Heavy Backpack Weight of Elementary School Students

Quality of Life Proposal

Carmen Hung & Safanah T Siddiqui

Submitted April 03, 2009

Table of Contents

Summary…….1

Background Research…… 2

Field Research and Analysis……...6

Recommendation and Implementation Plan……. 9

Financial Implications……...……....10

Conclusion……11

References..……..12

Appendix……..……15

Summary

In recent years, heavy backpack weight has become an issue of increasing significance, since it is known to have serious effects on health. Pain and other problems induced by heavy backpacks can affect an individual's quality of life in many ways; for instance, it may result in disruptions in daily activities and lost school time. The purpose of the study was to determine whether there was a correlation between relative backpack weight and back pain and the prevalence of back pain in NYC elementary school students. The field research consisted of surveys that were given to parents/guardians and interviews of teachers and school administrators. Participants were chosen randomly and their identities and answers to the surveys were kept confidential. The survey focused on gathering information about elementary students' habits of backpack carrying and effects of these habits—whether students experienced pain, and if so, when, where, and how often. After analysis of data, it was found that relative backpack weight ($r=0.047431$), method of wear ($r=-0.41573$), and distance between the bottom of the bag and waist ($r=0.022076$) were not significantly correlated with pain. Although only 22.22% had an unhealthy relative backpack weight, almost half of the subjects reported pain. It is possible that there is another factor contributing to the pain, although it remains unknown. More subjects or a wider range of subjects may be necessary to produce more significant results.

Although no significant correlations were found in this study, it is known that heavy backpacks are an issue; its effects on health continue to be heavily researched. Raising awareness of the issue—through a website, pamphlets, and flyers—will allow the public to be informed of the problem. Students will be able to learn about backpack safety, healthy backpack weight, and the proper method of wearing and loading.

Background Research

In the United States, it is estimated that over 40 million students carry backpacks to school (Pascoe et al., 1999). In a study performed by Iyer, it was reported that 6 out of 10 participants experienced chronic back pain due to carrying heavy backpacks (Iyer, 2001). This pain affects the lives of students in various ways including physical injury and a loss of time during activities. (Moore et al., 2007, Rice et al., 2008).

Carrying heavy backpacks can lead to pain and injury that prevent students from participating in everyday activities. It was estimated that in 2001, there were seven thousand injuries related to the use of backpacks (NEISS, 2001). In Moore's study (Moore et al., 2007), it was found that 4.2% of 261 students who reported pain lost school time because of their condition. In addition, 9.2% and 6.9% were not able to participate in the entire duration of school sports and physical education class, respectively (Moore et al., 2007). It is also possible that pain resulting from heavy backpack weight may hinder a student's performance in classes by distracting the student (D'Arcy, 2006). An unhealthy backpack weight is determined by finding the relative backpack weight, the ratio between backpack weight and body weight (Siambanes et al., 2004).

In addition to overall loss of school time, chronic back pain may interfere with other aspects of daily life. Treatment, such as chiropractic care and medication, may be time consuming and expensive (Gengler, 2008). It was found that students with a 15% relative backpack weight were more likely to receive chiropractic care than those with a 10% relative backpack weight (Moore et al., 2007). From this finding, it is suggested that heavier backpacks induce greater pain.

While it is known that carrying heavy backpacks may result in short-term effects such as soreness, pain, and discomfort (Rice et al., 2008), carrying heavy backpacks may also affect

musculoskeletal development and posture in adolescents (Negrini et al., 2007). A high relative backpack weight (exceeding 15%) is associated with upper and mid-back pain due to the change in posture while wearing a heavy backpack. Greater relative backpack weight is related to spinal misalignment or curvature, muscle strain, rounding of the shoulders, and spasms of the back and shoulders (Moore et al., 2007).

The long-term effects of carrying heavy backpacks remain unclear. However, it is known that lower back pain (LBP) in adolescence is correlated with lower back pain in adulthood. This relationship is seen in Hestbaek's study (2006), in which those who reported experiencing LBP before the follow-up experienced greater LBP as adults.

As described previously, pain of the neck, shoulders, and back may be related to the carrying of heavy backpacks (Siambanes et al., 2004). Carrying too many books puts a great amount of stress on the shoulders. The American Chiropractic Association recommends that relative backpack weight should not exceed 10 to 15% (Moore et al., 2007). In Rice's study (2008), 32% of 88 children reported musculoskeletal symptoms. Most students experienced low to moderate pain in regions of the shoulders and back, with others also experiencing pain in the head, abdomen, legs, and hands. Those who carried more than 15% of their weight were more likely to experience these symptoms (Rice et al., 2008). This relationship was also found in Siambane's study (2004). In Moore's study (2007), it was concluded that younger students were more at risk for developing back pain. As body weight increased with age, backpack weight did not vary significantly between different ages; meaning younger children generally had greater relative backpack weight than older students (Moore et al., 2007).

