Usefulness of a Positive Psychology-Motivational Interviewing Intervention to Promote Positive Affect and Physical Activity After an Acute Coronary Syndrome

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Most patients are not able to achieve recommended levels of physical activity following an acute coronary syndrome (ACS). Existing interventions to promote activity have not focused on promoting psychological well-being, which is independently linked to superior cardiac health. To address this gap, we developed and tested a combined positive psychology-motivational interviewing (PP-MI) intervention in post-ACS patients to assess its feasibility and explore potential benefits in an initial randomized trial. We compared a 12-week, phone-delivered, PP-MI intervention to an attention-matched, MI-based health education control condition among 47 post-ACS patients with low baseline health behavior adherence. Feasibility/acceptability were assessed through rates of session completion and participant session ratings; we also explored between-group differences in positive affect, other self-reported outcomes, and accelerometer-measured physical activity, through mixed effects regression models, at 12 and 24 weeks. PP-MI participants completed a mean of 10.0 (standard deviation 2.2) sessions (84%), and mean participant ratings of sessions' ease/utility were >8/10, above a priori thresholds for success. Compared with the control condition, PP-MI was associated with greater improvements in positive affect at 12 and 24 weeks (12 weeks: estimated mean difference [EMD] = 3.90 [SE = 1.95], p = 0.045, effect size [ES] = 0.56; 24 weeks: EMD = 7.34 [SE = 2.16], p <0.001, ES = 1.12). PP-MI was also associated with more daily steps at 12 weeks (EMD = 1842.1 steps/day [SE = 849.8], p = 0.030, ES = 0.76) and greater moderate-vigorous activity at 24 weeks (EMD = 15.1 minutes/day [SE = 6.8], p = 0.026, ES = 0.81).

In conclusion, PP-MI was feasible in post-ACS patients and showed promising effects on well-being and physical activity; additional studies are needed to confirm these findings. **(Am J Cardiol 2019;123:1906−1914)**

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Physical activity following an acute coronary syndrome (ACS) is strongly and independently associated with superior prognosis and lower rates of cardiac rehospitalizations,[1] yet the majority of post-ACS patients do not achieve recommended levels of activity.[2] Existing programs (e.g., cardiac rehabilitation) to promote activity may be beneficial, but they are typically time-intensive and attended by only a minority of patients.[3] Positive psychology (PP) interventions promote well-being concepts such as optimism and positive affect that are independently associated with superior cardiac outcomes and greater physical activity.[4] These interventions are simple, well-accepted, can be delivered remotely, and require little provider training compared with more intensive existing programs. In a prior intervention optimization study in post-ACS patients, a multipronged program that combined PP with a traditional behavioral approach (motivational interviewing [MI]) was associated with greater improvements in post-ACS health behavior adherence than PP alone or a prior treatment as usual cohort.[5] However, such a PP-MI program had never been studied against a control condition in post-ACS patients. Accordingly, we completed an

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initial randomized trial of the PP-MI intervention in ACS patients, compared with an MI-based health education condition, to assess feasibility and explore potential impact on positive affect, accelerometer-measured activity, and other clinical outcomes.

Methods

The Positive Emotions after Acute Coronary Events project used the Multiphase Optimization Strategy[6] to develop and optimize a PP-based intervention to promote physical activity in post-ACS patients. The current phase (Positive Emotions after Acute Coronary Events-IV), following qualitative, proof-of-concept, and factorial trial phases,[5,7] aimed to examine the feasibility and preliminary impact of an optimized 12-week, phone-delivered PP-MI intervention in an initial randomized trial. See CONSORT checklist (Supplementary Table 1) for additional detail. The study was pre-registered with clinicaltrials.gov (NCT03122184). Institutional Review Board approval was obtained before study initiation, and all participants provided informed consent.

Specifically, participants were adults admitted to an inpatient cardiology unit for an ACS (myocardial infarction or unstable angina) at 1 of 2 urban academic medical centers between May 2017 and April 2018 who had suboptimal health behavior adherence. For ACS, participants met international criteria for myocardial infarction[8] or study criteria for unstable angina, which per prior studies[9] required new angina within 2 months, exacerbation of existing angina at rest or with minimal exercise, or angina within 2 weeks of a myocardial infarction. Health behavior adherence was measured using Medical Outcomes Study Specific Adherence Scale (MOS-SAS)[10] items for diet, medications, and activity. Suboptimal adherence was defined as a summed MOS score $\leq$14/18, or total score of 15 with a physical activity score $\leq$5. Patients were excluded if they demonstrated cognitive deficits on 6-item screen,[11] had a condition likely to lead to death within 6 months, or were unable to communicate in English or participate in physical activity.

