Received: 8 December 2021 | Revised: 1 December 2022 | Accepted: 20 December 2022

https://doi.org/10.1016/j.rpth.2023.100045

STUDY PROTOCOL

# Psychological distress in pulmonary embolism survivors in a pulmonary embolism response team clinic: Protocol for a prospective observational study

Karen Hurley PhD[1] | Melinda Ryan MSN, APRN[2] | Debra Puffenberger PA-C[2] | Tamra Parker-Davis MSN, APRN[2] | Albatoul Bensitel MD[2] | Xuefeng Liu PhD[3] | Scott J. Cameron MD, PhD[2] | Leben Tefera MD[2]

[1]Department of Psychiatry and Psychology, Neurological Institute, Center for Adult Behavioral Health, Cleveland Clinic Foundation, Cleveland, Ohio, USA

[2]Department of Cardiovascular Medicine, Section of Vascular Medicine, Heart Vascular and Thoracic Institute, Cleveland Clinic Foundation, Cleveland, Ohio, USA

[3]Department of Quantitative Health Science, Lerner Research Institute, Cleveland Clinic Foundation, Cleveland, Ohio, USA

**Correspondence**
Leben Tefera, Department of Cardiovascular Medicine, Section of Vascular Medicine, Heart Vascular and Thoracic Institute, Cleveland Clinic Foundation, 9500 Euclid Avenue, Building J3-5, Cleveland, OH 44195, USA.
Email: TeferaL@ccf.org

**Funding information**
L30HL165499 to Leben Tefera and HL120200 and HL158801 to Scott J. Cameron.

**Handling Editor:** Dr Lana Antoinette Castellucci

## Abstract

**Background:** Pulmonary embolism (PE) is a leading cause of cardiovascular death. Psychological distress in PE is understudied and underrecognized.

**Objectives:** The primary aim of this proposed protocol was to describe the incidence of psychological distress symptoms (anxiety, depression, posttraumatic stress, and fear of recurrence) in the survivors of PE after discharge from hospitalization. The secondary aim was to assess the influence of acute disease, etiology, and treatment of PE on psychological distress.

**Methods:** This is a prospective observational cohort study in a large tertiary care referral center. The participants are adult patients presenting to the hospital with PE fulfilling objective pulmonary embolism response team (PERT) activation criteria. After discharge, patients complete a series of validated measures of psychological distress (anxiety, depression, posttraumatic stress, and fear of recurrence) and quality of life at follow-ups approximately 1, 3, 6, and 12 months after diagnosis and treatment of their PE. Factors influencing each type of distress are evaluated.

**Conclusion:** This protocol aims to identify the unmet needs of patients experiencing psychological distress following PE. It will describe anxiety, depression, fear of recurrence, and posttraumatic symptoms in PE survivors during the first year of outpatient follow-up in a PERT clinic.

KEYWORDS
anxiety, protocol, psychological distress, pulmonary embolism, survivors

**Essentials**

- Survivors of pulmonary embolism (PE) often experience unrecognized psychological distress.
- To our knowledge, no study has examined the association between PE severity and ensuing psychological distress to date.
- We proposed a novel comprehensive clinical evaluation protocol for PE survivors.
- Our protocol examines the impact of PE on psychological symptomatology in a quantifiable manner.

# 1 | INTRODUCTION

## 1.1 | Background and rationale

### 1.1.1 | Pulmonary embolism

Pulmonary embolism (PE) is globally the third leading cause of cardiovascular death behind myocardial infarction (MI) and stroke [1]. Annual incidence rates range from 39 to 115 per 100,000 population [2].

The diagnosis and treatment of PE has changed considerably in the recent years. Given the increasing complexity of treatment, treatment centers around the world are creating multidisciplinary pulmonary embolism response teams (PERTs), in which specialists from disciplines including vascular medicine, cardiology, pulmonology, hematology, and cardiothoracic surgery collaborate in difficult decision-making regarding acute treatment and postdischarge care [3]. The widespread use of computed tomography angiography has increased the detection rates, affording access to new treatment modalities, such as direct oral anticoagulants, catheter-directed therapies, and postsurgical and in-hospital thromboprophylaxis, which have dramatically revolutionized the treatment and prevention of PE.

