The Role of Functioning in Healthy Longevity Research

and Practice

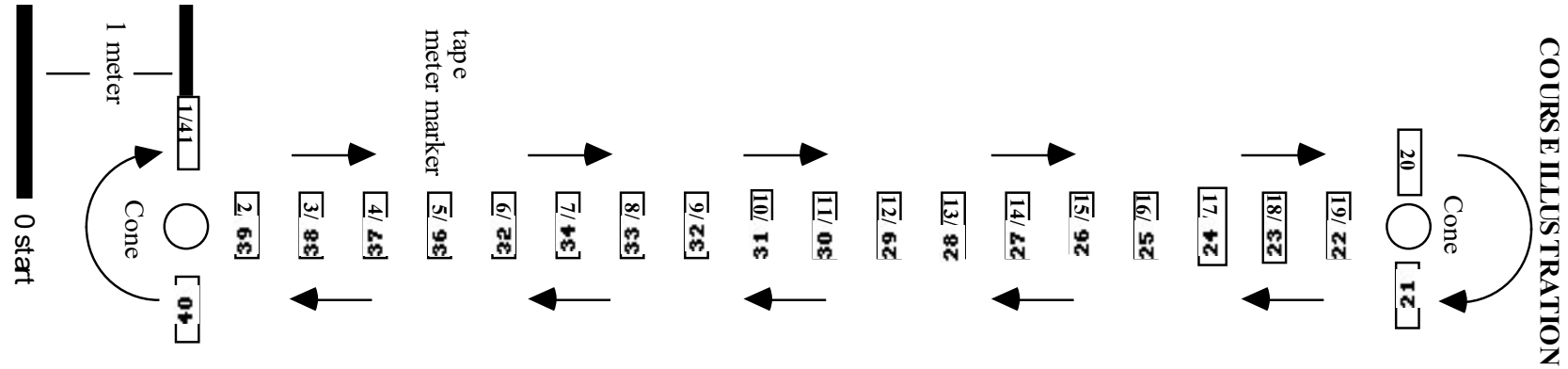
Eleanor M. Simonsick, PhD
Co-Director BLSA
Intramural Research Program
National Institute on Aging
National Institutes of Health

You Don't Know What You Don't Know

Why we need "hands-on" functional performance testing

Illustrative example:

Study:	**Health, Aging and Body Composition Study (Health ABC)**
Eligibility Criteria:	Age 70-79y No reported ADL difficulty or **difficulty walking ¼ mile** or climbing 1 flight of stairs assessed by phone, followed by an in-person in-home "confirmatory" assessment
Performance Test:	Long Distance Corridor Walk: 2-minute walk performed as quickly as possible immediately followed by a **400m walk** to be performed as quickly as possible



