

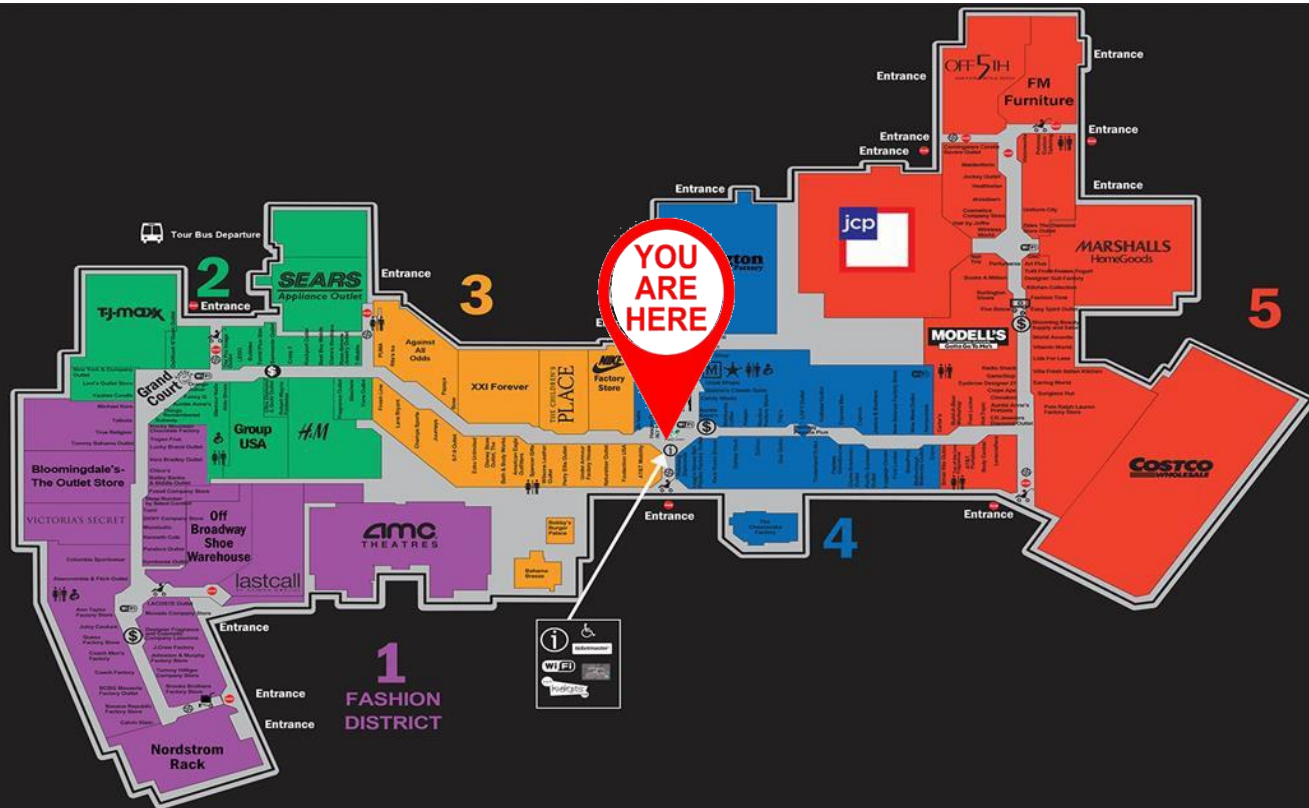


Data-Driven Training Techniques for Older Adults

Joseph Signorile, PhD
University of Miami

Why bother with a data driven model?

**YOU
ARE
HERE**



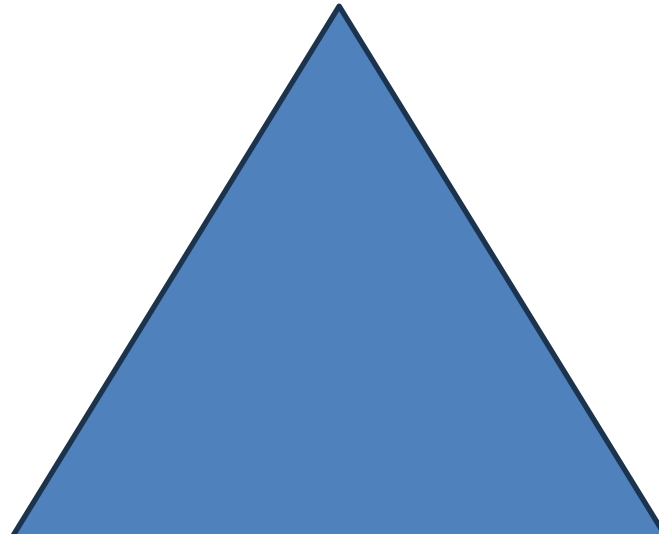
Tasting the Sauce



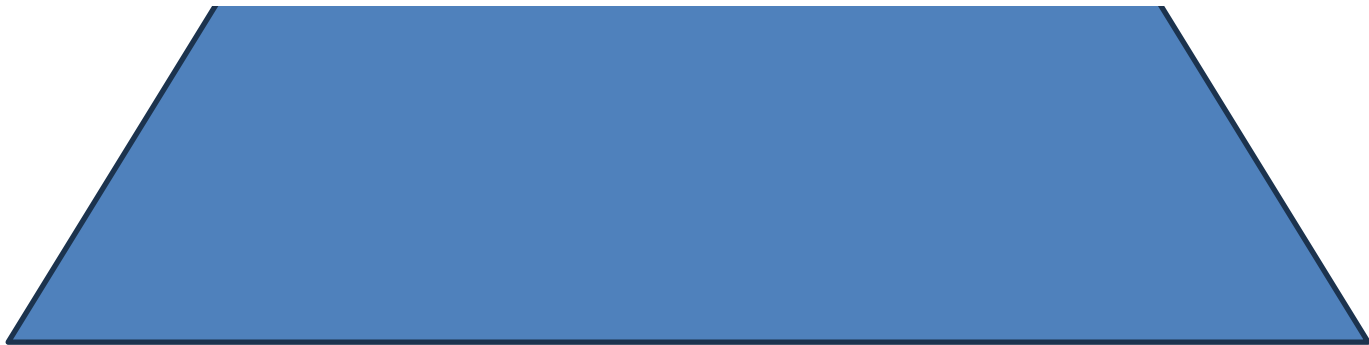
Functional versus Chronological Age



How Should I Structure the Model?



THE TRIANGLE



THE COMPONENTS

Physiological Factor

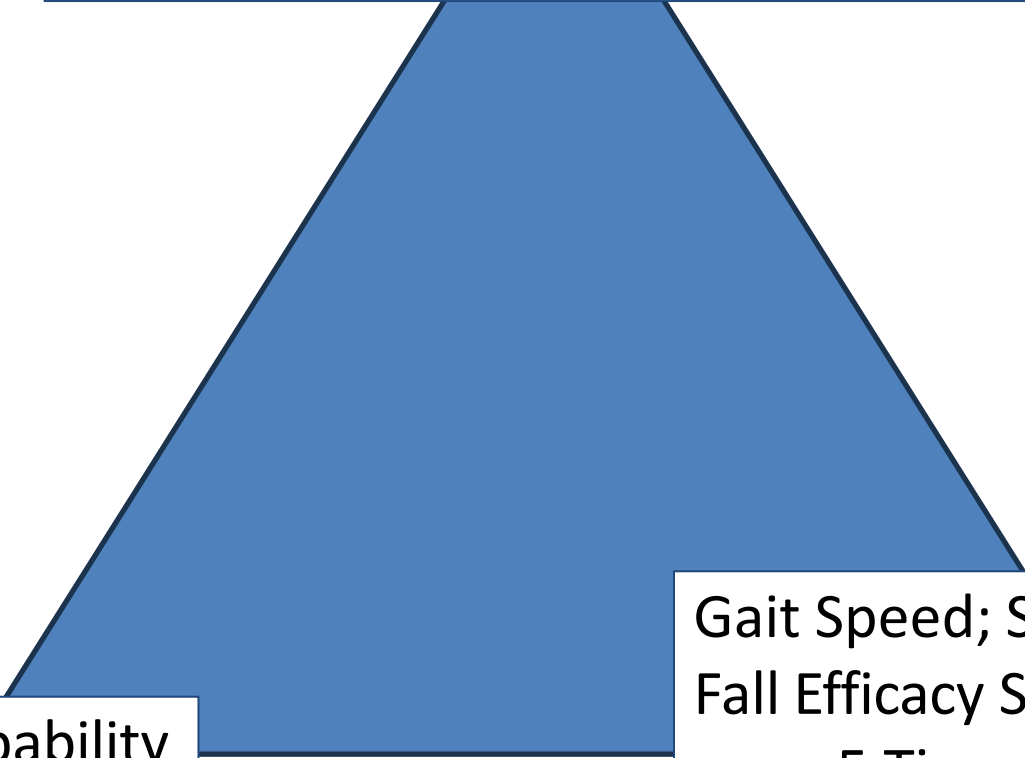


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graph TD; A[Physiological Factor] --- B[ADL Performance]; A --- C[Field Test Result]; B --- C; style A fill:#fff,stroke:#000; style B fill:#fff,stroke:#000; style C fill:#fff,stroke:#000;
```

ADL Performance

Field Test Result

Examples: Fall Probability



Leg Extension and Dorsiflexion Power
Leg Extension Asymmetry

Fall Probability

Gait Speed; Single Leg Stance;
Fall Efficacy Scale; BEST test;
5 Time Sit-to-Stand

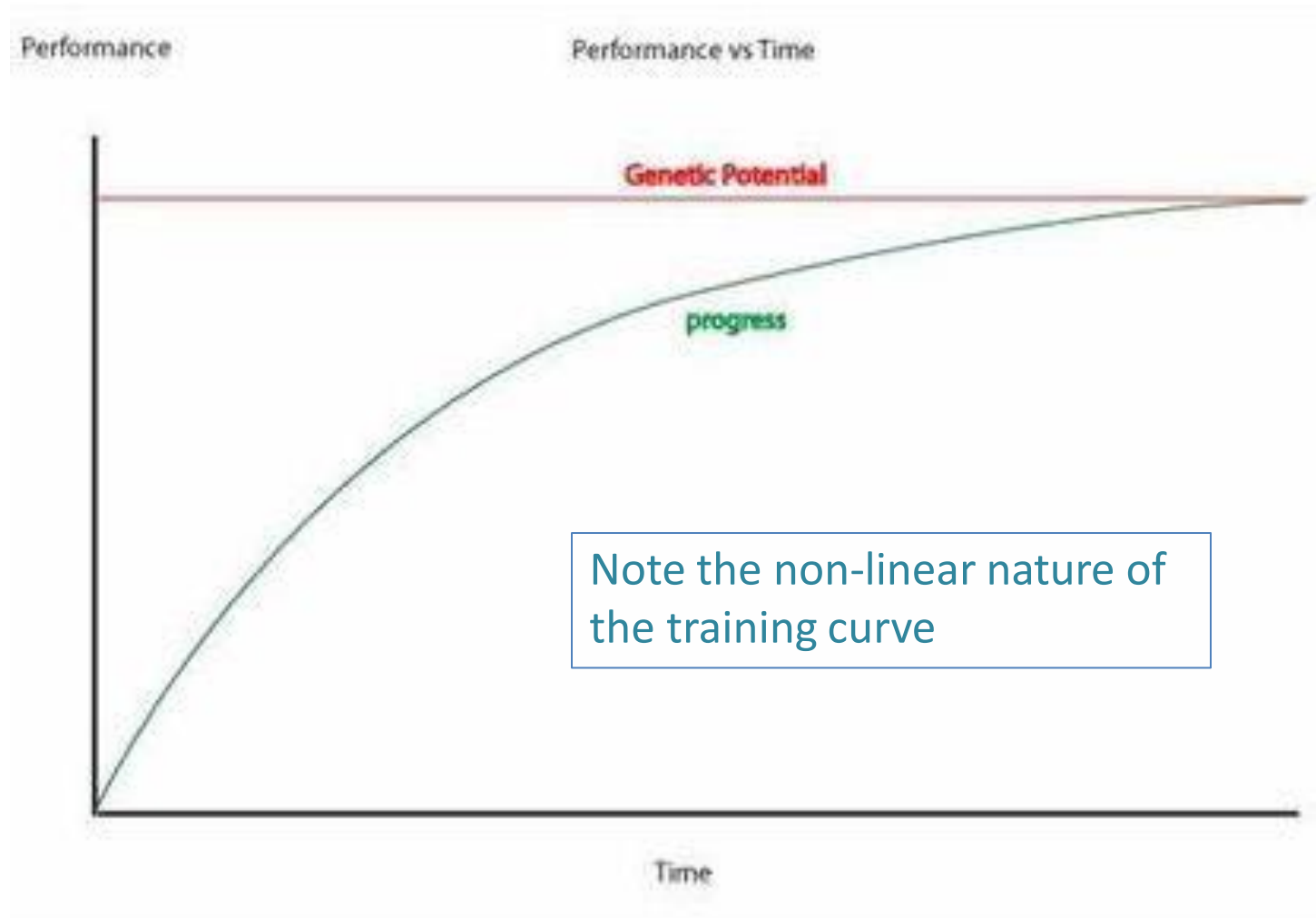
Normative Values

Why Bother???

