Warnings for Children

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A mother rushed her 18 month old son to the hospital with flu-like symptoms. Within minutes after arrival, her son went into cardiopulmonary arrest and died before doctors could even make a diagnosis. The autopsy revealed the child swallowed nine pill-sized magnets. The magnets had somehow fallen out of a toy belonging to older children from the same family.

A mother walked about, carrying her infant in a sling, his body pressed safely against her. When she finished her tasks and opened the sling to remove her child, he was dead. He suffocated.

Two children re-enact a television show escapade where monkeys swing across a river on a rope. They are using cords from window blinds, but one child becomes entangled and strangles as the cord encircles his neck.

An adolescent, feeling alone and isolated makes a 'friend' on-line and agrees to meet him. Her 'friend' is a child predator with a sexual offense history.

Could these accidents be prevented? Would a warning have sufficed to alter the behaviour of the caretaker or the child in such a way that a precious child would still be living? The sad fact is that we cannot know the answer. From these short scenarios, we do not know if product warning labels accompanied the products, and if they did, whether they were prominently displayed, easily understood, and clear in conveying the potential dangers.

We do know that warnings can work to alter the behaviour of caregivers and children's use of products (Wogalter and Laughery, 2005; Kalsher and Wogalter, 2008). According to a report by Health Canada (2003), health-related information on cigarette packages were rated second as an information source among youth (television was first). Also, after 30 months of providing the messages on cigarette packages, 86% of the youth polled reported believing the

warnings were effective sources of information, with 56% stating the messages helped them reduce their smoking or reduce their smoking around others (57%).

Clearly, warnings are expected to assist in accidental injury prevention. The US Food and Drug Administration (FDA) and the European Union's Council of Ministers and Parliament support the use of labeling for certain products. For example, the European Union's Council of Ministers and Parliament intends to require foods containing certain colorings to add a warning by mid-2010, stating "Consumption may have an adverse effect on activity and attention in children" (FlexNews, 2010). In another example, in the US, there is a mandate that labeling be included on products with small parts, designed for children of ages 3 to 6 (Child Safety Protection Act, 1994). Similar warnings are required for choking hazards for balloons, small balls, and marbles for children aged 3 and older. Warnings are also required for items such as bicycle helmets, which must include information on fit, protection, and replacement needs (in case of damage) (Bicycle Helmet Safety Act, 1994). Warnings are considered part of a good line of defence for protecting children against inadvertent injury (Kalsher and Wogalter, 2008).

Why are Warnings Important?

Many adults are unaware that injuries are a significant public health concern in the United States, as well as in other countries. According to the World Health Organization, over 2000 children and teenagers die each day from a preventable injury (Pederson, et.al. 2008). This translates to nearly 900,000 deaths, along with non-fatal injuries affecting 10 to 30 million children annually (WHO, 2005).

Globally, the leading causes of accidents resulting in death are traffic accidents, drowning, burns/fire, falls, poisonings, as well a combined category that includes smoothing/asphyxiation, choking, animal or snakebites, hypo and hyperthermia, and natural disasters (Ibid). The leading causes of injury death differ by age, gender, race, socioeconomic background, and country. For example, in the US two-thirds of injury deaths for children under the age of one were due to suffocation, while unintentional motor vehicle accidents was the leading cause of injury for children and youth of ages 1 to 19 (CDC, 2006).

There are a great deal more unintentional injuries resulting in emergency room visits. For example, approximately 9.2 million US children visit an emergency room following an injury each year (Nagesh et. al., 2008). For those under a year, rates did not vary by gender, but for those between ages 1 and 19, boys visited more often than girls. Table 1 shows the leading causes of injury (Ibid). Suffocation occurs most often among children who are under a year old, while fires/burns and drowning occur most for those ≤ four, and nonfatal falls and poisoning among those between ages one and four (Ibid).

The salient point is that a well-designed injury prevention program can make an impact by decreasing unintentional injuries and deaths (Kalsher and Wolgalter, 2008; Rice and Lueder, 2008). Such a program would include adhering to the hard control hierarchy and involving communities-of-interest (Table 2). As previously stated, warnings are an important part of a high quality system for preventing injuries. The first line of defense is always to remove the hazard entirely, thus removing the possibility of a guard not working or a human error resulting in injury.

