

Regular Aerobic Exercise as a Physical Resilience Promoting Intervention

AGS/NIA R13 Bench-to-Bedside Conference Series
Optimizing Resilience

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Background

Measures of Physical Functional Capacity (Reserve)

IADLS

SPPB

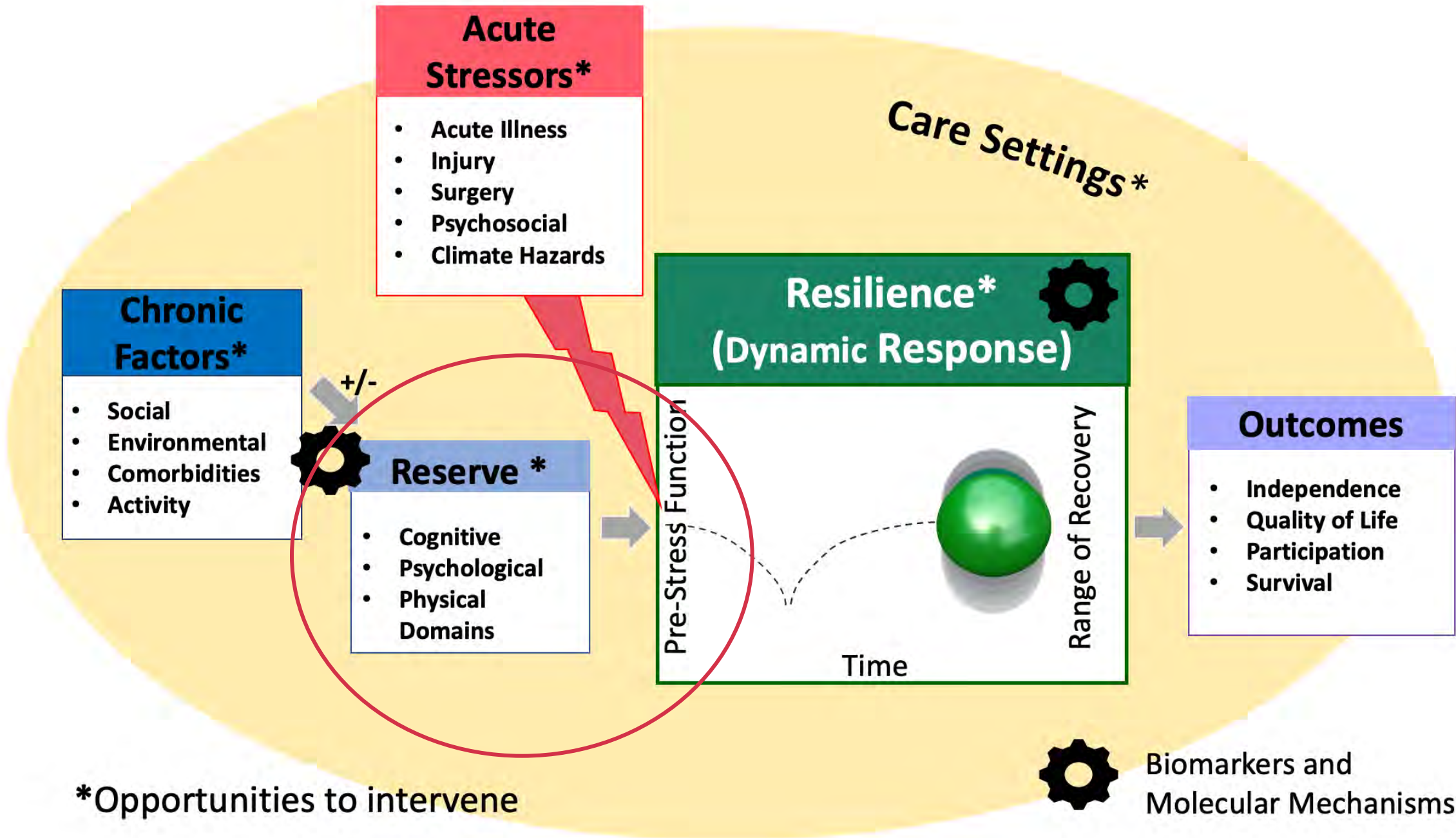
6-minute walk

Peak VO_2 and its compatriots


Measures of Physical Activities that Modify Physical Functional Capacity

Moderate to Vigorous Physical Activity – recall surveys