Potential participants were identified through daily review of inpatient census lists, and medically eligible patients were approached, with their permission, during hospitalization. Study staff performed assessments for exclusion criteria (e.g., cognitive screening), and for willing and eligible patients, study staff obtained informed consent and scheduled a baseline study visit. We aimed to enroll 65 hospitalized patients to have a minimum of 40 randomized patients, given an expected dropout rate of one-third of patients in the first 2 weeks post-ACS due to medical issues (e.g., readmissions) and other factors, based on our prior work.[5]

At an initial study visit 2 weeks postdischarge, participants completed baseline self-report questionnaires and were then randomized (1:1) to PP-MI or the MI-based health education condition through slips of paper (generated through random number generator) in sealed envelopes. After randomization, participants in both groups completed an in-person session with a study interventionist (psychologist or social worker), in which the interventionist provided a condition-specific treatment manual (see Supplementary Tables 2 and 3 for sample pages), reviewed the program's rationale and the first week's material, and assigned an initial exercise/activity. Finally, all participants received a copy of the hospitals' *Caring for Your Heart* handbook and an Omron waist-worn pedometer to assist with increasing physical activity.

Regarding the PP-MI intervention, following the initial study visit, participants completed 12 weekly, 30 to 45 minute PP-MI phone sessions with a study interventionist. The PP-MI intervention contained a PP component that focused on the completion of PP-based activities and integration of related skills into daily life and a separate MI component that utilized MI principles (and goal setting) to specifically promote physical activity. Pages from the PP-MI manual are provided in Supplementary Table 2 (full manual available from authors).

The PP exercises were chosen based on the literature[12] and the team's prior work delivering PP interventions.[5] Each PP session involved a specific weekly topic and exercise (e.g., writing a letter of gratitude and using a personal strength; see Table 1). Interventionists explained each PP exercise through guided review of the treatment manual; participants then completed exercise(s) independently during the week and wrote about the exercise and its effects. The following week, the interventionist helped participants to translate PP skills to promote well-being in daily life, and introduced a new PP exercise for the following week.

For the MI portion of the intervention (Table 1), interventionists utilized an overall "5A's" strategy (Ask, Advise, Assess, Assist, and Arrange) with participants. Each week, a specific MI-related topic (e.g., identifying pros and cons of increasing activity, setting SMART goals) was also reviewed with participants, and in-session activities focused on these skills. Participants set a physical activity goal each week; this goal was reviewed the following week.

Phone sessions were recorded. At weekly study interventionist meetings, interventionists listened to sessions with the team's behavioral intervention supervisors (CC, RM), who also rated sessions for fidelity to the PP and MI components of the intervention using a customized 14-point team-created scale developed and utilized in our prior studies[5,7]; control condition sessions were also recorded, reviewed, and rated for fidelity and cross-condition contamination.

An MI-based health behavior education intervention was selected to provide a relevant, attention-matched control condition. Although published intervention development and stage models[13] often recommend a treatment as usual control at this stage (NIH Stage 1b), we used a more intensive control condition to better explore the intervention's impact at this early stage.

The intervention provided health education content and utilized MI principles to assist participants in understanding important cardiac health behaviors and make changes to these behaviors (e.g., considering pros/cons and importance/confidence in change). The focus of the intervention was on multiple health behaviors, including physical activity, diet, and medication adherence, and had a parallel structure to the experimental arm. Specifically, the intervention manual combined MI-specific topics with health

Table 1
Components of the positive psychology-motivational interviewing intervention

