

# Positive psychology interventions for family caregivers coping with cancer: Who will use them?

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## Abstract

**Background:** Positive psychology-based (PPB) activities have been under-researched in cancer caregiving.

**Objective:** This study investigated caregiver: (1) attitudes toward using PPB activities while caregiving; and (2) characteristics associated with these attitudes.

**Methods:** Secondary analyses of a cross-sectional survey were conducted in a national caregiver sample of hematopoietic cell transplant (HCT) patients. Survey items assessed caregivers' likelihood of engaging in six PPB activities. Hierarchical regression was performed and potential predictors of PPB activity use (e.g., technology familiarity, coping style, caregiving duration) were examined.

**Results:** Most of the  $N = 948$  respondents were White (78.9%), female (65.5%), married (86.7%), employed (78.4%), and college-educated (79.8%). Caregivers favorably disposed to positive activities were younger and female, provided care for 6–12 months and >40 h/week, and used coping styles involving religion and social support.

**Conclusions:** Our findings provide guidance for development and testing of PPB activities for cancer caregivers.

## Keywords

Family, cancer, health behaviour, health psychology, quantitative methods, health promotion

## Introduction

Cancer is a life-threatening illness that represents one of the most difficult experiences faced by individuals during their lifetime (Christ, 1983; Woźniak and Iżycki, 2014). Invariably, cancer impacts the physical, mental, and social health and well-being of patients (*care recipients*) and their family members and friends (*family caregivers*) (Kent et al., 2016; Thomas et al., 2021; Thompson et al., 2021). Hematopoietic cell transplantation (HCT) represents one of the most intense and high-risk cancer procedures wherein informal caregivers are essential throughout the patients' illness continuum (Gemmill et al., 2011; Jamani et al., 2018). They are the backbone of their care recipients' recovery, especially in today's healthcare system in which earlier hospital discharges and subsequent outpatient care

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have placed increased demands on them (Kent et al., 2016; Thomas et al., 2021; Thompson et al., 2021). Indeed, caregiving is an under-resourced and under-valued activity (Talley et al., 2014; Talley and Crews, 2007). Family caregivers face a myriad of challenges navigating the demands of their paid jobs with unpaid caregiving tasks (D'Souza et al., 2020; Shin et al., 2018). Not surprisingly, those who take on heavy caregiving responsibilities at home face higher physical and emotional stressors, impeding their ability to provide care of their care recipients, make decisions, and even manage self-care (Lee et al., 2003; Schulz et al., 1997; Vitaliano et al., 2003). These chronic stressors can lead to adverse psychological, behavioral, and physiological effects on their daily lives and health that can, ultimately, adversely impact the patient (Northouse, 1995; Northouse et al., 2012).

In cancer caregiving, psychosocial interventions have been shown to reduce stress and burden (Badr et al., 2015). Historically, caregiving research has focused on the wide range of negative implications associated with caregiving (Pinquart and Sörensen, 2003). In HCT, the adverse consequences of caregiving have been well-documented with reports of increased depression and anxiety symptoms and other health-related concerns (Barata et al., 2016). Despite this, a majority of caregivers have also reported benefits of caregiving (Farran et al., 1991; Sanders, 2005). Thus, the imbalance of focusing primarily on the negative aspects may limit our ability to develop new assessment and intervention methods and tailor them to integrate effectively with the array of internal coping styles caregivers deploy, to enhance the adaptive and to mitigate ineffective coping styles. A 'corrective focus' may be needed in caregiving research to expand our knowledge about tapping into the positive aspects of caregiving (Miller and Lawton, 1997; Mosher et al., 2017). In HCT caregiver research, interventions have mainly targeted stress management or skills-building, with inconsistent effectiveness in reducing depression and anxiety or improving quality-of-life (Bangerter et al., 2018). However, positive psychology-based (PPB) interventions or *activities* may be effective strategies for enhancing caregiver well-being, while attenuating negative symptoms associated with care burden (Seligman et al., 2006).

