

Examining the Protective Function of Perceptions of Post-traumatic Growth Against Entrapment and Suicidal Ideation

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Abstract:

Background: Recent evidence has found that reporting post-traumatic growth (PTG) from a past stressful life event is associated with lower reports of suicidal ideation. Perceptions of PTG measure the extent to which an individual reports positive changes in their identity, relationships, and worldviews after a stressful event. However, little is known about how perceptions of PTG interact with feelings of defeat and entrapment to influence suicidal ideation. The current study examined this question through the Integrated Motivational-Volitional (IMV) Model of Suicidal Behaviour.

Methods: 521 adult participants (315 females with age range of 18-82, $M = 30.4$ years, $SD = 13.6$) completed an online cross-sectional questionnaire with defeat, entrapment, suicidal ideation, PTG, depression and anxiety measures. Hypotheses and data analysis plans were pre-registered prior to data collection.

Results: PTG negatively correlated with defeat, entrapment and suicide ideation. PTG predicted lower suicidal ideation when controlling for entrapment, depression and anxiety. PTG did not moderate the relationship between defeat on entrapment or the relationship between entrapment on suicide ideation.

Limitations: The findings were based on cross-sectional data where participants recalled experiences of defeat, entrapment and suicide ideation from the past year. The sample was a large community (non-clinical) sample, and most of the participants identified as White (85%).

Conclusion: Although PTG did not function as a moderator within the IMV model of suicidality, it predicted lower suicidal ideation while controlling for other known predictors of suicidal ideation.

Future research could explore the function of PTG in appraisal-based models of suicidality.

Keywords: Suicidal ideation, post-traumatic growth, coping, Integrated Motivational-Volitional Model of Suicidal Behaviour

Introduction

Suicide is a global public health problem and a leading cause of death worldwide – with more than 800,000 people dying by suicide each year (World Health Organisation, 2014). Suicidal ideation is one of the strongest predictors of suicide attempts (Nock et al., 2018) and deaths by suicide (Brown et al., 2005). Therefore, it is essential that researchers examine risk and protective factors that affect suicide ideation (Jobes & Joiner, 2019).

Increasingly, suicide research has focused on examining protective factors (e.g., trait resilience) that may function to reduce the saliency of negative feelings and thoughts that lead to suicidal ideation (O'Connor & Kirtley, 2018). The current study extended this research within the Integrated Motivational-Volitional Model of Suicidal Behaviour (IMV; O'Connor & Kirtley, 2018) to investigate whether perceptions of post-traumatic growth (PTG; Tedeschi & Calhoun, 1996) have a protective function against suicide ideation. Perceptions of PTG are the extent to which individuals report positive changes in their identity, relationships and worldviews after a highly distressing life event. Some research has found perceptions of PTG are associated with lower reports of suicidal ideation among military samples (Bush et al., 2011; Gallaway et al., 2011; Strader, 2018) and college students (Sheline, 2013).

This study examined PTG within the IMV model (O'Connor & Kirtley, 2018) as it is one of the most robustly tested empirical models of suicidal behaviour to date (Dhingra et al., 2015, 2016; O'Connor et al., 2013), and provides a clear framework to test how and when perceptions of PTG may affect suicide ideation. The IMV model posits that coping and resiliency processes interact with key risk factors to reduce their effect on suicide ideation. This study examined whether perceptions of PTG interacted with two risk factors for suicide ideation - feelings of defeat and entrapment.

Investigating Protective Factors in the IMV model

The IMV Model (O'Connor & Kirtley, 2018) provides a comprehensive understanding of the suicidal mind by outlining the directional pathways that may lead individuals to think about, plan and act on suicidal thoughts. As outlined in Figure 1, certain background factors (e.g., vulnerabilities, traumatic life events, and genetics) may create a risk for suicide ideation. The focus in this study is on the motivational phase, which explains the formation of suicide ideation through the experience of defeat and entrapment appraisals. For example, a person may experience an adverse event and feel

overwhelmed and incapable to change the situation (defeated), which in turn might lead to feelings that they cannot escape the situation (entrapment), which increases suicide ideation.

