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Helping Yourself by Offering Help: Mediators of Expressive Helping in Survivors of Hematopoietic Stem Cell Transplant

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Abstract

Background—A randomized experiment by Rini et al. (*Health Psychol.* 33(12):1541–1551, 2014) demonstrated that expressive helping, which involves three expressive writing sessions regarding hematopoietic stem cell transplant, followed by one writing session directed toward helping other stem cell transplant recipients, reduced psychological distress and bothersome physical symptoms among stem cell transplant recipients with elevated survivorship problems, relative to a neutral writing control condition.

Purpose—The current study evaluated whether word use reflective of emotional expression, cognitive processing, and change in perspective mediates the effects of expressive helping.

Method—The essays of 67 stem cell transplant recipients with high survivorship problems were analyzed with Linguistic Inquiry and Word Count. Multiple mediation modeling was used to test the hypothesized mechanisms of expressive helping on distress and bothersome physical symptoms.

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There are no other financial disclosures.

Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Williamson, Stanton, Austin, Valdimarsdottir, Wu, Krull, and Rini declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Results—Relative to the control condition, expressive helping produced significant reductions in psychological distress and marginal reductions in physical symptom bother in the analyzed subset of participants from the parent study. Results indicated that positive emotion word use significantly mediated effects of expressive helping on reduced distress, but only for participants who used average (compared to above or below average) rates of negative emotion words. Cognitive processing and change in perspective did not significantly mediate benefits of expressive helping.

Conclusions—Expressive helping carried its positive effects on distress through participants' higher expression of positive emotions when coupled with moderate rates of negative emotions. Findings highlight the benefit of expressing both positive and negative emotions in stressful situations.

Keywords

Expressive writing; Peer helping; Intervention; Cancer survivorship; Hematopoietic stem cell transplant; Mediation analysis; Emotional expression

Disclosing one's thoughts and feelings about a stressful experience is posited to facilitate positive adjustment. Numerous experiments demonstrate that expressive writing [2] produces significant physical and psychological health benefits in healthy and clinical populations [2–8]. However, substantial variability exists in the benefits derived from expressive writing (see [3] for meta-analysis), and the evidence for the beneficial effects of expressive writing among cancer populations has been mixed [9–16]. These findings highlight the importance of using theoretically grounded approaches to enhance the effectiveness of expressive writing in populations that could benefit from it. One method for achieving that goal is to develop new interventions that add theoretically based mechanisms of action to those that expressive writing is already hypothesized to engage. Expressive writing can then be compared to those approaches to evaluate their relative efficacy on psychological and physical health [16, 17].

To this end, Rini et al. [1] developed a novel psychosocial approach called expressive helping. It extends expressive writing by combining emotional disclosure with elements of peer helping (i.e., sharing one's experiences and encouragement with people undergoing a similar stressor). The present study focuses on a population in need of such an intervention: people with hematologic cancers (e.g., multiple myeloma, leukemia) treated with hematopoietic stem cell transplant. After stem cell transplant, survivors are immunosuppressed. Many of them feel isolated and report a desire to connect with each other [18] as well as to provide information to others preparing for stem cell transplant [19].

Expressive helping was developed to address the needs of stem cell transplant survivors and was evaluated in a randomized, controlled trial with 315 participants [1]. Participants completed four brief, guided writing sessions after being randomized to one of four groups: expressive helping, expressive writing, peer helping, or a neutral writing control. All groups wrote once a week for 4 weeks at home (e.g., [20]). In the expressive writing group, participants wrote about their deepest thoughts and emotions about the stem cell transplant experience for all four writing days. Peer helping participants wrote as if they were speaking

to another individual preparing for stem cell transplant for the four writing sessions. Expressive helping participants followed the expressive writing instructions on days 1–3 and peer helping instructions on day 4, and they were informed of this sequence in the first session. Neutral writing participants wrote a detailed factual account of the stem cell transplant experience for the first 3 days and details of activities during the prior week on the fourth day.

In order to evaluate a priori hypotheses regarding moderation by symptom severity, participants were clustered into high and low survivorship problem subgroups. Nearly all participants in the high problem cluster met criteria for at least three of four problems: high psychological distress, moderate to high cancer-related distress, poor health-related quality of life, and low sense of purpose. Findings revealed that neither expressive writing nor peer helping predicted psychological and physical adjustment to stem cell transplant, as compared to neutral writing. Rather, only expressive helping (i.e., the combination of expressive disclosure and peer helping instructions) conferred benefits [1]. Specifically, expressive helping produced a significant reduction in psychological distress and bothersome physical symptoms for stem cell transplant survivors in the high survivorship problem cluster.

