Integrative Cardiac Health Project (ICHP)

COL(RET) Marina Vernalis DO FACC
Medical Director, ICHP
Former Chief of Cardiology, Walter Reed Army Medical Center
Former CV Consultant to US Army Surgeon General
September 2013
The Problem

Cardiovascular Disease (CVD)

• Leading cause of morbidity & mortality in the US
• ~1-2% of the US population: ideal cardiac health
• Military population mirrors the general population
Our Mission

An outcomes research platform to:

- Optimize and sustain healthy lifestyles
- Build long-term functional resiliency
- CV and overall disease risk
- Enhance optimal healing
- Enrich quality of life
CVD Health Program

- Novel CVD Risk Assessment guides therapy
- Continuum of care via motivational coach platform
- Review process to identify pre-clinical disease states, medication compliance and clinical guidelines adherence
**AHA 2010**

- Never or Quit smoking >12 mo
- Total Cholesterol < 200 mg/dl
- BP < 120/80 mm HG
- Fasting Blood Sugar < 100
- BMI < 25
- Physical Activity 150 min/week mod activity or 75 min/week vigorous activity
- Healthy Diet 4-5 Factors

**ICHP 2006**

- Never or Quit smoking >12 months
- Total Cholesterol < 200 mg/dl
- BP < 120/80 mm HG
- Fasting Blood Sugar < 100 mg/dl
- BMI < 25
- Physical Activity 150 min/week mod activity or 75 min/week vigorous activity
- Healthy Diet 4-5 Factors
- Sleep 7 hrs or greater
- Stress Reduction
ICHP CV Health Model
Personalized CV Health Assessment

Biomarkers
Molecular Markers
Wearable Sensewear
Carotid Intimal Thickness
Surveys
Based on Holistic Health

Eat Well

Sleep Well

Move Well

Relax Well

ichpcenter.org

OUR INTEGRATIVE FORMULA WORKS
Utilizing ‘Systems Biology’
Systems Biology Approach

✓ Proactive
✓ Preventive
✓ Participatory
✓ Predictive
✓ Personalized
Systems Biology Approach

- Proactive
- Preventive
- Participatory
- Predictive
- Personalized
**Proactive**

- **Clinical Team Review** - review of individual metrics for every patient and evaluate overall clinical impact (biochemical & behavioral)

- Discover new diagnoses in profile (many in preclinical state) to target earlier intervention

- Evaluate if patient’s medical profile meets established clinical guidelines

- Create ONE unified plan for patient and assign targeted tracks (feedback reports sent to provider & patient)
## Patient Snapshot - CHP

### Patient Information
- **CPP00001 MADAGAN, BRIAN** 51 years old
- **Active Duty**: Yes
- **Rank/Branch**: Lieutenant Colonel Army
- **Occupation**: Engineer
- **PCP**: Dr. Smith
- **Marital Status**: Married
- **Children**: 20/y.o. 32/y.o.