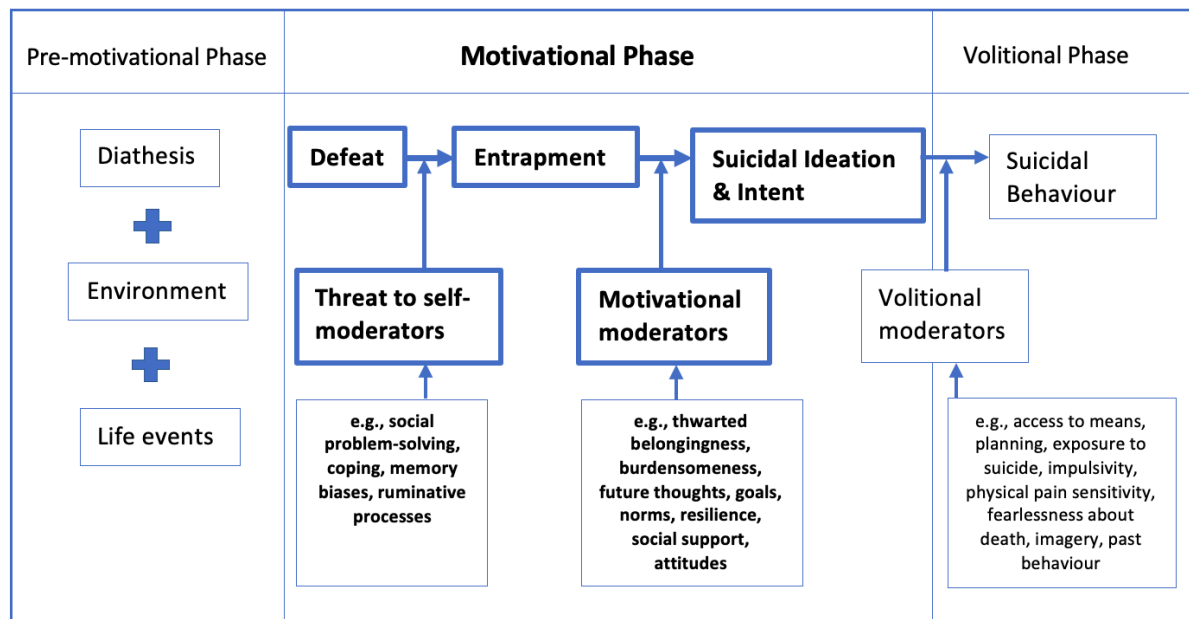
O'Connor and Kirtley (2018) have specified risk and protective factors - referred to as moderators in the IMV model - that act to strengthen or weaken the transition from defeat to entrapment (threat to self moderators) and from entrapment to suicide ideation (motivational moderators). The protective moderators in the motivational phase of the IMV model (e.g., coping, hope, resilience, positive future thinking, and social support; Figure 1) help individuals manage their negative appraisals of the situation, thereby lowering suicidal ideation.

Research on the IMV model has found support for the protective function of hope and resilience in cross-sectional studies. Hope was shown to be a significant motivational moderator and weakened the relationship between entrapment and suicidal ideation in students by Tucker et al (2016). Individuals who set goals and were motivated to achieve these goals were at lower risk of developing suicidal thoughts even when experiencing entrapment due to difficult circumstances. Wetherall et al (2019) explored the effect of resilience on the entrapment to suicidal ideation relationship and found a significant interaction between entrapment and resilience: individuals high in resilience reported lower suicidal ideation even when they experienced feelings of entrapment.

These findings, along with other research validating the model (e.g., Dhingra et al., 2015; Teismann & Brailovskaia, 2020), highlight the applicability of the IMV model in identifying protective factors that decrease the emergence of suicidal thoughts. However, continued research is needed to enhance such findings through this theoretical framework to aid prevention efforts.

Figure 1

The Integrated Motivational-Volitional Model of Suicidal Behaviour (modified after O'Connor and Kirtley, 2018).



Investigating Post-Traumatic Growth in the IMV Model

PTG warrants further investigation as a protective factor against suicide ideation. PTG measures the extent to which people report positive changes in their identity, relationships, and outlook following highly distressing life events. PTG is measured as reports of a greater appreciation of life, improved relationships, feelings of personal strength, identification of new possibilities, and greater spirituality (Tedeschi & Calhoun, 1996). Although the concept of PTG as defined by Tedeschi and Calhoun (1996) implies a real post-event transformation in character, research examining PTG longitudinally has not found people's perceptions to be strongly correlated with change in PTG-related domains over time (Boals et al., 2019; Frazier et al., 2009). These researchers have argued that perceptions of PTG may function more as a coping strategy, and therefore there is value in expanding the scope of the IMV model to examine whether perceptions of PTG function as a coping mechanism to reduce suicidal ideation.

The case for examining PTG as a protective moderator for suicidal ideation is strengthened through existing research, evidencing an inverse relationship between PTG and suicidal ideation. For example, Yu et al. (2010) investigated perceptions of PTG and suicide ideation among Chinese adolescents 1-month after an earthquake in 2008. Results suggested that PTG and reduced suicidal

ideation were significantly correlated. Gallaway et al. (2011), Bush et al. (2011) and Strader (2018) found that PTG was inversely related to suicide ideation among US Army soldiers with deployment experience. Sheline (2013) found that PTG moderated the relationship between the severity of lifetime trauma exposure on suicide risk; at low levels of PTG, the severity of traumatic life events was positively associated with suicide risk, whereas at higher levels of PTG, the severity of traumatic life events was negatively associated with suicide risk. While these findings are promising in showing PTG may reduce the saliency of suicidal ideation, further research is needed to situate PTG within existing models of suicidal behaviour to understand how PTG interacts with other known risk factors. This study was designed to address this question.