The Current Study

A hallmark of experimental medicine is to investigate whether interventions produce change in mechanisms theorized to alter the outcomes of interest (e.g., [21]). Such investigations enhance causal inference regarding the “active ingredients” of interventions and aid in the development of maximally effective approaches. Recently, researchers have called for investigations of mechanisms for psychosocial interventions among cancer survivors, the targeted population in this research [22, 23]. Accordingly, our primary goal was to build on evidence for the efficacy of expressive helping by investigating its mediators in predicting reduced distress and bothersome physical symptoms for stem cell transplant survivors. As such, we posited three classes of theoretically and empirically grounded mediators, all operationalized and assessed with Linguistic Inquiry and Word Count [24, 25].

We posited that expressive helping, relative to neutral writing, would influence linguistic indicators of emotional expression, cognitive processing, and change in perspective. Stress and coping theory posits that positive emotions serve a restorative function in the context of stressful events [26–28]. Research demonstrates that greater positive emotion word use is associated with health benefits [17, 29]. As such, we hypothesized that greater use of positive emotion words would mediate the effects of expressive helping on distress and physical symptom bother. The relationship between negative emotional expression and health outcomes, however, is mixed. Some research has demonstrated a linear relationship between negative emotion words and better outcomes [30, 31], whereas other research has found a curvilinear association between negative emotion words and better outcomes [29]. Accordingly, we investigated whether a moderate use (tested as a quadratic effect) or a greater use of negative emotion words (tested as a linear effect) would mediate the relationship of expressive helping on the outcomes.

It is also important to consider the interplay between positive and negative emotional expression. The differential emotion hypothesis of expressive disclosure posits that more positive emotion words relative to negative emotion words produce the greatest health benefits [29, 32]. Furthermore, the Dynamic Model of Affect [33] recommends that researchers investigate both independent effects of positive and negative affect as well as their “inter-affect” relationship in predicting health and well-being, because individuals with a weaker negative correlation between positive affect and negative affect during stress have been shown to demonstrate a greater ability to adapt to stress [34, 35]. Strikingly, however, testing interactive effects of positive and negative emotional expression has not yet been applied to linguistic data in expressive disclosure studies. Doing so would provide an empirical test of an inter-affect effect on the health benefits of expressive disclosure interventions. Therefore, we conducted an a priori moderated mediation analysis to test whether use of positive emotion words (as moderated by use of negative emotion words) would account for the effects of expressive helping on both reduced distress and fewer bothersome physical symptoms. Given the novelty of this analytic approach within expressive disclosure research, we explored the potential effects of moderated mediation without directional hypotheses.

Research also demonstrates that written emotional disclosure produces health benefits by helping individuals to process their experience and to create a coherent narrative [29, 36]. Thus, we hypothesized that essay words that reflect cognitive processing (i.e., cognitive mechanism, insight, causal words) would mediate the effect of expressive helping on psychological and physical adjustment. Furthermore, research suggests that change in pronoun usage from one writing session to another reflects a change in perspective of the author (e.g., I-focus versus you-focus) and predicts better health outcomes [37]. We expected that high rates of first-person singular pronouns during the first three writing sessions of expressive helping would help stem cell transplant survivors process their own stem cell transplant experience and prompt a subsequent high rate of second-person pronouns in the fourth session, as survivors prepare a narrative for other individuals preparing for transplant. As such, we expected that this change would facilitate positive outcomes. We also hypothesized that change over time in verb tense use from past tense in the first three sessions as expressive helping participants focus on their prior stem cell transplant experience to present and/or future tense in the fourth session, as they write about a future transplant for another individual, would account for the benefits of expressive helping.

Method

Participants

Participants ($N = 315$) in the original study [1] were men and women who had completed either allogeneic or autologous stem cell transplant in the prior 9 months to 3 years. Exclusion criteria included cancer relapse, presence of a substance use disorder, active psychosis, active suicidal ideation, or significant cognitive impairment. Participants were offered \$80 compensation. The high survivorship problem cluster ($n = 98$; 66 female) consisted of participants who entered the study with persistent moderate to severe survivorship problems. Participants in the low survivorship problem cluster ($n = 217$) were

not included in the current report, owing to nonsignificant intervention effects in the original study.