Methods of carrying backpacks may also influence pain, although this remains controversial. Korovessis (2004) found that asymmetric carrying—having strap(s) on only one

shoulder—resulted in greater pain in student participants. This was also discovered in a study conducted by Rice (2008). 26% of children who carried two-strap bags reported soreness, pain, and discomfort, whereas 50% of children who carried one-strap bags reported pain. The number of participants who experienced pain from asymmetric carrying was almost twice the number of those who carried their backpacks symmetrically (Rice et al., 2008). However, no statistically significant relationship was found between method of wear and back pain in Siambanes' study (Siambanes et al., 2004).

It has been found that walking to and from school with a backpack also influences back pain (Siambanes et al., 2004). In Siambanes' study, 43.6% of 3,498 participants walked to school. There was a significant relationship between back pain and walking to and from school ($p<0.01$). However, there was no statistically significant relationship between the length of the walk and back pain (Siambanes et al., 2004).

In September 2002, the American Occupational Therapy Association (AOTA) created and sponsored National Backpack Awareness Day (Michael, 2002). Since then, it has been held annually every September. This event has focused on raising awareness of health risks that may result from carrying heavy backpacks and informing teachers, students, and parents of a safe backpack weight (Jacobs, 2003). Students also participate in a weigh-in, after receiving parental consent. The student and his or her backpack are weighed to determine whether relative backpack weight falls within a healthy range (Holst, 2008). Educational resources such as brochures are made available in order to provide information on prevention of pain and injury from backpacks (Jacobs, 2003).

In addition to raising awareness of this issue, National Backpack Awareness Day has also been used as an avenue to teach students the correct method of wearing a backpack (Holst,

2008). It is recommended by the American Occupational Therapy Association that backpacks be worn close to the back to prevent muscle strain (AOTA, 2004). In the backpack, the heaviest items should be placed closest to the back. It is also important that one wears a backpack with well-padded shoulder straps on both shoulders to ensure an even distribution of weight. By following the AOTA's recommendations, students are less likely to become injured due to improper backpack loading and use (AOTA, 2004).

In recent years, the government has also begun efforts to lighten the load of students' backpacks. Such efforts include proposing weight limits on textbooks (Dillon, 2002, Michael, 2002). Governor Gray Davis of California signed a bill that took effect in 2004, banning textbooks weighing greater than the proposed limit (Dillon, 2002). In 2001, Assemblyman Joseph J. Roberts, Jr. of New Jersey sponsored a bill proposing that an Ergonomics in Education Study Commission be established (Senate and General Assembly of the State of New Jersey, 2003). The job of the commission is to study issues associated with ergonomics—the study of equipment design and efficiency in order to increase comfort, safety, and productivity—in New Jersey schools. Such issues include injuries related to non-ergonomic study environments, the development of ergonomic designs of classroom equipment and furniture, and the establishment of ergonomic education programs in order to determine the need, practicality, and cost of educating students about classroom ergonomics. This bill, Senate Bill No. 1495, was approved in May 2003 (Senate and General Assembly of the State of New Jersey, 2003).

It has been established that heavy backpack weight may be related to pain of the back, neck, and shoulders, among other parts of the body (Siambanes et al., 2004). As described above, this pain may interfere with one's quality of life in many ways (Gengler, 2008, Moore et al., 2007). However, the prevalence of this issue in the New York City area remains unclear. In

addition, it is not known whether the type of school, public or private, is a factor affecting the incidence of back pain in students. Further research must be conducted in order to determine how many people this issue affects in our community. This was done through a survey questionnaire involving New York City elementary school students as participants. The survey focused on students' habits of backpack use and pain experienced by the students. The data collected was analyzed to determine any correlations— such as whether there was a strong correlation between relative backpack weight/method of wear and pain of the student. This data was used in making recommendations to reduce the impact of and improve the problem.

Field Research and Analysis

Surveys were distributed in random third, fourth, and fifth grade classes of PS58 and Miraj School. Parents were asked about their child's habits of backpack carrying and whether he or she experienced pain. Details of the pain, such as prevalence, location, frequency (see Appendix A, Fig. 2), and effects such as lost school time, absence, and medical treatment (see Appendix A, Fig. 3), among others were noted. In addition, the survey asked parents and their children which qualities they look for when purchasing backpacks. They were told to rate the comfort of their backpack on a scale of one to five, with five being most comfortable (see Appendix A, Fig. 2).

Informed parental consent was required before participation in the study (see Appendix A, Fig. 1). Following collection, the surveys were numbered and detached from the consent form in order to keep results confidential. The students and their backpacks were weighed; the distance from the bottom of the backpack to the student's waist was also measured (see Appendix A, Fig. 3).

From interviewing teachers and administrators, it was found that most teachers have observed students being troubled or discomforted while carrying their backpacks; this was seen mostly in lower grade levels (Cohen, 2009). However, whether their students experienced back pain has not been brought to their attention. Although there is no official limit on the amount of books students are allowed to carry (Khandare, 2009; Mahoney, 2009), all teachers stated that they have made attempts to decrease the students' weight load; many did not assign students to bring home textbooks, while some limited it to once or twice a week. It is also interesting to note that many of the teachers were not aware that the safe relative backpack weight is no more than 10 to 15 percent of the child's body weight.

