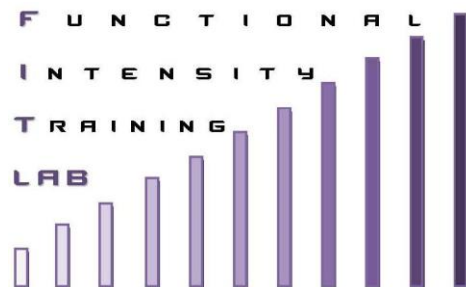




Functional Fitness Program

KSU FIT Lab Study





High-intensity functional training program among older adults: a pilot study

Becker C., BS, Heinrich K.M., PhD

Special Thanks to...

- Collaborator:
 - **Susie Harms PT**
- Trainers & Programmers
 - **Ainslie Kehler MS, CSCS**
 - **Victor Andrews**
 - **Kyle Swinford, BS**
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Purpose Statement:

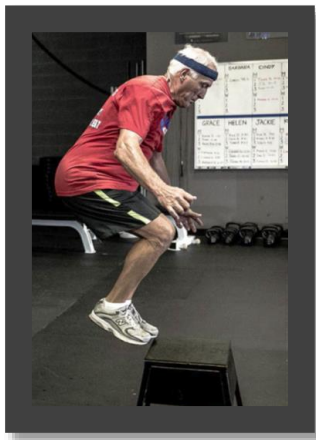
This pilot study investigated the feasibility and preliminary efficacy of high-intensity functional training (HIFT) via CrossFit among older adults.

Background:

- Falls
 - 1/3 of older adults ≥ 65 yr annually [1]
 - \uparrow risk for instability and strength loss
 - debilitating injuries[1]
 - 20 – 30% suffer moderate to severe injuries
 - lacerations, hip fractures, and head traumas
 - \downarrow ability to function

Background:

- Function
 - Balance & strength = independence & longevity [2]
 - Sarcopenia: ↑ Instability
 ↓ Activities of Daily Life (ADLs) [8]
 - Exercise interventions
 - Walking, Cycling
 - Weight lifting
 - Tai Chi, Pilates
 - Functional Training



Background:

HIFT (CrossFit):

- Multi-joint movements
 - Neuromuscular adaptations
- Relative high-intensity
- Optimal physical competence

HIFT Studies

- ↑ Balance, weighted object carrying speed, lower body strength and power, aerobic capacity and endurance [3]
- ↑ Social and performance efficacy

Figure 2. Ten General Physical Skills.

If your goal is optimum physical competence then all the general physical skills must be considered:

1. Cardiovascular/respiratory endurance–The ability of body systems to gather, process, and deliver oxygen.
2. Stamina–The ability of body systems to process, deliver, store, and utilize energy.
3. Strength–The ability of a muscular unit, or combination of muscular units, to apply force.
4. Flexibility–The ability to maximize the range of motion at a given joint.
5. Power–The ability of a muscular unit, or combination of muscular units, to apply maximum force in minimum time.
6. Speed–The ability to minimize the time cycle of a repeated movement.
7. Coordination–The ability to combine several distinct movement patterns into a singular distinct movement.
8. Agility–The ability to minimize transition time from one movement pattern to another.
9. Balance–The ability to control the placement of the body's center of gravity in relation to its support base.
10. Accuracy–The ability to control movement in a given direction or at a given intensity.

(Ed.–Thanks to Jim Crawley and Bruce Evans of [Dynamax](#))

(Glassman 2007, Understanding CrossFit)

Background:

- CrossFit is for all ages
- No research evidence for HIFT interventions with older adults.



[4]

Ted Gough is one of many seniors who are using CrossFit to preserve a high quality of life.

