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The Economics of Losing a Loved One: Delayed Reward Discounting in Prolonged Grief

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Abstract
The tendency for individuals to discount the subjective value of future rewards is a well-established phenomenon. Individual differences in the rate at which one devalues the future have been associated with a range of economic and health outcomes. In this study we investigate future reward discounting in prolonged grief (PG), a potential outcome of bereavement that is associated with significant impairment. A total of 75 bereaved individuals, recruited online, made a series of choices between a small amount of money available immediately and a larger amount available after a specified delay. Greater PG symptomatology was associated with greater discounting of both a small and a relatively larger delayed reward. Results are consistent with findings suggesting that individuals with PG have difficulties orienting to the future and help shed light on economic decision making processes that may contribute to ongoing dysfunction in PG.

Keywords
psychopathology, death and dying, decision making, rewards

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Prolonged grief (PG) is a potentially debilitating consequence of bereavement (Prigerson et al., 2009; Shear et al., 2011). The syndrome is characterized by an intense and prolonged yearning for the deceased and can feature marked difficulty accepting the death, avoidance of reminders, a sense that life lacks meaning, emotional numbness, bitterness, loss of trust, and a difficulty reengaging in activities. Although PG shares features with depression and posttraumatic stress disorder, it is a condition that is associated with a range of independent negative health outcomes (Bonanno et al., 2007; Shear et al., 2011). PG represents a significant public health cost, affecting approximately 10% of bereaved individuals. For this reason it is one of the new diagnoses proposed for ICD-11 (Maercker et al., 2013). In recent years a number of randomized controlled treatment outcome trials have demonstrated the efficacy of cognitive behavioral grief-focused treatments for PG (Boelen, de Keijser, van den Hout, & van den Bout, 2007; Bryant et al., 2014; Shear, Frank, Houck, & Reynolds, 2005). However, a significant number of patients fail to respond, and there remain significant gaps in our understanding of the construct.

An area that has received little attention is the extent to which decision-making processes may be disrupted in PG. Bereavement can affect many areas of an individual's life. In addition to managing reactions to the loss, the individual may be called on to settle the deceased's estate and must also reconstruct a life that does not involve the physical presence of the deceased (Maccallum & Bryant, 2013; Stroebe, Schut, & Boerner, 2010). Researchers have identified a number of deficits associated with PG that have the potential to interfere with this process. Relative to nonsymptomatic bereaved individuals, people with PG have evidenced deficits in imagining specific positive events in their future (Maccallum & Bryant, 2011), deficits in imagining future events unrelated to the deceased (Robinaugh & McNally, 2013), and deficits in social problem solving (Maccallum & Bryant, 2010). The extent to which PG is also associated with relative impairments in decision making has yet to be examined.

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In this study we focus on financial decision making. A fundamental aspect of financial decision making relates to how one appraises the subjective value of a given financial outcome or reward. There is a well-described psychological tendency, known as delayed reward discounting (or temporal discounting), for individuals to decrease the value of a reward the longer they must wait to obtain that reward (Kirby, 1997). For example, given the choice between taking $10 immediately and waiting one day to receive $20, most individuals would choose to wait. However, if required to wait three months, many would change their decision and take $10 immediately: $20 is considered less valuable (equal to or less than $10) if one has to wait 3 months for it. Typically, as the wait to the delayed reward increases, the more likely people are to choose smaller immediately available amounts. As the size of the delayed reward increases, however, people are willing to wait longer periods before switching to a smaller immediately available reward (for a review, see Green & Myerson, 2004).

Some discounting of future rewards makes sense. Future rewards have less utility than equivalent immediately available rewards (Lerner, Li, & Weber, 2013). Certain groups, however, have demonstrated a preference for switching to the smaller immediately available reward sooner and at a lower dollar value, including people with addictive behavior (Kirby, Petry, & Bickel, 1999; MacKillop et al., 2011) and clinical depression (Pulcu et al., 2014). Faster discounting has also been associated with the frequency and severity of drug use (MacKillop et al., 2011), poor self-care (Story, Vlaev, Seymore, Darzi, & Donlan, 2014), higher credit card debt (Meier & Sprenger, 2010), and lower GPA scores (Kirby, Winston, & Santiesteban, 2002). Furthermore, the rate at which one discounts future monetary rewards has been shown to predict future behavior in nonmonetary areas such as relapse to smoking (MacKillop et al., 2011).