Table 1. Leading Causes of Injury for US Children.	
Ages	**Leading Causes of Injury**
All Children	**Falls**
Ages 0-9	• Animal bites or insect stings • Being struck by or against an object for children
Ages 10-14	• Overexertion • Being struck by or against an object
Ages 15 – 19	• Falls • Motor vehicle occupant injuries • Being struck by or against an object

Table 2. Elements of a Good Injury Prevention Program.	
Adhere to the Hazard Control Hierarchy	Eliminate Hazards through: • Designing out hazards. • Guarding against those hazards that cannot be eliminated through design. • Warning about hazards that cannot be eliminated through design and/or guarding
Involve Communities of Interest	• Manufacturers • Commercial sales groups • Caregivers • Children • Cities, neighborhoods, and towns • Schools, youth centers, and churches
Use both a macroergonomic and microergonomic approach	• Include Outreach Programs • Identify community trends • Offer educational seminars to commercial sales groups, schools, daycares, and health care groups • Evaluate potential areas of risk and publish the results in local newspapers • Teach caregivers and children about hazards and risks • Participate in National Events, such as National Poison Week

While no one purchases an item expecting to incur an injury during use, accidents happen. Sometimes the issue is a defect in the product itself, other times accidents can be due to misuse of

the product or a deficiency that appears from wear and tear of a product over time. Warnings are important when a manufacturer seeks to alert users as to the proper use of a product, and what could happen if they do not use it properly. Some dangers are not obvious to the users. For example, hand sanitizers are frequently used when soap and water are not available. Yet, caregivers may not think about the impact should their child suck or lick their fingers after application of the sanitizer. Wogalter and Laughery (2005) identified three main purposes of warnings: 1) to assist individuals in making informed decisions by conveying pertinent, safety-related information; 2) to reduce or decrease injuries and health problems by encouraging safe behaviors; and 3) to remind (or re-remind) users of potential hazards.

The US government agency that protects consumers from the risk of injury or death, caused by products, is the Consumer Product Safety Commission (CPSC), under the authority of the Consumer Product Safety Act (CPSA). Table 3 shows some of the products that are and are not within the scope of the agency. The CPSC publicizes product recalls and establishes product safety standards and manufacturers fines for violations (CPSC, 2010). Specific test methods are required by the CPSC for simulating use (and potential misuse) of products designed for children under age eight. These test methods assist manufacturers in identifying potential harmful situations (hazards), such as reasonably foreseeable misuse, damage or abuse of the product (CPSC, 2010; 16 CFR §§ 1500. 50 to 1500. 53). Manufacturers in the US have a duty to warn users both about forseeable users and misuses of their products (Kalsher and Wolgalter, 2008; Madden 2006). As noted by Kalsher and Wogalter (2008), “if a product needs instructions or warnings to operate safely, but the product lacks adequate instructions and warnings, then the product can be considered defective” (p. 519), in accordance with the US doctrine of strict liability (American Law

Institute, 1998, as cited by Kalsher and Wogalter, 2008). Manufacturers are expected to have better knowledge of their product, as well as the most recent information about their products' use, compared with the products users' knowledge.

Table 3. Examples of products covered and not covered under the Consumer Product Safety Commission (CPSC).	
Covered	**Not Covered**
• Furniture • Clothing • Toys • Tools • Child Carrying Devices • Child Protective Devices (helmets, wrist guards, etc.)	• Tobacco • Medical Devices • Food

Why are Children More Vulnerable?

Children are more vulnerable to unintentional accidents for a number of reasons. First, as children, their primary 'job' is to explore and learn. For very young children, much of their play is explorative and based on trial-and-error. They explore through the use of their hands and mouths, touching, feeling and tasting things. Up to age two, they are reaching, grasping, lifting, banging, throwing, and mouthing objects. During play, children start and stop, select and limit their choices, thus directing their own recreation without a pre-determined, specific end-goal. Through their play they learn to manipulate objects, solve problems, understand their environment, control their own attention and focus, and to comprehend their own effect on the things and people around them. Through play, they learn to succeed and fail and try on various roles and personalities, as they explore both the world around them and their interactions with that world. They are building an underlying physical, emotional, social, and cognitive base for future endeavors, such as school and

work. Thus, their exposure may be greater, due to their own exploratory behaviors as well as their propensity to mimic adults. Their imitations of adults may lead them to use hazardous products or attempt activities beyond their abilities. Their exposure may also be greater due to their interaction with the environment. For example, their exposure to substances on the floor or ground is greater, as they are in frequent contact with the environment at that level during crawling and play.

> "…play is powerful and has structure and purpose and provides a means by which cognitive, physical and social learning occurs" (Burke, 1998).