Step Counts – objective measure via accelerometry, pedometers



*Opportunities to intervene

 Biomarkers and Molecular Mechanisms

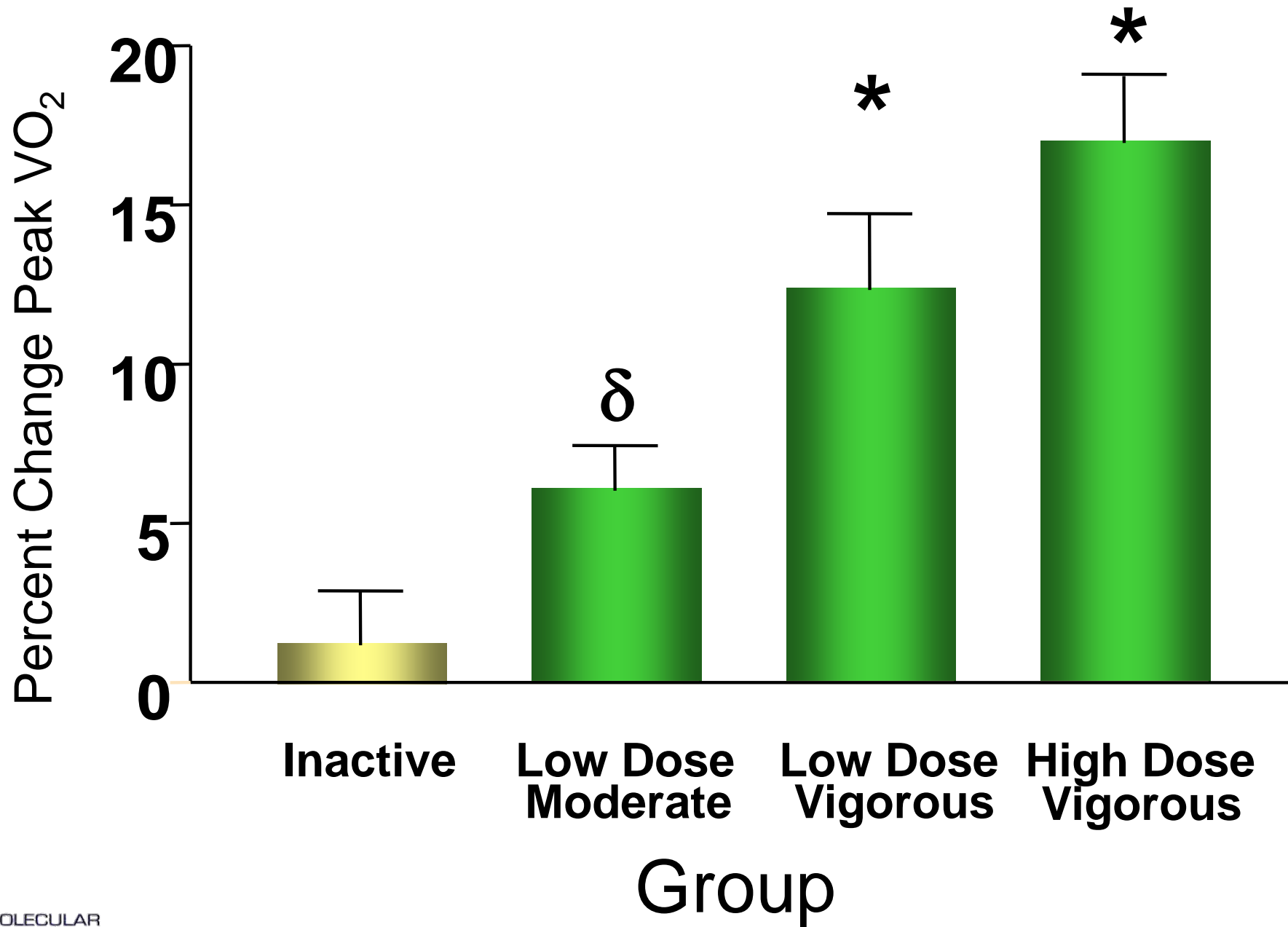


Studies of a Targeted Risk Reduction Intervention through Defined Exercise

Group	Intensity (% $\dot{V}O_{2peak}$)	Amount (kcal/kg/week)
Control	-	-
Low/Mod	Moderate (40-55%)	14 KKW
Low/Vig	Vigorous (65-80%)	14 KKW
High/Vig	Vigorous (65-80%)	23 KKW

Intensity Effect (indicated by a bracket on the left side of the table, spanning the Low/Mod and Low/Vig rows)

