Biological Markers of Aging in Highly Active Adults

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Introduction

- Physiologists have recently begun to suggest that much of the decline in the biological markers of aging is due to a reduction in daily vigorous physical activity.

- A description of biological markers of aging within a highly active population has yet to be defined.

Purpose:

To further explore the hypothetical differences in common biological markers of aging between a highly active cohort and the general population.

Hypothesis:

United States Master Swimmers present more favorable biological markers of aging than the general population across the spectrum of ages.

Methods

- 172 members of United States Masters Swimming (USMS) aged between 21 and 88 years (51.9 years +/-14), including 97 females (51.4 years +/-15) and 75 males (52.5 years +/-12), were assessed while attending a national championship swim event.
- Physiological, anthropometric and strength related variables were measured during the competition.
- Data were compared to values obtained from the literature for age matched members of the population at large (GP) via single sample tests.
- Anthropometric and lipid general populations values were obtained from NHANES III 1988-94.
- Total skeletal muscle mass was estimated from measures of limb circumference and skinfolds (upper arm, thigh, calf). (Lee, et al., 2000).
- Leg power was estimated using the Sayers equation and compared to general population values. (Payne, et al., 2000).
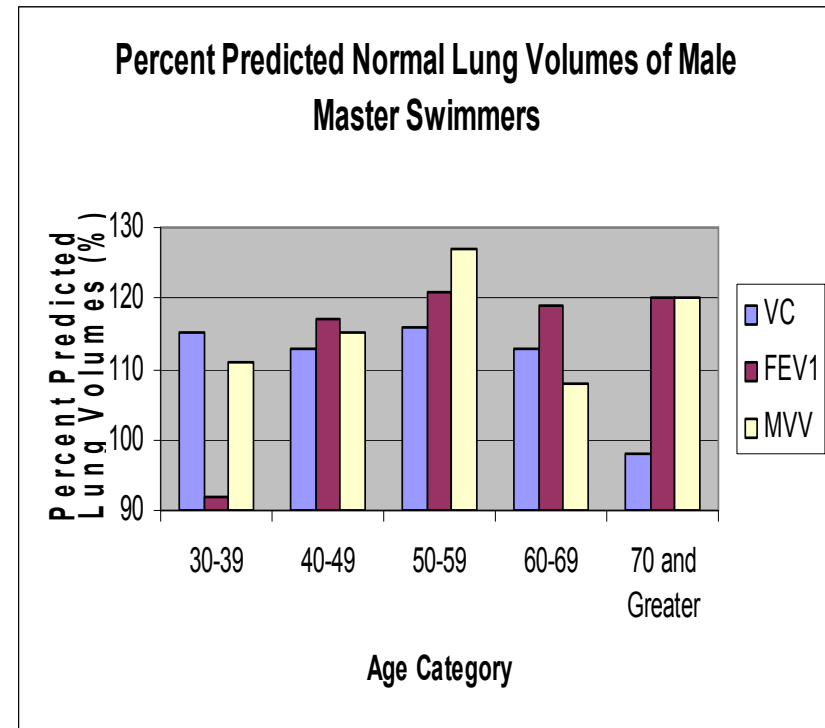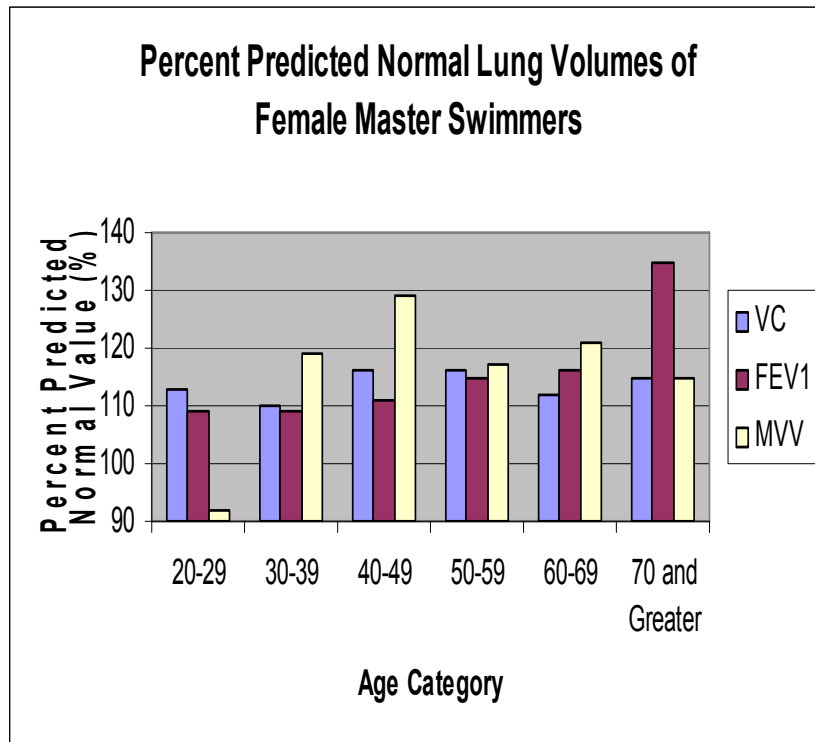
Results

