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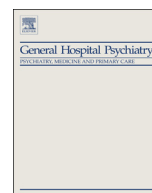
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journal homepage: <http://www.ghpjournal.com>Feasibility and utility of positive psychology exercises for suicidal inpatients[☆]

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ABSTRACT

Objective: The objective was to assess the feasibility and acceptability of nine positive psychology exercises delivered to patients hospitalized for suicidal thoughts or behaviors, and to secondarily explore the relative impact of the exercises.

Method: Participants admitted to a psychiatric unit for suicidal ideation or behavior completed daily positive psychology exercises while hospitalized. Likert-scale ratings of efficacy (optimism, hopelessness, perceived utility) and ease of completion were consolidated and compared across exercises using mixed models accounting for age, missing data and exercise order. Overall effects of exercise on efficacy and ease were also examined using mixed models.

Results: Fifty-two (85.3%) of 61 participants completed at least one exercise, and 189/213 (88.7%) assigned exercises were completed. There were overall effects of exercise on efficacy ($\chi^2 = 19.39$; $P = .013$) but not ease of completion ($\chi^2 = 11.64$; $P = .17$), accounting for age, order and skipped exercises. Effect (Cohen's d) of exercise on both optimism and hopelessness was moderate for the majority of exercises. Exercises related to gratitude and personal strengths ranked highest. Both gratitude exercises had efficacy scores that were significantly ($P = .001$) greater than the lowest-ranked exercise (forgiveness).

Conclusion: In this exploratory project, positive psychology exercises delivered to suicidal inpatients were feasible and associated with short-term gains in clinically relevant outcomes.

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1. Introduction

Patients who are psychiatrically hospitalized for a suicide attempt or suicidal ideation (SI) are at very high risk for suicide following discharge [1–3], with rates of suicide shortly postdischarge more than 100 times greater than the rate in the general population [4]. Despite this high risk of suicide, there has been relatively limited study of formal interventions to reduce suicidality during or shortly after psychiatric admission.

Existing interventions for suicidal patients (e.g., cognitive behavioral therapy [5,6] and dialectical behavior therapy [7,8]) typically target negative emotions and cognitions. However, positive cognitions

and emotions also appear to be important in reducing suicide risk, and reducing negative emotions may not automatically increase positive psychological states. For example, optimism and depression are only moderately correlated (median $r = -.43$ in 10 studies [9]), signaling that these constructs are not simply two sides of the same coin.

Optimism, gratitude and other positive states have been associated with reductions in hopelessness, suicidal ideation and suicide attempts, often independent of depression [10–16]. Positive emotions in suicidal patients have been linked to improved problem-solving [17], and a study of patients hospitalized for self-harm found that low positive future orientation more strongly predicted recurrent self-harm after discharge than did global hopelessness [18]. Therefore, explicit targeting of positive cognitive and emotional states like gratitude and positive future orientation may have effects on suicide risk above and beyond standard approaches.

Positive psychology (PP) interventions could represent an innovative and effective adjunctive tool for patients at high suicide risk. PP-based exercises focus on cultivating or amplifying a specific positive cognition or emotion. Representative interventions focus on

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expressing optimism, generating gratitude and reestablishing life purpose [19–22]. In contrast to more intensive interventions, PP exercises require minimal provider training, are often straightforward and enjoyable, and are accessible to a variety of patients, including those who cannot attend in-person appointments.

Overall, PP exercises have been successfully used by more than 4000 participants in over 50 clinical trials [20,21], though typically in nonclinical populations. However, PP exercises, including those focusing on gratitude, mindfulness and using strengths, have led to (often persistent) improvements in mood symptoms in patients with depressive symptoms [19,23,24], and a prior intervention on meaningful goals in older adults with suicidal thoughts led to greater self-efficacy and psychological well-being [25].

Such interventions have the potential to be useful for patients in crisis. These exercises could be easily administered to hospitalized patients, with the goal of increasing positive psychological states by discharge, when suicide risk is high. In addition, these interventions could be used postdischarge, and an efficient exploration of feasibility in suicidal patients could also inform that future implementation. Still, it has been unclear whether PP exercises would be feasible or acceptable in a broad population of hospitalized suicidal patients, or whether they would impact clinical outcomes in this seriously ill cohort, with valid concerns that such exercises may be a “bridge too far.”

