



## Predictors of completion of a psychological-behavioral intervention in acute coronary syndrome patients

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### ABSTRACT

**Objective:** Dropout from health behavior interventions in patients with heart disease is a major clinical issue that can impact recovery and prognosis. Positive psychology (PP)-based treatments have the potential to promote health behaviors, but predictors of PP intervention completion have not been examined in persons with heart disease.

**Methods:** Among 128 patients receiving a phone-based PP intervention to promote physical activity among acute coronary syndrome (ACS) patients, numerous baseline sociodemographic, medical, and psychological variables, along with self-reported pre/post improvements in happiness and optimism (on 0–10 Likert scales) associated with an initial PP exercise, were examined as potential predictors of intervention completion. Logistic and linear regression analyses were used to assess relationships between these predictors and (a) intervention completion (at least 4 of 8 sessions completed) and (b) number of total sessions completed.

**Results:** No patient characteristic was associated with greater likelihood of completing the PP intervention. However, immediate pre-post change in optimism following the initial exercise was associated with intervention completion (odds ratio = 1.98; 95% confidence interval: 1.28–3.05;  $p = .002$ ; mean post-exercise increase in optimism 0.79 [SD 1.52] in completers vs. mean optimism decrease of 0.59 [SD 1.42] in non-completers).

**Conclusions:** Pre-post change in optimism with a single PP activity predicted completion of an 8-week PP-based health behavior intervention in post-ACS patients. This information could be used clinically by having potential enrollees complete a single PP activity to assess intervention fit.

### 1. Introduction

Failure to complete health behavior interventions in cardiac patients is important because suboptimal adherence in this population is linked with recurrent events and mortality [1]. Intensive cardiac rehabilitation programs are effective, but a minority of cardiac patients enroll in them and roughly one-quarter drop out [2–4]. For more remotely-delivered behavioral interventions, rates of non-completion have likewise been as high as 83% [5, 6]. Dropout from physical activity programs is associated with gender, intervention characteristics, and baseline medical characteristics, and psychological factors appear even more important than baseline characteristics [7, 8]. Increasingly, there are also calls to customize intervention approaches based on specific patient factors [9]. These issues underscore the need to identify patient-level factors associated with completion of cardiac health behavior interventions.

One approach to promoting health behaviors in cardiac patients may involve psychological well-being. Optimism and related constructs are linked with participation in health behaviors and superior cardiac outcomes [10, 11]. Positive psychology (PP) interventions utilize deliberate completion of activities to promote well-being, and in healthy populations have been well-accepted and associated with improved mood and positive affect [12]. These interventions are simple, require minimal interventionist training, and have been delivered remotely. Such factors suggest that PP interventions could enhance psychological factors linked to cardiac health behaviors and be implemented in a variety of settings.

There has been minimal study of factors linked to rates of PP intervention completion in patients with heart disease or other conditions. Such knowledge would help in understanding which cardiac patients may be well-suited to a remote PP intervention targeting health behaviors. Accordingly, through a trial testing a PP intervention in post-

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acute coronary syndrome (ACS) patients, we examined baseline and early-treatment factors to assess whether they were associated with PP intervention completion or number of completed sessions.

## 2. Methods

### 2.1. Participants

The Positive Emotions after Acute Coronary Events-III (PEACE-III) study was a factorial design trial of an 8-week, phone-delivered PP intervention among patients hospitalized at two academic medical centers for an ACS. Methods [13] and main results [14] of the study have been reported. In short, the goal of this  $2 \times 2 \times 2$  factorial trial was to optimize the intervention by comparing intervention components (booster sessions beyond 8 weeks vs. no boosters; PP alone vs. addition of motivational interviewing; daily vs. weekly PP activities) to assess which were associated with greater improvements in physical activity and other behaviors; all participants received an active PP intervention. Enrollment occurred in hospital. Eligible participants met consensus criteria for ACS, had low baseline activity, and did not have cognitive, language-related, or physical limitations that precluded participation (see Supplementary Table 1 for details). Participants completed PP activities in a treatment manual and discussed them at weekly phone sessions with a study interventionist; the first exercise was typically completed in the hospital. Across all study arms, the PP intervention was associated with improvements in well-being, activity, and other health behaviors. Of note, assignment to study condition was not associated with completion [16]. Our healthcare system's Institutional Review Board approved the study, and participants provided written informed consent.