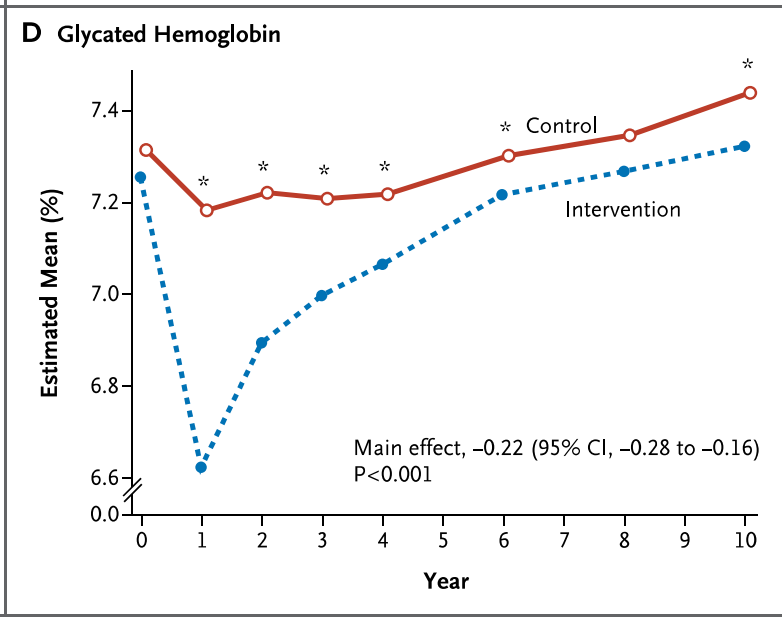
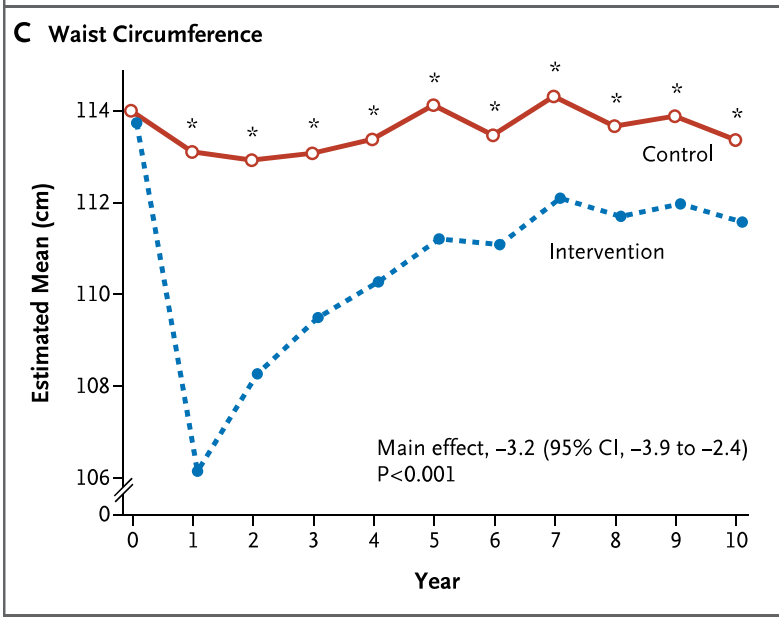
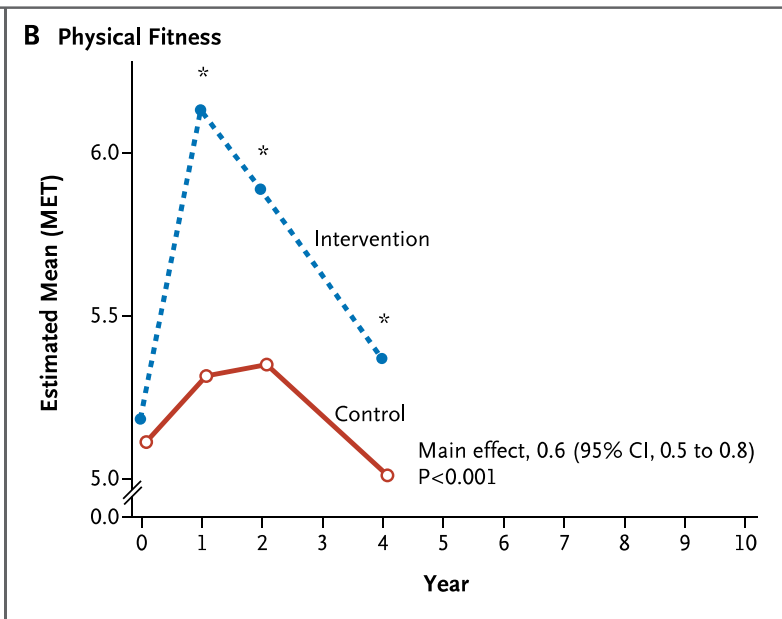
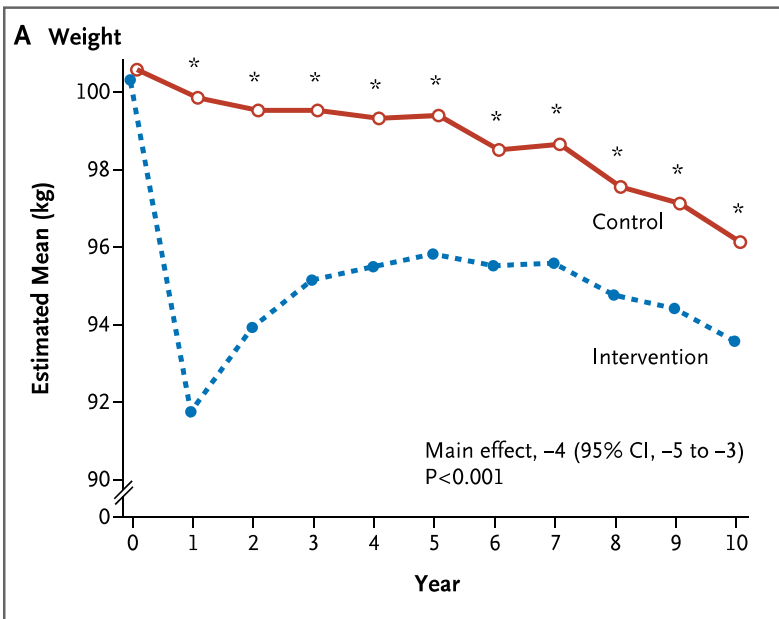
Amount Effect (indicated by a bracket on the right side of the table, spanning the Low/Vig and High/Vig rows)