Given the relative deficits observed among individuals with PG in terms of their ability to envisage a positive future and reengage with life, we hypothesized that PG may also be associated with a greater relative tendency to discount future rewards. To test this hypothesis we measured reward discounting among bereaved individuals using a monetary discounting task. Our participants made a series of hypothetical choices between a smaller amount of money available immediately and a larger amount available at different time points in the future, ranging from one day to one year. As previous research has shown that discounting behavior is sensitive to the size of the delayed reward (Green & Myerson, 2004; Green, Myerson, & McFadden, 1997), we examined two delayed reward amounts ($14, $100). We predicted that, overall, participants would discount the small amount more than the large amount, and that PG symptomatology would be associated with greater discounting of both rewards.

Method

Participants and procedure

This study was conducted using Amazon.com's Mechanical Turk (Mturk) service. First, 1,817 potential participants were screened for bereavement and other life events using the Life Events Questionnaire (LEQ), described later. Individuals who indicated that they had lost a parent, partner, or sibling in the previous 1 to 3 years were subsequently invited to participate in the study. General inclusion criteria were (a) at least 25 years of age, (b) proficiency in English, and (c) U.S. residency. Participants were paid $0.20 for completing screening and $4.50 for completing the study.

We report here on the 75 (35 male and 40 female) individuals (age M = 41.12, SD = 10.23) who were included in the final analysis. The most common loss was of a parent (76%). The most common causes of death were cancer or chronic illness (57.3%) and sudden illness (29.30%). Mean time since death was 2.03 years (SD = 0.80). Of participants, 59% were White and 86% had completed at least some college (see Table S1 in the Supplemental Material available online).

Measures

Prolonged Grief–13 (PG-13). The PG-13 (Prigerson et al., 2009) is a self-report measure that indexes the severity of PG. The measure assesses for the presence of yearning and distress at the lost relationship (Criterion A), difficulty accepting the death, shock, avoidance of reminders, numbness, bitterness, difficulty engaging in life, identity disturbance, and a sense of purposelessness and meaninglessness (Criterion B). A diagnosis of PG disorder (PGD) is indicated if Criterion A has been met for at least 6 months, five out of nine Criterion B items are endorsed daily or to a disabling degree, and there is evidence of serious day-to-day impairment in functioning (Criteria C).

Life Events Questionnaire. This questionnaire was developed to screen for bereavement status without alerting participants to the aims of the study. Participants indicated if they had experienced seven significant life events in the past 5 years (e.g., retirement, marriage, death of a spouse), when it occurred, and whether it caused ongoing distress. Events were presented in random order.

Center for Epidemiologic Studies–Depression Scale (CES-D). Depressive symptoms were measured using the 11-item version of the self-report CES-D (Radloff, 1977). This version accurately reproduces the results from the original 20-item CES-D (Kohout, Berkman, Evans, & Cornoni-Huntley, 1993).

Revised Life Orientation Test (LOT-R). The LOT-R (Scheier, Carver, & Bridges, 1994) is a six-item self-report measure assessing generalized expectancies for positive versus negative outcomes.

Delayed Reward Discounting Task (DRD). Delayed reward discounting was assessed using a semirandomized multi-item delay discounting task (Green & Myerson, 2004) presented using Qualtrics. Participants made choices between hypothetical smaller, immediate and larger, delayed monetary rewards. The two delayed rewards, $14 and $100, were available after 1 day, 1 week, 1 month, 6 months, or 1 year. The smaller rewards were proportional to the larger reward and available today: for $14 they were $4, $7, $10, $13; for $100 they were $10, $30, $50, $70, $85, and $99. On half of the trials the delayed reward was presented above the immediate reward and on the other half the positions were reversed. Participants were told to respond as if their choice was real but that they would not receive their selection; to focus involvement in the task they were informed that they would receive a bonus payment that doubled their pay for the task if their responses indicated they had responded consistently.

Procedure

Bereaved participants who met inclusion criteria on the LEQ were invited by email to participate in this study, described as a "Decision Making Survey." To participate, they clicked on an external survey link advertised on Mturk. In order, they completed demographics, the DRD, CES-D, LOT-R, and bereavement-related questions. The latter included whether they had experienced the death of a parent, partner, sibling, or other that caused ongoing distress, questions about the nature of the deaths, and the PG-13. Both the screening and experimental phases of the study included attention checks to ensure participants were following instructions (Goodman, Cryder, & Cheema, 2013; Paolacci, Chandler, & Ipeirotis, 2010). Bereavement questions were also compared for consistency across phases. The study was approved by the Internal Review Board at Teachers College, Columbia University.

