RJL SYSTEMS
Quantum Body Composition
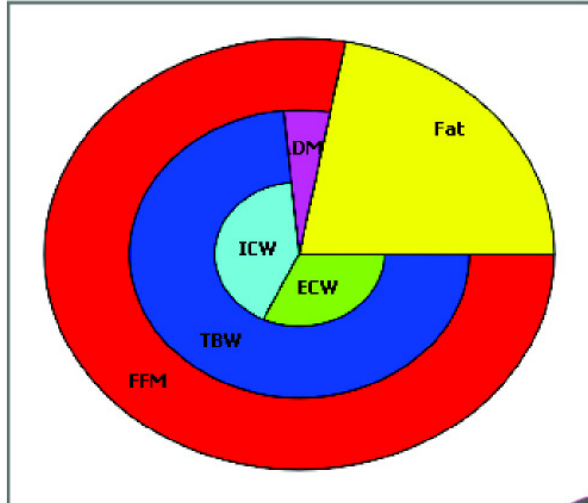
MEASURING AND MANAGING HEALTHY LIVING

RJL Systems is the Industry Innovator and First Company to introduce Bio-electrical Impedance Analysis ("BIA") to the market in 1979.
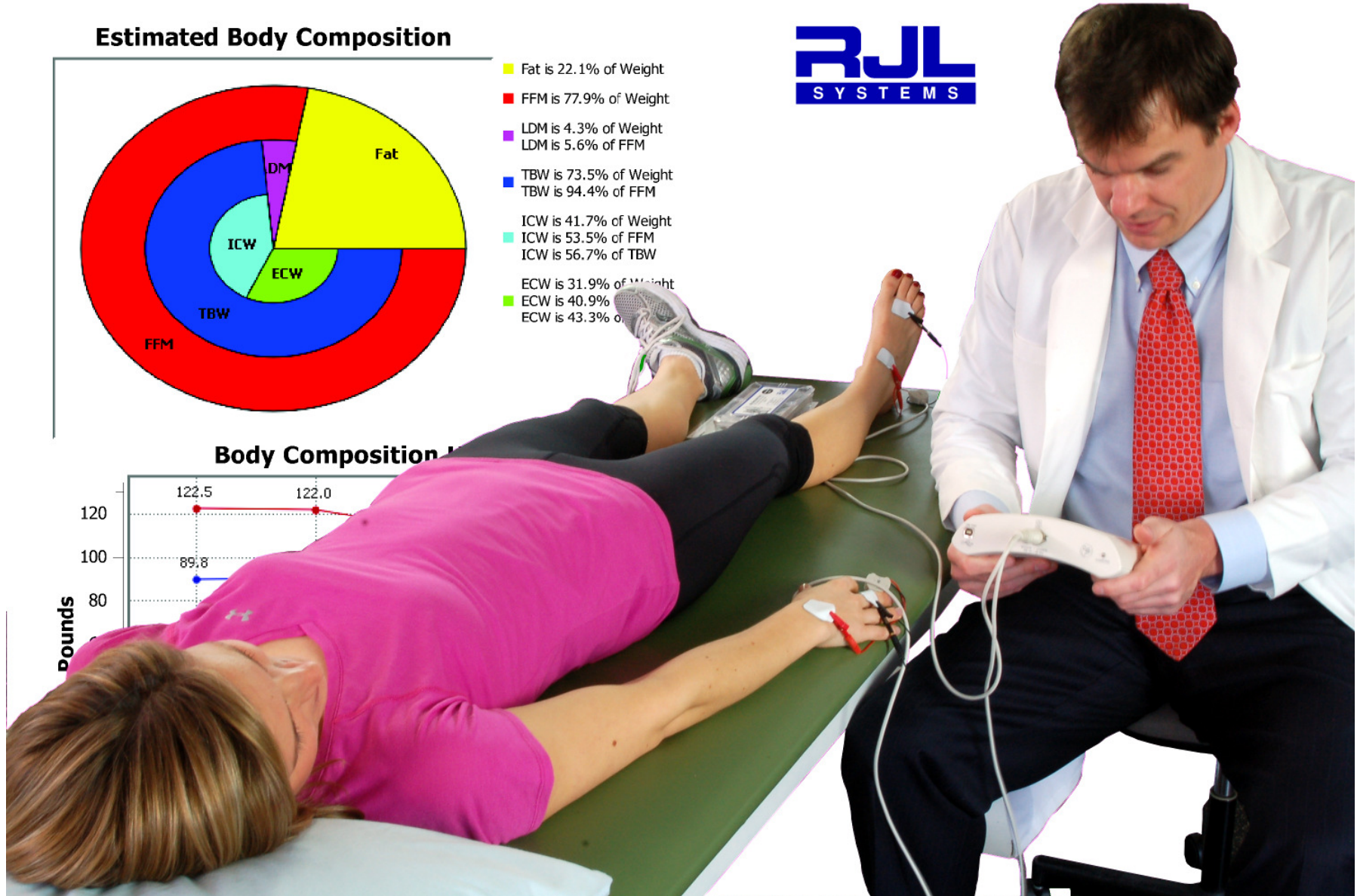
Phase Angle – What is it & why is it Important?