Normative Values: The Mall

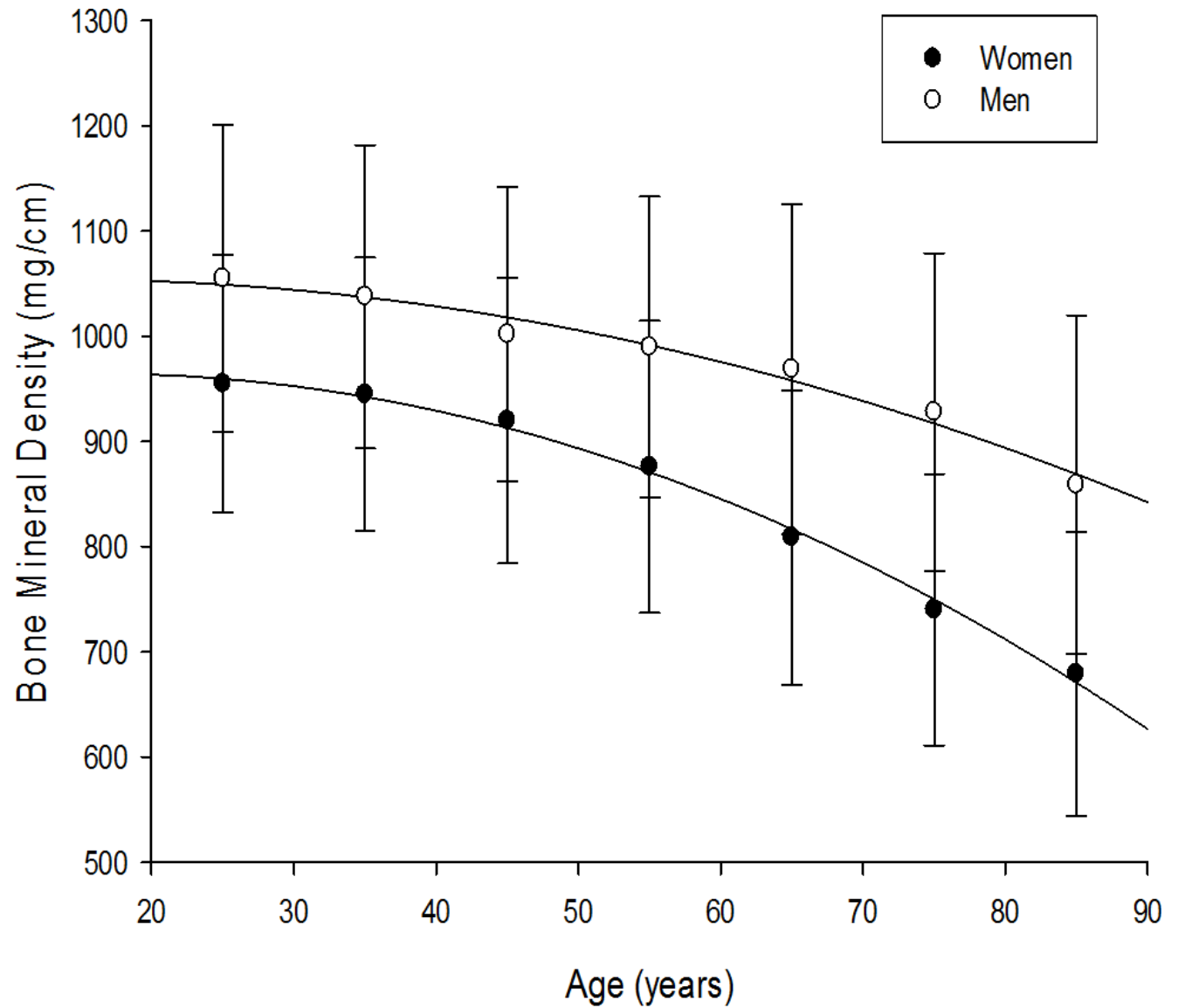
- Assess the status of the client on a particular test.
- Compare values among multiple field tests.
- Develop a targeted intervention

Assess the status of the client on a particular test to set expectations.



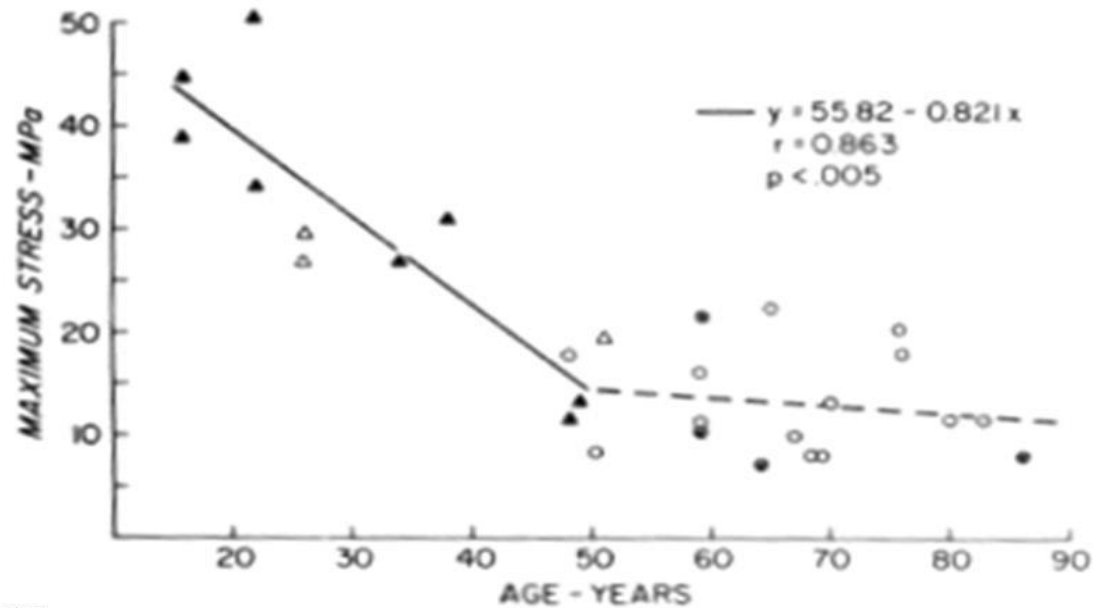
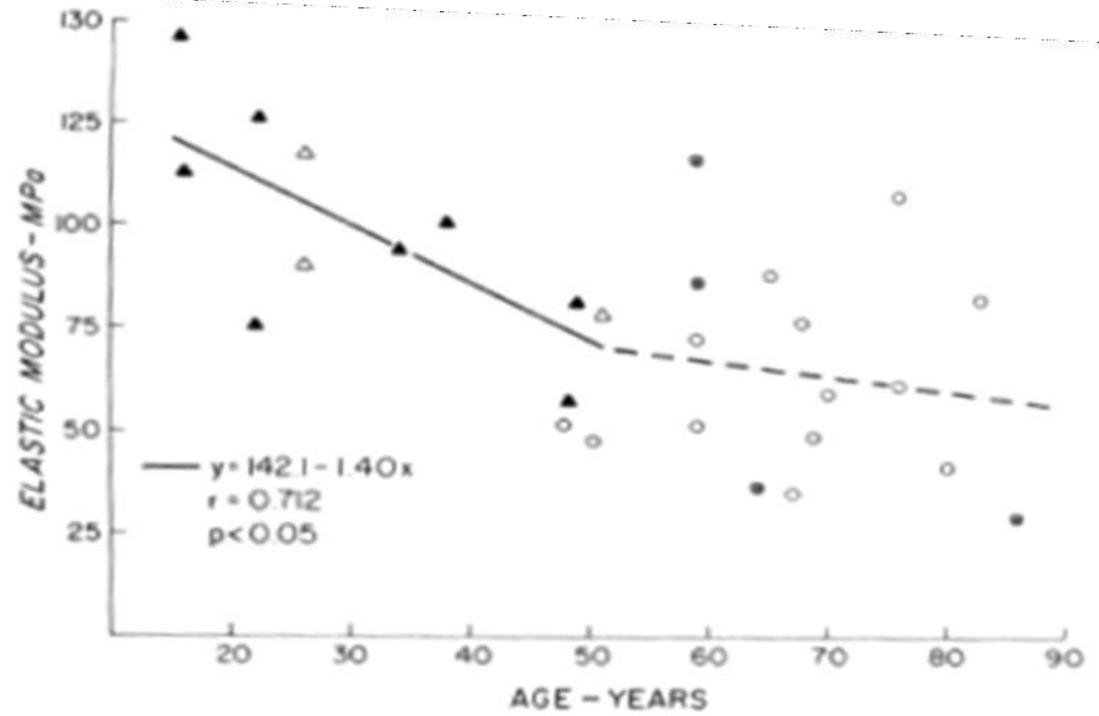
Compare values among
multiple field tests.