Procedure

Eligible participants for the parent study were identified in existing cancer patient databases at two medical centers in the northeastern USA, mailed materials describing the study, and called by study recruitment staff (see [1] for a full description of the sample and method). Announcements in newsletters, Internet sites for cancer survivors, and patient advocacy groups were also used in recruitment. Potential participants were screened for eligibility and provided informed consent. Randomization to the expressive helping, expressive writing, peer helping, or neutral writing condition occurred immediately before the first writing session using computer-generated permuted block randomization. Participants completed the four writing sessions over 4 weeks. For each session, a trained staff member called at an appointed time to provide instructions for the participant's assigned group, administering prewriting and post-writing assessments before and after the participant completed the writing. Participants wrote for 20 min in each of the first three writing sessions and for 20 to 40 min on writing day 4. A mailed questionnaire and telephone interview were used for the baseline assessment 1 week prior to the first writing session and for the follow-up assessment 3 months after the last writing session. Health changes might be detectable directly following the final writing session; however, Pennebaker and Chung [38] suggest that immediate effects of expressive writing may be fleeting and some effects may take weeks or months to emerge. As such, a 3-month followup time frame was chosen. This timing also reflects common practice; meta-analytic findings revealed 3 months to be the average follow-up time for expressive disclosure interventions [3]. An interviewer unaware of assigned condition administered the interviews. Procedures were approved by the relevant institutional review boards.

Measures

Psychological Distress—Participants completed the 53-item Brief Symptom Inventory at baseline and 3-month follow-up [39]. The Brief Symptom Inventory global score encompasses nine dimensions of psychological distress (e.g., depression, anxiety) experienced over the past week using a four-point Likert scale ranging from “not at all” to “extremely.” This scale demonstrated excellent reliability (current $\alpha = 0.94$) and has been used to measure distress in medical samples, including stem cell transplant survivors [40].

Physical Symptom Bother—At baseline and 3-month followup, participants completed the 33-item Cohen-Hoberman Inventory of Physical Symptoms [41]. Participants indicated how frequently various physical symptoms (e.g., back pain, nausea, fatigue) had been troublesome during the past week on a four-point Likert scale ranging from “not bothered” to “extremely bothered” (current $\alpha = 0.84$).

Analytic Strategy

Linguistic Content Analysis—Essays were analyzed using Linguistic Inquiry and Word Count, a computerized text analysis software program. Using a well-validated dictionary [25], the software counts words in established conceptual categories and creates percentage

scores for each category based on the total word count of the writing sample. The three linguistic variable sets examined in this study were emotional expression, cognitive processing, and change in perspective. Positive emotion (e.g., hope, proud) and negative emotion (e.g., scary, terrible) words were indicated by percentage means across writing sessions 1–4. Average rates of cognitive mechanism (e.g., explain, reconsider), causal (e.g., change, purpose), and insight (e.g., meaning, perceive) words, respectively, were examined. Tests of statistical significance did not differ whether we derived linguistic variables from the mean of each respective category across sessions 1–3 or used the mean from session 4 alone.

Multilevel modeling was used to compute change in perspective variables as indicated by change in first-person singular pronouns, second-person pronouns, past tense verbs, and future or present tense verbs. The nesting of repeated measures (multiple writing sessions) within individuals warranted a two-level multilevel model [42]. We created a person-specific variable corresponding to each of the aforementioned linguistic categories, indicating a change in the linguistic outcome that accompanied the change in expressive helping writing instruction (from writing days 1–3 to day 4). We used a statistical approach similar to that employed by previous researchers to construct a person-level variable from multiple repeated measurements (e.g., [43]). We first created a dummy variable to distinguish writing days 1–3 from writing day 4 (i.e., coded 0 for days 1–3 and 1 for day 4) and estimated a series of multilevel models with this level 1 “instruction change” variable, the level 2 condition variable, and the cross-level interaction of these variables as predictors of a linguistic category count. Both the intercept and the level 1 instruction change coefficients were allowed to vary randomly across individuals in these models, as specified in the following equations:

$$\text{L1} \quad Y_{ij} = \beta_{0j} + \beta_{1j} \text{InstructionChange}_{ij} + e_{ij} \quad (1)$$

$$\text{L2} \quad \beta_{0j} = \gamma_{00} + \gamma_{01} \text{Condition}_j + u_{0j} \quad (2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} \text{Condition}_j + u_{1j} \quad (3)$$