Accordingly, in this study, we examined as a primary aim the feasibility and acceptability of nine PP exercises in patients admitted to a psychiatric unit for SI or a suicide attempt. Secondly, we sought to explore the self-reported efficacy of the exercises as a whole and to compare such efficacy ratings among individual exercises.

2. Methods

2.1. Study overview

This study assessed the feasibility of PP exercises among suicidal inpatients (clinicaltrials.gov identifier=NCT01398891). While hospitalized, participants completed one randomly assigned PP exercise daily under the guidance of a study trainer, self-assessed their optimism and hopelessness immediately before and after exercise completion, and rated the ease and utility of each exercise. Institutional Review Board approval was obtained prior to all study procedures.

2.2. Participants

Eligible participants were adults admitted to the inpatient psychiatric unit at an urban academic medical center, for SI or following a suicide attempt, between May 2011 and February 2013. The 24-bed inpatient psychiatric unit is housed within the general hospital and cares for a broad population of adults 18 years and older. Mood disorders are the most common primary diagnosis, although the unit cares for patients across the spectrum of psychiatric illness. The mean admission duration is approximately 9 days.

2.3. Inclusion and exclusion criteria

Inclusion criteria for the study were admission to the unit for SI (passive or active) or a suicide attempt confirmed by medical record. Potential participants were identified by review of the unit census, followed by a discussion with the patient’s attending psychiatrist to determine eligibility. Patients who expressed interest in an optional study were then assessed by a physician or social work investigator for exclusion criteria.

Patients were excluded if they were to be discharged within 24 h or were unable to meaningfully participate due to inability to communicate in English or cognitive deficits identified by a six-item screen [26]. Patients were also excluded if they had current psychotic

symptoms (identified via the Mini International Neuropsychiatric Interview) [27]. If patients met all study criteria, they were provided a verbal description of the study and written consent form, and informed consent was obtained from a licensed study investigator.

Of note, although primary admission diagnosis was recorded, patients were not excluded from the study based on their primary psychiatric diagnosis. While studying a more homogeneous sample of patients can increase internal validity, the goal of the project was to identify the acceptability and utility of PP exercises in a broad population of suicidal patients given that clinical implementation of the exercises in this setting would likely occur across diagnoses rather than in a single diagnostic cohort.

2.4. Study design

Prior to the recruitment phase, nine exercises were identified via published literature [19,28–39] or directly from researchers, and modified appropriately for this population. Additional text outlining the rationale and instructions for each exercise was added to create written packets for each exercise to be provided to patients. Staff members involved in intervention delivery (a licensed clinical social worker and a Bachelor’s-level research coordinator with relevant inpatient clinical experience) were trained in several stages. They reviewed a provider training manual created specifically for the project (exercise packets and training manual available from the authors); this manual described the rationale and procedures for each exercise, provided guidance for maintaining the focus of the interaction solely on the PP exercise and its review, and contained specific advice to convey to participants to facilitate completion of the given exercise (e.g., methods of brainstorming). Staff also completed relevant background reading about PP, observed sessions and completed all exercises in pairs to gain experience performing and reviewing each exercise. Once enrollment was ongoing, sessions were reviewed with the principal investigator, who provided feedback.

2.5. Exercises

The nine PP exercises were selected after literature review and consultation with senior team members. The exercises were as follows (with related citations):

- Gratitude letter [19,32,33]: Participants recalled another’s kind act and wrote a letter to the person that described feelings of gratitude associated with this event. Participants could send the letter if desired.
- Personal strengths [19,40]: Participants completed a brief survey of personal strengths, selected a strength (e.g., perseverance, humility) to be used deliberately in the next 24 hours and then wrote about how they used the strength and the outcome.
- Acts of kindness [34,35]: Participants performed three kind acts for others within a single day and wrote about the acts and the outcome.
- Important, enjoyable and meaningful activities [36]: Participants intentionally completed three acts in a single day — a pleasurable act done alone (e.g., reading), a pleasurable act done with others (e.g., playing cards), and a meaningful or important act (e.g., creating a blood sugar log) — and wrote about them.
- Counting blessings [19,28,37,38]: Participants recalled three events in the past week for which they were grateful and recorded them in detail.
- Best possible self (social relationships) [29,32,33]: Participants imagined and wrote about their best possible future interpersonal relationships and considered how to take steps toward these relationships.