Because in other areas of medicine in which treatment advances have improved the levels of survivorship (eg, MI, stroke, and cancer), questions about quality of life (QOL) after acute patient management have become equally important. Several studies evaluating PE survivors describe a "post-PE syndrome" that encompasses physical symptoms including fatigue, exercise intolerance, dyspnea, and chronic functional limitations [4]. Studies have also shown that nearly half of PE survivors will have exercise limitations at 1 year that have been shown to negatively impact QOL [5,6]. PE survivors also have described the need for supportive services after the acute crisis has passed regarding uncertainty about returning to work and family roles [7]. In addition, patients surviving PE also report symptoms of anxiety, depression, and posttraumatic stress symptoms, although little is known about the incidence and severity [7–9]. Psychological needs in this population remains largely underrecognized and undertreated.

### 1.1.2 | Anxiety and depressive disorders

The emotional impact in survivors of PE deserves special attention. Qualitative interview studies of PE survivors report psychological distress after PE acute treatment including a sudden, traumatic onset, brush with mortality; inadequate physician communication; and fear of PE recurrence [9–12]. A handful of studies have examined anxiety and depression in this population by using validated measures; however, they have mainly been cross-sectional with small sample sizes. A study of 60 acute PE survivors showed higher scores on the measures of depression (as measured by the Beck Depression Inventory) and anxiety (State-Trait Anxiety Inventory) compared with controls recruited from a community health center [10]. In a mixed-method study using quantitative measures and semistructured interviews, 37 PE survivors indicated on a single-item visual analog scale psychological distress including anxiety, worry, and panic that was not present before their diagnosis of PE [9,11].

Open-ended interviews with PE survivors revealed the symptoms of posttraumatic stress such as intrusive thoughts related to the PE, flashbacks, distress experienced by retrieval queues, and hypervigilance [9,11]. Similar to findings in the psycho-oncology literature, Tran et al. [11] reported symptoms of posttraumatic stress disorder in a large portion of PE survivors. Only a small percentage of PE survivors exceeded a threshold generally meeting the full symptom criteria.

In contrast to PE, psychological distress has been extensively studied in patients surviving acute MI and stroke, which rank ahead of PE in the causes of cardiovascular mortality [1]. Large cohort studies using validated measures of psychological distress report an incidence of anxiety and depressive disorders in post-MI patients to be approximately 18% (anxiety disorders: 17%, depressive disorders: 1%) [13–16]. Anxiety is observed in nearly 25% of stroke survivors and up to 33% of patients following transient ischemic attack. Psychological distress may also manifest as elevated depressive and posttraumatic stress symptoms [17–23]. A dearth of research literature also exists on psychological adjustment in patients with cancer, both during active treatment and extending into survivorship, with symptoms of anxiety, depression, and posttraumatic stress reported as prominent [24,25].

Despite the abundance of literature on psychological distress in other disease states, several questions remain with respect to PE survivors. To our knowledge, no study to date has examined the association between the PE severity classification (Pulmonary Embolism Severity Index, simplified Pulmonary Embolism Severity Index score, 2019 European Society of Cardiology [ESC] PE Classification Criteria) in the acute phase and the ensuing psychological distress at the time of follow-up in the clinics [26–28]. No study to date has correlated the method of treatment for PE with the ensuing the presence or absence of psychological distress at follow-ups.

**TABLE 1** Institutional pulmonary embolism response team activation criteria.

| Institutional pulmonary embolism response team activation criteria |
|---|
| Systolic blood pressure of <90 mmHg or vasopressors required to achieve a systolic blood pressure of ≥ 90 mmHg |
| End organ hypoperfusion |
| Serum troponin > upper limits of normal |
| Right ventricular dysfunction as documented by computed tomography angiography or transthoracic echocardiography |
| Saddle embolus or significant pulmonary artery thrombus burden |

### 1.1.3 | Study aims

This study protocol will examine the impact of PE on patient psychological symptomatology and QOL following hospitalization and follow-up in an outpatient clinic.

The overarching goal of this study protocol builds on the findings to date on psychological distress in PE survivors by conducting a longitudinal study using a battery of validated psychological symptom measures (anxiety, depression, posttraumatic stress disorder, and fear of recurrence) that are widely used in other medical populations. This approach will allow the levels of psychological distress detected in patients with PE to be compared with those observed in groups with other diseases.

Our primary aim was to describe the incidence of psychological distress (anxiety, depression, posttraumatic stress, and fear of recurrence) and QOL in survivors of PE attending an outpatient PERT clinic after discharge from acute care and longitudinally during the first year of recovery.

