Cardiovascular Health Intervention Program

Central Michigan University

COLLEGE OF HEALTH PROFESSIONS

SCHOOL OF HEALTH SCIENCES

Bill Saltarelli, PhD------ CMU
Paul Visich, MPH PhD------University of New England
Cardiovascular disease statistics

Most Common Causes of Death, Michigan Compared with United States, 2005

- Diseases of the Heart: 231.4 (MI) vs. 211.1 (US)
- All cancers: 190.8 (MI) vs. 183.8 (US)
- Stroke: 46.6 (MI) vs. 46.5 (US)
- Chronic Lower Respiratory Diseases: 43.2 (MI) vs. 42.3 (US)
- Unintentional Injuries: 39.1 (MI) vs. 33.3 (US)

At minimum, two-year averages were used to improve the precision of the annual estimates.

Rate per 100,000 population
Age adjusted to 2000 total U.S. population
SPECIFIC PURPOSES OF THE CHIP

1. **Screen** 5th graders in Mid-Michigan for CVD risk factors.

2. **Provide** individual **risk factor reports** to parents and children.

3. **Increase awareness** of the importance of CVD prevention in Mid-Michigan

4. **Educate** children and parents on the importance of CVD and related risk factors.

5. **Start the process of promoting heart healthy lifestyles** in our children. **INCREASE HABITUAL PHYSICAL ACTIVITY**
Why Screen 5th Graders?

1. Research shows that **atherosclerosis begins in childhood**, and so prevention must also begin in childhood (Berenson 1998).

2. 30% of Mid-Michigan 5th Graders **express 3 or more CVD risk factors** and they **track to adulthood**

3. Between the ages 11-14 **physical activity begins to decline** and continues to decline into adulthood (CDC, 1999).

4. The kids are beginning to **make choices** on their own and can make beneficial behavioral choices.

5. Most kids **do not smoke yet**, and it’s a good time to explain the risks of smoking and encourage kids not to smoke.

6. Excellent candidates for **new ideas**

7. **Michigan Model Health curriculum** for 6th grade covers cardiovascular disease, nutrition, and physical activity
CHIP Backstory

Began in 2000

To date:
About 3000 Mid-Michigan children have participated from the following Counties
Isabella
Gratiot
Clare
Shiawassee
Saginaw
Mecosta
School Bus To CMU Finch Fieldhouse
Cardiovascular disease education

What is CVD
What are controllable/non controllable CVD risk factors
How can risk factors be modified by Physical Activity
Station # 1
Blood Lipids and Glucose

CHOLESTECH LDX ANALYZER

Measures:
- Total Cholesterol
- HDL Cholesterol
- LDL Cholesterol
- Triglycerides
- Non-HDL Cholesterol
- TC/HDL ratio
- Blood Glucose
Skin-fold measurement

Waist & Hip measurement

Height

Weight

Station #2 Body Composition
Station # 3
Blood Pressure
Station # 4

Cardiorespiratory Fitness - Aerobic Fitness

pacer/beep
run
test
Knowledge of CVD, CVD risk factors and Physical activity
Habitual Physical activity assessment
Sedentary behavior
Screen time
A Healthy Lunch
Goals of Intervention: Increase Habitual Physical Activity

Why physical activity?

1. After high blood pressure, tobacco use and high blood glucose, physical inactivity constitutes the 4th leading cause of death globally, with about 3.3 million attributable deaths per year.

2. Physical Activity can help modify:
   - Blood pressure
   - Blood lipids
   - Body composition
   - Aerobic fitness
   - Blood glucose (insulin sensitivity)

3. EXERCISE IS MEDICINE
A Drug Called Exercise

- **Side effects:** decreased BP, pulse and blood sugar; stronger muscles & bones, weight loss; improved mood, confidence, self esteem and concentration; Bowel & sleep habits improved; Look & feel better.

- **Adverse Reactions:** sweating, injury (overdose), sudden death (extremely rare).

- **Administration:** self administer or with others. Start off slowly, add minutes and intensity PRN. Change formulations to decrease boredom & improve compliance. Take outdoors or indoors any time of day.
Health Care Costs by Physical Activity Level

Active persons have 27% lower health care costs ($1500 per year less).

