

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



Valerie Rice
General Ergonomics / 8235 Agora Parkway, Ste.111 / Selma
TX 78154-1335 USA
E-mail: generao@gmail.com
Phone number: 210-313-0600



Carita DeVilbiss
DilemmaDoc, San Antonio, TX
E-mail: DilemmaDoc.com



ConnelMara Bazley
JimConna, Inc. /5966 County Road 109/ Carbondale/
CO 81623 USA
E-mail: cbazley@jimconna.com
Phone number: 970-618-5895



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 ($\leq 15\%$).



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?
 - Yes: Sheir-Neiss, Kruse, Rahman, Jacobson & Pelli, 2003
 - 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 as 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 (Siyyola, 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




General Ergonomics
DilemmaDoc
Confabular JimCorina, Inc

Background – Pain & Packs

Children’s back pain is associated with:

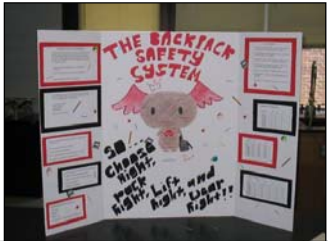
- more frequent use of back packs
- carrying significantly heavier backpacks (higher percent of body weight)
- those shorter in stature who carry backpacks as heavy as taller children report experiencing more low back pain (Korovessis, Koureas & Papazisis, 2004)



General Ergonomics
DilemmaDoc
Confabular JimCorina, Inc

Participants

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



General Ergonomics
DilemmaDoc
Confabular JimCorina, Inc

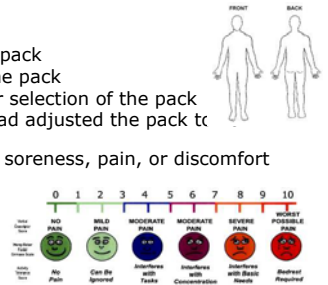
Procedure

- 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

General Ergonomics
DilemmaDoc
Confabular JimCorina, Inc

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 them
 - Musculoskeletal soreness, pain, or discomfort
 - Frequency
 - Intensity
 - Duration



General Ergonomics
DilemmaDoc
Confabular JimCorina, Inc

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%

General Ergonomics
DilemmaDoc
Confabular JimCorina, Inc

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

Frequency of Occurrence of Pain (% of total reported musculoskeletal symptoms)	
Frequency	Percent
1-2 days/week	28%
3-4 days/week	32%
Daily	40%

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%).

Results

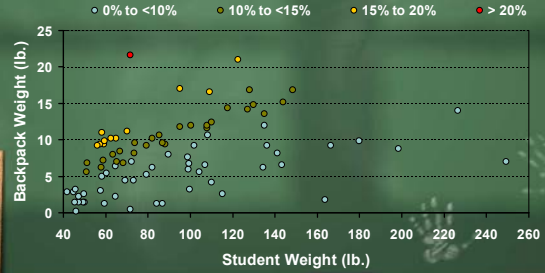
- Pack Type
 - Double Strap: 82%
 - Sling: 16%
 - Roller: 1%
- Carry
 - Double Strap
 - Both Shoulders: 83.3%
 - One Shoulder: 8.3%
 - Hands: 1.4%
 - Alternates between one and both shoulders: 6.9%
- Pain per Pack Type
 - Double Strap: 26%
 - Sling: 50%



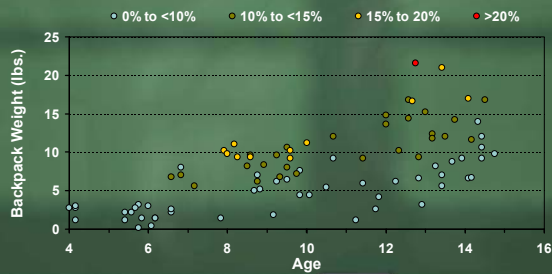
Demographics

	Boys			Girls			??	BACKPACK WEIGHT			BACKPACK AS % of BODY WEIGHT			
	min.	AVG	max.	0% to ≤10%	10% to ≤15%	15% to ≤20%		>20%						
Pre-K	0	4	1	5	1.20	2.20	3.00	5	0	0	0	0		
Kindergarten	3	6	2	11	0.20	1.89	3.20	11	0	0	0	0		
1st grade	3	2	0	5	2.20	5.92	8.00	2	3	0	0	0		
2nd grade	3	2	0	5	1.40	8.36	11.00	1	0	4	0	0		
3rd grade	6	6	1	13	1.80	7.12	9.60	18	6	2	0	0		
4th grade	2	7	1	10	4.40	7.54	11.20	5	3	2	0	0		
5th grade	3	3	1	7	1.20	6.33	12.00	5	2	0	0	0		
6th grade	3	2	0	5	6.20	12.28	16.60	1	3	1	0	0		
7th grade	5	6	2	13	3.20	11.78	21.60	5	6	1	1	0		
8th grade	9	5	0	14	6.60	11.32	17.00	9	4	1	0	0		
	37	43	8	88	0.20	7.83	21.60	49	27	11	1	0		
								55.7%	30.7%	12.5%	1.1%			

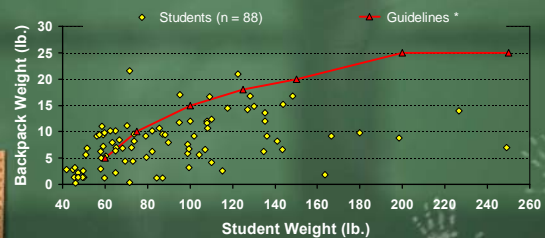
Backpack Weight as % of Body Weight



Backpack Weight as % of Body Weight



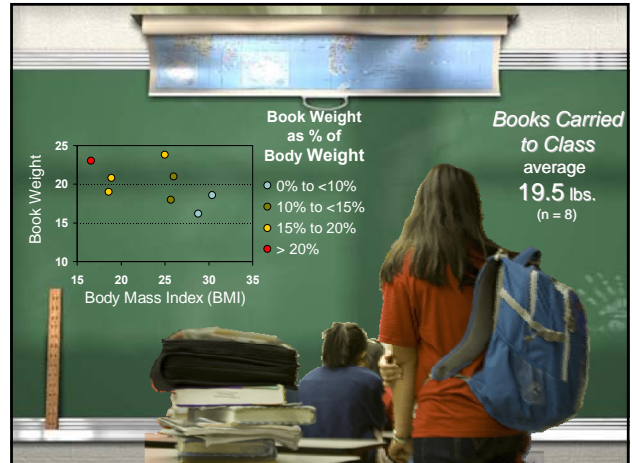
How do backpacks compare to standard guidelines?



* Recommended limits set forth by the American Chiropractic Association, the American Physical Therapy Association, and the American Academy of Orthopedic Surgeons (≤10%)

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 $\geq 10\%$ 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.



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



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.

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

