Youth Fitness and Health: A Literature Review and Synthesis

President’s Council on Fitness, Sport & Nutrition
Shellie Pfohl, Jane Wargo

Centers for Disease Control and Prevention
Jeff Becasen, Janet Fulton, Sarah Lee, Allison Nihiser
Michael Beets (University of South Carolina)
Mindy Millard-Stafford (Georgia Institute of Technology)
Overview

• Historical overview
  – Shellie Pfohl

• Project goals
  – Janet Fulton

• Systematic Review, Data Extraction Process
  – Mindy Millard-Stafford
History of Youth Fitness Tests

1950’s-early 80’s: AAHPER Youth Fitness Test
- Nationally available test
- Items addressed physical education objectives, sports, fitness, military preparedness
- Normative based data (based on national sample from 1957)
- 1966 began awarding Presidential recognition

1973: Texas Physical Fitness-Motor Ability Test
- Test items identified as appropriate for assessment of physical fitness or motor ability
- Standards from Texas youth

History of Youth Fitness Tests

- **1980s: AAHPERD Physical Best**
  - Health-related test similar to Texas PFMAT
  - Included body composition
  - Curriculum component
  - Criterion-referenced standards

- **1983: FITNESSGRAM**
  - Health-related test
  - Initial reports for performance or health related physical fitness

- **1988: President’s Challenge Physical Fitness Test**
  - Based on AAHPERD Youth Fitness Test
  - Awards system
  - Normative data from 1985 survey

History of Youth Fitness Test

- Additional options developed in 1980’s-1990’s
  - Fit Youth Today
  - Chrysler AAU Program
  - YMCA Youth Fitness Test

- Special populations
  - *The Brockport Physical Fitness Test Manual*
  - *AAHPERD: Adapted Physical Education Assessment Scale II*
## Comparison of Two National Tests

<table>
<thead>
<tr>
<th></th>
<th>Aerobic</th>
<th>Muscular Strength/Endurance</th>
<th>Flexibility</th>
<th>Body Comp</th>
<th>Agility</th>
<th></th>
</tr>
</thead>
</table>
| **Fitnessgram**  | • PACER or 1-mile walk/run or 1-mile walk test | • Curl-up
• Trunk lift
• Push-up or modified pull-up/flexed arm hang | • Back-saver sit and reach or shoulder stretch | • Skin-fold or BMI |         |                  |
| **President’s Challenge** | • 1-mile run/walk
• 1/4mi for 6-7yr olds
• 1/2mi for 8-9yr olds | • Curl-up or partial curl-up
• Pull-up or push-up | • V-sit Reach or sit and reach | | • Shuttle run |
## Youth Fitness Tests

Percentage school districts require or recommend in 2006*

<table>
<thead>
<tr>
<th></th>
<th>Elementary Schools</th>
<th>Middle Schools</th>
<th>High Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitnessgram</td>
<td>21.5</td>
<td>24.1</td>
<td>21.2</td>
</tr>
<tr>
<td>President’s Challenge Fitness Test</td>
<td>53.6</td>
<td>51.6</td>
<td>48.8</td>
</tr>
<tr>
<td>President’s Challenge Health Fitness Test**</td>
<td>30.7</td>
<td>29.3</td>
<td>29.7</td>
</tr>
<tr>
<td>YMCA Youth Fitness Test</td>
<td>5.0</td>
<td>8.1</td>
<td>6.2</td>
</tr>
</tbody>
</table>

*Districts may make multiple recommendations; percentages do not =100

**Discontinued in 2010

Lee et al. ((2007). Physical education and physical activity: results from the school health policies and programs study 2006. *J OSH,77*(8)}
Overarching Goal of this Project

- Identify essential components of physical fitness that should be measured in youth and can be linked to health
- Determine best tests to provide feedback on student health that are easily implemented in school setting
- Identify which tests (per each fitness component) should provide feedback based on criterion-referenced or percentile based scores
- Areas in need of more research
- Receive recommendations on potential awards structure for achievement on test or individual test items
Questions?
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Primary Goals

