

BACKPACKS CARRIED BY SCHOOL CHILDREN
A SURVEY OF FIVE SCHOOLS
IN CENTRAL TEXAS



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Executive Summary

There has been a lot of media coverage on backpacks carried by school children. These backpacks, which are carried by school children right from kindergarten through college, may have several potential health consequences. We conducted a survey to determine the average weight of backpacks carried by school children, determine the percent body weight represented by the backpack loads, determine the types of backpacks carried, classify the content of those backpacks weighing 10% or more of student body weights, and assess parental knowledge of the contents and weights of the backpacks.

A total of 1,105 students attending 3 elementary and 2 middle/junior high schools in central Texas were surveyed with parental written consent. Students' weights and heights were measured by trained research assistants using standardized methods, along with their backpack weights. All students whose backpacks weighed 10% or more of their body weights were surveyed further regarding the contents of their backpacks and parental knowledge about the contents and weight of the backpacks.

The average backpack weight was 8.0 lbs (range, 0.5 lbs to 29.8 lbs) and represented 9% (range, 1% to 37%) of their body weights. Average backpack weight varied considerably among the 5 schools; as expected, average backpack weights were higher in the middle/junior high schools than the elementary schools. Backpacks carried by girls and non-Hispanic white students were heavier on average than those carried by boys and students of other racial/ethnic backgrounds. A small proportion of the students (3%) had backpacks with rollers. Backpacks contained an average of 1.2 textbooks, 1.6 folders, and 1.4 binders. Overall, 55% of parents had at some point checked the contents of their child's backpack. However, only 7.5% of parents had ever weighed their child's backpack.

Our conclusions are that in central Texas, backpack loads represent a significant percentage of elementary and middle/junior high students' body weights and that many students are beginning to use backpacks with rollers. In addition, students whose parents check the contents of their backpacks were found to carry less weight with fewer textbooks. These findings are important to primary care physicians, school authorities, teachers, parents, and students regarding school backpack safety.

Fact Sheet

>>> Backpacks Carried by School Children in Central Texas <<<

- N** The average backpack weight carried by students was 8.0 lbs, but varied considerably from 0.5 lbs to 29.8 lbs.
- N** On the average, the backpack loads represented 9.1% of student body weights, with a range of 1-37% of body weight.
- N** Only 3% of students carried backpacks with rollers.
- N** On the average, backpacks with rollers (average weight = 11 lbs) weighed heavier than those without rollers (average weight = 8 lbs).
- N** The most common item carried in a student's backpack was a reading book.
- N** Students carried an average of 1.2 textbooks, 1.6 folders, and 1.4 binders.
- N** Besides textbooks, folders, binders, and reading books, other items carried in students' backpacks included small band instruments, extra clothing, lunch boxes, make-up kits, electronic devices, and personal hygiene items.
- N** The majority of parents (55.4%) had at some point checked the contents of their child's backpack.
- N** Only 7.5% of parents had ever weighed their child's backpack.
- N** Nearly a third of the students (29%) carried their backpacks on only one shoulder.
- N** More than a fifth (23%) of the students carried backpacks weighing between 10 and 14 percent of their body weights.
- N** The shoulders were the body part most reported by the students to be associated with pains from carrying their backpacks.
- N** Students who reported bodily pains, on average, carried a heavier backpack (average weight = 13.2 lbs) than those who did not (average weight = 11.3 lbs).
- N** Students whose parents had never checked the contents of their backpacks carried more textbooks, folders, and binders than those whose parents had checked their backpack contents before.

Introduction

Backpacks carried by school children may be associated with several potential health consequences including back strain, altered gait, bad posture, and eventual low back pain. Although, to our knowledge, there are no published studies on the prevalence of backpack-related problems, concern about children carrying heavy school bags or backpacks has been expressed not only in this country but also internationally as well, including countries such as India, Brazil, Poland, and Egypt. Heavy backpacks, including all other bags carried properly or improperly on the backs or shoulders of school children, can put pressure on their joints and ligaments to initiate the back strain process. Although wheeled backpacks, such as those made by *Spalding*, have begun to appear on the market, it is very unlikely that they will completely replace the traditional backpacks carried on the back. In addition, it is not known what proportion of school children carry these wheeled backpacks. While school children carry these heavy, one-size-fits-all backpacks, it is also uncertain that all the items in the backpacks will be needed on the days the backpacks are carried to school. Yet, one wonders how many parents take the time to check the weight or contents of these bulky backpacks.

This monograph summarizes the results of a survey of five schools in central Texas. While our *long-range goal* is to prevent backpack-related problems among school children and thereby avert the subsequent development of future back problems, the specific aims of the survey were to:

1. Determine the average weight of backpacks carried by school children.
2. Determine the percent body weight represented by the backpack loads.
3. Determine the types of backpacks carried.
4. Classify the content of those backpacks weighing 10% or more of their body weights.
5. Assess parental knowledge of the contents and weights of the backpacks *via* children's self reports.

Notes on Method: Factors Influencing Study Results

Although data collection at the schools was done mostly during Physical Education classes, several factors could have contributed to inaccuracies in the data collection.

At *Bonham Middle School*, data collection was done on a day called, DEAR or "Drop Everything And Read." Since this was a special day in the school year, the teachers had not given homework to students the night before. This resulted in the majority of the students, who had parental permission to participate in the study, not to bring their backpacks to school. Those who brought their backpacks had mostly magazines and library books rather than their text books.

At *Belton Junior High School* and *Nolanville Elementary School*, some of the teachers forgot to send the parents' consent/permission slips home with the students. Additionally, several of the older students at *Belton Junior High School* reported not taking the parents' consent/permission slips home because they didn't want to participate in the study. Only 4th and 5th graders participated at *Nolanville Elementary School*.

At *Moody Elementary School*, data collection was done one class after another. Even though the principal had made a public announcement instructing students to bring all their bags with them when their class was called, several of the older students in the 6th grade reported leaving their heavier books and band instruments in their lockers.

Using this Report

This report is intended to show the big picture regarding backpacks carried by school children in selected schools in central Texas. It is a primer to alert health professionals, school administrators, teachers, parents, and students about the hazards of backpacks and to educate them about their proper use. Findings should be interpreted in the light of the limitations outlined in the methods. Specifically, comparison of one school with another may not be always appropriate due to the variation in the data collection methods and the number of students from each school who participated in the survey.