BONE MINERAL DENSITY

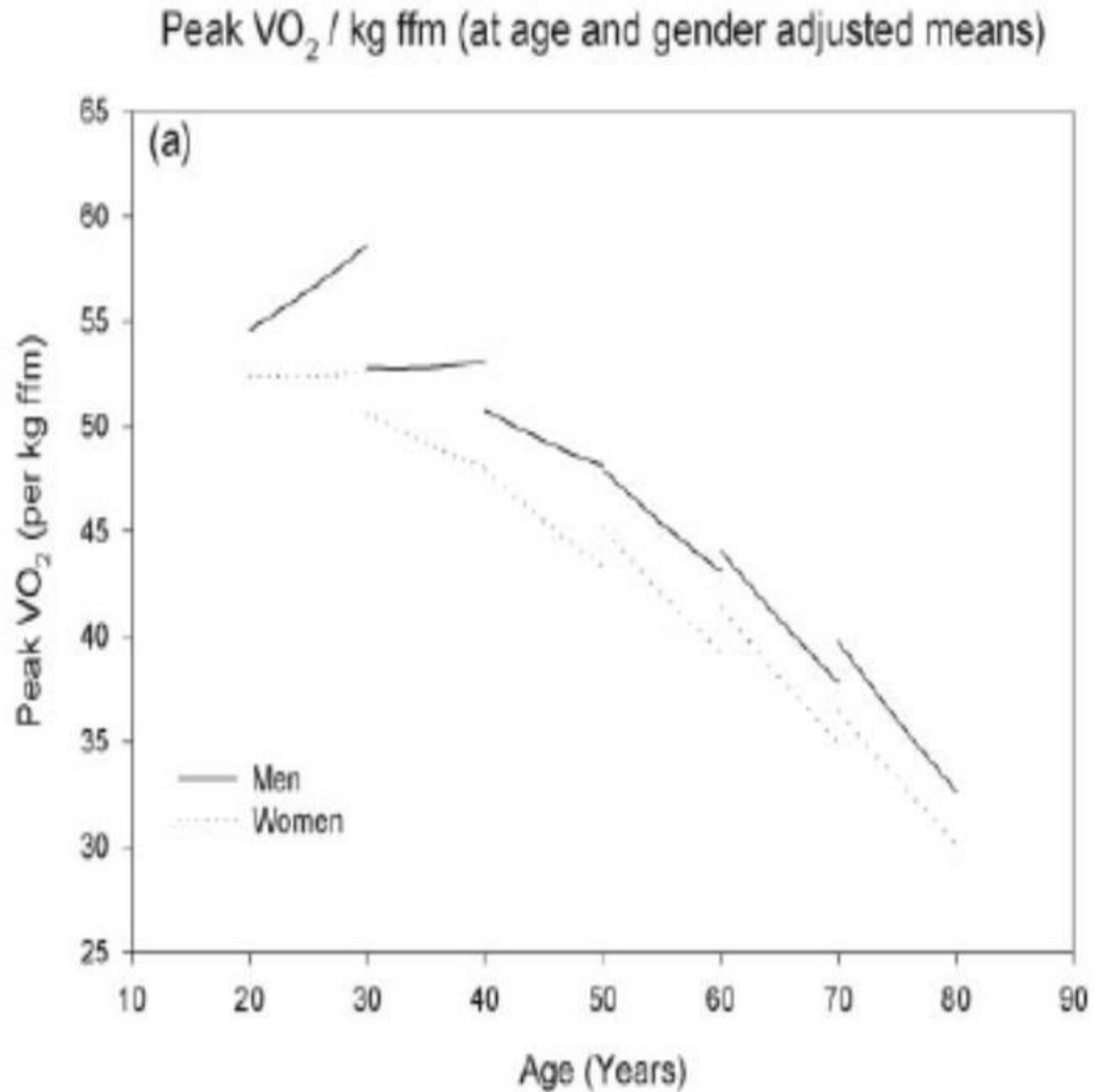


after data from <http://courses.washington.edu/bonephys/opbmdtz.html>

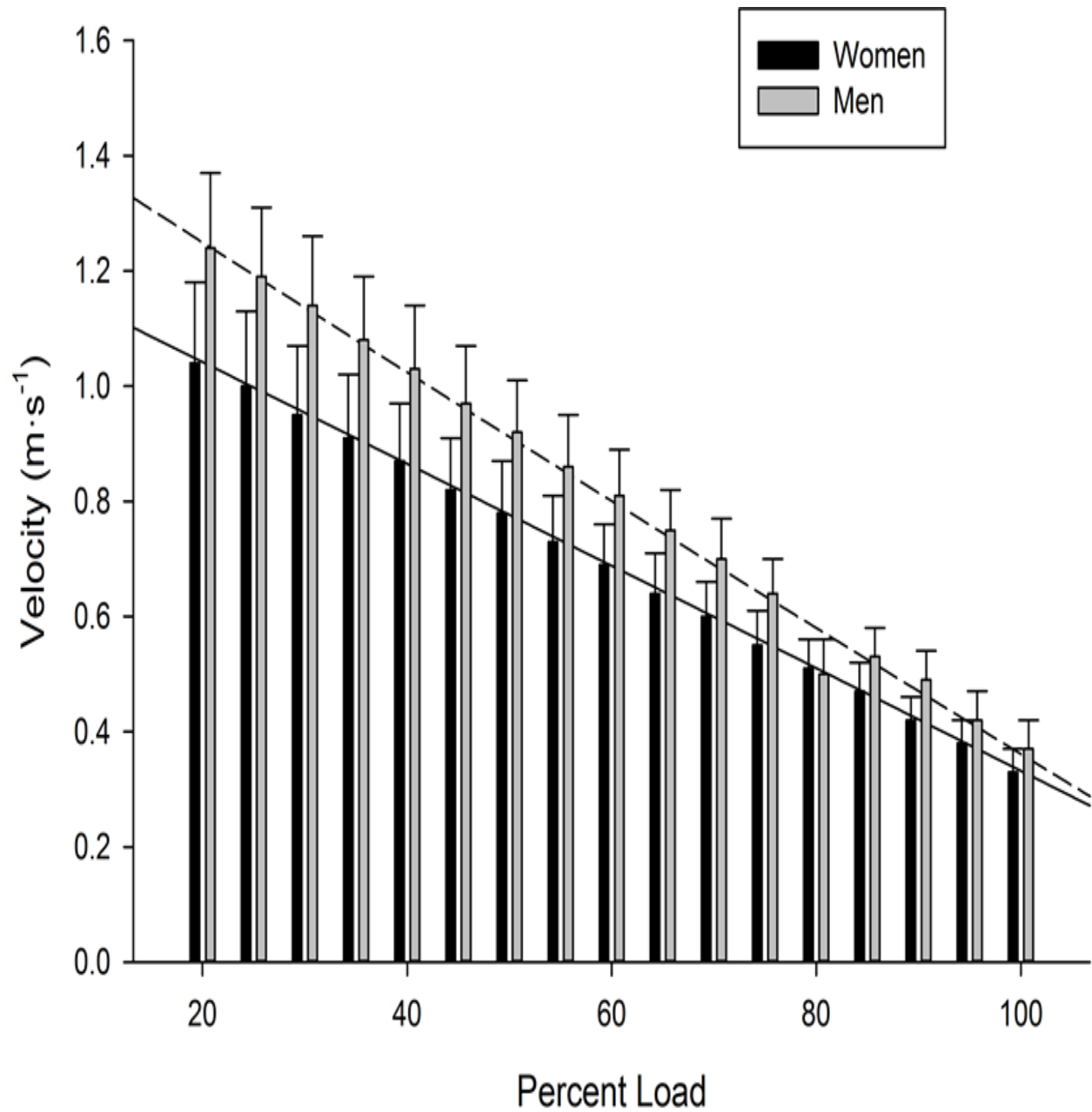
CONNECTIVE TISSUE



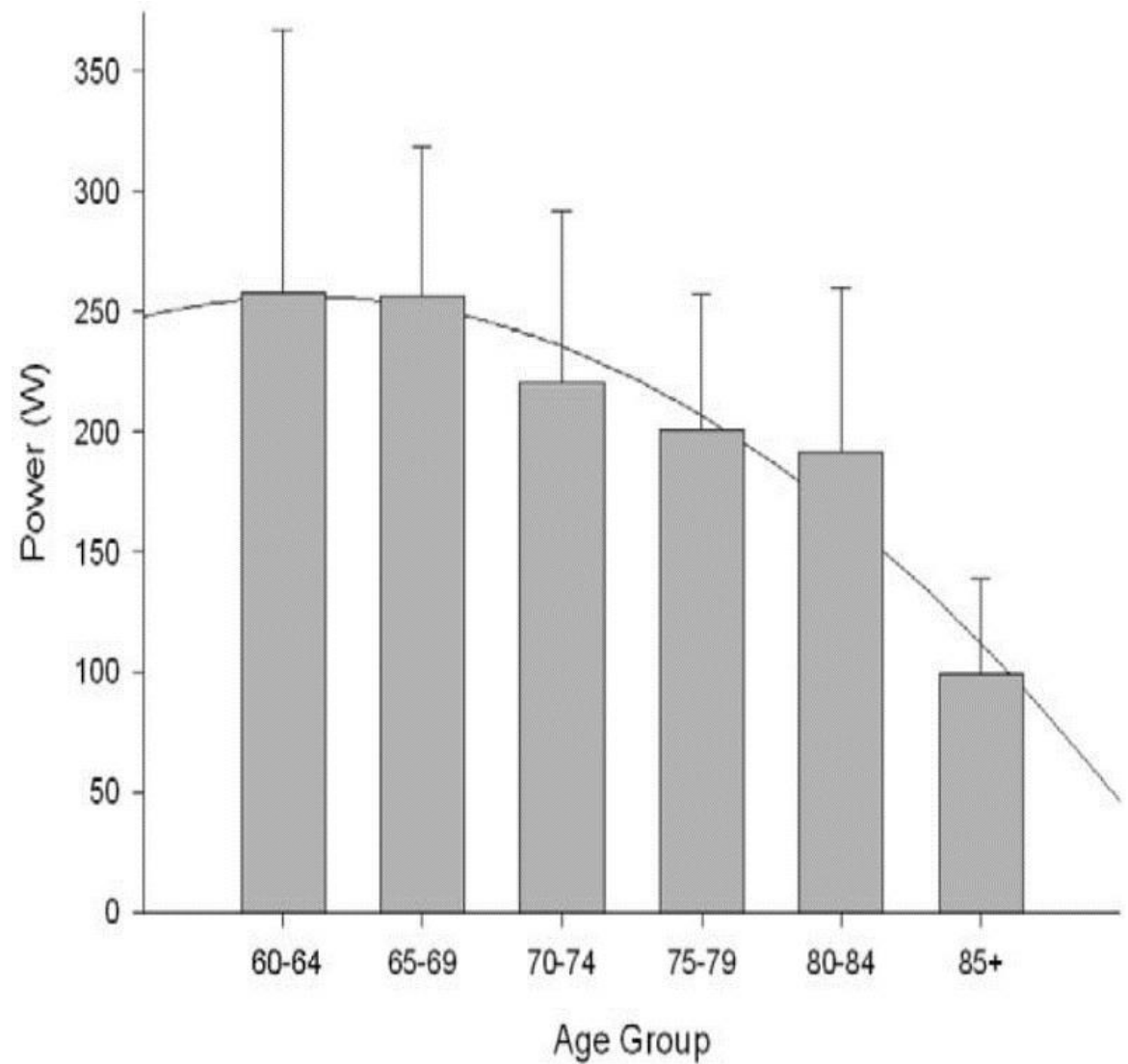
AEROBIC POWER



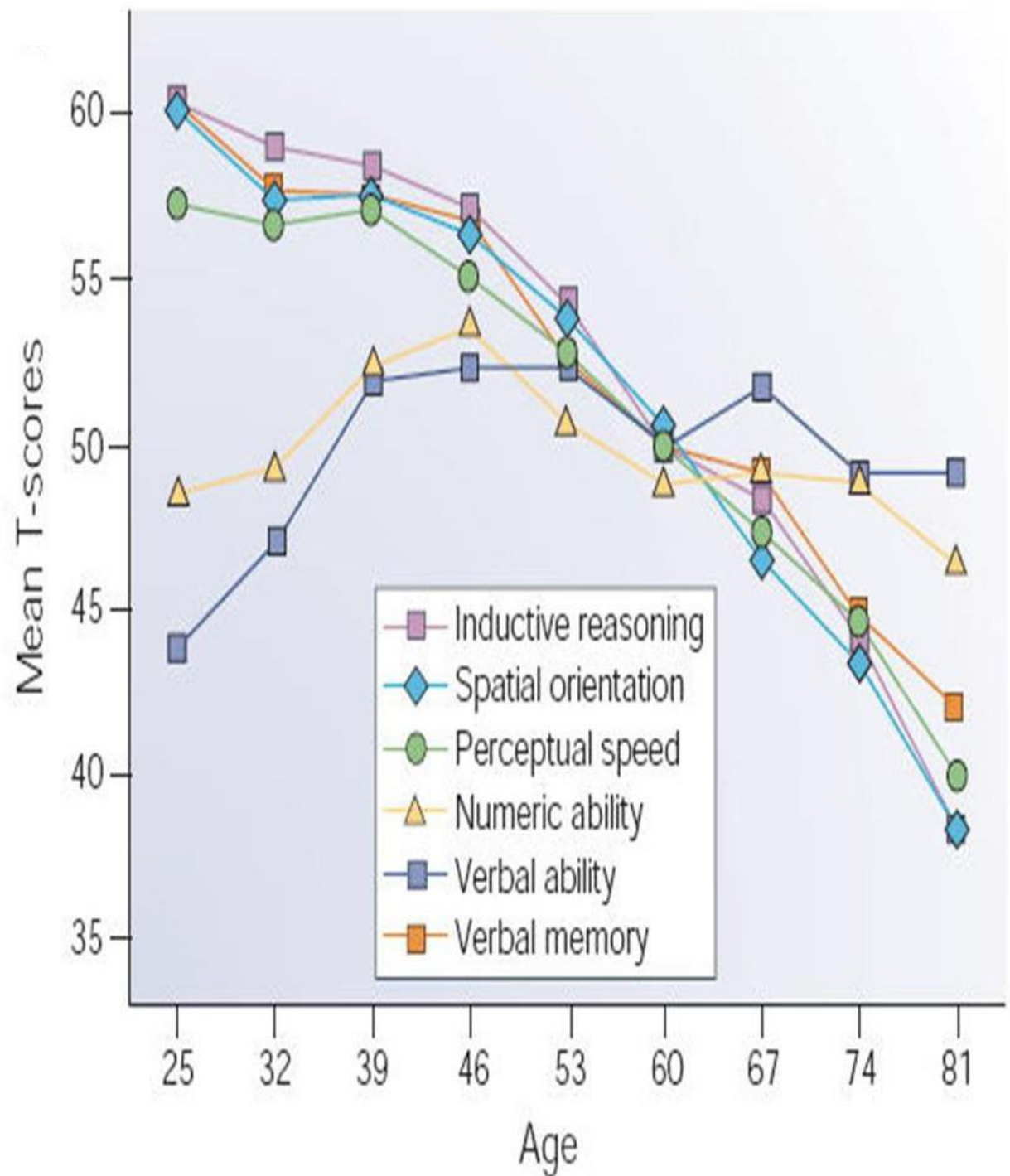
MOVEMENT SPEED



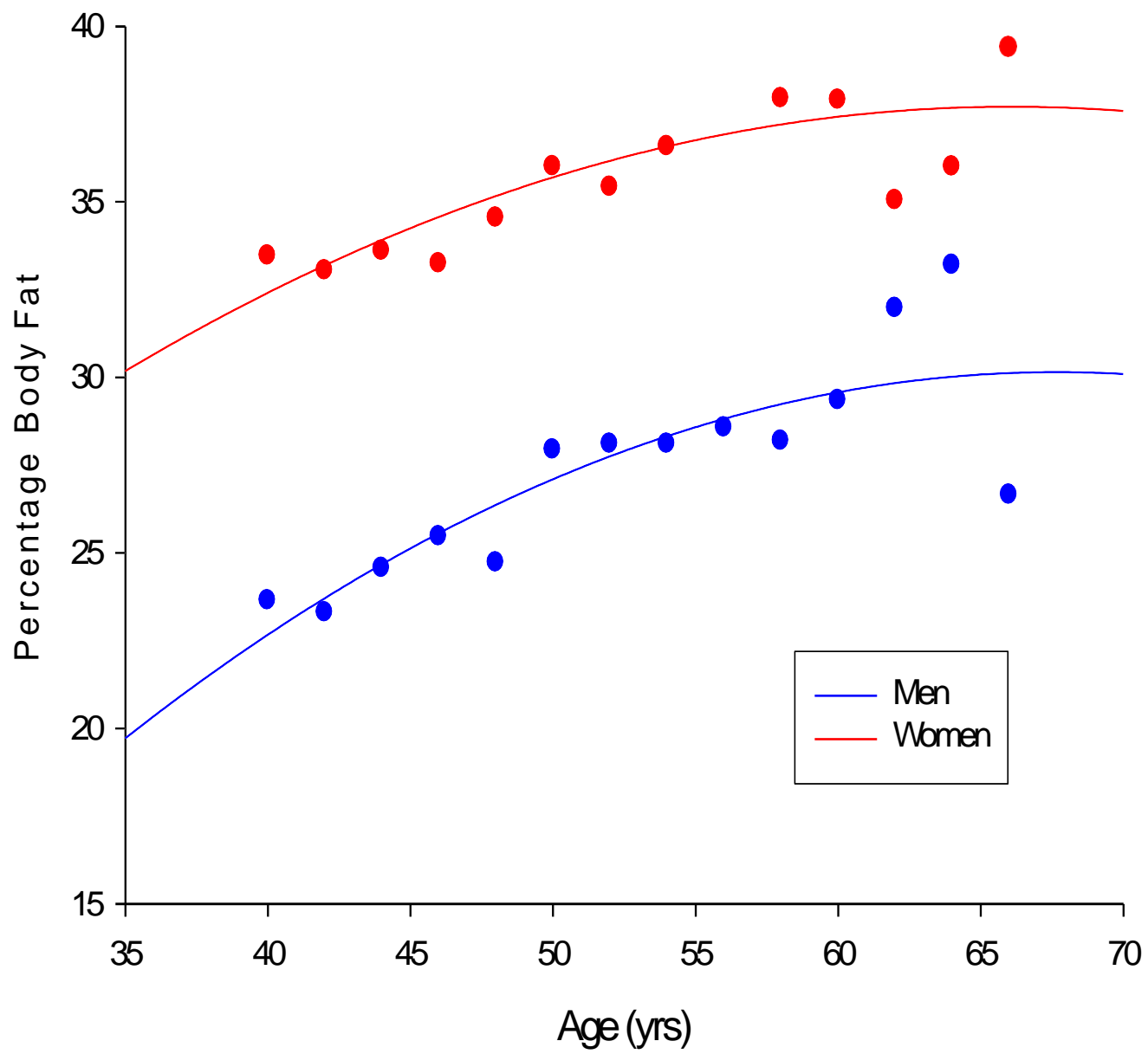
MECHANICAL POWER



COGNITION

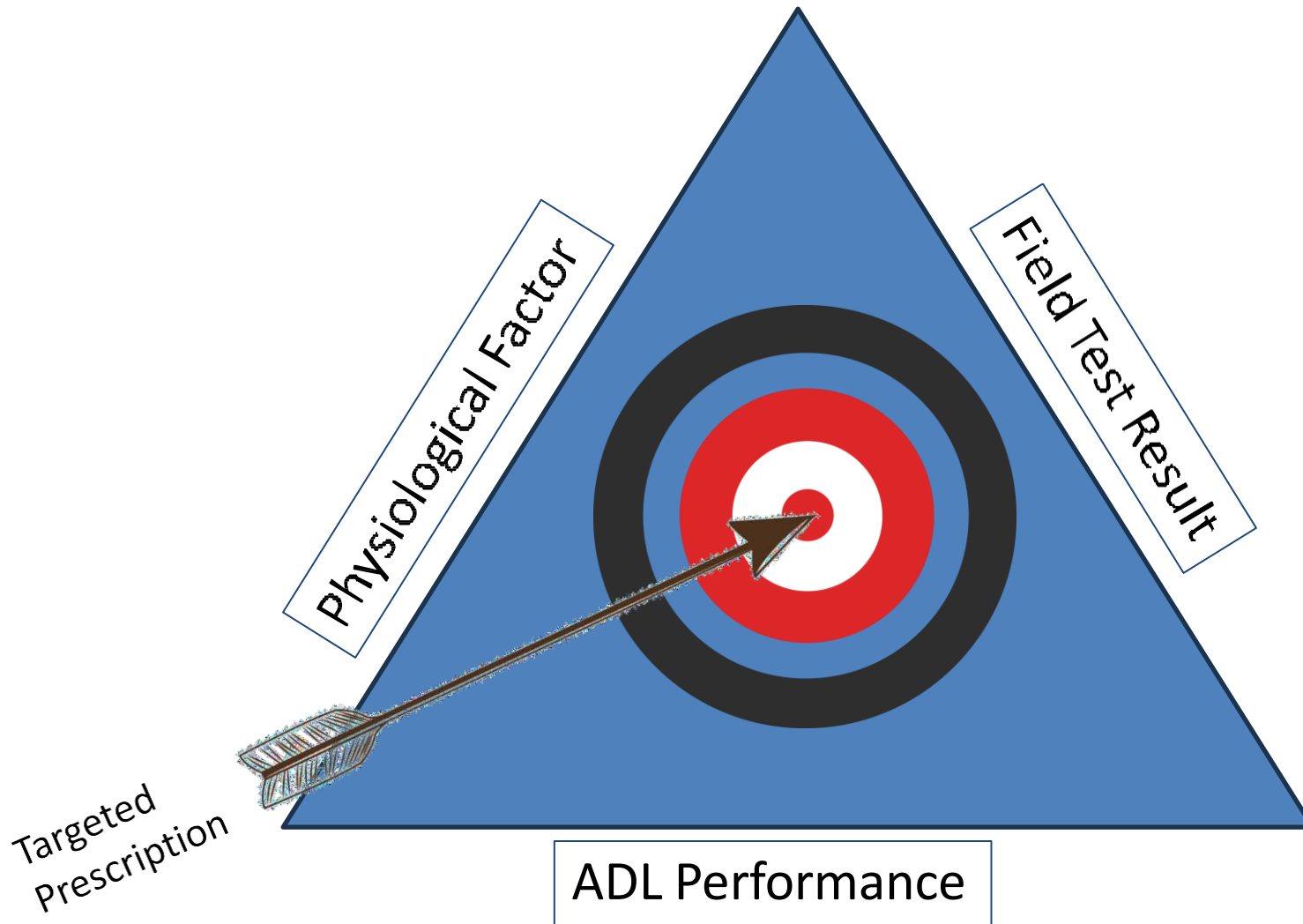


PERCENT BODY FAT



Develop a targeted intervention.

Develop a Targeted Intervention



Normative Values: Tasting the Sauce

- Reassess the status of the client on a particular test: improvement.
- Compare values among multiple field tests: New strengths and weaknesses
- Develop a targeted intervention: change the priorities

Reassess the status of the client on a particular test: improvement.