Anderson, Preventing Chronic Disease, 2005
### Physical Activity Education

Activities to teach children the skills and experiences to be able to write and follow individual exercise prescription

<table>
<thead>
<tr>
<th>Mode!</th>
<th>How Hard!</th>
<th>Activity Time!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td></td>
<td></td>
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<tr>
<td>Monday</td>
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<td></td>
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<tr>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXercise Rx-Prescription (Plan) FITT**
CMU Campus Tour
Incentive
CMU Class HSC 586 (2006)
Screening CVD risk Factors in children

Exercise Science BS and MS students
Dear Participants and Parents,

This Spring your child had the opportunity to participate in the Memorial FIT Kids/CMU Cardiovascular Health Intervention Program, where they participated in a cardiovascular health screening program. We hope that this program will help promote a healthier lifestyle for your child and potentially the whole family. After you have reviewed your child's results, please feel free to contact us with questions or comments (Dr. Bill Saltarelli, 989-774-3584 or Dr. Paul Visich, 989-774-2687). If your child has any abnormal values, we encourage you to also speak with your family physician or call Memorial Healthcare's call center at (989) 729-6422 for a physician referral.

<table>
<thead>
<tr>
<th>Student: (ID: )</th>
<th>Height: inches</th>
<th>Age:</th>
<th>Weight: lbs.</th>
</tr>
</thead>
</table>

Quick Summary of Cardiovascular Disease Risk Factors*

<table>
<thead>
<tr>
<th>CVD Risk Factor</th>
<th>Child's Value</th>
<th>Recommended Healthy Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index</td>
<td>Age: 10 11 12 Boys: &lt; 19 &lt; 20 &lt; 21 Girls: &lt; 20 &lt; 21 &lt; 22</td>
<td></td>
</tr>
<tr>
<td>Blood Pressure (Systolic/Diastolic)</td>
<td><strong>120/80</strong></td>
<td>10-12y olds; &lt;126 / &lt;82</td>
</tr>
<tr>
<td>Aerobic Capacity</td>
<td>ml/kg/min</td>
<td>All Boys:&gt;42 ml/kg/min Girls:10-12y olds; &gt;39 ml/kg/min</td>
</tr>
<tr>
<td>Blood Lipids: Total Cholesterol</td>
<td></td>
<td>Girls and Boys of all ages: T-C&lt; 170 HDL &gt; 39</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose (blood sugar)</td>
<td>mg/dl</td>
<td>Fasting: &lt; 110 mg/dl Non-Fasting: &lt; 140 mg/dl</td>
</tr>
<tr>
<td>Ideal Activity for health &amp; fitness</td>
<td></td>
<td>Exercise 5 or more times per week for at least 60 minutes that includes all types of physical activity (easy and hard).</td>
</tr>
<tr>
<td>Family History of Heart Disease</td>
<td></td>
<td>Heart attack, coronary artery procedure or sudden death in a grandfather or father less than 55 years of age or grandmother or mother less than 65 years of age.</td>
</tr>
</tbody>
</table>

Total number of cardiovascular disease risk factors:
Funding Plans

National Institutes of Health (NIH)

Developing Interventions for Health-Enhancing Physical activity.

R21/R33 (PAR-14-321)


Due Date: February 16, 2016
Duration: Begin Fall 2017 – Fall 2018
Award: Up to 275K for a 2 year study

Possible collaborators:

- McLaren Central Michigan
- Mid-Michigan Health
- MSU-Department of educational Psychology/Technology
- CMU- Health Professions
- CMU- College of Medicine
- Secondary Schools
- Saginaw Chippewa Indian Tribe
- Public Health departments
Summary of CHIP 2.0
One year program (Fall- Fall)

Fall 2017-Fall 2018 CVD screening, knowledge, behaviors and attitudes

Physical activity intervention (Spring/Summer)

- Peer taught exercise planning “jigsaw”
- Monthly assessment of PA (surveys and activity monitors)
- Monthly visits to classrooms to re-focus exercise plans
- Incentives to increase physical activity
- Family night to allow children to teach parents about exercise planning
- Weekly family night at Finch- physical activities planned
- Snail and e-mail communication through summer
- Possible web site for communication

Outcome measures:

Hopefully we will see positive changes in:

- CVD risk factor profiles
- Habitual physical activity
- Knowledge about exercise plans
- Attitudes towards health behaviors

