

LITERATURE HIGHLIGHTS

Predicting 1-Year Health Status Using Patient-Reported Variables in Symptomatic PAD

With Kim G. Smolderen, PhD, and Carlos Mena-Hurtado, MD

In a study published in the *Journal of Vascular Surgery* evaluating a novel health status prediction model for peripheral artery disease (PAD), Scierka et al found that, among 47 variables analyzed, psychosocial and socioeconomic factors were most predictive of 1-year PAD-specific health status.¹

Investigators used data from the PORTRAIT registry, a prospective registry of symptomatic patients with PAD who presented to vascular outpatient clinics in the United States, the Netherlands, and Australia between June 2011 to December 2015, to develop a 1-year health prediction model. At baseline, data were collected on demographics, socioeconomic factors, and medical history. Patients underwent either invasive treatment or medical management within 3 months of presentation, and telephone interviews were conducted at 3 months, 6 months, and 1 year to obtain information about health status.

A total of 47 predictor variables were analyzed, including demographic, socioeconomic, psychosocial, comorbidities, PAD characteristics, PAD care metrics, and baseline PAD-specific health status.

The primary outcome was 1-year PAD-specific health status after the initial PAD workup, as determined by the Peripheral Artery Questionnaire (PAQ), a 20-item disease-specific questionnaire that measures physical limitation, symptoms, quality of life, social limitation, and treatment satisfaction (range, 0-100, with higher scores indicating better health status).

A random forest model was used to assess the association between the 47 candidate variables and 1-year PAQ summary scores. Hierarchical multivariable logistic

KEY FINDINGS

- Ten easily obtainable patient characteristics were found to contribute to variations in 1-year PAD-specific health status.
- Higher baseline PAQ summary score, initial invasive treatment, and White race were associated with higher 1-year PAQ summary scores.
- Symptom exacerbation, current/prior diagnosis of depression, low social support, and symptom duration > 6 months were associated with lower 1-year PAQ summary scores.
- The absolute difference in explained variance in 1-year PAQ summary scores between the base and extended models was very small even though the extended model included more variables.

regression was then performed to assess the association between variables of significance in the initial model (10 variables) and 1-year PAQ summary scores. This base logistic regression model was expanded to include 19 additional variables to further assess potential relevance to PAD health status and outcomes. Patients with missing PAQ summary scores were excluded from the analysis.

After 202 patients were excluded due to missing PAQ summary scores, 1,073 patients were included for analysis (mean age, 67.7 ± 9.3 years; 37% female). More

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Study investigators Kim G. Smolderen, PhD, and Carlos Mena-Hurtado, MD, provide some additional insights into implications of the study results and future areas of research.

How do prediction models better inform risk adjustment strategies and quality performance benchmarks? Are there plans to further validate and replicate this prediction model?

This is an initial pathway toward more precision medicine approaches in PAD, not only as it relates to clinical outcomes but also related to the patient experience. We will need replication and validation in larger databases in different settings, ensuring representativeness of patients.

What strategies can be implemented in practice to better address psychosocial comorbidities in the PAD patient population?

More and more, PAD is evolving toward team-based care. As an expansion of team-based care, the integration of behavioral health specialties is a pathway to further explore and promote, as we generate the evidence base for the efficacy of these team-based approaches for improving PAD outcomes.

How can best practices in psychosocial screening and collaborative care be developed?

Screening practices go hand in hand with care pathways that have been established with behavioral health specialties so that there is follow-through and a path to treatment for those who screen positive. Models of care that have developed these approaches originated in primary care. Real-world evidence for the translation of these collaborative care models has yet to be developed in the vascular specialty setting.

Recommended Reading

Katon WJ, Lin EH, Von Korff M, et al. Collaborative care for patients with depression and chronic illnesses. *N Engl J Med*. 2010;363:2611-2620. doi: 10.1056/NEJMoa1003955

Kolte D, Parikh SA, Piazza G, et al. Vascular teams in peripheral vascular disease. *J Am Coll Cardiol*. 2019;73:2477-2486. doi: 10.1016/j.jacc.2019.03.463

Smolderen KG, Samaan Z, Decker C, et al. Association between mental health burden, clinical presentation, and outcomes in individuals with symptomatic peripheral artery disease: a scientific statement from the American Heart Association. *Circulation*. 2023;148:1511-1528. doi: 10.1161/CIR.0000000000001178

Smolderen KG, Alabi O, Collins TC, et al. Advancing peripheral artery disease quality of care and outcomes through patient-reported health status assessment: a scientific statement from the American Heart Association. *Circulation*. 2022;146:e286-e297. doi: 10.1161/CIR.0000000000001105

Spertus J, Jones P, Poler S, Rocha-Singh K. The Peripheral Artery Questionnaire: a new disease-specific health status measure for patients with peripheral arterial disease. *Am J Heart*. 2004;147:301-308. doi: 10.1016/j.ahj.2003.08.001

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patients (62.1%) were enrolled from the United States compared with the Netherlands (30.2%) and Australia (7.7%), and most patients (82.4%) were White. The mean PAQ summary score at baseline was 49.8 ± 21.7 .

Variables shown to be of highest importance and retained in the initial random forest effects model included baseline PAQ summary score, Patient Health Questionnaire (PHQ)-8 depression score, Generalized Anxiety Disorder (GAD)-2 anxiety score, new-onset symptom presentation, insurance status (United States only), current/prior diagnosis of depression, low social support, initial invasive treatment, duration of symptoms, and race.

In the linear regression model, baseline PAQ summary score, new-onset symptom presentation, current/prior diagnosis of depression, low social support, initial invasive treatment, duration of symptoms, and race were significantly associated with 1-year PAQ summary score.

Higher baseline PAQ summary score, initial invasive treatment, and White race were associated with higher 1-year PAQ summary scores (all $P < .001$), whereas symptom exacerbation at presentation ($P = .006$), current/prior depression diagnosis ($P = .008$), low social support ($P = .005$), and symptom duration > 6 months ($P = .044$) were associated with lower 1-year PAQ summary scores.

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The absolute difference in explained variance for 1-year PAQ summary scores between the base and extended models was very small (2%) even though the extended model included more variables (base model with 10 variables, $R^2 = 0.312$; extended model with 29 variables, $R^2 = 0.335$).

According to the investigators, generalizability of the study may be limited because patients with missing 12-month PAQ scores who were excluded had higher scores on the PHQ-8, Perceived Stress Scale-4, and GAD-2 and were more likely to be depressed and sedentary. In addition, the 1-year prediction model only

explained approximately 30% of the variation in 1-year health status, and further research is needed to expand the findings.

Investigators concluded that because the expanded model did not substantially improve the model's prediction performance, the 10 psychosocial and socioeconomic factors measured in the base model are important in predicting a patient's 1-year health status. These factors could be considered during the evaluation of PAD patients to help understand the breadth of factors that may improve functional status and quality of life. ■

1. Scierka LE, Perl-Okonny PA, Romain G, et al. Psychosocial and socioeconomic factors are most predictive of health status in patients with claudication. *J Vasc Surg*. Published online January 22, 2024. doi: 10.1016/j.jvs.2024.01.021