➢The USMS population averaged 4.9 hours moderate and 7.9 hours of vigorous activity per week with 90% reporting year round swimming.

Males	USMS	General Population
Height (m)	1.8	1.76
Weight (kg)	85.72	82.1
BMI	26.39	26.6
Waist (cm)	89.6	95.2
Hip (cm)	93.9	99.6*
Waist to Hip Ratio	.95	.95
Superailliac Sknfd (mm)	14.8	22.3**
Tricep Sknfd (mm)	10.0	13.1*

Females	USMS	General Population
Height (m)	1.66	1.62
Weight (kg)	65.92	69.2
BMI	24.17	26.5
Waist (cm)	77.2	88.6**
Hip (cm)	94.7	102.2**
Waist to Hip Ratio	.81	.85**
Subscapular Sknfd (mm)	16.9	21.3*
Tricep Sknfd (mm)	17.6	23.5**

Table 1-2. Anthropometric values of male and female Master Swimmers versus the general population (NHANES III).($p < 0.05$, $p < 0.01$)

Pulmonary Function

Percent Predicted Normal Lung Volumes of Female Master Swimmers

Percent Predicted Normal Lung Volumes of Male Master Swimmers

Figures 1-2. Pulmonary function for USMS members were 15% greater on average than predicted values.

Total Cholesterol

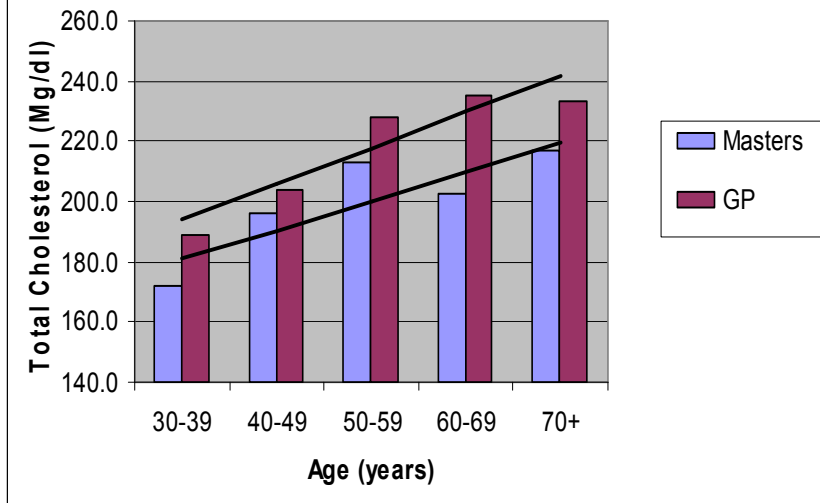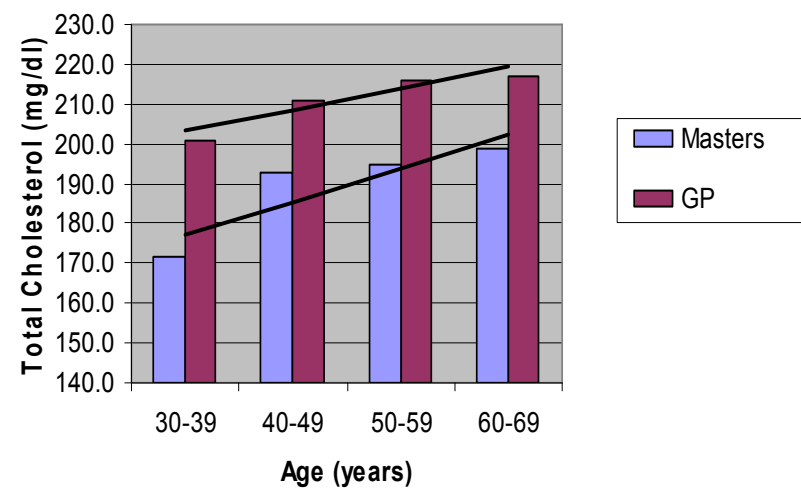Figure 1. Serum Total Cholesterol of Female Master Swimmers Compared to the General Population