Data analysis

Points of indifference were calculated for each magnitude ($14 or $100), for each delay based on the smallest immediate amount of money selected in lieu of waiting the specified delay. Following Myerson, Green, and Warusawitharana (2001) we generated area under the curve scores (AUC) varying between 0.0 and 1.0, smaller values representing greater discounting. The AUC was used as the main index of discounting as it provides a single, theoretically neutral measure (de Matta, Goncalves, & Bizarro, 2012; Green & Myerson, 2004; Myerson et al., 2001). However, it is possible that similar AUCs may be associated with different discounting curves. To explore this possibility we also calculated the hyperbolic discounting function (Green & Myerson, 2004; Mazur, 1987; Reed, Kaplan, & Brewer, 2012). The k estimate is said to represent the overall speed of discounting within the model. The maximum value is 1: Larger ks indicate steeper discounting.

Five participants were excluded from the analysis because their choices were unsystematic, three were excluded because they always chose the delayed reward (see Johnson & Bickel, 2008), and three were excluded as their k values were more than three standard deviations above the mean. We report on data from the remaining 75 participants. First we conducted hierarchical multiple regression analyses (HMR) to examine the relationship between discounting and PG symptomatology. Next we examined discounting by individuals meeting diagnostic criteria for PGD (Prigerson et al., 2009) using analysis of variance (ANOVA). Age was significantly correlated with discounting in our sample and was entered on Step 1 of the HMR (see also Green, Myerson, & Ostaszewski, 1999). PG-13 scores were entered on Step 2, and depression was entered on Step 3. Due to the overlap between some core symptoms of PG and depression (Robinaugh, LeBlanc, Vuletich, & McNally, 2014), we explored the incremental impact of depression by constructing an index of depression that excluded symptoms of grief. This index included the CES-D items assessing appetite, sleep, motivation and energy levels, and mood. The index demonstrated adequate reliability (α = .79). Optimism was not significantly correlated with any of the discounting indices (r = –.13 to .05) and was not included in the HMR.

Results

Continuous measure of PG symptoms

The results of each step of the HMRs are included in Table 1. For the AUC$100 measure, the overall model was significant, $F(3, 71) = 6.07$, $p < .001$, adj. $R^2 = .171$. On the first step, age accounted for 7.6% ($p < .018$) of variation in the data. On Step 2, PG-13 scores explained an additional 12.5% ($p < .002$) of variation. Adding depression on Step 3 did not significantly increase the variance explained. Similarly, for the $k^{\$100}$ estimate the overall model was significant, $F(3, 71) = 3.39$, $p < .024$, adj. $R^2 = .088$. On Step 1, age accounted for 1.8% (*ns*) of variation in data. On Step 2, PG-13 scores explained

Table 1. Hierarchical Multiple Regression Parameter Estimates for Discounting Indices for the $100 and $14 Delayed Rewards

Step	Variable	β	*SE* β	Standardized β	*t*	*p*	$R^2\Delta$
$100 AUC							
Step 1	Age	.008	.003	.275	2.45	.017	.076
Step 2	Age	.006	.003	.210	1.96	.054	.125
	PG	–.010	.003	–.359	–0.35	.001	
Step 3	Age	.006	.003	.202	1.85	.068	.003
	PG	–.009	.004	–.321	–2.494	.015	
	Dep	–.007	.013	–.071	–.545	.588	
k Step 1	Age	.000	.000	–.135	–1.164	.248	.018
Step 2	Age	.000	.000	–.076	–0.675	.502	.103
	PG	.001	.000	.326	2.906	.005	
Step 3	Age	.000	.000	–.085	–0.747	.457	.004
	PG	.001	.000	.369	2.736	.008	
	Dep	–.001	.001	–.079	–0.579	.565	
$14 AUC							
Step 1	Age	.006	.002	.271	2.402	.019	.073
Step 2	Age	.005	.002	.225	2.019	.047	.061
	PG	–.005	.002	–.250	–2.246	.028	
Step 3	Age	.004	.002	.197	1.776	.080	.036
	PG	–.003	.003	–.124	–0.940	.350	
	Dep	–.017	.010	–.233	–1.762	.082	
k Step 1	Age	–.001	.000	–.162	–1.402	.165	.026
Step 2	Age	–.001	.000	–.117	–1.024	.309	.058
	PG	.001	.001	.245	2.134	.036	
Step 3	Age	–.001	.000	–.127	–1.087	.281	.004
	PG	.001	.001	.286	2.076	.042	
	Dep	–.001	.002	–.076	–0.546	.587	

Note: AUC = area under the curve score; Dep = Center for Epidemiologic Studies–Depression Scale incremental score; PG = Prolonged Grief–13 scale score.

an additional 10.3% ($p < .006$) of variation. Depression did not explain significant additional variance. Overall, higher PG-13 scores were associated with greater discounting of $100.