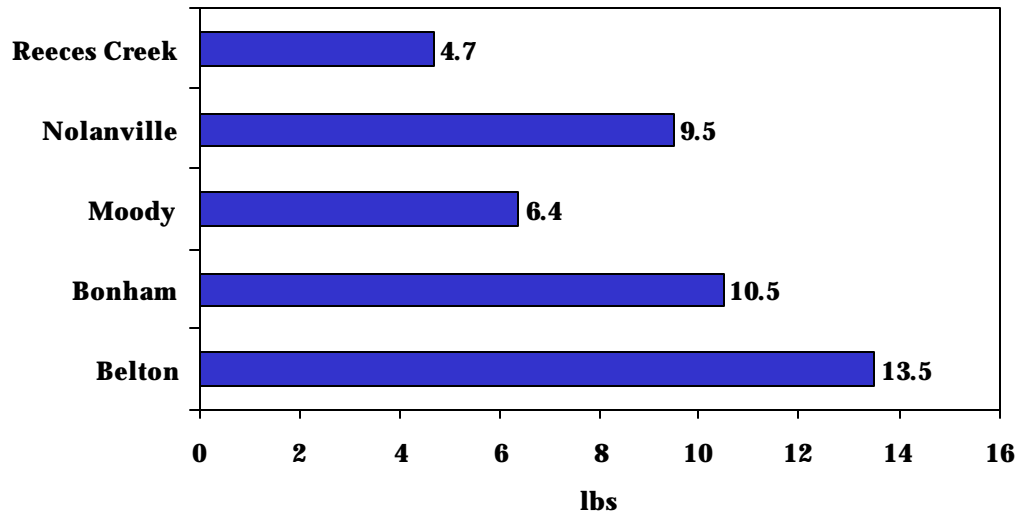
Findings are presented in the form of tables, figures, and bulleted interpretations. A one-page thumbnail presentation of detailed findings for each school is also provided.

Table 1
Summary Statistics on Backpacks Carried by School Children
Central Texas, 2001

Ave. backpack wt. carried	8.0 lbs
Range of backpack wt. carried	0.5 - 29.8 lbs
Ave. body wt. represented by backpacks	9.1 %
Range of body wt. represented by backpacks	0.9 - 37.4 %
Parents with knowledge of backpack contents	55.4 %
Parents with knowledge of backpack weight	7.5 %

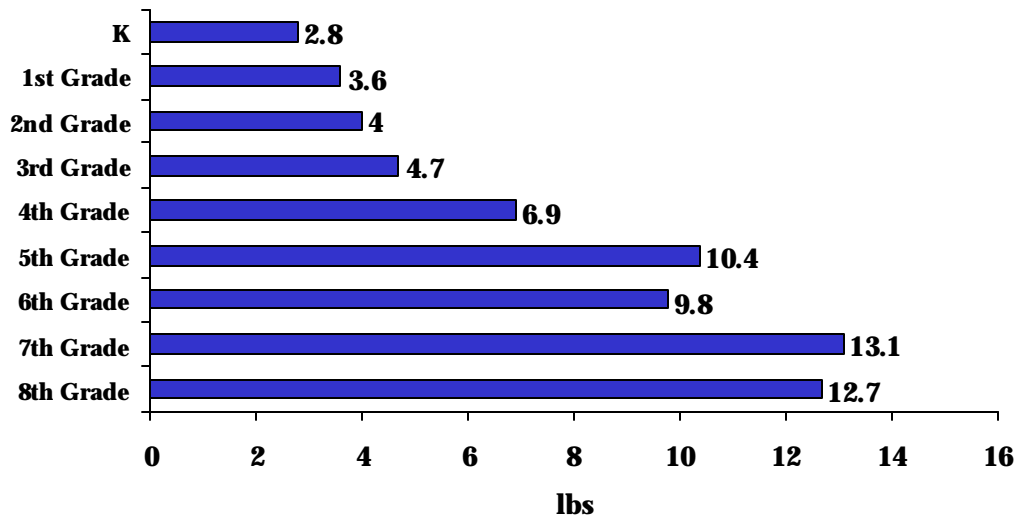
- ' Mean backpack weight carried by the school children was 8.0 lbs, but varied considerably from 0.5 lbs to 29.8 lbs.
- ' On the average, the backpack loads represented 9.1% of student body weights, with a range of 1-37% of body weight.
- ' The majority of parents (55.4%) had at some point checked the contents of their child's backpack.
- ' Only 7.5% of parents had ever weighed their child's backpack.

Figure 1
Mean Weight of Backpacks by School
Central Texas, 2001



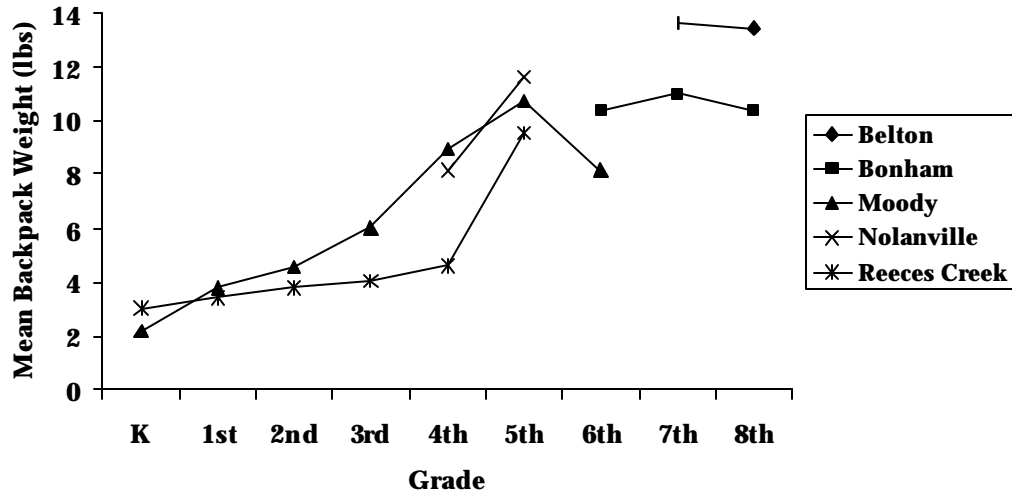
- ' Mean backpack weight carried varied considerably among the five schools; as expected, mean backpack weights were higher in the middle/junior high schools than the elementary schools.
- ' Backpacks of the middle/junior high school students weighed twice as much as those carried by the elementary school students.
- ' Among elementary schools, students from Reeces Creek Elementary carried the least weight.
- ' Among elementary schools, students from Nolanville Elementary carried the most weight.
- ' Among middle/junior high school students, those from Belton Junior High School carried the most weight.