You Don’t Know What You Don’t Know

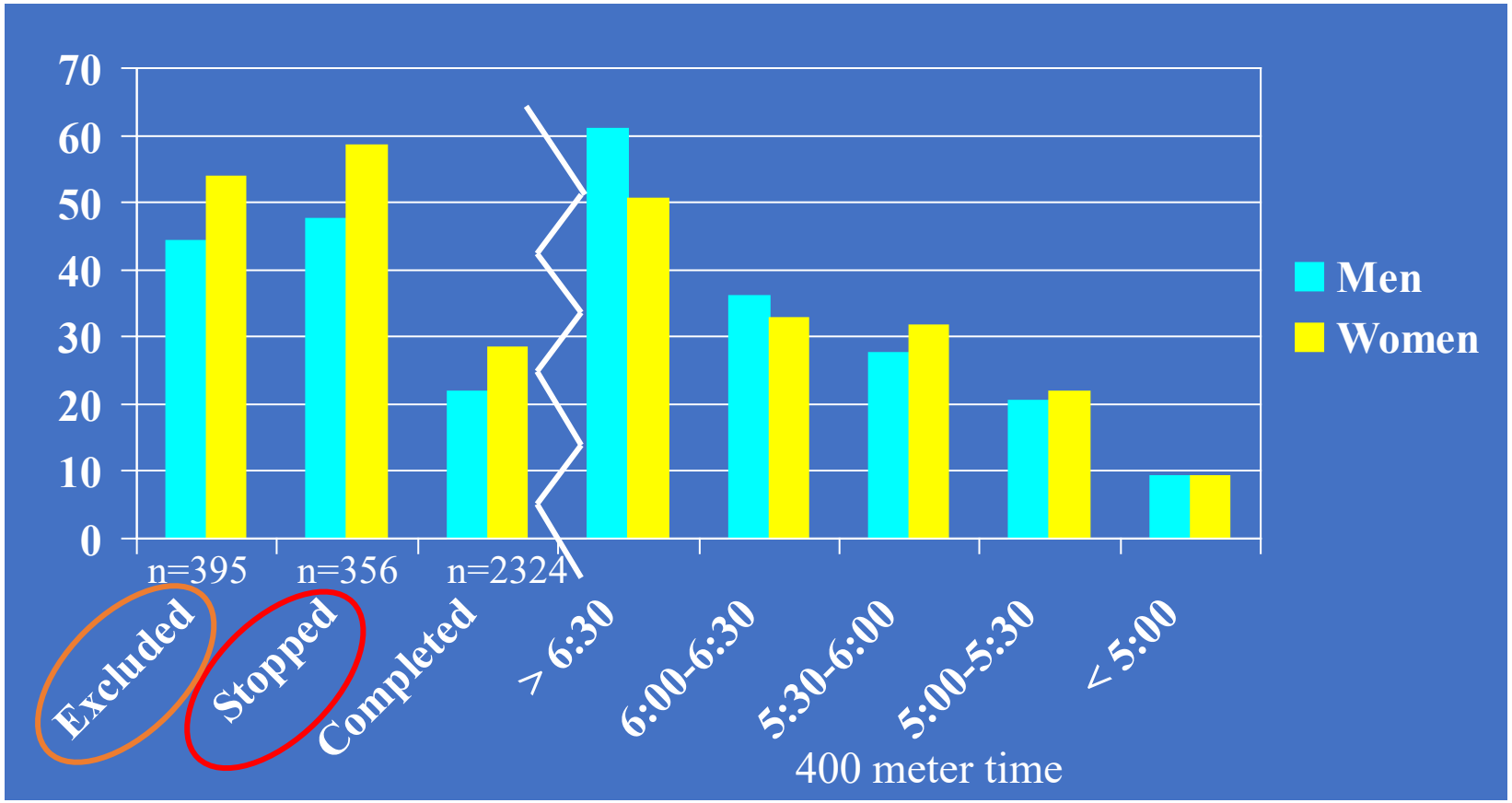
Why we need “hands-on” functional performance testing

Exclusion criteria

ECG abnormality
40>RHR>110
SBP>180, DBP>109
Recent cardiac event, procedure or worsening symptoms

Stopping criteria

Testing HR>135
Chest or leg pain
Shortness of breath
Excessive fatigue



Curtains!!! Functional Assessment as a Window on Health and Aging

Performance testing can reveal limitations but not necessarily the underlying cause

Illustrative example: **Effect of Structured Physical Activity on Prevention of Major Mobility Disability in Older Adults: The LIFE Study Randomized Clinical Trial**

Eligibility: Age 70-89 years; sedentary < 20 min/w regular PA and < 125 min/w moderate PA; **SPPB score ≤ 9;** able to walk 400m w/in 15 min w/o sitting or any assistance; cognitively intact by 3MSE

Primary Hypothesis (in my words): Getting people on the cusp of mobility disability to engage in structured physical activity including strength training will delay onset of mobility disability (i.e., inability to walk 400m w/in 15 min)

Underlying/Corollary Question (in my words): Are performance deficits in older adults modifiable through activities that directly impact performance ability OR are these deficits **manifestations of a broad range of health-related factors** that are not evident or diagnosable from functional performance alone?

Curtains!!! Functional Assessment as a Window on Health and Aging

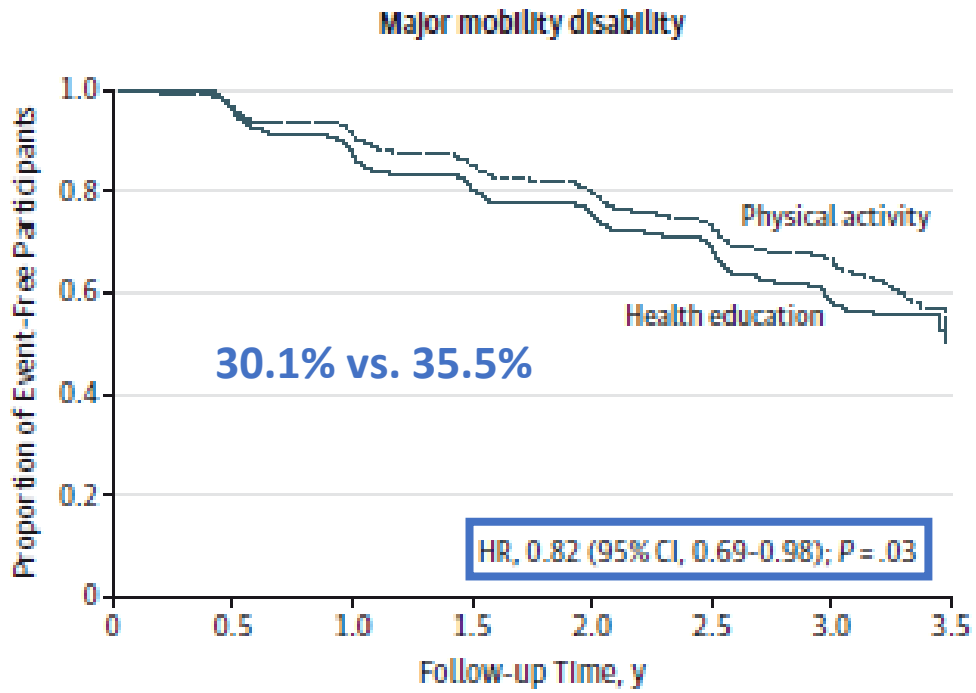
Performance testing can reveal limitations but not necessarily the underlying cause