From the survey data, it was found that the majority of students, 84.42%, carried two-strap backpacks, 11.69% carried shoulder bags and less than 3.0% carried tote bags. Of the seventy-five who completed the survey, 49.35% reported pain. Of these, 52.63% of participants reported pain while wearing backpacks, 5.26% when not wearing backpacks, and 26.32% when both wearing and not wearing backpacks. A small percentage of parents left these survey questions blank. In the current study, over 75% of pain reporters experienced shoulder pain, compared to lower numbers of students having neck (31.58%) or back pain (28.95%); 15.79% of the participants did not specify the location of pain. These categories were calculated separately, although many students noted two or more locations of pain. Although such a large percentage of students reported pain, a majority of them still rated the comfort of their bag as 3 or 4, with 5 meaning most comfortable (see Fig. 4). The answers to such questions may be subjective because students may have different perceptions of pain and comfort. When asked about priorities for purchasing a bag, 57% of the parents chose comfort as their top priority (see Fig. 5).

Fig. 4

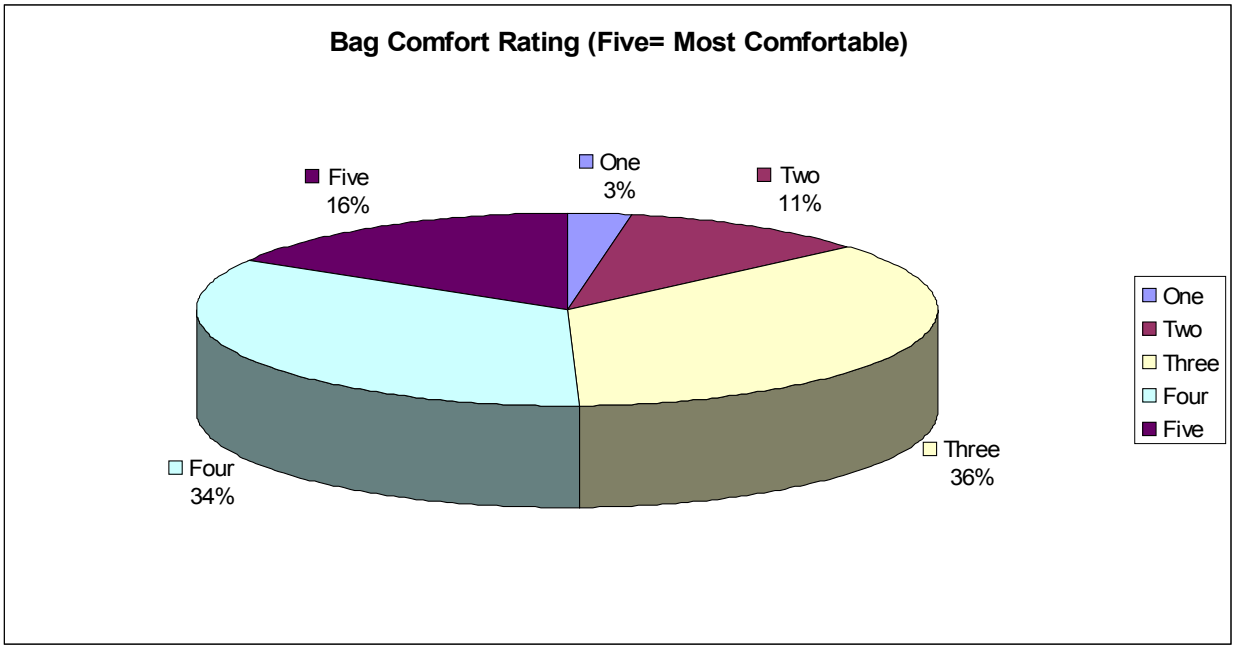
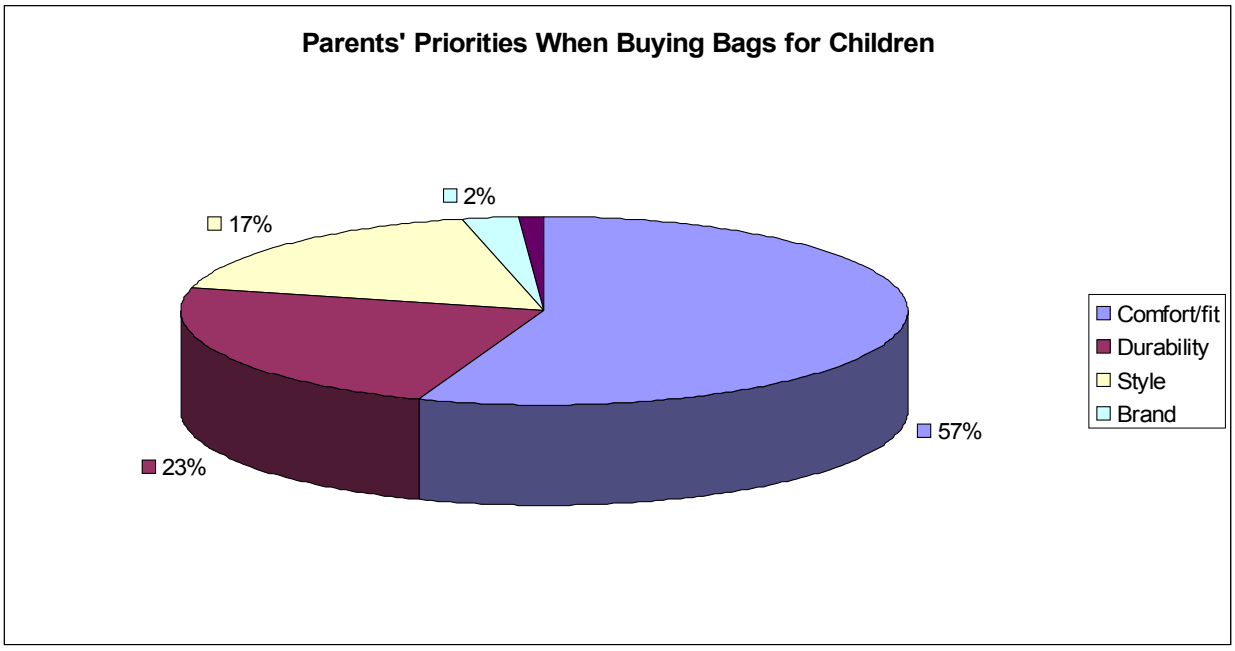