PPB activities have been developed to improve health (e.g., physical, mental, social) and well-being through well-studied constructs e.g., positive daily reflection (Seligman et al., 2005, 2006), gratitude (Cohn et al., 2014; Emmons and McCullough, 2003; Kashdan et al., 2006; Moskowitz et al., 2012), savoring (Bryant, 1989). Simple, intentional, and routinely practiced strategies aimed at enhancing positive thoughts, emotions, and behaviors have been shown to be effective and highly scalable (Carr et al., 2021; Emmons and McCullough, 2003; Hassett and Finan, 2016; Sin and Lyubomirsky, 2009). PPB activities have been used to support individuals with heart disease (Huffman et al., 2011), cancer (Casellas-Grau et al., 2014; Raque-Bogdan

et al., 2020), diabetes (Cohn et al., 2014), chronic pain (Braunwalder et al., 2022; Hausmann et al., 2014), health-related stress (Moskowitz et al., 2012), and depression (Sin and Lyubomirsky, 2009). In fact, an economic evaluation of a PPB intervention that sought to foster positive emotions, stimulate positive functioning, and reduce depressive symptoms found that cost-effectiveness was increased in individuals randomized to the PPB intervention arm compared with the waitlisted usual care group (Bolier et al., 2013). The strong evidence-base for PPB activities to enhance resilience or positive adaptations despite high-risk or chronic stress provides support for their use in family caregivers of patients undergoing HCT. To our knowledge, the use of PPB interventions in the HCT caregiver population have been limited.

Thus, based on the strong evidence base for PPB activities to enhance resilience or positive adaptations in diverse settings and populations, the present study had two main aims: (1) to investigate whether family caregivers of HCT patients would consider using digitally-guided PPB activities to enhance their psychological well-being while caring for their care recipients; and (2) to identify caregiver characteristics that may be associated with individuals who may be more likely to use PPB activities such as adeptness with digital technology, and religious, social or emotion-focused coping styles. The insights gained from this study could inform future interventions, support programs, and research endeavors aimed at enhancing the well-being of family caregivers in similar contexts. Thus, the motivation for this study was to better understand the relevance of these activities in a unique caregiving setting. The contribution(s) to the literature may include the following: (1) by focusing on caregivers of HCT patients, this study may shed light on whether PPB activities would be acceptable within a unique caregiving context that experiences significant stress, emotional distress, and potential psychological strain and so could possibly expand or offer new approaches in contributing to the well-being of individuals facing significant caregiver demands; (2) by identifying caregiver characteristics that might influence their willingness to engage in PPB activities, this could offer valuable insights into factors, such as coping styles or other demographic factors that could impact the adoption of these activities; and (3) the findings could have practical implications for designing interventions aimed at supporting family caregivers of HCT patients. Finding certain caregiver characteristics associated with a higher likelihood of engaging in PPB activities may help inform the study design.

## Methods

### Study procedures

The current study received approval by the Institutional Review Board and is part of a larger, multiphase project among family caregivers and patients undergoing HCT (Chaar et al.,

2019; Kedroske et al., 2020; Rozwadowski et al., 2020). As outlined by Kedroske et al., 2020, we previously developed a mobile health (mHealth) app that provided patient-specific information, education, and skills-building exercises. After a period of pilot testing the app by HCT caregivers, we conducted qualitative interviews to better understanding their user experience. The major themes that emerged from these interviews including the following: (1) the app's usefulness, ease-of-use, and likeability; (2) positive aspects of caregiving (i.e., benefits of providing care); and (3) desire for the app to be expanded to the outpatient setting, specifically providing caregiver-specific resources (e.g., sleep, activity, nutrition) and positive activities components (Fauer et al., 2018). Thus, in addition to the qualitative research findings from our single institution, we sought to develop a caregiver health survey and distribute it beyond the single institution, tapping a national sample that reflected a more diverse HCT population. The motivation for the survey was to examine design considerations for an outpatient version of the app. Thus, the data herein were derived from this recently completed National Caregiver Health Survey (Gupta et al., 2021; Raj et al., 2021). The survey was developed through cognitive interviews of family caregivers of HCT patients using verbal probing and think-aloud techniques (Collins, 2003; Kedroske et al., 2020).