Methods:

Study Design

- Single-group
- Pre-test, Posttest
 - Familiarization Period
- Pilot Study



Methods:

Participants

- 8 total enrolled
 - Recruited from the Manhattan, KS area
 - Ages 65-84 years
 - 75% female
 - 100% white
 - 50% college graduates



Methods:

Participants

- Screening
 - Licensed Clinical Physical Therapist Screening
 - Functional limitations
 - Berg Balance Scale assessment [5]
 - Exercise modifications suggestions

Methods:

Measures

- Initial, baseline and follow-up assessments
 - OPTIMAL©Instrument [6]
 - Self-assessed Difficulty and Confidence Rating of Functional Activities
 - Functional Performance Tests
 - Timed Up & Go
 - Lift and Carry
 - Chair Stand
 - Stair Climb
 - 6-Minute Walk Test
- Baseline and follow-up
 - CHAMPS Activity Questionnaire

Instructions: Please circle the level of difficulty you have for each activity today.	Able to do without any difficulty	Able to do with little difficulty	Able to do with moderate difficulty	Able to do with much difficulty	Unable to do	Not applicable
1. Lying flat	1	2	3	4	5	9
2. Rolling over	1	2	3	4	5	9
3. Moving-lying to sitting	1	2	3	4	5	9
4. Sitting	1	2	3	4	5	9
5. Squatting	1	2	3	4	5	9
6. Bending/stooping	1	2	3	4	5	9
7. Balancing	1					
8. Kneeling	1					
9. Standing	1					
10. Walking-short distance	1					
11. Walking-long distance	1					
12. Walking-outdoors	1					
13. Climbing stairs	1					
14. Hopping	1					
15. Jumping	1	2	3	4	5	9
16. Running	1	2	3	4	5	9
17. Pushing	1	2	3	4	5	9
18. Pulling	1	2	3	4	5	9
19. Reaching	1	2	3	4	5	9
20. Grasping	1	2	3	4	5	9
21. Lifting	1	2	3	4	5	9
22. Carrying	1	2	3	4	5	9

OPTIMAL© Instrument

- self-assessment of perceived *difficulty* and *self-confidence* in performing 22 basic maneuvers [6].

Methods:

Measures

– Physical Function Tests

Test Name	Domain Measured	Activities and Participation
Seated Timed Up & Go	Mobility, strength, balance and agility	Change & Maintaining body position, Walking and Moving
Lift and Carry	Coordination, upper body strength and agility	Carrying moving & handling objects, Walking and Moving
Chair Stand	Lower body strength and Power	Change & Maintaining body position.
Stair Climb	Power and balance	Walking and Moving
6-Minute Walk Test	Cardiovascular endurance	Walking and Moving

Methods:

Intervention

- 8-week, 2 days/week HIFT intervention
- Led by certified trainers (CF-L1 Tested)
- 16 total HIFT sessions designed based on a CrossFit® training template [7]



Table 2. Exercises by Modality

Gymnastics

Air Squat
Pull-up
Push-up
Dip
Handstand Push-up
Rope Climb
Muscle-up
Press to Handstand
Back Extension
Sit-up
Jumps
Lunges

Metabolic Conditioning

Run
Bike
Row
Jump Rope

Weightlifting

Deadlifts
Cleans
Presses
Snatch
Clean and Jerk
Medicine-Ball Drills
Kettlebell Swing



Methods:

Intervention

- Intensity
 - Relative
 - Heart rate (HR) monitors
 - $HR_{max} = 220 - \text{age}$
- Scaling
 - Weight used, Lower repetitions or rounds, Modified movements:



Overhead Squat	Deadlift	Handstand Push Up	Box Jump
<ul style="list-style-type: none">• Front Squat• Back Squat• Lunge• Air Squat• Sit to Stand• Assisted Sit to Stand	<ul style="list-style-type: none">• Sumo Deadlift• Air Deadlift• Hip Hinge• Bow to Stand	<ul style="list-style-type: none">• Pike Push Up• Push Up• Snake Push Up• Plank• Wall Push Up• Wall Plank	<ul style="list-style-type: none">• Tuck Jump• Step Up• Hop

Methods:

Intervention

A typical workout session was as follows:

- *5 minutes: check-in, fill out daily sheets, HR monitors
- *15 minutes: warm-up
- *15 minutes: instruction and technique work on the body weight squat and Kettlebell swings
- *5 minutes: water/bathroom break
- *10 minutes: Workout of the Day – as many rounds as possible (AMRAP) in 11 minutes of 10 air squats, 10 Kettlebell swings, 2 Shuttle run/ walks (length of the room back and forth=1)
- *10 minutes: cool down, static stretching and mobility stretches