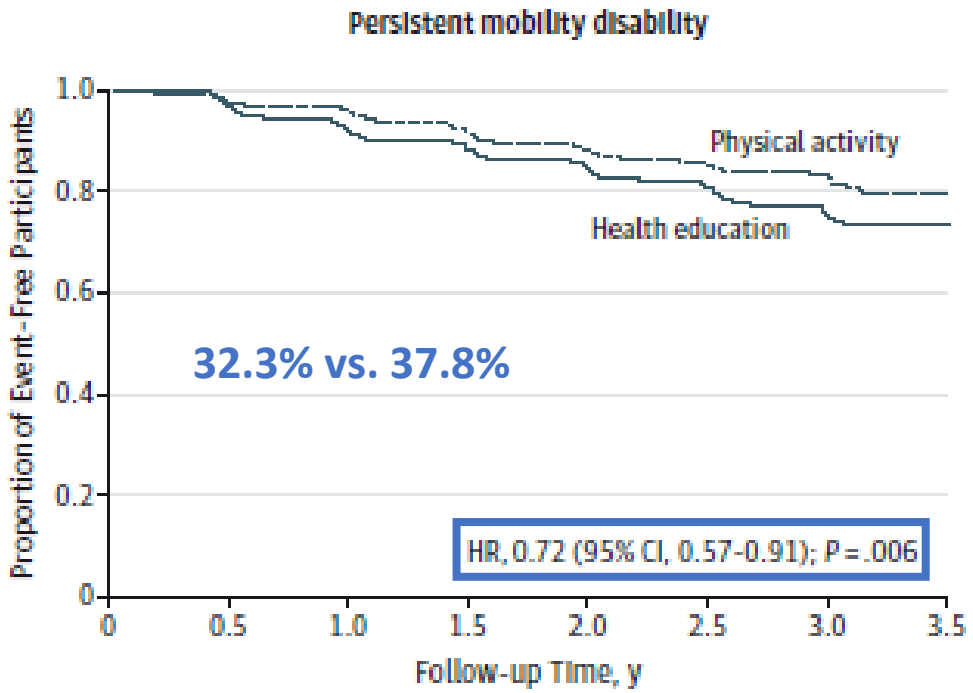
Intervention (N=818): 30 min moderate pace walking, 10 min lower extremity strength, 10 min balance training and flexibility 2 days/week at a center and 3-4 days/week at home for 24 months

Control/Successful Aging Health Education Program (N=817): Weekly health education workshops for 26 weeks; monthly thereafter, w/ 5-10 min gentle upper extremity stretching and flexibility exercises

Primary Findings: The LIFE Study

Figure 3. Effect of a Moderate Physical Activity Intervention on the Onset of Major Mobility Disability and Persistent Mobility Disability