With respect to the AUC$14 measure, the overall model was significant, $F(3, 71) = 4.85$, $p < .005$, adj. $R^2 = .135$. On Step 1, age explained 7.3% ($p < .02$) of variation in the data. On Step 2, PG-13 scores explained an additional 6.1% ($p < .029$) of variation. Depression explained 3.6% (*ns*) of the variation. As seen in Table 1, older age was associated with a larger AUC$14 and higher PG-13 scores with a smaller AUC$14. When depression was included in the analysis, they became nonsignificant predictors. For the $k^{\$14}$ estimate the overall model including depression was not significant ($p < .09$). However, age and PG-13 scores were significant, $F(2, 72) = 3.308$, $p < .043$, adj. $R^2 = .59$. Age explained 2.6% (*ns*) of the variance. PG-13 scores accounted for an additional 5.8% ($p < .036$) of the variance. PG-13 scores were associated with greater discounting.

PGD diagnostic category

Of the 75 participants, 21 met criteria for PGD ($M = 39.76$, $SD = 4.81$). Figure 1 displays the normalized mean indifference points for each time delay for $14 (Panel A) and $100 (Panel B) for participants who met criteria for PGD and those who did not (non-PGD, $n = 54$). A Group (non-PGD vs. PGD) × Magnitude ($14 × $100) repeated measures ANOVA on AUC revealed significant main effects for Group, $F(1, 73) = 6.38$, $p < .015$, $\eta = .08$, and Magnitude, $F(1, 73) = 22.41$, $p < .001$, $\eta = .23$, and a significant Group × Magnitude interaction, $F(1, 73) = 6.93$, $p < .011$, $\eta = .09$. Overall the PGD group had a smaller mean AUC than the non-PGD group. Follow-up testing indicated that for the PGD group, the AUC$14 ($M = 0.44$, $SD = 0.18$) and AUC$100 ($M = 0.49$, $SD = 0.28$) did not differ significantly, whereas for the non-PGD group the $14AUC ($M = 0.53$, $SD = 0.22$) was smaller than the $100AUC ($M = 0.69$, $SD = 0.27$), $t(53) = –6.98$, $p < .001$ (95% CI = –.24, –.11).