Fig. 5



It is known that carrying heavy loads places a large amount of stress on the shoulders (Siambanes et al., 2004). Carrying the backpack on only one shoulder causes uneven weight distribution, which can lead to pain and poor posture (Negrini et al., 2007). It is interesting to

note that only 27.27% of students carried backpacks on only one shoulder. Even with the small number of students carrying their bags on one shoulder, many students reported shoulder pain.

The mean relative backpack weight was 7.86% +/ -3.35%; it is recommended that the ratio between body weight and backpack weight should not exceed 10%. Of the 76 participants, 22.22% were found to have an unhealthy ratio. 60% of these students reported pain, while 40% did not. Although there were a low percentage of students with an unhealthy backpack weight, an unhealthy distance between the bag and waist, and improper wear, almost half of participants reported pain. These values indicate that there may be another factor influencing the students' back pain, although it remains unknown.

In one particular class, many of the students had relative backpack weights close to and even greater than 15%. It was observed that these students were required to bring home textbooks along with workbooks and other supplies. The AOTA suggests that the distance between the waist and the bottom of the backpack should be greater than or equal to 4 inches. The mean distance measured 3.3 inches +/- 1.17 inches; 37.70% of participants were found with a distance greater than 4 inches.

Despite these percentages, it was found that there was no correlation between backpack weight and pain ($r = 0.181864$). The results may have been skewed because not all participants were weighed. There was also no significant correlation between the distance from the bottom the bag to the waist and back pain ($r = 0.022076$). This shows that there must be other factors that caused majority of the kids to experience back pain, and further study is needed.

Recommendation and Implementation Plan

A website (www.bagsafety.weebly.com) was created in order to raise awareness and inform the public about backpack safety (see Appendix B Fig. 1). Information included

instructions for proper method of wear and healthy relative backpack weight (see Appendix B Fig. 2). The website addressed results of many studies regarding the effects of heavy backpacks on health and statistics regarding affected populations (see Appendix B Fig. 3). The results of our study were also included (see Appendix B Fig. 4). There is also a link to the American Occupational Therapy Association (http://www.promoteot.org/AI_BackpackAwareness.html) in order to provide those interested with more information on backpack safety and instructions for holding a Backpack Awareness Day at their school (see Appendix B Fig. 5). The websites will be advertised through pamphlets and flyers and handed out to schools and pediatrician clinics.

A Backpack Awareness Day will be held at P.S. 58 in June. Events planned include a presentation of the study's results to the parents and teachers, information distribution about backpack safety in the form of pamphlets and flyers (see Appendix C and D), and a workshop for the students. The presentation will inform parents and teachers about backpack safety for their children and students. The results of our studies will also be presented in order to raise awareness of the issue. At the event, there will be a demonstration for proper backpack loading. The students will be taught about proper backpack wear and will be asked about what they learned through a quiz.

Financial Implications

Cost Item	*Purpose*	*Donation*
Rent	Space in which to hold student workshops and present information to parents and teachers on Backpack Awareness Day.	Yes—P.S. 58 and Miraj School
Staff	Occupational Therapists and Physical Therapists to help present information.	Yes—P.S. 58 staff members
Supplies	Pamphlets and flyers to be printed.	No

Conclusion

Although no significant results were found in our study, there have been many studies that confirm the effects of back pain due to carrying heavy loads. Heavy backpack weight has been correlated with pain and musculoskeletal development (Rice, 2008, Siambanes, 2004). These conditions may require treatment and lead to lost school time (Moore, 2007) among other things.