Rationale and Hypotheses for Current Study

This study aimed to examine the extent to which PTG interacted with two key risk factors outlined in the IMV model – defeat and entrapment – to reduce suicidal ideation. Our primary focus was on the interaction between defeat and PTG on entrapment, which examined PTG as a threat to self-moderator within the IMV model (Figure 1). This hypothesis was derived from research that has conceptualised PTG as a coping response (Jayawickreme & Blackie, 2014) and is in line with related research on positive illusions that found people perceive benefits to reduce the threat of stressful experiences on their self-concepts (Taylor & Brown, 1988). However, given that research has found a direct inverse relationship between PTG and suicide ideation, we also examined the interaction between PTG and entrapment on suicide ideation (i.e., PTG as a motivational moderator; Figure 1).

To examine these questions in a methodologically rigorous and transparent scientific manner, we conducted *a priori* power analyses to determine sample size and pre-registered our hypotheses prior to data collection. We collected a large community sample, which is important given the hidden nature of suicidal thoughts and the fact that the majority of people who think about suicide do not seek treatment (Bruffaerts et al., 2011).

Pre-registered hypotheses

H1: We hypothesised that PTG would interact with defeat appraisals and hamper the transition from defeat to entrapment. In other words, individuals high in PTG would report lower suicidal ideation even when they experience high feelings of defeat.

H2: We also examined an alternative hypothesis to determine if PTG interacted with entrapment appraisals to hamper the transition from entrapment to suicide ideation. In other words, individuals high in PTG would report lower suicidal ideation even when they experience high feelings of entrapment.

Methods

Our research questions, hypotheses, and the analytical strategy were pre-registered on the Open Science Framework prior to data collection. The registration URL is:

https://osf.io/nhtku?view_only=0153848427024a07bd7ade2aa52e7c2a

Participants

Given that the IMV model was developed to apply across various populations (O'Connor, 2011), and to our knowledge, this is the first study examining the role of PTG within the IMV model, we did not screen participants based on suicidal ideation scores. Non-clinical samples are widely employed as a proxy for clinical samples in model testing studies (Pelton & Cassidy, 2017).

We conducted an *a priori* power analysis to determine the required sample size (*see the supplementary material for detailed information*). The power analysis indicated that 493 participants were required to test our primary question (H1), and 2,619 were required to test our secondary question (H2)¹. 730 participants started the survey; however, 239 of them excluded for the reasons stated in the 'data analytic strategy' section below (e.g., missing data). The remaining 521 participants consist of 315 females (60.5%) and 193 males (13 of whom did not identify as male or female), with an age range 18-82, $M = 30.4$ years, $SD = 13.6$. Of the 521 participants, 445 identified as White, 40 as Asian, 17 as mixed race, 10 individuals used the open-text option, and 9 did not provide their ethnicity. A total of 309 participants (59.3%) reported at least some degree of suicidal ideation during the past year (i.e., suicidal ideation scores higher than zero).

Procedure and Materials

All data were collected through a cross-sectional questionnaire administered online using Qualtrics software. The study was advertised on online platforms, including Prolific, Reddit, Facebook, and the authors' university research recruitment website. Recruitment was not topic-blind; participants

¹ Given the large sample sizes required, participant recruitment focused on the primary question (H1). We did conduct analyses in line with our pre-registered hypothesis and data analysis plan for the secondary question (H2); however, we note that our analyses were underpowered and caution should be applied when interpreting the theoretical significance of the null findings for H2.

were informed that the survey contained some questions about suicidal thoughts. We highlighted that we were recruiting participants with or without mental health challenges. After participants had read the information sheet and given consent, they provided their age, gender and ethnicity followed by the questionnaires outlined in the next section and finished with a positive mood induction task. Participants recruited via Prolific were compensated with £1.70 (in accordance with prolific payment recommendations), and participants who were recruited through other platforms were offered the opportunity to be entered into a raffle to win one of the 16 Amazon vouchers (£20). Ethical approval was obtained from the authors' School Ethics Committee prior to data collection.

Participants completed the questionnaires in the order specified below:

Defeat. The 16-item Defeat Scale developed by Gilbert and Allan (1998) was used to assess participants' feelings of failed struggle, losing rank, and defeat in the past year on a five-point Likert scale, ranging from 'never' to 'always'. Higher scores indicate greater feelings of defeat. A sample item from the scale is *"I feel like I have lost important battles in life."* Cronbach's Alpha for the present sample was .96.

Entrapment. The 16-item Entrapment Scale developed by Gilbert and Allan (1998) was used to assess participants' perceptions of being unable to escape feelings of defeat and rejection in the past year on a five-point scale, ranging from 'not at all like me' to 'extremely like me'. Higher scores indicate greater feelings of entrapment. A sample item from the scale is *"I am in a situation I am trapped in."* Cronbach's Alpha here was .95.

Suicidal Ideation. The Depressive Symptom Index – Suicidality Subscale (DSISS) was used to measure the frequency and intensity of suicide ideation and impulses during the past year. Scores on each item range from 0 to 3 (e.g., "I do not have thoughts of killing myself" to "I always have thoughts of killing myself"). Higher scores indicate greater severity of suicide ideation during the past year (Joiner et al., 2002). Cronbach's Alpha here was .91.

