PE/Physical Activity, Academic Performance, and Overweight/Obesity

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Wake County School Health Advisory Council (SHAC)

Objectives

- Understand the PT perspective on childhood overweight/obesity
- Recognize the levels of evidence presented
- Understand the significance of PE/PA in schools
- Understand the impact of PE/PA on academic performance

PT Perspective on Childhood Overweight/Obesity

- Adverse biological effects[1-3]
  - Cardiovascular disease
  - Diabetes
  - Orthopedic/musculoskeletal conditions
  - Neurological & pulmonary conditions
- Adverse psychological effects[2, 3]
  - Depression/anxiety, decreased QoL
- Increased comorbidities, healthcare costs

Overweight/Obesity in US Children

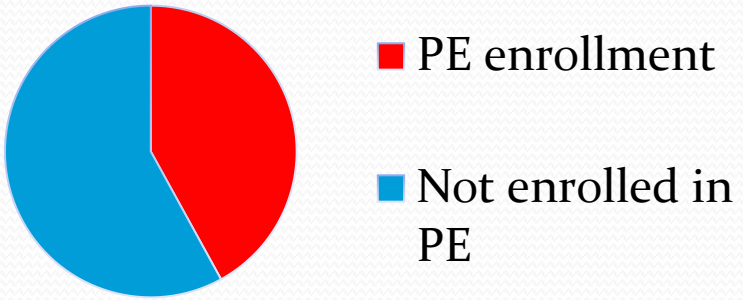
- Obesity rates
  - Tripled in last 30 years[5]
  - Statistics demo

    http://www.cdc.gov/obesity/data/adult.html

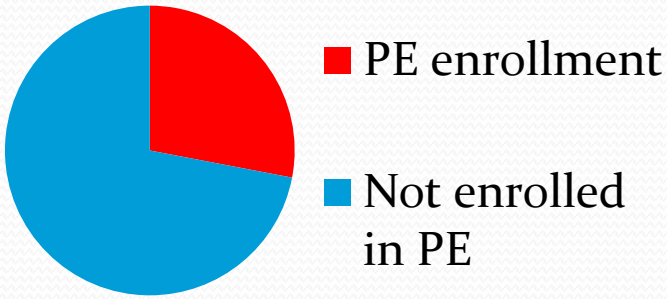
http://www.bing.com/images/search?q=overweight+children+pictures&qpvt=overweight+children+pictures&FORM=IGRE#a

PE in Schools

1991



2003



- 1991 – 42% PE enrollment
- 2003 – 28% PE enrollment
- Statistics[5]
  - <4% elementary schools
  - <8% middle schools
  - <5% of ALL US schools offer daily PE

Offer Daily PE

Levels of Evidence Pyramid

Top 3 Levels for Today's Evidence

Cross-sectional studies

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid.

Evidence

- 16 studies
  - 6 Cross-sectional studies
  - 6 Longitudinal Cohort studies
  - 2 Cohort studies
    - 1 Randomized
    - 1 Non-randomized
  - 1 Systematic Review
  - 1 Meta-Analysis

Cross-Sectional Study #1

- Questionnaire: Teachers' attitudes of perceived PE success/frequency/duration
  - Results[8]:
    - Males more enthusiastic than females
    - Cognitive/physical/social/emotional benefits
    - Better concentration on PE days
    - Poorer concentration non-PE days
    - Improved material retention after PE administered

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid.

Cross-Sectional Studies #2-6

- 5 studies/5 states/Grades K-12
  - State standardized tests for math and language arts/reading
  - Fitness measures
    - Fitnessgram
      - Aerobic capacity
      - Muscular strength/endurance
      - Flexibility
      - Body composition

Cross-Sectional Studies #2

- Results[7]:
  - Aerobic capacity: high effect size on male/female math scores
  - Muscular strength: high effect size on male/female math scores
  - Body composition: no effect on academic performance
  - Flexibility: no effect on academic performance
  - Females>males: fitness, academic performance

Cross-Sectional Studies #3

- Study with 90% African American students
- Results[9]:
  - No relationship between BMI and test scores
  - Not generalizable to area demographics

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid

Cross-Sectional Studies #4, 5

- Results[4, 10]:
  - Aerobic capacity related to math and language arts/reading
    - 1 study: girls>boys for math
  - Significant relationship between BMI/muscular strength in 1 study, not in other
  - Significant relationship between flexibility and math scores

Cross-Sectional Studies #6

- Results[11]:
  - As cardiovascular results worsened and BMI increased:
    - Standardized math test scores declined
    - Language arts/reading test scores did not change

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid

Longitudinal Cohort Studies

- 6 studies
  - 1 Retrospective study (K-5)
  - 2 Quasi-experimental (K-5) US/Australia
  - 2 Prospective (K-5, 7-9) Taiwan
  - 1 Prospective (12 yr olds)

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid

Longitudinal Cohort Study #1

- Retrospective (K-5)
  - Results[2]:
    - BMI/standardized math/reading test scores used
    - Overweight children had significantly lower reading and math scores

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid

Longitudinal Cohort Studies #2, 3

- Quasi-experimental in US/Australia
- Intervention group – PE 30 min/day, 5 days/wk
- Control group – no PE
- Results[1, 6]:
  - Higher math scores over both years
  - Improved reading/writing scores
  - Smaller increase in body fat

