
 **Wake Forest™**  
Baptist Health

INTENSIVE CARDIAC REHABILITATION

KILLIAN ROBINSON MD



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**OBJECTIVES**

- **DEFINE CARDIAC REHABILITATION INTENSIVE AND OTHERWISE**
- **DESCRIBE BRIEFLY A HISTORY OF THE FIELD**
- **REVIEW CURRENT NATIONAL RECOMMENDATIONS FOR SUCH PROGRAMS**
- **COMPARE US PROGRAMS WITH OTHER COUNTRIES**
- **REVIEW SOME OF OUR OWN DATA**

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**DISCLOSURES**

- **NONE**

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### Definition of Cardiac Rehabilitation

- "...Comprehensive long-term programs involving medical evaluation, prescribed exercise, cardiac risk factor modification, education and counseling..."

Wenger et al. US Department of Health and Human Services, 1995.

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### Phases of Cardiac Rehabilitation

1. Phase 1 (in hospital immediately following index event).
2. Phase 2. Rehabilitation in the outpatient setting early after a cardiovascular event (usually within the first 3-6 months) but possibly up to one year.
3. Phase 3 (longer term and ongoing delivery of rehabilitation services for outpatients).

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### INTO THE BED

- Small to moderate size infarcts, 1 month of bed-rest, 2 weeks complete convalescence and 1 month graded convalescence and another month consolidating recovery
- Less than 3 weeks in bed is unwise....
- Authors: G Kenneth Mallory, Paul White, Jorge Salcedo-Salgar
- Year - 1939

G Kenneth Mallory, Paul White, Jorge Salcedo-Salgar. Am Heart J 1939

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QUIZ #1

ONE OR ALL OF THESE PHYSICIANS:

- 1. Discovered cardiac arrhythmia
- 2. Discovered the cure for cancer
- 3. Improved Cardiac Rehab
- 4. 1 and 3




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INTO THE CHAIR

- Armchair Treatment
- N=81
- Majority out of bed in 2 days
- Some within hours
- Chair patients rarely had pulmonary edema
- Authors: Samuel Levine and Bernard Lown
- Year: 1952

Levine & Lown, JAMA 1952  
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Quiz #2 – Year 1955

September 24:

- Breakfast: sausage, bacon, mush, hotcakes
- Lunch: hamburger with raw onion
- Infarct - Bedrest

October 11 Allowed to see a cabinet member

October 22 In a chair for a few hours daily

November 7 Walking and starting to climb stairs

November 11 Wheeled to airplane and lifted on board

**Blamed the onion for "indigestion" on the day of his infarction**



Kucharski, A. Perspectives in Biology and Medicine. 1978

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QUIZ #2

1. Theodore Roosevelt
2. Franklin Roosevelt
3. Grover Cleveland
4. Dwight Eisenhower
5. Lyndon Johnson

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INTO THE JOB

- Prolonged bedrest “deleterious”
- 3 weeks in bed, 3 weeks of light activity in the home, 3 weeks of normal everyday activity
- Physical reconditioning and occupational rehab should begin within 3 months
- Full working capacity 6 months
- Authors: WHO “experts” - couldn’t find their names!
- Year - 1964

WHO Technical Report Series No 270 Geneva 1964

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INTO THE REHAB PROGRAM

- Passive movements after a few days
- Early mobilization - days
- Return to hospital and formal rehab begun 3 weeks after discharge
- Length of program: 6-8 weeks
- Number of visits per week: 2
- Author: Nanette Wenger
- Year - 1969



Wenger N, Strickland M, et al. JAMA 1969

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**CONTEMPORARY PROGRAMS –  
CORE GOALS**

1. Optimize cardiovascular risk reduction
2. Foster healthy behaviors
3. Foster compliance with those behaviors
4. Reduce disability
5. Promote an active lifestyle for patients with cardiovascular disease

Belady GJ et al. Circulation 2007.

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**QUIZ #3**



The old guy:

1. Same name as the priest in M\*A\*S\*H\*
2. Invented water
3. Said smoking was bad
4. 1 & 3

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**CONTEMPORARY PROGRAMS –  
CORE COMPONENTS**

1. Patient assessment
2. Nutritional counseling
3. Weight management
4. Blood pressure management
5. Lipid management
6. Diabetes management
7. Tobacco cessation
8. Psychosocial management
9. Physical activity counseling
10. Exercise training



Belady et al. Circulation 2007.