Figure 2
Mean Weight of Backpacks Carried by Grade
Central Texas, 2001



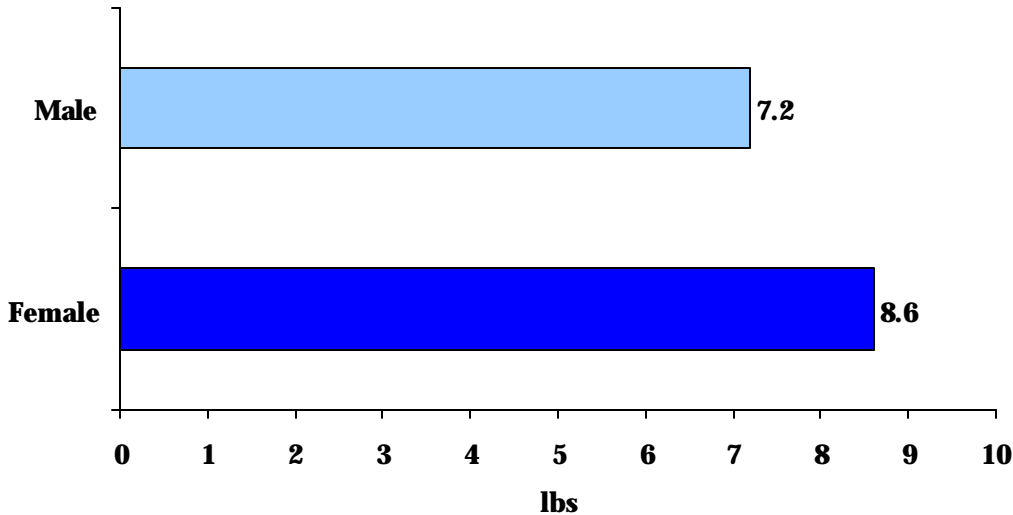
- ' Generally, mean backpack weight increased with grade.
- ' Backpacks carried by students in 7th grade were the heaviest among all grades.
- ' Surprisingly, mean backpack weights decreased from 5th to 6th grade and from 7th to 8th grade.

Figure 3
Mean Weight of Backpacks Carried by Grade and School
Central Texas, 2001



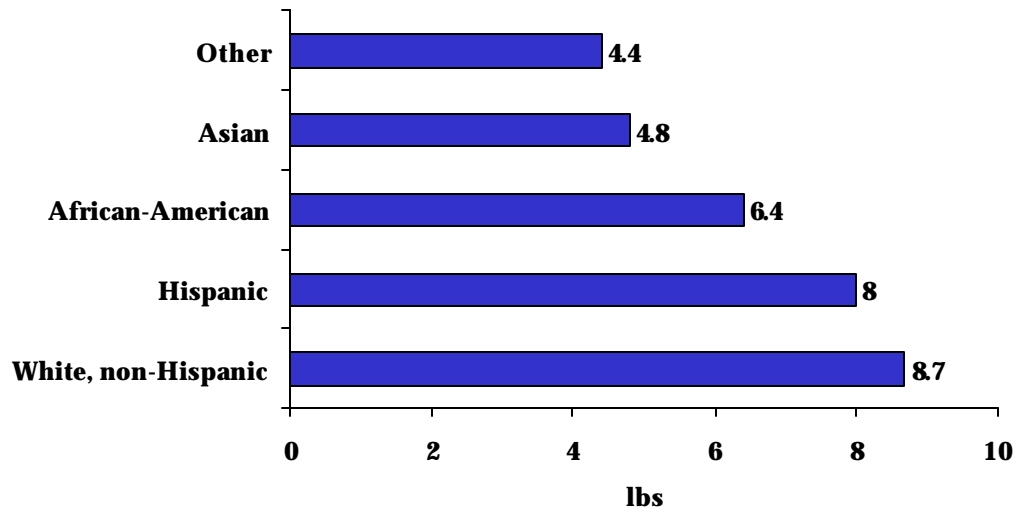
- ' For all schools, mean backpack weight generally increased with grade.
- ' In the elementary schools, mean backpack weight increased dramatically from 4th grade to 5th grade.

Figure 4
Mean Weight of Backpacks Carried by Gender
Central Texas, 2001



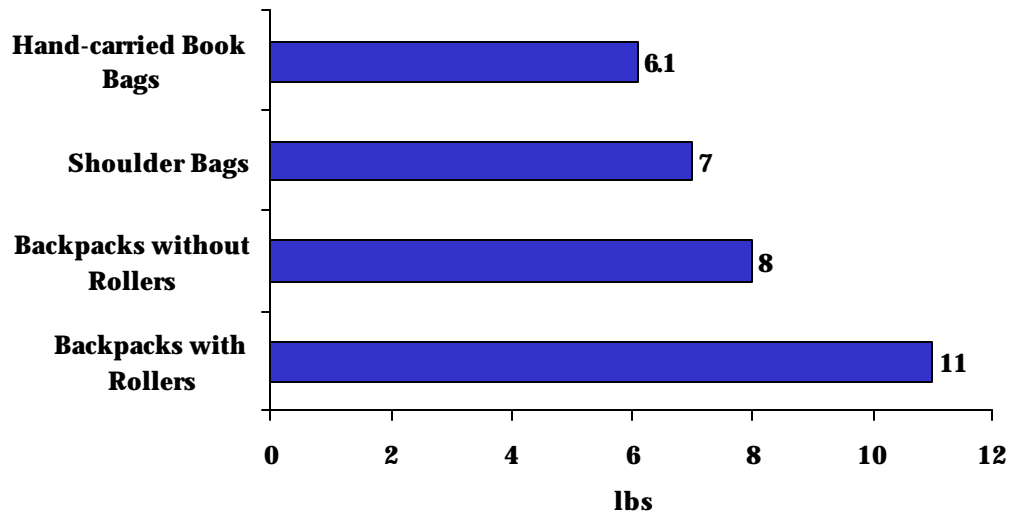
' Girls (mean wt. = 8.6 lbs) carried heavier backpacks than boys (mean wt. = 7.2 lbs).

Figure 5
Mean Weight of Backpacks Carried by Race & Ethnicity
Central Texas, 2001



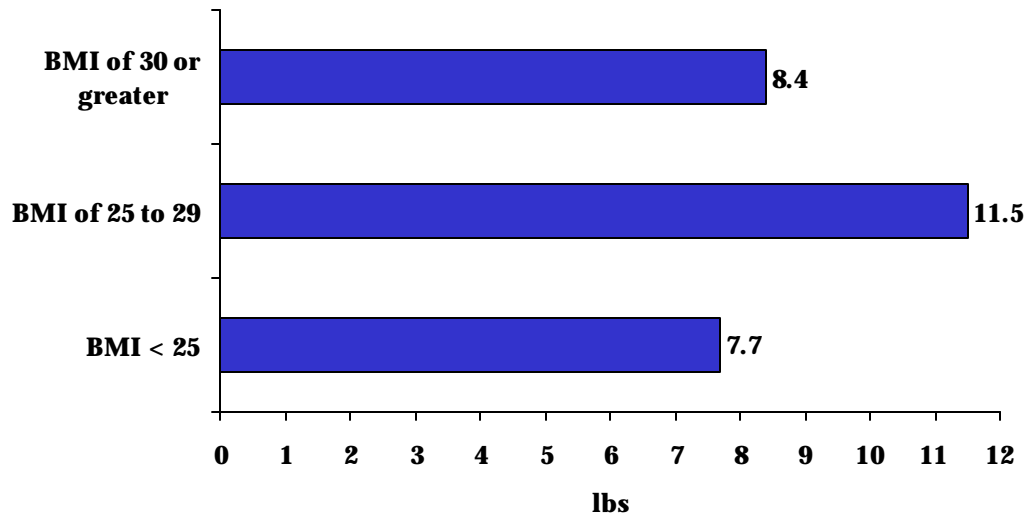
' Non-Hispanic white students carried the heaviest backpacks (mean wt. = 8.7 lbs).