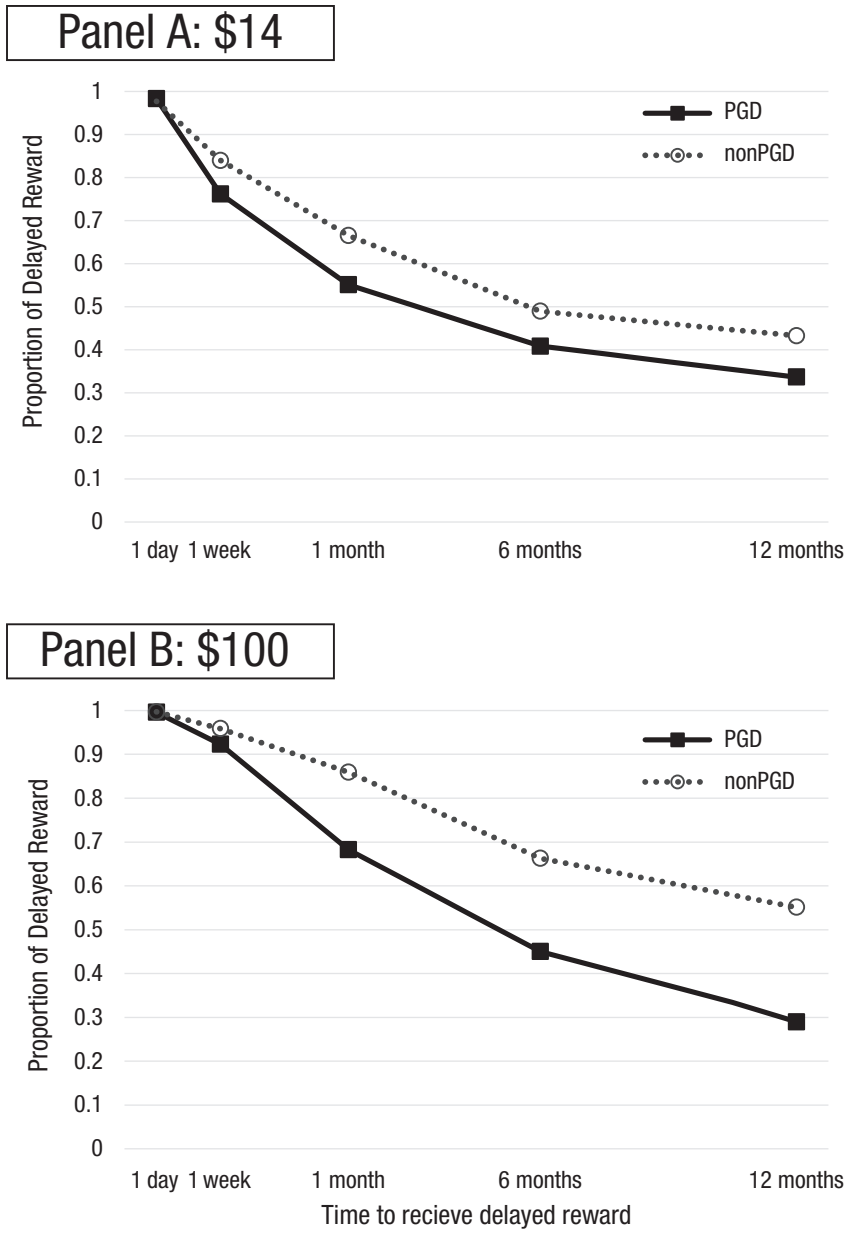

Fig. 1. Indifference points for accepting the immediately available reward for the $14 (A) and $100 (B) delayed rewards.

Estimates of *k* were positively skewed and were log10 transformed for between group analyses. A Group × Magnitude ANOVA on these transformed estimates indicated a significant main effect for Group, $F(1, 73) = 5.28$, $p < .024$, $\eta = .067$, and Magnitude, $F(1, 73) = 65.46$ $p < .001$, $\eta = .473$, and a Group × Magnitude interaction, $F(1, 73) = 5.93$, $p < .018$, $\eta = .075$. Follow-up testings suggested overall steeper discounting of $14 compared with $100; however, the difference between these estimates was larger for the non-PGD group (*Mdiff* = 0 .72), $t(53) = 9.92$, $p < .001$, than the PGD group (*Mdiff* = 0.39), $t(20) = 3.35$, $p < .003$.

Discussion

In this study we examined delayed reward discounting in PG. We found that higher levels of PG symptoms were associated with greater discounting for a relatively small ($14) and larger ($100) delayed reward. Previous investigations of delayed reward discounting have found that discounting rates are impacted by reward magnitude, with healthy individuals typically discounting smaller rewards more than larger rewards (Green et al., 1997; Green & Myerson, 2004). Consistent with this finding we observed a stronger relationship between PG symptoms

and discounting for the $100 reward. The majority of participants discounted the $14 at a faster rate, and age was also a predictor of discounting for this small amount (see also Green et al., 1999). It is interesting that the subgroup of individuals who met PGD criteria appeared less sensitive to reward magnitude, evidencing no difference between AUCs for the two amounts. Our second index of discounting, the *k* estimate suggested somewhat steeper discounting of $14. Inspecting the indifference points presented in Figure 1, it is possible that the PGD group discounted $100 less steeply than $14 in the short term, but at 6 and 12 months this was no longer the case. Lack of sensitivity to reward magnitude over time is consistent with findings that PGD is associated with difficulties envisaging the future (Maccallum & Bryant, 2011; Robinaugh & McNally, 2013).

A number of potential mechanisms may underlie the relationship between PG symptoms and greater discounting. Pulcu et al. (2014) reported that clinically depressed individuals showed a similar preference for short-term over long-term economic rewards. In particular hopelessness was a predictor of discounting behavior. In our study, increased discounting was not explained by additional depressive symptoms nor correlated with optimism. Isolating the separate influence of grief and depression in a bereaved sample is, however, a complex endeavor. Although PG is a distinct construct, associated with unique impairment (Bonanno et al., 2007; Prigerson et al., 1995; Simon et al., 2007), comorbidity is common (Shear et al., 2011; Simon et al., 2007) and there is also overlap between some of the core symptoms of PG and depression (Robinaugh et al., 2014). Clarification of the factors contributing to discounting in PG may benefit from the examination of individual mechanisms. There is evidence to suggest that common characteristics of depression may in fact have opposing influences on discounting. Whereas Pulcu et al. (2014) found that hopelessness was linked with faster discounting in a sample of depressed individuals, Lempert and Pizzagalli (2010) found that high anhedonic individuals discounted more slowly, suggesting that anhedonia reduced an individual's responsiveness to immediate rewards. Lerner et al. (2013) showed that sad mood in healthy participants, as distinct from depression, also promoted faster discounting. Although depressive symptoms did not explain our findings, it is possible that current sadness may have contributed to the relationship we observed.