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**AACVPR/ACC/AHA Performance Measures for Cardiac Rehabilitation: REFERRAL**

1. Appropriate referral of patients.
  - a. Qualifying hospital patients are referred to program prior to discharge.
  - b. Qualifying outpatients with a diagnosis within the last year are referred to a program.

Note: Healthcare system and/or its providers are responsible for these performance measures.

Thomas et al. J Am Coll Cardiol 2007

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**Eligible Patients**

1. MI, acute coronary syndrome.
2. CABG.
3. PCI.
4. Stable angina.
5. Heart valve repair or replacement.
6. Heart or lung transplantation.
7. CHF.
8. PVD.

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**AACVPR/ACC/AHA Performance Measures for Cardiac Rehabilitation: RESPONSIBLE PARTIES**

1. Nurses, exercise specialists, nutritionists, respiratory therapists etc
2. Physician
3. Administrators

Thomas et al. J Am Coll Cardiol, 2007

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AACVPR/ACC/AHA Performance Measures for Cardiac Rehabilitation: STRUCTURAL MEASURES

1. Physician medical director
2. Emergency response team available

Thomas et al. J Am Coll Cardiol, 2007

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AACVPR/ACC/AHA Performance Measures for Cardiac Rehabilitation: PROCESS MEASURES

1. Assessment/documentation of patient's risk before the program
2. A process for assessment of patients for changes in symptoms during program
3. Individualized assessment and evaluation of modifiable risk factors
4. Development of individualized risk reduction interventions for identified conditions and coordination of care with other healthcare providers
5. Monitoring of response and documentation of program effectiveness through ongoing analysis of aggregate data

Thomas et al. J Am Coll Cardiol, 2007

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PERFORMANCE MEASURES FOR CARDIAC REHABILITATION: DATA COLLECTION INSTRUMENTS

Age	Diagnosis	Sex	Race	Smoking 1	Smoking 2	HTN	Chol	DM	QOL pre	QOL post	Weight pre	Weight post
50	2	1	1	0	0	1	1	0	22		211	214
51	1	1	1	0	0	1	0	0		27	191.5	179
52	3	1	1	0	1	0	1	0	18	18	186	180
53	18	1	1	0	0	1	0	0	19		218	227
53	1	2	1	0	0	1	0	0	27	29	221	219
54	12	1	1	0	0	0	0	0	28		161	
56	17	2	1	0	0	1	1	0	26		167	171
57	16	2	1	1	1	1	1	0			162	
65	3	1	1	0	0	1	1	0	27		163	163
66	18	1	1	0	0	0	1	0	8	11	174	168
73	1	2	1	0	1	0	1	0	16	13	233.5	223
75	1	2	1	0	0	1	1	1	16	20	189	179
76	1	1	1	0	0	1	1	0	27		182.5	178
78	12	1	1	0	0	0	1	0	26		174	180
80	1	1	1	0	0	1	1	0	29	30	175	175
86	3	1	1	0	0	1	0	0			190	
				1	3	11	11	1	21,923	21,142	191,281	188,923
									8	6	3	1

Thomas et al. JACC 2007

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**QUIZ #4**

- 1. ALL PROGRAMS ARE HOSPITAL-BASED AND LAST 3 MONTHS
- 2. ALL PROGRAMS ARE INDOORS
- 3. ALL PROGRAMS HAVE NUTRITIONAL COUNSELLING
- 4. NONE OF THE ABOVE

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**QUIZ #5**

- 1. IN EUROPE, EVERYONE GOES TO CARDIAC REHAB EVEN IF THEY DON'T NEED TO**
- 2. IN EUROPE, 90% OF ELIGIBLE PATIENTS GO TO CARDIAC REHAB BECAUSE IT'S ALL FREE**
- 3. IN EUROPE, PEOPLE ARE CRAZY AND DO JUST AS THEY PLEASE**
- 4. NONE OF THE ABOVE**

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### Entry rates for Eligible Patients

1. US – 20% overall but varies by state
2. UK - 30%
3. Canada – 30%
4. European countries variable but low

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### Reasons for Non-participation

1. No close center (usually Wilkes or rural Virginia) (n=75)
2. No interest (n=106)
3. Financial reasons (n=72)
4. Not able: hospice, palliative care, home health, palliative care etc. (n=167)
5. SNF (n=27)
6. Job hours (n=15)
7. Done before (n=22)
8. No transport (n=13)