Before Training (75-79 y Male)

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	2	2	2.00	75-90
Chair Sit-and-Reach, Right (in.)	2	2	2.00	75-90
Back Scratch, Left (in.)	-3	-2.5	-2.75	50-75
Back Scratch, Right (in.)	-3	-2	-2.50	50-75
Modified Trunk Rotation (in.)	27	27	27.00	50-70
Single-Leg Stance Balance (s)	10	10	10.00	50-75
Functional Reach (in.)	14	13.5	13.75	50-75
8-Foot (2.4 m) Up-And-Go (s)	7.2	7.3	7.25	25-50
30-Second Chair Stand (reps)	10	12	11.00	25-50
Modified Ramp Power (s)	1.2	1	1.10	25-50
30-Second Arm Curl (reps)	16	16	16.00	50-75
Gallon Jug Shelf (s)	9.4	9.86	9.63	50-75
6-Minute Walk (yards)	600		600.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	4.25	4.2	4.23	25-50
15-Foot (4.6 m) Walk, Maximal (s)	3	3.02	3.01	10-25
% Body Fat	24.8	24.8	24.78	50-75
BMI			24.96	50-75

Note: Changes

Following Training

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	2	2	2.00	75-90
Chair Sit-and-Reach, Right (in.)	2	2	2.00	75-90
Back Scratch, Left (in.)	-3	-2.5	-2.75	50-75
Back Scratch, Right (in.)	-3	-2	-2.50	50-75
Modified Trunk Rotation (in.)	27	27	27.00	50-70
Single-Leg Stance Balance (s)	10	10	10.00	50-75
Functional Reach (in.)	14	13.5	13.75	50-75
8-Foot (2.4 m) Up-And-Go (s)	6	6.2	6.10	50-75
30-Second Chair Stand (reps)	15	14	14.50	50-75
Modified Ramp Power (s)	1	0.96	0.98	50-75
30-Second Arm Curl (reps)	16	16	16.00	50-75
Gallon Jug Shelf (s)	9.4	9.86	9.63	50-75
6-Minute Walk (yards)	600		600.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	3.7	3.7	3.70	75-90
15-Foot (4.6 m) Walk, Maximal (s)	2.5	2.7	2.60	50-75
% Body Fat	24.8	24.8	24.78	50-75
BMI			24.96	50-75

Now Develop a new training
Prescription...
...or repeat as needed

Compare values among multiple field tests: New strengths and weaknesses

INDEPENDENCE



Power

Agrobie Capacity

Strength

Balance

Flexibility

Mobility

Compare values among multiple
field tests:

New strengths and weaknesses

The testing battery which was used during the initial evaluation should be employed on a regular basis within the program to assess progress and modify the training prescription.

Before Training (80-84 y Male)

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	2	2	2.00	75-90
Chair Sit-and-Reach, Right (in.)	2	1.5	1.75	75-90
Back Scratch, Left (in.)	-1.5	-2	-1.75	75-90
Back Scratch, Right (in.)	-1.5	-1.5	-1.50	75-90
Modified Trunk Rotation (in.)	27	27	27.00	50-70
Single-Leg Stance Balance (s)	10	10	10.00	50-75
Functional Reach (in.)	14	13.5	13.75	50-75
8-Foot (2.4 m) Up-And-Go (s)	7.2	7.2	7.20	25-50
30-Second Chair Stand (reps)	10	11	10.50	25-50
Modified Ramp Power (s)	1.2	1.1	1.15	25-50
30-Second Arm Curl (reps)	16	16	16.00	50-75
Gallon Jug Shelf (s)	9.4	9.86	9.63	50-75
6-Minute Walk (yards)	600		600.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	4.2	4.2	4.20	25-50
15-Foot (4.6 m) Walk, Maximal (s)	2.9	2.8	2.85	25-50
% Body Fat	24.8	24.8	24.78	50-75
BMI			24.96	50-75

...and note new needs

Note: Improvements

Following Training

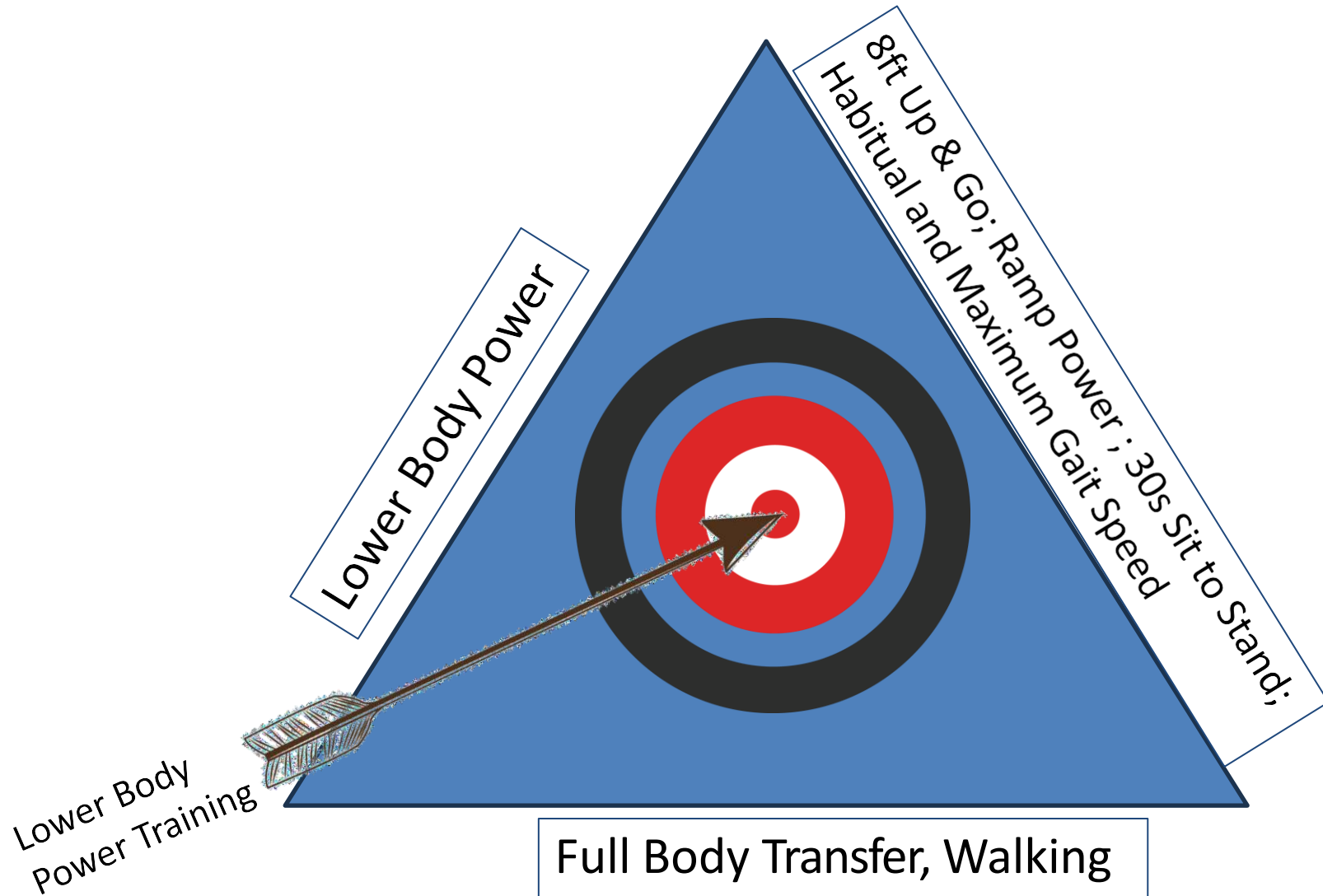
Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	2	2	2.00	75-90
Chair Sit-and-Reach, Right (in.)	2	1.5	1.75	75-90
Back Scratch, Left (in.)	-1.5	-2	-1.75	75-90
Back Scratch, Right (in.)	-1.5	-1.5	-1.50	75-90
Modified Trunk Rotation (in.)	27	27	27.00	50-70
Single-Leg Stance Balance (s)	10	10	10.00	50-75
Functional Reach (in.)	14	13.5	13.75	50-75
8-Foot (2.4 m) Up-And-Go (s)	5.2	5	5.10	75-90
30-Second Chair Stand (reps)	18	17	17.50	75-90
Modified Ramp Power (s)	0.92	0.94	0.93	75-90
30-Second Arm Curl (reps)	16	16	16.00	50-75
Gallon Jug Shelf (s)	9.4	9.86	9.63	50-75
6-Minute Walk (yards)	600		600.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	3.7	3.7	3.70	75-90
15-Foot (4.6 m) Walk, Maximal (s)	2.1	2.3	2.20	75-90
% Body Fat	24.8	24.8	24.78	50-75
BMI			24.96	50-75

Now Develop a new training
Prescription...

...or repeat as needed

Develop a targeted intervention:
change the priorities

Modify Targeted Intervention



- High-Velocity Power Training
- Velocity-based Training

For either of these training methods we prefer pneumatic resistance training since they reduce the problems with:

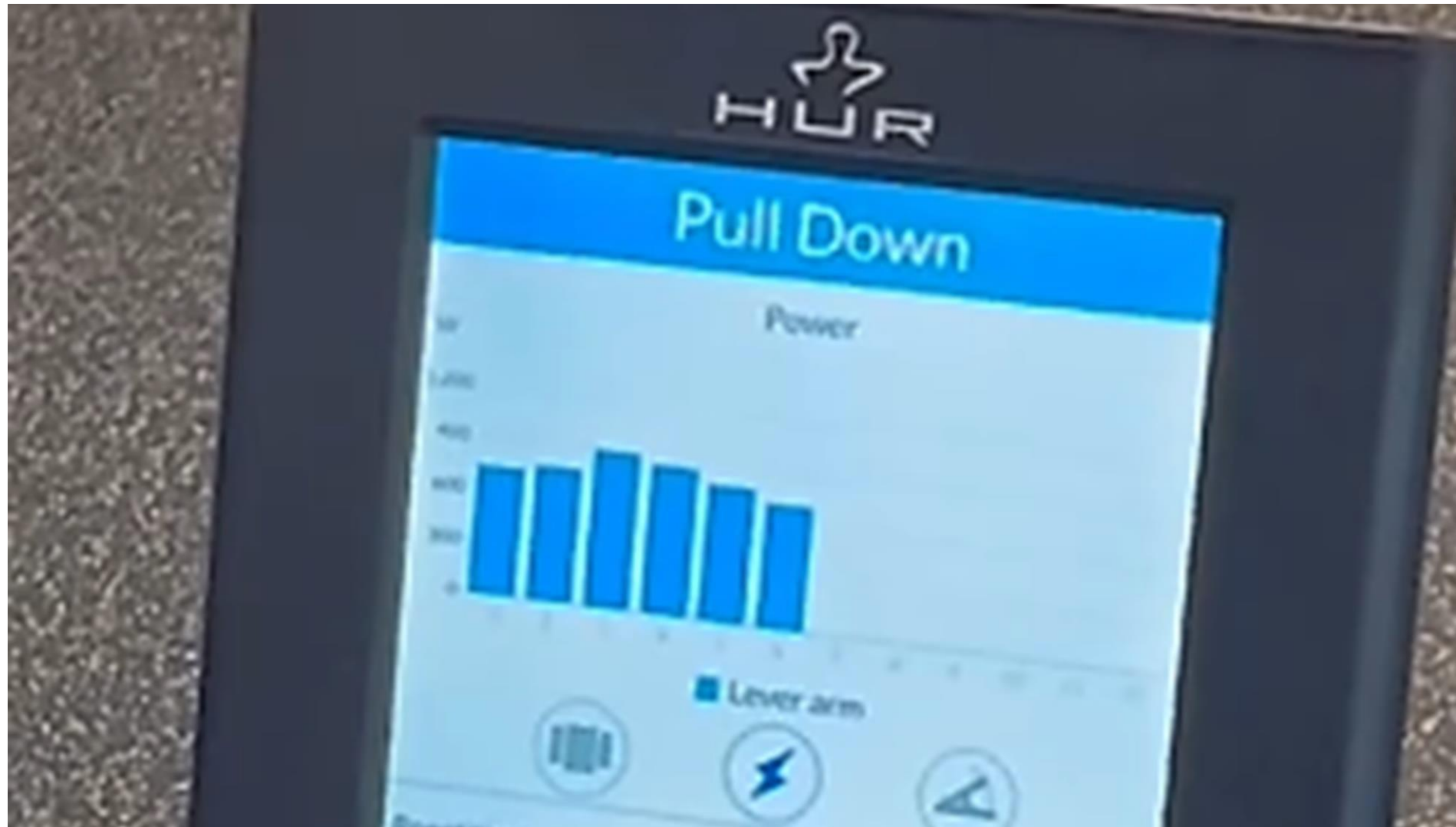
- Deceleration
- Momentum
- Safety







- Allow constant monitoring by the client and clinician.



