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Precision Rehabilitation: Optimizing Function, Adding Value to Health Care

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To the editor,—

We commend French et al¹ on their excellent timely contribution to the evolving field of precision medicine with a strong focus on functional real-world outcomes. In June 2021 our National Institutes of Health Medical Rehabilitation Research Resource Network hosted a Precision Rehabilitation conference that endorsed many topics well delineated by French et al. Among these are the need for greater standardization and precision in measuring function, more frequent and longitudinal assessments, use of more varied study designs and heterogeneous patient populations, and strategic use of technology advances (electronic health records, wearable devices). Their emphasis on prediction, innovation in big-data analytical approaches, and collaborative team science is commendable but seriously limited by omitting 3 salient topics from the retreat and subsequent discussions: (1) the value of patients as active collaborators, (2) the potential high effect of genomics and biomarkers, and (3) the need for a unifying transdisciplinary framework to guide research and practice. We write this letter to stimulate further dialogue and inspire innovation.

French et al accurately argue that precision rehabilitation progress will require intentional collaboration among stakeholders, including clinicians, researchers, information technology experts, training programs, and funding organizations. Because the goal of precision rehabilitation is to identify the right treatment(s), the right dosage(s), and right time(s) to maximize function and quality of life, patients must be recognized as essential stakeholders.^{2,3} Patients uniquely can identify personally meaningful functional improvements, novel ideas about treatment approaches, and strategies to recruit and retain representative patient samples. Additionally, engaging patients as partners in precision rehabilitation is particularly compelling because many treatments occur over extended periods and rely on active patient participation.

Excluding genetics from a vision of precision rehabilitation is a missed opportunity. Genomics drove the launch of precision medicine and notable successes in cancer.⁴ In rehabilitation, for example, Heitz et al⁵ discovered that higher polygenic dopamine gene scores, but not other brain-derived neurotrophic factor genes, predicted greater treatment-induced functional gains for children with hemiparesis. Such discoveries can increase understanding of individual differences in treatment responsiveness and brain plasticity. Systematically studying gene X treatment interactions across the lifespan can illuminate mechanisms to guide developing novel treatments, especially with respect to the International Classification of Functioning, Disability, and Health model.⁶ Closely related, monitoring biomarkers (eg, more precise characterization of functional and structural central nervous system changes) is vital to advance precision rehabilitation.

Above all, precision rehabilitation lacks a unifying conceptual framework sufficiently detailed to guide precision rehabilitation research and incorporate new findings. Ideally, this framework will build on other precision medicine frameworks while adding the distinctive

emphasis on functional, long-term, and patient-identified outcomes. Constructs missing from earlier frameworks include the effect of context, barriers, and facilitators to treatment that vary across heterogeneous patient groups and mechanisms to foster shared understanding among patients and/or advocates, scientists, clinicians, and health care systems. Thus, we advance the proposition that a precision rehabilitation conceptual framework—widely embraced and applied—will accelerate major discoveries; transcend longstanding silos defined by patient conditions, age groups, and rehabilitation subspecialties; and facilitate wide-spread equitable implementation of findings with high fidelity, active monitoring, patient engagement, and cost/time efficiencies.

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