Our secondary aim was to assess the influence of acute disease (eg, PE severity classification as outlined above; intensive care unit admission), etiology (cancer, thrombophilia, surgery, etc.), and treatment (eg, anticoagulation, catheter-directed intervention, intravenous thrombolysis) as factors of psychological distress in PE survivors at follow-ups after discharge from acute care.

## 2 | METHODS AND ANALYSIS

### 2.1 | Study design

To study our proposed aims, we will conduct a prospective observational study in which we screen for the symptoms of depression, anxiety, fear of recurrence, and posttraumatic symptoms in patients following up in an outpatient PERT clinic. The setting will be a 1400-bed large tertiary hospital in Cleveland, Ohio.

Patients presenting with PE fulfilling institutional PERT activation criteria will be studied (Table 1). A PERT can be activated by a clinician on the basis of the following clinical criteria: (1) ESC-defined high-risk PE, (systolic blood pressure [BP] of <90 mmHg or vasopressors required to achieve a BP of ≥ 90 mmHg) and end organ hypoperfusion, (2) ESC-defined intermediate-risk PE (normotensive status and objective evidence of right ventricular dysfunction as documented by computed tomography angiography, transthoracic echocardiography, and/or elevated cardiac troponin levels), and (3) saddle embolus or significant pulmonary artery thrombus burden not meeting the criteria for high-risk or intermediate-risk PE.

Through joint decision-making, a group of multidisciplinary clinicians discuss the best modality of treatment for specified patients. In keeping with contemporary PE management guidelines, patients with hemodynamic instability (ie, systolic BP of <90 mmHg or vasopressors required to achieve a systolic BP of ≥ 90 mmHg) will be considered for reperfusion treatment. However, all treatment options are discussed on a case-by-case basis [28]. Before discharge, follow-ups for patients will be arranged in a multidisciplinary PERT clinic (Figure 1).

In the PERT clinic, patients will be treated according to the current standard of medical care for PE follow-ups. This includes the assessment of anticoagulation needs, thrombophilia evaluation, physiological indicators of performance (eg, 6-minute walk test), and any needed follow-up imaging. Patients will be followed up for a year—at baseline (initial outpatient visit) and at 3-, 6-, and 12-month intervals following their acute PE.

Patients presenting to the PERT clinic will be identified by clinic schedulers. These patients are designated "PERT follow-up" in the ambulatory clinic schedule and identified by a research coordinator the day before. At the start of the clinical encounter, a research coordinator will approach the patient and ask for participation in this study regarding the impact of PE on psychological well-being. If they agree, consent will be obtained electronically through an iPad. Patients complete the validated iPad questionnaires assessing the symptoms of depression, anxiety, fear of recurrence, posttraumatic stress, and QOL. Distress measures were selected for which cutoff scores have already been established through previous research, in which scores above the cutoff indicate increased likelihood of a diagnosable psychiatric disorder (eg, General Anxiety Disorder-7 [GAD-7] score > 10 or Patient Health Questionnaire-9 [PHQ-9] score > 10). Patients with distress scores above the cutoff on 1 or more measures will be prioritized for referral for psychological services (eg, extended psychotherapy, psychiatric medication).

### 2.2 | Participants

The patient group and clinical context for this study will be every patient following up in the institutional PERT clinic. Each patient will be a survivor of PE previously managed by the inpatient PERT team presenting for typical outpatient follow-up care. Patients fitting the exclusion criteria as outlined in Table 2 will be excluded from the study. Our institution averages 3 PERT activations weekly. Therefore, over the ensuing 2 years, approximately 200 patients will be enrolled (see below for sample size calculations).