Figure 2. Serum Total Cholesterol of Male Master Swimmers Compared to General Population

Figures 3 and 4. Total cholesterol of the master swimmers population averaged 8.1% (female) and 10.4% (male) lower than the general population across ages.

High Density Lipoprotein

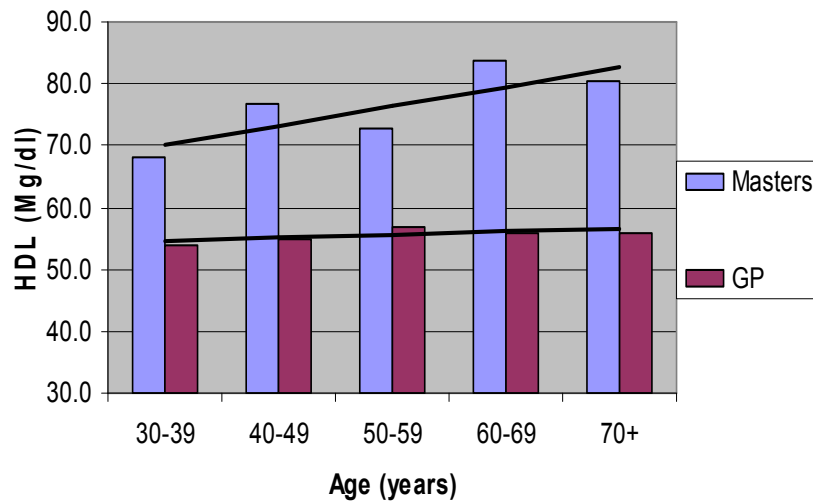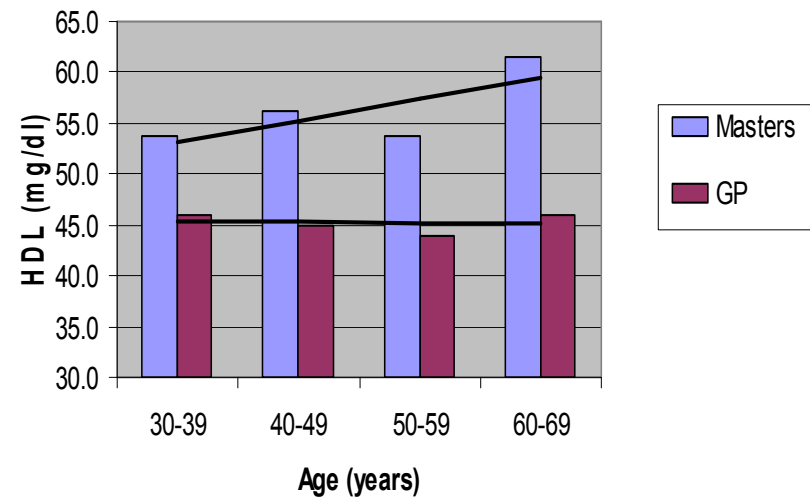Figure 3. High Density Lipoprotein (HDL) of Female Master Swimmers Compared to General Population
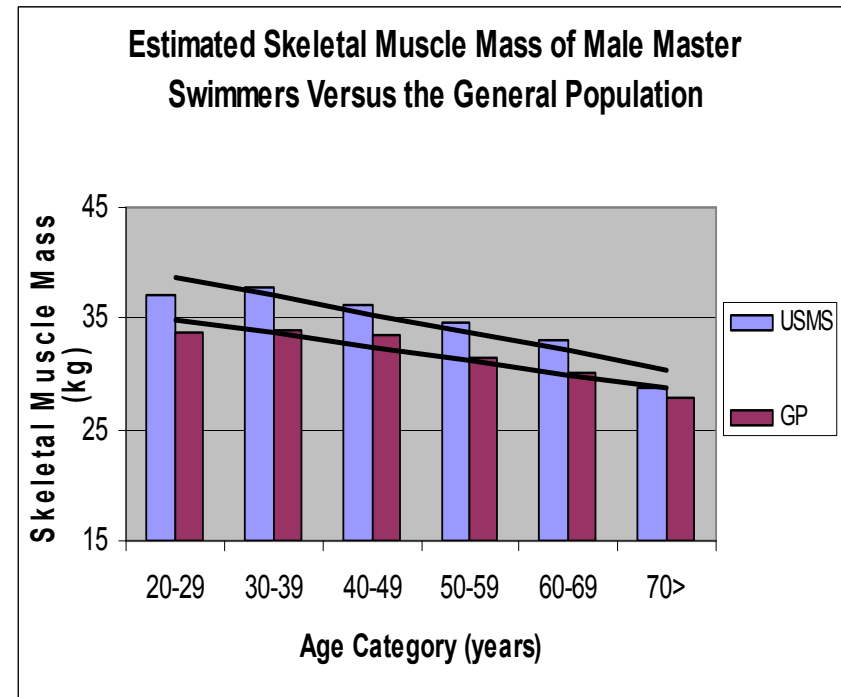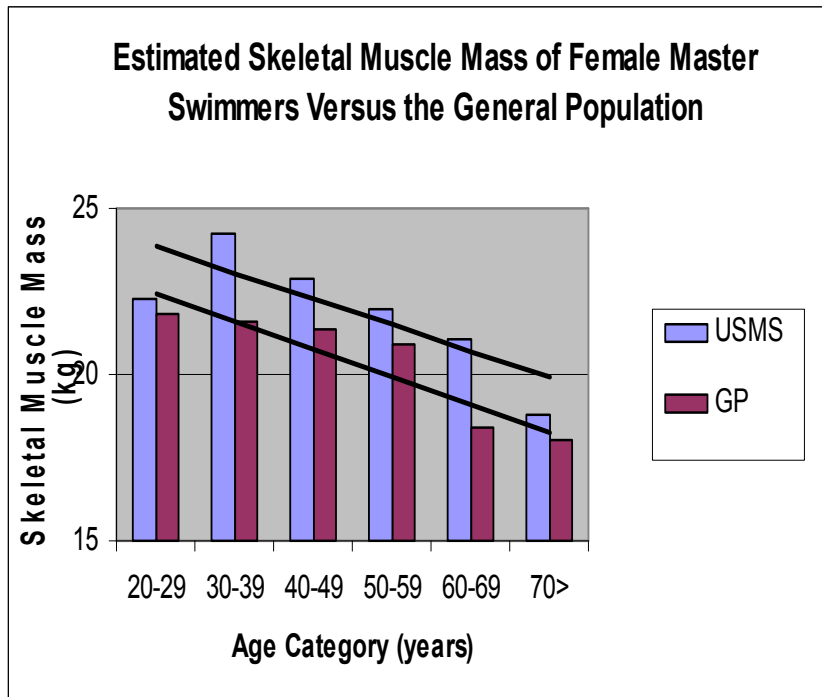
Figure 4. High Density Lipoprotein (HDL) of Male