Figure 6
Mean Weight of Backpacks Carried by Type of Bag/Pack
Central Texas, 2001



- ' Backpacks with rollers (mean wt. = 11 lbs) carried by students weighed heavier than those without rollers (mean wt. = 8 lbs).
- ' Students who had shoulder bags or other hand-held book bags carried less weight than those with backpacks.

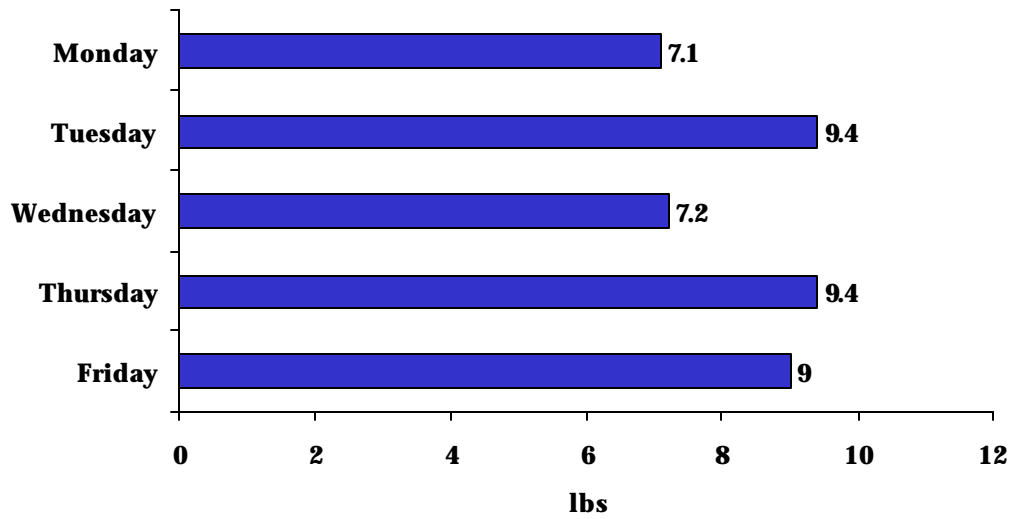
Figure 7
Mean Weight of Backpacks Carried by BMI of Student
Central Texas, 2001



BMI = Body Mass Index

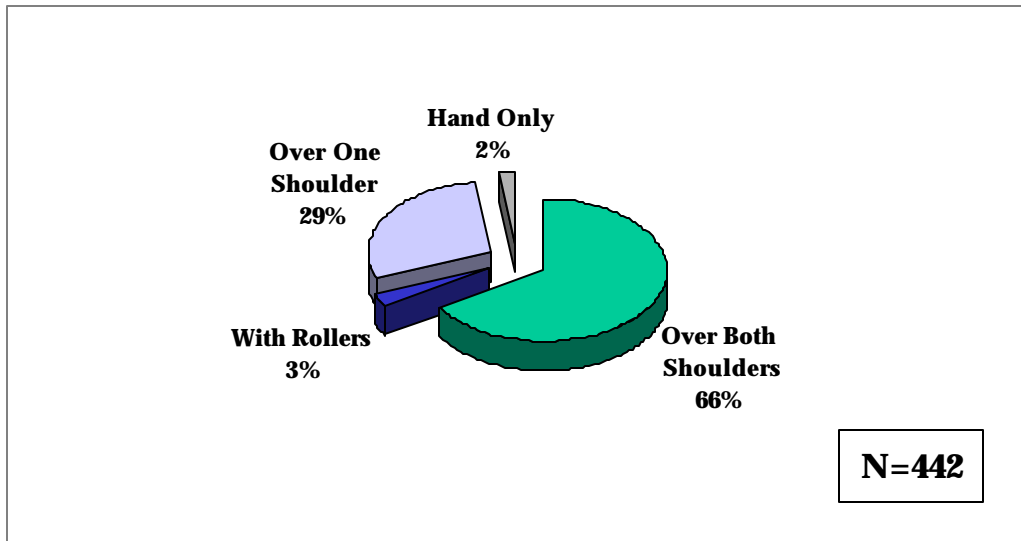
- ' Mean backpack weight varied by the body mass index of the students; those with the lowest body mass index carried the least weight.

Figure 8
Mean Weight of Backpacks Carried by Day of the Week
Central Texas, 2001



' Heavy backpacks were carried mostly on Tuesdays, Thursdays, and Fridays.

Figure 9
Reported Mode of Carrying Backpacks by School Children
Central Texas, 2001



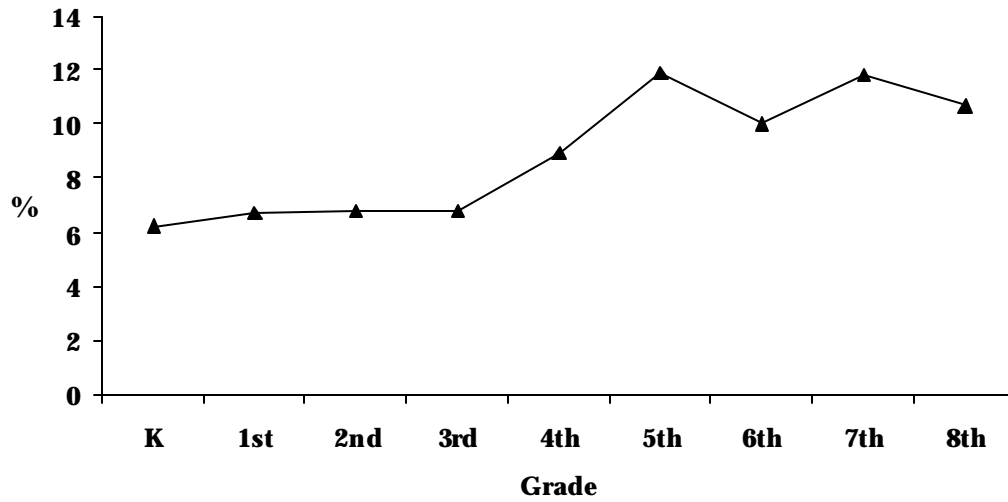
- ' The majority (66%) of students carried their backpacks on both shoulders.
- ' Nearly a third of the students (29%) carried their backpacks on only one shoulder.
- ' Only 3% of all students carried backpacks with rollers.

