. It would be relevant to conduct longitudinal studies with the same respondents to determine whether posttraumatic growth and other positive effects of the train derailment are sustained over time. This type of study could also be beneficial for different subgroups of the population, such as young people attending secondary and post-secondary schools, as there have been few studies to date with this age group to identify the positive consequences of disasters.

Limitations

Although the results support the importance of integrating diverse variables to identify those that are associated with the presence of posttraumatic growth, these results cannot be generalized to all individuals exposed to other types of disasters. It is possible that people who refused to complete the telephone survey had different socio-demographic characteristics and more or less precarious state of health than those who elected to respond. It is also possible that those exposed to the train derailment and agreed to participate in this study were better able to cope with the different stresses experienced, and therefore would be more likely to show posttraumatic growth, than those who refused to complete the questionnaire administered by telephone. Further, some respondents may not have been completely honest when answering questions about their mental health status, especially the questions on the presence of mood, anxiety, or depression issues. The use of validated tests would have been preferable, but as the data was primarily collected through a telephone survey, it was necessary to focus on certain issues to the detriment of others. The findings from the variables which were focused on, such as different types of exposure and effects on various life domains, offer valuable contributions to the existing literature.

In addition, the lack of pre-disaster data with respect to respondents' health status and the fact that the data collection was performed more than three years after the train derailment are limitations that do not allow us to conclude that exposure to this disaster is the only traumatic event causing posttraumatic growth. People were able to experience various other personal, marital, family, professional, or social events that forced them to question their values, beliefs, and lifestyle and that could have contributed to the effects we founds. In order to avoid this limitation, multiple traumatic experiences should be controlled for in future studies of long-term impacts after a disaster. In the same vein, the cross-sectional nature of this study does not allow us to collect information on the stability of posttraumatic growth over time. Longitudinal studies are therefore preferred after a disaster to try to overcome this difficulty. The high number of respondents in the two groups of participants is, however, a positive factor in the internal validity of the results. Finally, other measures for post-traumatic stress and for resilience might be more appropriate in some situations; however, the measures used here have been used repeatedly in previous work, were validated in these studies, and showed high internal reliability in the current study.

Conclusion

Studies have widely documented the negative impacts that a disaster may have on the health of individuals. However, few have demonstrated that these negative impacts can coexist with the presence of posttraumatic growth. The present study suggests that posttraumatic growth can occur in a significant number of victims (43.1%) after exposure to a train derailment, a percentage higher than a study conducted one year after earthquakes in Italy (18.6%, Bianchini et al., 2017). Conducting of this study three years after the traumatic event left more time for respondents to develop effective coping strategies, in turn allowing them to develop posttraumatic growth.

This study also demonstrates that certain factors are associated with posttraumatic growth. Among the pre-traumatic factors, gender and income were associated with the presence of posttraumatic growth. Some stressful events such as the loss of a loved one and relocation were also positively associated with posttraumatic growth. The presence of post-traumatic

stress disorder, complicated grief, and positive mental health, as well as having access to a high level of social support, were also factors contributing to the presence of this growth. Thus, this study encourages us to consider differently the preventive and curative interventions to be implemented before, during, and after a disaster. It is essential then to develop various types of interventions, both individually and collectively, allowing individuals, particularly men and those with post-traumatic stress disorder, to normalize both negative and positive feelings when exposed to a traumatic event.

Authors' Note

This research was supported by a grant from Social Sciences and Humanities Research Council of Canada (CRSH). This study was validated by two ethics committees: CER-UQAC and CER-Université de Sherbrooke.

References

Achterhof, R., Dorahy, M. J., Rowlands, A., Renouf, C., Britt, E., & Carter, J. D. (2017). Predictors of posttraumatic growth 10–11 months after a fatal earthquake. *Psychological Trauma: Theory, Research, Practice, and Policy, 10*(2), 208-215. doi: 10.1037/tra0000286

Alexander, D. A., & Klein, S. (2001). Ambulance personnel and critical incidents: Impact of accident and emergency work on mental health and emotional well-being. *The British Journal of Psychiatry*, *178*(1), 76–81. doi: 10.1192/bjp.178.1.76

American Psychiatric Association. (2015). *Diagnostic and statistical manual of mental disorders* (5th ed., French translation edited by P. Boyer, J-D. Guelfi, J-F. Henry, A. Lisoprawski, C-B. Pull, M-C. Pull, & G. Welsh). Washington, DC: Author.