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid

Longitudinal Cohort Studies #4, 5

- Prospective (K-5, 7-9) in Taiwan
- K-5 study – 6 years; 7-9 study – 2 years
- Standardized math/science/social studies tests
- Aerobic capacity/BMI/flexibility/ab strength/endurance
- Results[12, 13]:
  - BMI changes not related to academic performance (K-5)
  - Relationship between aerobic capacity/academic performance (7-9)
  - No relationship between flexibility/muscular strength and academic performance (7-9)

Longitudinal Cohort Study #6

- Prospective (12 yr olds)
- Overweight (BMI>97th percentile)
- 1 year study focusing on health education, PA, team/net sports
- Results[3]:
  - BMI declined, academic performance improved

Source: SUNY Downstate Medical Center. Medical Research Library of Brooklyn. Evidence Based Medicine Course. A Guide to Research Methods: The Evidence Pyramid

Cohort Studies

- 2 Studies
- State standardized tests & Fitnessgram
  - Randomized (K-5)
  - Non-randomized (K-8)

http://www.bing.com/images/search?q=pictures+of+healthy+children+exercising&qpvt=pictures+of+healthy+children+exercising&FORM=IGRE#view=detail&id=F6FC44F6C5548AED0526F545A21CB68AC500766B&selectedIndex=0

Cohort Study #1

- Randomized (K-5)
- Intervention: PA integration into core curricula 30 min/day, 3 days/wk, 3 months
- Control: no PA
- Results[14]:
  - No relationship between BMI and academic performance

http://www.bing.com/images/search?q=pictures+of+healthy+children+exercising&qpvt=pictures+of+healthy+children+exercising&FORM=IGRE#view=detail&id=F6FC44F6C5548AED0526F545A21CB68AC500766B&selectedIndex=0

Cohort Study #2

- Non-randomized (K-8)
- Intervention: All year: PE 5 days/wk, 45 min/day
- Control: Fall semester only: PE 1 day/wk, 30 min (K), 45 min (Gr1-5), 50 min (Gr 6-8)
- Results[15]:
  - K-5 girls outperformed boys with cognitive measures and aerobic capacity, muscular strength/endurance, but not for BMI
  - Overweight/obese prevalence may decrease

Systematic Review

- Grades K-12
- School-based PE/PA & academic performance
- 43 studies identified
- Results[16]:
  - 50.5% (+) associations, 48% non-significant, 1.5% (-) associations
  - (+) relationship between PE and academic performance in all studies
  - No (-) associations between PE and academic achievement found *despite less classroom time*

Systematic Review, continued

- Results[16]:
  - Attention better after recess than before recess
  - (+) association between classroom-based PA and academic performance
  - Students who participate in extracurricular activities *are less likely to drop out of school if playing sports*

http://joyerickson.files.wordpress.com/2011/03/high-school-sports.jpg

Meta-Analysis

- Ages 5-16 yrs
- School-based PE/PA & academic performance
- 59 studies identified
- Results[5]:
  - Cardiovascular health has largest effect on academic performance
  - Studies with rigorous design showed larger effect sizes
  - Kids with higher fitness levels had higher academic achievement/cognitive functioning

Meta-Analysis, continued

- Results[5]:
  - PA frequency of 3x/wk has better outcomes than 2x/wk
  - Largest effect size demonstrated with math scores
    - Math > IQ > Reading
  - Larger effect sizes seen in K-5 than Gr 6-10

Evidence Strength/Limitations

- Weak in research design, sample size, power
  - BUT: systematic review/meta-analysis
    - Corroboration with weaker-designed studies
- Lack of generalizability
  - 8 studies: low income/SES or not representative of local demographics
    - May have most to gain
  - BUT: 6 studies represented local demographics

Evidence Strength/Limitations, cont.

- 5 Studies included Gr 6-12, BUT:
  - (+) relationships PA/academic performance
  - Classroom time ↓, and no ↓ in academic performance
- Inability to Demonstrate:
  - Causality due to design
  - Reproducibility
- BUT: Detailed measures delivery, robust studies, *best study design given school setting*

Factors that Aid/Limit Influencing Advocacy

- Limiting Factors:
  - Variable generalizability
  - Inconclusive intervention choice
  - Further long term effects of PE/PA?
- Aiding Factors:
  - (+) relationships noted across all studies

http://inside.akronchildrens.org/wp-content/uploads/2014/01/family-exercising-together.jpg

Evidence Improvement Recommendations

- Robust studies with:
  - Generalizability
  - Power analysis
  - Detailed intervention
  - Consistent measures:
    - Fitness
    - Academic Performance

http://bloximages.chicago2.vip.townnews.com/heraldextra.com/content/tncms/assets/v3/editorial/e/98/e984b214-328c-11e2-922a-0019bb2963f4/50aa9f4f13ebd.preview-620.jpg

Conclusion

- Promote increased PE/PA frequency
  - K-5, perhaps middle, high schools
- (+) association in 98.3% of studies
- No association in 1.7% of studies
  - Used BMI solely
- (-) association in 1.5%
  - Systematic review
    - 3.8/251 associations

http://www.allparentstalk.com/wp-content/uploads/2012/07/kids_exercising.jpg

Conclusion, cont.

- Strong relationship = funding?
- Common Core
  - Allow comparison on national level?
- PE/PA are facilitators to academic performance
- Different forms physical fitness = different relationship = (+) relationship
- Start early

http://1.bp.blogspot.com/-7nj5GLyfMbY/UGIT-NUS5eI/AAAAAAAACmw/tokc7GOGmsk/s1600/healthy+kids.jpg

Thank You!

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