Backpack Awareness Day is an annual event held sometime during September by the American Occupational Therapy Association (AOTA). Occupational Therapists usually visit several schools to raise awareness of backpack related problems. A Backpack Awareness Day can be arranged by contacting the AOTA via their website, http://www.promoteot.org/AI_BackpackAwareness.html. The AOTA have held Backpack Awareness Day events in various states in America.

By holding events such as Backpack Awareness Day, awareness of backpack related problems can be raised in the groups of children, parents, and teachers. Children would know the proper ways to load their backpacks to prevent back pain and, on the rare occasion they would still experience back pain, they would be able to recognize it and learn to voice their problems to their parents and teachers. The parents and teachers, in turn, would be more aware of such problems faced by the students. Once aware, they would know to take further steps to prevent back pain, such as decreasing the amount of weight carried by the students and/or buying more comfortable backpacks.

References

[1]D'Arcy, Yvonne. "Treatment Strategies for Low Back Pain Relief. " The Nurse Practitioner: The American Journal of Primary Health Care. (April 2006). 31(4):16-25.

[2]Dillon, Sam. "Heft of Students' Backpacks Turns into Textbook Battle. " The New York Times. (December 24, 2002).

[3]Gengler, Amanda. "Relieve the Cost of Back Pain. Plan; Health and Wealth. " Money. (October 2008). 44.

[4]Hestbaek, Lise, Charlotee Leboeuf-Yde, Kirsten Ohm Kyvik, and Clause Manniche. "The Course of Low Back Pain from Adolescence to Childhood. " Spine. (2006). 31(4):468-472.

[5]Holst, Jan. " Backpack awareness can save children from back, joint pain. " Michigan Live. (September 23, 2008).

[6]Iyer, Shruti R. "An ergonomic study of chronic musculoskeletal pain in schoolchildren. " Indian Journal of Pediatrics. (2001). 68(10):937–941.

[7]Jacobs, Karen. "Occupational Therapy National Awareness Campaign to Promote Health in Student Backpack Users. " Physical Therapy Practice. (2003). 15(3):03; 40-42.

[8]Michael, R. "AOTA Creates National Backpack Awareness Day. " Ergonomics Today. (September 2002).

[9]Moore, Michael J., Gregory L. White, and Donna L. Moore. "Association of relative backpack weight with reported pain, pain sites, medical utilization, and lost school time in children and adolescents. " Journal of School Health. (May 2007). 77.5:232(8).

[10] Korovessis, Panagiotis, Georgios Koureas, and Zisis Papzisis. "Correlation between backpack weight and way of carrying, sagittal, and frontal spinal curvatures, athletic activity, and dorsal

and low back pain in schoolchildren and adolescents. " Journal of Spinal Disorders and Techniques. (2004). 17:33-40.

[11]Negrini, Stefano and Alberto Negrini. "Postural effects of symmetrical and asymmetrical loads on the spines of schoolchildren. " Scoliosis. (July 9, 2007). 2.8:8. Health Reference Academic Center.

[12]Pascoe, D. D. & Pascoe, D. E.. "Bookbags help to shoulder the burdens of school work." Teaching Elementary Physical Health. (March 1999). 18–22.

[13]Rice, Valerie, Carita Devilbiss, and ConneMara Bazley. "An educational exercise on backpacks for schoolchildren." International Applied Human Factors and Ergonomics Conference. (July 2008).

[14]Siambanes, David, Jason W. Martinez, Edgar W. Butler, Thomas Haider. "Influence of school backpacks on adolescent back pain." Journal of Pediatric Orthopaedics. (2004). 24:211-217.

[15]"The U.S. Consumer Product Safety Commission National Electronic Injury Surveillance System (NEISS) database." (2001). Numbers quoted are the national estimated figures.

Primary Sources - Interviews

[1]Capic. Teacher. P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

[2]Cefalu. Teacher. P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

[3]Cohen. Teacher P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

[4]Falzone. Teacher. P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

[5]Khandare, Valshali. Occupational Therapist. P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

[6]Mahoney, Margaret. Assistant Principal. P.S. 58. "Backpack Weight Regulations." Personal Interview. January 2009.

[7]McSherry. Teacher. P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

[8]Verticchio. Teacher. P.S. 58. "Backpack Weight Safety Awareness." Personal Interview. January 2009.

Appendix

A. Fig. 1 – Consent Form

The Effect of Backpack Weight on Elementary School Students: A Research Study

You are invited to participate in a study to determine the effect of carrying heavy backpacks on children. The purpose of this study is to gather information about habits of carrying backpacks in elementary school students and possible effects of these habits.

This survey consists of fifteen questions and takes approximately 10 to 15 minutes to complete. The weight of your child and his/her backpack will be measured by the student researchers, in addition to completing the survey.

The risks of participating in this study are minimal. Your child may feel discomfort in having himself/herself weighed by the researchers. However, all results are completely confidential and the researchers will not be aware of the identities of the participants.

The benefits of this research study include a possible scholarship for the student researchers. Recommendations implemented based on the results of this study may also improve the quality of life of students in the community.