### 2.2. Procedures

Baseline variables were examined to assess their association with intervention completion (i.e., performance of at least half of the PP exercises). These included sociodemographic factors (gender, age, race, marital status, living alone), clinical variables (prior ACS, peak troponin T, left ventricular ejection fraction, duration of hospitalization, Charlson [medical] comorbidity index [15]), and baseline psychological/behavioral measures (Hospital Anxiety and Depression Scale [16], Life-Orientation Test—Revised [optimism] [17], Perceived Stress Scale-4 [18], Positive and Negative Affect Schedule [positive affect items; PANAS] [19], and Medical Outcomes Study [MOS] Specific Adherence Scale items for physical activity and diet [20]). In addition, prior to completing the first exercise (recalling positive life events), participants rated their optimism and happiness on 0–10 Likert scales; the ratings were then repeated immediately following completion of the exercise. These pre/post ratings were additionally examined as predictors of intervention completion.

We selected these sociodemographic variables based on prior clinical cardiac programs or behavioral intervention studies finding them to be linked with completion [2, 21–25]. Likewise, medical factors and psychological variables have been linked with completion of such programs [2, 22–26]. Finally, initial response to mental health interventions is associated with greater intervention adherence/engagement [27, 28], and we therefore included these early-treatment ratings following the first PP exercise as predictors.

### 2.3. Analyses

We first examined predictors of *intervention completion* via separate univariable analyses using logistic regression. Completion was considered as a dichotomous variable, defined as completing 4+ of 8 possible core intervention sessions, which we selected based on our assessment that completing 4 core sessions of a PP program would provide sufficient information/practice to promote well-being and

given the success of other 4-session PP-type programs [29, 30]; we repeated these analyses using 5 and 6 completed sessions as the cutoff for completion without meaningful effects on outcomes. We did not include booster sessions because not all participants were assigned boosters). We defined an intervention session as completed if the PP exercise was completed by the participant and subsequently reviewed with the study trainer during the weekly phone session [13].

We then examined predictors of *total completed sessions* (out of 8) using linear regression. For each continuous predictor, the reported odds ratio or regression coefficient corresponds to a one standard deviation increase in the predictor. We included all 128 participants whenever possible to maximize power to detect predictors of completion. For pre-post changes in happiness/optimism following an initial exercise, we were only able to include those who had completed the exercise. Based on the number of dropouts observed ( $n = 45$ ), our analyses had 80% power to detect an effect size of 0.52 using a two-sample *t*-test with two-sided  $\alpha = 0.05$ . Analyses were completed via Stata 15 (StataCorp: College Station, TX);  $p < .05$  was considered significant.

## 3. Results

Baseline characteristics of study participants ( $N = 128$ ) are provided in Supplementary Table 2; there were no significant differences between completers and non-completers. The associations between each baseline characteristic and intervention/session completion are provided in Table 1. No significant associations were observed between sociodemographic, medical, and psychological predictors, and intervention completion/completed sessions.

However, among participants who completed at least one exercise ( $n = 99$ ), immediate pre-post change in optimism was associated with intervention completion (odds ratio = 2.94; 95% confidence interval [CI]: 1.48–5.87;  $p = .002$ ). Participants who ultimately completed the intervention reported greater optimism benefit from the initial exercise (mean post-exercise increase in optimism 0.79 [SD 1.52] in completers vs. mean optimism decrease of 0.59 [SD 1.42] in non-completers;  $p = .009$ ; Supplementary Fig. 1). The area under the ROC curve examining discrimination between the groups based on optimism change was 0.75. Greater changes in optimism were also associated with more sessions completed (estimated coefficient for one-SD increase = 0.79; 95% CI: 0.34–1.24;  $p = .001$ ;  $R^2 = 0.11$ ). Pre-post change in happiness was not associated with intervention completion or sessions completed (Fig. 1).

## 4. Discussion

Baseline participant characteristics failed to predict completion of a post-ACS, phone-based, PP health behavior intervention. However, change in optimism following an initial exercise was associated with intervention completion.

The finding that baseline characteristics did not predict completion is in some contrast to literature finding that age, race, medical comorbidity, and psychological factors have been associated with adherence to cardiac rehabilitation and other health behavior interventions [4, 22–26]. Our findings may differ because our intervention's intensity (completion of simple PP exercises), modality (phone-based), and target (psychological well-being) differed from many of these programs. These findings could suggest that a PP intervention is applicable to a wide range of cardiac patients irrespective of baseline sociodemographic, medical, or psychological factors.

The association between optimism change with the first exercise and likelihood of intervention completion indicates that this metric may signal patients' likelihood of completing the program. This finding is consistent with findings from other mental health-related treatments (medication-based and psychological) that early treatment response is associated with completion [27, 28]. It suggests that those who find

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