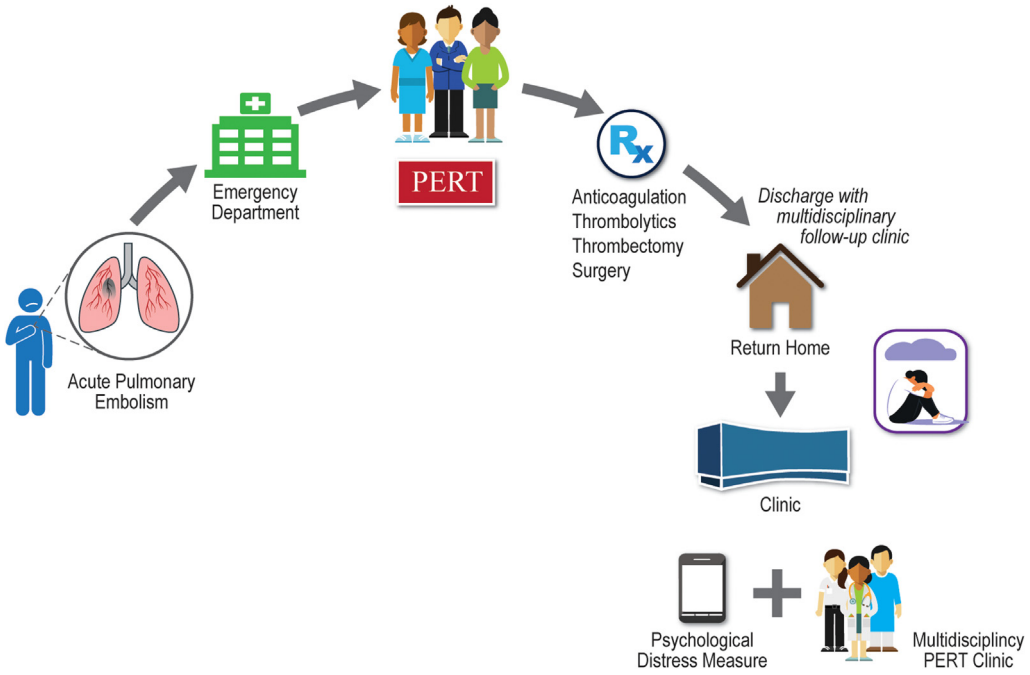


**FIGURE 1** Proposed work flow. Patients presenting to the hospital requiring pulmonary embolism response team (PERT) activation and treatment by the PERT team will be followed up in an outpatient PERT clinic and undergo psychological distress testing

## 2.3 | Measurement of psychological symptoms and QOL

A set of 5 well-validated QOL measures will be administered to assess the levels of anxiety, depression, posttraumatic stress, fear of recurrence, and health-related QOL. All have been used extensively in related medical populations (cancer and cardiac) and have demonstrated internal reliability, sensitivity, construct validity, and criterion validity where applicable (ie, ability to screen for Diagnostic and Statistical Manual of Mental Disorders IV/V diagnoses).

a. Anxiety symptoms (GAD-7) [29]. The GAD-7 is widely used to assess the symptoms of generalized anxiety such as worry, irritability, and insomnia and as a screening tool in medical settings to triage patients for mental health intervention. A score of 10 or greater can be interpreted as representing moderate levels of anxiety. Higher scores indicate higher levels of anxiety.
b. Depressive symptoms (PHQ-9) [30]. The PHQ-9 has been widely adopted in medical settings to assess the symptoms of depression, including changes in mood, sleep, appetite, concentration, and self-esteem. A score of 10 or greater generally represents moderate depression.
c. Posttraumatic symptoms (Impact of Events Scale; Impact of Events Scale-Intrusion Subscale) [31]. The Impact of Events Scale was developed to assess the stress-related symptoms in patients presenting for treatment after major negative life events, including life-threatening illness [32]. The Intrusion Subscale consists of 7 items that assess involuntary, intrusive thoughts about a stressor, nightmares, flashbacks, and intense distress at reminders of a negative event. The Intrusion Subscale has been used in the psycho-oncology literature to describe disease-specific distress, in contrast to generalized anxiety and depression [33].
d. Fear of Disease Recurrence Questionnaire (FDRI-PE; adapted from the Fear of Cancer Recurrence Inventory [FCRI]) [34]. We will use

**TABLE 2** Inclusion and exclusion criteria.

| Inclusion criteria | Exclusion criteria |
|---|---|
| All patients undergoing a PERT activation following up in an outpatient PERT clinic | Refusal to participate in the study, whether through the direct patient consent process or the proxy consent process |
| At least 18 y of age | Physical, psychiatric, sensory, or cognitive disability that renders the patient unable to give informed consent or complete study materials |
| Consent for participation | Unable to read or comprehend English |
| Is able to read and comprehend English | |

PERT, pulmonary embolism response team.