The person-specific β_{1j} coefficient (from Eq. (1)) for each individual was the output for use as a mediator. This is an empirical Bayesian estimate which reflects the extent to which pronoun or verb tense use increased or decreased along with the change in expressive helping writing instruction for each individual. Because such estimates combine an individual’s specific data with the general pattern of data from other individuals within the same writing condition (i.e., an individual-specific u is combined with sample-based γ estimates in Eq. (3)), these values are more stable and reliable estimates than any simple difference calculated exclusively from individual-specific data, resulting in reduced sampling variance for these measures [42, 44].

Mediation Analyses—Writing group was operationalized using a dummy code to evaluate the effect of expressive helping, relative to neutral writing (i.e., neutral writing = 0, expressive helping = 1), on the outcome variables [45]. Psychological distress and physical symptom bother were entered as dependent variables in separate models. Mediation analyses for the effects of expressive writing and peer helping groups were also conducted, and the results can be found in the Electronic Supplemental Materials.

Traditionally, mediation analyses are explained through four steps [46]. The first step involves testing a direct relationship between the predictor and the dependent variable, or the total effect (i.e., c path). If the c path is significant, then the next step is to test whether the predictor variable predicted the proposed mediator (i.e., a path). Then, the third step consists of testing whether the mediator is related to the dependent variable, controlling for the predictor (i.e., b path). The fourth and final step involves testing whether the c path is attenuated to nonsignificance when the mediator was entered as a covariate (i.e., c' path). However, recent research indicates that indirect effects can be present in the absence of a significant direct effect or a nonsignificant total effect [47–49].

We also conducted mediation analyses for participants in the parent study's low survivorship problem cluster ($n = 217$). Compared to participants in the high survivorship problem cluster, these participants began the study with lower general and cancer-related distress, as well as higher health-related quality of life and sense of purpose. The parent study did not detect benefits of expressive helping in this cluster. Findings from the current study's analyses for this cluster are reported in the Electronic Supplemental Materials. In general, all findings replicated those for the high survivorship problem cluster.

We tested mediation using guidelines proposed by Preacher and Hayes [49] and used PROCESS, a conditional modeling program which uses an ordinary least squares framework to test both direct and indirect effects [50]. The current analyses used PROCESS Model 4 for all tests of mediation (including multiple mediation) without any moderators and PROCESS Model 14 for tests of moderated mediation. Hypotheses involving curvilinear effects were tested using MEDCURVE, a modeling program that tests instantaneous indirect effects in simple mediation models with nonlinear paths [51]. Researchers have recommended using bootstrap analyses for mediation in the absence of significant main effects or when the expected effect size is small [48]. Accordingly, bootstrap estimates using 5000 repetitions were used to construct 95% bias-corrected confidence intervals for the indirect effects. We tested three models of emotional expression, one model of cognitive processing, and one model of change in perspective for each of the two dependent variables.

Results

Sample Characteristics

Of the 98 participants in the high survivorship problems cluster who were randomized, 81 completed the follow-up assessment. Three from the expressive helping condition, six from the peer helping condition, five from the expressive writing condition, and three from the neutral writing condition relapsed, died, dropped out, or lost contact between baseline and follow-up and were not included in analyses. Additionally, five participants (two peer

helping, one expressive writing, and two neutral writing) did not follow the writing instructions and were not included. Finally, nine participants (two expressive helping, three peer helping, one expressive writing, and three neutral writing) completed the writing, but their linguistic data were inadvertently destroyed. The final sample for all subsequent analyses was $N = 67$ (17 expressive helping, 16 peer helping, 19 expressive writing, and 15 neutral writing). Table 1 shows the zero-order correlations between the mediator variables and the outcomes at baseline and follow-up.

Among the 67 participants included in the analyses, there were no significant differences (all p 's > 0.05) between writing groups on any of the demographic variables (i.e., age, sex, ethnicity, marital status, education, income), medical characteristics (i.e., stem cell transplant type, stem cell transplant-related complications, history of graft-versus-host disease, medical comorbidities), or dependent variables at baseline (i.e., psychological distress, physical symptom bother). Table 2 provides characteristics of the sample.

