An Educational Exercise on Backpacks for School Children: Including Children, Faculty and Parents

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Purpose
- To increase backpack awareness among students
- Introduce ergonomics and research to 8th graders
- To investigate backpack use and wear among students at a private elementary school
- Secondly, but no less important, were the goals to increase awareness among educators and parents.

Background
- Backpacks carried by children range from 7.7% to 12% of children's body weight (Chiang, Jacobs and Orsmond, 2006; Forjuoh, 2004; Forjuoh, Lane, Schuchmann, 2003).
- Recommended limits set forth by the American Chiropractic Association, the American Physical Therapy Association & the American Academy of Orthopedic Surgeons (≤15%).

Background – Back Pain
- 37% of 11 – 14 yrs of age
- 74% of 12 - 18 yrs of age - and up to 74%
- Other Potential Factors:
  - Prolonged computer use or gaming
  - Sports
  - Risk factors
    - Being female
    - Age (more frequent in adolescents than in younger children)
    - Family history of back pain
    - History of spinal trauma
    - Time sitting and watching television
    - Intense physical activities including competition sports
    - Specific psychological configurations
    - Psychosomatic factors

Background – Back Pain
- Height, body weight and kyphosis, lordosis, and scoliosis?
  - Yes, scoliosis: Skaggs, Early, D’Ambra, Tolo & Kay, 2006
  - No: Korovessis, Koureas & Papazisis, 2004
- Larger body mass index?
  - No: Kovacks, et al., 2003
- Packs tend to get heavier as children age?
  - Yes: from 6.2% among kindergarteners to 12% among 5th graders (average being 8.2%) (Forjuoh, 2004; Forjuoh, Lane & Schuchmann, 2003).
  - No: Weight is approximately the same for younger and older students when all are adolescents (Grimmer and Williams, 2000).

Pain Location Varies by Age
- "dorsal pain" peak at age 11 for both girls and boys.
- "low back pain" peaks at age 11 for girls and 15 for boys
- Peaks in pain occurred just before and just after puberty (Korovessis, Koureas & Papazisis, 2004).
- Pain during youth is associated with pain as a young adult (Siiyola, et al, 2004).
- How much is too much to carry? How much causes pain?
  - 10% of their body weight
  - 15% of their body weight
  - 20% of their body weight
Background – Pain & Packs

Children’s back pain is associated with:
- more frequent use of back packs
- carrying significantly heavier backpacks (higher percent of body weight)
- those shorter in stature who carry backpacks as heavy as taller children report experiencing more low back pain (Korovessis, Koureas & Papazisis, 2004)

Participants
- 88 children (37 boys and 43 girls)
- kindergarten through eighth grade
- Attending a private school in San Antonio, TX

Procedure
- Teach:
  - Introduction to Human Factors, Research, Research Methods, Data Collection
  - Introduction to this Study
  - Data Collection Methods for this Study
- When: Before school care over three days
- Assignments:
  - Escorting subjects to and from the study area
  - Compiling and checking data forms
  - Interviewing and reviewing questionnaires
  - Measuring student heights
  - Weighing students and backpacks

Methods
- Survey: Birth date, gender & grade level.
- Interview:
  - Type of pack
  - Typical wear of pack
  - Who selected the pack
  - Criteria used for selection of the pack
  - Whether they had adjusted the pack to fit them
  - Musculoskeletal soreness, pain, or discomfort
    - Frequency
    - Intensity
    - Duration

Results – Pack Selection
- Who?
  - Child - 56.8%
  - Mother - 29.5%
  - Father - 3.4%
  - Other - 10.2%.
- Criteria?
  - Color - 31.8%
  - Designs on the pack - 11.4%
  - Size - 10.2%
  - Unable to answer the question - 37.5%
- Adjustments
  - Yes: 70.4%
  - No: 26.1%
  - No Report: 3.4%

Results - Pain
- 32% reported experiencing pain
  - Intensity: Primarily Low:
    - 1-2 for 39%
    - 3-4 for 29.3%
    - 5-6 for 24.4%
    - 7-8 for 4.9%
    - 9-10 for 2.4%
  - Duration: Fairly Long
    - Few days - 6.1%
    - Few weeks - 30.3%
    - Few months - 9.1%
    - 6 months - 15.2%
    - A year or more - 36.4%
**Results - Pain**

<table>
<thead>
<tr>
<th>Frequency of Occurrence of Pain (% of total reported musculoskeletal symptoms)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 days/week</td>
<td>28%</td>
<td></td>
</tr>
<tr>
<td>3-4 days/week</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>

Pain was reported more often by older children, compared with younger children: Kindergarten – 2nd Grade (14.8%), 3rd – 5th Grade (27.8%), 6th – 8th Grade (57.4%).

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**Demographics**

<table>
<thead>
<tr>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-K</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Kindergarten</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1st grade</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>2nd grade</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3rd grade</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4th grade</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>5th grade</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>6th grade</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7th grade</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>8th grade</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>43</td>
</tr>
</tbody>
</table>

**Backpack Weight as % of Body Weight**

- 0% to <10%
- 10% to <15%
- 15% to 20%
- >20%

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**Results**

- **Pack Type**
  - Double Strap: 82%
  - Sling: 16%
  - Roller: 1%

- **Carry**
  - Double Strap
    - Both Shoulders: 83.3%
    - One Shoulder: 8.3%
    - Hands: 1.4%
    - Alternates between one and both shoulders: 6.9%

- **Pain per Pack Type**
  - Double Strap: 26%
  - Sling: 50%
Results – Pain

- No difference in soreness, pain and discomfort reported when comparing those carrying 10% of less than their body weight with those who carried more than 10% (Chi2=2.027, p=0.15).
- Girls did not report pain more often than boys (Chi2 =0.309, p=0.58). But...
  - Eighth graders put their packs into a designated area in their homeroom and carry their books for the morning and afternoon classes by hand.
  - Weights carried by hand while changing classes were ≥ 10% of students’ body weight for 75% of 8th grade students.

Recap

- Most packs are selected by the child or the mother according to the colors and designs on the pack.
- Most children have adjusted their pack straps.
- Most use a double strap over both shoulders.
- Carrying a sling pack results in greater reported pain.
- Pack weight increased with age.

Conclusions

- Parents and children need more education on selection of back packs.
- Recurrent musculoskeletal pain is occurring among our children.
- Schools may need more guidance on which weight criteria to use.

Recap

- Approximately 1/3 of students were experience musculoskeletal pain of relatively low to moderate intensity.
- Symptoms of pain occurred equally over 1-2 days, 3-4 days, or daily.
- Most symptoms had been present for either nearly a year or more or for only a few weeks.
- Pain was reported most often in the shoulders and the back.
- Pain occurred more often among older children.
- No differences were found, according to
  - Age
  - Gender
  - Percent of body weight carried

Involving children in the research and community outreach appears effective as a means to reach students and parents.