Table 2
Percent Body Weight Represented by Backpack Weight
Central Texas, 2001

Carried 10-14 percent of their Body Weight	23.3 %
Carried 15-19 percent of their Body Weight	9.3 %
Carried at least 20 percent of their Body Weight	3.2 %

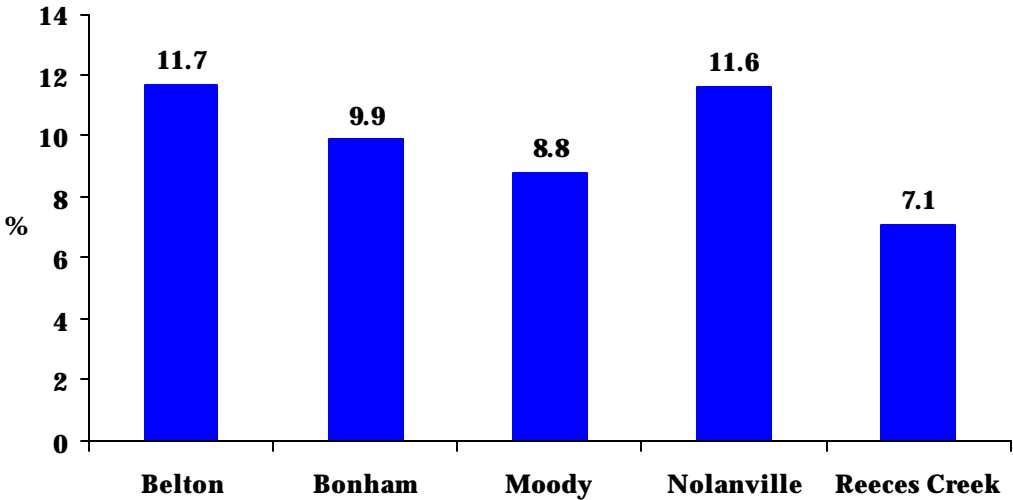
- ' More than a fifth (23%) of the students carried backpacks weighing between 10 and 14 percent of their body weights.
- ' Only 3% of the students carried backpacks weighing 20 percent or more of their body weights.

Figure 10
Percent Body Weight Represented by Backpack Weight by Grade
Central Texas, 2001



- ' Among children in grades K-3, backpack loads represented approximately 6 percent of their body weights.
- ' Students in 5th grade and 7th grade carried backpacks which represented the most percent body weights.

Figure 11
Percent Body Weight Represented by Backpack Weight by School
Central Texas, 2001



' Students from Nolanville Elementary carried backpacks (11.6% of their body weights) which represented a similar body weight as those from Belton Junior High School (11.7% of their body weights).

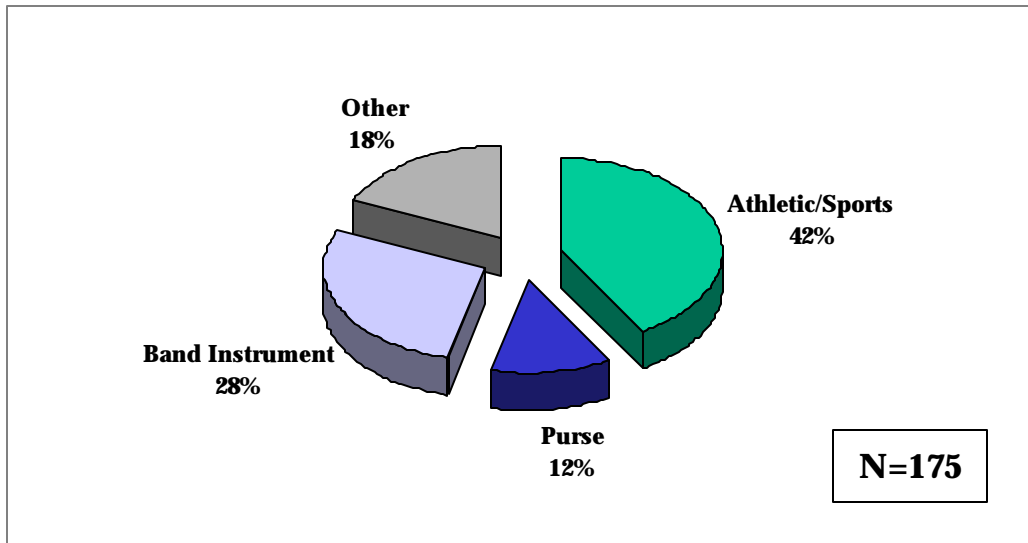
Table 3
Reported Contents of Backpacks Carried by School Children
Central Texas, 2001

<u>Item</u>	<u>% Reporting</u>	<u>Max. Number</u>	<u>Average</u>
1. Reading book	87.3	*	*
2. Binders	76.9	7	1.4
3. Textbooks	64.3	5	1.2
4. Folders	61.6	11	1.6
5. Extra clothing	24.9	*	*
6. Personal hygiene item	20.4	*	*
7. Electronic device	15.4	*	*
8. Lunch box/sack	15.2	*	*
9. Make-up bag/kit	12.2	*	*
10. Small band instrument	2.9	*	*
11. Other additional item	51.1	*	*