- Best possible self (accomplishments) [29,32,33,39]: Participants imagined and wrote about their best possible future accomplishments and considered how to actualize this future.
- Forgiveness letter [30,41,42]: Participants selected a hurtful event that occurred at least 2 years prior and wrote a letter to a transgressor. The goal of the letter was to forgive the transgressor for at least some aspect of the event. The letter was not to be sent.
- Behavioral commitment to values-based activities [31]: Participants selected from an extensive list a principle that guided the way they hoped to live (e.g., being physically fit, creating beauty) and then made (and wrote about) a small step toward reconnecting with this principle.

2.6. Procedures

To help characterize this population, enrolled participants completed baseline measures of depression (Quick Inventory of Depressive Symptomatology–Self-Report [QIDS-SR] [43]), hopelessness (Beck Hopelessness Scale [BHS] [44]) and optimism (Life Orientation Test Revised [LOT-R] [45]). Baseline demographic and psychiatric characteristics were obtained through chart review.

After completion of baseline measures, a study trainer met with each participant for approximately 10 min to provide and review a brief introductory packet that described the rationale for using PP exercises in this setting. The trainer provided guidance on exercise completion and described the structure of the study (daily exercise completion, exercise ratings before and after completion, and daily meetings to review exercises).

The participant was then assigned a PP exercise to be completed in the next 24 h. The order of exercise assignment for each participant was determined via random number generator. The trainer provided a written exercise packet, and participants were told to complete the activity and write about it in the packet.

At the front of each exercise packet was a preexercise rating sheet with a pair of five-point Likert scales on which participants rated their current levels of optimism and hopelessness (1 = *not at all optimistic*, 5 = *completely optimistic*; 1 = *not at all hopeless*, 5 = *very hopeless*); this was completed immediately prior to undertaking the exercise. After exercise completion and before review with the study trainer, participants completed a postexercise rating sheet at the end of the packet. This sheet included the same scales for optimism and hopelessness, along with scales regarding ease of completion (1 = *not at all easy*, 5 = *very easy*) and overall utility (1 = *not at all helpful*, 5 = *very helpful*). Finally, the sheet contained open-ended questions about how the exercise was useful and how it could be improved.

We chose hopelessness and optimism as key outcome measures due to their established links to suicidality [10–12]. Hopelessness has been associated with completed suicide, independent of severity of mood symptoms [46,47], and therefore we chose hopelessness rather than depression as our primary negative psychological measure, especially given the transdiagnostic nature of our study cohort. We chose to utilize this guided self-help approach (rather than creating a psychotherapeutic intervention) to provide participants some support and guidance around exercise completion without developing an intervention that would require extensive training, schooling or cost. These factors are aligned with suggestions to create interventions packaged for wide dissemination [48].

Each weekday, following exercise completion, the study trainer met with the participant to discuss the prior exercise and to assign a new exercise. These meetings typically lasted 15 min. On weekends, participants were assigned two exercises, and both were reviewed the following Monday. Participants' involvement was complete at discharge or after completion of all nine exercises, whichever came first. If an exercise was not completed, it was skipped. If participants had clear clinical worsening or expressed suicidal thoughts, study staff

personally notified clinical teams and asked participants if they wished to suspend participation.

2.7. Statistical analyses

Descriptive statistics (e.g., proportions, means) were calculated for baseline characteristics and all individual exercise ratings. Independent-samples *t* tests and χ^2 analyses were used to compare baseline characteristics between participants who completed at least one exercise and those who did not.

The primary goal of the study was to assess the feasibility and acceptability of the exercises as a whole. To assess these metrics, we calculated the proportion of enrolled participants who completed at least one exercise, rates of overall exercise completion and mean number of exercises completed per participant.

The secondary goal of our study was to rank the exercises to identify the most promising interventions for future study. To compare metrics among individual exercises, we recorded rates of exercise completion, pre–post changes in optimism and hopelessness, and ratings of ease and utility for each exercise. Given that there were multiple ratings of exercise efficacy, we created, a priori, an *efficacy score* that combined three ratings (pre-/postexercise change in hopelessness + pre–post change in optimism + overall utility = *efficacy score*, with higher scores indicative of greater efficacy) for completed exercises.

Given that not all subjects completed each exercise and to account for the order of exercise administration and age (given data about greater impact of PP exercises in older adults [20]), we compared scores across the exercises on all outcome variables (change in hopelessness, change in optimism, utility, ease, *efficacy score*) using mixed-effects regression models with a patient-specific random effect and fixed effects for age and exercise order. Using this model, adjusted means for each outcome and exercise were calculated, and a global test comparing all exercises was used to assess whether there was a significant overall effect of exercise on outcomes independent of exercise order or age.