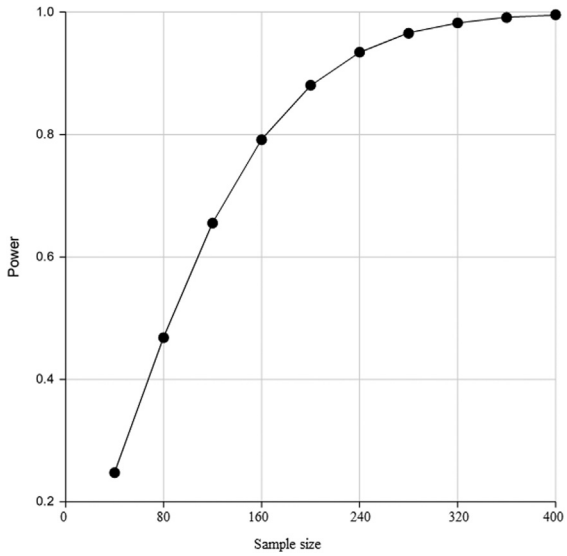


**FIGURE 2** Change in power with the total sample size based on generalized estimating equations models

the severity subscale of the FCRI that has been adopted in the literature as a short form of the full FCRI questionnaire. Items will be reworded to refer to fear of recurrence of PE; a similar approach has been used to assess fear of recurrence in stroke patients [35]. We will assess the internal validity of the adapted FDRI-PE by calculating Cronbach's alpha and construct validity by comparing with published norms for the FCRI.

e. PE Quality of Life: PEmb-QOL [36]. A validated and reliable questionnaire created to specifically assess the QOL of PE survivors. The questionnaire contains 6 dimensions focusing on the frequency of complaints, activities of daily living limitations, work-related problems, social limitations, and intensity of complaints with higher scores indicating worse outcomes. A previous study has shown discordance between patient's interview responses and those reported in PEmb-QOL scores, in particular with regard to fears of recurrence [37]. Our protocol will improve on this study with the inclusion of the FDRI-PE.

## 2.4 | Data collection and management

Responses to psychological distress and QOL questionnaires will be collected via an iPad during follow-up in the PERT clinic. Data surrounding a patient's treatment for PE will be gathered in a chart review of the hospital's electronic medical record. Data abstractors include 4 trained clinicians who are not part of the inpatient PERT decision-making team. They will review each patient's chart and input the objective data necessary to derive PE severity classification, etiology of the PE, and modality of treatment administered during hospitalization. Additional variables for the study are included in the protocol addendum (Supplementary Data). These data will be entered into an institutional PERT REDCap data registry. In addition, once completed, data from the questionnaire responses will be similarly entered into the study REDCap data registry.

A brief data collection manual will be created that defines each clinical variable that will be collected from the medical record. Abstractors will be provided with a scoring sheet to record the data from the medical record and trained to complete the scoring sheet to criterion by physician investigators. To evaluate the interrater reliability, a subset of participant study records will be randomly selected and re-rated by an independent clinician who has received the same training, and interrater reliability will be calculated using Cohen's kappa.

Items that are not mentioned in the medical record will be recorded as missing. The medical chart scoring sheet used by the abstractors will include the option "unknown" so that missingness will be recorded in a consistent fashion. Missingness will be analyzed to detect whether data are missing at random versus missing not at random. If items are determined to be missing not at random, missingness will be included as a variable in the analysis of study outcomes.

## 2.5 | Statistical analysis

Baseline characteristics of study participants will be summarized as mean ± standard errors for continuous variables and proportions ± standard errors for categorical data. Continuous variables will be evaluated for normality, independence, and homoscedasticity by the Q-Q and residual plots. Normality of data will be tested by the Shapiro–Wilk test and homoscedasticity by the Levene test. When appropriate, Student's *t*-tests will be used to compare the means of outcome measures between 2 groups, and the Mann–Whitney U-test will be used instead for skewed data. For Gaussian-distributed data with 3 or more groups, 1-way analysis of variance models will be conducted to examine the significance of overall mean difference among the groups, followed by Bonferroni pair-wise multiple comparisons. Kruskal–Wallis tests followed by Dunn post-test will be used instead when data are non-Gaussian. For categorical data, group differences in proportions/percentages will be assessed by using the Pearson chi-squared tests or Fisher exact tests. Statistical significance will be accepted as a $P$ value of $<.05$.

Generalized estimating equations (GEE) models will be conducted to estimate the association parameters of interest separately with each distress outcome as a dependent variable, acute disease (eg, PE risk stratification level, and intensive care unit admission), etiology (cancer, thrombophilia, surgery, etc.), and treatment (eg, anticoagulation, catheter-directed intervention, and intravenous thrombolysis) as primary independent factors, and the baseline confounders (eg, age, gender, race, family history, baseline distress levels) as covariates. We will adjust for the baseline factors to control for the confounding impact from varied baseline levels and reduce the bias. GEE models allow us to account for the intraclass correlation of repeated measures within subjects and raise the precision of estimates and analysis power in a longitudinal cohort study. All data analyses will be performed on a personal computer with Windows 10 using SAS 9.4 (SAS Institute Inc.).

