

Recommendations for Providing Feedback and Medical Reassurance Following Maximal-Graded Exercise Testing for Exercise Prescription in Cardiac Rehabilitation

Samantha G. Farris, PhD; Jasmin C. Hutchinson, PhD; Clinton A. Brawner, PhD; Steven J. Keteyian, PhD; Daniel E. Forman, MD; Quinn R. Pack, MD, MSc

A maximal-graded exercise test (GXT) is a valuable tool in cardiology for safety screening and identifying abnormal responses to exercise (eg, ischemic electrocardiographic changes, abnormal hemodynamics, arrhythmias, and symptoms). A GXT is also recommended for use in cardiac rehabilitation (CR) as the basis of an exercise prescription.^{1,2} Using GXT, an individualized target exercise training heart rate can be clarified, enhancing the efficacy of exercise training.³

Yet, GXT is rarely used in CR programs, its benefits are not uniformly recognized, and little is known about whether or how psychoeducational feedback is provided following a GXT. For example, a 2021 survey of CR programs in the United States⁴ found that just 11% directly order a GXT for their patients. In addition, only 25% of CR program directors believe that GXT was important for the safe prescription of exercise for patients in CR, and only 38% believe that a GXT provides important information for the development of an individualized exercise prescription.⁴

There is also a potential psychological benefit to a GXT. Anxiety associated with exercise after suffering an index cardiac event is common⁵ and has the potential to undermine goals for higher intensity exercise training and even participation at any level.⁶ Conversely, the results of a GXT can provide reassurance (ie, alleviating doubt or fear) which is important for reducing uncertainty about the safety of exercise. Not only do the GXT results have the potential to provide reassurance to patients, but CR clinicians might also feel more confident (and less worried) when supervising patients during exercise if they have knowledge about patient limits and exercise capacity. Nonetheless, a GXT also has the potential to be aversive, especially if it is poorly contextualized.⁷ In fact, a GXT can actually promote anxiety if patients are not provided with adequate feedback and education.⁸ Timing of feedback and education is relevant, as

delays between the completion of the GXT and feedback may unintentionally amplify a patient's anxiety.⁷ However, guidelines provide no direction or best-practices for communicating results after a GXT in patients with heart disease.⁹ For this reason, in this paper, we offer recommendations for psychoeducational feedback after a GXT, particularly for patients beginning an exercise program, in the CR setting.

RECOMMENDATIONS FOR GXT PSYCHOEDUCATION FEEDBACK

The ideal scenario would be to provide patients with clear (non-ambiguous) feedback about the exercise test results and exercise safety parameters, immediately after testing, with the goal of decreasing exercise-related anxiety, and in turn, optimizing the efficacy of exercise participation in CR. To this end, we gathered a multidisciplinary group of clinician-scientists who represented distinct expertise from cardiology, clinical exercise physiology, and exercise and clinical psychology. The group engaged in repeated rounds of collaborative discussion, which involved the review of the principles of exercise testing, exercise psychology, and cognitive-behavioral treatment of anxiety. The team of experts also completed qualitative observations of GXT protocols at four different clinics and engaged in discussion with GXT staff to understand standard procedures and protocols. Based on these discussions and observations, the group identified gaps in current practice and determined essential elements to incorporate into psychoeducational feedback. The experts then refined this information by evaluating existing literature, integrating clinical and research expertise, and considering feasibility within clinical settings. Through a consensus-driven approach, the group iteratively refined the recommendations listed in the table, ensuring they were both evidence-based and practically applicable in exercise testing environments.

The psychoeducational feedback session with a patient would, ideally, be a brief interaction (5-10 min) that occurs immediately after the GXT. Our recommended core elements for psychoeducational feedback after a GXT are detailed in Table 1, along with the rationale and illustrative examples of how each core element is communicated to the patient.

We also make several recommendations how to deliver the feedback (eg, style of delivery, avoiding use of certain terms, etc.). First, we recommend use of the term "exercise test" rather than "exercise stress test" to minimize any unintended priming effects that the word "stress" might have on shaping negative expectations about the aversiveness of the testing protocol. Second, during testing, use open-ended questions, like "How are you feeling", as opposed to leading questioning, especially questions that assume an inevitable symptom onset (eg, "Are you having chest pain, yet?"). Use of the word "yet" can unintentionally

Author Affiliations: Department of Psychology, Rutgers-the State University of New Jersey, New Brunswick, New Jersey (Dr Farris); Department of Exercise Science, Springfield College, Springfield, Massachusetts (Dr Hutchinson); Division of Cardiovascular Medicine, Henry Ford Hospital, Detroit, Michigan (Dr Brawner and Keteyian); Department of Medicine, University of Pittsburgh, and VA Pittsburgh Healthcare System, Pittsburgh Pennsylvania (Dr Forman); and Department of Healthcare Delivery and Population Science, University of Massachusetts Medical School-Baystate, Springfield, Massachusetts (Dr Pack).