### Risk Scores
- **ICHGP CV**: 5%
- **Framingham**: 5%
- **CIIM**: Normal
- **Family CV Hx**: Positive

### N/E Problems
- N. Gastroesophageal reflux disease
- N. Pulmonary hypertension

### Medication(s)
- Zantac 150 (Every 6-8 hours as PRN)
- Lisinopril 20 MG (1x Daily)

### Laboratory Data

<table>
<thead>
<tr>
<th>Data</th>
<th>Baseline</th>
<th>Outcome</th>
<th>ICHG Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>161 mg/dL</td>
<td>130 mg/dL</td>
<td>&lt;200 mg/dL</td>
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<tr>
<td>LDL</td>
<td>160 mg/dL</td>
<td>65 mg/dL</td>
<td>&lt;70 mg/dL</td>
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<tr>
<td>HDL</td>
<td>67 mg/dL</td>
<td>44 mg/dL</td>
<td>&gt;50 mg/dL</td>
</tr>
<tr>
<td>TG</td>
<td>143 mg/dL</td>
<td>119 mg/dL</td>
<td>&lt;150 mg/dL</td>
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<tr>
<td>Lp(a)</td>
<td>42 mmol/L</td>
<td>44 mmol/L</td>
<td>&lt;75 mmol/L</td>
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<tr>
<td>Glucose</td>
<td>112 mg/dL</td>
<td>110 mg/dL</td>
<td>&lt;100 mg/dL</td>
</tr>
<tr>
<td>Insulin</td>
<td>11 μIU/ml</td>
<td>15 μIU/ml</td>
<td>2.6-24.9 μIU/ml</td>
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<tr>
<td>HgA1C</td>
<td>5.5%</td>
<td>4.4%</td>
<td>4.8-6.7%</td>
</tr>
<tr>
<td>HOMA</td>
<td>2</td>
<td>2</td>
<td>&lt;2.8</td>
</tr>
<tr>
<td>CRP</td>
<td>3 mg/dL</td>
<td>1 mg/dL</td>
<td>&lt;0.3 mg/dL</td>
</tr>
<tr>
<td>TSH</td>
<td>6.4 μIU/ml</td>
<td>2.4 μIU/ml</td>
<td>0.27-4.29 μIU/ml</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>21 ng/mL</td>
<td>35 ng/mL</td>
<td>&gt;30 ng/mL</td>
</tr>
<tr>
<td>BMI</td>
<td>34.5 kg/m²</td>
<td>31.3 kg/m²</td>
<td>&lt;25</td>
</tr>
<tr>
<td>WC</td>
<td>108 cm</td>
<td>108 cm</td>
<td>&lt;95 cm</td>
</tr>
<tr>
<td>Fat %</td>
<td>33%</td>
<td>21%</td>
<td>11-21.9%</td>
</tr>
<tr>
<td>BP</td>
<td>122/80 mmHg</td>
<td>122/80 mmHg</td>
<td>&lt;120/80 mmHg</td>
</tr>
</tbody>
</table>

### Survey
- B. Perceived Stress Scale
- B. Pittsburg Sleep Quality Index
- B. Epworth Sleepness Scale
- B. Berlin Questionnaire
- B. Rate Your Plate
- B. SF-36

### Relevant Info
- Recent dose increase

### GXT
- Sample Text: GXT
- Smoking: Yes [nset: 18y/o, years: 25, #paks/day: 1]
- Alcohol: Yes [nset: 21y/o, #drinks: 12]

### Quote
- Get healthier and live longer

### Barriers
- Lack of motivation

### Joys
- Golf and family

### Motivators
- Children and grandchildren
Proactive
Identifying Pre-Clinical States

New Pre-Hypertension
- 19% New Pre-Hypertension
- 81% Total Sample

New Pre-Diabetes
- 31% New Pre-Diabetes
- 69% Total Sample

New Sleep Apnea
- 48% Positive Berlin Survey
- 52% Total Sample

New Overweight/Obesity
- 36% New Overweight/Obesity
- 64% Total Sample

n=463
Preventive CV Health Program

- Themed and sequential appointments with experts
- Standardized algorithms used with specific objectives for each appointment
- Motivational coaching addressing barriers
- Putting patient in power position and allowing for setbacks to sustain participation
Preventive Infrastructure for Health

ICHP-FLOW OF CARE
Empowering Health And Healing
Predictive Molecular Goals

- Identify a molecular health profile for an individual to better tailor therapies (reflecting gender, ethnicity)

- Develop molecular signatures for “healthiness” in order to ultra-personalize care over a lifetime

- Utilize personal assays in a predictive fashion for earlier intervention and effective resource allocation
Gene Expression Profiles
Intensive Lifestyle Modification

**Blue lines:** Immune/defense response genes

**Red Lines:** Cholesterol/lipid storage, homeostasis, transport genes
Therapy Based on Genetic Composition Predicting Response to Healthy Lifestyle Program