Consent

You are making a decision about whether or not to allow your child to participate in a high school student's research project. Your signature below indicates that you have been made aware of the project's description and purpose, any potential risks and benefits, and of the researcher's obligation to ensure confidentiality.

Your signature indicates that you have read the information provided above and have decided to permit your child to participate. You may withdraw your child at any time without prejudice after signing this form should you choose to discontinue your child's participation in this study.

_____
Print Student's Name

_____
Print Parent's Name

_____ _____
Parent/Guardian's Signature Date

-OR-

I do not wish for my child to participate in this study.

_____
Print Student's Name

_____
Print Parent's Name

_____ _____
Parent/Guardian's Signature Date

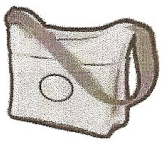
Contact Information

[redacted]

Fig. 2 – Survey Page 1

1. What grade is your child in?
   (a) 3rd (b) 4th (c) 5th

2. What type of backpack does your child carry to school?
   (a) tote (b) shoulder bag (c) two-strap bag (d) rolling backpack (e) other (Please describe)

_____
_____
_____

4. What do you generally look for when picking out your child's schoolbag? Please number the choices in order of importance (1 being most important).
   ____ style
   ____ brand names
   ____ comfort/fit
   ____ durability
   ____ other _____

5. **If you chose choice **C or D** for **question 2**:*
   How does your child usually carry his/her backpack?
   (a) one or both straps on one shoulder
   (b) straps on both shoulders
   (c) rolled on floor

7. How would your child rate the overall comfort of his/her bag?
   1 2 3 4 5
   (very uncomfortable) (very comfortable)

8. Has your child ever experienced back, shoulder, or neck pain? (a) yes (b) no

*If you chose choice **A** for **question 8**, please complete the remaining questions.*

9. Where has your child experienced this pain? Check all that apply.
   - ☐ neck
   - ☐ shoulders
   - ☐ upper back
   - ☐ mid-back
   - ☐ lower back

10. How often has your child experienced back, shoulder, or neck pain?
    (a) a few times a year
    (b) a few times a month
    (c) a few times a week
    (d) every day
    (e) always

11. When does your child feel this pain?
    (a) only while wearing the bag
    (b) while not wearing the bag
    (c) both a and b
    (d) other (please specify): _____

Please continue onto the next page ➔

Fig. 3 – Survey Page 2

12. How does this pain affect your child's daily activities? Check all that apply.
    - ☐ absence from school
    - ☐ visits to doctors/medical professionals
    - ☐ over the counter medication
    - ☐ lost classroom time
    - ☐ exemption from gym class or other physical activities
    - ☐ distraction from daily activities
    - ☐ other: (please specify) _____
    - ☐ none of the above

13. Has your child seen a doctor for his/her pain?
    (a) no (b) 1-2 times (c) 3-5 times (d) more than 5 times

14. Has you child ever taken medication or have any other medical treatment for his/her pain?
    (a) no (b) yes

For the researchers' use only: Please do not write in this box
School: _____
Weight of child: _____ lb.
Backpack weight: _____ lb.
Distance from bottom of bag to child's waist: _____ in.
Survey # _____

B. *Fig. 1 – Website Homepage*

Fig. 2 – Website "Causes & Prevention"