### 2.6 | Sample size justification

Above are respective GEE models for the association analysis of psychological distress measures after PE discharge, including anxiety, depression, posttraumatic stress disorder, fear of disease recurrence, and QOL. The primary risk factors are acute disease (eg, PE severity classification: 2-5 categories depending on the classification systems), etiology (eg, cancer: dichotomous, yes or no), and treatment (eg, anticoagulation: dichotomous). All patients with PE will have distress outcome assessments at 1- (baseline), 3-, 6-, and 12-month follow-ups. Power calculations were based on the GEE regression models with 3 repeated measures of psychological distress outcomes (not counting the baseline measure) and 4 PE risk categories (high, intermediate-high, intermediate-low, and low) that are grouped according to the ESC 2019 classification system. Figure 2 demonstrates how the analysis power changes with the total sample size, given the moderate effect size (Cohen's $f = 0.25$) measured by the overall mean difference in psychological distress scores between PE risk categories. By including $n = 200$ patients in the study, this study will be able to achieve 88% power to detect an effect of PE risk classification levels on the distress scores with false positive rates below 5% when the effect size is moderately large. When including $n = 300$ patients, the power will increase to more than 96%. The etiology and treatment factors are dichotomous with fewer number of categories compared with the PE risk levels. We anticipate that the study has the higher power to detect the effects on the distress outcomes when the actual effect size is moderate, given $n = 200$ patients.

### 2.7 | Ethics and dissemination

This protocol and the informed consent document and any subsequent modifications will be reviewed and approved by the hospital institutional review board or ethics committee responsible for oversight of the study. The study commenced on November 1, 2022. The study will end enrollment of patients on November 1, 2024.

### 2.8 | Informed consent forms

A signed consent form will be obtained from each participant. Participants who cannot consent for themselves, such as those with a legal guardian (eg, person with power of attorney), will be excluded from the study. The consent form will describe the purpose of the study, procedures to be followed, and the risks and benefits of participation. A copy will be given to each participant and appropriately documented in the participant's medical record.

### 2.9 | Participant confidentiality

Any data obtained will be identified only by a participant identification number to maintain confidentiality. All records will be kept in a secured online database. If collected on paper, they will be kept in a locked cabinet. All data entry and manipulation will be performed by using participant identification numbers only. Information will not be released without the written permission of the participant, except as necessary for monitoring by institutional review board or other institutional boards.

### 2.10 | Dissemination of results

The results will be presented at a hospital quarterly PERT quality assurance meeting. At its conclusion, a research report based on the protocol will be submitted to a peer-reviewed journal for the consideration of publication.

## 3 | LIMITATIONS OF THE STUDY

This protocol describes a study that will be conducted at a large academic medical center with a PERT team and mental health professionals who specialize in treating patients with medical illnesses. It is possible that the protocol could not be performed at regional treatment centers without the access to PERT teams and advanced therapies. Second, heterogeneity of medical issues in patients with PE, both pre-PE and post-PE, mean that other factors may drive psychological distress in addition to the ones we have selected to study. For example, patients whose PE originated from an occult cancer face the threat to life beyond the risk of PE recurrence and invasive treatments (surgery, chemotherapy, and radiation) that are associated with increased distress. Other patients (eg, with premorbid obesity) may have 1 or more chronic conditions that affect QOL. Third, this protocol was created to examine psychological distress in PERT patients. This will omit patients with traditionally low severity or PE treated in the ambulatory setting. Finally, our study will only enroll English speakers. Although some of the study measures have been validated in other languages, most were validated only in English.

## 4 | FUTURE PROSPECTIVE AND CONCLUSION

PE is a major cause of morbidity and mortality. PERTs have been proven to elevate the care of patients with PE by offering more coordinated care and expert consensus. Despite major advances in the treatment of PE, little has been performed to address the significant psychological distress known to exist in this patient population. Herein, we describe a protocol for a study to examine the psychological distress in PE survivors attending an outpatient PERT clinic. On completion, we hope that these data will shine light on the need of evidence-based psychosocial interventions that can be adapted for the integration into multidisciplinary care plans and improve the well-being of patients recovering from PE.