Week	PP component activity assigned[†]	MI component topic discussed[‡]
0[*]	*Gratitude for positive events* • Participants recall three events in the prior week that led to satisfaction, happiness, or other positive states.	*Moving for better health/activity tracking* • Participants review their current activity level, set a specific physical activity goal, and discuss the importance and confidence in making the change as well as the pros/cons of changing their activity.
1	*Gratitude letter* • Participants write a letter of gratitude thanking a person for an act of kindness; the letter can be shared if desired.	*Setting a SMART physical activity goal* • Participants learn about and set a SMART (specific, measurable, attainable, relevant, and time-based) behavioral goal.
2	*Capitalizing on positive events* • Participants recall three recent positive events, then share the details with others or otherwise record/celebrate the events.	*Barriers and problem solving* • Participants consider past and anticipated barriers and facilitators to being more physically active. They continue to refine/set new goals.
3	*Using gratitude in daily life* • Participants focus on implementing gratitude-based interventions and skills into daily life.	*Reviewing and reflecting on physical activity* • Participants reflect on their physical activity in prior weeks and their progress toward their overall activity goal. Participants are mailed a graph of their weekly step counts over the past four weeks.
4	*Remembering past successes* • Participants recall a prior event in which they experienced success. They then write about the event, the positive feelings evoked, and their contribution to the success.	*Finding new routes* • Participants explore their neighborhood using a systematic audit tool and identify new places to walk.
5	*Using personal strengths, part 1* • Participants choose a personal strength and then use it in a new way over the subsequent week.	*Using neighborhood and equipment resources* • Participants consider neighborhood resources that could help them be active, and equipment they have or need that could promote activity.
6	*Using personal strengths, part 2* • Participants choose an additional personal strength and then use it in a new way over the subsequent week.	*Using social resources, making small changes* • Participants discuss how their social resources can be used to promote physical activity. Participants also consider ways to introduce small amounts of physical activity into their daily schedules.
7	*Using strengths in daily life* • Participants focus on implementing strengths-based interventions and skills into daily life.	*Reviewing and reflecting on physical activity* • Participants reflect on their physical activity in prior weeks and their progress toward their overall activity goal. Participants are mailed a graph of their weekly step counts over the past eight weeks.
8	*Enjoyable and meaningful activities* • Participants complete activities that bring immediate boosts in mood and others that are more deeply meaningful.	*Continuing progress and managing 'slips'* • Participants learn about managing 'slips' off track from their goals.
9	*Performing acts of kindness* • Participants complete three acts of kindness in one day, then write about how the acts made them feel.	*Reducing sitting time* • Participants assess the amount of time they spend sitting during the day and discuss strategies for reducing their sitting time.
10	*The "Good Life"* • Participants write about an ideal life over the next year in one or more domains, such as health or relationships.	*Standing breaks* • Participants discuss the benefits of standing breaks and brainstorm strategies for incorporating regular standing breaks.
11	*Focusing on life meaning* • Participants focus on implementing enjoyment- and values-based activities and skills into daily life.	*Increasing strength through exercise* • Participants learn about the benefits of strength training and discuss ways to perform such training. Participants are mailed a graph of their weekly step counts over the past twelve weeks.
12[§]	*Planning for the future* • Participants review their favorite exercises and make a plan for continuing to use their PP-based skills in the future.	*Reviewing progress and considering the future* • Trainers assist participants with reviewing their accomplishments and help them to create a plan for physical activity for the near future.

MI = motivational interviewing; PP = positive psychology.

[*] In-person study visit.

[†] Each week, in the PP component of the intervention, the study interventionist assists the participant in considering how to apply skills from the PP exercise in daily life.

[‡] Each week in the MI component of the intervention, the interventionists also use the 5A's model to: (a) *ask* participants about their physical activity goals, (b) *advise* them about current activity guidelines and/or refer them to their treatment team, (c) *assess* readiness to set an activity goal, (d) *assist* participants in clarifying their goals and problem-solving barriers to reaching those goals, and (e) *arrange* for the next session by summarizing the participant's plan for the physical activity goal and scheduling the next session.

[§] Participants in the PP-MI group also receive a journal after completing the 12-week intervention. In their final phone session, they are advised to use the journal to monitor positive psychological states and/or physical activity.

education content (e.g., education about self-monitoring, benefits of physical activity on heart disease). Participants had weekly phone sessions with the study interventionist to learn about specific health behaviors, describe their current level of engagement in these behaviors, identify ways to improve engagement, problem-solve barriers, and identify resources to improve adherence. The interventionist utilized MI principles throughout these sessions (see pages from intervention manual and overall intervention outline, Supplementary Tables 3 and 4). The same study clinicians were interventionists for the PP-MI and the MI-based education group.

Regarding data collection and study outcomes, baseline sociodemographic and medical data were gathered through participant interview at the initial study visit supplemented by chart review. Self-report outcome measure assessments were administered at baseline (prerandomization) and at 12 and 24 weeks by blinded study staff; accelerometer data (see later) to obtain objective information on physical activity was downloaded at follow-up time points.

The study's primary aim was to assess PP-MI feasibility and acceptability. For feasibility, interventionists recorded whether participants successfully completed phone sessions each week (i.e., completion of PP-based activity plus completion of phone call [with MI-based goal-setting] with interventionist). For acceptability, after PP exercise completion (e.g., recalling positive life events), participants separately rated the ease and helpfulness (utility) of that week's PP exercise on a 0 to 10 Likert scale (0 = very difficult, not at all helpful; 10 = very easy, very helpful). Likewise, participants rated the ease and utility of the MI component of the prior week's session on the same 0 to 10 scale. Interventionists collected these ratings from participants at weekly calls.