Effects of Expressive Helping on Psychological and Physical Health

In all following analyses, the dummy code comparing expressive helping to the neutral writing group was the independent variable. To assess change over time in the outcome of interest, the baseline value of the dependent variable was entered as a covariate. Age and number of medical comorbidities were covariates for the psychological distress analyses, whereas number of stem cell transplant-related complications (other than history of graft-versus-host disease) was entered as a covariate for the physical symptom bother analysis, because these variables predicted the outcomes at $p < 0.05$ in the full sample [1].

The intervention main effects for expressive helping were re-assessed in the current sample. Expressive helping produced a significant reduction in psychological distress, $b = -0.20$, $SE = 0.09$, $t = -2.26$, $p = 0.032$, 95% CI $[-0.39, -0.02]$, relative to neutral writing. Expressive helping also predicted a marginally significant reduction in physical symptoms, $b = -8.20$, $SE = 4.08$, $t = -2.01$, $p = 0.054$, 95% CI $[-16.56, 0.16]$. These results differ slightly from those presented in Rini et al. [1] likely due to reduced power from a smaller sample size in the re-analysis.

Emotional Expression—First, positive emotion word use was tested in a mediation model to assess a linear effect on the two outcomes (in separate analyses). Indirect effects of the mediation model for expressive helping on the outcomes were not significant (p 's > 0.05). An evaluation of the relationship between expressive helping and positive emotion word use (i.e., the a coefficient, which refers to the unstandardized regression weight from the independent variable to the mediator) revealed that expressive helping participants evidenced more positive emotion words (a 's = 1.74–1.77, p 's < 0.05) than neutral writing participants. The linear effect of positive emotion word use, however, was not significantly associated with the outcomes (p 's > 0.12).

Next, negative emotion word use was entered as a mediator in a quadratic model to assess a curvilinear effect and in a separate mediation model to assess a linear effect on the two outcomes. Indirect effects of the curvilinear or the linear mediation models for expressive helping on the outcomes were not significant (p 's > 0.05). An evaluation of the relationship

between expressive helping and negative emotion word use revealed that participants in the expressive helping condition evidenced more negative emotion words (a 's = 1.63–1.66, p 's < 0.05) than neutral writing participants. Neither the linear effect of nor the quadratic effect of negative emotion word use, however, was significantly associated with the outcomes (p 's > 0.09).

Finally, to test an interactive indirect effect of positive and negative emotional expression (that is, whether effects of positive emotional expression on outcomes depended on patterns of negative emotional expression), positive emotion word use was entered as a mediator variable and negative emotion word use was entered as a moderator of the relationship between positive emotion words and the outcome (i.e., the b coefficient, which refers to the unstandardized regression weight from the mediator variable(s) to the outcome). As shown in Table 3, positive emotion word use reliably and significantly mediated the effect of expressive helping on reduced distress among participants with average rates of negative emotion words. Positive emotion words did not mediate the effect of expressive helping on the outcomes at one SD above or below the mean of negative emotion word use. An omnibus index of moderated mediation [52], however, was nonsignificant ($p > 0.05$), indicating that these mediated effects did not significantly differ from each other.

Cognitive Processing—Insight, causal, and cognitive mechanism words were entered simultaneously as mediating variables. Although they did not significantly mediate the effects of expressive helping on psychological distress or physical symptom bother (p 's > 0.05), expressive helping participants evidenced higher rates of insight, causal, and cognitive mechanism words than did neutral writing participants (a 's = 0.35–4.52, p 's < 0.05). The mediators were unrelated to the outcomes, however (p 's > 0.15).

Change in Perspective—The empirical Bayesian estimates for change over time in first-person singular pronouns, second-person pronouns, past tense verbs, and present/future tense verbs were simultaneously entered as mediator variables. Change in perspective did not significantly mediate the effects of expressive helping on psychological distress or bothersome physical symptoms (p 's > 0.05). As predicted, expressive helping produced a significant increase in second-person pronouns over time (a 's = 2.03–2.27, p 's < 0.05). The mediating variables were not associated with the outcomes, however (p 's > 0.20).