Stressful Life Event. The Trauma History Screen (THS) was used to determine the most distressing and challenging life event participants had experienced in their lifetime (Carlson et al., 2011). Participants were asked to indicate whether the event in the 14-item checklist (e.g., a really bad car, boat, train or aeroplane accident) occurred ('yes' or 'no'). They were then asked to think about the event they selected and briefly describe what happened. Finally, participants were asked how much the event bothered them emotionally; ratings were from 1 ('not at all') to 5 ('very much').

Examples of the events that participants reported included sudden death of loved ones, sexual and physical abuse, car accidents with injuries, suicide attempts.

Post-traumatic Growth. The 10-item Post-traumatic Growth Inventory – Short Form (PTGI-SF; Cann et al., 2011) was used to assess participants' perceptions of positive outcomes to occur in response to the distressing life event that they reported in the previous question (i.e., THS). The PTGI-SF has 2-items on the following domains of PTG: personal strength, appreciation of life, relating to others, new possibilities and spiritual change. Respondents answered each item on a 6-point scale, ranging from (0) *'I did not experience this change as a result of the event'* to (5) *'I experienced this change to a very great degree as a result of the event'*. Example item from the scale include: *'I have a greater appreciation for the value of my own life'*. Cronbach's Alpha here was .90.

Anxiety and Depression. The Hospital Anxiety and Depression Scale (HADS) was used to assess symptoms of anxiety and depression (Zigmond & Snaith, 1983) on a 4- point scale indicating the strength of agreement with each item (from 0 to 3). It consists of 14 questions, of which 7 correspond to the anxiety subscale (*example item: 'Worrying thoughts go through my mind' with these possible answers: a great deal of the time, a lot of the time, from time to time- but not too often, only occasionally*) and 7 correspond to the depression subscale (*example item: 'I have lost interest in my appearance' with these possible answers: definitely, I don't take as much care as I should, I may not take quite as much care, I take just as much care as ever*). Cronbach's Alphas were .84 and .82 for anxiety and depression, respectively.

Data Analytic Strategy

All pre-registered analyses were conducted in SPSS 24. The cut-off point for survey completion rate was determined as 75% (Wetherall et al., 2019); thus, an individual's data were excluded if they did not complete at least 75% of each scale. Two hundred and eighteen participants (28.68%) out of 760 were excluded. There were not any significant differences in age ($t(688) = 1.32, p = .168$), gender ($\chi^2(2) = 2.15, p = .341$) and ethnicity ($\chi^2(5) = 8.99, p = .110$) between the excluded data ($N=218$) and retained data ($N=542$). We performed an Expectation Maximisation technique² to replace missing items in the data for participants who met or exceeded the 75% threshold.

² See supplementary material for details.

Bivariate correlation analyses were conducted to test simple relationships between study variables³. To explore our primary moderation hypotheses, we used Hayes' PROCESS macro for SPSS (2012) to test the interaction between PTG and defeat or entrapment. The PROCESS macro uses regression to test moderation effects. This method calculated the conditional effect of defeat on entrapment at different values (-1 SD, +1 SD) of the moderator (i.e. PTG) with bootstrapping set at 5000 samples. Z-standardization was also performed to facilitate the interpretation of the regression weights (Hayes, 2018). We examined outliers and ensured the data met the assumptions required for regression prior to conducting moderation analyses (i.e., normality of residuals, homoscedasticity, VIF scores and outliers). We identified outliers in the data by calculating Mahalanobis and Cook's distance and Leverage values (Cohen et al., 2013) and removed participants that exceeded the cut-off scores for two or more of these values ($N=21$)⁴. All regression assumptions were met with the exception of homoscedasticity. We, therefore, report heteroscedasticity-consistent standard errors (HC4; Hayes & Cai, 2007) to account for this violation. We controlled for the influence of depression and anxiety in all analyses.

Results

Correlations

Correlations between all variables are presented in *Table 1*. All variables were significantly associated with each other in the predicted directions. Suicide ideation was positively correlated with defeat, entrapment and anxiety with large effect sizes and depression with medium effect sizes (Gignac & Szodorai, 2016). PTG was negatively correlated with defeat and suicide ideation with medium effect sizes, and it was negatively correlated with entrapment, anxiety and depression with small effect sizes (Gignac & Szodorai, 2016).

³ Defeat and entrapment were significantly correlated ($r = .84$). We ran our pre-registered analyses despite this high correlation given the theoretical importance of the distinction between these two variables in the IMV model. This analysis strategy is consistent with other published research that has similarly found a high correlation (e.g., Tucker et al., 2016). However, we also conducted an exploratory factor analysis on the defeat and entrapment scales and ran another moderated regression to examine the interaction between PTG and the combined defeat/internal entrapment factor on suicide ideation. Consistent with our reported results, the PTG interaction was not significant (see supplementary materials for details).

⁴ We used numerous outlier indicators to balance removing a portion of our sample against the possibility that the discrepant data points have an undue influence.