• To provide a narrative review (and data tables) summarizing peer-reviewed, published original investigations from the last 10 years that will address:
  – What is the relationship of fitness (defined as aerobic capacity, muscular strength, muscular endurance, flexibility) with health outcomes in youth?
  – Is a change in fitness (measured by specific tests such as hand grip strength or 1.5 mile walk/run) associated with a change in health outcome in youth?
    • Youth defined as apparently “healthy” with no disability or congenital disease - but include both obese and non-obese
  – Where are the research gaps?
    • Particularly when evidence is insufficient but clinically important
Youth Fitness and Health Literature Review Model

Youth Fitness

- Aerobic capacity
- Muscular strength
- Muscular endurance
- Flexibility
- Body composition

Health Outcome

- Adiposity / Obesity
- Cardiovascular / Cardiopulmonary
- Emotional / Mental
- Immune / Inflammatory
- Injury (low back pain, other)
- Metabolic
- Musculoskeletal
- Reproductive / Growth
## Key Inclusion Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature</td>
<td>Peer-reviewed</td>
</tr>
<tr>
<td>Publication date</td>
<td>Past 10 years</td>
</tr>
<tr>
<td>Population</td>
<td>Healthy, school-aged</td>
</tr>
<tr>
<td>Age range</td>
<td>5-18 years</td>
</tr>
<tr>
<td>Study designs</td>
<td>Experimental, Longitudinal</td>
</tr>
</tbody>
</table>
What the review will NOT include

- Reliability and validity of fitness tests
- Strengths/weaknesses of a fitness measure to assess health outcomes
- Cut points in fitness scores for health outcomes
- Tracking of fitness over time
- Association of physical activity and health
  - Strong et al. 2005, PAG 2008
- Study quality assessment
Multiple Partnerships

- President’s Council on Fitness, Sport & Nutrition
- CDC
  - Division of Adolescent and School Health
  - Division of Nutrition, Physical Activity and Obesity
  - NCCDPHP, Office of Informatics and Information Resource Management
- Department of Health and Human Services
  - Counselor to Secretary Koh
- Georgia Institute of Technology
- University of South Carolina
Great Teamwork!

- Jeff Becasen
- Michael Beets
- Summer Debastiani
- Bill Dietz
- Janet Fulton
- Dora Hughes
- Carrie Kuzontkoski
- Sarah Lee
- Akaki Lekiachvili
- Mindy Millard-Stafford
- Allison Nihiser
- Shellie Pfohl
- Marissa Sheldon
- Sobhan Tadjalli
- Jane Wargo
- Elizabeth Wilson
Questions?
Overview

• Historical overview
  – Shellie Pfohl

• Project goals
  – Janet Fulton

• Systematic Review, Data Extraction Process
  – Mindy Millard-Stafford
Process for systematic review

1. Purpose, parameters, objectives of the review are defined
2. Key word/terms developed
3. Separate lit. searches conducted for each fitness component
4. Abstract review & decision making
   - YES: Retrieve full article
   - NO: Article not retrieved
5. Code retrieved articles
6. Decision on inclusion/exclusion for final review
   - EXCLUDE—DONE W/ARTICLE
   - INCLUDE: Summarize/synthesize the evidence for each fitness component and health outcome. ACCESS entry.
7. ACCESS query to determine weight/level of evidence for answering research questions
8. Final report
Lit Search: Inclusion Criteria

- English language
- Date of Publication: Jan 1, 2000 - Dec 20, 2010
- Peer-reviewed literature, original investigation (no grey literature or hand searching)
- Human subjects only, age from 5-18 yrs
  - Main antecedent or exposure variable is youth/child/adolescent physical fitness:
    - Aerobic capacity
    - Muscular strength
    - Muscular endurance
    - Flexibility (and motor fitness)
      - related to an activity class / exercise program / or cohort study, AND
  - Main health outcome variable or risk factor clearly described within designated health outcome category
Main Health Outcome Categories