### Participants

Participants were recruited by two non-profit organizations located in the United States and serving HCT patients and family caregivers: National Bone Marrow Transplant Link nbmtLINK and Blood and Marrow Transplant Information Network (BMT InfoNet). These organizations advertised the survey in their electronic newsletters and email distribution lists whose members voluntarily opt in (Gupta et al., 2021). All listed members were presumed to have been sampled. Recruitment into the lists was voluntary and opt-in. Total counts of members in the lists and noncoverage of the target population were unknown. Additional survey responses were obtained by distributing a study brochure that contained the survey URL and QR code at the BMT InfoNet's Celebrating a Second Chance at Life Survivorship Symposium (May 2–5 2019, Orlando, FL). A waiver of informed consent documentation was obtained and information about the survey was provided on the first screen page.

Eligibility criteria included: (a) unpaid family caregiver of an HCT patient; (b) 18 years of age or older; and (c) able to read and complete an online survey in English. A US\$20 Amazon gift card was offered to respondents for completing the survey.

### Measures

**Socio-demographic characteristics.** Demographic information, including age, gender, income, education, race,

ethnicity, marital status, and employment status, were obtained from self-report in the survey.

**Caregiving characteristics.** Caregiver relationship to care recipient (i.e., parent, adult child, spouse/partner, another relative), supporting other care recipients (i.e., Yes, No), care duration (i.e., less than 6-month, 6–12 months, 12–24 months, >24 months), care burden (i.e., less than 20 h of caregiving per week, 20–40 h of caregiving per week, 40 h or more of caregiving per week), in the same household as care recipient (i.e., Yes, No), and transplant type (i.e., allogeneic, autologous) were obtained from self-report in the survey.

**Coping Styles.** Four coping styles were derived from factor analysis of a subset of 16-items was selected from the 28-item Brief COPE (Carver, 1997) in accordance with the advice of the scale author that the scale be tailored to the focused interests of the study sample. As interpretation of the scale is dependent on subscales derived by factor analysis, we undertook factor analysis that yielded four coping factors which were strategic (e.g., taking action to improve situation, see it in more positive light, learning to live with it), emotional (e.g., refusing to believe situation, using alcohol or drugs to get through, blaming oneself), religious (e.g., praying or meditating, finding comfort in religion or spiritual beliefs), and social support (e.g., trying to get advice or help from others) (Supplemental Table 1). The mean response to the component items in each factor served as the caregiver's score for that factor.

**Technology use.** Technology use was assessed by the total number of different mHealth apps used currently at least once per day on a mobile phone or tablet, ranging from 0 to 9.

**Caregiver uptake of PPB activities.** Respondents were instructed to read through six different activities (Table 1) and rate how likely they would participate in that activity on a scale of 1–5, ranging from *extremely unlikely* to *extremely likely*. The items were summed to create a total likelihood score of caregiver uptake for PPB activities and used as a dependent variable in the models, described below.

### Data collection

The survey was administered online using Qualtrics software (Qualtrics XM) between May 02 and June 30, 2019.

### Statistical methods

Continuous measures were summarized by sample mean and standard deviation (SD); categorical measures were summarized with counts and percentages of the sample in each category. The bivariate association of PPB activities score was examined with each individual measure within