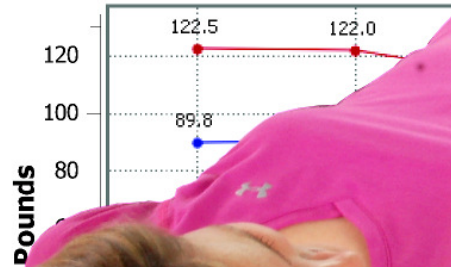Certified Company ISO 13485

RJL Systems is an FDA registered company

Estimated Body Composition

Fat is 22.1% of Weight

FFM is 77.9% of Weight

LDM is 4.3% of Weight
LDM is 5.6% of FFM

TBW is 73.5% of Weight
TBW is 94.4% of FFM

ICW is 41.7% of Weight
ICW is 53.5% of FFM
ICW is 56.7% of TBW

ECW is 31.9% of Weight
ECW is 40.9%
ECW is 43.3% o

What is Phase Angle and Why is it Important?

What is Phase Angle? - Introduction

A Bioelectrical Impedance Analyzer (BIA) is a noninvasive, inexpensive, and portable tool that is commonly used for estimating body composition. RJL Systems' BIA devices use a 50 kHz signal to measure resistance (R) and reactance (XC), which are the components of impedance (Z). Phase angle (PA) is generally reported in degrees, and is the measure of how much the signal is being delayed by the reactance. Mathematically, these four values (Z, R, XC, and PA) are related to each other as follows:

$$Z = \sqrt{(R^2 + X_C^2)} \qquad\qquad PA = \arctan\left(\frac{X_C}{R}\right) \times \left(\frac{180}{\pi}\right)$$

Many claims have been made by different individuals over the years as to the significance of phase angle measurements in a clinical setting.

The goal of this document is to present average ranges of phase angle for the American population by sex and age. RJL Systems makes no claims as to any prognostic or diagnostic utility of phase angle, and places no significance in whether any given phase angle value is below, within, or above the average range.

Note: it is important to note that, at the time of this writing, the United States Food and Drug Administration has not evaluated any of these claims and does not currently recognize any clinical utility of the measurement.

Phase Angle – Methods & Discussion

In the United States, the Centers for Disease Control (CDC) have an ongoing series of studies called the National Health and Nutrition Examination Survey, or NHANES[1]. The third NHANES survey (commonly abbreviated NHANES-III) collected data from 1988 - 1994, and was the first NHANES to include BIA data.[2]

The NHANES-III data set contains records for 33,994 individuals, although not all participants took part in every section of the survey. Eliminating all records that do not have BIA data reduces the data pool to 17,660 records.

[1]   "About the National Health and Nutrition Examination Survey"
https://www.cdc.gov/nchs/nhanes/about_nhanes.htm
                - referenced 2018-08-29.
[2]   "Data Files" https://wwwn.cdc.gov/nchs/nhanes/nhanes3/DataFiles.aspx - referenced 2018-08-29.