* These were Yes/No questions

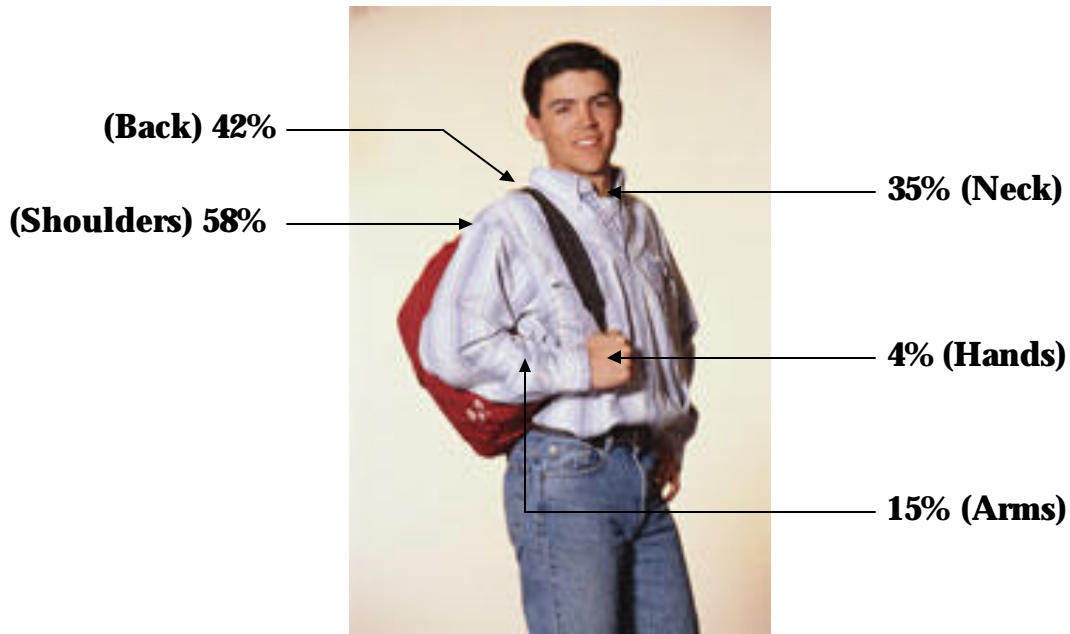
- ' The most common item carried in a student's backpack was a reading book.
- ' Students carried an average of 1.2 textbooks, 1.6 folders, and 1.4 binders in their backpacks.
- ' Besides textbooks, folders, binders, and reading books, other items carried in students' backpacks included small band instruments, extra clothing, lunch boxes, make-up kits, electronic devices, and personal hygiene items.

Figure 12
Bags Other Than Backpacks Carried by School Children
Central Texas, 2001



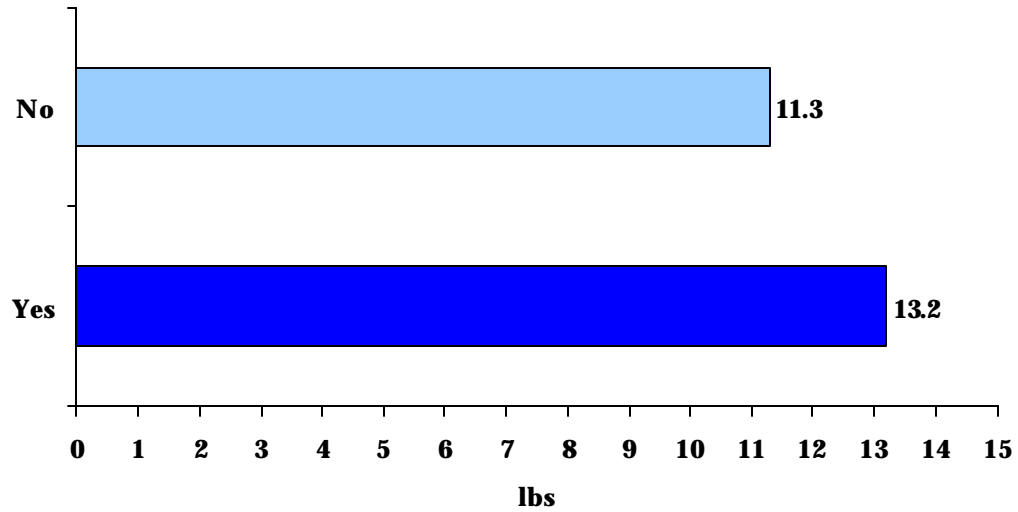
- ' Along with their backpack loads, some students carried additional loads.
- ' The most common additional loads carried by students were athletic or sports bags (42%).

Figure 13
Reported Bodily Pains Associated with Carrying Backpack by
School Children, Central Texas, 2001



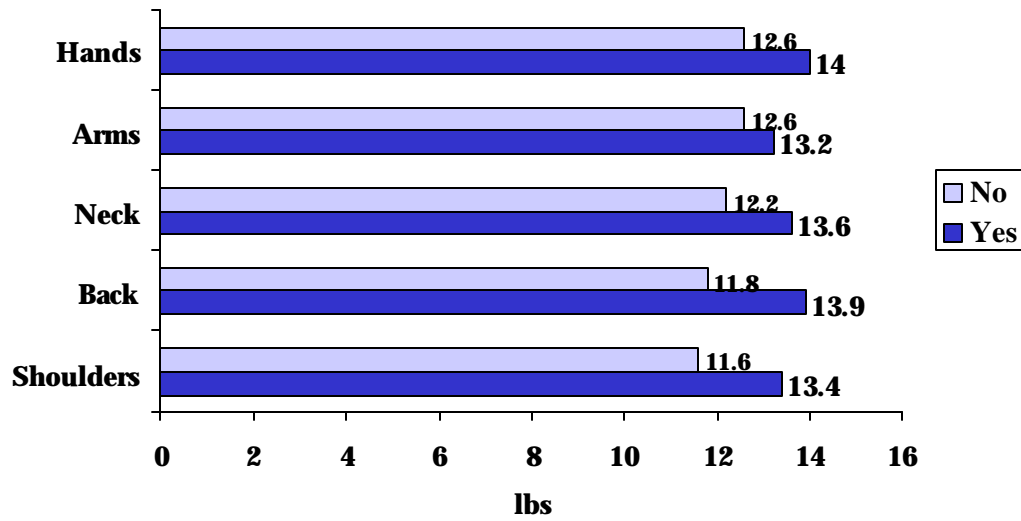
- ' The shoulders were the body part most reported by the students to be associated with pains from carrying their backpacks.
- ' The hands were the body part least reported by the students to be associated with pains from carrying their backpacks.

Figure 14
Mean Weight of Backpacks Carried by Reported Bodily Pain
Central Texas, 2001



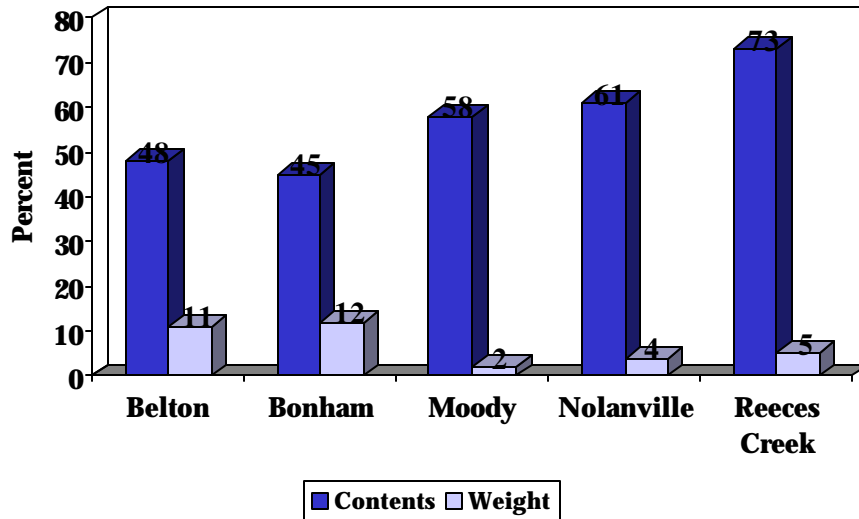
- ' Reported bodily pains by the students was associated with carrying a heavier backpack (mean weight = 13.2 lbs).