Anderson, D., Prioleau, P., Taku, K., Naruse, Y., Sekine, H., Maeda, M., … Yanagisawa, R. (2016). Post-traumatic stress and growth among medical student volunteers after the March 2011 disaster in Fukushima, Japan: Implications for student involvement with future disasters. *Psychiatric Quarterly, 87*(2), 241–251. doi: 10.1007/s11126-015-9381-3

Antunez, J.M., Navarro, J.F., & Adan, A. (2015). Circadian typology is related to resilience and optimism in healthy adults. *Chronobiology International, 32*(4), 524-530.

Bergeron, M., & Hébert, M. (2004). *Mesure de la qualité du soutien perçu de l'entourage lors du dévoilement de l'agression sexuelle et face à la démarche d'aide entreprise*. Document inédit. Canada: Université du Québec à Montréal.

Bianchini, V., Giusti, L., Salza, A., Cofini, V., Cifone, M., Casacchia, ... Roncone, R. (2017). Moderate depression promotes posttraumatic growth (Ptg): A young population survey 2 years after the 2009 L'Aquila earthquake. *Clinical Practice and Epidemiology in Mental Health, 13*, 10-19.

Bonanno, G. A., Brewin, C. R., Kaniasty, K., & La Greca, A. M. (2010). Weighing the costs of disaster: Consequences, risks, and resilience in individuals, families, and communities. *Psychological Science in the Public Interest, 11*(1), 1–49. doi: 10.1177/1529100610387086

Bruchon-Schweitzer, M. (2002). *Psychologie de la santé: modèles, concepts et méthodes*. Paris: Dunod.

Calhoun, L. G., & Tedeschi, R. G. (1999). *Facilitating posttraumatic growth: A clinician's guide*. Mahwah, NJ: Erlbaum.

Camirand, H., Traoré, I., Baulne, J., & Courtemanche, R. (2016). *L'enquête québécoise sur la santé de la population 2014-2015 : pour en savoir plus sur la santé des Québécois : résultats de la deuxième édition*. Canada: Institut de la statistique du Québec.

Campbell-Sills L., & Stein, M.B. (2007). Psychometric analysis and refinement of the Connor-Davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress, 20*(6), 1019-1028.

Carra, K. A., & Curtin, M. (2017). Posttraumatic growth among Australian farming women after a flood. *Journal of Loss and Trauma, 22*(5), 453–463. doi: 10.1080/15325024.2017.1310506

Chan, C. S., & Rhodes, J. E. (2013). Religious coping, posttraumatic stress, psychological distress, and posttraumatic growth among female survivors four years after hurricane Katrina. *Journal of Traumatic Stress, 26*(2), 257–265. doi: 10.1002/jts.21801

Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety*, *18*(2), 76–82.

Dursun, P., Steger, M. F., Bentele, C., & Schulenberg, S. E. (2016). Meaning and posttraumatic growth among survivors of the September 2013 Colorado floods. *Journal of Clinical Psychology, 72*, 1247–1263. doi: 10.1002/jclp.22344

Fergusson, D. M., Boden, J. M., Horwood, L. J., & Mulder, R. T. (2015). Perceptions of distress and positive consequences following exposure to a major disaster amongst a well-studied cohort. *Australian & New Zealand Journal of Psychiatry, 49*(4), 351–359. doi: 10.1177/0004867414560652

Généreux, M., Perreault, G.,& Petit, G. (2016). Portrait de la santé psychologique de la population du Granit en 2015. *Vision santé publique, 51*, 1-8.

Gibbs, L., Bryant, R., Harms, L., Forbes, D., Block, K., Gallagher, H. C., …Waters, E. (2016). *Beyond bushfires: Community resilience and recovery final report*. Australia: University of Melbourne.

Guo, J., Fu, M., Xing, J., Qu, Z., & Wang, X. (2017). Coping style and posttraumatic growth among adult survivors 8 years after the 2008 Wenchuan earthquake in China. *Personality and Individual Differences, 111*, 31–36. doi: 10.1016/j.paid.2017.01.046

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*(5), 797–816. doi: 10.1037/0022-006X.74.5.797

Horowitz, M., Wilner, N., & Alvarez, W. (1979). Impact of event scale: a measure of subjective stress. *Psychosomatic Medicine*, *41*(3), 209–218.

Jeste, D. V., Savia, G. N., Thompson, W. K., Vahia, I. V., Glorioso, D. K., Martin, A. S., … Depp, C. A. (2013). Association between older age and more successful aging:

critical role of resilience and depression. *American Journal of Psychiatry, 170*(2), 188-196.