To further facilitate easy understanding, we have created a pair of graphs. The means and both bounds of the average ranges for phase angle in each subgroup were plotted using the mean age for that subgroup as the X-coordinate. Once all of the points were plotted, cubic splines were fitted to each of the traces, and the region comprising the average band was shaded. Those graphs can be found on the following pages.

Phase Angle – Methods & Discussion

The NHANES surveys used a different manufacturer's BIA devices, but published equations exist to compensate for the difference in calibration methods to convert the resistance and reactance measurements reported by those devices to the equivalent values that would have been reported using an RJL BIA.

After applying the conversion equations, the data was separated according to sex and ten-year age range. (10-19, 20-29, etc.) Within each subgroup, mean average and standard deviation were calculated for both phase angle and age. The resulting average ranges and the number of people in each subgroup can be seen in the tables below. Because of the nature of a standard distribution, it can be assumed that approximately 68% of the individuals within each subgroup fall within the average ranges.

Males									
Age Group	10 - 19	20 - 29	30 – 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99
Phase Angle	8.0 ± 1.0	8.7 ± 0.9	8.5 ± 0.9	8.2 ± 1.0	7.6 ± 0.9	7.1 ± 0.9	6.4 ± 1.0	5.7 ± 0.9	5.4 ± 1.2
Age	15.4 ± 2.3	24.5 ± 2.8	34.3 ± 2.8	43.9 ± 2.8	54.4 ± 2.8	64.3 ± 2.9	73.6 ± 2.6	82.8 ± 2.5	90.0 ± 0.0
(n)	1379	1553	1383	1155	792	1055	724	472	32

Females									
Age Group	10 - 19	20 - 29	30 – 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99
Phase Angle	7.5 ± 0.8	7.8 ± 0.8	7.7 ± 0.9	7.6 ± 0.8	7.1 ± 0.9	6.7 ± 0.9	6.2 ± 1.0	5.6 ± 0.9	5.0 ± 0.7
Age	15.3 ± 2.3	24.5 ± 2.9	34.5 ± 2.9	43.8 ± 2.8	54.3 ± 2.8	64.3 ± 2.8	73.9 ± 2.8	83.0 ± 2.6	90.0 ± 0.0
(n)	1448	1511	1632	1248	907	1031	817	477	44

