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Targeted Exercise Training to Optimize Leg Power, Leg Speed and Mobility Among Older Adults

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To the Editor:

Mobility problems are a signal condition identifying older adults at risk for developing subsequent disability, morbidity and mortality.^{1,2} The standard treatment for mobility limitations is rehabilitative exercise. Recently, within a large multicenter trial, a rehabilitative exercise program reduced the rate of disability after 2.6 years of follow up.³ While rehabilitative exercise is indeed clinically beneficial, exercise is commonly viewed uniformly. In other words, a single mode of exercise should be prescribed for all individuals. The purpose of this report is to challenge this assumption by performing an additional analysis of a novel mode of exercise training in order to highlight its clinical potential.

One of the few randomized controlled trials evaluating different modes of rehabilitative exercise compared a conventional resistance training program advocated by the National Institute of Aging (NIA) to another mode of training that emphasized speed of movement, muscle power and task specific training.^{4,5} These targets were selected based on their established links to mobility limitation among older adults.^{6,7} The intervention, known as **Increased Velocity Exercise Specific to Task (InVEST)**, had individuals performing functional tasks using weighted vests for resistance. Exercise training was provided 3 times per week for 16 weeks. A component of each exercise task was performed as quickly as possible to train for speed of movement and resistance was added to the vests as participants progressed. The primary findings of the study were that: 1) InVEST produced equivalent improvements in leg strength, and greater improvements in leg power than NIA; and 2) both

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groups demonstrated robust improvements in mobility measured by the Short Physical Performance Battery (SPPB). A secondary analysis revealed that among the 50% of participants that were limb velocity impaired at baseline (i.e. < median value), InVEST produced clinically important improvements in SPPB scores compared to NIA. This led us to conclude that InVEST may be more beneficial for patients that are velocity impaired.

Since this publication, recent studies have reported clinically important thresholds for changes in limb power and velocity as well as for the Late-Life Function Instrument, a patient-reported measure of mobility that was a secondary outcome in the InVEST study.^{8,9} In light of these data additional analysis of the InVEST study is warranted to better understand the clinical relevance of our findings. Therefore, we analyzed data from InVEST to: 1) evaluate changes in leg power and velocity with respect to clinically relevant thresholds; and 2) determine the clinical importance of the effects of InVEST on the basic lower-extremity function scale of the LLFI.

For aim 1, with NIA training 2 % and 4% changes were observed after 16 weeks of training in leg press power and leg press velocity, respectively. With InVEST training 14% and 15% changes were observed after 16 weeks of training in leg press power and leg press velocity, respectively. Clinically meaningful thresholds for these parameters are described as 9-10% for leg press power and 6-7% for leg velocity.⁹

Using repeated measures analysis of covariance, we evaluated change in basic lower-extremity function on the LLFI among all participants and then among those with baseline strength and velocity below median values (Table 1). We controlled for age, gender, and study site, which were clinically relevant covariates. Among all participants neither statistically significant nor meaningful group by time effects were observed. Among participants that were strength impaired, InVEST produced changes that were both statistically significant and exceeded the minimal detectable change within a 90% confidence interval (MDC_{90})⁶ in basic lower extremity function compared to NIA. Among participants that were velocity impaired, while the group by time difference was not statistically significant ($p=.08$), the observed difference in basic lower extremity function (5.0 units) did exceed a meaningful threshold of change ($MDC_{90}=4.4$).

Taken together these findings further underscore the clinical potential of InVEST training. In comparison to a gold standard mode of progressive resistance training, InVEST produced improvements in leg power and leg speed that surpassed clinically relevant thresholds. Also, regardless of whether individuals were either strength or velocity impaired at baseline, the observed differences in patient-reported basic lower-extremity function exceeded clinically meaningful levels. InVEST was designed to be a simple, low cost means of training muscle power and physical function. The components of muscle power, leg strength and leg speed, are linked to mobility decline and disability among community-dwelling older adults.^{7,10} While our findings should be confirmed within a clinical trial powered to evaluate changes in patient-reported function, they highlight that InVEST is a mode of training that has great clinical promise for patients with mobility limitations.

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Table 1

Adjusted mean LLFI scores at completion of 16 weeks of training for N=138 mobility limited older adults undergoing either InVEST or NIA training based upon baseline impairment status.

	Participant status (N)		NIA	InVEST	Group effect p-value	Time effect p-value	Adjusted mean group difference	Group × Time p-value
Late-Life Function Instrument Basic Lower Extremity Function (MDC ₉₀ = 4.4 units)	All (N=138)	Pre	77.1	77.2				
		Post	77.5	81.0	.46	.03	3.5	.10
	Strength Impaired (N=69)	Pre	79.4	78.0				
		Post	77.8	83.7	.44	.02	5.9 *	.02
	Velocity Impaired (N=69)	Pre	77.4	76.7				
		Post	75.9	80.9	.49	.39	5.0 *	.08

All models adjusted for baseline, gender, study site

* value exceeds MDC₉₀