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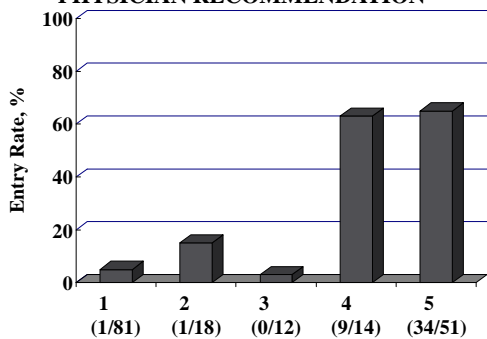
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### PARTICIPATION RATE BY STRENGTH OF PHYSICIAN RECOMMENDATION



Ades et al. Arch Int Med 1992

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**INTENSIVE LIFESTYLE INTERVENTIONS**

ORNISH program  
 An almost vegan diet for 1 year but egg white, fat-free milk allowed  
 Meditation  
 Regular exercise  
 Quantitative angiography

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**Baseline Characteristics of Experimental Control Groups**

	Mean (SD)	
	Experimental group (n = 22)	Control group (n = 19)
Male/Female	21/1	15/4
Age (yr)	56.1 (7.5)	59.8 (9.1)
Weight (kg)	91.1 (15.5)	80.4 (22.8)
Body mass index (kg/m <sup>2</sup> )	28.4 (4.1)	26.5 (5.3)

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Ornish et al. Lancet 1990

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**Changes in Risk Factors**

	Mean (SD) at baseline		Mean (SD) at 12 mo		P Value (two-sided)
	Experimental group (n = 20-22)	Control group (n = 17-19)	Experimental group (n = 20-22)	Control group (n = 17-19)	
<i>Serum lipids (mmol/l)</i>					
Total cholesterol	5.88 (1.29)	6.34 (1.02)	4.45 (1.15)	6.00 (1.55)	0.0192
LDL cholesterol	3.92 (1.25)	4.32 (0.77)	2.46 (1.55)	4.07 (1.17)	0.0072
HDL cholesterol	1.00 (0.26)	1.35 (0.52)	0.97 (0.40)	1.31 (0.38)	0.8316
Triglycerides	2.38 (1.26)	2.45 (2.47)	2.91 (1.47)	2.24 (1.79)	0.2472
<i>Weight (kg)</i>	91.1 (15.5)	80.4 (22.8)	81.0 (11.4)	81.8 (25.0)	<0.0001

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Ornish et al. Lancet 1990

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### Changes in Angina Symptoms

	Mean (SD) at baseline		Mean (SD) at 12 mo		p value
	Exp. group (n = 20)	Control group (n = 17)	Exp. group (n = 20)	Control group (n = 17)	
Chest pain frequency	5.1 (14.1)	2.4 (3.8)	0.5 (0.8)	6.2 (12.9)	0-0578
Chest pain duration (min)	2.7 (4.7)	3.5 (7.9)	1.6(4.5)	6.9 (14.5)	0-1390
Chest pain severity	2.3 (1.6)	1.8 (1.1)	1.7 (1.2)	2.5 (1.2)	0-0006

Ornish et al. Lancet 1990

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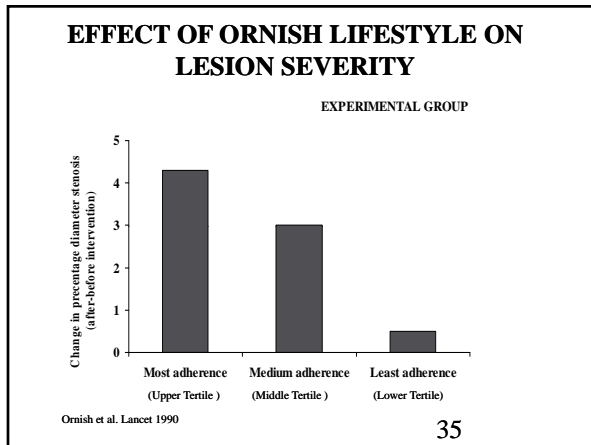
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### Intensive Cardiac Rehabilitation I

Intensive cardiac rehabilitation is defined as a physician-supervised program that furnishes cardiac rehabilitation services more frequently and often in a more rigorous manner.....AND