There are other complex aspects to PG. Individuals with PG experience ongoing distress and yearning for the deceased, and a range of emotional and behavioral changes (Prigerson et al., 2009; Shear et al., 2011). To explore the extent to which individual symptoms were related to discounting, we conducted an exploratory post hoc analysis of correlations between items on the PG-13 and AUC for $100. Adjusting for number of comparisons ($p < .004$), discounting was significantly correlated with difficulty accepting the loss ($r = -.34$), confusion about role in life ($r = -.35$), emotional numbness ($r = -.38$), and difficulty trusting people ($r = -.46$). These correlations suggest that greater discounting was associated with greater focus on the loss, self-identity confusion, and a reduced ability to trust. The former are consistent with observed difficulties orienting to the future (Maccallum & Bryant, 2011; Robinaugh & McNally, 2013). The latter offers an additional potential mechanism: The decision to take the immediate reward may in part be motivated by a lack trust that the delayed reward will be given at the specified time. Future studies could investigate these mechanisms using experimental paradigms that enhance future focus or manipulate perceived trustworthiness.

Several limitations to our study are worth noting. At this stage we cannot conclude whether increased discounting contributed to the development of PG symptoms or occurred as a consequence of PG. Future studies will benefit from investigating these issues using prospective and longitudinal designs to better establish causal relationships. Irrespective, however, the presence of delayed discounting could have important economic and health implications (MacKillop et al., 2011; Story et al., 2014). A tendency to devalue future rewards may result in individuals making financial decisions that cause significant disadvantage, not just in the acute stage of grief (Lerner et al., 2013) but over prolonged periods. This could encourage a feedback loop, whereby ongoing difficulties strengthen a focus on the loss (Maccallum & Bryant, 2013). The findings suggest individuals with high levels of PG may benefit from learning skills in decision making and future goal setting. We also note that the construct of PG has undergone several iterations, and there are proposals for somewhat broader symptom profiles (American Psychiatric Association, 2013; Shear et al., 2011). The symptoms assessed by the PG-13 are included within these alternatives, and we await further research regarding these proposals.

In addition we note that our sample comprised community members who completed self-report measures of their symptoms online. Replication will be required in clinical samples to determine the extent to which findings are generalizable to treatment-seeking participants. Notwithstanding, we also consider the study's sampling method to be one of its strengths. To date the majority of studies investigating cognitive processes in PG have used participants who have self-selected for participation in grief-related studies. By including individuals who have not self-selected for a bereavement study, our findings may have greater generalizability for the population of individuals experiencing PG. Finally, participants made

choices between hypothetical rewards. A growing number of studies have demonstrated that hypothetical rewards produce similar outcomes as real rewards (de Matta et al., 2012; Dixon, Lik, Green, & Myerson, 2013). Nonetheless it would be interesting for future studies to compare responding with real money and real delays.

In conclusion, PG is a complex and debilitating condition that affects approximately 10% of bereaved individuals. Although targeted treatments have demonstrated efficacy (Boelen et al., 2007; Bryant et al., 2014; Shear et al., 2005), there remain significant gaps in our understanding. Although much work to date has focused on investigating processes and mechanisms related to the lost relationship, in the current study we examined basic decision making processes that have potential to significantly affect individual economic and health outcomes. The finding that PG is associated with an enhanced tendency to prefer short-term rather than long-term economic strategies extends our understanding of the factors that may contribute to the maintenance of PG. Future studies combining experimental manipulations with a range of methods, including neuroimaging, will assist in isolating the cognitive, emotional, and neurological pathways underpinning the phenomenon.

Author Contributions

F. Maccallum and G. A. Bonanno designed the study and wrote the article. F. Maccallum undertook data collection and analysis. Both authors approved the final version of the article.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information may be found at http://cpx.sagepub.com/content/by/supplemental-data.

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