Since participants occasionally did not complete an assigned exercise, two approaches were used for analysis in the presence of missing data. The first approach analyzed all available data assuming that noncompletion of an exercise was uninformative about the missing value and therefore used the *efficacy score* and ease as described above. Because subjects with missing data may have failed to complete an exercise because the exercise was difficult or had poor perceived utility for the subject, a second approach created a *modified efficacy score* that assumed no pre–post change and assigned the lowest utility score when an exercise was not completed. After the value was imputed, the same mixed model from above was used for analysis. We similarly created a *modified ease score* using for uncompleted exercises.

In addition, unadjusted (i.e., raw) pre–post changes in optimism and hopelessness for each individual exercise were also investigated using paired *t* tests. From this analysis, we calculated Cohen's *d* (effect size [49]) and the proportion of participants experiencing a pre–post improvement of one or more points in hopelessness and optimism (if not at the ceiling value on the preexercise rating). All quantitative analyses were performed using Stata version 11.0 (StataCorp, College Station, TX, USA); all tests were two-tailed.

Finally, open-ended qualitative responses were transcribed and independently reviewed for themes by two staff members with experience in qualitative research. A list of themes was generated and combined, with disagreements resolved via discussion and review of the primary material.

3. Results

Fig. 1 displays the recruitment and enrollment flow for the study. Fifty-two (85.3%) of 61 consenting participants completed baseline

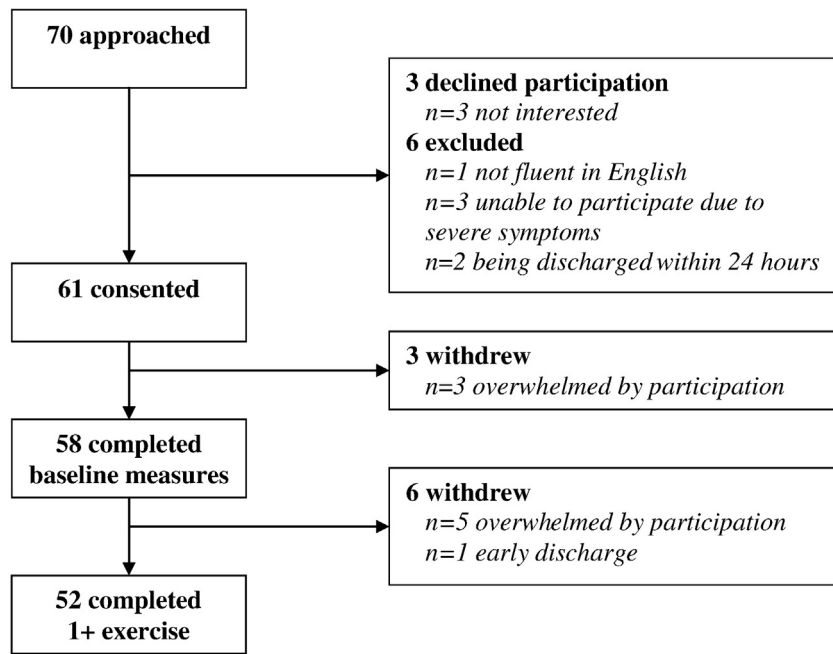


Fig. 1. Diagram of recruitment and enrollment.

measures and at least one exercise. Participants who completed at least one exercise did not differ significantly on any baseline characteristic from those who dropped out (all $P > .10$).

Table 1 displays the baseline characteristics of the 52 participants who completed at least one exercise. Major depressive disorder was the primary diagnosis in 82.7% ($n = 43$) patients. Participants had moderate to severe depression at enrollment (QIDS-SR=16.49 [standard deviation {S.D.} 6.08]; cutoff for severe depression=16 [43]) and moderate to severe hopelessness (BHS=11.37 [S.D. 5.80]; cutoff for high suicide risk=9 [50]). In total, 189 (88.7%) of 213 assigned exercises were completed, with participants completing a mean of 3.63 (S.D. 1.93) out of 4.10 (S.D. 2.05) assigned exercises. The most common reported reason for exercise noncompletion was insufficient time ($n = 9$).