Table 1

Means, Standard Deviations and Correlation Coefficients of All Study Variables (N=521; N= 506 for defeat scale)

Variable	1	2	3	4	5	6
1. Defeat	-					
2. Entrapment	.836**	-				
3. Suicide Ideation	.628**	.661**	-			
4. PTG	-.213**	-.163**	-.245**	-		
5. Anxiety	.636**	.712**	.506**	-.107*	-	
6. Depression	.718**	.669**	.470**	-.142**	.596**	-
M	28.85	26.91	2.73	17.84	10.17	6.89
SD	13.80	16.53	2.82	11.76	4.63	4.27
Range	0-64	0-64	0-12	0-50	0-21	0-21

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

Main hypothesis testing

To examine our primary hypothesis (H1) that PTG would moderate the relationship between defeat and entrapment, we conducted a moderated regression analysis using model 1 of Hayes (2012) PROCESS macro with defeat as the predictor variable (X), entrapment as the outcome variable (Y), PTG as the moderator (M) and depression and anxiety as the covariates (CZ). The overall regression model was significant ($F(\text{HC4}) [5,500] = 435.224$, $p = .000$, $R^2 = .756$) accounting for 75.6% of the variance. However, PTG did not interact with defeat to predict entrapment ($p = .366$). The only significant predictors of entrapment were defeat ($B = .739$) and anxiety ($B = .1031$), such that higher scores of defeat and anxiety predicted higher entrapment (see Table 2).

Table 2

Regression Analysis on Entrapment with Defeat, PTG, Anxiety and Depression scores (N=506)

Variable	B	S.E (HC4)	T value	P value	95% CI
1. Defeat	.739	.046	15.835	.000	[.6476, .8310]
2. PTG	.013	.033	.415	.678	[-.0516, .0793]
3. Defeat*PTG	.002	.002	.903	.366	[-.0025, .0068]
4. Anxiety	1.031	.126	8.170	.000	[.7834, 1.2794]
5. Depression	.225	.131	1.706	.088	[-.0340, .4840]

Note. Unstandardised parameter estimates are presented. HC4: Heteroscedasticity-consistent standard errors.

Although underpowered, we examined our secondary hypothesis (H2) to explore whether PTG would moderate the relationship between entrapment and suicide ideation. We conducted a moderated regression analysis using model 1 of Hayes (2012) PROCESS macro with entrapment as the predictor variable (X), suicide ideation as the outcome variable (Y), PTG as the moderator (M) and depression and anxiety as the covariates (CZ). The overall regression model was significant ($F(\text{HC4}) [5,515] = 103.752, p=.000, R^2=.462$) accounting for 46.2% of the variance. However, PTG did not interact with entrapment to predict suicide ideation ($p = .09$). We found that PTG had a direct effect on suicide ideation ($B = -.035$), indicating that individuals with higher scores of PTG are less likely to report suicidal thoughts during the past year. Furthermore, entrapment predicted suicide ideation ($B = .097$), with higher entrapment associated with higher suicidal ideation (see Table 3).

Table 3

Regression Analysis on Suicidal Ideation with Entrapment, PTG, Anxiety and Depression scores (N= 521)

Variable	B	S.E (HC4)	T value	P value	95% CI
1. Entrapment	.097	.009	10.344	.000	[.0789, .1159]
2. PTG	-.035	.008	-4.219	.000	[-.0516, -.0188]
3. Entrapment*PTG	-.000	.000	-1.707	.088	[-.0018, .0001]
4. Anxiety	.041	.028	1.476	.140	[-.0138, .0972]
5. Depression	.016	.037	.437	.662	[-.0577, .0907]

Note. Unstandardised parameter estimates are presented. HC4: Heteroscedasticity-consistent standard errors.

Discussion

Given the importance of identifying resiliency and coping processes for intervention work, this study investigated whether perceptions of PTG function to reduce the saliency of suicidal ideation. To our knowledge, the present study is the first exploration of the role of perceptions of PTG within the IMV model and to examine the interaction between PTG and key suicide risk factors outlined in the IMV (i.e., defeat and entrapment). Contrary to our expectations, we did not find PTG to moderate the relationship between defeat and entrapment or entrapment and suicide ideation. However, importantly, we found that perceptions of PTG had a negative direct effect on suicidal ideation. Although our findings did not confirm the hypotheses, they are important null results for the field of suicide research to consider, given the methodological strengths of the current study (i.e., *a priori* power analyses, large community sample and pre-registered hypotheses and data analytic plans).

Negative direct effect of PTG on suicidal thoughts

Our analysis revealed that PTG had a negative direct effect on suicidal ideation, indicating that individuals who perceived a greater degree of positive change from a distressing life event in their past reported fewer suicidal thoughts while controlling for depression and anxiety. While past research has found this relationship in college students or military personnel (Bush et al., 2011; Sheline, 2013; Strader, 2018), this is the first study to observe this relationship in a community sample. This finding is further consistent with research demonstrating that perceiving benefits from adversity has beneficial consequences for individuals' health (Tennen & Affleck, 2002). Yet, our study did not find that perceptions of PTG enacted their influence on suicidal ideation by weakening the influence of two key risk factors on suicide ideation – feelings of defeat and entrapment. However, we note that our analyses were underpowered to detect effects for the secondary hypothesis (i.e., the PTG and entrapment interaction) as a sample of 2,619 participants was required. Thus, this study cannot reliably conclude about the role of PTG in the motivational moderator pathway, as future research with a very large sample is required.