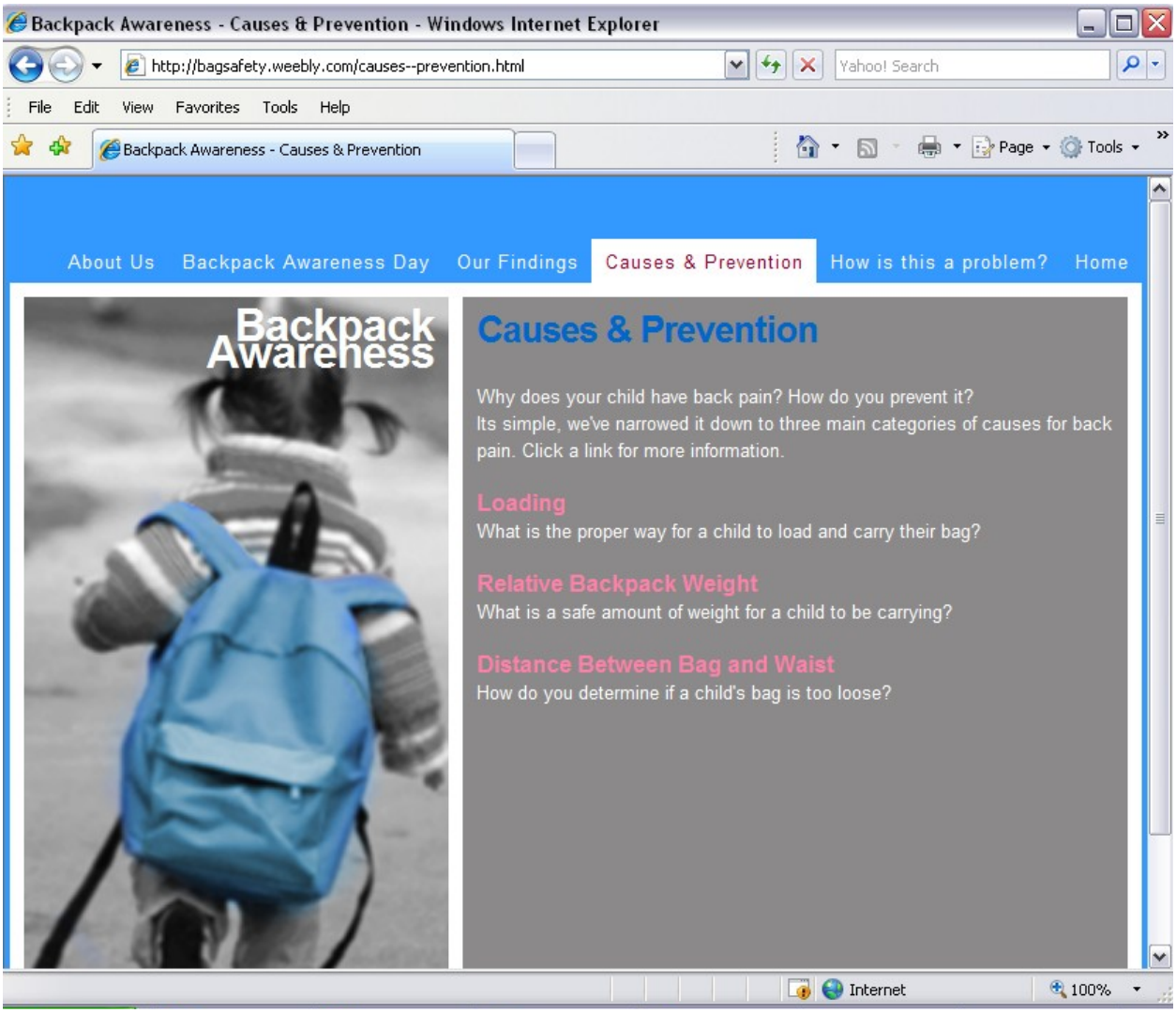


Fig.3 – Website "How is this a problem?"

