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Reconsidering Maximal Testing for Resistance Training Prescription in Cardiac Rehabilitation: A Repetition-Range, Submaximal Approach

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Dear Editor,

We read with great interest the AHA scientific statement “Core Components of Cardiac Rehabilitation Programs: 2024 Update” and strongly support the recommendation of resistance training as a core component of cardiac rehabilitation.¹ We write to offer an implementation-focused perspective on intensity prescription in routine cardiac rehabilitation, emphasizing feasibility, measurement robustness, and scalability across contemporary delivery models. Thus, effective and progressive resistance training can be prescribed without routinely anchoring intensity to maximal testing or to %1-RM estimates derived from assessments that require sets performed to concentric muscle failure.

Although maximal repetition testing has historical precedent, its routine prioritization for intensity prescription in cardiac rehabilitation warrants reconsideration given implementation limitations.¹ Reliable 1-RM assessment typically requires structured familiarization to minimize learning effects and stabilize performance; in some reports, multiple sessions (up to nine) were needed to obtain stable 1-RM values.² Such requirements increase logistical complexity, patient burden, and cumulative exposure to high-strain efforts before training begins. Moreover, if a baseline 1-RM is underestimated due to insufficient familiarization, any %1-RM prescription becomes imprecise. Over time, without explicit guidance on systematic retesting, prescribed %1-RM values may progressively disconnect from true strength capacity, particularly given the rapid early improvements that can occur with training.

From an adaptation standpoint, training to concentric muscular failure is not required to achieve clinically meaningful improvements in strength and hypertrophy. Meta-analytic evidence indicates that meaningful gains can be achieved across a wide range of loads when sets are performed with high, yet submaximal effort, without mandating failure-based training.³ Consistent with this, our group has shown that instructing individuals to end sets via volitional interruption based on perceived fatigue yields robust strength and hypertrophy adaptations across loading zones while avoiding the highest-strain terminal repetitions associated with failure-based efforts.⁴

In this context, a repetition-range-based model with clearly defined submaximal stopping criteria provides a pragmatic alternative to routine maximal testing and %1-RM-anchored prescription. Resistance exercise can be prescribed using target repetition ranges tailored to clinical status (e.g., ~10–15RM), with sets terminated before high-effort failure and with controlled breathing. Notably, an earlier Circulation scientific advisory⁵

recommended performing 10–15 repetitions at lower relative resistance for cardiac patients and identified volitional fatigue as an appropriate submaximal endpoint, an approach consistent with repetition-range prescription without obligatory maximal testing. The 2024 update does not highlight this framework, underscoring the ongoing need for discussion about practical intensity prescription methods. Load can then be adjusted to maintain performance within the prescribed repetition range, operationalizing progressive overload within routine sessions. Importantly, progression within a predefined repetition range itself constitutes objective evidence of strength improvement. Thus, performing more repetitions with the same load (within the target range), or sustaining the same repetition target with a higher load, reflects increased force-generating capacity, without requiring periodic maximal reassessment.

Taken together, available evidence supports repetition-range-based programming with submaximal set termination as an operational framework to preserve progressive overload while improving feasibility and measurement robustness in routine cardiac rehabilitation. Future implementation guidance may benefit from explicitly incorporating this approach.

References

1. Brown TM, Pack QR, Aberegg E, Brewer LC, Ford YR, Forman DE, Gathright EC, Khadanga S, Ozemek C, Thomas RJ, 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. *Circulation*. 2024;150:e328-e347. doi: 10.1161/CIR.0000000000001289
2. Ploutz-Snyder LL, Giamis EL. Orientation and familiarization to 1RM strength testing in old and young women. *J Strength Cond Res*. 2001;15:519-523.
3. Grgic J, Schoenfeld BJ, Orazem J, Sabol F. Effects of resistance training performed to repetition failure or non-failure on muscular strength and hypertrophy: A systematic review and meta-analysis. *J Sport Health Sci*. 2022;11:202-211. doi: 10.1016/j.jshs.2021.01.007
4. Nobrega SR, Ugrinowitsch C, Pintanel L, Barcelos C, Libardi CA. Effect of Resistance Training to Muscle Failure vs. Volitional Interruption at High- and Low-Intensities on Muscle Mass and Strength. *J Strength Cond Res*. 2018;32:162-169. doi: 10.1519/JSC.0000000000001787

5. Pollock ML, Franklin BA, Balady GJ, Chaitman BL, Fleg JL, Fletcher B, Limacher M, Pina IL, Stein RA, Williams M, et al. AHA Science Advisory. Resistance exercise in individuals with and without cardiovascular disease: benefits, rationale, safety, and prescription: An advisory from the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association; Position paper endorsed by the American College of Sports Medicine. *Circulation*. 2000;101:828-833. doi: 10.1161/01.cir.101.7.828