**Table 1.** Example of positive psychology-based (PPB) activities.

Activity Name	Description
Savoring	In this activity, you will be asked to spend a few minutes each day savoring at least two everyday experiences (e.g., morning coffee, the warmth of sunshine, a call from a friend). You are to be mindful (very aware of the moment), while savoring the experience and use all of your senses (sight, hearing, smell, taste, and touch) to solidify the memory
Piggybank	In this activity, every evening you would think about the things that made you happy that day. You would write down one of these moments on a piece of paper, fold up this piece of paper and drop it in a piggy bank (we would provide the piggy bank). At the end of 30 days, you would “close your account,” which means that you would open the piggy bank and read and savor all the deposited happy memories
Kindness	Although we typically do many kind things every day, we often do not set out to intentionally do kind things for others or even ourselves. You would pick 1 day in the week and do 5 acts of kindness. Self-care is important too - be sure to do something kind for yourself. Perhaps you would take a long bubble bath, go for a walk in the park, enjoy a popsicle, or sleep an extra 20 minutes
Strengths	You would identify your top seven character strengths using a brief questionnaire. These strengths could include things like kindness, creativity, perseverance, bravery, intelligence, and many others. You would then be directed to use one of these strengths in a new way every day over a week
Pleasant Activity Scheduling	For this activity, you would set aside a small block of time each day for a positive activity. This could be as simple as watching a favorite show, taking a bubble bath, or having ice cream with a friend. You are to treat this “appointment” with the same seriousness as you would other appointments on your calendar
Gratitude	Every day, for 30 days, you would write down three things for which you are grateful. The challenge for you is that every day would write down three new things. In this exercise, you would be reminded to keep your eyes open for life’s simple pleasures

Caregivers were asked to rate each activity on a scale of one to five indicating the likelihood that they would do a particular PPB activity: 1 = Extremely unlikely; 2 = Moderately unlikely; 3 = Neither unlikely or likely; 4 = Moderately likely; 5 = Extremely likely.

technology use, caregiver demographics, caregiving characteristics, and coping styles using Pearson’s sample correlation coefficient for continuous measures, point-biserial correlation for categorical measures, and Kendall’s Tau for ordinal measures. Our measures were then reduced to only those that had a statistically significant bivariate association and were fit in a series of nested regression models in a stepwise fashion, all of which had positive activities score as the outcome. The first regression model included a single predictor, which was the level of technology use of the caregiver. This was followed by a second model, which included significant caregiver demographics; a third model included significant caregiving characteristics; and a fourth model included coping styles. All four models were compared to each other using coefficients of determination ( $R^2$ ) and F-statistics. Multicollinearity tests fell within the acceptable range, indicating that the predictor variables were not highly interrelated amongst themselves. Statistical significance was defined as a  $p$  value less than 0.05. Analyses were performed using R (version 4.0.4) and SPSS (version 26).

## Results

### Socio-Demographic and caregiving characteristics

The mean age of the caregiver population was 43.9 years (range, 18–89 years). The majority of caregivers were White

(78.7%) and non-Hispanic (82.6%). As shown in Table 2, more than two-thirds of the respondents identified as female (65.5%), married (86.7%), employed (78.4%), college educated (79.8%), and received an annual household income greater than US\$50,000 (65.7%).

The majority of caregivers lived in the same household as their care recipient (82.9%) and supported another relative (68%). Caregivers tended to be parents of their care recipient (32.8%) with the remaining being adult children (28.9%), spouses/partners (27.1%), and 11% not falling into these family categories (e.g., friends, neighbors). Almost one-quarter (23.1%) spent greater than 40 h per week of caregiving, and more than half (52.8%) reported caregiving for more than 6-months.

### Coping styles

Caregivers endorsed *strategic* as the most commonly endorsed coping style with a mean of 3.18 (range, 0–4) and *emotional* as the least commonly endorsed coping style with a mean of 2.5 (SD = 0.70).

### Technology use

The caregivers had used different types of electronic apps to take care of their own health such as apps for diet, weight management or nutrition (64%), fitness or step counting apps (66%), sleep or meditation apps (35%), medication and

**Table 2.** Summary of positive psychology-based (PPB) activities score stratified by caregiver demographics, caregiving characteristics, and coping styles.