The study's secondary aim was to explore between-group differences in impact on positive affect (main psychological target) and physical activity (measured through accelerometer), along with other psychological, functional, and behavioral outcomes at 12 and 24 weeks.

Positive affect was the proximal target of the intervention and our main psychological outcome given its links to health outcomes and sensitivity to change.[14] Positive affect was measured through the positive affect subscale of the Positive and Negative Affect Schedule (PANAS[15]; range 10 to 50; internal consistency [α] in this sample = 0.89). Dispositional/trait optimism was measured through the Life Orientation Test—Revised[16] (range 0 to24; α in this sample = 0.81). Depression and anxiety were measured through the Hospital Anxiety and Depression Scale[17] subscales for depression and anxiety (HADS-D, HADS-A; range 0 to 21; α = 0.69 [depression] and 0.85 [anxiety]).

Physical activity, the main overall intervention target, was measured through waist-worn Actigraph G3TX+ accelerometer (Actigraph, Pensacola, Florida) for 1 week, at weeks 12 and 24. Accelerometers were sent to participants before the 12- and 24-week assessments and returned by mail. Consistent with prior research,[18] participants were required to have 8 hours of wear time for 4+ days; accelerometers were returned to participants for additional wear as needed. We did not record activity at baseline given that participants were within 2 weeks of ACS and had highly variable ability and medical clearance to be active at that stage. However, data on pre-ACS activity was collected using the International Physical Activity Questionnaire[19] to control for baseline activity in study analyses.

Moderate-to-vigorous physical activity (MVPA) and steps were the main study measures of activity. We utilized MVPA given its links to health outcomes, including mortality,[20] with the cutoff for MVPA set at 1,952 counts/min. We also used total steps given increasing data that even lighter intensity activity is associated with superior medical prognosis.[21]

Additional functional and behavioral measures included physical function, measured through the 12-item Duke Activity Status Index.[22] Mental and physical health-related quality of life (HRQoL) were measured using the widely-used 12-item Medical Outcomes Study Short Form-12 (SF-12) scale.[23] Finally, we measured composite health behavior adherence (to diet, activity, and medications) through the MOS items for these behaviors.

For data analysis, descriptive statistics (means, standard deviations [SDs], proportions) were used to summarize baseline characteristics of randomized participants, with chi-square analyses and independent samples *t* tests used to examine between-group differences. For feasibility (primary aim), descriptive statistics were used to record the mean number of completed sessions (out of 12 possible weekly sessions). For acceptability, we calculated the means and SDs of the ease/utility scores for the PP and MI components of the intervention, for a total of 4 separate mean scores. A priori, we set 70% completion of assigned sessions and mean ratings of 7.0/10 on ease/utility scales as benchmarks for feasibility and acceptability, based on prior work on psychological-behavioral interventions using similar scales and thresholds.[5]

For our exploratory analyses of between-group differences in study outcomes, we used an intent-to-treat model. For positive affect and all other self-reported outcome measures, we used mixed effects regression models with an unstructured covariance matrix to examine between-group differences in change from baseline on each outcome at 12 and 24 weeks. For analysis of physical activity (MVPA and steps), we likewise used mixed effects models to calculate between-group differences in activity at 12 and 24 weeks, controlling for pre-ACS physical activity through the International Physical Activity Questionnaire. We analyzed for statistical significance (using 2-tailed alpha = 0.05 as a threshold in this exploratory trial) and, given that this initial study was not designed/powered to detect significant between-group differences, calculated effect size (ES) differences by dividing the coefficient (estimated mean difference [EMD]) by the estimated SD of the outcome measure at the time point of interest. We performed exploratory analyses using a median split at baseline adherence (MOS) to assess the impact of the intervention on positive affect and physical activity in those with very low adherence compared with those with higher but suboptimal adherence. Analyses were performed through Stata 15.2 (StataCorp: College Station, Texas).

For sample size calculations/power analysis, we used prior studies of PP-based interventions in cardiac patients. In such studies, 81% of all possible sessions were completed[5]; using this data and 24 participants assigned to

PP-MI, this study was powered at over 80% to detect a true proportion of ≥70% sessions completed assuming a moderate SD of 15%. For acceptability, using prior ratings for ease and utility of sessions (mean 7.9 [SD 2.2]),[5] this study had over 95% power to detect mean ratings of ≥7.0 for each of the ease and utility scales. This initial study was not designed to detect between-group differences in study outcomes with N=47.