Phase Angle – Average Males Graph

Male Phase Angle Average Range
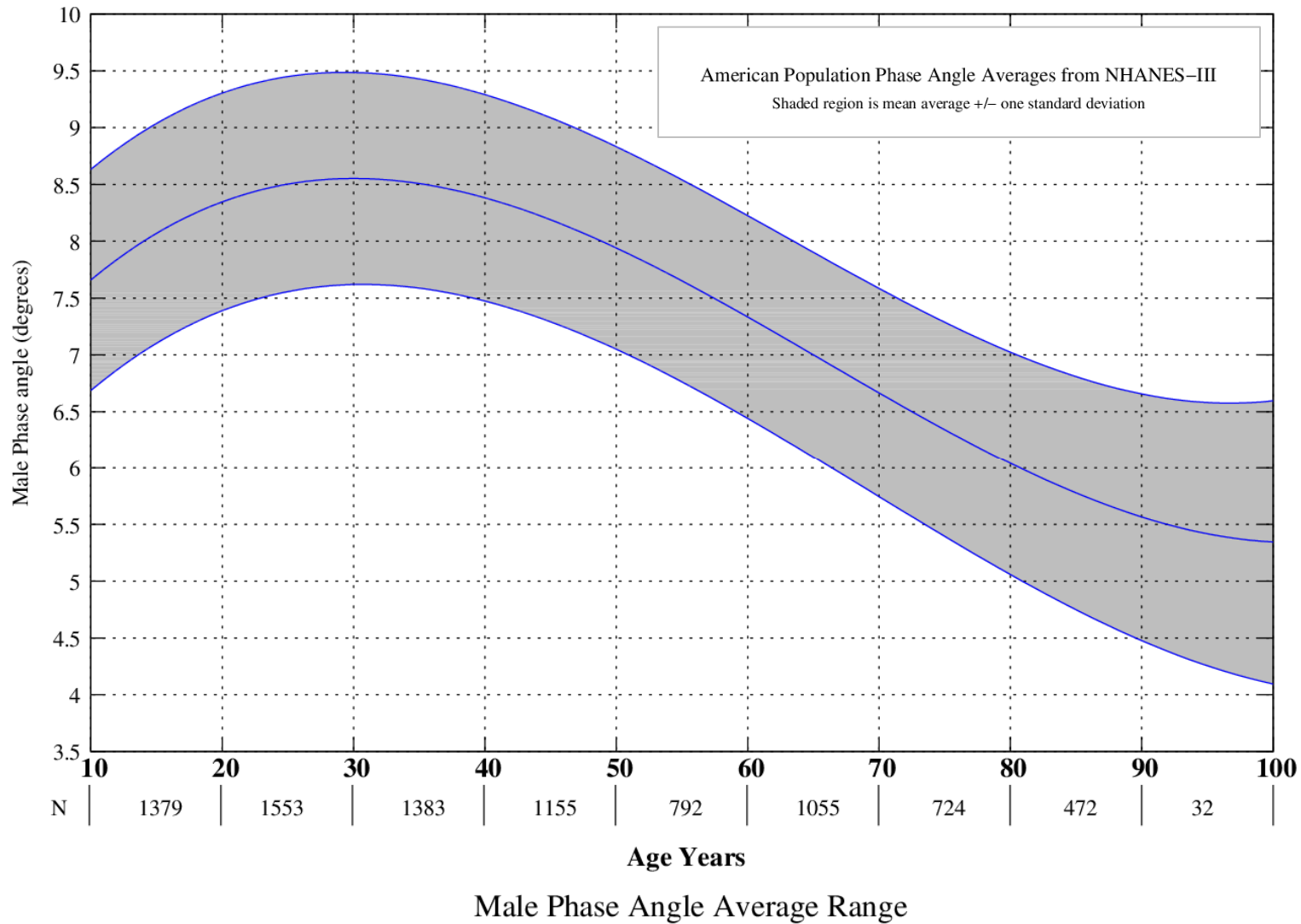
- Where does your patient fall on the Phase Angle (PA) spectrum?