Table 2 displays participant ratings using adjusted means calculated via mixed models and the proportion of participants who completed each exercise. Individual exercise completion ranged from 77% (best possible self social relationships) to 100% (counting blessings). Pre-post optimism and hopelessness improved across exercises, with adjusted mean change between 0.24 and 1.12 for optimism and between 0.30 and 1.20 for hopelessness.

With respect to individual exercise efficacy, there was a global effect of exercise on modified efficacy scores, independent of age and exercise order ($\chi^2 = 19.39$; $df = 8$, $P = .013$), suggesting that exercise content had a significant effect on efficacy. Regarding specific exercises, the gratitude letter, counting blessings and personal strengths exercises had the highest efficacy and modified efficacy scores, whereas the forgiveness letter, best possible self (social relationships) and values-based activities exercises had the lowest efficacy and modified efficacy scores. Though pairwise comparisons were not specified beforehand, exploratory analyses demonstrated that the forgiveness letter had a significantly lower adjusted mean modified efficacy score than the gratitude letter (adjusted mean difference=1.9 [95% confidence interval {CI} 0.8–3.0]; $P = .001$) and counting blessings (adjusted mean difference=1.8 [95% CI 0.7–2.9]; $P = .001$) independent of age and exercise order; these effects remain significant after Bonferroni correction.

Modified ease scores (Table 2) suggested that four exercises (acts of kindness; important, enjoyable and meaningful activities; gratitude letter and personal strengths) ranked highest (adjusted mean modified ease scores=3.50–3.55 among these four exercises), while forgiveness

letter (adjusted score=2.70) ranked lowest. There was no significant effect of exercise on modified ease scores ($\chi^2 = 11.64$; $df = 8$; $P = .17$).

Paired t test analyses (Table 3) demonstrated that unadjusted pre-post changes in optimism and hopelessness were statistically significant ($P < .01$ in most cases) for all exercises except the forgiveness letter, which had a nonsignificant change in optimism ($P = .38$). At least half of participants experienced a one-point improvement in optimism and hopelessness for each individual exercise except the forgiveness letter. Cohen's d for each exercise other than the forgiveness letter ranged from 0.48 to 1.19 for both optimism and hopelessness.

The majority of qualitative comments were positive (138 of 190 comments [72.3%]), with most comments focusing on the high ease of

Table 1
Baseline demographic, diagnostic and self-report data

Characteristic	Participants completing at least 1 exercise ($n = 52$)
Age (mean [S.D.])	41.63 (14.68)
Women (n [%])	33 (63.5%)
Caucasian (n [%])	49 (94.2%)
Primary diagnosis (n [%])	
Major depressive disorder	43 (82.7%)
Bipolar affective disorder	6 (11.5%)
Generalized anxiety disorder	1 (1.9%)
Eating disorder	1 (1.9%)
Posttraumatic stress disorder	1 (1.9%)
Insurance (n [%])	
Uninsured/free care/connector health plan	7 (13.5%)
Medicare	12 (23.1%)
Medicaid	8 (15.4%)
Commercial	25 (48.1%)
Baseline scores (mean [S.D.])	
LOT-R—Total	15.00 (6.24) ^a
LOT-R—Optimism	7.55 (3.61) ^a
LOT-R—Pessimism	7.45 (3.35) ^a
BHS	11.37 (5.80) ^b
QIDS-SR	16.49 (6.08) ^c

Note. All scores based on $n = 52$ unless otherwise noted.

^a $n = 51$.

^b $n = 49$.

^c $n = 45$.

Table 2
Pre-/postexercise ratings (exercises listed in order of adjusted *modified efficacy score*)