## ACKNOWLEDGMENTS

We gratefully acknowledge financial support by L30HL165499 to L.T. and HL120200 and HL158801 to S.J.C.

## FUNDING

This study was supported by L30HL165499 to L.T. and HL120200 and HL158801 to S.J.C.

## AUTHOR CONTRIBUTIONS

L.T., K.H., and S.J.C. designed the project. L.X. completed the analytical work. K.H., M.R., D.P., T.P.D., A.B., S.J.C., and L.T. wrote, revised, and finalized the manuscript.

## RELATIONSHIP DISCLOSURE

There are no competing interests to disclose.

## TWITTER

*Scott J. Cameron* @2Scottish

*Leben Tefera* @LebenTefera

## REFERENCES

[1] Wendelboe AM, Raskob GE. Global burden of thrombosis: epidemiologic aspects. *Circ Res*. 2016;118:1340–7.

[2] Martin KA, Molsberry R, Cuttica MJ, Desai KR, Schimmel DR, Khan SS. Time trends in pulmonary embolism mortality rates in the United States, 1999 to 2018. *J Am Heart Assoc*. 2020;9:e016784.

[3] Dudzinski DM, Piazza G. Multidisciplinary pulmonary embolism response teams. *Circulation*. 2016;133:98–103.

[4] Klok FA, Barco S. Follow-up after acute pulmonary embolism. *Hamostaseologie*. 2018;38:22–32.

[5] Kahn SR, Akaberi A, Granton JT, Anderson DR, Wells PS, Rodger MA, et al. Quality of life, dyspnea, and functional exercise capacity following a first episode of pulmonary embolism: results of the ELOPE cohort study. *Am J Med*. 2017;130:990e9–990e21.

[6] Kahn SR, Hirsch AM, Akaberi A, Hernandez P, Anderson DR, Wells PS, et al. Functional and exercise limitations after a first episode of pulmonary embolism: results of the ELOPE prospective cohort study. *Chest*. 2017;151:1058–68.

[7] Bennett PK, Patterson K, Noble S. Predicting post-traumatic stress and health anxiety following a venous thrombotic embolism. *J Health Psychol*. 2016;21:863–71.

[8] Noble S, Lewis R, Whithers J, Lewis S, Bennett P. Long-term psychological consequences of symptomatic pulmonary embolism: a qualitative study. *BMJ Open*. 2014;4:e004561.

[9] Hunter R, Lewis S, Noble S, Rance J, Bennett PD. "Post-thrombotic panic syndrome": a thematic analysis of the experience of venous thromboembolism. *Br J Health Psychol*. 2017;22:8–25.

[10] Liu CP, Li XM, Chen HW, Cui JY, Niu LL, He YB, et al. Depression, anxiety and influencing factors in patients with acute pulmonary embolism. *Chin Med J (Engl)*. 2011;124:2438–42.

[11] Tran A, Redley M, Wit K de. The psychological impact of pulmonary embolism: a mixed-methods study. *Res Pract Thromb Haemost*. 2021;5:301–7.

[12] Hernandez-Nino J, Thomas M, Alexander AB, Ott MA, Kline JA. Communication at diagnosis of venous thromboembolism: lasting impact of verbal and nonverbal provider communication on patients. *Res Pract Thromb Haemost*. 2022;6:e12647.

[13] Feng HP, Chien WC, Cheng WT, Chung CH, Cheng SM, Tzeng WC. Risk of anxiety and depressive disorders in patients with myocardial infarction: a nationwide population-based cohort study. *Medicine (Baltimore)*. 2016;95:e4464.

[14] Walters P, Barley EA, Mann A, Phillips R, Tylee A. Depression in primary care patients with coronary heart disease: baseline findings from the UPBEAT UK study. *PLoS One*. 2014;9:e98342.

[15] Larsen KK, Christensen B, Nielsen TJ, Vestergaard M. Post-myocardial infarction anxiety or depressive symptoms and risk of new cardiovascular events or death: a population-based longitudinal study. *Psychosom Med*. 2014;76:739–46.

[16] Roest AM, Martens EJ, Denollet J, de Jonge P. Prognostic association of anxiety post myocardial infarction with mortality and new cardiac events: a meta-analysis. *Psychosom Med*. 2010;72:563–9.

[17] Campbell Burton CA, Murray J, Holmes J, Astin F, Greenwood D, Knapp P. Frequency of anxiety after stroke: a systematic review and meta-analysis of observational studies. *Int J Stroke*. 2013;8:545–59.