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### Intensive Cardiac Rehabilitation II

Per §1861(eee)(4)(A) of the Social Security Act must accomplish one or more of the following:

- Positively affected the progression of coronary heart disease
- Reduced the need for coronary bypass surgery
- Reduced the need for percutaneous coronary interventions

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### Intensive Cardiac Rehabilitation III

Must also reduce five or more of the following:

- Low density lipoprotein;
- Triglycerides;
- Body mass index;
- Systolic blood pressure;
- Diastolic blood pressure; and/or
- Cholesterol, BP and diabetes medications

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### Intensive Cardiac Rehabilitation IV

Individual ICR programs must be approved through the national coverage determination process to ensure that they demonstrate these accomplishments.

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# DOES IT WORK?

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All – cause mortality in secondary prevention programs

Type of Study	Treatment Group	Control Group	RR (95% CI)	RR (95% CI)
Program without exercise				
Subtotal (95% CI)	4598	4604	◆	0.87 (0.76-0.99)
Program with exercise				
Subtotal (95% CI)	2404	2251	◆	0.88 (0.74-1.04)
Program with exercise only				
Subtotal (95% CI)	1165	1120	◆	0.72 (0.54-0.95)
Total (95% CI)	8167	7975	◆	0.85 (0.77-0.94)

0.1 0.2 0.5 1.0 2.0 5.0 10.0  
Favors Treatment                      Favors Control