Greater in Experimental Groups --jigsaw
What have we learned about kids and CVD risk factors
<table>
<thead>
<tr>
<th>RISK FACTOR (RISK CUT POINTS)</th>
<th>Percent of boys at risk</th>
<th>Percent of girls at risk</th>
<th>Total percent of children at risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (Boys &gt;20, Girls &gt;21)</td>
<td>45.7</td>
<td>40.5</td>
<td>43.1</td>
</tr>
<tr>
<td>Blood Pressure (&gt;126/&gt;82)</td>
<td>8.6</td>
<td>9.1</td>
<td>9.3</td>
</tr>
<tr>
<td>Glucose (&gt;110mg/dl)</td>
<td>3.4</td>
<td>2.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Cholesterol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(TCL &gt;170 or HDL &lt;39)</td>
<td>58.4</td>
<td>59.7</td>
<td>59.1</td>
</tr>
<tr>
<td>Family History</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(parents or grandparents)</td>
<td>31.1</td>
<td>29.4</td>
<td>30.2</td>
</tr>
<tr>
<td>Physical Activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(&lt;5 days/wk/ 60min-all types PA)</td>
<td>64.8</td>
<td>74.5</td>
<td>69.7</td>
</tr>
</tbody>
</table>

Total N= 2867 (Girls=1426, Boys= 1441)
37% of children express 3+ CVD risk factors

Note: Research has shown that children who express 3+ CVD risk factors show blood vessel changes suggestive of atherosclerosis beginning at an early age.
### IDF definition of metabolic syndrome in children

**Obesity (>waist) plus 2 other factors**

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Obesity (WC)</th>
<th>Triglycerides</th>
<th>HDL-C</th>
<th>Blood pressure</th>
<th>Glucose (mmol/l) or known T2DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 to &lt;10</td>
<td>≥90(^{th}) percentile</td>
<td>Metabolic syndrome cannot be diagnosed, but further measurements should be made if there is a family history of metabolic syndrome, T2DM, dyslipidaemia, cardiovascular disease, hypertension and/or obesity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to &lt;16</td>
<td>≥90(^{th}) percentile or adult cut-off if lower About 63 cm</td>
<td>≥1.7 mmol/l (≥150 mg/dl)</td>
<td>&lt;1.03 mmol/l (&lt;40 mg/dl)</td>
<td>Systolic ≥130 mm Hg or diastolic ≥85 mm Hg</td>
<td>≥5.6 mmol/l (100 mg/dl) [or known T2DM] (If ≥5.6 mmol/l recommend an OGTT)</td>
</tr>
<tr>
<td>16+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WC:** waist circumference; **HDL-C:** high-density lipoprotein cholesterol; **T2DM:** type 2 diabetes; **OGTT:** oral glucose tolerance test.
# Prevalence of the Metabolic Syndrome Among U.S. Adolescents Using the Definition From the International Diabetes Federation

According to the IDF definition, an individual aged 10–15 years has the metabolic syndrome if he or she has central adiposity (≥90th waist circumference percentiles) and at least two of the following: high blood pressure, low HDL cholesterol, high triglycerides, and high fasting glucose.

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>CHIP (2005-2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age 12-17</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td>4.0% (0.6)</td>
<td>5.5% (0.6)</td>
</tr>
<tr>
<td>Boys:</td>
<td>6.6% (1.3)</td>
<td>5.6% (.9)</td>
</tr>
<tr>
<td>Girls:</td>
<td>2.1% (0.6)</td>
<td>3.1% (0.4)</td>
</tr>
</tbody>
</table>

NHANES data 04
Linear rise with age
Thank You
Questions
### Percent of Children with Multiple CVD Risk Factors

<table>
<thead>
<tr>
<th>Number of CVDRF</th>
<th>Percent at Risk CVDRF Total</th>
<th>Percent of girls at each # of CVDRF</th>
<th>Percent of boys at each # of CVDRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.8</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>1+</td>
<td>96.2</td>
<td>96.4</td>
<td>95.9</td>
</tr>
<tr>
<td>2+</td>
<td>79.4</td>
<td>79.8</td>
<td>78.9</td>
</tr>
<tr>
<td>3+</td>
<td>50.2</td>
<td>49.4</td>
<td>50.9</td>
</tr>
<tr>
<td>4+</td>
<td>23.3</td>
<td>22.4</td>
<td>24.2</td>
</tr>
<tr>
<td>5+</td>
<td>6.7</td>
<td>6.3</td>
<td>7.0</td>
</tr>
</tbody>
</table>

* *50% of the children express 3 or more CVDRF*

Mid-Michigan Children: Age= 11.7y (6th graders)