Figure 15
Mean Weight of Backpacks Carried by Reported Bodily Pains
Central Texas, 2001



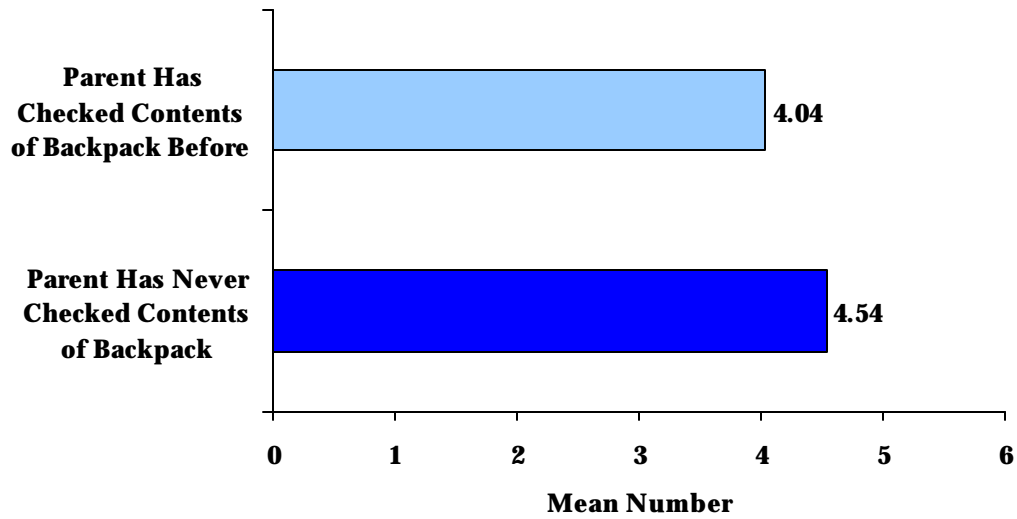
- ' A greater disparity in mean backpack weights was found for body parts most reported (e.g. shoulders, back) by the students to be associated with bodily pains.

Figure 16
Reported Parental Knowledge of the
Contents & Weight of Backpacks Carried by School Children
Central Texas, 2001



- ' Parents of elementary students were more likely to check the contents of their children's backpacks than those of middle/junior high students.
- ' Parents of middle/junior high students were more likely to check the weights of their children's backpacks than those of elementary students.
- ' Parents of Reces Creek Elementary had the most knowledge of the contents of their children's backpacks.
- ' Parents of Bonham Middle School had the least knowledge of the contents of their children's backpacks.

Figure 17
Mean Number of Textbooks, Folders & Binders Carried in Backpacks by Parental Knowledge of Backpack Contents
Central Texas, 2001



- ' Students whose parents had never checked the contents of their backpacks carried more textbooks, folders, and binders than those whose parents had checked their backpack contents before.

Survey Sites and Response Rates

<i>Characteristic</i>	<i>Belton</i>	<i>Bonham</i>	<i>Moody</i>	<i>Nolanville</i>	<i>Reeces Creek</i>	<i>Total</i>
Number of Students Enrolled in School	1,040	520	370	227	730	2,887
Number of Student Participants	237	123	219	100	426	1,105
Rate of Student Participation	22.8%*	23.7% [¶]	59.2%	44.1%*	58.4%	38.3%
Site of Data Collection in School	P.E. & Health Classes	P.E. Classes	Health Class	P.E. Classes	P.E. Classes	-
Number of Days of Data Collection	2	1	1	1.5	1.5	7

P.E. = Physical Education

* Some teachers forgot to send the parents' consent/permission slips home with the students.

[¶] Data collection took place on a DEAR: "Drop Everything And Read" day when teachers had not given homework the night before. Consequently, the majority of the students chose not to bring their backpacks to school. Those who brought their backpacks had mostly magazines and library books.

Belton Junior High School

Characteristic	N*	Average Weight of Backpack	% Body Wt Represented by Backpack Load	n [†]	% Parents Ever Checked Contents of Backpack	% Parents Ever Checked Weight of Backpack
<i>All Students</i>	237	13.5 lbs	11.7%	159	48.4%	10.7%
<i>Sex</i>						
Male	76	12.5 lbs	10.6%	40	62.5%	10.0%
Female	161	14.0 lbs	12.2%	119	43.7%	10.9%
<i>Race & Ethnicity</i>						
White	175	14.1 lbs	12.2%	127	45.7%	8.7%
Black	9	11.0 lbs	9.0%	5	20.0%	20.0%
Hispanic	45	11.8 lbs	10.2%	23	60.9%	17.4%
Other	8	12.4 lbs	11.3%	4	100%	25.0%
<i>Grade</i>						
7 th	107	13.6 lbs	12.2%	71	57.7%	12.7%
8 th	130	13.4 lbs	11.3%	88	40.9%	9.1%
<i>Type of Backpack[‡]</i>						
Without Rollers	228	13.7 lbs	13.7%	157	48.4%	10.8%
With Rollers	1	10.0 lbs	8.9%	1	100%	0%

* [¶] May not add to totals due to missing data.

[†] Include only students whose backpacks weighed 10% or more of their body weights.

[‡] Exclude students who did not carry actual backpacks.

Bonham Middle School

Characteristic	N*	Average Weight of Backpack	% Body Wt Represented by Backpack Load	n [†]	% Parents Ever Checked Contents of Backpack	% Parents Ever Checked Weight of Backpack
All Students	123	10.5 lbs	9.9%	67	44.8%	11.9%
<i>Sex</i>						
Male	43	10.6 lbs	9.3%	22	54.5%	13.6%
Female	79	10.4 lbs	10.2%	44	40.9%	11.4%
<i>Race & Ethnicity</i>						
White	81	10.2 lbs	9.6%	39	41.0%	7.7%
Black	18	11.9 lbs	11.2%	12	50.0%	16.7%
Hispanic	10	10.6 lbs	9.3%	6	50.0%	0%
Other	14	10.8 lbs	10.4%	10	50.0%	30.0%
<i>Grade</i>						
6 th	55	10.4 lbs	10.5%	36	44.4%	11.1%
7 th	28	11.0 lbs	10.2%	12	58.3%	8.3%
8 th	40	10.4 lbs	9.0%	19	36.8%	15.8%
<i>Type of Backpack[‡]</i>						
Without Rollers	121	10.5 lbs	9.9%	65	44.6%	12.3%
With Rollers	2	14.1 lbs	11.6%	2	50.0%	0%

* [¶] May not add to totals due to missing data.