Discussion

The central finding of this study is that expressive helping carries its positive effects on distress in part through participants' higher expression of positive emotions, consistent with theory and research [29, 53]. Although, higher expression of positive emotions appears beneficial for expressive helping participants only when negative emotional expression is moderate. The findings of Pennebaker and colleagues [29] suggest a curvilinear association between negative emotion words and physical health such that moderate but not high or low expression of negative emotions in writing was associated with benefit. We did not find a corresponding unique effect of negative emotion words in the current study. Rather, our results highlight the importance of joint effects of positive and negative emotion words, suggesting that high expression of positive emotions is beneficial for reducing distress when

accompanied by moderate negative emotional expression. Additionally, results indicated that cognitive processing and change in perspective did not mediate the beneficial effects of expressive helping. As hypothesized, there were significant effects of expressive helping on causal, insight, and cognitive mechanism words as well as increases in second-person pronouns over time, but these mediators were unrelated to the outcomes. The generalizability of these findings may be limited, given that participants in the current study were those with high survivorship problems who also evidenced high adherence to the writing instructions and participated at the follow-up assessment. However, participants in the parent study generally evidenced high adherence to the writing instructions [1].

Considering these findings in light of a broader body of research is informative. Previous randomized controlled trials of expressive disclosure have yielded mixed results as to whether higher versus lower use of positive and negative emotion words confers health benefits. Some research indicates that higher use of positive emotion words is associated with better health [17, 29], supporting the theory that positive emotions have adaptive functions within the context of stress [28]. However, positive emotion word use was not associated with better adjustment in a randomized controlled trial of expressive disclosure among women living with breast cancer [31]. Similarly, higher rates of negative emotion words have been associated with better outcomes [30]. Yet, in nonclinical samples, higher use of negative emotion words has been associated with worse health outcomes [54, 55]. Other researchers have found no association [56]. Given that previous investigations demonstrate that positive and negative affect are largely independent of each other [57, 58] and have been shown to differentially predict health outcomes [33], it is important to examine both the independent and interactive effects of positive and negative emotion word use. To the best of our knowledge, no previous studies have examined the interaction of positive and negative emotional expression to predict the health benefits of expressive disclosure, and we recommend this approach in future research.

Given that many stem cell transplant patients experience many symptoms of anxiety and/or depression following transplant [59], it is possible that lower than average use of negative emotion words from expressive helping participants reflects avoidance-oriented coping. By contrast, expressive helping participants who used higher than average rates of negative emotion words might be ruminative or pessimistic in their approach to the writing task. We posit that expressive helping participants co-expressing a moderate level of negative emotions, along with positive emotions, are engaging in approach-oriented coping, which effectively communicates the complexity of their emotional experience with stem cell transplant.

It is unclear why the significant indirect effect of emotional expression was only observed for reduced distress and not for physical symptom bother. It may be that reductions in bothersome physical symptoms would be affected by expressive helping but would be followed by reductions in distress, reducing our ability to detect them in the current study. Future studies should incorporate a longer follow-up assessment to assess whether reductions in distress as a result of expressive helping, in turn, predict later reductions in physical symptom bother. Additionally, meta-analytic findings [3] indicate that the effect size for expressive disclosure on distress ($r = 0.059$, $p = 0.0001$) is larger and more reliable

than on physical symptoms ($r = 0.017$, $p = 0.068$), indicating that emotional expression may explain a larger portion of the effects on distress.

Among participants in the low survivorship problems cluster, mediation analyses suggested that positive emotion word use significantly mediated effects of expressive helping on reduced distress *and* physical symptom bother, but only for participants who used average (compared to above or below average) rates of negative emotion words (see Electronic Supplementary Materials). Thus, it is likely that a significant indirect effect of emotional expression was only observed for reduced distress (and not physical symptom bother) in the current study due to reduced statistical power from a smaller sample size in the high survivorship problem cluster. Additionally, the lack of significance at one SD above and below the mean of negative emotion word use may be due to low sample size or high variability, which might alternately explain the nonsignificant omnibus test of moderated mediation.