- Allow constant monitoring by the client and clinician.

G	H	I	J	K	L	M	N	O	P	Q	R
Exercise	Set #	Load	Perf. Load	Reps	Perf. Reps	Rep #	Arm	Rep Load	Max Velocity	Peak Power	
Chest Pres	1	29.0 lb	29.0 lb	10	10	1	Left	29.1 lb	0.166	89.43	
Chest Pres	1	29.0 lb	29.0 lb	10	10	2	Left	29.1 lb	0.207	108.79	
Chest Pres	1	29.0 lb	29.0 lb	10	10	3	Left	29.1 lb	0.195	91.65	
Chest Pres	1	29.0 lb	29.0 lb	10	10	4	Left	29.1 lb	0.224	108.89	
Chest Pres	1	29.0 lb	29.0 lb	10	10	5	Left	29.1 lb	0.203	106.08	
Chest Pres	1	29.0 lb	29.0 lb	10	10	6	Left	29.1 lb	0.183	91.89	
Chest Pres	1	29.0 lb	29.0 lb	10	10	7	Left	29.1 lb	0.173	90.09	
Chest Pres	1	29.0 lb	29.0 lb	10	10	8	Left	29.1 lb	0.166	82.74	
Chest Pres	1	29.0 lb	29.0 lb	10	10	9	Left	29.1 lb	0.195	94.57	
Chest Pres	1	29.0 lb	29.0 lb	10	10	10	Left	29.1 lb	0.163	87.07	
Chest Pres	1	29.0 lb	29.0 lb	10	10	1	Right	29.1 lb	0.137	70.74	
Chest Pres	1	29.0 lb	29.0 lb	10	10	2	Right	29.1 lb	0.193	108.07	
Chest Pres	1	29.0 lb	29.0 lb	10	10	3	Right	29.1 lb	0.169	88.12	
Chest Pres	1	29.0 lb	29.0 lb	10	10	4	Right	29.1 lb	0.176	93.19	
Chest Pres	1	29.0 lb	29.0 lb	10	10	5	Right	29.1 lb	0.16	80.47	
Chest Pres	1	29.0 lb	29.0 lb	10	10	6	Right	29.1 lb	0.152	80.59	
Chest Pres	1	29.0 lb	29.0 lb	10	10	7	Right	29.1 lb	0.138	74.41	
Chest Pres	1	29.0 lb	29.0 lb	10	10	8	Right	29.1 lb	0.166	97.85	
Chest Pres	1	29.0 lb	29.0 lb	10	10	9	Right	29.1 lb	0.152	80.7	
Chest Pres	1	29.0 lb	29.0 lb	10	10	10	Right	29.1 lb	0.137	72.49	

- Allow constant monitoring by the client and clinician.

Visit (# 46)

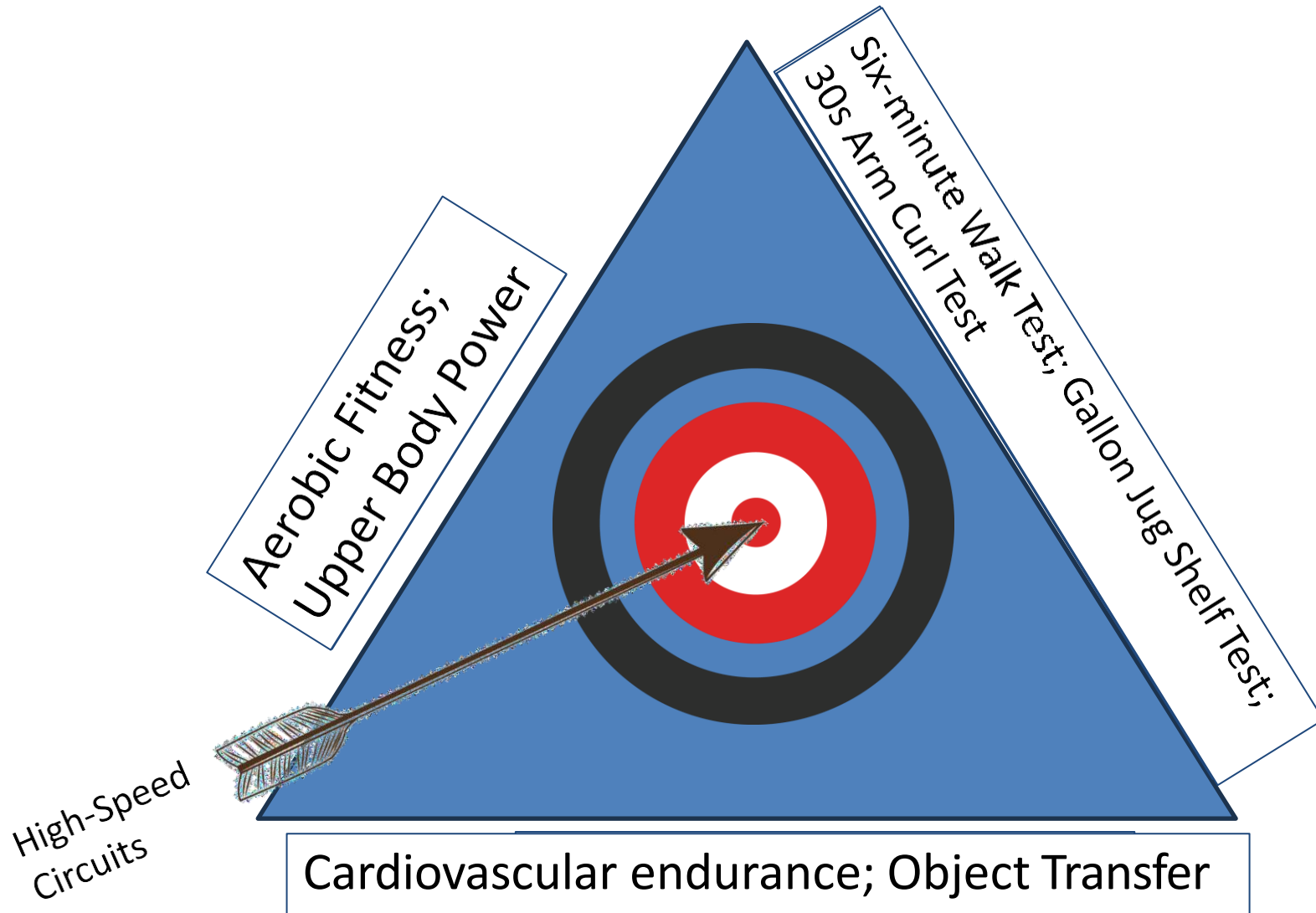


Visit date Sept. 20, 2023 (Who was training at the same time?)
 Visit duration time 11 min
 Logged in 3:13 p.m.
 Logged out 3:25 p.m.
 Based on training Medicine ball Power Testing
 Visit type Regular Visit



#	Activity	Started	Ended	Status		
1	Chest Press	3:14 p.m.	3:25 p.m.	Fully Performed		
Set No.	Load [lb]	Perf. Load [lb]	Reps	Perf. Reps	Target Power [W]	Avg Peak Power [W] L / R
1	29.0	29.0	10	10	345	95 / 84
Rep No.	Rep Load [lb] - L/R		Range of Motion [mm] - L ⁰ / R ⁰		Peak Power [W] - L/R	
1	29.1	29.1	61	1	89	71
2	29.1	29.1	66	61	109	108
3	29.1	29.1	67	60	92	88
4	29.1	29.1	70	63	109	93
5	29.1	29.1	69	62	106	80
6	29.1	29.1	68	58	92	81
7	29.1	29.1	69	56	90	74
8	29.1	29.1	70	61	83	98
9	29.1	29.1	72	61	95	81
10	29.1	29.1	71	56	87	72
Set No.	Load [lb]	Perf. Load [lb]	Reps	Perf. Reps	Target Power [W]	Avg Peak Power [W] L / R
2	29.0	29.0	5	5	345	215 / 150
Rep No.	Rep Load [lb] - L/R		Range of Motion [mm] - L ⁰ / R ⁰		Peak Power [W] - L/R	
1	29.0	29.0	68	51	186	145
2	29.0	29.0	39	29	251	164
3	29.0	29.0	49	39	251	166
4	29.0	29.0	45	38	195	121
5	29.0	29.0	64	53	196	155

Modify Targeted Intervention





1. Leg Press



2. Chest Press



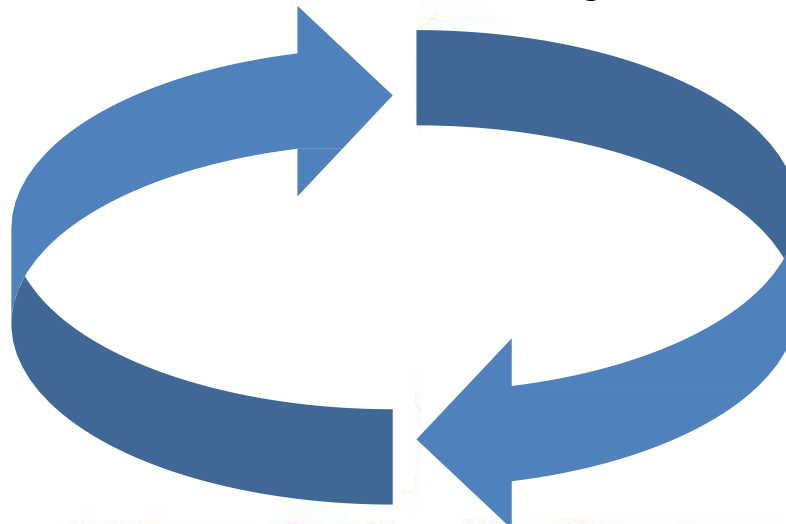
3. Leg curl



4. Overhead Press



10. Arm Curl



5. Lat Pulldown



9. Triceps Extension



8. Seated Row



7. Hip Adduction



6. Hip Abduction

Additional Interventions

Cardiovascular

- Treadmill Walking
- Overground Walking
- Aerobic Dance, etc.
- Unloaded Interval

Arm Strength

- Bands
- Dumbbells
- Body weight
- Exercise machines

Normative Values: Age

- Reassess the status of the client on a particular test: against other age groups.
- Compare values among multiple field tests: New strengths and weaknesses: against other age groups
- Teach the concepts of chronological versus functional age
- Bend the Aging Curve

Reassess the status of the client on a particular test against other age groups.