Assumptions of the IMV Model

The current study advanced existing research on PTG perceptions and suicide ideation (e.g., Bush et al., 2011) by examining hypotheses within an existing framework – the IMV model - for understanding the suicidal mind. The null results for the moderation analyses, therefore, need to be considered within the context and assumptions of the IMV model.

We found a very strong correlation between defeat and entrapment in line with previous studies. The conceptual relationship between defeat and entrapment has also attracted criticism in the literature. Some argue that they should be considered as distinct constructs (e.g., Williams, 1997; O'Connor & Kirtley, 2018), while others suggest considering the two constructs as a single factor (e.g., Johnson et al., 2008; Griffiths et al., 2014). We decided to proceed with our analysis despite the high correlation uncovered here, since this strategy was used in previous studies (Dhingra et al., 2015; Tucker et al., 2016). However, as we were aware that this high correlation may have influenced our ability to detect how PTG influenced defeat and entrapment, we ran some additional exploratory analyses to examine the moderation involving defeat, internal entrapment and suicidal ideation scales. Importantly, the moderation effect of PTG was not significant (see supplementary materials). Thus, while this high correlation seems to be a limitation that should be addressed by the IMV model, this issue does not appear to account for the null results in this study.

Dhingra et al. (2016) previously empirically validated the pathways specified in the IMV model, but they did not test key moderators asserted to be critical for the transitions from defeat to entrapment, entrapment to suicidal ideation and suicidal ideation to suicidal behaviours. While research has found support for some key moderators in the IMV - hope (Tucker et al., 2016) and resilience (Wetherall et al., 2019) – some studies have not found support for moderators, including maladaptive coping (Zortea et al., 2020) and reflective rumination (Tucker et al., 2016; Hollingsworth, 2017). One possibility for this inconsistency might be the characteristic differences of the moderators proposed by the model. Previously tested motivational moderators, such as resilience (Wetherall et al., 2019), hope (Tucker et al., 2016) and optimism (McLean, 2020), were measured as personality traits, whereas other moderators involve thought patterns (e.g., ruminative processes) and perceptions/appraisals (e.g., a sense of burdensomeness). It might be possible that personality traits (e.g., resilience) are *stable patterns*, while appraisal processes are influenced by one's social environment (Joseph & Linley, 2005) and may therefore only exert an influence when other conditions also facilitate the appraisal process. This notion is further supported by Jia et al. (2017), who found that PTG scores were dependent on participants' level of social support after an earthquake. Thus, to put this into the context of the current study, it is possible that experiencing a great deal of distress (i.e., feelings of defeat) without available social resources may leave individuals unable to perceive PTG from past adversities.

Future Research Directions

This discussion raises two possibilities that future research can explore. First, if PTG was measured in a trait-like manner, would similar findings to past research on IMV moderators be found? Second, should the influence of PTG on suicide ideation be examined within the context of another model of suicide behaviour? The Schematic Appraisal Model of Suicide (SAMS; Johnson et al., 2008) is one possible candidate given its focus on positive self-appraisal processes.

Considering the first possibility, although PTG is not a trait-like factor and involves appraisal processes (Tedeschi & Calhoun, 2004), researchers could instead measure a related cognitive coping strategy – individual differences in positive reappraisal – to determine if this acts similarly to other trait moderators within the IMV model. This alternative moderator is a promising direction for future research on the IMV because individual differences in positive reappraisal have been associated longitudinally with PTG (Park et al., 1996; Sears et al., 2003) and identified in a literature review focused on predictors of PTG (Linley and Joseph, 2004). Furthermore, positive reframing

coping was negatively associated with depression and suicidal ideation in a sample of adolescents and young adults (aged 13-25) recruited from a psychiatric emergency department in the US (Horwitz et al., 2018); and identified as a coping strategy less likely to be used among those classified as suicidal compared to non-suicidal individuals (controlling for depression, anxiety and stress) (Liang et al., 2020).

A second avenue for future research is the exploration of the role of PTG within the SAMS model (Johnson et al., 2008). Here, a positive self-appraisal system is theorised to have a protective function in reducing the likelihood of suicidality. Specifically, this model posits there are three types of broad positive self-appraisals that can help individuals regulate how threatening they perceive a difficult event to be: coping with emotions, problem-solving and social support (Johnson et al., 2008). Johnson et al. (2010) found that individuals with moderate or high levels of positive self-appraisals reported less suicidality, even at elevated levels of stress, due to challenging life events. The authors posit that the development of positive self-appraisals (regarding the individual's belief in their coping ability concerning problem-solving, managing negative emotions, and access to social support) should be the focus to decrease suicide risk. We suggest that perceptions of PTG in which individuals identify positive changes from overcoming past adversities, may function as an emotional coping aspect of positive self-appraisals within this model.