Results

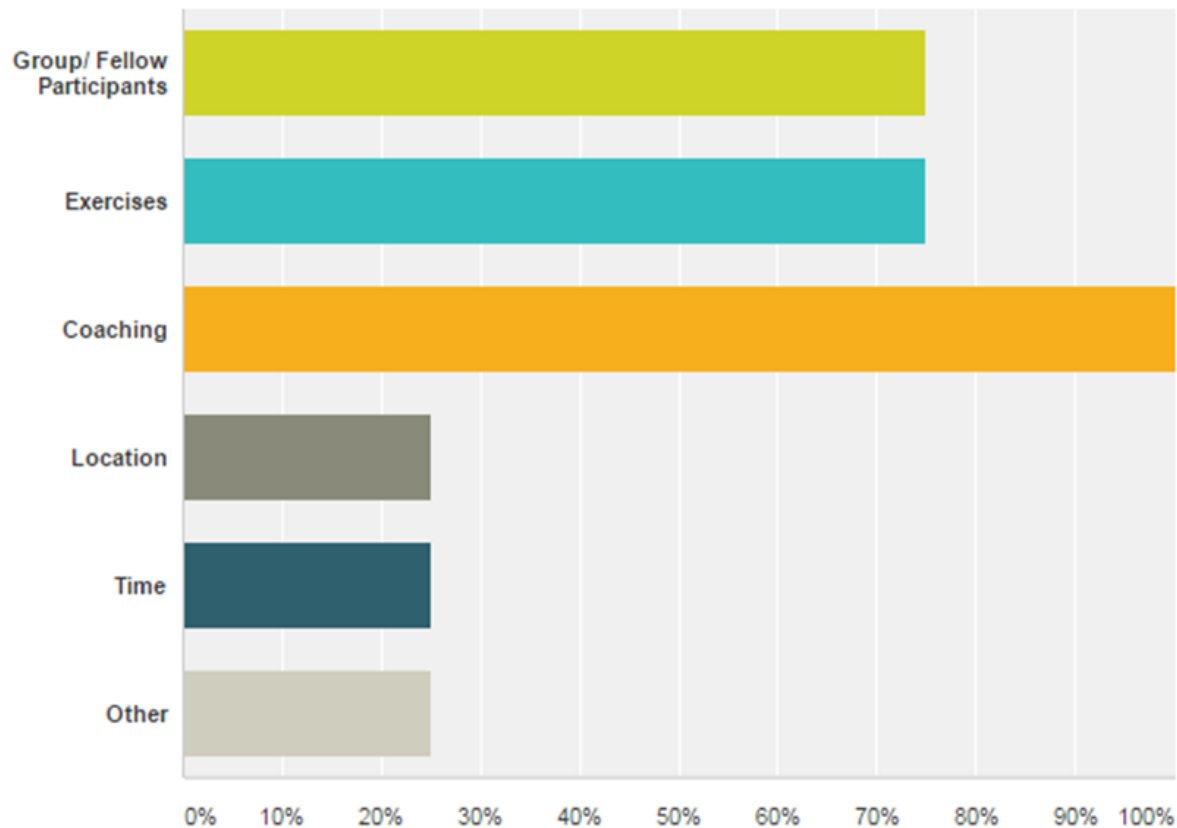
- Recruitment rate: 62%
 - (8/13 screened and eligible)
 - Four screened individuals were excluded due to heart medication.
- Adherence rate was 88% (N= 7)
 - One dropout for perceived health concerns, motivation, enjoyment of type of exercise and competitive group setting.

Results

Intervention Acceptability:

What did you like most about this study?

Answered: 4 Skipped: 0





Results



“What did you like most about this study?”

This two months of fitness training has been a real benefit! The coaching was great, combining expertise with sensitivity to our limitations while stretching our limits.