We also investigated change in perspective as a potential mediator for expressive helping participants. Consistent with previous research [37] and theory [60], we conceptualized change in perspective as dynamic shifts in pronoun or verb tense usage. Although expressive helping participants, relative to neutral writing participants, evidenced a significantly greater increase of second-person pronoun usage over time, change in use of pronouns and verb tense did not reliably mediate the positive effects of expressive helping. These results are inconsistent with the findings of Campbell and Pennebaker [37], who demonstrated that variation in pronoun usage was related to positive health outcomes. In the aforementioned study, the physically healthy individuals who comprised the samples wrote about a traumatic experience that, in all cases, was social in nature. In that context, change in perspective was likely reflective of participants thinking about themselves within the context of others in their existing social networks (e.g., friends, family), who were either directly involved in or affected by the traumatic experience. For the current sample of stem cell transplant patients in the expressive helping condition, the change in pronoun usage likely reflected the attempt to communicate one's stem cell transplant experience to a stranger (i.e., someone preparing for stem cell transplant). Thus, changing perspective within the context of a symbolic social network (i.e., shared identity of stem cell transplant survivorship) may not be responsible for the effects of expressive helping.

It is also important to keep in mind that the final day of the expressive helping writing instructions asked participants to use insights gained from their first 3 days of writing (when they were writing for themselves using standard expressive writing instructions) to share useful advice and encouragement with others undergoing stem cell transplant, writing as if speaking directly to them (i.e., using peer helping instructions on the final writing day). That is, the instructions asked them specifically to change perspectives and shifts in pronoun usage may be a direct result of the writing instructions. Further research would need to examine in a larger sample whether this instructed change in pronoun usage is therapeutic. Although this shift in perspective did not affect outcomes in the current study, we posit that participants will benefit from perceiving that they are providing helpful advice and encouragement to people preparing to undergo stem cell transplant. Future studies on expressive helping should examine whether this perception varied across participants in the

expressive helping group and whether variation in this perception is associated with positive outcomes.

Cognitive mechanism, causal, and insight word use were higher in the expressive helping group, relative to the neutral writing group but were not associated with reductions in distress or bothersome physical symptoms. These results are inconsistent with studies that suggest that higher use of cognitive processing words is associated with health benefits [29, 36]. Given the average time since stem cell transplant in the current sample ($M = 84.40$ weeks, $SD = 37.41$), it may be the case that participants had already gained benefits from processing the stem cell transplant experience; however, this interpretation is unlikely given the high rates of reported distress in the current sample. Alternatively, participants with pervasive problems following considerable time since treatment completion might represent a subgroup of patients for whom cognitive processing is ineffective.

Limitations of the study should be noted. First, the parent study found an effect only in a subgroup of the full sample (i.e., high survivorship problem cluster), and the mediation analyses in the current report only focused on that subgroup; thus, the power of analyses to evaluate significant mediation was restricted by the sample size. However, mediation analyses for participants in the parent study's low survivorship problem cluster were also conducted (see Electronic Supplementary Materials), and the results generally replicated the findings from the high survivorship cluster. Nonetheless, further research should assess theoretically grounded mediators of expressive disclosure and expressive helping in larger samples and utilize efforts to control for type I error inflation. Second, dependent measures relied on self-report. Future research should incorporate clinically significant physiological and/or behavioral indicators of health to enhance our understanding of the health benefits of expressive disclosure. Third, the observed changes in putative linguistic mediators may have resulted from the constraints of the writing instructions rather than reflecting internal processes (e.g., cognitive processing) being prompted by the experimental manipulation. Fourth, although Linguistic Inquiry and Word Count software has been widely used to analyze textual data, the software program ignores the semantic context in which words are used. Future research could incorporate tools such as sentiment analysis [61] to investigate the nuances of emotion word use within the context of each sentence rather than by examining the words in isolation.

There are also notable strengths of the present study. To the best of our knowledge, this study was the first to test the interaction of positive and negative emotional expression as a mediator of expressive disclosure. Moderated mediation techniques can be used in future research to further elucidate the independent, complex, and potentially adaptive utility of positive and negative emotional expression. In addition, no previous studies have utilized multilevel modeling techniques to capture change in perspective across writing sessions. Future research that investigates change in perspective as a mechanism for expressive disclosure can build upon the analytic framework outlined in the current study. Additionally, the current mediation analyses may aid in hypothesis generation for future expressive disclosure interventions. Findings also provide evidence that can be used to enhance the efficacy of expressive helping.