Variable	Category	Count (%)	Mean (SD)	PPB activities score M (SD)
Uptake of PPB Activities				21.6 (5.1)
Technology Use				
Number of Apps			3.3 (2.1)	
Demographics				
Age			43.9 (13.0)	
Gender	Male	310 (34.1)		20.76 (5.05)
	Female	596 (65.5)		22.11 (5.04)
	Not Reported	4 (0.4)		
Income (US dollar)	≤US\$50,000	239 (26.3)		19.20 (5.53)
	US\$50,001-US\$99,999	359 (39.5)		22.41 (4.37)
	≥US\$100,000	241 (26.5)		23.42 (4.34)
	Not Reported	71 (7.8)		
White race	Yes	746 (78.7)		21.51 (5.29)
	No	194 (20.5)		22.15 (4.09)
	Not Reported	8 (0.8)		
Hispanic ethnicity	Yes	158 (16.7)		23.98 (5.21)
	No	783 (82.6)		21.15 (3.56)
	Not Reported	7 (0.7)		
Currently married	Yes	823 (86.8)		21.54 (5.05)
	No	120 (12.7)		22.37 (5.12)
	Not Reported	5 (0.5)		
Employed	Yes	743 (78.4)		21.67 (4.69)
	No	197 (20.8)		21.50 (6.39)
	Not Reported	8 (0.8)		
Education attained	Some college or less	263 (28.9)		21.53 (5.40)
	College degree or more	644 (70.8)		21.69 (4.94)
	Not Reported	3 (0.3)		
Caregiving Characteristics				
Caregiver relation to care recipient	Parent	301 (33.1)		23.02 (3.51)
	Adult Child	272 (29.9)		20.16 (5.38)
	Spouse	238 (26.2)		21.30 (6.06)
	Other Relation	97 (10.7)		22.37 (4.37)
	Not Reported	2 (0.2)		
Transplant type	Allogeneic	804 (84.8)		21.79 (6.05)
	Autologous	130 (13.7)		21.62 (4.92)
	Not Reported	14 (1.5)		
Caring for others	Yes	644 (67.9)		21.47 (4.50)
	No	301 (31.8)		22.03 (6.16)
	Not Reported	3 (0.3)		
Time since HCT	≤6 months	227 (24.9)		20.59 (5.65)
	6 -12 months	190 (20.9)		23.59 (4.42)
	12-24 months	158 (17.4)		21.66 (5.13)
	>24 months	332 (36.5)		21.25 (4.69)
	Not Reported	3 (0.3)		
Weekly caregiving time commitment	≤20 h/week	330 (36.3)		21.82 (4.34)
	20-40 h/week	366 (40.2)		20.57 (5.21)
	>40 h/week	210 (23.1)		23.31 (5.34)
	Not Reported	4 (0.4)		
Lives with recipient	Yes	786 (82.9)		21.65 (5.11)
	No	156 (16.5)		21.63 (4.92)
	Not Reported	6 (0.6)		
Coping Styles				
Emotional <sup>a</sup>			2.50 (0.70)	

(continued)

**Table 2.** (continued)

Variable	Category	Count (%)	Mean (SD)	PPB activities score M (SD)
Religious <sup>b</sup>			2.85 (0.84)	
Social Support <sup>b</sup>			2.95 (0.70)	
Strategic <sup>b</sup>			3.18 (0.44)	

<sup>a</sup>Lower scores are more desirable.

<sup>b</sup>Higher scores are more desirable.

appointment reminder apps (65%). Caregivers reported using a mean of 3.3 (SD = 2.1) electronic apps at least once daily (Table 2).

### Correlates of uptake of PPB activities

The first regression model, controlling only for technology use (i.e., the number of apps used daily), accounted for  $R^2 = 1.7\%$  of the variance in PPB activities score ( $p < .001$ ;  $F(1,745) = 14.2$ ). The second regression model, in which caregiver demographics were also included had  $R^2 = 19.7\%$  and accounted for an additional 18% more of the variability in PPB activities score ( $p < .001$ ;  $F(4,741) = 42.7$ ). The third regression model, in which caregiving characteristics were also included had  $R^2 = 28.1\%$  and accounted for an additional 8.4% of the variability in PPB activities score ( $p < .001$ ;  $F(8,733) = 11.8$ ). The final regression model, in which coping styles were also included, had  $R^2 = 30.9\%$  and accounted for an additional 2.8% of the variability in PPB activities score ( $p < .001$ ;  $F(3,730) = 10.7$ ).

Based on the fitted coefficients for the final regression model (Table 3), caregivers who reported a greater disposition toward using the PPB activities were younger, female, and used more apps. Caregivers with income below US\$50,000 per year were less likely to use PPB activities compared with caregivers with annual income between US\$50,000–US\$99,999.