Second, these tiny, intense investigators are naïve. Their immaturity and lack of experience can make even their simplest exploratory journey dangers as they encounter typical, unexpected perils, such as door jams that pinch, brick fireplaces that scratch or cut when you fall against them, hot water on a stove burner that scalds, or small objects that can choke a small child (Figures 1 - 3). Even as children age, they do not always fully understand the consequences of their actions. Children begin to understand consequences as they enter the formal operational stage of development at about age twelve and begin to use deductive reasoning, logic, and systematic planning to solve problems (Wadsworth, 1989). Yet, recent research on brain development shows the frontal cortex does not mature until young adulthood (Sowell, Thompson, Homes, Jernigan, and Togo, 1999; Thompson, Giedd, Woods, MacDaonald, Evans, and Toga, 2000). The implications from imaging research are that even teenagers and young adults may not think through consequences comprehensively, and respond impulsively and emotionally (Baird, Gruber, Fein, Maas, Steingard, and Renshaw, 1999).

Third, an injury that occurs during growth can differ from an injury that occurs after one is grown. For example, the growth plates (physis) of children are soft and more easily damaged during physical activities or from infection or disease. They are located near each end of the long bones and are the weakest area of a child's skeleton. An injury that might cause a sprain in an adult, might result in a serious growth plate injury in a child, potentially interfering with proper development (NIH, 2010). Adolescent girls are subject to back pain (Lueder and Rice, 2008), which may influence (or be influenced by) their activities such as carrying books or backpacks, participating in sports, and sitting for long periods of time during school. Another example involves accidental poisonings. Children are physically smaller than adults and have faster metabolisms and respiration. Their bodies absorb poisons more quickly than adults, given the same exposure level (Rice and Lueder, 2008) and they retain more poison per pound of body weight. In addition, developing physiological systems (in a child) are more vulnerable to damage (Ibid).

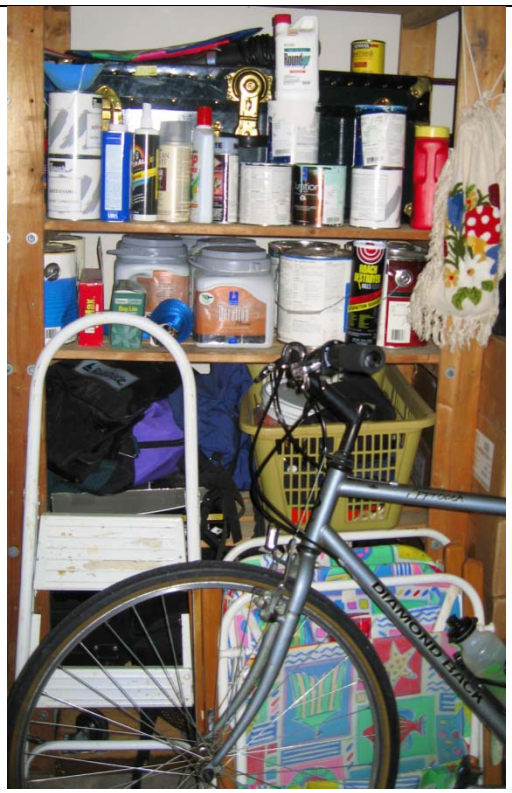

Figure 1. Storage areas under the sink or in the garage often hold items that can pose a hazard t children.

Figure 2. Children are naïve. Young children may be unable to distinguish between the safety or relative dangers of objects, such as these liquids.

Figure 3. A child is not likely to be able to discern which of these pills is medicine and which is candy, and may impulsively eat one without asking an adult for guidance.

Fourth, misunderstandings occur between children and adults. Children cannot express themselves and their concerns easily, and their caregivers may not readily comprehend what is wrong. A child may not recognize there should be cause for concern or may not know how to accurately describe their unease or pain. Because adults and children may have similar symptoms

for completely different disorders, caregivers may discount a child's report of pain (Burton, Clarke, McClune, and Tillotson, 1996). Parents (or other caregivers) may overestimate the maturity level of their own children and their ability to handle certain situations (Brown, Lepsis, Chen and Harris, 2002 as cited in Torres, 2008; Paradis, as cited by Hendricks, 2008) or underestimate the seriousness of the situation - both can put a child at greater risk.

These misunderstandings can also apply to warnings. Youth may be attracted to certain characters, shapes for colors. For example, children may be drawn to poison labels showing a skull and cross bone, thinking it they are associated with pirates (Schneider, 1977). A study conducted by Pierce and colleagues (1998) demonstrated cigarette advertisements featuring "Joe Camel" were popular among adolescents. Children and teenagers may find labels they associate with maturity to be attractive (Rated R movies or videogames) (Resnick, 2006). Others may seek test their limits by engaging in behaviors others perceive as unsafe, believing they can "handle it" (Bushman and Stack, 1996). On the other hand, being able to refer to a warning may reinforce warning or direction provided by caregivers (Kalsher and Wogalter, 2008).