This work suggests important goals for future research and clinical implications for intervention. It may be beneficial to tailor the language of the expressive helping writing instructions to encourage the expression of both positive and negative emotions. For example, the writer could be prompted to express their “deepest thoughts and feelings, both negative and positive.” Furthermore, psychosocial paradigms that harness peer support may be helpful for other medical populations for whom traditional support groups may not be feasible, such as those who may experience isolation owing to immunosuppression (e.g., cystic fibrosis) or are living with a rare disease (e.g., uveal melanoma). Expressive helping is a promising approach for reducing distress in stem cell transplant survivors, and both the replication and further investigation of its mechanisms will aid in developing implementation strategies to maximize its benefits.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Zero-order correlations between linguistic mediator variables and outcomes at baseline and follow-up in the current sample ($N = 67$)

Table 1

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Cognitive mechanism words	–												
2 Causal words	0.51*	–											
3 Insight words	0.68*	0.39*	–										
4 Social words	0.25*	0.16	0.11	–									
5 Increase in first-person pronouns	–0.06	0.02	–0.10	–0.08	–								
6 Increase in second-person pronouns	0.19	0.05	0.29*	0.11	–0.64*	–							
7 Increase in past tense verbs	–0.09	–0.14	–0.18	0.17	0.17	–0.28*	–						
8 Increase in present and future tense verbs	0.37*	0.30*	0.35*	0.01	–0.04	0.36*	–0.78*	–					
9 Positive emotion words	0.65*	0.31*	0.51*	0.39*	–0.09	0.08	0.12	0.11	–				
10 Negative emotion words	0.50*	0.33*	0.58*	0.02	–0.01	0.18	–0.07	0.23	0.45*	–			
11 Brief Symptom Inventory–BL	–0.11	–0.23	–0.24	–0.25*	0.37*	–0.22	0.05	–0.03	–0.04	–0.03	–		
12 Brief Symptom Inventory 3-month FU	–0.21	–0.27*	–0.31*	–0.27*	0.39*	–0.24	0.08	–0.02	–0.20	–0.10	0.77*	–	
13 Cohen Hoberman Inventory of Physical Symptoms–BL	–0.20	–0.08	–0.29*	0.02	0.30*	–0.22	–0.02	–0.04	–0.04	–0.16	0.56*	0.56*	–
14 Cohen Hoberman Inventory of Physical Symptoms 3-month FU	–0.28*	–0.11	–0.34*	–0.11	0.40*	–0.28*	0.03	–0.03	–0.12	–0.18	0.54*	0.66*	0.79*

BL baseline, FU 3-month follow-up

* $p < 0.05$

Table 2

Descriptive statistics for participants ($n = 67$) in the high survivorship problems cluster who were included in the analytic sample

Variable	<i>n</i> (%)	Mean (SD)
Sex (female)	44 (65.7%)	
Age (years)		51.69 (12.03)
Marital status (married/partnered)	50 (74.6%)	
Race/ethnicity		
Non-Hispanic white	84 (85.7%)	
Non-white	14 (14.3%)	
Education		
High school or less	6 (9.0%)	
Partial college or trade school	14 (17.9%)	
Four-year college degree	21 (31.3%)	
Graduate degree	26 (38.8%)	
Type of transplant		
Autologous	28 (41.8%)	
Allogeneic	39 (58.2%)	
History of graft-versus-host disease	33 (49.3%)	
Number of other stem cell transplant complications		3.37 (1.66)
Number of medical comorbidities		1.61 (1.30)
Baseline BSI global score		0.98 (0.46)
Baseline CHIPS total score		39.11 (17.49)

BSI Brief Symptom Inventory, *CHIPS* Cohen Hoberman Inventory of Physical Symptoms

Table 3

Estimates for the indirect effect of positive emotion word usage as moderated by negative emotion word usage on psychological distress and physical symptoms

	Psychological distress (BSI)		Physical symptoms (CHIPS)	
	Indirect effect of positive emotion	95% CI for bootstrapping	Indirect effect of positive emotion	95% CI for bootstrapping
Expressive helping ($n = 17$)				
-1 SD negative emotion	-0.23	-0.59, 0.03	-3.31	-19.75, 10.41
Mean negative emotion	-0.21*	-0.53, -0.02	-2.67	-12.65, 7.09
+1 SD negative emotion	-0.19	-0.60, 0.04	-2.02	-12.85, 10.03

Outcomes are mean scores at the 3-month post-intervention follow-up, statistically controlling for the baseline value of the dependent variable and the relevant covariates for each outcome. The neutral writing condition ($n = 15$) served as the reference group

BSI Brief Symptom Inventory, *CHIPS* Cohen Hoberman Inventory of Physical Symptoms

* $p < 0.05$, as indicated by the 95% confidence interval for bootstrapping