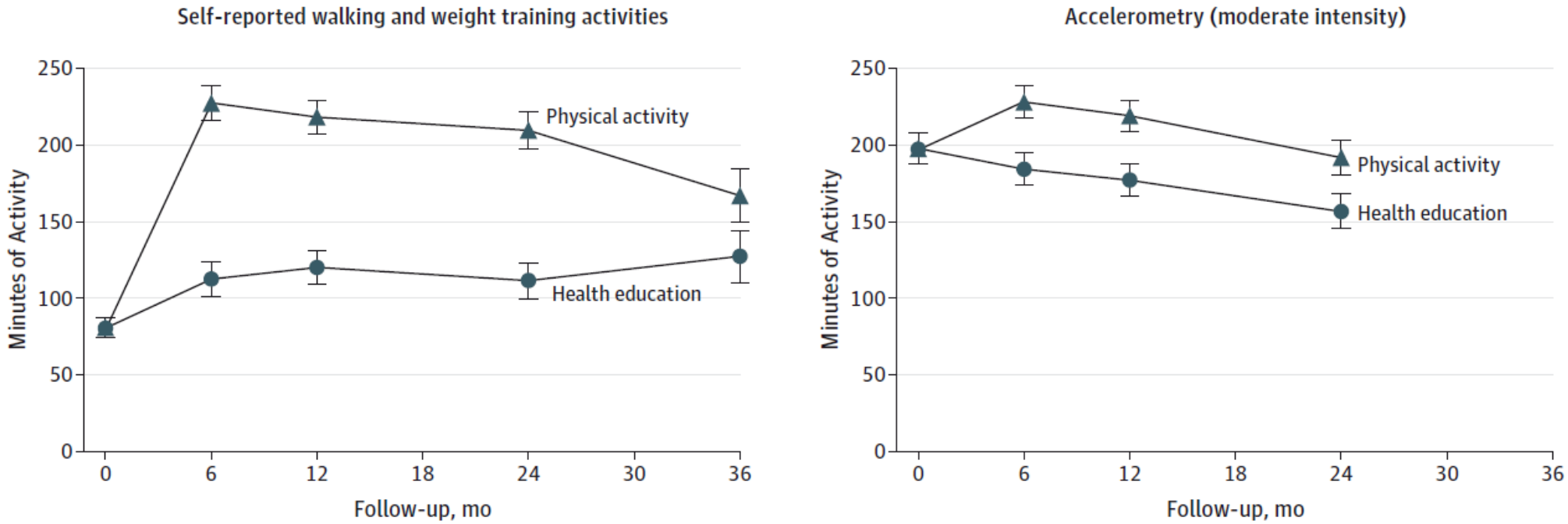




No. at risk															
Physical activity	818	758	706	646	559	378	182	11	818	761	726	673	579	393	188	12
Health education	817	765	680	617	540	358	162	13	817	762	707	655	567	371	178	10
Events																
Physical activity	0	29	67	115	155	197	224	246	0	18	32	64	88	104	113	120
Health education	0	33	105	155	190	232	277	286	0	25	64	91	118	138	158	162

Self-Reported and Measured Adherence*: The LIFE Study

Figure 2. Self-reported and Accelerometry-Derived Physical Activity by Treatment Group



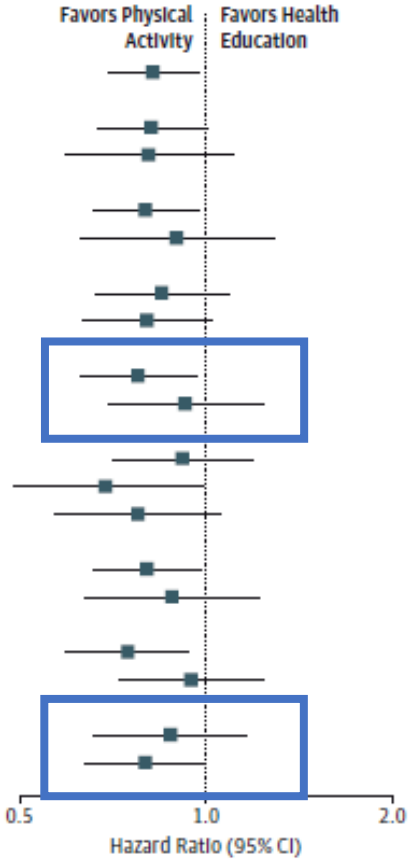
No. of participants									
Physical activity	818	774	761	724	292	590	423	420	349
Health education	817	796	777	738	295	581	422	425	346

*PA group attended 63% of sessions excluding medical leave … 58.6% went on medical leave at least once; 201 (25.7%) at least twice for a mean duration of 135 days

Subgroup Results: The LIFE Study

Figure 4. Hazard Ratio of Major Mobility Disability for Physical Activity vs Health Education According to Subgroups