Exercise Completed/assigned	Change in hopelessness	Change in optimism	Utility	Efficacy	Modified efficacy	Ease	Modified ease
Gratitude letter 21/23 (91.3%)	1.00 (0.20)	1.13 (0.22)	3.84 (0.22)	5.90 (0.44)	5.59 (0.47)	3.69 (0.24)	3.50 (0.28)
Counting blessings 25/25 (100%)	0.69 (0.19)	0.78 (0.20)	4.01 (0.20)	5.48 (0.40)	5.52 (0.46)	2.97 (0.23)	2.97 (0.27)
Personal strengths 16/18 (88.9%)	0.81 (0.23)	0.79 (0.25)	4.25 (0.25)	5.79 (0.50)	5.29 (0.53)	3.91 (0.28)	3.53 (0.32)
Acts of kindness 18/21 (85.7%)	1.20 (0.22)	0.83 (0.23)	3.59 (0.23)	5.65 (0.47)	5.02 (0.49)	3.91 (0.26)	3.55 (0.29)
Important, enjoyable and meaningful activities 25/26 (96.2%)	0.59 (0.19)	0.78 (0.20)	3.87 (0.20)	5.22 (0.41)	4.86 (0.45)	3.75 (0.23)	3.51 (0.27)
Best self (accomplishments) 22/25 (88.0%)	0.76 (0.20)	0.76 (0.21)	3.31 (0.21)	4.82 (0.42)	4.48 (0.45)	3.20 (0.24)	2.98 (0.27)
Behavioral commitment to values-based activities 18/19 (94.7%)	0.50 (0.23)	0.58 (0.25)	3.49 (0.24)	4.60 (0.49)	4.32 (0.54)	3.38 (0.28)	3.17 (0.32)
Best self (social relationships) 20/26 (76.9%)	0.84 (0.21)	0.53 (0.23)	3.79 (0.22)	5.17 (0.45)	4.12 (0.46)	3.93 (0.25)	3.19 (0.27)
Forgiveness letter 24/30 (80.0%)	0.30 (0.19)	0.24 (0.20)	3.77 (0.20)	4.34 (0.41)	3.69 (0.41)	3.14 (0.23)	2.70 (0.25)
Overall 189/213 (88.7%)	0.73 (0.09)	0.71 (0.10)	3.77 (0.10)	5.20 (0.21)	4.72 (0.22)	3.51 (0.12)	3.21 (0.12)

Note. Ratings are adjusted means and standard errors from random-effects model accounting for age and exercise order. All ratings based on five-point Likert scales. Modified efficacy index and ease scores accounted for participants who were assigned but did not complete an exercise.

completion and generation of positive emotions related to the exercises; negative comments focused on feeling too overwhelmed to complete the writing portion or to carry out an activity requiring interpersonal engagement. A substantial ($n=9$) number of negative comments were related to the *forgiveness letter*, with themes related to the aversive nature of recalling a past slight and having negative feelings emerge when writing about the event.

4. Discussion

In a population of suicidal patients with high levels of hopelessness and depression, on our primary aim, we found that administration of PP exercises was feasible and well accepted. Nearly 90% of assigned exercises were completed, a substantial finding considering that

participants were in crisis and receiving additional intensive treatment. However, a small proportion of participants were unable to participate in exercise completion, suggesting that a subset of this population may be too severely ill or distressed to engage even in this simple intervention.

Furthermore, regarding our secondary aim, PP exercises were associated with improvement of hopelessness and optimism, central therapeutic targets in this clinical cohort because of their independent links to suicidal thoughts and behaviors [50,51], with moderate effect sizes on these key outcomes. This suggests that PP interventions may impact meaningful clinical outcomes, at least in the short term, in this important high-risk cohort.

The number of previous exercises completed had the potential to impact outcome assessments. We addressed this in two ways. First,

Table 3
Paired *t* tests assessing pre- and postexercise changes in hopelessness and optimism, separated by exercise

Exercise	Mean improvement ^a	95% CI	<i>t</i>	<i>P</i> value	Cohen's <i>d</i> (mean/S.D.)	Improvement
Pre/post change in hopelessness						
Counting blessings	0.64	0.27–1.01	3.53	0.002	0.71	12/21 (57.1%)
Best self (accomplishments)	0.77	0.30–1.25	3.40	0.003	0.72	11/19 (57.9%)
Best self (social relationships)	0.80	0.33–1.27	3.56	0.002	0.80	10/17 (58.8%)
Forgiveness letter	0.29	0.06–0.52	2.60	0.016	0.53	6/22 (27.3%)
Gratitude letter	1.05	0.60–1.49	4.93	<0.001	1.08	14/16 (87.5%)
Important, enjoyable and meaningful activities	0.68	0.35–1.01	4.24	<0.001	0.85	8/16 (50.0%)
Acts of kindness	1.17	0.65–1.69	4.74	<0.001	1.12	12/13 (92.3%)
Personal strengths	1.00	0.35–1.65	3.30	0.005	0.83	8/15 (53.3%)
Values-based activities	0.50	0.41–0.96	2.30	0.035	0.54	8/16 (50.0%)
					<i>Across all:</i>	95/157 (60.5%)
Pre/post change in optimism						
Counting blessings	0.80	0.28–1.32	3.18	0.004	0.64	11/21 (52.4%)
Best self (accomplishments)	0.73	0.29–1.16	3.46	0.002	0.74	13/19 (68.4%)
Best self (social relationships)	0.50	0.01–0.99	2.13	0.047	0.48	9/17 (52.9%)
Forgiveness letter	0.13	–0.16–0.41	0.90	0.38	0.18	5/22 (22.7%)
Gratitude letter	1.14	0.70–1.58	5.43	<0.001	1.19	15/16 (93.8%)
Important, enjoyable and meaningful activities	0.76	0.44–1.08	4.88	<0.001	0.98	15/18 (83.3%)
Acts of kindness	0.78	0.12–1.43	2.52	0.022	0.59	9/13 (69.2%)
Personal strengths	0.81	0.25–1.37	3.10	0.007	0.78	9/15 (60.0%)
Values-based activities	0.44	0.09–0.79	2.68	0.016	0.63	8/16 (50.0%)
					<i>Across all:</i>	95/173 (54.9%)