Clark et al. Ann Intern Med 2005

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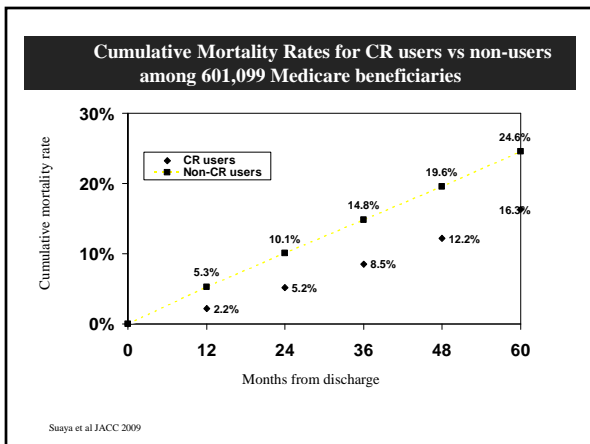
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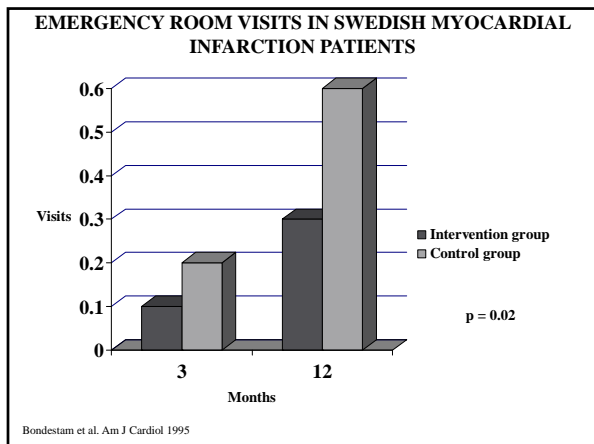
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- ### HOW DOES IT WORK??
1. PHYSICAL ACTIVITY
  2. IMPROVED NUTRITION
  3. SMOKING CESSATION
  4. INCREASED SURVEILLANCE
  5. BETTER LIPID MANAGEMENT
  6. VOCATIONAL COUNSELLING
  7. PSYCHOSOCIAL EFFECTS
  8. HEALTHY USER EFFECT
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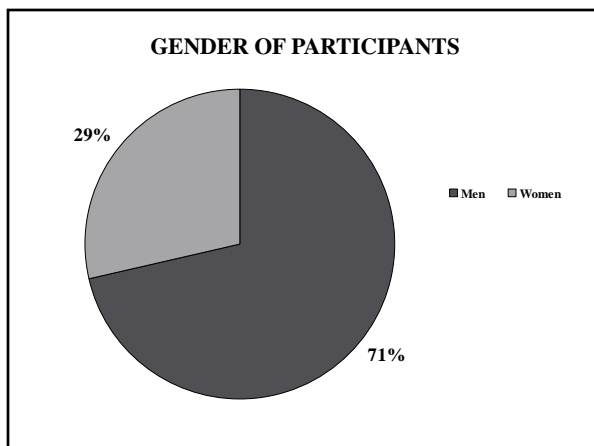
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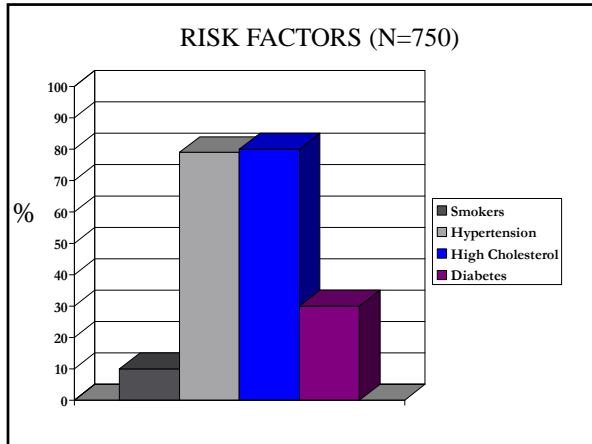
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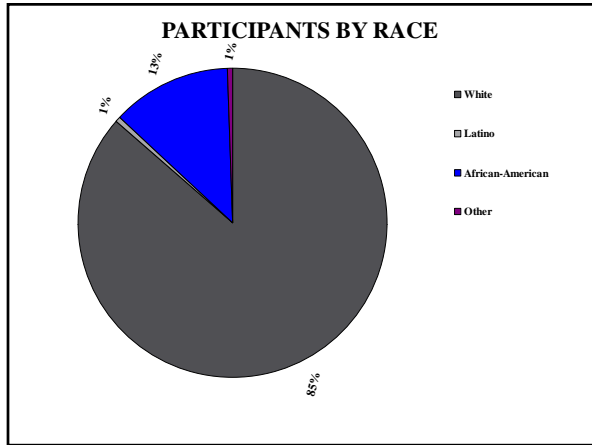
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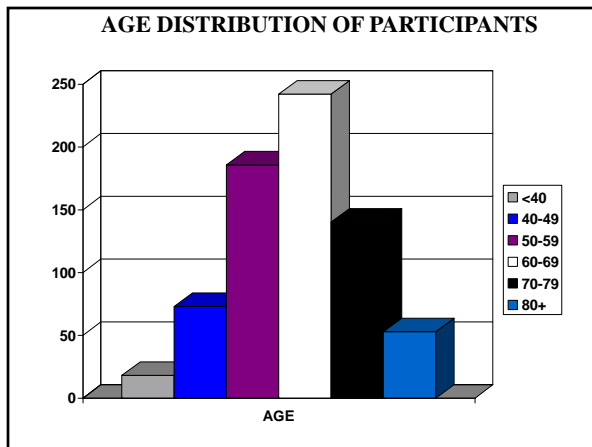
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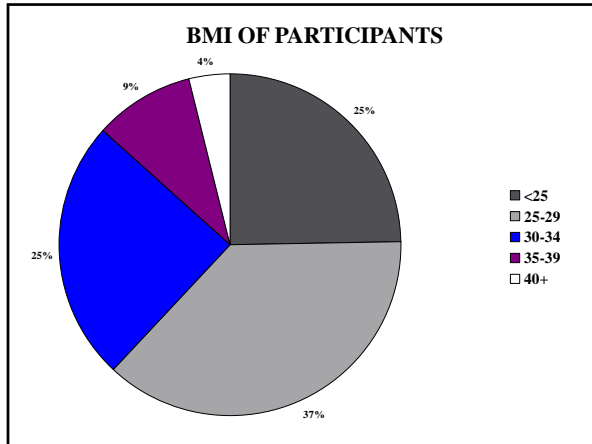
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**Body Weight and BMI**

	<b>Before</b>	<b>After</b>	
Weight	192.4 ±39.7	189.3 ±38.6	p<0.001
BMI	28.7 ±5.9	28.0 ±5.5	P<0.001

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**Heart Rate and Blood Pressure**

	<b>Before</b>	<b>After</b>	
RHR	76.6 ±14.7	71.3 ±12.1	p<0.001
Systolic	123.9 ±19.9	118.1 ±15.9	p<0.001
Diastolic	71.0 ±10.3	68.7 ±9.4	P<0.001