Subgroup	Physical Activity Events, No.	Physical Activity Total Participants	Health Education Events, No.	Health Education Total Participants	Hazard Ratio (95% CI)	Interaction P Value
Overall	246	818	290	817	0.82 (0.69-0.98)	
Sex						
Women	171	547	204	551	0.82 (0.67-1.01)	.95
Men	75	271	86	266	0.81 (0.59-1.11)	
Ethnicity/race						
Non-Hispanic white	182	604	234	635	0.80 (0.66-0.98)	.58
Other	64	211	56	180	0.90 (0.63-1.29)	
Age, y						
70-79	123	477	138	455	0.85 (0.67-1.09)	.76
≥80	123	341	152	362	0.81 (0.63-1.03)	
History of CVD						
No CVD	155	582	187	563	0.78 (0.63-0.97)	.34
CVD	91	236	103	254	0.93 (0.70-1.24)	
History of diabetes						
None	114	406	126	414	0.92 (0.71-1.19)	.41
Impaired fasting glucose	59	192	68	165	0.69 (0.49-0.99)	
Diabetes	73	220	96	238	0.78 (0.57-1.06)	
Gait speed						
<0.8 m/s	173	485	210	508	0.81 (0.66-0.99)	.63
≥0.8 m/s	73	333	80	309	0.88 (0.64-1.22)	
SPPB						
<8	135	353	177	378	0.75 (0.60-0.94)	.19
8 or 9	111	465	113	439	0.95 (0.73-1.23)	
3MSE (post hoc)						
<90	95	261	108	261	0.88 (0.66-1.16)	.58
≥90	151	557	182	556	0.80 (0.64-0.99)	



The Tyranny of Low Expectations

We need to assess not only indicators of failing/failure, but also age-appropriate metrics of success

Case Study: Sarcopenia

Sarcopenia – Cleveland Clinic

Sarcopenia is the **age-related progressive loss** of muscle mass and strength. The main symptom of the condition is muscle weakness. Sarcopenia is a type of muscle atrophy **primarily caused by the natural aging process**.

Sarcopenia – European Working Group on Sarcopenia in Older People (2) (2018)

Sarcopenia is a **muscle disease (muscle failure) rooted in adverse muscle changes that accrue across a lifetime**; sarcopenia is common among adults of older age but can also occur earlier in life.

Age and Ageing 2019; 48: 16–31 doi: 10.1093/ageing/afy169

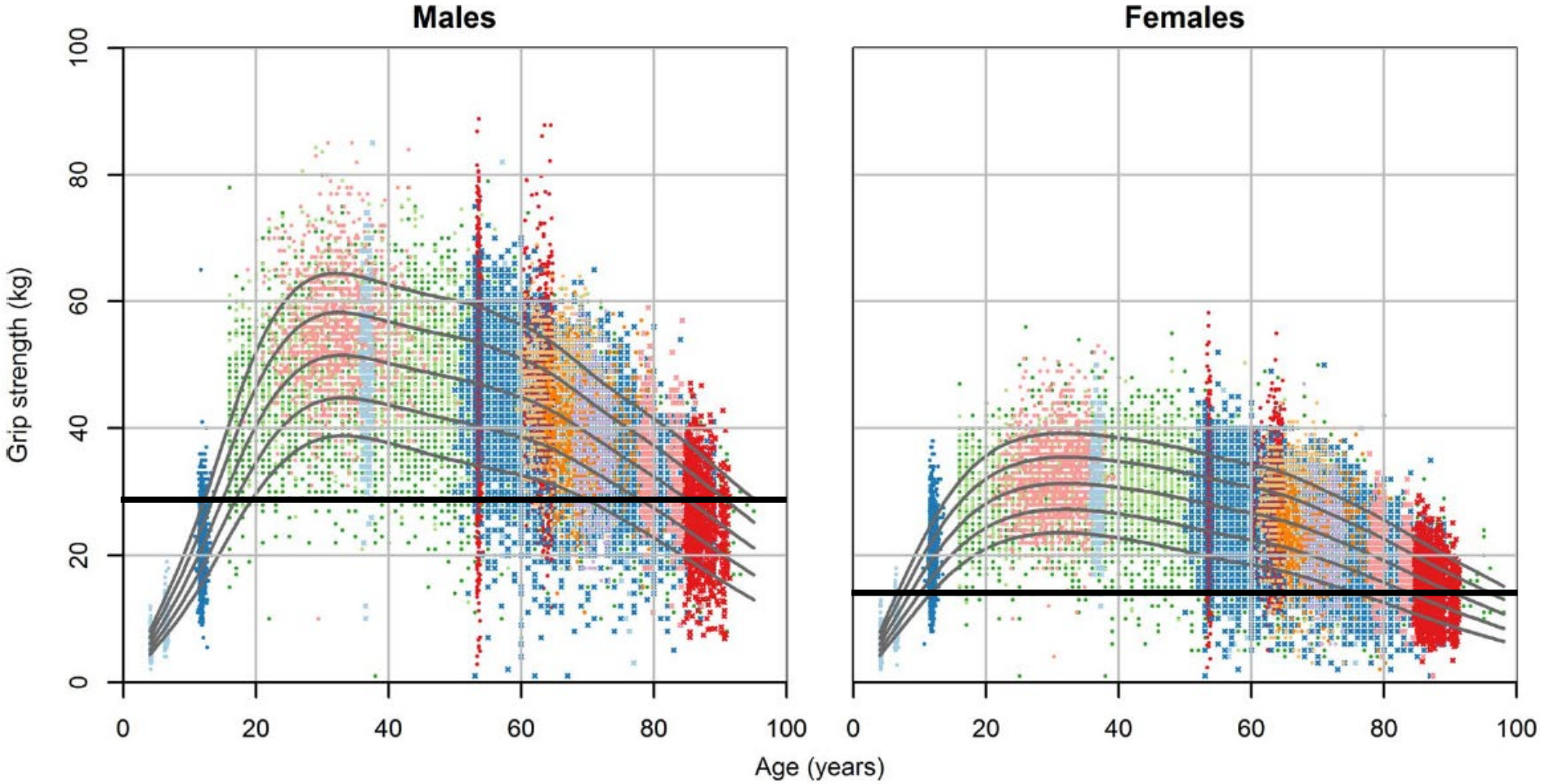
Sarcopenia: Revised European Consensus on Definition and Diagnosis