- Musculoskeletal
- Cardiovascular / Cardiopulmonary
- Metabolic
- Adiposity / Obesity
- Emotional / Mental
- Injury (low back pain, other)
- Immune / Inflammatory
  - Reproductive / Growth

(Measures of Physical Activity not Included)
Subject Inclusion/Exclusions

- Apparently healthy youth, adolescents broken out as a distinct group
- Obese and non-obese included
- Activity status (sedentary-athletic) included
- Congenital diseases / disabilities excluded (e.g. cerebral palsy, cystic fibrosis, heart abnormalities, motor deficits)
Sample Search Strategy

- Database: PsycINFO <2000 o November Week 3 2010>
- Search Strategy:

1. climb$.mp. (1643)
2. stair$.mp. (861)
3. fitness centers.mp. (35)
4. strength training.mp. (228)
5. resistance training.mp. (173)
6. exp *Weightlifting/ (123)
7. weight lifting.mp. (73)
8. Gymnastics.mp. (238)
9. tree climbing.mp. (4)
10. rope climbing.mp. (6)
11. rock climbing.mp. (55)
12. calisthenics.mp. (15)
13. muscle strength.mp. (498)
14. or/1-12 (3122)
15. exp *cardiovascular disorders/ (22811)
16. exp *cardiovascular system/ (2703)
17. exp *cerebrovascular disorders/ (9793)
18. cardiac function.mp. (181)
19. exp *respiratory tract disorders/ (5981)
20. exp *chronic obstructive pulmonary disease/ (229)
21. exp *lung disorders/ (1559)
22. respiratory function tests.mp. (6)
23. lung function.mp. (227)
24. exp *asthma/ (2144)
25. or/15-24 (30533)
26. 11 and 25 (78)
27. exp *neoplasms/ (19608)
28. 11 and 27 (13)
29. exp *mental health/ (17478)
30. exp *anxiety/ (21542)
31. exp *depression/ (5773)
32. exp *sleep disorders/ (6121)
33. exp *cognition/ (9177)
34. exp *memory/ (50017)
35. exp *attention/ (24306)
36. exp *dementia/ (33831)
37. exp *psychological stress/ (3831)
38. exp *anger/ (5075)
39. exp *self concept/ (28529)
40. exp *Parkinson's Disease/ (7920)
41. exp *multiple sclerosis/ (4271)
42. exp *amyotrophic lateral sclerosis/ (628)
43. exp *Attention Deficit Disorder with Hyperactivity/ (8097)
44. or/29-43 (212528)
45. 11 and 44 (275)
46. functional health.mp. (417)
Process for systematic review

1. Purpose, parameters, objectives of the review are defined
2. Key word/terms developed
3. Separate lit searches conducted for each fitness component
4. Abstract review & decision making
   - YES
     - Retrieve full article
     - Code retrieved articles
     - Decision on inclusion/exclusion for final review
     - INCLUDE
       - Summarize/synthesize the evidence for each fitness component and health outcome. ACCESS entry.
   - NO
     - Article not retrieved

5. Final report
Screening Abstracts

- Over 32,000 abstracts from 5 literature searches retrieved by CDC Reference Librarian (Completed early 2011).

Endnote Libraries organized by fitness component:

- **Aerobic Capacity**
  - 6,849 records from literature search; 4,795 screened

- **Muscular Strength**
  - 3,876 records from literature search; 2,642 screened

- **Muscular Endurance**
  - 10,393 records from literature search; 6,563 screened

- **Flexibility**
  - 11,192 records from literature search; 6,016 screened
Screening Abstracts

- Consist of 4 questions that confirm pre-established inclusion criteria; 1 question addressing study design
- Screening guide applied to only article title and abstract
- Any “No” responses made record ineligible and assigned an exclusion code
1. Does the document report on an original experimental data-driven study?