Triglycerides

rs780094-Triglycerides Results

Enhanced Lifestyle Management Program
Macrophage Migration Inhibitory Factor (MIF): Influence of Gender

Cardiovascular Disease Risk Factor Modification Decreases HS-CRP and Macrophage Migration Inhibitory Factor (MIF): Influence of Gender

Edward J Miller, Boston Univ Sch of Med, Boston, MA; Kimberly A. Mamula, Windber Res Inst, Windber, PA; Lin Leng, Marta Piecychna, Yale Univ Sch of Med, New Haven, CT; Marina N. Vernalis, Walter Reed Natl Military Medical Ctr, Bethesda, MD; Richard Bucala, Yale Univ Sch of Med, New Haven, CT; Darrell L Ellsworth, Windber Res Inst, Windber, PA

Pro-inflammatory MIF decreases in response to an intensive diet/lifestyle intervention, with improvement being more evident in women than men.

In addition to traditional risk factors, intensive lifestyle intervention may lessen vascular/CAD risk in women by decreasing circulating MIF & HS-CRP.

American Heart Association Scientific Meeting November 5, 2012
Sleepiness by Gender & Race

Obstructive Sleep Apnea (OSA) Symptoms

- Black Women
- White Women
- Black Men
- White Men

* Pre-published data: Do NOT Reproduce
Fatigue by Gender & Race

Obstructive Sleep Apnea (OSA) Symptoms

- Black Women
- White Women
- Black Men
- White Men

Fatigue (%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

No OSA OSA

* Pre-published data: Do Not Reproduce
Personalized

- Use risk assessment to detect the most vulnerable to heart attack/stroke
- Optimize CVD risk factors through personalized, patient engagement strategies (gender and ethnic relevant)
- Conduct evidence-based research to improve outcomes
- Dynamically refine clinical practice algorithms and motivating educational tools based on data to promote/sustain healthy lifestyle behaviors
Aim 1: Improving Risk Assessment

Proportion of CIMT (Abnormal)

CIMT Carotid Intimal Medial Thickness Ultrasound Measurement Surrogate Marker of Atherosclerosis

Count

Proportion

Normal

55%

Abnormal

75%

Abnormal

n=125

n=114
Decision Support Tool

Enhancing Framingham CVD Risk Assessment

Low / Intermediate Framingham Risk Categories

Family History of CVD? Parent or Sibling

Yes

Premature?
Male<55 yrs old
Female<65 yrs old

Yes

Reclassify as High-Risk

No

Do not Reclassify as High-Risk

Empowerment Dialogue & High-Risk Acknowledgement Document
• We sought to determine if a brief, portable stress reduction technique: **Ten-Minute Tension Tamer** can lower perceived stress levels and improve the CVD risk profile.

• Measured change in PSS; n=344:
  - Stress improvers
  - Stress non-improvers

• Two groups compared using two-sample t-tests, with p < 0.05

  218 (65%) improved stress levels (mean -6.6 pts)
  116 (34%) did not improve stress (mean +4.6 pts)
# Making the Stress Sleep Connection

<table>
<thead>
<tr>
<th></th>
<th>( \Delta \text{ PSS} ) (pts)</th>
<th>( \Delta \text{ PSQI} ) (of 24 pts)</th>
<th>( \Delta \text{ Sleep Latency} ) (mins)</th>
<th>( \Delta \text{ Total Sleep} ) (mins)</th>
<th>( \Delta \text{ Fatigue} ) (of 10 pts)</th>
<th>( \Delta \text{ Gluc} ) (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improvers</strong></td>
<td>n=218 (65%)</td>
<td>-6.6</td>
<td>-1.78</td>
<td>-4.4</td>
<td>23</td>
<td>-0.89</td>
</tr>
<tr>
<td><strong>Non-Improvers</strong></td>
<td>n=116 (34%)</td>
<td>4.6</td>
<td>0.89</td>
<td>1.9</td>
<td>3</td>
<td>0.27</td>
</tr>
<tr>
<td>p value</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.04</td>
<td>0.012</td>
<td>&lt;0.001</td>
<td>0.03</td>
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</table>
## Understanding the Mechanisms