[18] Broomfield NM, Quinn TJ, Abdul-Rahim AH, Walters MR, Evans JJ. Depression and anxiety symptoms post-stroke/TIA: prevalence and associations in cross-sectional data from a regional stroke registry. *BMC Neurol*. 2014;14:198.

[19] Ayerbe L, Ayis S, Crichton S, Wolfe CD, Rudd AG. The natural history of depression up to 15 years after stroke: the South London Stroke Register. *Stroke*. 2013;44:1105–10.

[20] Pedowitz E, Derby L, Cruz GJ, Trainor A, Edmondson D, Cornelius T. Relationship between NIH stroke symptoms and post-traumatic stress disorder in patients evaluated for transient ischemic attack/stroke. *Gen Hosp Psychiatry*. 2021;70:98–102.

[21] Stein LA, Goldmann E, Zamzam A, Luciano JM, Messé SR, Cucchiara BL, et al. Association between anxiety, depression, and post-traumatic stress disorder and outcomes after ischemic stroke. *Front Neurol*. 2018;9:890.

[22] Dossa A, Glickman ME, Berlowitz D. Association between mental health conditions and rehospitalization, mortality, and functional outcomes in patients with stroke following inpatient rehabilitation. *BMC Health Serv Res*. 2011;11:311.

[23] Nikayin S, Rabiee A, Hashem MD, Huang M, Bienvenu OJ, Turnbull AE, et al. Anxiety symptoms in survivors of critical illness: a systematic review and meta-analysis. *Gen Hosp Psychiatry*. 2016;43:23–9.

[24] Mitchell AJ, Chan M, Bhatti H, Halton M, Grassi L, Johansen C, et al. Prevalence of depression, anxiety, and adjustment disorder in oncological, haematological, and palliative-care settings: a meta-analysis of 94 interview-based studies. *Lancet Oncol*. 2011;12:160–74.

[25] Linden W, Vodermaier A, Mackenzie R, Greig D. Anxiety and depression after cancer diagnosis: prevalence rates by cancer type, gender, and age. *J Affect Disord*. 2012;141:343–51.

[26] Aujesky D, Obrosky DS, Stone RA, Auble TE, Perrier A, Cornuz J, et al. Derivation and validation of a prognostic model for pulmonary embolism. *Am J Respir Crit Care Med*. 2005;172:1041–6.

[27] Jiménez D, Aujesky D, Moores L, G_omez V, Lobo JL, Uresandi F, et al. Simplification of the pulmonary embolism severity index for prognostication in patients with acutesymptomatic pulmonary embolism. *Arch Intern Med*. 2010;170:1383–9.

[28] Konstantinides SV, Meyer G, Becattini C, Bueno H, Geersing GJ, Harjola VP, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J*. 2020;41:543–603.

[29] Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166:1092–7.

[30] Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16:606–13.
[31] Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. *Psychosom Med*. 1979;41:209–18.
[32] Einsle F, Kraft D, Kollner V. Post-traumatic stress disorder (PTSD) in cardiology and oncology–which diagnostic tools should be used? *J Psychosom Res*. 2012;72:434–8.
[33] Thewes B, Meiser B, Hickie IB. Psychometric properties of the Impact of Event Scale amongst women at increased risk for hereditary breast cancer. *Psychooncology*. 2001;10:459–68.
[34] Simard S, Thewes B, Humphris G, Dixon M, Hayden C, Mireskandari S, et al. Fear of cancer recurrence in adult cancer survivors: a systematic review of quantitative studies. *J Cancer Surviv*. 2013;7:300–22.
[35] Townend E, Tinson D, Kwan J, Sharpe M. Fear of recurrence and beliefs about preventing recurrence in persons who have suffered a stroke. *J Psychosom Res*. 2006;61:747–55.
[36] Klok FA, Cohn DM, Middeldorp S, Scharloo M, Büller HR, van Kralingen KW, et al. Quality of life after pulmonary embolism: validation of the PEmb-QoL Questionnaire. *J Thromb Haemost*. 2010;8:523–32.
[37] Hernandez-Nino J, Ott MA, Thomas M, Alexander AB, Kline JA. Assessing quality of life after pulmonary embolism: comparing results from the PEmb-QoL with semistructured interviews. *Res Pract Thromb Haemost*. 2022;6:e12732.

## SUPPLEMENTARY MATERIAL

The online version contains supplementary material available at https://doi.org/10.1016/j.rpth.2023.100045