Girls N=1426  Boys N=1441
Cardiovascular Health Intervention Program Timeline
# Cardiovascular Disease Risk Factors 2005-2008

<table>
<thead>
<tr>
<th>RISK FACTOR</th>
<th>Percent of Boys at risk</th>
<th>Percent of Girls at risk</th>
<th>Percent of children at risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI</strong> (Boys &gt;20, Girls &gt;21)</td>
<td>43.3</td>
<td>41.2</td>
<td><strong>42.2</strong></td>
</tr>
<tr>
<td>Blood Pressure &gt;90 percentile</td>
<td>28.8</td>
<td>28.1</td>
<td><strong>28.6</strong></td>
</tr>
<tr>
<td>Glucose (&gt;100mg/dl)</td>
<td>28.2</td>
<td>21.5</td>
<td><strong>28.6</strong></td>
</tr>
<tr>
<td><strong>Cholesterol</strong> (TCL &gt;170 or HDL &lt;39)</td>
<td>63.1</td>
<td>61.2</td>
<td><strong>62.1</strong></td>
</tr>
<tr>
<td>Family History (parents or grandparents)</td>
<td>27.7</td>
<td>27.0</td>
<td><strong>27.3</strong></td>
</tr>
<tr>
<td>Physical Inactivity &lt;5 days/wk/ 60min-all types PA</td>
<td>66.6</td>
<td>76.1</td>
<td><strong>71.5</strong></td>
</tr>
</tbody>
</table>

Mid-Michigan Children: Age= 11.7y (6th graders)

Total N= 3022  Girls N=1550  Boys N=1472
Fall 2016: Day at CMU

• Cardiovascular Risk Factor Screening
  – Body composition, blood pressure, blood lipids, aerobic fitness, PAC/C survey
• Introduction to Education
• Assigned Student Learning Groups (3)
• Healthy Lunch
• Tour of CMU
• Hand out CHIP Shirts
Fall 2016: Classroom Visit #1

- Review Cardiovascular Disease and its risk factors
- Explain the basics to exercise prescription
- CMU students reinforce student learning group’s knowledge
Spring 2017: Classroom Visit #1

• Review of cardiovascular disease and its risk factors
• Explain the basics to exercise prescription
• CMU students reinforce student learning groups knowledge
Spring 2017: Classroom Visit #2

• Cooperative Learning (Jigsaw) teaching groups
  – 1 member from each student learning group and a CMU student will meet to share their individual expertise and therefore each student will teach their peers about their expertise (mode, intensity/duration, or frequency)
  – Collectively, this shared knowledge will be used to write a specific personal exercise prescription.
Spring 2017: Classroom Visit #3

• Teaching groups will meet to review compliance of the written exercise prescription and add modifications to follow with the progression principle
Spring 2017: Classroom Visit #4

• Assessment of physical activity
• Family event
  – Presentation by 5th graders
  – Family exercise prescription
Summer 2017

• Reinforce physical activity of the student
• Physical Activity Survey (PAC/C)
• ActiGraph Physical Activity Assessment
• Send cardiovascular risk factor reports to parents
Expert groups will meet to review compliance of the written exercise prescription and to add modifications to follow the progression principle.
Fall 2017: Day at CMU

• Cardiovascular Risk Factor Screening
  – Body composition, blood pressure, blood lipids, aerobic fitness, PAC/C survey
• Healthy Lunch
• Concluding Presentation
Community Partners

CMU College of Health professions
   - Exercise Science students to screen and educate children
   - Equipment
   - CHIP director
CMU College of Medicine
   ???
Secondary schools
   - Supply kids, space and time to teach about PA
MSU
   - Expertise with jigsaw cooperative learning method
McLaren Central Michigan
   - Fitness staff to help with aerobic test (beep)
   - Nurse to oversee screening especially finger prick
   - Help with parent report, maybe MD to define risk and suggest follow up
   - Referrals to doctor for high risk children
   - Make kids aware of Isabella county activity opportunities
   - Help in designing Information web site maybe linked to McLaren
   - Help designing incentives (t-shirt/water bottles etc)
   - Money if we need it for phase 1
   - Distribution of parent reports
Principal component analysis reveals gender-specific predictors of cardiometabolic risk in 6th graders

Mark D Peterson¹, Dongmei Liu¹, Heidi B IglayReger¹, William A Saltarelli², Paul S Visich³ and Paul M Gordon¹*

Abstract

Background: The purpose of this study was to determine the sex-specific pattern of pediatric cardiometabolic risk with principal component analysis, using several biological, behavioral and parental variables in a large cohort (n = 2866) of 6th grade students.