4/8/2016 3:15 PM

The small group allowed time for individual attention. The coaches were very aware of difficulties and offered good modifications when needed, were extremely supportive and encouraging. I liked being with peers in age and abilities as opposed to a "general" offering of exercises that would include those with more abilities or familiarity of exercises. It was a great introduction to cross-fit principles and exercises that I would not have explored on my own. It pushed me to do things I might not otherwise have done because I felt we were learning safe techniques. I noticed a difference in my daily chores/activities almost immediately after starting the class. I looked forward to the classes each week.

4/7/2016 5:02 PM

The coaching was the best aspect of the entire study. It helped motivate me to continue in the study and to continue in the free month after. I never felt pressured to do anything unsafe or outside my capacities, but I also always felt a little pressure to push myself and to expand what I was able to do.

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Results

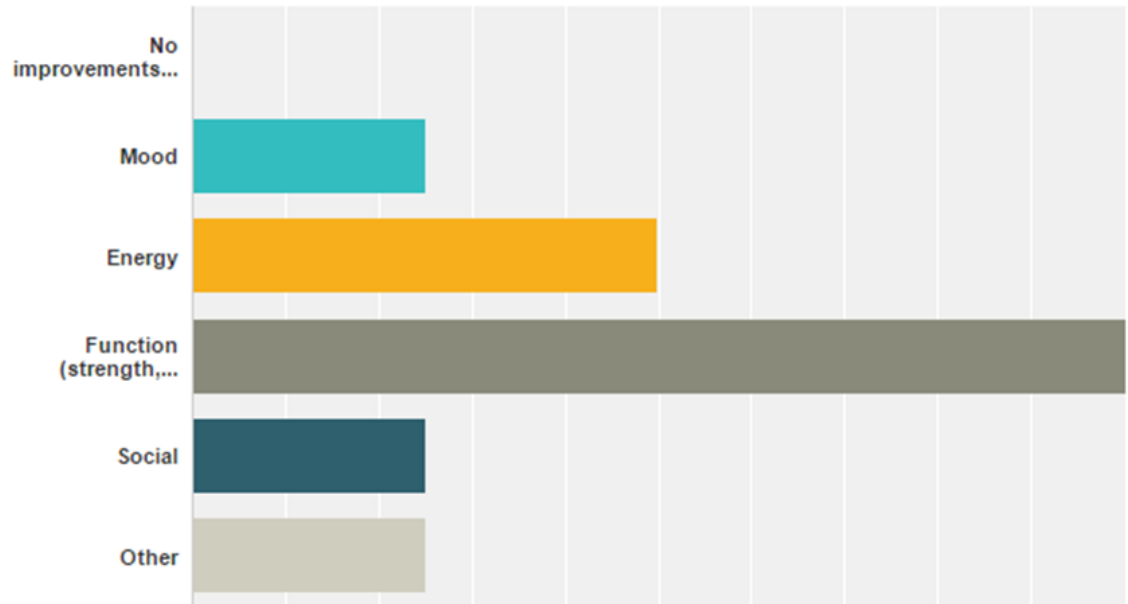
- Intervention Acceptability
 - High responses for motivation to adhere for:
 - Personal goals
 - Coach and researcher relationships
 - Exercise program itself
 - Participants attained goals included:
 - improving fitness by physical markers of function (N=3)
 - acquiring new skills (N=1)



Results

Where have you seen improvements in your daily life outside the FFP class?

Answered: 4 Skipped: 0



Showing 3 responses

I see improvements in flexibility, balance, endurance, strength.

4/8/2016 3:15 PM

While I may have more energy in the long run, I was really tired after the classes. I feel much stronger while doing daily activities (as well as the exercises) with more endurance. I'm sure my flexibility has increased, although not as much as I would like. I am sleeping better at night for the most part.

4/7/2016 5:02 PM

Easier getting out of a recliner chair, stronger on my bike, less winded after pedalling up a long hill.

