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A Little Exercise

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All parts of the body which have a function if used in moderation and exercised in labors in which each is accustomed, become thereby healthy, well developed and age more slowly; but if unused and left idle they become liable to disease, defective in growth and age quickly.

—Hippocrates, c. 450 B.C.

Talk about wisdom! Nearly 2500 years later, the debate about exercise and aging continues with little understanding of the topic beyond Hippocrates' words.

The report by the LIFE Study investigators on the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) study that appears in this issue of the Journal adds to the growing number of reports demonstrating that well-designed and supervised training programs encompassing strength, balance, and/or endurance-promoting activities in the very old and/or debilitated can improve performance on low-level functional tasks. Somewhat imbedded in the findings is another increasingly well-documented principle—performance-based tests can identify individuals on the brink of severe loss or decline in health and functional independence, some of whom will benefit from performance training and attention to the underlying functional deficits.

The LIFE-P study adds pivotal information to the substantial and multifaceted literature on the benefits of physical activity in older persons (1–13), and provides important evidence that increased physical exercise in older persons with functional limitations improves lower extremity performance, one of the most important risk factors for late-life disability (14). Although large observational studies supported the role of exercise in late life as a means to improve or slow down age-related decline in physical performance, it remained uncertain whether this association was causal or whether physical activity just served as a proxy measure for “life engagement or health behaviors” associated with better health. Further, although considerable data in the literature suggests that tests of lower extremity performance, such as the Short Physical Performance Battery (SPPB), are quick and effective tools for identifying older persons at high risk of disability (15,16), evidence that SPPB score can be successfully modified was limited to small studies.

We compliment the authors for the scientific rigor of the LIFE-P study. No doubt they have broken new ground and provided further justification and preliminary data critical to an improved design and conduct of a clinical trial to determine whether increasing physical activity prevents or delays disability in older persons.

In the spirit of full disclosure, we should state that both authors of this editorial were involved in early discussions about the design of the LIFE study. Below we offer the perspectives and

sometimes differing opinions of a geriatrician (L.F.) and social scientist (E.M.S.) on the findings and future direction of the LIFE study.

Through the Eyes of a Geriatrician

Luigi Ferrucci, MD, PhD

Taking a translational perspective, and still under the influence of the exciting results of the LIFE study, I feel the urge to discuss two topics that, although outside the scope of the original LIFE pilot study, nonetheless demand careful consideration for future research in this area.

First, we should seriously consider new strategies for reaching out to the frailest and sickest segment of the older population. By excluding among potential participants with a SPPB of 9 and able to walk 400 meters those affected by severe medical conditions, the authors of the LIFE study may have limited the generalizability of their findings, possibly for no good reason. In fact, previous studies have found that increasing physical activity improves health outcomes in persons affected by specific chronic diseases, such as pulmonary disease, congestive heart failure, and lower extremity osteoarthritis, regardless of their severity (12,17,18). Thus, it is possible that including in the study population those persons affected by severe chronic diseases would have actually strengthened the study findings.

Second, in spite of the multitude of evidence that physical activity improves health status, prevents a number of negative health outcomes, and improves quality of life in individuals across the age spectrum, leisure time and structured physical activity levels have changed very little over the last few decades, especially in older persons (19). No matter how strong the evidence that physical activity delays disability, this information by itself has not been effective in modifying individual behavior. Physical activity is not alone in this regard. For example, despite overwhelming evidence of the harmful effects of smoking on health, attitudes toward smoking did not significantly change until extensive antismoking policies were implemented and wide multimedia educational campaigns launched (20). In the geriatric community, despite substantial literature clearly demonstrating that tailored, multicomponent interventions can effectively prevent falls, implementation of these interventions has been at best sporadic and incomplete (21). I strongly advocate that the good news conveyed by the LIFE investigators about the health benefits of exercise must transcend the scientific community and be disseminated to policymakers and health care planners. To grab their attention, we need to demonstrate that the beneficial effects of exercise result in considerable improvements in health and quality of life and a sizeable reduction in health care costs. The LIFE study has come very close to this goal. Interestingly, the survival curve for mobility outcome began to diverge over the last 2 months of the study, suggesting that, with a larger sample size and a longer follow-up, prevention of mobility disability could be demonstrated. I have little doubt that the prevention of disability would be paralleled by a substantial reduction in health care utilization.

The LIFE study provides a proof of principle that promoting physical activity in older persons is possible. A mix of strengthening of the infrastructures that creates more opportunities and incentives for physical activity and a new societal and cultural appreciation for exercise in old age may do the trick. Paramount to this change is our ability to find new, creative ways of making exercise a joyful and rewarding experience, especially for the life-long sedentary. At the same time, it is important that the study of the specific mechanisms by which exercise improves health is continued. These mechanisms may represent an access door to the secret gears that connect aging, disease, and physical function.