Results

Forty-seven post-ACS patients (PP-MI: n = 24; control: n = 23) were enrolled and randomized (see CONSORT diagram, Figure 1). Baseline sociodemographic, medical, and psychological characteristics are provided in Table 2. Follow-up data were obtained from 42 (91%) of participants at one or both time points (n = 39 at 12 weeks; n = 33 at 24 weeks); serious adverse events (rehospitalizations) did not differ between groups (n = 4 [PP-MI]; n = 3 [control]).

Regarding the study's primary aim of feasibility and acceptability, PP-MI participants completed a mean of 10.0 (SD 3.9) sessions (84% of all possible sessions). In addition, 78% of PP-MI participants completed a majority of sessions (7+). Of note, participants receiving the MI-alone health education intervention completed a mean 10.7 (SD 3.1) sessions (89%), suggesting strong engagement with

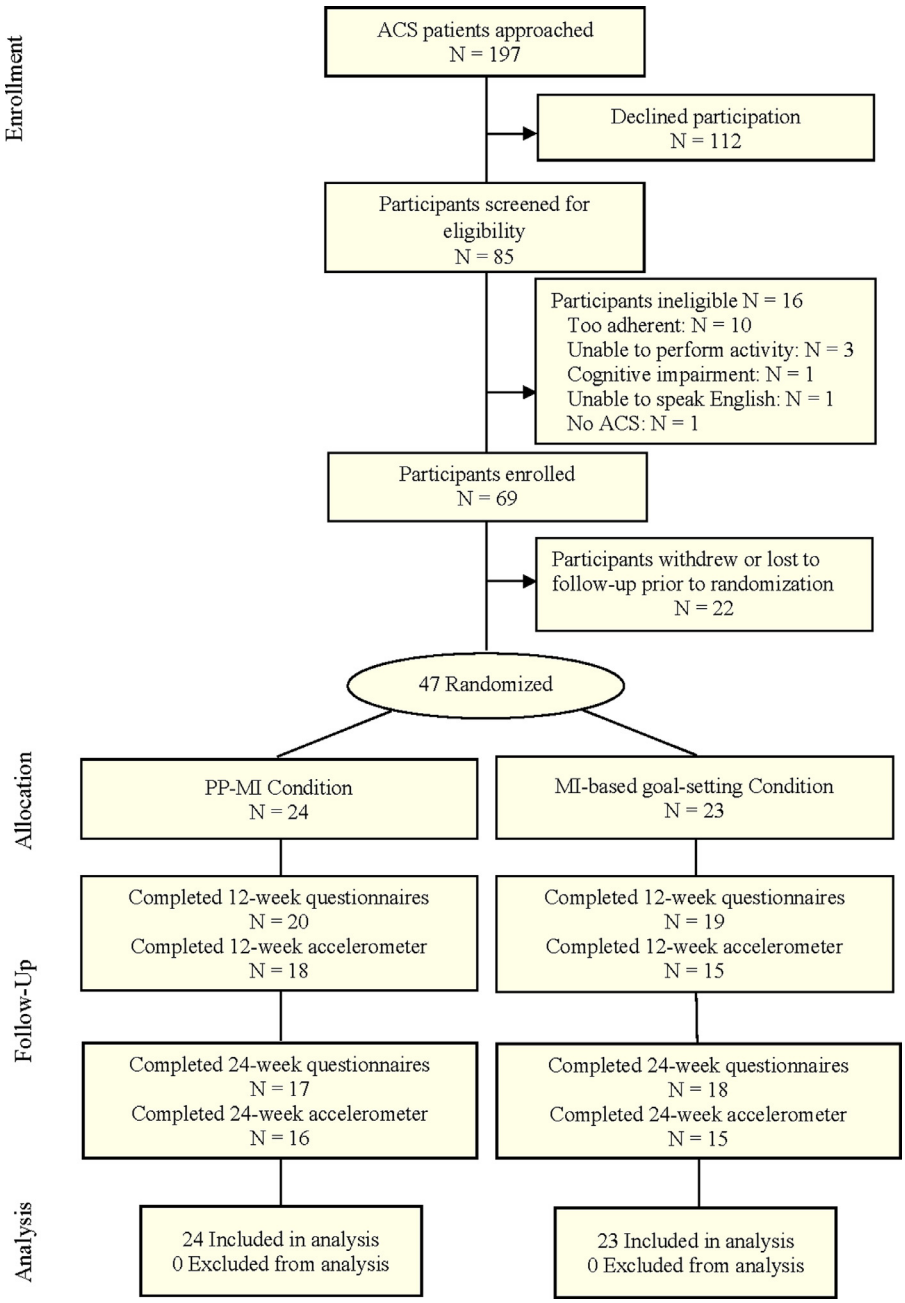

Figure 1. Study flow diagram.