Jin, Y., Xu, J., Liu, H., & Liu, D. (2014). Posttraumatic stress disorder and posttraumatic growth among adult survivors of Wenchuan earthquake after 1 year: Prevalence and correlates. *Archives of Psychiatric Nursing, 28*(1), 67–73. doi: 10/1016/j.apnu.2013.10.010

Joseph, S. (2009). Growth following adversity: Positive psychological perspectives on posttraumatic stress. *Psihologijske teme, 18*(2), 335–344.

Kaijun, E., Yuqing, E., Zhengkui, E., Peiling, E., & Chuguang, E. (2015). Coexistence and different determinants of Post-traumatic Stress Disorder and Post-traumatic Growth among Chinese survivors after earthquake: Role of resilience and rumination. *Frontiers in Psychology, 6,* 1-9. doi: 10.3389/fpsyg.2015.01043

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L., … Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalence and trends in nonspecific psychological distress. *Psychological Medicine*, *32*(6), 959–976. doi: 10.1017/S0033291702006074

Keyes, C. L. M. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Social Behavior*, *43*(2), 207–222.

Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology*, *73*(3), 539–548.

Keyes, C. L. M. (2007). Promoting and protecting mental health as flourishing: A complementary strategy for improving national mental health. *American Psychology*, *62*(2), 95–108.

Linley, P. A., & Joseph, S. (2004). Positive change following trauma and adversity: A review. *Journal of Traumatic Stress, 17*(1), 11–21. doi: 10.1023/B:JOTS.0000014671.27856.7e

Lowe, S., Rhodes, J., & Waters, M. (2015). Understanding resilience and other trajectories of psychological distress: A mixed-methods study of low-income mothers who survived hurricane Katrina. *Current Psychology, 34*(3), 537–550. doi: 10.1007/s12144-015-9362-6

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, *71*(3), 543-562.

Mahalik, J. R., Locke, B., Ludlow, L., Diemer, M., Scott, R. P. J., Gottfried, M., & Freitas, G. (2003). Development of the conformity to masculine norms inventory. *Psychology of Men & Masculinity*, *4*(1), 3–25. doi: 10.1037/1524-9220.4.1.3

Maltais, D., & Côté, N. (2007). Soutien social et personnes âgées en cas de désastre: Points saillants des recherches existantes**.** *Vie et vieillissement, 6*(2), 39-42.

Maltais, D., & Gauthier, S. (2010). Long term impacts on personal and spiritual values for French Canadian elderly victims of a flood in Quebec: a question of resilience. In A. Kalayjian and D. Eugene (Eds.), *Mass trauma and emotional healing around the world: rituals and practices for resilience and meaning-making*, (vol. 1, p. 193–211). US: ABC-CLIO.

Maltais, D., Lachance, L., Brassard, A., & Dubois, M. (2005). Soutien social et santé psychologique de victimes d'inondations. *Sciences Sociales et Santé*, *23*(2), 5-38.

Marshall, E. M., Frazier, P., Frankfurt, S., & Kuijer, R. G. (2015). Trajectories of posttraumatic growth and depreciation after two major earthquakes. *Psychological Trauma: Theory, Research, Practice, and Policy, 7*(2), 112-121. doi: 10.1037/tra0000005.

Mordeno, I., Nalipay, M., Alfonso, M., & Cue, M. (2016). Examining the latent structure of posttraumatic growth between male and female survivors in the immediate aftermath of a flash flood disaster. *Current Psychology, 35*(4), 587–594. doi:10,1007/s12144-015-9325-y

Mordeno, I. G., Nalipay, M. J. N., & Cue, M. P. (2015). The role of functionality in the latent structure of posttraumatic growth among survivors of a flash flood disaster. *Psychological Studies*, *60*(2), 138–145.

NIST. (2019). Engineering Statistics Handbook section 4.4.5.2.: Accounting for non-constant variation across the data. Retrieved from www.itl.nist.gov/div898/handbook/pmd/section4/pmd452.htm.

Park, C-L (2016). Meaning making in the context of disaster. *Journal of Clinical Psychology*, *72*(12),1234-1246.

Petit, G., & Gosselin, J. (2016). La ville de Lac-Mégantic et la catastrophe de juillet 2013. In D. Maltais & C. Larin (Eds.), *Lac-Mégantic: De la tragédie à la résilience (*pp. 93-107). Québec: Les Presses de l'Université du Québec.

Platt, J. M., Lowe, S. R., Galea, S., Norris, F. H., & Koenen, K. C. (2016). A longitudinal study of the bidirectional relationship between social support and posttraumatic stress following a natural disaster. *Journal of Traumatic Stress, 29*(3), 205–213.