Table 3. EWGSOP2 sarcopenia cut-off points

Test	Cut-off points for men	Cut-off points for women	References
EWGSOP2 sarcopenia cut-off points for low strength by chair stand and grip strength			
Grip strength	**<27 kg**	**<16 kg**	Dodds (2014) [26]
Chair stand	**>15 s for five rises**		Cesari (2009) [67]
EWGSOP2 sarcopenia cut-off points for low muscle quantity			
ASM	**<20 kg**	**<15 kg**	Studenski (2014) [3]
ASM/height^2	**<7.0 kg/m^2**	**<5.5 kg/m^2**	Gould (2014) [125]
EWGSOP2 sarcopenia cut-off points for low performance			
Gait speed	**≤0.8 m/s**		Cruz-Jentoft (2010) [1] Studenski (2011) [84]
SPPB	**≤8 point score**		Pavasini (2016) [90] Guralnik (1995) [126]
TUG	**≥20 s**		Bischoff (2003) [127]
400 m walk test	**Non-completion or ≥6 min for completion**		Newman (2006) [128]

Age and Ageing 2019; 48: 16–31 doi: 10.1093/ageing/afy169

Grip Strength across the Life Course: Normative Data from Twelve British Studies

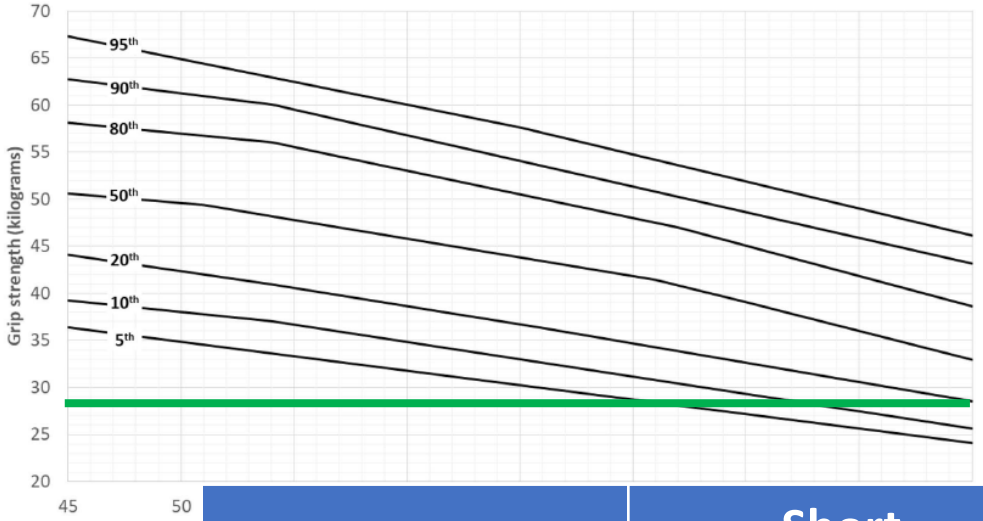


PLOS ONE | DOI:10.1371/journal.pone.0113637 December 4, 2014

Normative values for grip strength, gait speed, timed up and go, single leg balance, and chair rise derived from the Canadian Longitudinal Study on Ageing