Master Swimmers Compared to the General Population
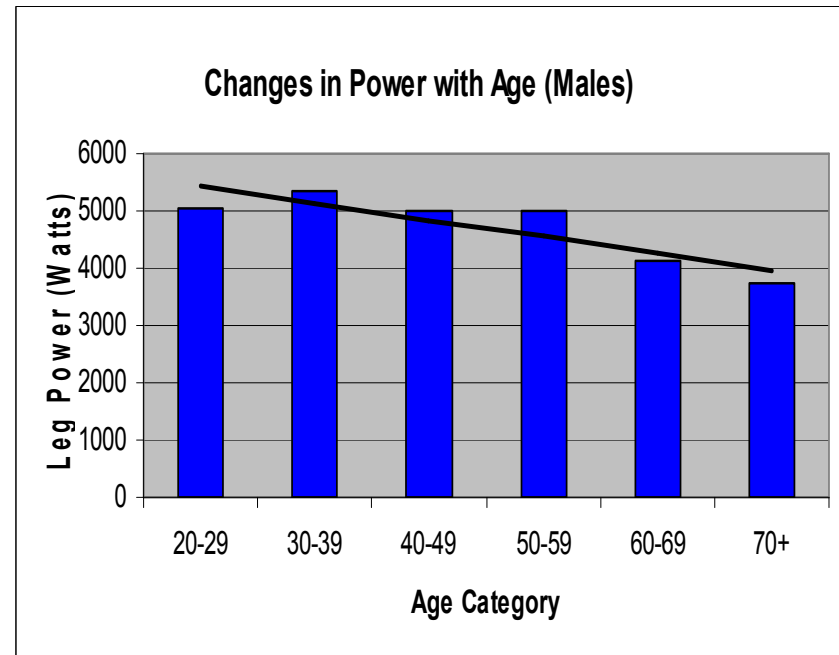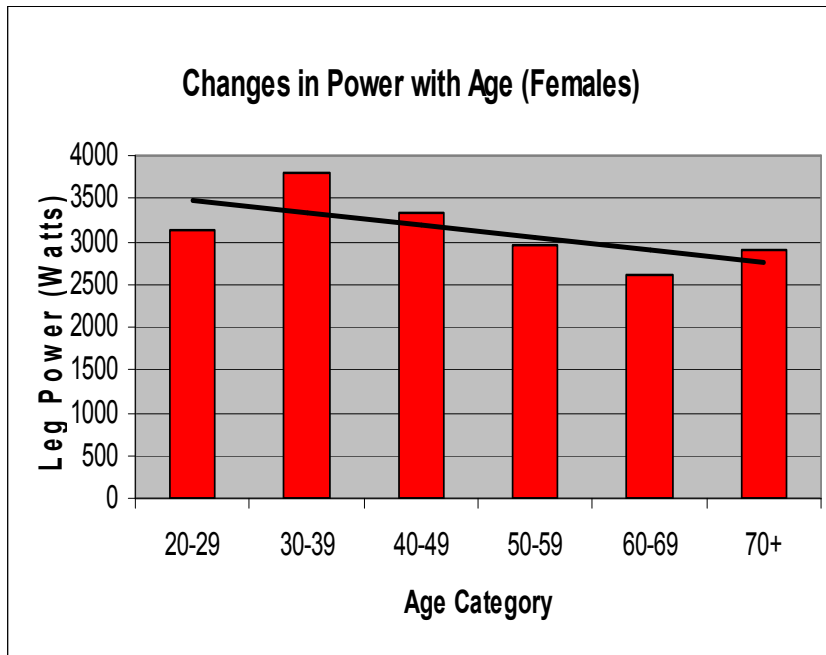
Figures 4 and 5. HDL was significantly higher for male and female Master Swimmers (p < 0.05) compared to the general population (NHANES III). (Figures 3-4)