Prigerson, H. G., Maciejewski, P. K., Reynolds, C. F., Bierhals, A. J., Newsom, J. T., Fasiczka, A., ... Miller, M. (1995). Inventory of complicated grief: A scale to measure maladaptive symptoms of loss. *Psychiatry Research*, *59*(1), 65–79.

Reilly, E. D., Rochlen, A. B., & Awad, G. H. (2014). Men's self-compassion and self-esteem: The moderating roles of shame and masculine norm adherence. *Psychology of Men & Masculinity*, *15*(1), 22-28. doi: 10.1037/a0031028.

Saccinto, E., Prati, G., Pietrantoni, L., & Pérez-Testor, C. (2012). Posttraumatic stress symptoms and posttraumatic growth among Italian survivors of emergency situations. *Journal of Loss and Trauma, 18*(3). 210-226. doi: 10.1080/15325024.2012.687321

Shakespeare-Finch, J., & Barrington, A. J. (2012). Behavioural changes add validity to the construct of posttraumatic growth. *Journal of Traumatic Stress, 25*(4), 433–439. doi: 10.1002/jts.21730

Shakespeare-Finch, J., & Lurie-Beck, J. (2014). A meta-analytic clarification of the relationship between posttraumatic growth and symptoms of posttraumatic distress disorder. *Journal of Anxiety Disorders, 28*(2), 223–229. doi:10.1016/j.janxdis.2013.10.005

Shear, M.K. (2015). Complicated grief. *The New England Journal of Medecine*, *372*, 153-160. doi: 10.1056/NEJMcp1315618

Simard, N. (200). *Relations entre les stratégies d'adaptation et les manifestations post-traumatiques et dépressives des sinistrés des inondations de juillet 1996 au Saguenay*. Canada: Université du Québec à Chicoutimi.

Smith, R., McIntosh, V., Carter, J., Colhoun, H., Jordan, J., Carter, F., & Bell, C. (2016). Thriving after trauma: Posttraumatic growth following the Canterbury earthquake

sequence. *Australasian Journal of Disaster and Trauma Studies, 20*(2), 125–134.

Suar, D., Sekar Das, S., & Alat, P. (2015). Bereavement, postdisaster trauma and behavioral changes in tsunami survivors. *Death Studies*, *39*(4), 226-233. doi: 10.1080/07481187.2014.979957

Sveen, J., Pohlkamp, L., Ohlén, J., Sandberg, J., Brandange, K., & Gustavsson, P. (2016). Posttraumatic stress among not-exposed traumatically bereaved relatives after the MS Estonia disaster. *Plos One, 11*(11), 1-10. doi: 10.1371/journal.pone.0166441

Tang, C. S. K. (2007). Posttraumatic growth of Southeast Asian survivors with physical injuries: Six months after the 2004 Southeast Asian earthquake-tsunami. *Australasian Journal of Disaster and Trauma Studies 2007*(1). Retrieved from http://trauma.massey.ac.nz/issues/2007-1/tang.htm

Tedeschi, R. G., & Calhoun, L. G. (1996). The posttraumatic growth inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress, 9*(3), 455–471. doi: 10.1002/jts.2490090305

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*(1), 1–18. doi: 10.1207/s15327965pli1501_01

Ticehurst, S., Webster, R.A., Carr, V.J., & Lewin, T.J. (1996). The psychosocial impact of an earthquake on the elderly. *Journal of Geriatric Psychiatry*, *11*(11), 943–951. doi: 10.1002/(SICI)1099-1166(199611)11:11%3C943::AID-GPS412%3E3.0.CO;2-B

Wu, Z., Xu, J., & Sui, Y. (2016). Posttraumatic stress disorder and posttraumatic growth coexistence and the risk factors in Wenchuan earthquake survivors. *Psychiatry Research, 237*, 49–54. doi: 10.1016/j.psychres.2016.01.041

Xu, J., & Liao, Q. (2011). Prevalence and predictors of posttraumatic growth among adult survivors one year following 2008 Sichuan earthquake. *Journal of Affective Disorders, 133*(1–2), 274–280. doi: 10.1016/j.jad.2011.03.034

Zimet, G.D., Dahlem, N.W., Zimet, S.G., & Farley, G.K. (1988). The Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, *52*(1), 30-41.

Zimet, G.D., Powell, S.S., Farley, G.K., Werkman, S., & Berkoff, K.A. (1990). Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, *55*(3-4), 610-617.

Zoellner, T., & Maercker, A. (2006). Posttraumatic growth in clinical psychology: A critical review and introduction of a two component model. *Clinical Psychology Review, 26*(5), 626–653. doi: 10.1016/j.cpr.2006.01.008