Note: If document is literature review, Code 3 for Possible Retrieval

Inappropriate FORMAT Exclusion CODES (11-14)

<table>
<thead>
<tr>
<th>Yes / No/ Can’t tell</th>
<th>IF Yes go on to QUESTION #2.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If policy statement</td>
<td>(11)</td>
</tr>
<tr>
<td>If case report code</td>
<td>(12)</td>
</tr>
<tr>
<td>If lay article (magazine)</td>
<td>(13)</td>
</tr>
<tr>
<td>If other article format</td>
<td>(14)</td>
</tr>
<tr>
<td>If literature review/ meta-analysis</td>
<td>(3)</td>
</tr>
</tbody>
</table>

2. Are healthy children, youth or adolescents (without disability or congenital disease) included in the sample, and are their results reported separately from adults?

Inappropriate population (code 21, 22)

<table>
<thead>
<tr>
<th>Yes / No/ Can’t tell</th>
<th>IF Yes go on to QUESTION #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>If NO youth THEN CODE</td>
<td>(21)</td>
</tr>
<tr>
<td>If Youth, but special pop, disability/congenital disease</td>
<td>(22)</td>
</tr>
<tr>
<td>IF CAN’T TELL GO ON TO NEXT BLOCK and code (99)</td>
<td></td>
</tr>
</tbody>
</table>

3. Does the study report on at least one Component of **FITNESS**?

- **Muscular strength** (1 RM upper or lower body exercise, hand grip dynamometer)
- **Muscular endurance** (reps of push-ups, curl-ups, pull-ups)
- **Flexibility** (sit reach)
- **Aerobic capacity** ($V_{O_2\text{max}}$, mile run)
- **Motor fitness** (agility, coordination etc)

<table>
<thead>
<tr>
<th>Yes / No/ Can’t tell</th>
<th>IF Yes go on to QUESTION #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF NO THEN CODE 2 digit exclusion code:</td>
<td></td>
</tr>
<tr>
<td>Single Acute exercise bout</td>
<td>(32)</td>
</tr>
<tr>
<td>Other therapeutic exercise</td>
<td>(33)</td>
</tr>
<tr>
<td>FITNESS component not measured</td>
<td>(34)</td>
</tr>
<tr>
<td>IF CAN’T TELL GO ON TO NEXT BLOCK and code (99)</td>
<td></td>
</tr>
</tbody>
</table>

4. Does the study report a **health measure**?

Ex: Low back pain; Bone density, BMC; Hypertension, cardiovascular risk factors; Musical skeletal health; Metabolic syndrome (insulin resistance, blood glucose); Body composition (BMI, waist circumference, %fat); Mental health (depression, anxiety)

<table>
<thead>
<tr>
<th>Yes / No/ Can’t tell</th>
<th>IF Yes go on to QUESTION #5</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF NO THEN CODE (2 digit exclusion)</td>
<td></td>
</tr>
<tr>
<td>No health outcome measure</td>
<td>(42)</td>
</tr>
<tr>
<td>IF CAN’T TELL GO ON TO NEXT BLOCK and code (99)</td>
<td></td>
</tr>
</tbody>
</table>

If questions 1-4 All “Yes”, go to Question 5.
If any question is “Can’t tell” or no abstract is present, code 99 for further review

5. **Is it a fitness intervention** study (pre-, post-tests with form of activity that could improve a fitness component and a health measure, pre- & post- or change score)

| Yes | (1E) |
| No | Go to question 6 |

6. **Is it a prospective cohort study design?**

| Yes | (1PRO) |
| No | (1) |
Search Results
Aerobic Fitness and Health
(Published Jan 1, 2000 to DEC 20, 2010)

YOUTH AEROBIC FITNESS AND HEALTH OUTCOMES

LIT SEARCH

6,849 CITATIONS
PubMed, CINAHL, Sport Discus, Medline, Psycho Info, Web of Science, ProQuest, Embase

2,054 Duplicates

4,795 Screened for Exclusion
4,795 AEROBIC FITNESS abstracts screened

Exclusion Criteria Categories
- Not data-driven study (~480 papers, 60 Reviews)
- No Data on Healthy Youth, Child, Adolescents (~2,000 papers)

Exclusion Criteria Categories
- No Fitness Component Data (~200 papers)
- No Health Outcome Measure (~567 papers)