Legacy Health Effects

- Legacy effect: the sustained benefit of a treatment long after cessation of the intervention
- Adopted for the first time in medical literature in 2008: benefits of early and strict control of diabetes on cardiovascular complications in the UK Prospective Diabetes Study



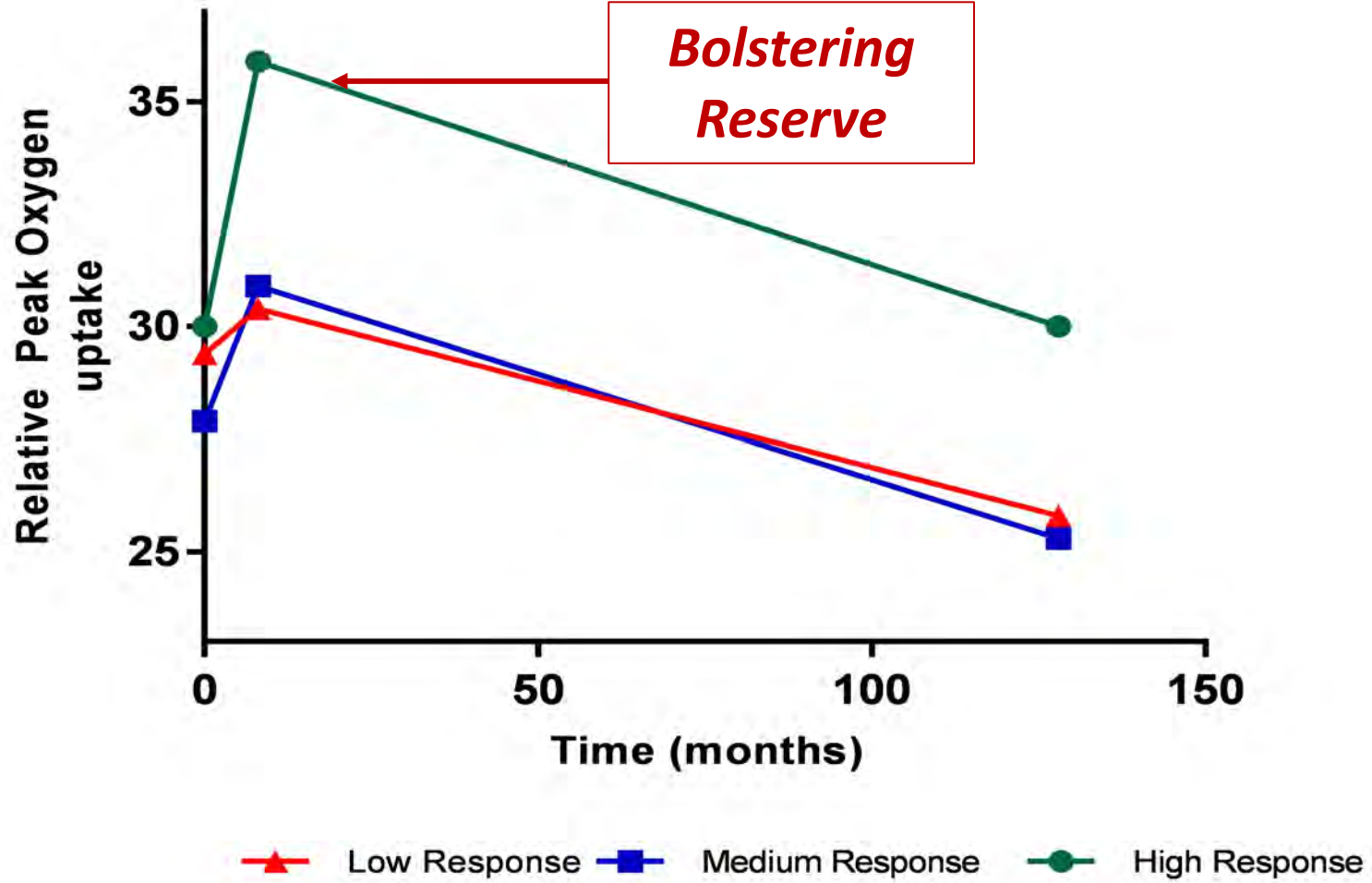


STRRIDE I Reunion

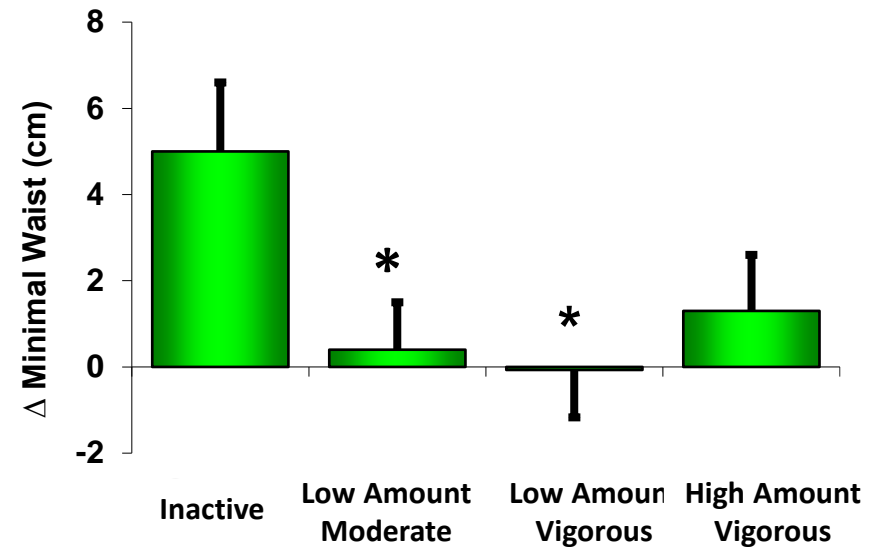