Table 2
Baseline characteristics of participants

Characteristic	Control condition (n = 23)	PP-MI condition (n = 24)	Total (N = 47)
Age (years)	61.7 ± 12.4	59.9 ± 9.0	60.8 ± 10.7
Men (%)	19 (83%)	17 (71%)	36 (77%)
White race (%)	19 (83%)	24 (100%)	43 (92%)
Married (%)	14 (61%)	18 (75%)	32 (68%)
Lives alone (%)	6 (26%)	5 (21%)	11 (23%)
Hypertension (%)	16 (70%)	18 (75%)	34 (72%)
Hyperlipidemia (%)	19 (83%)	19 (79%)	38 (81%)
Type 2 diabetes mellitus (%)	3 (13%)	7 (29%)	10 (21%)
Prior ACS (%)	7 (30%)	5 (21%)	12 (26%)
Cardiac risk factors	2.2 ± 1.0	2.3 ± 1.0	2.2 ± 1.0
Age-adjusted Charlson Comorbidity Index	3.6 ± 2.1	3.5 ± 1.9	3.6 ± 2.0
Current smoker (%)	5 (22%)	4 (17%)	9 (19%)
Body mass index (kg/m^2)	29.7 ± 5.9	30.7 ± 6.4	30.2 ± 6.1
Peak TnT (ng/ml)	1.6 ± 2.8	1.6 ± 2.4	1.6 ± 2.6
Left ventricular ejection fraction (%)	52.9 ± 13.5	53.9 ± 7.0	53.4 ± 10.6
Psychological characteristics			
Positive affect (PANAS; range 10-50)*	33.3 ± 6.3	28.5 ±7.2	30.9 ± 7.2
Dispositional optimism (LOT-R; 0-24)	16.5 ± 4.6	16.1 ± 5.7	16.3 ± 5.1
Anxiety (HADS-A; range 0-21)	5.2 ± 4.0	5.5 ± 3.9	5.3 ± 3.9
Depression (HADS-D; range 0-21)	3.5 ± 2.4	4.0 ± 2.9	3.7 ± 2.7
Health outcome measures			
Mental health-related quality of life (SF-12 MCS; range 0-100)	49.3 ± 8.0	46.9 ± 8.9	48.1 ± 8.5
Physical health-related quality of life (SF-12 PCS; range 0-100)	39.7 ± 9.0	37.0 ± 7.0	38.3 ± 8.0
Functional capacity (DASI; range 0-58.2)	43.2 ± 13.9	37.3 ± 13.3	40.2 ± 13.8
Self-reported adherence (MOS-SAS; range 3-18)	11.1 ± 2.6	9.9 ± 2.7	10.5 ± 2.7
Medications at discharge			
Aspirin (%)	23 (100%)	24 (100%)	47 (100%)
Beta blocker (%)	20 (87%)	23 (96%)	43 (92%)
ACE/ARB (%)	16 (70%)	17 (71%)	33 (70%)
Antiplatelet (%)	22 (96%)	22 (92%)	44 (94%)
Statin (%)	22 (96%)	23 (96%)	45 (96%)
Antidepressant (%)	4 (17%)	8 (33%)	12 (26%)

ACE = angiotensin converting enzyme inhibitor; ACS = acute coronary syndrome; ARB = angiotensin receptor blocker; DASI = Duke Activity Status Index; HADS-A = Hospital Anxiety and Depression Scale, Anxiety subscale; HADS-D = Hospital Anxiety and Depression Scale, Depression subscale; LOT-R = life orientation test-revised; PANAS = positive and negative affect schedule; SF-12 MCS = Short Form-12, Mental health composite score; SF-12 PCS = Short Form-12, Physical health composite score; MOS-SAS = Medical Outcomes Study Specific Adherence Scale; MVPA = Moderate to vigorous physical activity.
* $p < 0.05$.

this control condition. Regarding PP-MI acceptability, participants' mean ratings (0 to 10 scale) of PP-MI activity ease and utility were 8.3 (SD 2.3) and 8.0 (SD 2.3), respectively, for the PP component, and 8.1 (SD 2.4) and 8.2 (SD 2.2) for MI, all above the a priori acceptability threshold of 7.0/10.