Estimated Skeletal Muscle Mass

Figures 6 and 7. Estimates of skeletal muscle mass were significantly higher (p < 0.05) for USMS males (34.7 kg, +/- 4.1) and females (21.88 kg, +/- 2.9) when compared to the general population.

Estimated Power

Figures 8 and 9. Muscle power, estimated from vertical jump, declined with age for men and women. On the average, USMS were in the 82nd percentile when compared to the general population.
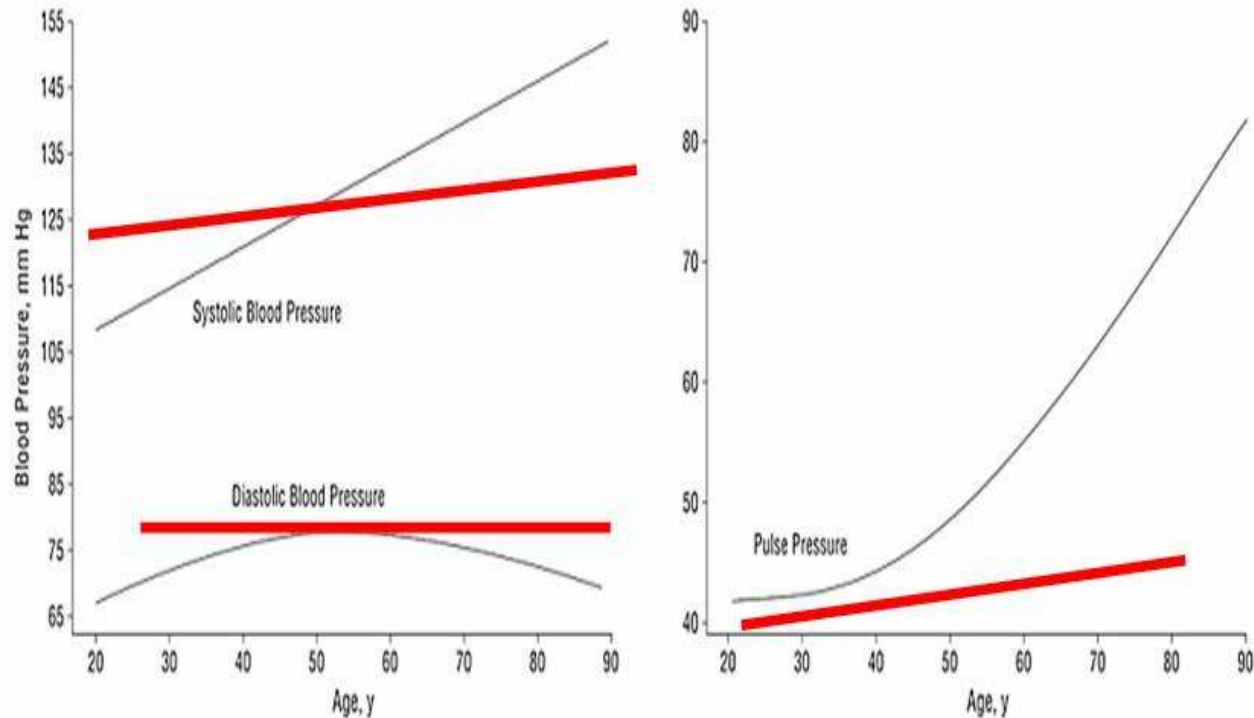
Blood Pressure

Figure 10. Changes in blood pressure across the age spectrum. Master Swimmers population is depicted in red and the GP in black (NHANES III, figure adapted from Hajjar, et. al., 2001)

Discussion

- USMS is a highly active population who participate quantitatively and qualitatively in daily physical activity well above the national recommendations.

- Both Master Swimmers and the general population exhibit functional declines in physiological systems as they age.

- Master Swimmers present a more favorable cardiovascular disease risk profile as evidenced by lower triglycerides, total cholesterol, and blood pressure and higher HDL values.

- In many instances the 'rate of change' appears to be dissimilar when comparing the USMS and the general population.

- Most importantly, the markers of aging appear to be 'more positive' for the youngest swimmers as well as the oldest swimmers.

- Thus, Master Swimmers appear to maintain a higher level of functioning, independence, and quality of life as they age, as compared with the general population.

Conclusions

- The comparisons between members of a highly active population and the general population suggest that despite similarities in height, weight, and BMI, the active population exhibits numerous biological traits consistent with optimal lifestyles across the spectrum of ages studied.

- Maintenance of physiological function, e.g. muscle mass and lung function, are consistent with a higher quality of life and functional independence.

Current Project

- "Age Associated Changes in Total Body Skeletal Muscle Mass and Strength in the Master Swimmers Population"

- Funded by United States Masters Swimming

Purpose

- Determine whether or not individuals who can be described as having participated in a lifetime of physical activity have a higher level of physical function (as reflected by total skeletal muscle mass, swim performance and strength) and quality of life.

Subjects

- 15 male and 15 female United States Master Swimmers from specified age groups age (20-29, 30-39, 40-49, 50-59, 60-69, 70 and greater) for a total of 180 subjects.

- 15 male and 15 subjects from the general population from each of the specified age groups (total of 180 subjects).

Muscle Mass Measurements

- Estimation from 4 skinfold and circumference measurements

- Eight electrode Bioelectrical Impedance Analysis (BIA)

- 24 hour creatinine excretion

Other Measurements

- Hand grip strength: Upper body strength
- Vertical jump:
  - Lower body strength
  - Estimated power
- Quality of Life (SF-36)
- 7 day physical activity recall
- Health history

Research Questions

- How do Master Swimmers compare to the general population with respect to total skeletal muscle mass and strength?

- Is there evidence to suggest that the rate of decline in skeletal muscle mass and strength may be different in the Master Swimmers population as compared to the general population?

- Is there a relationship between skeletal muscle mass, performance, strength and quality of life?

- Is there evidence to suggest that quality of life may be different in the Master Swimmers population as compared to the general population as a function of muscle mass?