<table>
<thead>
<tr>
<th></th>
<th>PSS</th>
<th>Insulin</th>
<th>HOMA</th>
<th>Glucose</th>
<th>TC</th>
<th>LDL</th>
<th>TG</th>
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</thead>
<tbody>
<tr>
<td><strong>Low PSS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>15.89</td>
<td>13.76</td>
<td>3.82</td>
<td>109.51</td>
<td>171.4</td>
<td>100.17</td>
<td>107.14mg</td>
</tr>
<tr>
<td>Post</td>
<td>15.05</td>
<td>13.28</td>
<td>3.49</td>
<td>103.73</td>
<td>167.6</td>
<td>94.70</td>
<td>103.30</td>
</tr>
<tr>
<td><strong>Mean Change</strong></td>
<td>0.84</td>
<td>0.48</td>
<td>0.332</td>
<td>5.78</td>
<td>3.81</td>
<td>5.46</td>
<td>3.84</td>
</tr>
<tr>
<td><strong>High PSS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>28.96*</td>
<td>20.47</td>
<td>5.55</td>
<td>107.8</td>
<td>205.5</td>
<td>127.48</td>
<td>135.48</td>
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<tr>
<td>Post</td>
<td>22.92*</td>
<td>13.92</td>
<td>3.42</td>
<td>95.84</td>
<td>180.7</td>
<td>102.88</td>
<td>106.76</td>
</tr>
<tr>
<td><strong>Mean Change</strong></td>
<td>6.04*</td>
<td>6.55</td>
<td>2.13</td>
<td>11.96</td>
<td>24.76</td>
<td>24.6</td>
<td>28.72</td>
</tr>
</tbody>
</table>

*p* values: 0.0003, 0.0009, 0.003, 0.04, 0.007, 0.004, 0.04
Significantly Building Self-Efficacy

Validated Self-Efficacy Survey for Cardiovascular Health

Pre intervention (Baseline)  Post intervention (2 months)

n=58
p<0.001 Paired t-test
Initial Exercise Prescription Note

Name: BRIAN MADAGAN  DOB: 10/27/1961 (31)  Gender: M

Medication List

<table>
<thead>
<tr>
<th>N/E</th>
<th>Current Problem List</th>
<th>Medication List</th>
<th>Relevant Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Gastroesophageal reflux disease</td>
<td>Zantac 150 (Every 6-8 hours as PRN)</td>
<td>Recent dose increase</td>
</tr>
<tr>
<td>N</td>
<td>Pulmonary hypertension</td>
<td>Lisinopril 20 MG (1x Daily)</td>
<td>controlled</td>
</tr>
</tbody>
</table>

Aerobic Exercise:
120 Min Wk Walk

Current Non-Aerobic Exercise:
30 Min Wk Chores
60 Min Wk On the Job Activity

Barriers:
Lazy, So Much Work

Joy's: Golf and family
Motivators: Children and grandchildren

Abnormal Measures:
LDL 100 mg/dl
Glucose 112 mg/dl
Vit D 21 ng/ml

Body mass index 37.6 kg/m²
Body fat observable 33 %

Body circumference 111 cm

Smoking: Yes

Quote: Get healthier and live longer

Medical Hx Reviewed: [X]

Orthopedic: Sample Text Ortho

Cardiac: Sample Text Cardiac

Injuries: Yes [X] No [ ]

GXT: Neg [X] Pos [ ]

Sample Text Injuries

Sample Text GXT

Approved for Exercise: [X]

Doctor Limitations: Sample Text Dr Limits

ICHIP Risk Score: 9

% Fat: 33

Exercise Prescription/Outcome Goals

Aerobic Exercise Action Plan

<table>
<thead>
<tr>
<th>Intensity:</th>
<th>Target Heart Rate Goal: 65 = 109, 75 = 126, 85 = 143</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency:</td>
<td>Days per week: Sample Text Days</td>
</tr>
<tr>
<td>Time:</td>
<td>Minutes per session: Sample Text Min Session</td>
</tr>
</tbody>
</table>

Patient Plans to:
Form an exercise habit. Exercise more often.