Following Training (75-79 y Woman)

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	2.3	2.3	2.30	50-75
Chair Sit-and-Reach, Right (in.)	2.5	2.5	2.50	50-75
Back Scratch, Left (in.)	-1	-1	-1.00	50-75
Back Scratch, Right (in.)	-1	-1.5	-1.25	50-75
Modified Trunk Rotation (in.)	26.5	27	26.75	50-75
Single-Leg Stance Balance (s)	12	13	12.50	50-75
Functional Reach (in.)	11	10.5	10.75	50-75
8-Foot (2.4 m) Up-And-Go (s)	5.1	5	5.05	75-90
30-Second Chair Stand (reps)	15	16	15.50	75-90
Modified Ramp Power (s)	1	1.1	1.05	75-90
30-Second Arm Curl (reps)	14	16	15.00	50-75
Gallon Jug Shelf (s)	9	9.86	9.43	50-75
6-Minute Walk (yards)	550		550.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	3	3.1	3.05	75-90
15-Foot (4.6 m) Walk, Maximal (s)	2.1	2.2	2.15	75-90
% Body Fat	28.9	28.9	28.9	50-75
BMI			22.86	50-75

Note: Changes

Comparison to (60-64 y Woman)

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	2	2	2.00	50-75
Chair Sit-and-Reach, Right (in.)	2	2	2.00	50-75
Back Scratch, Left (in.)	1	1.5	1.25	50-75
Back Scratch, Right (in.)	1	1	1.00	50-75
Modified Trunk Rotation (in.)	27	26	26.50	50-75
Single-Leg Stance Balance (s)	27	26	26.50	50-75
Functional Reach (in.)	15	15	15.00	50-75
8-Foot (2.4 m) Up-And-Go (s)	5.1	5	5.05	50-75
30-Second Chair Stand (reps)	15	16	15.50	50-75
Modified Ramp Power (s)	1	1.1	1.05	75-90
30-Second Arm Curl (reps)	16	17	16.50	50-75
Gallon Jug Shelf (s)	8.8	9	8.90	50-75
6-Minute Walk (yards)	650		650.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	3	3.1	3.05	75-90
15-Foot (4.6 m) Walk, Maximal (s)	2.1	2.2	2.15	75-90
% Body Fat	28.1	28.1	28.1	50-75
BMI			25.84	50-75

Note: Functional Age

Compare values among multiple field tests: New strengths and weaknesses: against other age groups.

Following Training (75-79 y Woman)

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	1.5	1.5	1.50	50-75
Chair Sit-and-Reach, Right (in.)	1.5	2	1.75	50-75
Back Scratch, Left (in.)	1	1	1.00	75-90
Back Scratch, Right (in.)	1	1	1.00	75-90
Modified Trunk Rotation (in.)	29	31	30.00	75-90
Single-Leg Stance Balance (s)	18	19	18.50	50-75
Functional Reach (in.)	11	10.5	10.75	50-75
8-Foot (2.4 m) Up-And-Go (s)	5.8	5.7	5.75	50-75
30-Second Chair Stand (reps)	14	14	14.00	50-75
Modified Ramp Power (s)	1.2	1.2	1.20	50-75
30-Second Arm Curl (reps)	18	16	17.00	75-90
Gallon Jug Shelf (s)	7.8	7.7	7.75	75-90
6-Minute Walk (yards)	600		600.00	50-75
15-Foot (4.6 m) Walk, Usual (s)	3.1	3.93	3.52	50-75
15-Foot (4.6 m) Walk, Maximal (s)	2.3	2.5	2.40	50-75
% Body Fat	28.6	29.0	28.8	50-75
BMI			23.38	50-75

Note: Differences in Quartiles

Comparison to (60-64 y Woman)

Test	Trial 1	Trial 2	Average	Percentile
Chair Sit-and-Reach, Left (in.)	1.5	1.5	1.50	25-50
Chair Sit-and-Reach, Right (in.)	1.5	2	1.75	25-50
Back Scratch, Left (in.)	1	1	1.00	50-75
Back Scratch, Right (in.)	1	1	1.00	50-75
Modified Trunk Rotation (in.)	29	31	30.00	75-90
Single-Leg Stance Balance (s)	18	19	18.50	25-50
Functional Reach (in.)	11	10.5	10.75	<10
8-Foot (2.4 m) Up-And-Go (s)	5.8	5.7	5.75	25-50
30-Second Chair Stand (reps)	14	14	14.00	25-50
Modified Ramp Power (s)	1.2	1.2	1.20	50-75
30-Second Arm Curl (reps)	18	16	17.00	50-75
Gallon Jug Shelf (s)	7.8	7.7	7.75	75-90
6-Minute Walk (yards)	600		600.00	25-50
15-Foot (4.6 m) Walk, Usual (s)	3.1	3.93	3.52	50-75
15-Foot (4.6 m) Walk, Maximal (s)	2.3	2.5	2.40	50-75
% Body Fat	28.6	29.0	28.8	50-75
BMI			25.84	50-75

Teach the concepts of chronological
versus functional age

Training and Functional Age

Upper Body Transfer

TABLE 3A - Male Normative Scores by Percentiles



Age	5 th Percentile	25 th Percentile	50 th Percentile	75 th Percentile	95 th Percentile
<65	12.6	8.3	7.7	6.8	5.9
65–69	10.2	9.0	7.9	7.4	5.2
70–74	13.2	10.2	8.9	8.1	6.7
75–79	14.5	10.2	9.2	8.7	7.5
80–84	14.8	11.6	10.2	8.2	7.3
>85	18.6	14.8	12.7	10.2	9.4

Scores are in seconds required to transfer all five 1-gallon jugs. Adapted from ⁽¹⁾.

Training and Functional Age

Upper Body Transfer

TABLE 3B - Female Normative Scores by Percentiles

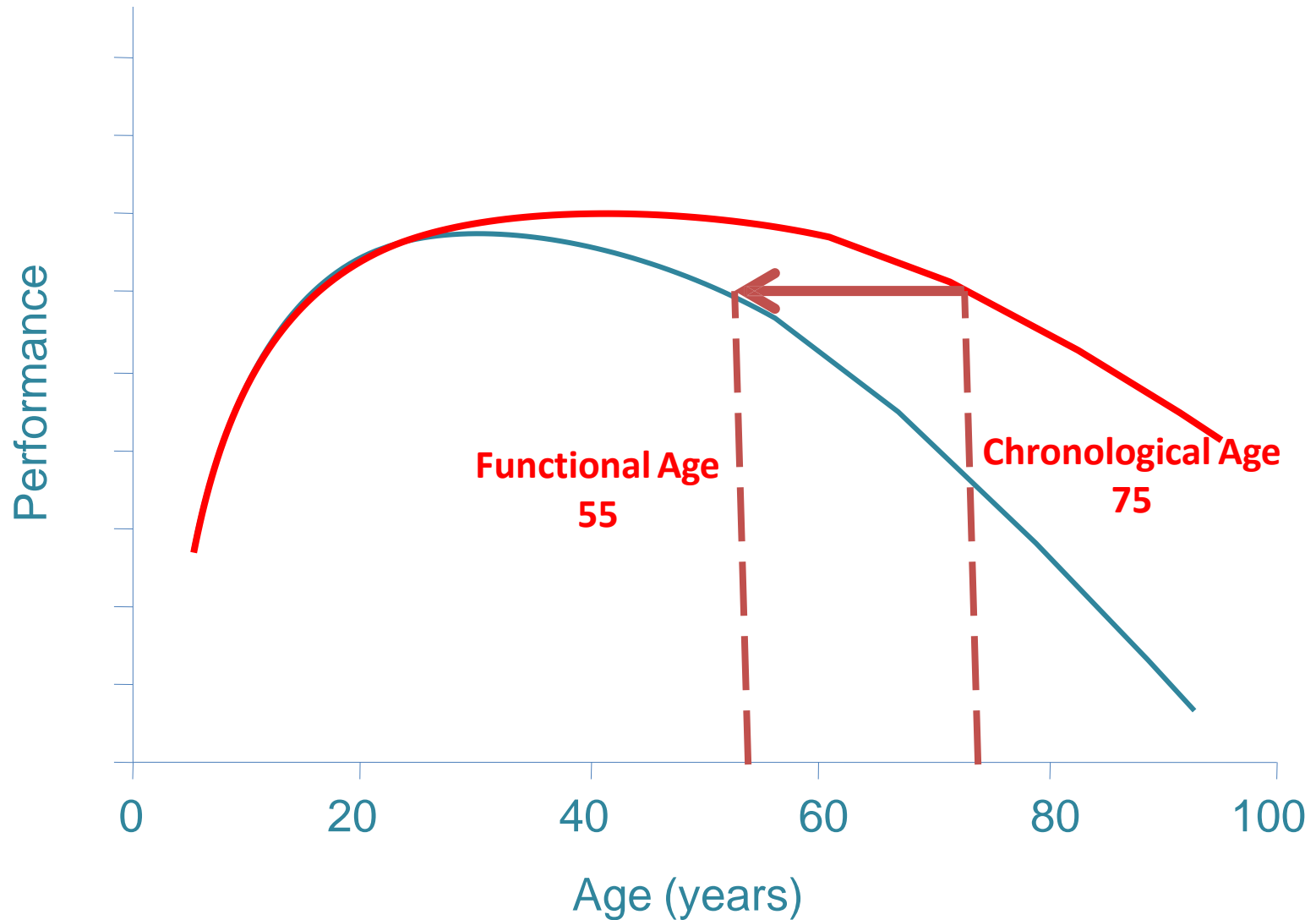


Age	5 th Percentile	25 th Percentile	50 th Percentile	75 th Percentile	95 th Percentile
<65	13.2	10.8	8.9	8.1	7.1
65-69	11.4	9.8	9.1	8.3	7.5
70-74	13.5	11.4	9.6	8.7	7.7
75-79	15.2	11.6	10.1	8.9	8.0
80-84	15.6	12.5	11.4	9.8	8.7
>85	18.7	14.0	12.7	11.4	9.3

Scores are in seconds required to transfer all five 1-gallon jugs. Adapted from ⁽¹⁾.

Bend the Aging Curve

BENDING THE AGING CURVE



DECEMBER



Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 ORNAMENT PARTY 	2	3 Every Tuesday TODDLER TUESDAY! \$10 All Days 5 & Under	4 Share VIP Discount on Wednesdays!	5 Ladies Night! \$5 Studio Fees	6 6pm-9pm CHRISTMAS TREE Painting Party 	7 Let's PAINT, SIP AND BE MERRY Color Me Mine
8 Holiday KIDS NIGHT OUT 	9 Free Studio Fees & 10% off MILITARY MONDAY Every Monday	10	11	12 Let's PAINT, SIP AND BE MERRY Color Me Mine	13	14 HOLIDAY HOUSE WORKSHOP 6pm-9pm
15 Stocking Mosaic 10a-12p	16	17 Every Tuesday TODDLER TUESDAY! \$10 All Days 5 & Under	18 Share VIP Discount on Wednesdays!	19 Ladies Night! \$5 Studio Fees	20 KIDS NIGHT OUT CANVAS for parents' last minute shopping! 6-8:30pm	21 BOOK A Party!
22 Hanukkah Begins	23 4pm-6pm Reservation Only Special NEEDS PAINTING	24	25 CLOSED MERRY CHRISTMAS!	26 1st Day of Kwanzaa	27 Date Night	28
29	30 Holiday Camp 	31 Last day to purchase VIP Passes at 50% off!	 Extended Holidays Hours Sun/Mon: 11pm-7pm Tues-Sat: 10am to 9pm			

Make a Santa Hand Plate or Paint a Tree/Truck



Weekly:
BOGO Every Tuesday!
STUDIO FEES

\$3 OFF Your Bill
IF YOU Check in on

TODDLER TUESDAY! **MILITARY MONDAY**
\$10 All Day 5 & Under
Not to be combined with any other offer.

Get \$10 toward a visit in January: Buy a Gift Card 12/20-12/31 & receive \$10 toward a visit in January for yourself! Give Promo Code SECRET SANTA at check out. In studio gift card purchases only.

VIP Membership Passes are 50% off through 12/31!