This research is informed by grants #R01AG077179 and #R01AG070136.

The authors declare that they have no conflict of interest.

All authors meet the 4 ICMJE criteria for authorship. All authors have read and approved the manuscript.

Correspondence: Samantha G. Farris, PhD State University of New Jersey, Department of Psychology, 1 Spring Street, Suite 200, New Brunswick, NJ 08901 (samantha.farris@rutgers.edu).

Copyright © 2025 Wolters Kluwer Health, Inc. All rights reserved.

DOI: 10.1097/HCR.0000000000000968

Table 1 Recommended Core Elements of Psychoeducational Feedback, Rationale, and Illustrative Clinical Language		
Protocol Component	Rationale	Illustrative Example of Feedback
Before GXT		
Select an appropriate GXT protocol. Explain the purpose and nature of the GXT. Provide opportunities for the patient to ask questions or clarify any concerns.	Selecting an appropriate protocol and providing information about the GXT is not only part of good clinical practice, ⁹ but it also fosters reassurance. ⁷ Knowing what to expect in the GXT can also help reduce patient anticipatory anxiety.	"The purpose of the exercise test today is to identify a personalized target heart rate for you to reach when you exercise." "Information from today's test will be used to help safely guide your exercise in CR." "The treadmill will start at a slow pace and every 2 minutes the walking pace, or the incline will increase. Each increase will be small. We will be watching the entire time to ensure the test is safe for you."
After GXT		
Explain GXT test results.	Providing an explicit statement about the test results that is framed around exercise safety can reduce exercise anxiety.	If normal test: "There were no concerns with your EKG which means it is safe for you to exercise" If abnormal test or premature stop: "We stopped the test today because of [X symptoms]. The results of the test helped us identify a safe exercise heart rate range that is specifically tailored to you"
Explain aerobic or cardiorespiratory fitness and the goal of CR.	Psychoeducation is used to increase patient knowledge of the purpose of the GXT and CR. Access to knowledge is important for reducing uncertainty and anxiety.	"The exercise test provides us information about your fitness level and ability to perform daily activities." "The goal of CR is to improve your fitness level because improvements in such are associated with improved survival."
Identify and explain target heart rate range for exercise.	Describing that the results will be used to ensure <i>safe</i> exercise is an essential part of reassurance.	"This heart rate range will provide a safe and effective exercise prescription for you while in CR"
Discuss exercise restrictions (if any) and at-home exercise clearance.	Patients may be overly cautious with exercise and are unsure what they are able to do safely, including when they are unsupervised (eg, at home). Providing explicit clearance for exercise and discussing any restrictions is an important piece of reassurance and education.	"There are no restrictions to your exercise in the clinic or at home." "Not only is it safe for you to exercise at home, we <i>recommend</i> that you exercise at home". "You can do any types of physical activity you want... What types of activities would you like to try?"
Use teach-back to check for understanding.	This technique is used to confirm that the patient understands what they have learned during the session. The teach-back can be focused on the key safety take-aways.	"If you were going to explain the results of your exercise test today to your partner/friend/etc, what would you tell them?" "What are your main takeaways from today? Is exercise safe for you? Are you cleared to exercise at home? What is your target heart rate range?"
Provide results and recommendations in a handout.	We recommended the use of a handout that lists the patient's target heart rate, exercise capacity relative to their CR peers, ¹⁰ and at-home exercise recommendations. This is helpful to ensure patients understand and remember what they have learned.	"I just provided you a lot of information which I know can be overwhelming. I wrote all of this down for you on this handout."

Abbreviations: CR, cardiac rehabilitation; GXT, graded exercise test.

provoke worry about exercise. Third, the GXT provides clinically valuable information about whether the results are "normal" or "abnormal" and can be used to provide reassurance, but appropriate framing is essential. When results are normal (eg, asymptomatic test without repolarization changes), this information should be communicated to the patient in a direct and unambiguous manner. If the GXT is terminated prematurely because symptoms were present, or the test was positive or inconclusive for myocardial ischemia, we recommend explicitly omitting use of terms like "abnormal" or "inconclusive" to describe test results. These terms

can amplify fear and doubt. Instead, results could be described as "useful information" that will be used to develop a safe exercise plan. For example, if there is ST depression suggestive of myocardial ischemia at a heart rate of 120 beats/min, then the test was "useful" by setting the upper limit of the target heart rate range at 110 beats/min.