213 Experimental and 57 prospective papers initially screened for FULL DATA EXTRACTION (42 1 Pro, 28 of first 75 1E retained as of Aug 15)

294 Cross-sectional studies (Not slated for Extraction)

~210 Papers initially unclear and reviewed after full paper retrieved, deemed not meeting inclusion criteria
YOUTH MUSCULAR STRENGTH AND HEALTH OUTCOMES

LIT SEARCH

3,876 CITATIONS
PubMed, CINAHL, Sport Discus, Medline, Psycho Info, Web of Science, ProQuest, Embase

1,229 Duplicates

2,647 Screened for Exclusion

Search Results
Muscular Strength and Health
Published January 1, 2000-December 20, 2010
2,647 Abstracts Screened in Muscular Strength Library

Exclusion Criteria Categories

- Not data-driven study (241 papers, 99 Reviews)
- No Data on Healthy Youth, Child, Adolescents (1141 papers)

Exclusion Criteria Categories

- No Fitness Component Data (779 papers)
- No Health Outcome Measure (179 papers)

83 Experimental Design and 23 Prospective papers Reviewed for FULL DATA EXTRACTION
# 62 Experimental, 13 Prospective Studies retained

104 Cross-sectional studies (Not Slated for Extraction)

362 Papers required review of full paper but did not meet inclusion criteria
Search Results
Muscular Endurance and Health
Published January 1, 2000-December 20, 2010

YOUTH MUSCULAR STRENGTH AND HEALTH OUTCOMES

LIT SEARCH

10,393 CITATIONS
PubMed, CINAHL, Sport Discus, Medline, Psycho Info, Web of Science, ProQuest, Embase

2,938 Duplicates, 892 screened other Library

6,563 Screened for Exclusion
6,563 Abstracts Screened in Muscular Endurance Library

Exclusion Criteria Categories
- Not data-driven study (439 papers, 125 Reviews)
- No Data on Healthy Youth, Child, Adolescents (3,084 papers)

Exclusion Criteria Categories
- No Fitness Component Data (1,329 papers)
- No Health Outcome Measure (304 papers)

Papers Reviewed for FULL DATA EXTRACTION
# 36 Experimental, 9 Prospective Studies retained

309 Cross-sectional studies (Not Slated for Extraction)

Papers required review of full paper but did not meet inclusion criteria
YOUTH MUSCULAR STRENGTH AND HEALTH OUTCOMES

LIT SEARCH

11,192 CITATIONS
PubMed, CINAHL, Sport Discus, Medline, Psycho Info, Web of Science, ProQuest, Embase

5,176 Duplicates

6,016 Screened for Exclusion

22 1E, 17 1Pro “Unique” papers
Process for systematic review

1. Purpose, parameters, objectives of the review are defined
2. Key word/terms developed
3. Separate lit. searches conducted for each fitness component
4. Abstract review & decision making
   - YES
     - Retrieve full article
     - Code retrieved articles
     - Decision on inclusion/exclusion for final review
     - INCLUDE
       - Summarize/synthesize the evidence for each fitness component and health outcome. ACCESS entry.
     - EXCLUDE—DONE W/ARTICLE
   - NO
     - Article not retrieved
     - ACCESS query to determine weight/level of evidence for answering research questions

Final report
Coding articles and Microsoft Access

- Articles that were coded and verified as 1E or 1PRO were moved to next phase for full article abstraction/coding.
- No additional evaluation for study quality (PEDro (11 pt), Modified van Tulder Scale (9 pt))
- Youth Fitness and Health Database was developed and housed on DASH Shared Drive
Youth Fitness & Health Database

- Data extraction for studies after full review of paper to verify met inclusion criteria:
  - Subject data
  - Intervention description
  - Fitness test results (Pre and post-test Mean ± SD or change score)
  - Specific health outcomes: Mean (+ SD if provided)
  - General Health Outcome results by category
Select the fitness test from the drop down menu. You’ll have an opportunity to put in the specifics below. If a test was done on the right and left sides of the body, you’ll need to do a separate fitness test entry for each. Each study may have multiple tests, which are entered using the pencil.