Parent caregivers and caregivers with another relationship to the patient (i.e., other than parent, child, or spouse) were more likely to use PPB activities compared with child caregivers, but there were no differences between spousal caregivers and child caregivers. Caregivers providing care for 6–12 months were more favorably disposed to PPB activities compared with those providing care for more than 24 months. However, there were no differences reported of likelihood of use of PPB activities between caregivers providing care for less than 6 months or more than 12 months. Additionally, caregivers providing care for more than 40 h per week reported greater likelihood of using PPB activities compared with those who provided care less than 20 h per week. Further, caregivers using more Religious and Social Support Coping and less Emotional Coping reported greater likelihood of using PPB activities.

### Discussion

This study aimed to understand the likelihood of caregivers of HCT patients using PPB activities to enhance their psychological well-being based on the “National Caregiver Health Survey for Hematopoietic Cell Transplant” (Kedroske et al., 2020). The findings herein of HCT caregivers willing to engage with PPB activities during the HCT care trajectory are encouraging. While less is known about the benefits of using PPB activities in cancer caregivers, and in particular in the HCT caregiver population, the caregivers in this study rated themselves more likely to use or engage with PPB activities between 6–12 months of caregiving and providing more than 40 h per week of care. It is possible that once the acute stress associated with peritransplant has resolved (Bevans et al., 2008; Simoneau et al., 2013), caregivers are more willing to engage in such PPB activities to help restore psychological well-being. Importantly, we found that the degree of care burden (i.e., more than 40 h per week) was associated with likelihood of using PPB activities, perhaps indicative of perception of unmet needs to increase their resilience and endurance to meet ongoing caregiving demands.

Interestingly, we also found that after adjusting for technology use, caregivers who reported likelihood of using PPB activities were younger, female, caregiving for 6–12 months, providing over 40 h per week of care to their HCT recipient, and more oriented to coping styles involving religion and receiving social support. Caregivers less likely to use PPB activities reported income less than US\$50,000 per annum, provided care 20–40 h per week, and were more likely to endorse emotional coping styles. These are important considerations in design and development of HCT caregiver interventions because many extant interventions have traditionally focused on the first 100 days of the HCT trajectory or phases of care (Gemmill et al., 2011). Moreover, existing interventions tend to require expert trainers, intensive training, and monitoring (Reinhard et al., 2008). Thus, in cancer caregiving populations at risk for high care burden, innovative interventions, like self-guided PPB activities, accessed on a digital or mobile platform have the potential to provide support to the *right* person, at the *right* time, and at the *right* place, in a low-cost, flexible, and sustainable manner.

**Table 3.** Hierarchical multiple regression of correlates of disposition toward positive psychology-based (PPB) activities, based on technology use, caregiver demographics, caregiving characteristics and coping styles.

Correlates	Model 1 Adjusted $R^2 = .017$	Model 2 Adjusted $R^2 = .197$	Model 3 Adjusted $R^2 = .281$	Model 4 Adjusted $R^2 = .309$
	Coef	Coef	Coef	Coef
Technology use				
Apps Total	.0137***	0.084*	0.097**	0.089*
Demographics				
Age (years)		-0.093**	-0.078*	-0.084*
Gender				
Male		Ref	Ref	Ref
Female		0.189***	0.141***	0.127***
Income (US dollar)				
Mid income 50-99K		Ref	Ref	Ref
Low Income <50K		-0.355***	-0.266***	-0.257***
High Income >100K		0.099**	0.059	0.067
Caregiving characteristics				
Caregiver Relationship				
Adult Child			Ref	Ref
Parent			0.219***	0.193***
Spouse			0.063	0.053
Other			0.109**	0.088*
Caregiving Hours				
<20/week			Ref	Ref
Full-time 20-40/week			-0.074*	-0.075*
Over-time >40/week			0.153***	0.146***
Time since HCT				
>24 months ago			Ref	Ref
<6 months ago			0.068	0.071
6 to 12 months ago			0.161***	0.170***
12 - 24 months ago			0.030	0.032
Coping styles				
Emotional Coping				-0.098**
Religious Coping				0.117***
Social Support Coping				0.107**