Fourth, we emphasize the value of clear and confident communication, knowing that the perception of the clinician's knowledge and credibility can influence the reassuring value of feedback session. If providers do not know how to answer a patient's question during the feedback session, we

recommend giving a concrete response delivered with a confident tone along the lines of “I will get you the answer to that question before your next session” to avert any delays in providing pertinent medical information. Finally, medical appointments can be overwhelming, and patients often cannot recall medical information especially if they are acutely anxious. Therefore, the session should be appropriately paced and not rushed. We also recommend that patients have ample opportunity to ask questions throughout the feedback session (not just at the end of the session). Frequent open-ended invitations to ask questions (eg, “What questions do you have so far”) can help to ensure understanding and prevent patients from feeling overwhelmed.

IMPLICATIONS AND FUTURE DIRECTIONS

Based on the recommendations herein, a GXT psychoeducational feedback protocol has been developed and is currently under empirical evaluation as part of a larger randomized clinical trial (ie, PACESETTER, clinicaltrials.gov #NCT05925634). As part of the ongoing trial, clinical exercise physiologists (CEPs) were trained to deliver the psychoeducational feedback in a uniform manner that is consistent with the recommendations provided above. The CEP completed a 2-hour training session that involved didactics about anxiety and medical reassurance, a step-by-step review of the protocol used to provide feedback, role play demonstration, experiential practice, and question and answer. After training, they completed practice sessions to gain more familiarity with the protocol and were provided verbal and written feedback by the supervising clinicians (clinical psychologist and CEP) until competence was achieved. As part of the ongoing monitoring of the trial, the psychoeducational feedback sessions are audio-recorded and reviewed for manual adherence. The feedback protocol has potential to be scalable if efficacious. By increasing awareness of the benefits of a GXT in CR, combined with providing thoughtful psychoeducational feedback, we believe there is an opportunity to improve both the patient and clinician experience, as well as program outcomes.

REFERENCES

1. Brown TM, Pack QR, Abernethy E, et al. core components of cardiac rehabilitation programs: 2024 update: a scientific statement from the American heart association and the American association of cardiovascular and pulmonary rehabilitation. *J Cardiopulm Rehabil Prev.* 2025;45(2):e6–e25. doi:10.1097/HCR.0000000000000930.
2. Winchester DE, Maron DJ, Blankstein R, et al. ACC/AHA/ASE/ASNC/ASPC/HFSA/HRS/SCAI/SCCT/SCMR/STS 2023 multimodality appropriate use criteria for the detection and risk assessment of chronic coronary disease. *J Am Coll Cardiol.* 2023;81(25):2445–2467. doi:10.1016/j.jacc.2023.03.410.
3. Brawner CA, Pack Q, Berry R, Kerrigan DJ, Ehrman JK, Keteyian SJ. Relation of a maximal exercise test to change in exercise tolerance during cardiac rehabilitation. *Am J Cardiol.* 2022;175:139–144. doi:10.1016/j.amjcard.2022.04.009.
4. Pack QR, Shea M, Brawner CA, et al. Exercise prescription methods and attitudes in cardiac rehabilitation: a national survey. *J Cardiopulm Rehabil Prev.* 2022;42(5):359–365. doi:10.1097/HCR.0000000000000680.
5. Farris SG, Abrantes AM, Bond DS, Stabile LM, Wu W-C. Anxiety and fear of exercise in cardiopulmonary rehabilitation: patient and practitioner perspectives. *J Cardiopulm Rehabil Prev.* 2019;39(2):E9–E13. doi:10.1097/HCR.0000000000000401.
6. Bäck M, Cider Å, Herlitz J, Lundberg M, Jansson B. Kinesiophobia mediates the influences on attendance at exercise-based cardiac rehabilitation in patients with coronary artery disease. *Physiother Theory Pract.* 2016;32(8):571–580. doi:10.1080/09593985.2016.1229828.
7. Petrie KJ, Müller JT, Schirmbeck F, et al. Effect of providing information about normal test results on patients’ reassurance: randomised controlled trial. *Br Med J.* 2007;334(7589):352–354. doi:10.1136/bmj.39093.464190.55.
8. Shea MG, Farris SG, Hutchinson J, Headley S, Schilling P, Pack QR. Effects of exercise testing and cardiac rehabilitation in patients with coronary heart disease on fear and self-efficacy of exercise: a pilot study. *Int J Behav Med.* 2024;31(5):659–668. doi:10.1007/s12529-023-10207-9.
9. Fletcher GF, Ades PA, Kligfield P, et al. Exercise standards for testing and training: a scientific statement from the American heart association. *Circulation.* 2013;128(8):873–934. doi:10.1161/CIR.0b013e31829b5b44.
10. Ades PA, Savage PD, Brawner CA, et al. Aerobic capacity in patients entering cardiac rehabilitation. *Circulation.* 2006;113(23):2706–2712. doi:10.1161/CIRCULATIONAHA.105.606624.