Each fitness test will need to be added separately. First choose which component of fitness is being measured. DO NOT CHOOSE BODY COMP.

In the example, the fitness test is 1RM strength, so “Muscular Strength” was selected under Fitness Component.
Youth Fitness & Health Database

<table>
<thead>
<tr>
<th>Fitness Component</th>
<th>Test description</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>Sit and reach (cm)</td>
<td>Flexibility decreased (p&lt;0.001) from adolescence to adulthood. Correlation for sit and reach score between adolescence and adulthood (r=0.76) was significant (p&lt;0.001).</td>
</tr>
</tbody>
</table>
# Youth Fitness & Health Database

## Health Outcomes Summary

<table>
<thead>
<tr>
<th>Health Outcomes</th>
<th>Summary effect of fitness</th>
<th>Summary measures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>obesity / weight / waist cir.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>obesity / weight / waist cir.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cardiovascular (hypertension, CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>musculoskeletal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metabolic (i.e. insulin resistance)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mental/emotional (i.e., depression)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Conclusion

<table>
<thead>
<tr>
<th>Health Outcomes</th>
<th>Summary effect of fitness</th>
<th>Summary measures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>obesity / weight / waist cir.</td>
<td>Positive</td>
<td>BMI, Waist Circumference</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Positive</td>
<td>Null</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
</tr>
</tbody>
</table>
Proposed Examples for Evidence Tables

- Appendix with Full Citation by Study Design and Fitness Component (Strength, Aerobic, Muscular Endurance)
- Subject data, Fitness test means, general health outcomes (+/null)

- Summary break-out by Fitness test (broken out by Study design as a proxy for quality)
  - Ex: All Experimental Randomized Design Studies for Standing Broad Jump and Fitness conclusion field and General Categories of Health (null, positive)

- Summary tally sheet of health outcomes by Fitness test
**Muscular Strength: Experimental design by Fitness Test**

**Fitness tests: Vertical Jump**

**ID:** 34  **Author:** Ingle L, Sloap M, Tolfrey K  
**Title:** The Effect of Complex Training and Detraining Programme on Selected Strength and Power Variable in Early Pubertal Boys  
**Journal:** J Sport Sci Vol 24:987-997  
**Year:** 2006

**Population:** middle school adolescents, approximately 11-15 years  
**Gender:** Male

**Group Descriptions/Conditions**

**Intervention:** Plyometric and resistance training. **Control:** Asked to maintain their habitual levels of physical activity and to refrain from starting a structured exercise training program.

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>SD</th>
<th>Post</th>
<th>SD</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>32.6</td>
<td>5.8</td>
<td>33.9</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>32.8</td>
<td>4.2</td>
<td>33.7</td>
<td>4.1</td>
<td></td>
</tr>
</tbody>
</table>

- **Test Description:** Vertical Jump (cm). 3 jumps performed with highest jump recorded.

- **Fitness Conclusion:** Leg strength increased (p<0.01) in strength trained vs. control group over 12 wk.

- **Health outcomes:** obesity/weight/waist circumference/visceral fat
  - **Summary effect:** Positive

- **Health Conclusion:** Change in % body fat after 12 weeks for strength trained boys vs. no change in control. Sig. group by time interaction.

**ID:** 67  **Author:** Dao H, Frelut M-L, Peres G  
**Title:** Effects of a Multidisciplinary Weight Loss Intervention on Anaerobic and Aerobic Aptitudes in Severely Obese Adolescents  
**Journal:** Int J Obesity 28:870-878  
**Year:** 2004

**Population:** middle school adolescents, approximately 11-15 years, high school only, approximately 14-19 years  
**Gender:** Both

**Group Descriptions/Conditions**

**Intervention:** Severely obese adolescent boys; Other1= Severely obese adolescent girls

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>SD</th>
<th>Post</th>
<th>SD</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>37.7</td>
<td>8.8</td>
<td>41.4</td>
<td>8.5</td>
<td>0.154</td>
</tr>
<tr>
<td>Control</td>
<td>33.2</td>
<td>7.4</td>
<td>36.6</td>
<td>6.8</td>
<td>0.112</td>
</tr>
</tbody>
</table>

- **Test Description:** Vertical Jump (cm) with both legs. Modified Sargent test using a counter movement jump.