See Table 3 for detail regarding between-group differences in study outcomes for the study's secondary aims. The PP-MI condition was associated with large ES and statistically significant improvements in change from baseline PANAS (positive affect) score at both 12 and 24 weeks (12 weeks: EMD 3.90 [SE 1.95], p = 0.045, ES = 0.56; 24 weeks: EMD 7.34 [SE 2.16], p <0.001, ES = 1.12), compared with the MI-based control condition. The intervention was not associated with substantial change in dispositional optimism (through Life Orientation Test—Revised), but it was associated with large effect size (ES = 0.54 to 0.83) improvements in depression and anxiety, compared with the control condition, at 12 weeks and lesser (ES = 0.13 to 0.21) effects at 24 weeks.

Regarding physical activity, compared with the MI-based health education control condition, the PP-MI intervention was associated with higher, although nonsignificant, MVPA at 12 weeks and with large ES and significantly greater differences in MVPA at 24 weeks (12 weeks: EMD 9.46 min/day [SE 7.92], p = 0.23, ES = 0.42; 24 weeks: EMD 15.1 [SE 6.8], p = 0.026, ES = 0.81). Conversely, PP-MI participants took a significantly greater number of steps at 12 weeks, with a modest reduction of between-group differences at 24 weeks (12 weeks: EMD 1842 steps [SE 850], p = 0.030, ES = 0.76; 24 weeks: EMD 1617 steps [SE 1081], p = 0.14, ES = 0.53).

On analysis of additional functional and behavioral outcomes (Table 3), the PP-MI intervention was associated with a medium effect size (and nonsignificant) difference improvement in the Duke Activity Status Index (physical function) at 12 weeks, growing to a large and significant effect at 24 weeks. The intervention was associated with large effects on mental HRQoL at both time points and a small, nonsignificant effect on physical HRQoL at 12

Table 3
Between-group differences in change from baseline on study outcome measures

	12 weeks					24 weeks				
Measure	EMD	SE	z	p	ES	EMD	SE	z	p	ES
Positive affect										
Positive affect (PANAS)	3.90	1.95	2.00	0.045*	0.56	7.34	2.16	3.40	<0.001*	1.12
Physical activity										
MVPA (minutes/day)	9.46	7.92	1.20	0.23	0.42	15.08	6.75	2.23	0.026*	0.81
Steps (per day)	1842	850	2.17	0.030*	0.76	1617	1081	1.50	0.14	0.53
Additional psychological measures										
Optimism (LOT-R)	0.30	1.44	0.21	0.83	0.06	−1.08	1.57	−0.69	0.49	0.20
Depression (HADS-D)	−2.22	0.83	−2.69	0.007*	0.83	−0.55	0.87	−0.63	0.53	0.21
Anxiety (HADS-A)	−1.53	0.92	−1.67	0.096†	0.54	−0.45	0.96	−0.47	0.64	0.13
Additional functional/behavioral measures										
Function (DASI)	3.75	3.80	0.99	0.32	0.37	8.91	3.58	2.49	0.013*	0.95
Mental HRQoL (SF-12 MCS)	7.32	2.37	3.09	0.002*	0.75	4.29	2.24	1.92	0.055†	0.46
Physical HRQoL (SF-12 PCS)	0.42	2.58	0.16	0.87	0.05	4.44	2.54	1.75	0.080†	0.61
Adherence (MOS SAS)	1.48	0.91	1.64	0.10	0.66	1.27	1.03	1.24	0.22	0.56

EMD = estimated mean difference; ES= effect size; HADS = Hospital Anxiety and Depression Scale ; HADS-A = Hospital Anxiety and Depression Scale, Anxiety Subscale, HADS-D = Hospital Anxiety and Depression Scale, Depression Subscale; LOT-R = life orientation test, revised; MCS = Mental Component Score; MOS SAS= Medical Outcomes Study Specific Adherence Scale; MVPA= moderate to vigorous physical activity; PANAS = positive affect negative affect schedule; PCS = Physical Component Score; SF-12= Medical Outcomes Study Short Form-12.

* $p < 0.05$.

† $p < 0.10$.

weeks growing to a medium to large, nonsignificant effect at 24 weeks. Finally, the intervention was associated with medium to large ES magnitude, but nonsignificant, effects on composite self-reported health behavior adherence, compared with the control condition.

On exploratory analysis examining between group effects in those with lower and higher baseline adherence, we found similar relative impact of PP-MI on positive affect at 12 and 24 weeks, but that those with the lowest baseline adherence appeared to have substantially greater physical activity with PP-MI compared with those in MI alone (see Supplementary Table 5).

Discussion

Overall, a 12-week, phone-delivered, combined PP-MI intervention was feasible and well-accepted in a high-risk cohort of patients who were recently hospitalized for an ACS and had low baseline health behavior adherence. PP-MI participants completed 84% of all possible sessions and provided mean scores of over 8/10 on ratings of intervention ease and utility for both intervention components. These findings are consistent with our prior findings on such metrics for PP interventions in clinical settings,[5] and they suggest that this program may be a viable option for many patients in the high-risk period immediately following an ACS.