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

Emerging research suggests that the positive emotions experienced by individuals may positively influence mental and physical health and well-being. Positive psychology-based interventions have been developed within Positive Psychology to *cultivate positive feelings, behaviors, or cognitions* (Seligman et al., 2006). In recent years, applications of PPB activities have steadily risen (Casellas-Grau et al., 2014; Huffman et al., 2014; Seligman et al., 2006). Indeed, the literature supports activities, such as daily positive reflection, gratitude journaling, and conducting acts of kindness, in populations that include heart disease, stroke, diabetes, chronic pain, and cancer (Casellas-Grau et al., 2014;

Cohn et al., 2014; Griffin et al., 2014; Hausmann et al., 2014; Huffman et al., 2011; Moskowitz et al., 2012; Müller et al., 2016; O'Toole et al., 2017; Terrill et al., 2018). In fact, these and other recent studies have identified PPB activities as having potentially larger, more sustainable impact than those targeting symptom reduction alone (Bakas et al., 2017; Joyce et al., 2018; Yehuda et al., 2006). Two meta analyses that included 69 randomized controlled studies provide evidence base for the impact of positive psychology interventions on enhancing subjective and psychological well-being and attenuating depressive symptoms (Bolier et al., 2013; Sin and Lyubomirsky, 2009).

Our findings point to the possibility that individuals more open to seeking external sources of support in the form of social support and religious/spiritual coping strategies were more likely to be favorably oriented towards the use of PPB activities; and individuals who endorsed emotional coping style were less likely to use PPB activities. We were not able to collect information on what caregivers would do within each activity. Rather, we summarized a total likelihood score. As such, it is possible that caregivers with certain coping styles may engage with PPB activities differently (i.e., preferences for each activity could differ by caregiver coping style) and should be examined in more detail in future studies. Conceivably, individuals who report more emotional coping, such as self-blame, denial, inability to regulate emotions, and use of alcohol or illicit drugs may require more intense targeted interventions.

Several other limitations of this study should be acknowledged. Not surprisingly, as seen with other positive psychology studies (Bolier et al., 2013; Lyubomirsky et al., 2011; Mitchell et al., 2009), our current study had imbalanced gender groups (more females than males). It is not uncommon for HCT caregivers to be predominantly females (Jamani et al., 2018). Interestingly, we found that caregivers were less likely to endorse using PPB activities if they reported income less than US\$50,000 per annum and provided 20–40 h of care per week. The cross-sectional design of our survey limits our ability to extrapolate the cause or effect of these associations, but this should be explored in future research. Our predominantly white and highly educated population also limits the generalizability of our findings, including that our recruitment was restricted to the electronic mailing lists and reach of the two largest non-profit transplant organizations based in the U.S. We also cannot rule out that our findings were affected by missing data or a biased sampling of individuals who, by nature of the study design (i.e., internet-based), may be more comfortable with technology, and have easy access to it.

## Conclusion

Despite our findings being limited by cross-sectional design and demographics that tended to be female, white, non-Hispanic, having higher income and education, this study had several strengths in that the sample was large and attitudes of a positive psychology intervention were assessed. Notably, our findings provide guidance for design, development, and testing of cost-effective mHealth self-guided interventions aimed at supporting informal caregivers of HCT patients in their often-protracted caregiving responsibilities.

## Contibutorship

FH contributed to writing the original draft, data analysis and interpretation, and approval of the final article. VG contributed to writing the original draft, data analysis and interpretation, and approval of the final article. AM contributed to manuscript writing and approval of the final article. TB contributed to writing the original draft, data analysis and interpretation, and approval of the final article. SWC contributed to study conception and design, data collection, analysis, and interpretation of data, manuscript writing and approval of the final article.

## Declaration of conflicting interests

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## Guarantor

SWC.

## Ethical statement

### Ethical approval

This study was approved by the Institutional Review Board.

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## Supplemental Material

Supplemental material for this article is available online.

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