Increase activity during the day by walking to lunch or during meetings, using a distant metro stop, or walking to wind down at the end of the day.
Healthy Action Prescription for:
BRIAN MADAGAN

- Invest in good, comfortable shoes, and consider ways to slip in 10-minutes walking, stair climbing, etc., to boost your energy, brain and mood!
- Engage in weekend activities such as museums, biking, bowling, swimming, etc. The calories add up!

Registered Nurse Practitioner

Please do not hesitate to contact us with questions (301)400-1111.
Lifestyle Prescriptions Work

Stress Reduction Prescription

Name: Mrs. Anne Why
Date: 30 August 2102

You plan to:

1. Practice listening to track 4 on the relaxation disc, 3 times per week, during your lunch break. Your goal is to internalize these skills at which point they become second nature to you.
2. Short practices (5-8 minutes) are more effective than 1 long weekly practice.
   a. Closing your eyes and silently repeating “breath in, breath out” shifts mind to relaxed state, slowing heart rate and blood pressure.
   b. When the mind wanders, return to “breath in, breath out” to quiet thoughts and release worry.
   c. When worry appears, return to “breath in, breath out” for one or two breaths to exclude or ignore thoughts as they come up.
   d. Keeping inhalations natural and unforced reduces tension, blood pressure. Breathe in deeply, expanding the abdomen, on the exhale, contract the abdomen.
3. Take a break from “fixing” to build self-acceptance, contentment.
4. Exercise regularly for healthy weight and blood pressure and less stress.
5. Aim for 7 hours of uninterrupted sleep to maintain blood pressure at a healthy level. Reduce liquids and TV/computer stimulation after 8PM, in preparation for winding down to sleep.
6. Practice gratitude and express thanks to stay positive.

Marilyn Grunewald MSW
Clinical Stress Reduction Specialist

Refills available at next appointment

RX

301.400.1111
## Making a Positive Impact

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre</th>
<th>Post</th>
<th>p-value</th>
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<tbody>
<tr>
<td>TG</td>
<td>146.37</td>
<td>99.61</td>
<td>0.00001</td>
</tr>
<tr>
<td>TC</td>
<td>189</td>
<td>178.84</td>
<td>0.003</td>
</tr>
<tr>
<td>SBP</td>
<td>127.77</td>
<td>124.96</td>
<td>0.02</td>
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<tr>
<td>DBP</td>
<td>80.44</td>
<td>77.93</td>
<td>0.002</td>
</tr>
<tr>
<td>HDL</td>
<td>54.89</td>
<td>58.46</td>
<td>0.01</td>
</tr>
<tr>
<td>LDL</td>
<td>110.97</td>
<td>103.03</td>
<td>0.007</td>
</tr>
<tr>
<td>Sag Diameter</td>
<td>22.6</td>
<td>21.45</td>
<td>0.04</td>
</tr>
<tr>
<td>WC</td>
<td>99.75</td>
<td>96.9</td>
<td>0.018</td>
</tr>
<tr>
<td>PSQI</td>
<td>7.31</td>
<td>6.36</td>
<td>0.01</td>
</tr>
<tr>
<td>PSS</td>
<td>21.8</td>
<td>18.52</td>
<td>0.0001</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>27.96</td>
<td>33.66</td>
<td>0.0001</td>
</tr>
<tr>
<td>IPAQ</td>
<td>869.6</td>
<td>1197.58</td>
<td>0.002</td>
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