Age and Ageing 2023; **52:** I–I I

Grip strength percentiles by age – males n=12,443



Grip strength percentiles by age – females n=11,367

The EW openia

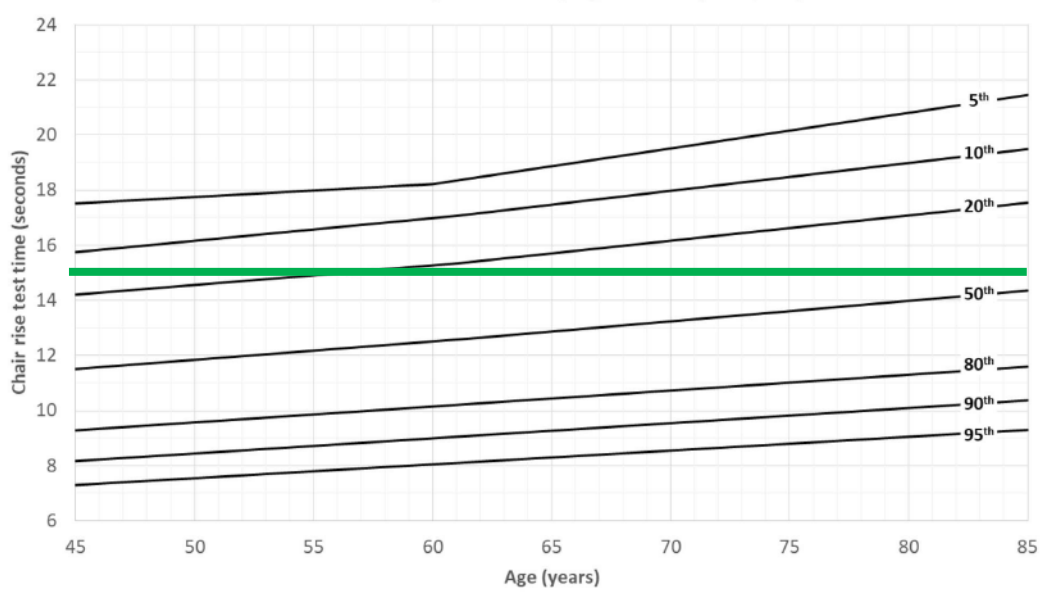
	Short	Average	Tall
Men age 65+	32	39	43
Women age 65+	19	23	27

Correlation between height and grip strength = 0.67 – UK Biobank data

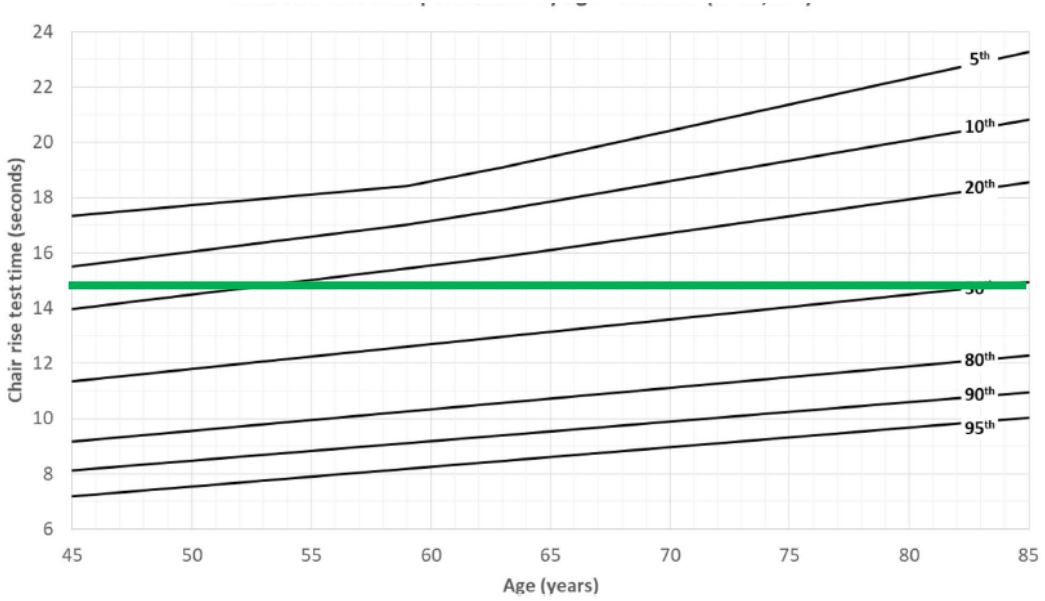
http://dx.doi.org/10.1016/j.jamda2013.06.013

Normative values for grip strength, gait speed, timed up and go, single leg balance, and chair rise derived from the Canadian Longitudinal Study on Ageing *Age and Ageing* 2023; **52:** I–I I