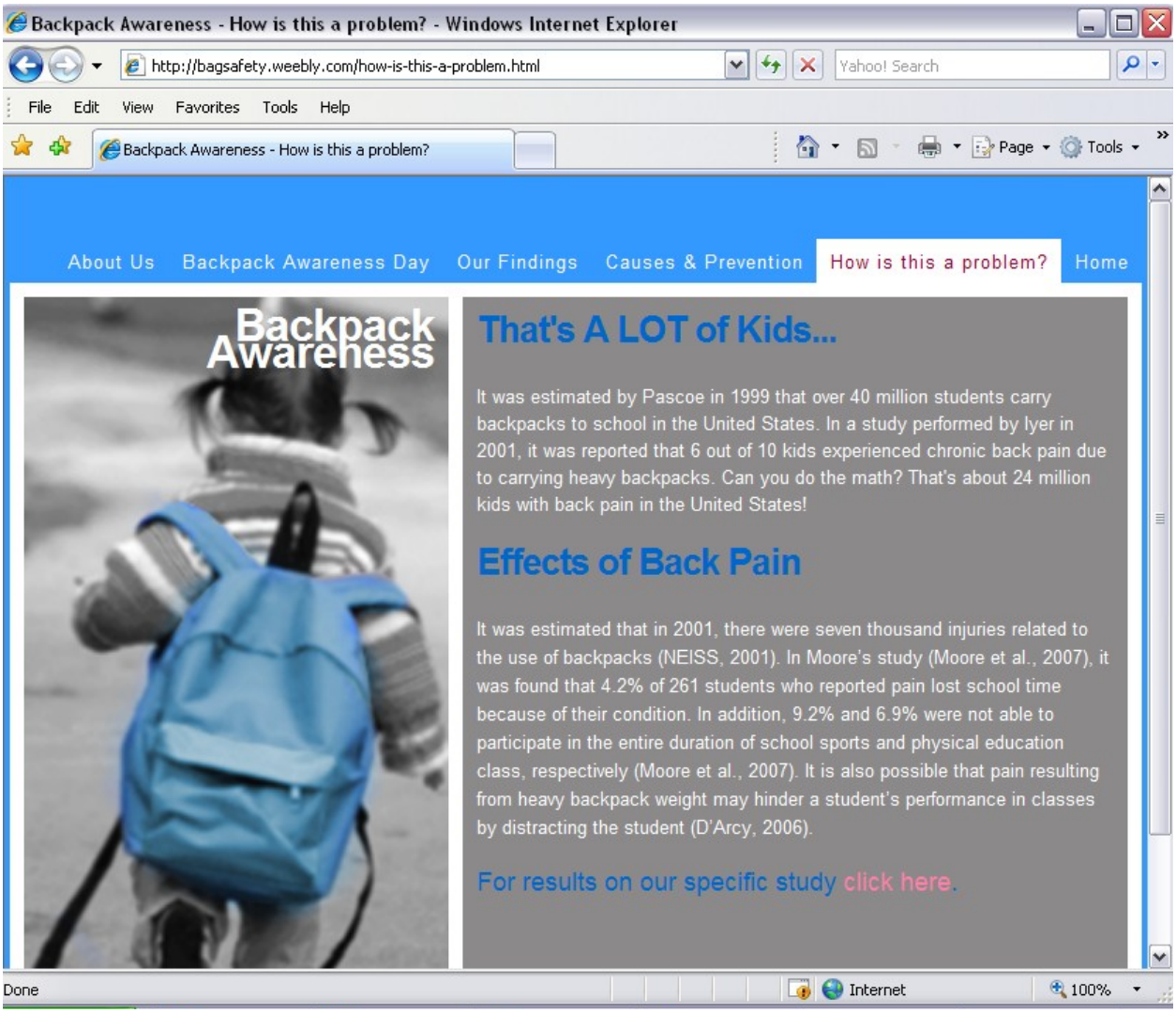


Fig. 4 – Website "Our Findings"

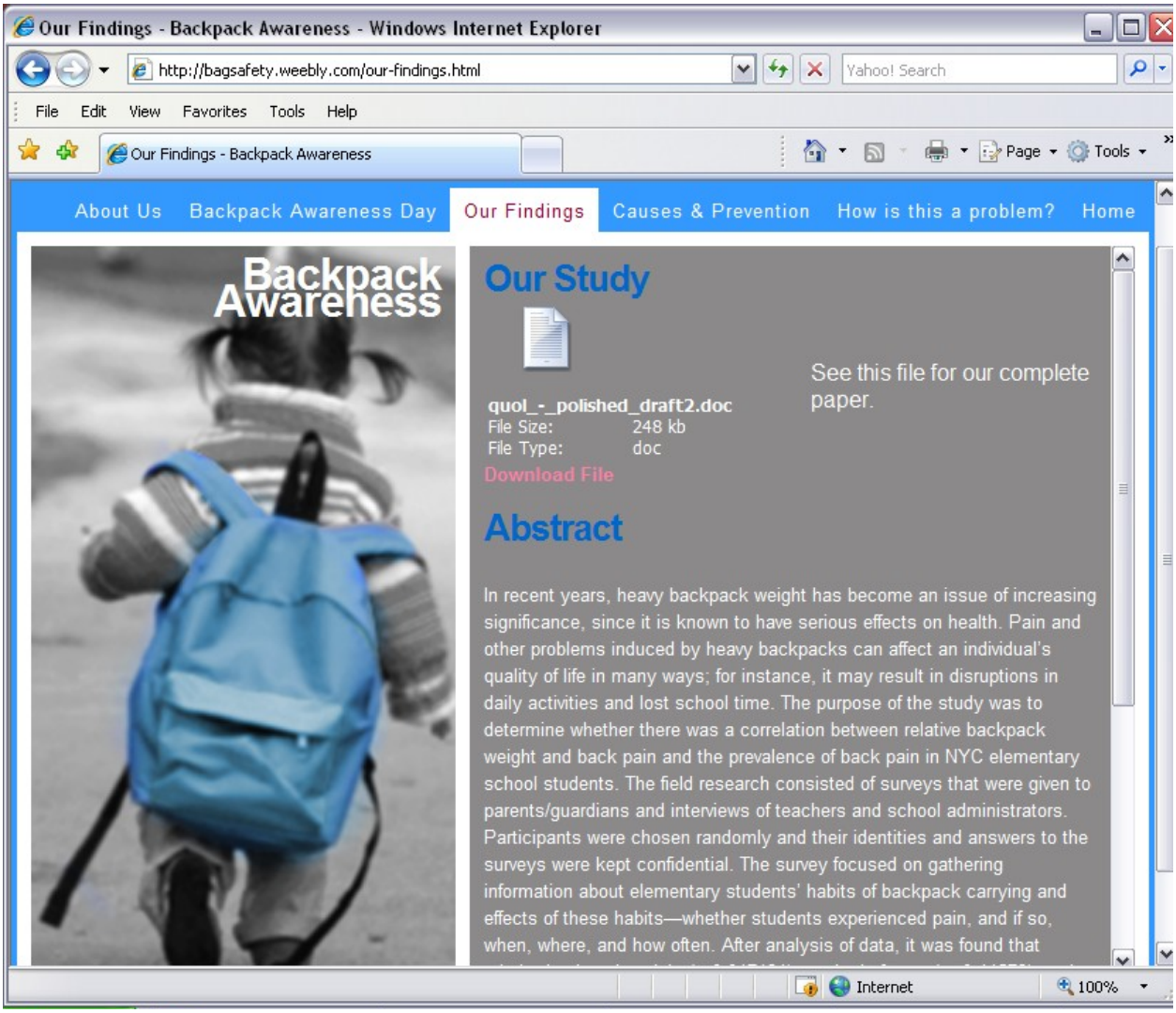


Fig. 5 – Website "Backpack Awareness Day"

C. *Pamphlet*

D. *Flyers*