Methods: Cardiometabolic risk components included waist circumference, fasting glucose, blood pressure, plasma triglycerides levels and HDL-cholesterol. Principal components analysis was used to determine the pattern of risk clustering and to derive a continuous aggregate score (MetScore). Stratified risk components and MetScore were analyzed for association with age, body mass index (BMI), cardiorespiratory fitness (CRF), physical activity (PA), and parental factors.

Results: In both boys and girls, BMI and CRF were associated with multiple risk components, and overall MetScore. Maternal smoking was associated with multiple risk components in girls and boys, as well as MetScore in boys, even after controlling for children’s BMI. Paternal family history of early cardiovascular disease (CVD) and parental age were associated with increased blood pressure and MetScore for girls. Children’s PA levels, maternal history of early CVD, and paternal BMI were also indicative for various risk components, but not MetScore.

Conclusions: Several biological and behavioral factors were independently associated with children’s cardiometabolic disease risk, and thus represent a unique gender-specific risk profile. These data serve to bolster the independent contribution of CRF, PA, and family-oriented healthy lifestyles for improving children’s health.

Keywords: Pediatrics, Principal component analysis, Cardiorespiratory fitness, Obesity
Parental smoking and cardiometabolic risk

Mothers smoking related to increase metabolic risk score
Does parental physical activity influence children's PA?

Active mothers foster active girls
Summary Points of the Cardiovascular Health Intervention Program

Value of CVD risk factor screening and education in children
a. Many children and their parents are unaware of their CV risks
b. Awareness of risk factors is key to behavior change
c. Prevention needs to begin early
d. Elementary children can understand CVD risk factors and make changes

The experience for health science students
a. Brings CVD risk factors and preventive cardiology real world significance
b. Opportunity to apply what they have learned in the classroom
c. Provides health science students experience in clinical type situations
d. Provide a valuable service to the community that schools cannot provide
What’s new for 2013
Physical Activity Education
Activities to teach children the skills and experiences to be able to write and follow individual exercise prescription
New For 2013

Switch to Fitnessgram pacer/beep test
BIG PICTURE OF A BIG PROBLEM

The solution to our obesity epidemic and subsequent early blood vessel disease must include:

Primary health care providers
Schools (lunches, physical education, school activities)
Community (active environment, activities etc)
Parent s( healthy lifestyles and role models)
All Allied Health professionals to get on board with
Children
Universities
Churches
ACSM “Exercise is Medicine”

Exercise prescription every patient every visit
Purpose for Developing the CHIP

Awareness:
To begin to make children and parents aware and personally responsible of their health by physically participating in a screening program to learn about their individual cardiovascular disease risk factors.

Personal Information:
If a child and parent(s) knows what their health risks are, they are more likely to consider making changes to improve their health.”

Intervention:  (to increase kids physical activity)
Knowledge to write and follow a personal exercise plan (Rx)
Promoting habitual physical activity in children and their families
Influence of Diet and Exercise on Individual Cardiovascular Risk Factors in Obese Children (1 Year Program)

Subjects: 56 obese children, median age- 9y old

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>1 y Later</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m2)</td>
<td>24.6</td>
<td>22.4***</td>
</tr>
<tr>
<td>HDL-C (mg/dl)</td>
<td>46</td>
<td>50*</td>
</tr>
<tr>
<td>Trig.s (mg/dl)</td>
<td>111</td>
<td>92*</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>116</td>
<td>108**</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>62</td>
<td>55*</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>87</td>
<td>85</td>
</tr>
<tr>
<td>Insulin (mU/L)</td>
<td>16</td>
<td>8*</td>
</tr>
<tr>
<td>Insulin Resist.</td>
<td>3.5</td>
<td>1.9*</td>
</tr>
<tr>
<td>IMT (mm)</td>
<td>.62</td>
<td>.55***</td>
</tr>
</tbody>
</table>

P<.05*, p<.01**, p<.001***

Prevalence of CHD is estimated to Increase 5-16% by 2035, with more than 100,000 cases of CHD attributed to the predicted increase in obesity. Bibbins-Domingo, K. etal, N Engl J Med. 2007;57(23):2371-2379.
Community Partners

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