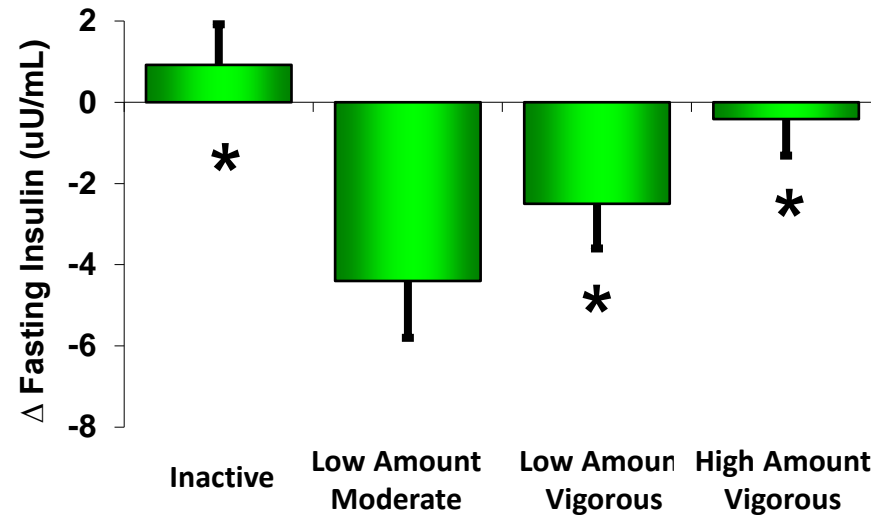
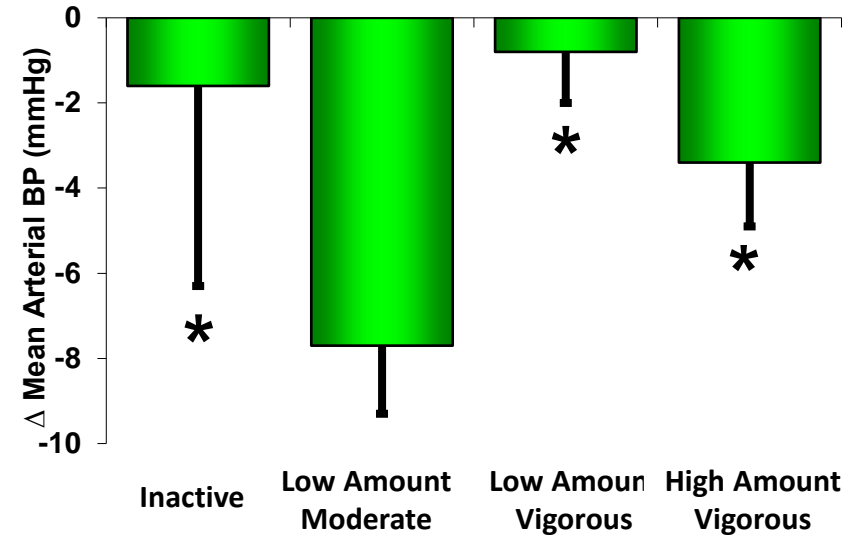
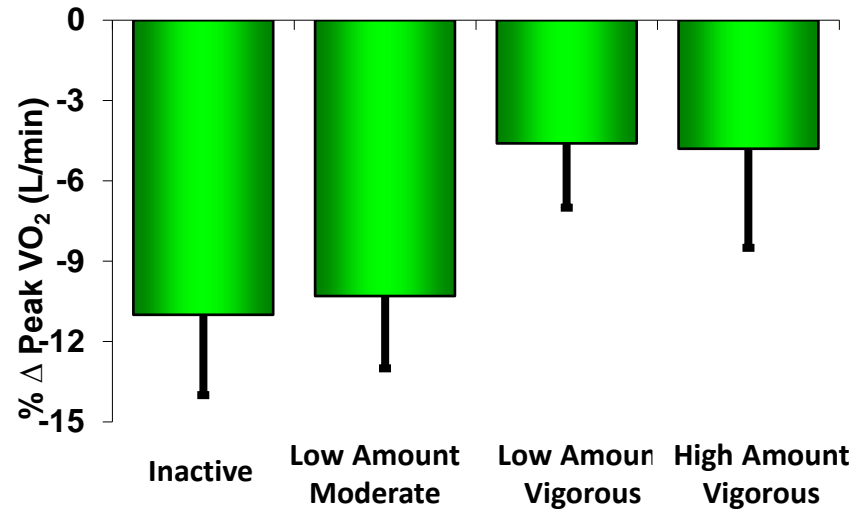
- Ten years later, 104 STRRIDE I participants returned for a Reunion study
 - *High enthusiasm displayed to return for follow-up testing*
 - Assessments included fasted blood sample, blood pressure, waist circumference, and maximal cardiopulmonary exercise test