4/7/2016 12:07 PM

Results

- OPTMIAL Perceived Functional Questionnaire

All 22 items were scored for both confidence and difficulty.

$$= \frac{[\text{Total score} - \text{Total number of items scored}]}{[\text{Total possible score} - \text{Total number of items scored}]}$$

- Familiarization to baseline

- Difficulty scores: -1.7%
- Confidence scores: -3.9%

- Baseline to follow-up

- Difficulty score: +1.6%
- Confidence score: +6.7%

Instructions: Please circle the level of difficulty you have for each activity today.	Able to do without any difficulty	Able to do with little difficulty	Able to do with moderate difficulty	Ab wit di
1. Lying flat	1	2	3	
2. Rolling over	1	2	3	
3. Moving-lying to sitting	1	2	3	
4. Sitting	1	2	3	
5. Squatting	1	2	3	
6. Bending/stooping	1	2	3	
7. Balancing	1	2	3	

Results

- Functional Performance Tests

- Familiarization to Baseline

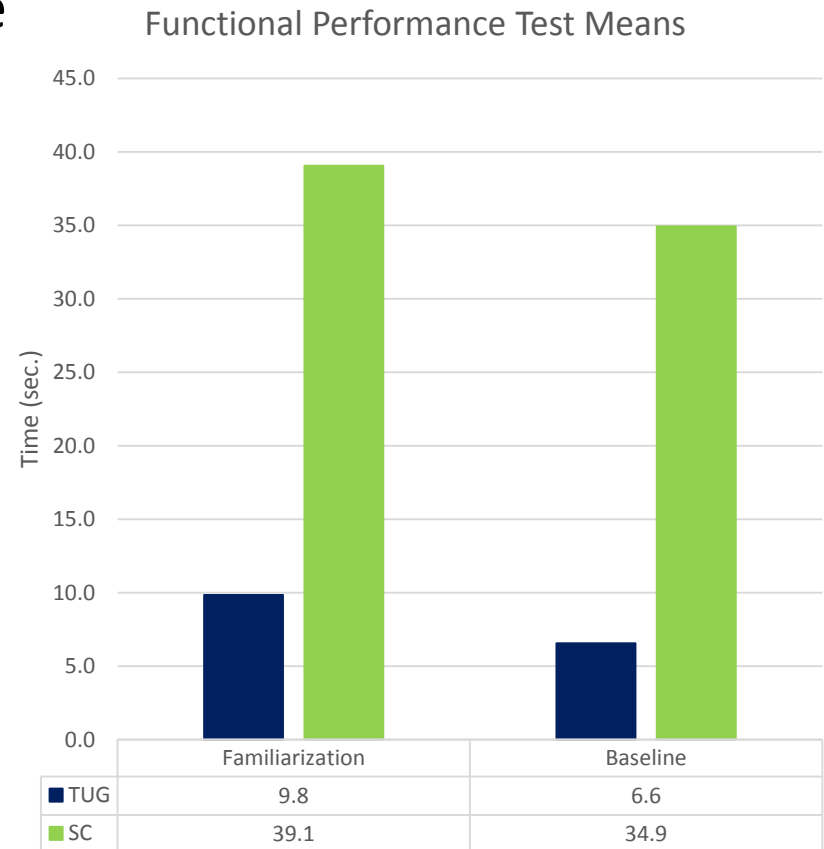
- Significant changes in the two of the five tests*:

- Timed Up & Go

- 3.2 ± 2.3 sec, $t = 4.0$
 $p = 0.005$

- Stair Climb

- 2.5 ± 1.2 sec, $t = 6.1$
 $p < 0.000$



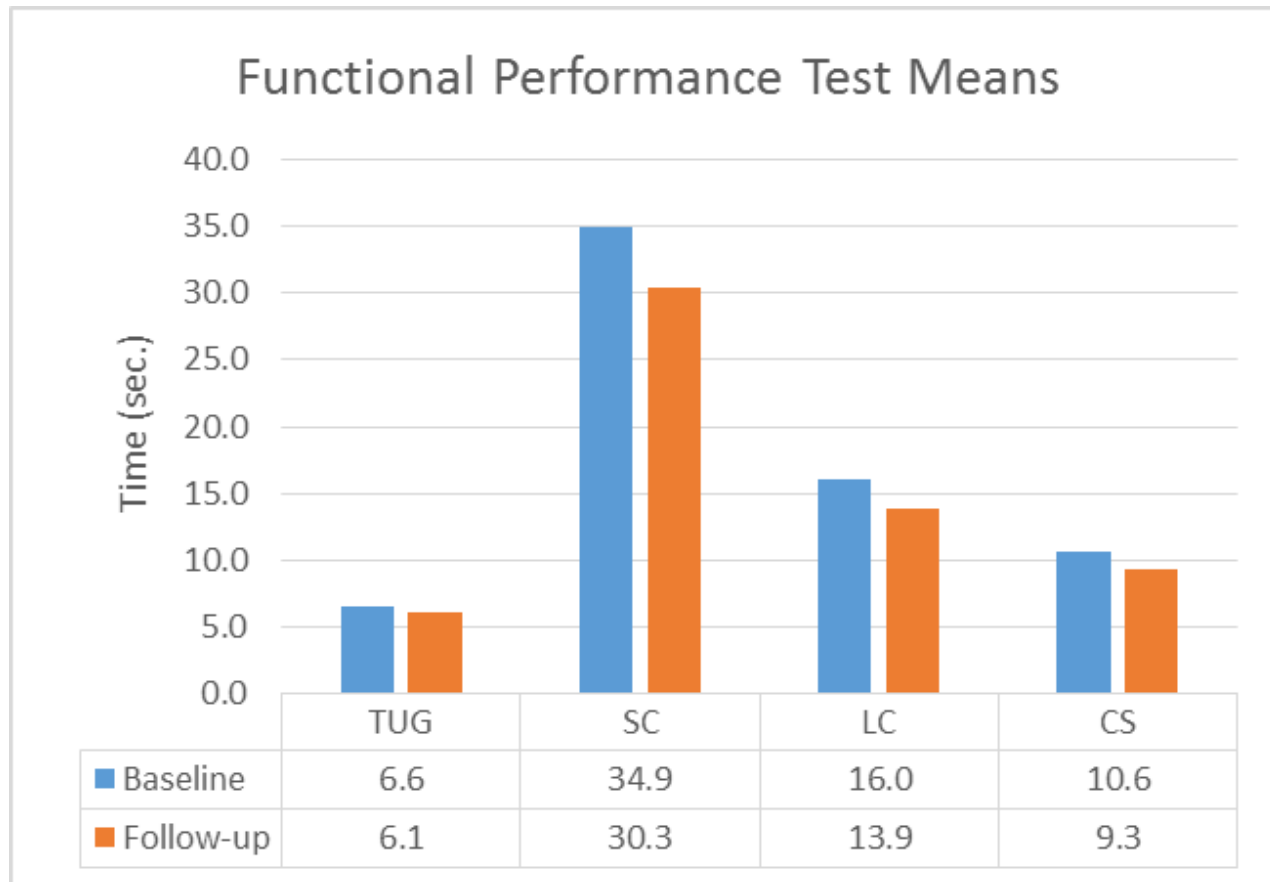
*Three test protocols were kept identical from familiarization to baseline sessions.

Results

- Functional Performance Tests:
 - Baseline to Follow-up
 - Scores Taken: 6/7 (attendance of 75% or more of exercise sessions)
 - **Significant changes** in three of five functional movements:
 - Timed Up & Go:
 - » -0.5 ± 0.35 sec, $t = 3.5$, $p = 0.017$
 - Lift & Carry:
 - » -2.1 ± 0.82 sec, $t = 6.3$, $p = 0.002$
 - Stair Climb:
 - » -4.6 ± 3.8 sec, $t = 3.0$, $p = 0.031$
 - Non-significant, but **positive changes**:
 - Chair Stand:
 - » -1.3 ± 1.4 sec, $t = 2.3$, $p = 0.067$