Study Limitations and Strengths

The results of this study should be discussed within the context of some notable limitations. First, as discussed previously, the analyses for the secondary hypothesis were underpowered. The *a priori* power analysis indicated that the required sample size was beyond the resources for this study (at over 2000 participants). Future research is needed to examine the moderation within an adequately powered sample before solid conclusions can be drawn about the role of PTG as a motivational moderator in the IMV model. Second, we examined these questions in a community sample where we did not screen for participants with suicide ideation. This may have limited the relevance of our questions and reduced our chances of observing the hypotheses. However, 59% of our sample still reported some degree of suicide ideation in the past year, indicating that this question is relevant to non-clinical samples. In fact, exploring suicide risk in community samples is vital as highlighted in Geulayov et al.'s (2018) iceberg model of self-harm, most self-harmful thoughts and behaviours occur in the community and are unknown to clinical services. Thus, there is a need to increase the evidence base from community samples to implement effective community prevention strategies.

We used 'the past year' as the timeframe in the questionnaires to capture an extensive range of experiences of defeat, entrapment and suicidal ideation. Thus, some individuals may not have currently been experiencing these feelings and instead had to recall these experiences from earlier in the year. Future studies can consider replicating this research in a sample of individuals with current suicidal thoughts to explore PTG function in that specific population. However, it is also important to note that positive psychological approaches might not be applicable during a suicidal crisis where the individual is likely to experience negative intensive thoughts with constricted thought-action repertoires, as Wingate and colleagues have highlighted (2006). Finally, most of the participants (85.4%) were white in our sample, limiting our findings' generalisability to other individuals with different ethnic backgrounds.

Despite these limitations, the study has several notable theoretical and methodological strengths that advance prior research examining the relationship between PTG and suicide ideation. First, the study was planned and pre-registered in accord with the principles of open science. Specifically, *a priori* power analyses were conducted to determine sample size, and all research questions were pre-registered with a data analytic plan. Second, this study advanced previous research and attempted to situate PTG within existing models of suicidal behaviour alongside other known risk factors. Third, the results from this study have several important clinical implications. Specifically, consistent with the IMV model, defeat predicted entrapment and entrapment predicted suicidal ideation in a non-clinical community sample. Furthermore, perceptions of PTG predicted lower suicide ideation when controlling for other known risk factors, including entrapment, anxiety and depression. It is therefore essential that researchers examine suicidality in community non-clinical samples.

Conclusion

Our results demonstrated that perceived PTG predicted less suicidal ideation in a large community sample, indicating individuals who can identify positive changes and find benefits from negative experiences are less likely to report suicidal thoughts. The findings of the present study showed that PTG does not moderate either the relationship between defeat-entrapment or entrapment-suicidal ideation as specified within the IMV model. More research is needed on the entrapment-suicidal ideation interaction for the aforementioned reasons. PTG warrants further investigation as a protective factor for suicide ideation, given the direct relationship between the two. Future research could explore the function of PTG in appraisal-based models of suicidality (Johnson et al., 2008) or adapt the measurement and focus on related trait abilities, such as positive reappraisal.

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Supplementary Materials

A-priori power analysis to compute the required sample size

To determine the sample size for the primary moderation analysis, a power analysis was conducted using G*Power 2 (Faul et al., 2009).

- With an effect size (f^2) of .016, an alpha of .05, a standard power level of .80, a total of 3 predictors (defeat, PTG, defeat*PTG), the results of the power analysis showed that a minimum of **493** participants would be needed to achieve an appropriate power level for this study (*effect size was determined based on the previous paper that looked at resilience*defeat interaction in predicting entrapment [Wetherall et al., 2019]*).

Another power analysis has been conducted to determine the required sample size for the secondary research question.

- With an effect size (f^2) of .003, an alpha of .05, a standard power level of .80, a total of 3 predictors (entrapment, PTG, entrapment*PTG), the results of the power analysis showed that a minimum of **2619** participants would be needed to achieve an appropriate power level for this study (*effect size was determined based on the previous paper that looked at resilience*entrapment interaction in predicting suicide ideation [ibid]*). Recruiting 2619 participants per population seems to be challenging and not feasible, but even so, this hypothesis will be tested, recognising the potential limitation of a small sample size to find a significant effect.

Expectation Maximisation Technique to Replace Missing Items in the Scales

After removing those for whom the completion rate was below 75% for each scale, 0.16% of data were missing. The missing data patterns were checked against demographic characteristics. There was no systematic bias in the missingness of the following measures; Entrapment Scale, PTGI-SF, DSISS, and HADS, indicating that missingness is at random. Therefore, we applied the Expectation Maximisation (EM) technique to replace missing items in these scales. This technique is an iterative way to approximate the set of data parameters when the data is not complete. We found that the missingness in the Defeat Scale was not missing at random; therefore, we did not impute data for the missing items (N=15, 0.17% of the whole observations of defeat measure) in the defeat scale.