^a On 1–5 Likert scale. Improvement scores based on participants with greater than or equal to one-point (positive) changes in hopelessness and optimism. Denominator based on participants who completed exercises but did not have ceiling scores for prehopelessness or preoptimism.

we accounted for potential improvements in preexercise baseline ratings over time by measuring pre/post changes in optimism and hopelessness (rather than just postexercise scores). In addition, the random-effects model (estimating the effect of each exercise) accounted for the ordering of the exercise, suggesting that differences in outcomes for different PP exercises were not caused solely by differences in the number of previous exercises completed.

Though the primary goal of this pilot project was to assess overall feasibility and utility, we found meaningful variability in the degree to which exercises were experienced as easy to complete and clinically useful. Though the cumulative effect of the package of exercises may have influenced outcomes, the global test of exercise efficacy found that specific exercise type, independent of exercise order, was significantly associated with self-reported efficacy.

Straightforward exercises that did not require substantial introspection appeared to perform best. For example, exercises on gratitude—the *gratitude letter* and *counting blessings*—had high utility scores and were associated with substantial improvements in optimism. This finding is consistent with prior work that has linked gratitude to lower levels of depression, hopelessness and suicidal thoughts/attempts [13,52–56], though is in some contrast to a study that found a gratitude letter to reduce depressive symptoms in mildly, but not more severely, depressed participants [57]. The exercise focusing on a personal strength was also associated with substantial improvements in this population and was perceived as easy to complete, consistent with prior work finding this exercise to be associated with prolonged improvement in depressive symptoms [19].

In contrast, the *forgiveness letter* exercise performed most poorly. Qualitatively, many patients experienced a resurgence of anger or sadness when recalling a past slight and found it difficult to move past these feelings in the midst of crisis [58]. In addition, exercises focused on life purpose and optimism had lower efficacy ratings than most other exercises (though with Cohen's $d > .4$ on optimism and hopelessness in all cases). Asking patients to take on 'big' issues such as life purpose or imagining an optimal future might have been more difficult for some patients at this stage. Alterations in delivery or timing (e.g., after some symptom recovery) might render these exercises more useful in this population.

This preliminary study had several limitations. Our sample was a largely Caucasian population on a single psychiatric unit. There were no sham or control exercises. Participants concurrently received psychological and psychopharmacological interventions during admission, although ratings were completed in the narrow window between exercise initiation and completion, minimizing potential "noise" from other interventions. However, this meant that we were not able to assess the overall/cumulative effect of the exercises as a package. Additionally, patients may have felt compelled to rate higher improvements in symptoms after exercise completion than before, either to justify their participation or to please the researchers, although as noted there were substantial differences in improvement among various exercises. Finally, in this initial study that was primarily aimed at feasibility (and short-term effects on optimism and hopelessness), we did not serially measure suicidality via a validated scale or obtain postdischarge outcomes, and thus, we cannot make claims about the ultimate impact of these exercises on suicide risk postdischarge.

In conclusion, PP exercises administered to suicidal inpatients were well accepted, were completed at high rates and appeared to be associated with self-rated improvements in clinically relevant short-term outcomes. Specific exercises, especially those related to gratitude and using personal strengths, appeared to be most effective in this context. Additional work is needed to confirm this pilot work, refine suboptimal exercises, test the exercises in a larger cohort with a control group and assess their impact on longer-term outcomes.

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