Phase Angle – Average Females Graph

Female Phase Angle Average Range
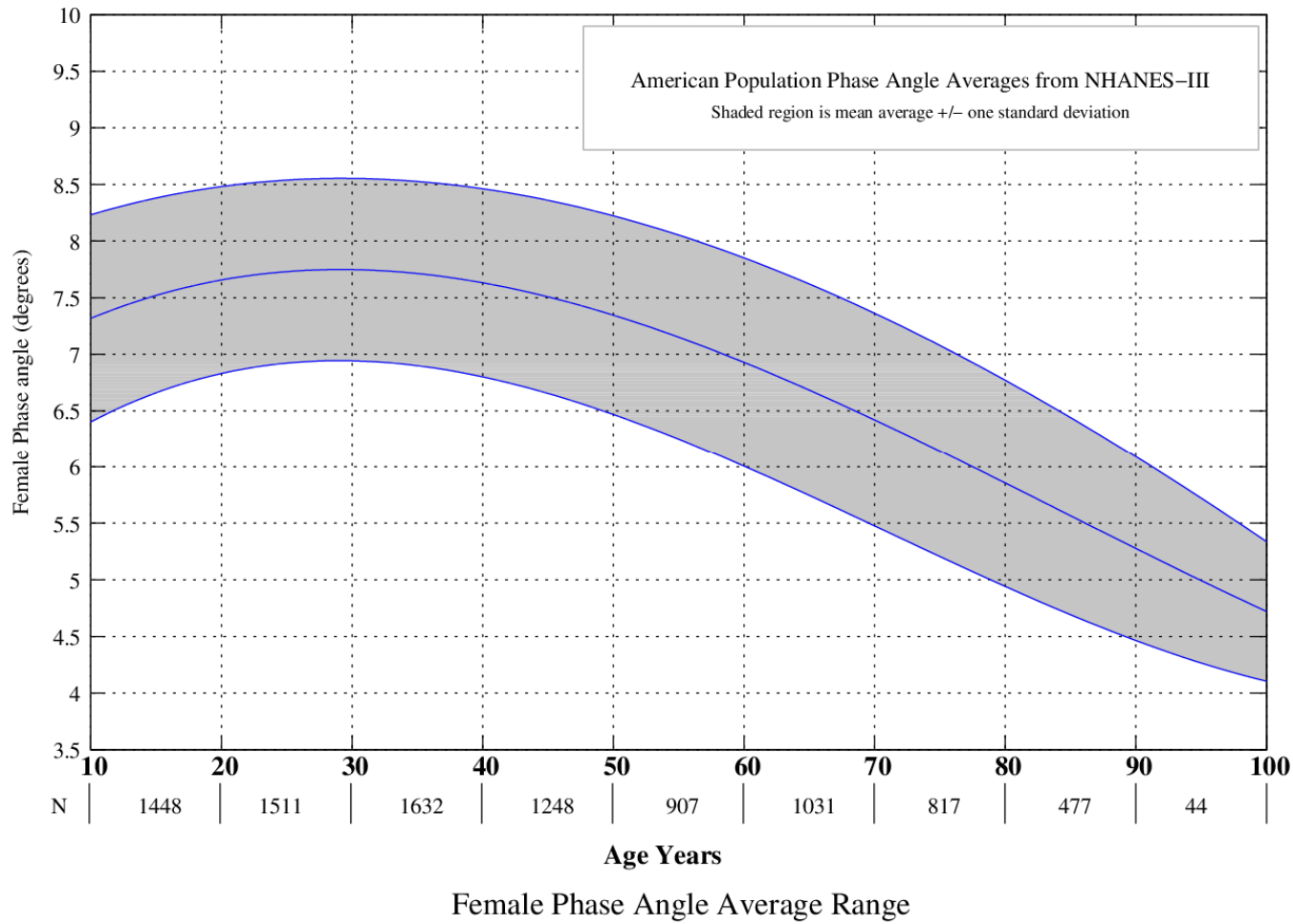
- Where does your patient fall on the Phase Angle (PA) spectrum?

RJL Systems Overview

➢ RJL Systems, a Michigan-based, an established, Class II, ISO-13485 medical device company **(www.rjlsystems.com)** is known as the innovator and premier manufacturer of Bioelectrical Impedance Analysis (body composition) instruments, both domestically and internationally.

➢ The company invented/engineered the first BIA Analyzer and holds U.S. registered patents on the devices.

➢ RJL Systems revolutionized the BIA industry through FDA clearance of the BIA Analyzer as a Class II Medical Device in 1983.

➢ The company's BIA Analyzers are the instruments of choice for scientists, researchers, clinicians, physicians, and other medical professionals whether they are in health care practices/institutions, educational, governmental, or industrial settings.