Chair rise percentiles by age – males n=12,880



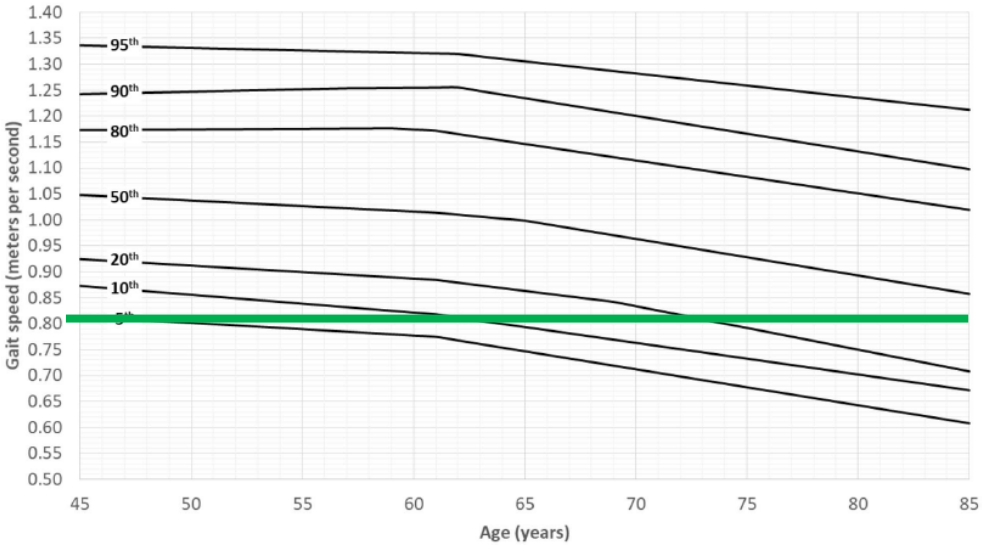
Chair rise percentiles by age – females n=12,184



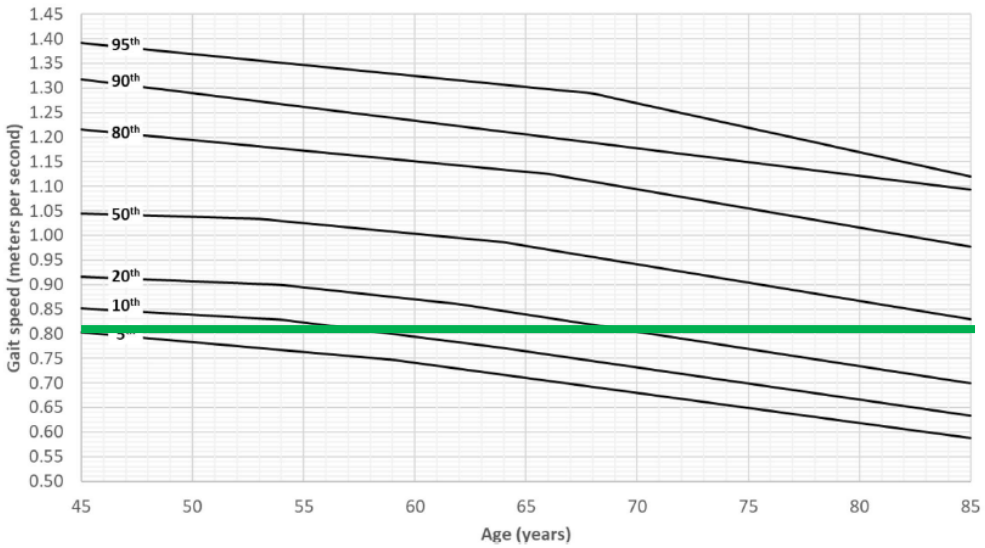
Applying the EWGSOP2 chair stand criteria defines nearly 50% of 80 year-old men and women as having sarcopenia

Normative values for grip strength, gait speed, timed up and go, single leg balance, and chair rise derived from the Canadian Longitudinal Study on Ageing *Age and Ageing* 2023; **52:** I–I I

Gait speed percentiles by age – males n=13,013



Gait speed percentiles by age – females n=12,289



Applying the EWGSOP2 gait speed criteria defines 30 to 40% of 80 year-old men and women as having sarcopenia

For Healthy Longevity

Functional performance testing is essential as many individuals are unaware of their capacities and limitations

Functional performance testing is just the beginning as the behaviors and health conditions that underly or contribute to deficient performance are vast

Functional performance testing should tap capacities as well as limitations and evaluation criteria should account for age, sex and size

Thank you for the invitation to share my thoughts and the opportunity to learn from all of you