Greater Short-term Fitness Response Attenuates Decline Over Time



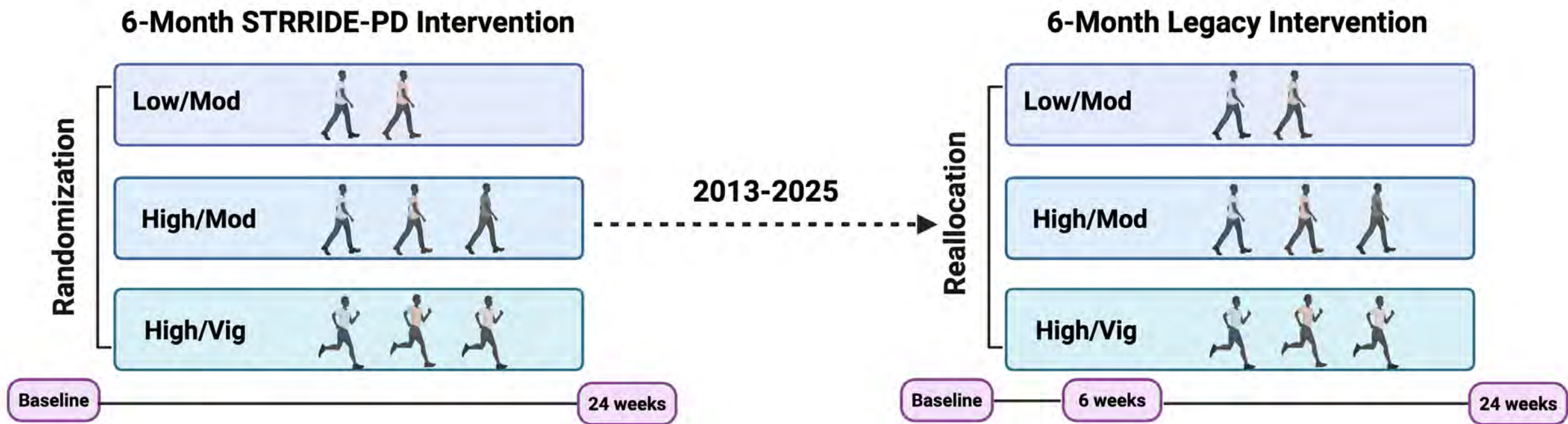
Reunion Results



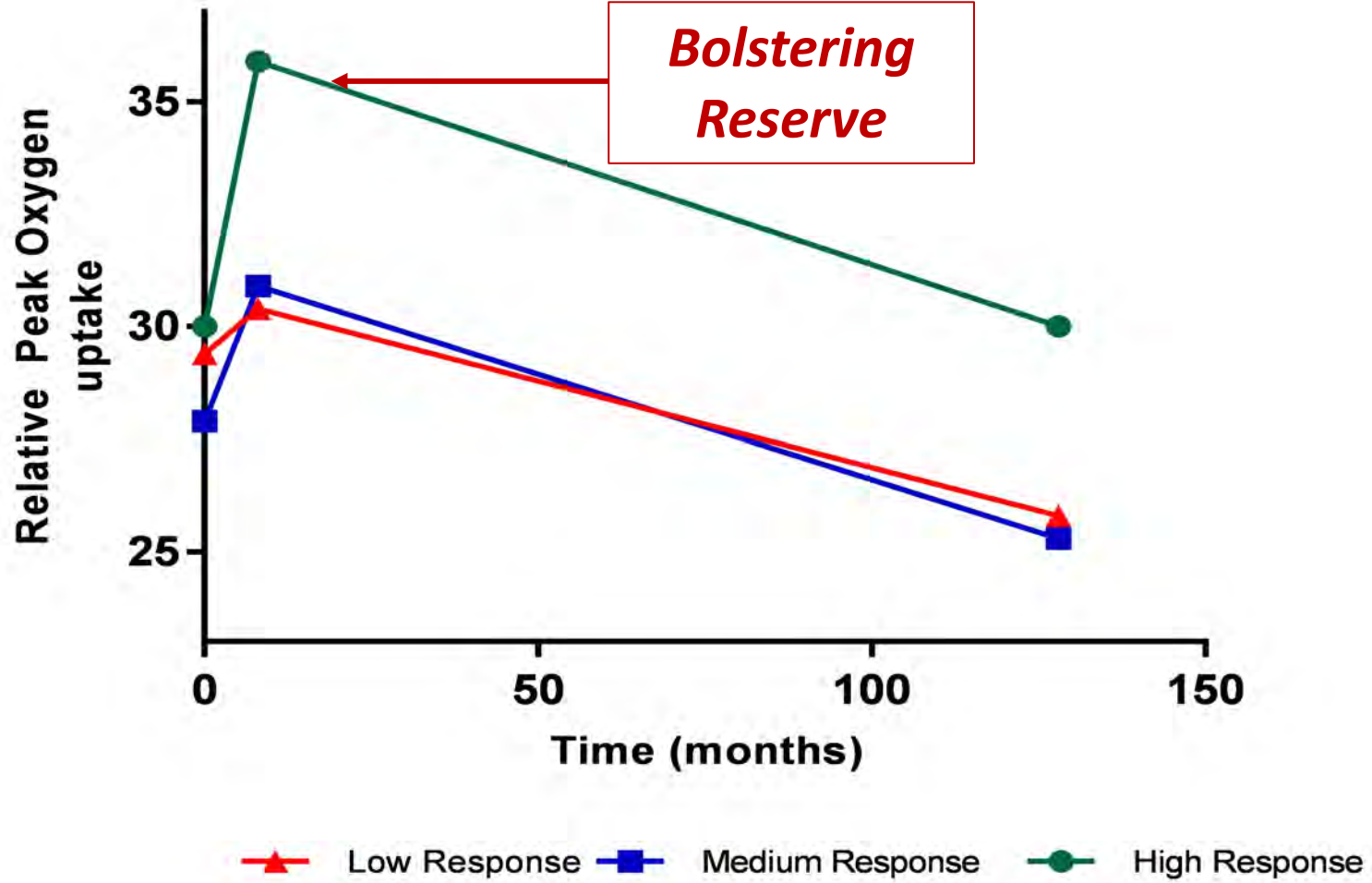
Leanna Ross REC project

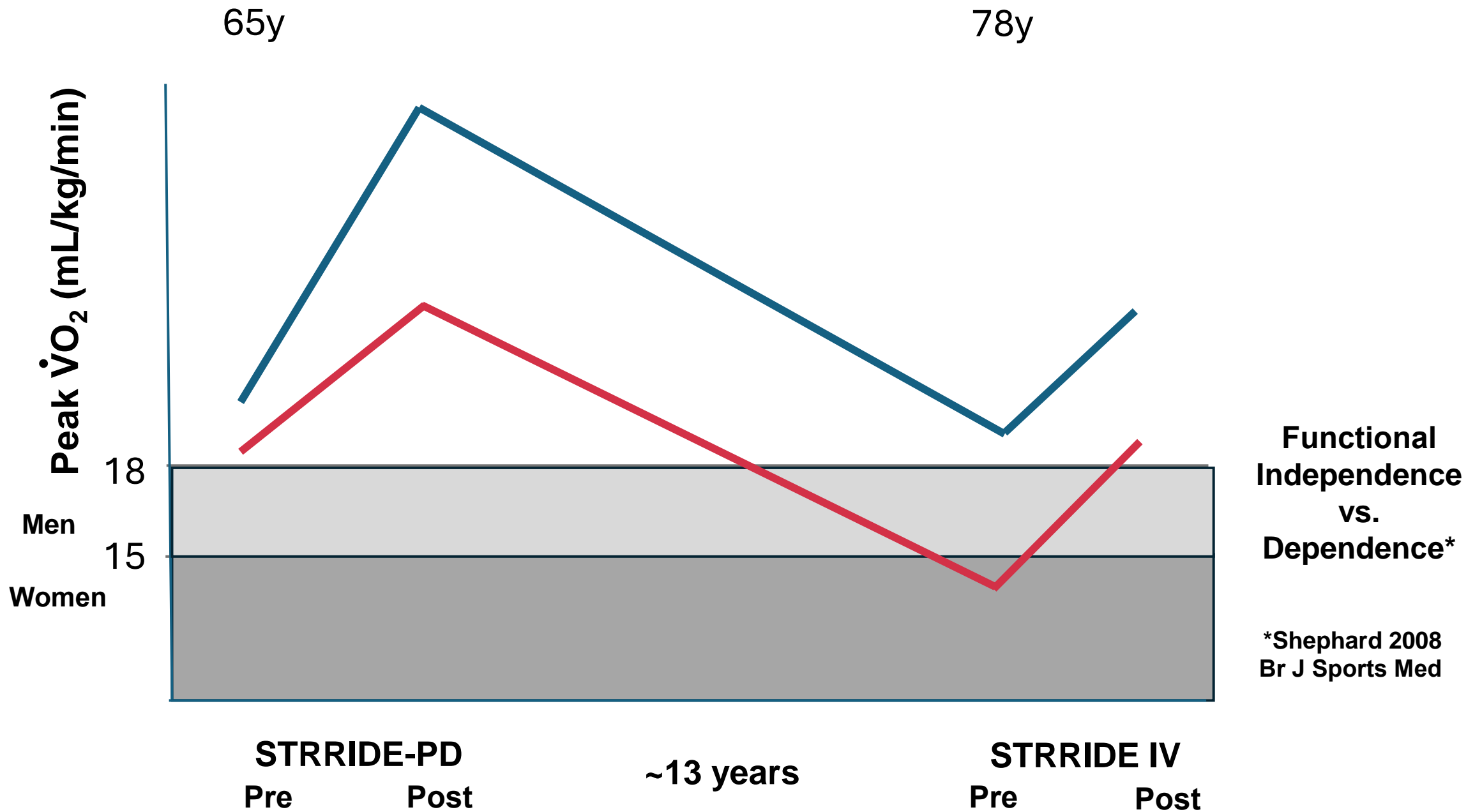
For this study, baseline peak $\dot{V}O_2$ is considered a marker of physical reserve, while post-intervention peak $\dot{V}O_2$ represents a marker of resilience adaptation to an acute physiologic stressor (i.e., the CPET).