- **Fitness Conclusion:** Vertical Jump Increased (p<0.001) in boys and girls (15.11%). Vertical Jump increased with age and pubertal development before and after weight loss.

- **Health outcomes:** obesity/weight/waist circumference/visceral fat
  - **Summary effect:** Positive

- **Health Conclusion:** Adiposity significantly decreased (<0.001) in boys and girls with dietary/exercise program
Summary

Fitness tests: **Vertical Jump**

**Experimental (randomized into control/intervention group)**

<table>
<thead>
<tr>
<th>StudyID</th>
<th>Mean Age</th>
<th>Author</th>
<th>Journal</th>
<th>Year</th>
</tr>
</thead>
</table>

**Fitness Conclusion:** Leg strength increased (p<0.05) by 5% with no load, and 7.5%,13.9% with 20 and 30 kg load in strength trained boys compared to Control.

<table>
<thead>
<tr>
<th>Health Category</th>
<th>Health Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Positive</td>
<td>Growth/ maturation (peak ht velocity, menses)</td>
</tr>
<tr>
<td></td>
<td>Immune function</td>
</tr>
<tr>
<td>1 Null</td>
<td>obesity /weight / waist circumference / visceral fat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>StudyID</th>
<th>Mean Age</th>
<th>Author</th>
<th>Journal</th>
<th>Year</th>
</tr>
</thead>
</table>

**Fitness Conclusion:** Leg strength increased (p<0.01) in strength trained vs. control group over 12 wk.

<table>
<thead>
<tr>
<th>Health Category</th>
<th>Health Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Positive</td>
<td>obesity /weight / waist circumference / visceral fat</td>
</tr>
<tr>
<td></td>
<td>musculoskeletal (BMD, FFM or lean mass)</td>
</tr>
<tr>
<td>2 Null</td>
<td>obesity /weight / waist circumference / visceral fat</td>
</tr>
</tbody>
</table>

**Experimental other (e.g. no control group)**

<table>
<thead>
<tr>
<th>StudyID</th>
<th>Mean Age</th>
<th>Author</th>
<th>Journal</th>
<th>Year</th>
</tr>
</thead>
</table>

**Fitness Conclusion:** Vertical jump increased (p<0.001) in boys and girls (15,11%). Vertical Jump increased with age and pubertal development before and after weight loss.

<table>
<thead>
<tr>
<th>Health Category</th>
<th>Health Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Positive</td>
<td>obesity / weight / waist circumference / visceral fat</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Null</td>
<td>obesity / weight / waist circumference / visceral fat</td>
</tr>
</tbody>
</table>
## Aerobic Fitness Tests Summary Table (Draft)

**Experimental Design Studies with Control group**
*(Randomized and Quasi-experimental)*

<table>
<thead>
<tr>
<th>Fitness Test</th>
<th># of Studies</th>
<th>Avg. n in Study (Range)</th>
<th>Health Outcome Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Obesity</td>
</tr>
<tr>
<td>VO₂max - TM</td>
<td>20</td>
<td>200(15-400)</td>
<td>10</td>
</tr>
<tr>
<td>VO₂max - Bike</td>
<td>10</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>VO₂max Est.</td>
<td>5</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>PACER</td>
<td>50</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Run Test</td>
<td>3</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Walk Test</td>
<td>15</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Note: Pos, Null, Neg indicate the outcomes of the studies for each health outcome category.
Project Timeline

- August 26 2011: Finalize evidence table format for Access queries from Panel
- September 2011: Complete review and extraction of articles
- October 2011: Begin writing aerobic fitness, strength, and endurance sections
- November 1, 2011: Complete first draft of summary of findings
- November 14-15, 2011: Expert panel convened by IOM
Questions?