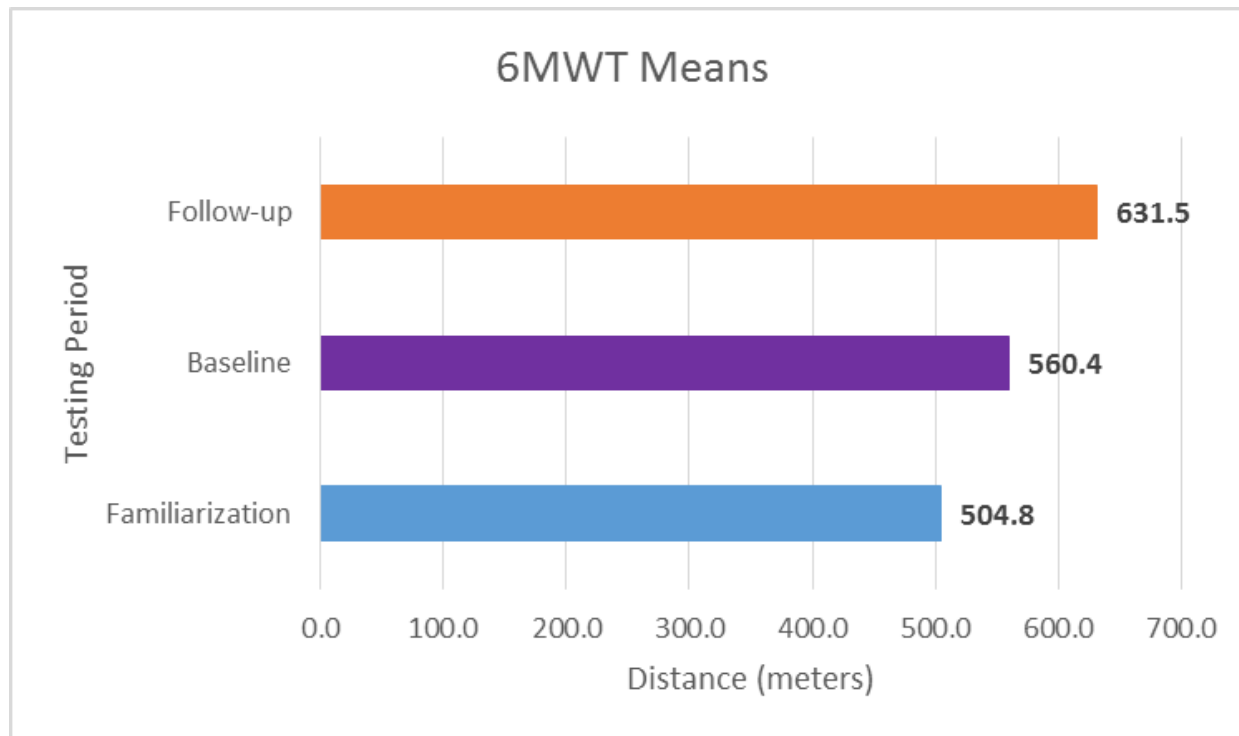
Results

- Functional Performance Tests:
 - Baseline to Follow-up



Results

- Functional Performance Tests:
 - Familiarization to Baseline
 - 6MWT: $-50.4 \pm 91.9\text{m}$, $t = 1.6$, $p = 0.165$
 - Baseline to Follow-up
 - Scores Taken: 6/7 (attendance of 75% or more of exercise sessions)
 - 6MWT: $+71.6 \pm 80.2\text{m}$, $t = 2.2$, $p = 0.082$



Results

Significant Findings:

- Quantitative:
 - Mobility, strength, balance and agility; Coordination and upper body strength; Power and balance
- Qualitative:
 - Enjoyment, adherence, movement patterns, self-assessed functionality

Test Name	Domain Measured	Activities and Participation
Seated Timed Up & Go	Mobility, strength, balance and agility	Change & Maintaining body position, Walking and Moving
Lift and Carry	Coordination, upper body strength and agility	Carrying moving & handling objects, Walking and Moving
Chair Stand	Lower body strength and Power	Change & Maintaining body position.
Stair Climb	Power and balance	Walking and Moving
6-Minute Walk Test	Cardiovascular endurance	Walking and Moving



Conclusion:

Eight weeks of HIFT training was well-received and feasible for older adults, and effective for improving confidence, decreasing perception of difficulty, and improving performance in functional tasks. HIFT programs for older adults should be further explored as a comprehensive and efficient means to maintain or improve daily function.

Implications

- The data gathered from this study will help facilitate further fall prevention exercise program research and maintenance of functionality in daily activities for continued independence of older adults.



Pictures courtesy of K-State Cross fit



References:

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