[†] Include only students whose backpacks weighed 10% or more of their body weights.

[‡] Exclude students who did not carry actual backpacks.

Moody Elementary School

Characteristic	N*	Average Weight of Backpack	% Body Wt Represented by Backpack Load	n [†]	% Parents Ever Checked Contents of Backpack	% Parents Ever Checked Weight of Backpack
<i>All Students</i>	219	6.4 lbs	8.8%	85	57.6%	2.4%
<i>Sex</i>						
Male	103	6.3 lbs	8.6%	38	57.9%	0%
Female	116	6.5 lbs	8.9%	47	57.4%	4.3%
<i>Race & Ethnicity</i>						
White	169	6.6 lbs	9.2%	70	55.7%	1.4%
Black	10	6.5 lbs	6.6%	2	50.0%	0%
Hispanic	40	5.5 lbs	7.7%	13	69.2%	7.7%
Other	-	-	-	-	-	-
<i>Grade</i>						
Kindergarten	24	2.2 lbs	4.5%	1	100%	0%
1 st	39	3.8 lbs	7.1%	8	87.5%	0%
2 nd	30	4.6 lbs	7.4%	8	50.0%	0%
3 rd	34	6.0 lbs	8.9%	15	80.0%	0%
4 th	41	9.0 lbs	11.5%	25	52.0%	4.0%
5 th	29	10.7 lbs	12.1%	18	44.4%	0%
6 th §	22	8.2%	8.7%	10	40.0%	10.0%
<i>Type of Backpack</i> ‡						
Without Rollers	190	6.4 lbs	8.6%	75	60%	1.3%
With Rollers	1	7.8 lbs	11.3%	1	100%	0%

* † May not add to totals due to missing data.

† Include only students whose backpacks weighed 10% or more of their body weights.

‡ Exclude students who did not carry actual backpacks.

§ Most reported leaving their heavy books and band instruments in their lockers.

Nolanville Elementary School

Characteristic	N*	Average Weight of Backpack	% Body Wt Represented by Backpack Load	n [†]	% Parents Ever Checked Contents of Backpack	% Parents Ever Checked Weight of Backpack
All Students	100	9.5 lbs	11.6%	57	61.4%	3.5%
<i>Sex</i>						
Male	43	8.9 lbs	10.8%	21	85.7%	0%
Female	57	9.9 lbs	12.2%	36	47.2%	5.6%
<i>Race & Ethnicity</i>						
White	73	9.5 lbs	11.5%	42	64.3%	2.4%
Black	9	8.4 lbs	10.2%	4	50.0%	0%
Hispanic	4	9.8 lbs	9.1%	2	50.0%	0%
Other	14	9.8 lbs	13.8%	9	55.6%	11.1%
<i>Grade</i>						
4 th	62	8.2 lbs	10.5%	31	67.7%	0%
5 th	38	11.6 lbs	13.3%	26	53.8%	7.7%
<i>Type of Backpack[‡]</i>						
Without Rollers	79	9.0 lbs	10.9%	39	64.1%	2.6%
With Rollers	15	12.8 lbs	16.0%	15	60.0%	6.7%

* [¶] May not add to totals due to missing data.

[†] Include only students whose backpacks weighed 10% or more of their body weights.

[‡] Exclude students who did not carry actual backpacks.

Reeces Creek Elementary School

<i>Characteristic</i>	<i>N*</i>	<i>Average Weight of Backpack</i>	<i>% Body Wt Represented by Backpack Load</i>	<i>n[†]</i>	<i>% Parents Ever Checked Contents of Backpack</i>	<i>% Parents Ever Checked Weight of Backpack</i>
<i>All Students</i>	426	4.7 lbs	7.0%	74	73.0%	5.4%
<i>Sex</i>						
Male	208	4.6 lbs	7.1%	33	69.7%	6.1%
Female	218	4.7 lbs	7.0%	41	75.6%	4.9%
<i>Race & Ethnicity</i>						
White	196	4.6 lbs	7.2%	33	72.7%	9.1%
Black	141	4.8 lbs	7.0%	25	80.0%	0%
Hispanic	48	5.8 lbs	7.8%	12	58.3%	8.3%
Other	41	3.4 lbs	6.0%	4	75.0%	0%
<i>Grade</i>						
Kindergarten	70	3.0 lbs	6.8%	8	87.5%	0%
1 st	73	3.4 lbs	6.4%	8	75.0%	0%
2 nd	71	3.8 lbs	6.5%	6	83.3%	0%
3 rd	74	4.1 lbs	5.8%	9	77.8%	11.1%
4 th	73	4.6 lbs	6.1%	9	66.7%	0%
5 th	65	9.6 lbs	11.1%	34	67.6%	8.8%
<i>Type of Backpack[‡]</i>						
Without Rollers	407	4.6 lbs	6.9%	66	71.2%	6.1%
With Rollers	9	7.9 lbs	11.5%	6	83.3%	0%

* [¶] May not add to totals due to missing data.

[†] Include only students whose backpacks weighed 10% or more of their body weights.

[‡] Exclude students who did not carry actual backpacks.

Guidelines and Recommendations

K *Symptoms Associated with Backpacks*

The following are some of the symptoms that may be associated with backpack related problems. If your child complains about any of the following symptoms, and they think it is backpack related, schedule an appointment with your family physician.

- Headache
- Middle back discomfort
- Lower back pain
- Shoulder pain
- Neck pain
- Waist pain

K *Recommendations about Backpack Safety SKILLS*

- **S**elect the right size backpack with wide, padded straps and enough back padding
- **K**now the weight limit of the backpack to carry, preferably <10-15% of body weight
- **I**nspect what is to be packed to make sure everything is needed and pack properly
- **L**ift backpack correctly with bent knees and facing backpack when picking it up
- **L**earn to adjust backpack straps so it rests properly on the back, not below the waist
- **S**earch for updates on backpack safety from Internet sites and your family doctor

K *Other Backpack Safety Tips*

- If you choose to use a backpack with rollers, always roll it rather than carry it
- Always remember to leave items you don't need at home
- Use both straps firmly tightened all the time over both shoulders
- When the backpack has a waist strap, always use it
- When packing a backpack, remember to place heaviest items close to your back
- A backpack is not a toy or weapon: don't fight with it

K *Important Backpack Related Internet Sites*

- www.backpacksafe.com (*Backpack Safety America*)
- www.familyeducation.com (*Backpack Safety Tips*)
- www.apta.org/news/backpack (*American Physical Therapy Association - APTA*)
- www.aaos.org (*American Academy of Orthopedic Surgeons - AAOS*)
- www.schoolhealth.org/backpack.html (*American Academy of Pediatrics - AAP*)
- www.cdc.gov/ncipc (*Centers for Disease Control and Prevention - CDC*)

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