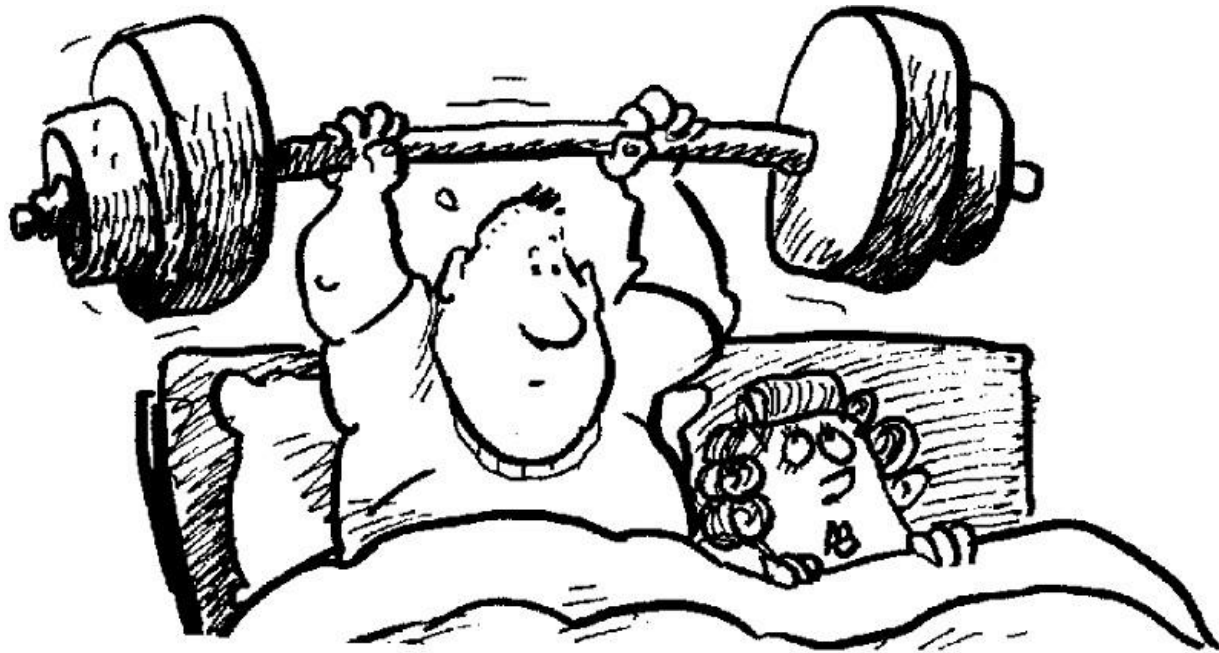
Color Me Mine is, as always, non-toxic and food safe. The Paint-It-Yourself Ceramics Studio ©© 1998 - 2018 Color Me Mine Enterprises, Inc. All rights reserved.

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Color Me Mine®
Hamilton/Princeton

The Periodization Models

PERIODIZATION



Louie knew that if he stopped, he'd lose everything he'd worked for!

Types of Periodization



- Classic Linear Periodization



- Undulating (Non-linear) Periodization

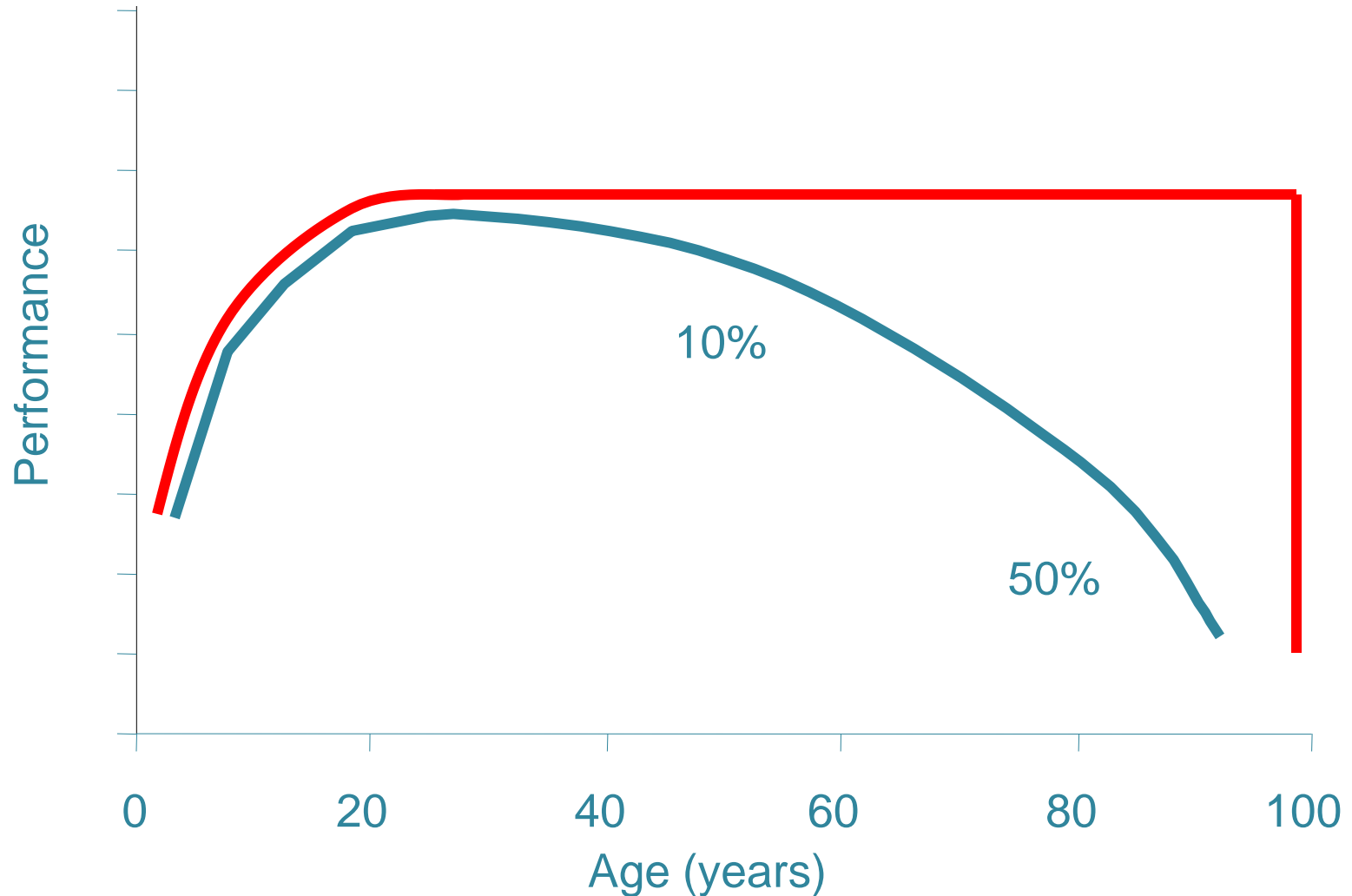
Linear Periodization

Phase	Hypertrophy	Strength	Power
Sets	3-4	2-3	3
Repetitions	8-12	4-6	6-8
Load (%1RM)	60-75	80-85	≈50
Tempo	2–3 second concentric and eccentric	2–3 second concentric and eccentric	Maximal concentric velocity, 1–2 second isometric hold, 2–3 second eccentric
Duration (Weeks)	8-12	6-8	4-5

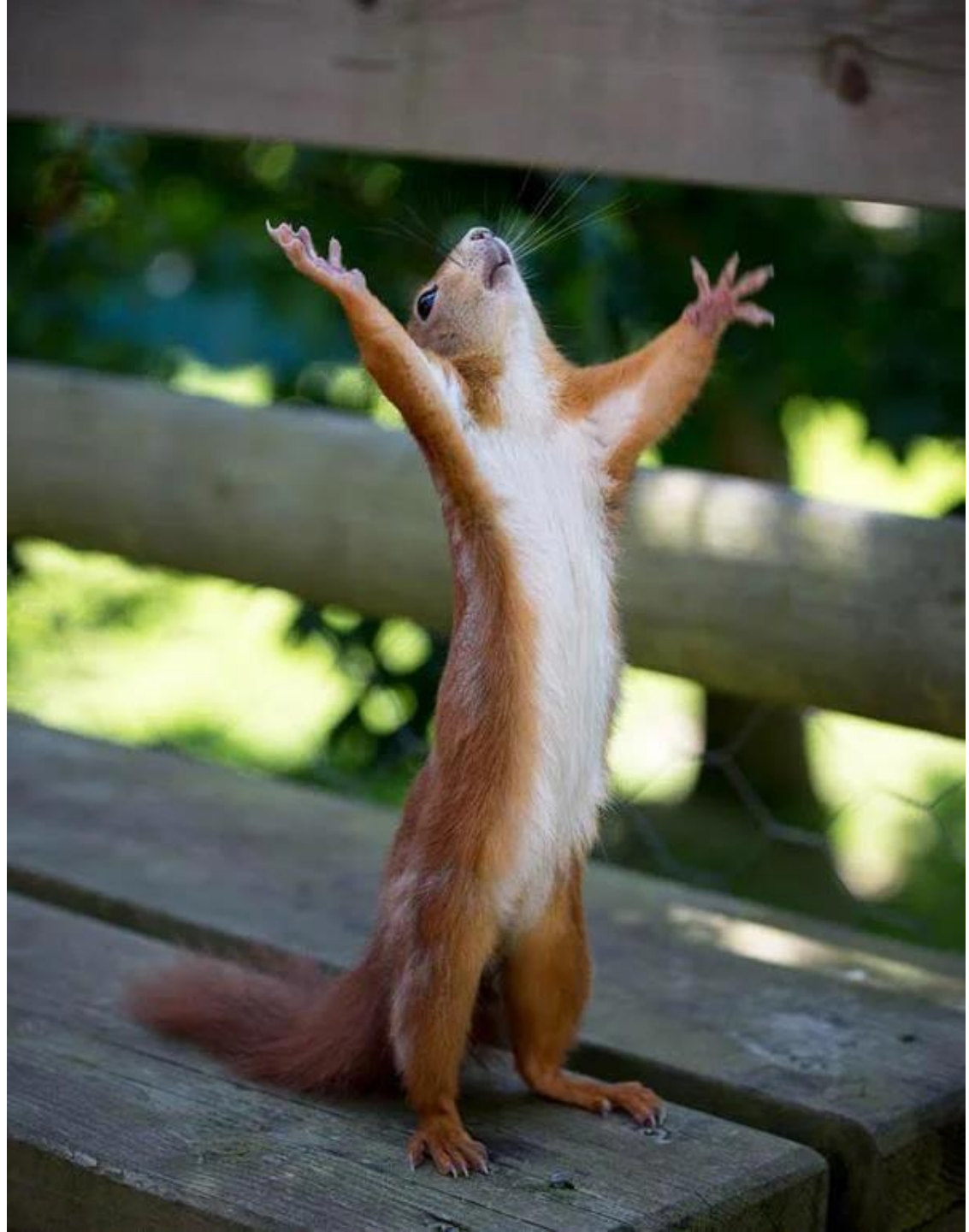
UNDULATING PERIODIZED PROGRAM

PHASE	Day	Sets	Reps	Load (%1RM)	Tempo
Hypertrophy	Day 1	3-4	8-12	60-75%	2–3 second concentric and eccentric
Strength	Day 2	2-3	4-6	80-85%	2–3 second concentric and eccentric
Power	Day 3	3	6-8	≈50%	Maximal concentric velocity, 1–2 second isometric hold, 2–3 second eccentric

STRIVE FOR THE IDEAL AGING CURVE



THANK YOU!





Thank you for attending!
We appreciate your support.

Joseph Signorile, PhD
University of Miami