Surprisingly, little is known about the energetic cost of activities performed every day, such as walking and climbing stairs. It is quite possible that the effect of exercise simply improves the efficiency of these motor activities, therefore reducing their energetic cost. Alternatively,

physical activity may increase the threshold for the development of fatigue, thereby promoting more active motor behavior. This dichotomy parallels the struggle between two concepts that have been animatedly debated by Greek philosophers: *dynamis* and *energeia*. In fact, roughly, the Greek word *dynamis* means “ability” or “potential”; whereas *energeia* corresponds to “current activity.” As usual ... nothing is ever new under the sun.

Through the Eyes of a Social Scientist

Eleanor M. Simonsick, PhD

In reading this article and taking a public health perspective, I was reminded of three critically important issues for the life quality and functional independence of the ever-growing elder nation.

First, despite solid evidence of the prognostic value of a simple (and economical) set of performance-based tests, the SPPB, among others, these measures have yet to be adopted as a component of standard clinical practice (15,22). Remarkably, these measures rarely appear even in “comprehensive” geriatric assessment programs. Second, for individuals found to have functional deficits, limited options exist within the established health care community to obtain effective treatment. Clearly, as the current article and others before it have shown, exercise works. Third, poor functional performance is prognostic for a variety of negative health outcomes, only a few of which may be responsive to exercise training. This principle is also well established and supported by the current study, in that, after 12 months, 37% had no evidence of improved SPPB score.

So, isn't it about time for us—gerontologists, geriatricians, nurse practitioners, physical therapists, health policy-makers, insurance providers, and the like to put our heads together to develop and *implement* system-wide practices for preventative assessment and screening to identify persons who may appear healthy and functionally intact, but already have detectable functional limitations and teeter at the edge of loss of independence? Such screening must also aim to distinguish individuals likely to benefit from regular supervised physical training, both those that have declined due to disuse and those who have detrained as a consequence of specific treatable or manageable health conditions (e.g., claudication, osteoarthritis) from those who are severely ill or suffer from severe dementia.

To facilitate delivery of effective treatments, habilitation programs must be reimbursable. Thus, we need to work toward creating a new diagnostic classification, something like, *low functional reserve*, replete with specific diagnostic criteria and subclassifications, follow-up assessment procedures, and treatment recommendations and strategies. Parallel efforts with substantial input from the rehabilitative medicine and physical therapy communities are also required to develop certifications and credentialing procedures for the facilities and personnel who will provide the necessary habilitation services.

The LIFE-P article together with the vast research literature on both the prognostic significance of performance-based testing in older adults and the responsiveness of older adults to physical training provide initial evidence to support action toward developing new health care policy to permit identification and treatment of *low functional reserve*. The research component is nonetheless far from complete and much remains to be learned. For example, although we can discern that not all SPPB 8s, for instance, share the same difficulties, physiologic impairments, and comorbidities, limited work has considered the multiple etiologies and functional impairments that underlie poor performance. Further studies are also needed to document the cost effectiveness of functional habilitation. Although the current report indicates high screening yields, the cost implications of an SPPB score falling below 9, for instance, or becoming unable to walk 400 meters without assistance, remain unknown.

It is important to reiterate that this article provides findings from a pilot study designed to test the feasibility of and refine effect size estimates for a larger effort. Although a sizeable proportion of study participants were able to attend an acceptable number of sessions and show performance improvements, a sizeable percentage could not fully commit to the program or avoid functional decline. In a limited resource environment, it is imperative that services be offered and made available only to those apt to benefit. Thus, it would seem prudent to utilize the substantial clinical and physical and cognitive function data collected as part of the screening process and baseline assessment to refine participant selection and expand the exclusion criteria. Further, recent reports from observational studies have identified individuals with SPPB scores above 9 and walking speeds of less than 1.0 m/s as highly vulnerable and at great risk of mobility limitation and disability (23). Thus, consistent with this work, a modest expansion of the eligibility criteria that reaches up the functional spectrum appears in order. Lastly, as a bit of a radical proposal, in designing and conducting the full trial to facilitate implementation of a successful program, serious consideration should be given to establishing a partnership or formal collaboration with the Center for Medicare and Medicaid Services (CMS), the agency that would ultimately pay for the functional screening/diagnostic costs and habilitation regimens and would in turn benefit from any cost savings derived from the prevention or delay of dependency. The CMS demonstration project model appears well suited to this effort.

In sum and simply put, there exists a sizeable subset of older adults at high risk of losing the capacity to ambulate outside of their home that can be easily identified and successfully rehabilitated. Designing and implementing a process to identify and treat these individuals is critical to maintaining the life quality and independence of a large and growing segment of the U.S. population. Phase 3 of the LIFE study, provided a more informed selection of participants and collaboration with key agencies, has great potential for affecting this process.

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