What RJL BIA Quantum Device Provides?
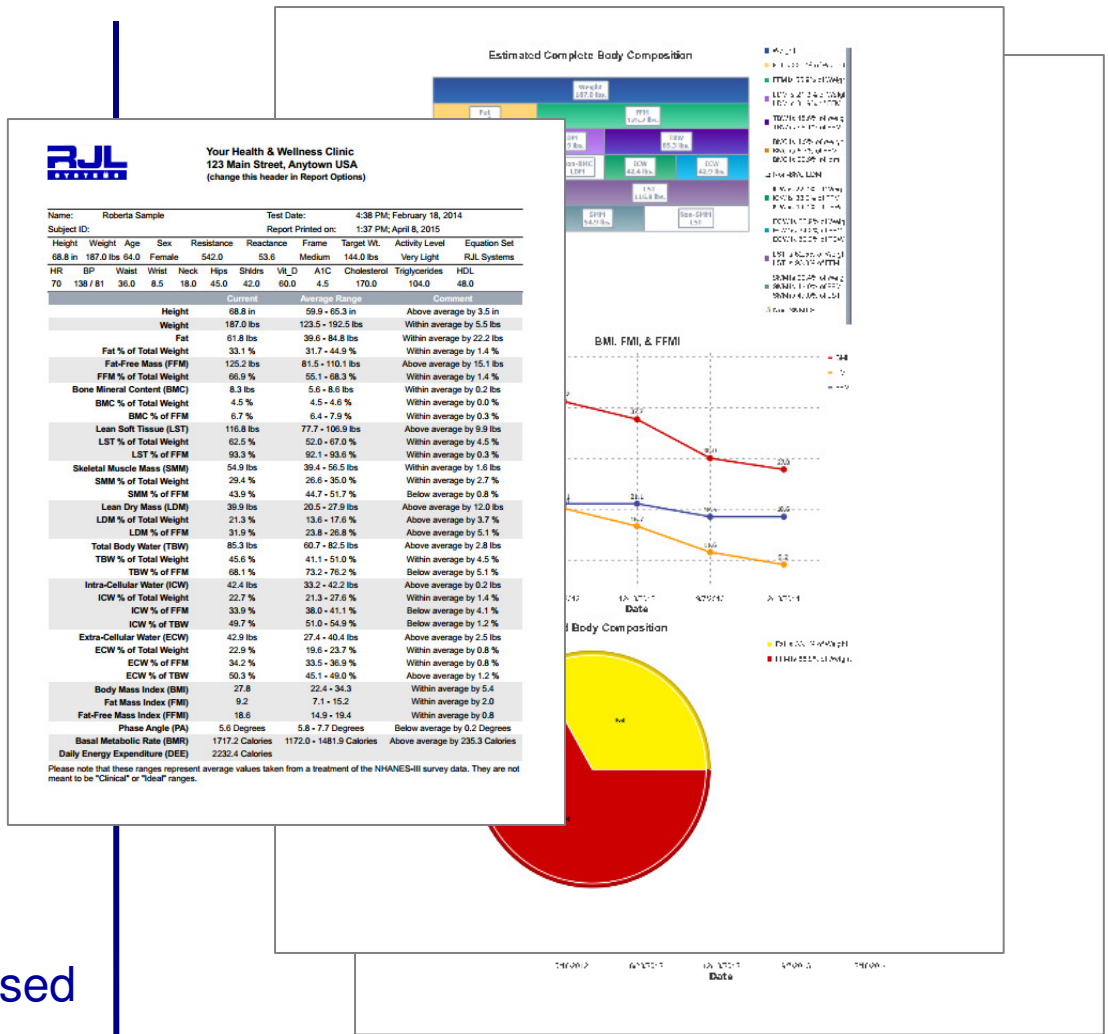
RJL SYSTEMS
Quantum Body Composition

Quantum IV Whole Body Composition

Biometrics reported on:

- **Fat Mass (FM)**
- **Fat Free Mass (FFM)**
- **Lean Dry Mass (LDM)**
- **Total Body Water (TDW)**
- **Intra & Extra-cellular Water (ICW & ECW)**
- **Bone Mineral Content (BMC)**
- **Lean Soft Tissue (LST)**
- **Skeletal Muscle Mass (SMM)**
- **Basal Metabolic Rate (BMR)**
- **Daily Energy Expenditure (DEE)**
- **Body Mass Index (BMI)**
- **Phase Angle (PA)**

The BC 4.2 software provides time-graphs, bar & pie charts along with all patient history tracking.

Note: All body composition equations based peer review papers and studies.

Whole Body Composition Report - BC 4.2 Software

Note: BC 4.2 Software - MAC & PC Compatible

RJL
S Y S T E M S
Quantum Body Composition