Exploratory Factor Analysis of Defeat and Entrapment Scales

We conducted an exploratory factor analysis (EFA) on both the defeat and entrapment scales' items (32 items) to examine the factor structure.

We began by determining whether our data was appropriate for an EFA. The EFA was appropriate, according to Bartlett's test ($\chi^2 [496] = 13686.428, p = .000$). The Kaiser-Meyer-Olkin sampling adequacy measure signified a suitable participant: item ratio of 15.8:1 ($KMO=.974$). The first five eigenvalues were: 17.590, 1.962, 1.257, 1.142, .744.

Parallel analysis was used to determine the number of components to extract (Preacher and MacCallum, 2003). PA creates randomly generated datasets with the same number of cases and variables as the original dataset. An EFA is then performed on each dataset. Any factors within the existing dataset with eigenvalues greater than those seen in less than 5% of PA datasets are considered not to have occurred by chance. We used SPSS syntax provided by O'Conner (2000) to conduct PA. The first five eigenvalues for 95% of the thousand randomly generated datasets were equal or less than 1.56, 1.48, 1.42, 1.38 and 1.33. Only the *first two* eigenvalues exceeded chance values (17.59, 1.96), indicating that two factors should be extracted.

As a further test, an EFA was conducted with forced two-factor extraction, using oblique rotation, assuming these two constructs were correlated. The forced two factor solution indicated that defeat, internal and external entrapment were highly related constructs (see Table S1 below). Importantly, defeat items as well as internal entrapment items were loaded on factor one where majority of the external entrapment items loaded on factor two with loadings greater than .6.

Previous research suggested combining the defeat and entrapment scales but we only found evidence for internal entrapment items that are loading into the factor 1 with defeat items. As an exploratory analysis, we replicated our moderation analyses with the combined defeat and internal entrapment scale to demonstrate whether the predicted moderation is found when this conceptual similarity is taken into an account. We examined whether PTG moderated the relationship between 'combined defeat-internal entrapment' and 'suicidal ideation' relationship (H3).

H3: PTG moderated the relationship between 'combined defeat-internal entrapment' and 'suicidal ideation'

Our exploratory analysis revealed that the model is significant ($F(HC4) [5,500] = 105.6235, p=.000, R^2=.463$); however, PTG did not interact with defeat&internal entrapment in predicting suicidal ideation (see Table S2).

Table S1

Factor Loadings and Communalities Based on an EFA with Direct Oblimin Rotation and Two Factor Solution for Defeat and Entrapment Scales' Items

Items	Component		Communalities
	Factor 1	Factor 2	
Defeat 1	.747	.367	.558
Defeat 2	.664	.216	.462
Defeat 3	.838	.436	.703
Defeat 4	.630	.226	.409
Defeat 5	.762	.412	.581
Defeat 6	.730	.488	.551
Defeat 7	.778	.492	.618
Defeat 8	.796	.400	.634
Defeat 9	.633	.223	.414
Defeat 10	.826	.406	.682
Defeat 11	.826	.390	.683
Defeat 12	.811	.344	.664
Defeat 13	.814	.387	.663
Defeat 14	.808	.429	.653
Defeat 15	.781	.438	.612
Defeat 16	.779	.339	.611
Entrapment 1 (E)	.692	.720	.662
Entrapment 2 (E)	.713	.714	.677
Entrapment 3 (E)	.201	.653	.450
Entrapment 4 (E)	.624	.741	.631
Entrapment 5 (E)	.781	.609	.670
Entrapment 6 (E)	.598	.656	.525
Entrapment 7 (E)	.723	.654	.633
Entrapment 8 (E)	.428	.729	.535
Entrapment 9 (E)	.678	.780	.715
Entrapment 10 (E)	.489	.818	.676
Entrapment 11 (I)	.776	.557	.638
Entrapment 12 (I)	.798	.446	.639
Entrapment 13 (I)	.758	.516	.597
Entrapment 14 (I)	.773	.582	.645
Entrapment 15 (I)	.783	.514	.631
Entrapment 16 (I)	.840	.564	.731

Note. Principal Component Analysis with Direct Oblimin rotation. (I): Internal Entrapment items; (E): External Entrapment items. Communalities - extraction column: proportion of variance of each variable that can be explained by the factor

Table S2

Regression Analysis on suicidal ideation with combined defeat&internal entrapment, PTG, anxiety and depression scores (N=506)

Variable	<i>b</i> value	S.E (HC4)	T value	P value	95% CI
1. Defeat&internal entrapment	.078	.007	6.165	.000	[.0630, .0938]
2. PTG	-.029	.008	-3.679	.000	[-.0450, -.0137]
3. Defeat&internal entrapment*PTG	-.000	.000	-1.343	.179	[-.0012, .0002]
4. Anxiety	.079	.029	2.736	.006	[.0225, .1368]
5. Depression	-.030	.035	-.852	.394	[-.1011, .0399]

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