In addition, in this initial randomized trial, the PP-MI intervention was associated with large ES (and statistically significant) differences in improvement in positive affect as measured by the PANAS, the proximal target of the PP intervention component. Our overall findings that the intervention had substantial effects on positive affect, depression, and anxiety, but not trait optimism, are consistent with a prior PP-alone intervention study in ACS patients.[24] Modifying positive affect in post-ACS patients may have important implications, given the relation between positive affect and lower risk of first ACS or overall mortality in healthy persons,[4] and the links between positive affect and reduced mortality in chronic illnesses such as HIV and diabetes.[4,14] Post-ACS patients are a high-risk population—with up to 20% rehospitalized or dying in the next year—and improving positive affect in this population could therefore be of substantial importance.

We also found that PP-MI was associated with greater physical activity as measured by accelerometer, with PP-MI participants completing 9 to 15 more minutes of MVPA per day and taking 1,600 to 1,800 more steps per day than those in the MI-based health education condition. These findings are consistent with prior work illustrating the links between positive psychological well-being and greater physical activity in healthy individuals, medically-ill persons, and post-ACS patients.[4,25] Such findings are also consistent with a 2012 randomized study of a positive affect intervention after percutaneous coronary intervention finding that the intervention, compared with a health education intervention, was associated with greater self-reported physical activity.[26] This study adds to this literature by studying a higher-risk population (post-ACS patients with low baseline health behavior adherence), utilizing an MI-informed control condition, and using objective measures of physical activity. The ES for PP-MI was also greater than small observed ESs for MI on physical activity in patients with diabetes[27] and on medication adherence in patients with chronic disease.[28]

The sequence of improvements in mental health outcomes (depression and anxiety) at 12 weeks followed by greater changes in functional/health-related outcomes at 24 weeks is consistent with a prior psychiatric intervention trial in depressed cardiac patients,[29] suggesting that improvements in psychological well-being may lead to improved physical health-related outcomes in a lagged manner. The continued

gains in positive affect at 24 weeks suggest that the skill-building intervention approach may have been effective in integration of PP skills into daily life postintervention. PP-MI also appeared to have the greatest effect on activity in those with lower baseline adherence, although this analysis was exploratory given the small sample.

Although these findings reflect some promise of the PP-MI intervention, it is important to emphasize that this was an initial exploratory trial, and larger and longer studies are needed to better understand the nature and durability of the intervention's effects. If such findings are confirmed in future trials, these findings could have implications for clinical practice. Such a program could be added to existing cardiac rehabilitation programs (the gold standard for behavioral promotion post-ACS), although an even greater use may be in the up to 85% of eligible post-ACS patients who do not attend cardiac rehabilitation,[30] which can often require substantial time and resources (e.g., transportation). PP-based interventions are simple, typically require minimal provider training in practice, and can be delivered remotely, and such a program could be a broadly applicable, low-cost, low-burden intervention for post-ACS patients.

This study had several strengths, including the multisite nature of the study, ongoing fidelity assessments, use of an attention-matched and relevant control condition plus pedometer provision, and objective assessments of physical activity. The study also had multiple limitations. It was performed in academic settings, with a largely White, non-Latino cohort and over 75% men, limiting generalizability. This initial trial had a relatively small sample and requires follow-up studies with larger samples to more definitively assess impact on activity and cardiac events. The control condition, while MI-based, attention-matched, and delivered systematically, was not as intensive as some MI programs (and did not focus solely on physical activity), and future studies could utilize even more intensive and matched MI programs to assess the differential effect of the PP-MI program. The intervention had somewhat smaller effects on overall adherence, likely because the MI intervention, but not PP-MI, focused on additional health behaviors. Finally, roughly 1/4 of participants dropped out before randomization, although this was anticipated based on similar rates in our prior work with hospitalized ACS patients,[5] who may have recurrent symptoms immediately postdischarge requiring readmission or additional interventions, impeding participation.

In summary, a phone-based PP-MI program to promote well-being and physical activity in post-ACS patients was feasible and well-accepted, and it was associated with medium to large effects on positive affect and physical activity compared with an attention-matched, MI-informed control condition. Future studies are required to confirm these findings in a larger and more diverse sample as a stand-alone intervention or complement to cardiac rehabilitation, and to examine the intervention's effects on broader clinical outcomes.

Disclosure

The authors have no other relevant conflicts of interest to report.

Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amjcard.2019.03.023.

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