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### Lipid Profile

	Before	After	
LDL	97.6 ±38.9	80.3 ±30.6	p<0.001
HDL	41.2 ±17.7	42.9 ±15.8	p<0.001
Trig	144.6 ±120.6	126.0 ±84.6	P<0.001

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### Overall Quality of Life

Before	After	
22.5	24.5	p<0.001

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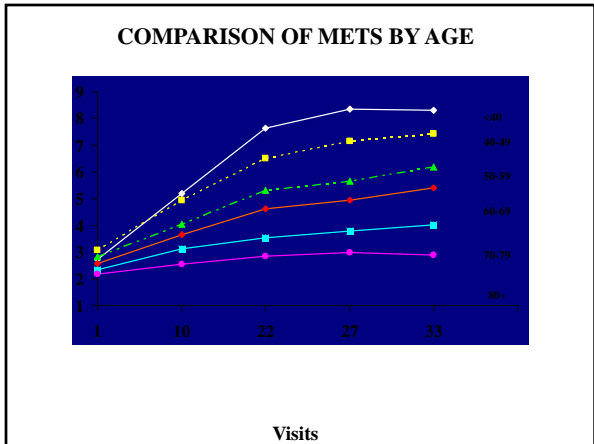
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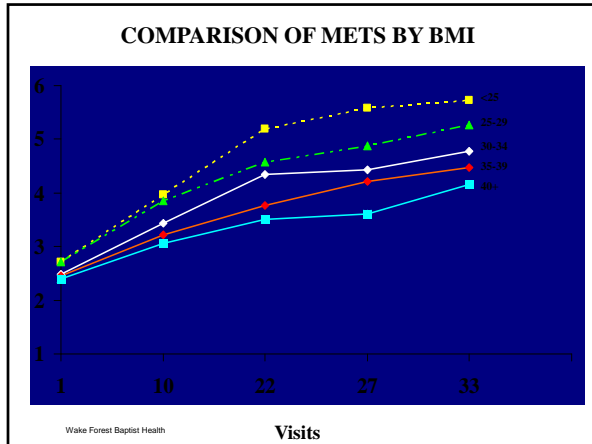
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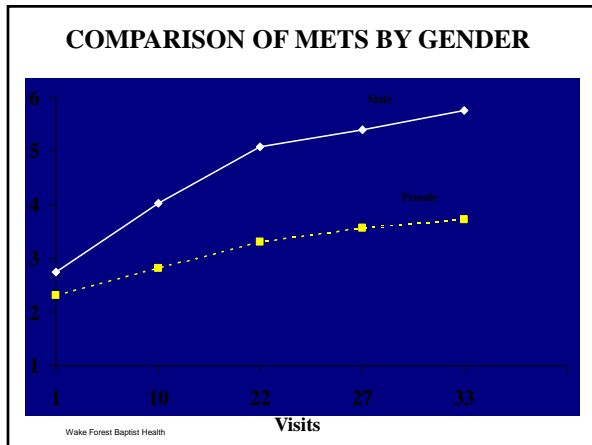
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### CONCLUSIONS - I

1. SUCCESSFUL AND VIABLE
2. RECRUITMENT RATES ARE BETTER THAN NATIONAL AVERAGE
3. ARE COMPLIANT WITH ACC/AHA/AACVPR GUIDELINES

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### CONCLUSIONS - II

SALUTARY AND MEASURABLE EFFECTS ON:

- BODY WEIGHT
- BLOOD PRESSURE
- HEART RATE
- LIPID PROFILE
- QUALITY OF LIFE
- EXERCISE CAPACITY

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### CONCLUSIONS - III

THE DEGREE, TIME COURSES AND FINAL EXTENT OF IMPROVEMENT IN EXERCISE CAPACITY VARIES IN RELATION TO:

- VERY ADVANCED AGE
- GENDER
- DEGREE OF OBESITY

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### THE FUTURE

EXPAND AND REFINE FOR DIFFERENT SUBGROUPS AND POPULATIONS

- OCTOGENARIANS AND OLDER
- VERY OBESE
- FEMALES
- MINORITIES
- LOW INCOME GROUPS

NOTE: These groups are under represented in the trials published so far

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- Cardiology Fellows
- Amy Taylor, Wendy Greenleaf, Melody Dickerson, Stephanie Starling
- Secretary: Sue Longinotti, Nicole Massey

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