STRRIDE IV Pilot Study



Greater Short-term Fitness Response Attenuates Decline Over Time





Extra for Discussion

It's All About Climate!

The Issue of Our Time



Clinical: Cardiac Rehabilitation

A Detailed Analysis of Cardiac Rehabilitation on 180-Day All-Cause Hospital Readmission and Mortality

Brian D. Duscha, MS; Leanna M. Ross, PhD; Andrew L. Hoselton, BS; Lucy W. Piner, MS; Carl F. Pieper, DrPH; William E. Kraus, MD

Journal of Cardiopulmonary Rehabilitation and Prevention 2023;00:1-6

Evaluate the effect of CR on all-cause mortality and readmission rates inclusive of 30, 60, 90 and 180 days for discharged patients eligible for CR.

Baseline Differences:

Demographic and Clinical Characteristics

- No obvious thematic differences between groups
- By observation, maybe supports underserved populations do not go to CR?
- More total risk factors in non-CR group?

Characteristic	Cardiac Rehabilitation (n=214)	No Cardiac Rehabilitation (n=2,427)
Age	64.8 ± 10.9	62.9 ± 12.6
Sex (%)		
Male	65.9	64.7
Female	34.1	35.3
Race (%)		
White	80.4	70.5*
Black	14.9	25.3
Other	4.2	3.8
Unknown	0.5	0.4
Discharge Criteria (%)		
AMI Only	20.6	20.4
PTCA Only	14.0	33.0*
CABG Only	29.0	19.3*
AMI + PTCA	33.2	23.9*
AMI + CABG	2.8	3.5
Controllable Risk Factors and Comorbid Illness		
Diabetes	30.4	38.4*
Hypertension	74.8	76.6
Hyperlipidemia	81.3	69.0*
Smoking History	34.6	59.7*
Obesity	33.2	40.0
Depression or anxiety	23.8	17.1
Cerebrovascular Disease	11.2	13.3
Chronic Obstructive Pulmonary Disease	12.6	13.6
Heart Failure	13.1	12.8
Peripheral Artery Disease	6.1	9.0
Renal Disease	13.1	16.0
Total Number of Controllable Risk Factors [#]	2.8 ± 1.3	3.0 ± 1.3*
Medications		
Beta Blocker	93.5	85.9*
ACE Inhibitor	51.4	57.9
Statin	91.6	85.2*
Ca Channel Blocker	10.7	15.0
Aspirin	94.9	89.1*
Nitroglycerin PRN	52.8	47.8
Insulin	11.7	20.3*
Other Glucose Control Agent	12.1	15.6
Anti-anginal	0.5	9.7*
Diuretic	43.5	39.6
Anticoagulation	20.1	20.7

* Includes diabetes, hypertension, hyperlipidemia, smoking history, obesity and depression or anxiety

Statistical Approach

Four-phase plan to assess both all-cause re-admission and all-cause mortality:

- Model 1. CR vs No CR (unadjusted)
- Model 2. Adding demographics to Model 1
- Model 3. Adding controllable risk factors to Model 2
- Model 4. Adding discharge criteria to Model 3

*Subsequently added medications known to reduce event rates and mortality to Models 2-4

Results – Risk of Readmission

	Hazard Ratio	95% Confidence Interval	P-value
Model 1 Unadjusted	0.612	(0.412 – 0.909)	0.015
Model 2 + Demographics	0.608	(0.409 – 0.903)	0.014
Model 3 + Comorbidities	0.631	(0.423 – 0.941)	0.024
Model 4 + Discharge Criteria	0.630	(0.421 – 0.942)	0.025

Adding medications (aspirin, statins, beta blockers) to Models 2 through 4: none were significant predictors and did not attenuate the magnitude of the cardiac rehab effect.

Results – Risk of Readmission or Death

	Hazard Ratio	95% Confidence Interval	P-value
Model 1 Unadjusted	0.553	(0.370 – 0.820)	0.003
Model 2 + Demographics	0.542	(0.365 – 0.804)	0.002
Model 3 + Comorbidities	0.572	(0.384 – 0.853)	0.006
Model 4 + Discharge Criteria	0.568	(0.380 – 0.847)	0.006

Adding medications (aspirin, statins, beta blockers) to Models 2 through 4: none were significant predictors and did not attenuate the magnitude of the cardiac rehab effect.

Survival Analysis -- Compare Groups