Who are the Warnings for and What makes them Effective?

Warnings for children need to target adults who are caregivers, as well as children. Children rely on adults. Typically, adults purchase children's products. They also guide children on safety issues they may not understand themselves for the reasons described above.

Warnings for Adults. Guidelines for the design of warnings are provided by the American National Standards Institutes (ANSI) Z535.4 standard (see Table 4 and Figure 4). Internationally, the International Organization for Standardization (ISO) publishes standards for safety labels. The primary difference is that the ISO standard recommends the use of pictures rather than text, in an attempt to broaden the warnings application to those who cannot read the particular language in which the warning is written. ANSI permits a symbol to substitute for text, if testing reveals 85% comprehension and less than 5% misunderstanding of the critical message.

Warnings should be parsimonious. That is, they should be easy to understand, uncluttered (so the reader can quickly and easily grasp the meaning), and use the simplest, most straightforward manner of presentation possible, while still accurately conveying the appropriate message. Graphics are particularly helpful to reinforce the verbal and/or numeric message and assist with providing the reader with a conceptual understanding.

In creating easy to comprehend written warnings, one should attend to the likely reading ability, reading grade level, visual acuity, and the primary language of the individuals who will need to receive the message. The durability of the warning label is also vital, as fading, scratching or other damage can erode the quality of the warning and the readers' ability to consequently understand the message (Figure 5). Pictures can often convey the message more quickly, but care must be taken to ensure they are understood and will result in behavioral change, rather than simply eliciting opinions that the picture (and warning itself) will impact behaviors. Warnings should be displayed prominently and the placement of a warning can mean the difference between the caregiver or user noticing it and never seeing it. Optimally, warnings should be placed on the

object or product itself, where it is most evident. Warnings may also be located on inserts or within the products instructions as supplements, for any of the following reasons; there is insufficient room on the product, there is additional information necessary for safe use, the placement of the warning would interfere with the products use, or it is probable the warning could erode with use. Placement of warnings should follow carefully studied and implemented prioritization according to the hazards themselves (Box 1), as well as the spacing or time limitations associated with the product (Kalsher and Wogalter, 2008). A set of guidelines for warnings, that is applicable to warnings for children and for adults can be found in Kalsher and Wogalter (2008, pg. 526).

Table 4. ANSI guidelines for warnings.

Requirement	**Description and/or Example**
Signal Word • Danger: Notifies reader about a condition which, if not avoided, will result in death or serious injury. • Warning: Notifies reader about a condition which, not avoided, could result in dealth or serious injury. • Caution: Notifies reader about a condition which, if not avoided, may result in miniro or moderate injury.	 • White letters and red background • Black letters and orange background • Black letters and yellow background (sometimes are reversed)
Hazard, nature or type,	i.e. 'what the hazard is' Cut, Burn, Shock, Drown, Poison, Choking, etc.
Consequences likely if the hazard in encountered, ie	i.e. 'what can happen' Severe injury, death, serious accident, sometimes similar to nature or type of hazard
Instructions on how to avoid the hazard	i.e. 'how to avoid the hazard'

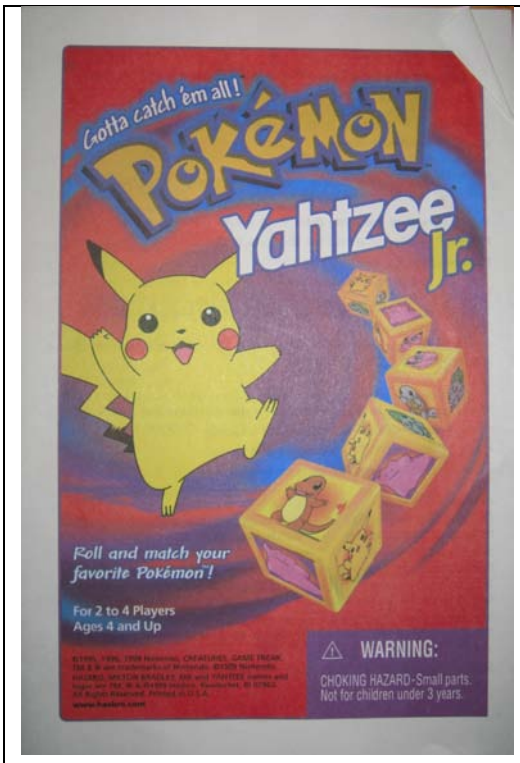

Figure 4. The hazard warning on this box includes a signal word, the hazard, the potential consequences if one does not avoid the hazard, and how to avoid the hazard.

Figure 5. The warning on this basketball stand has become worn due and can no longer be read or understood.

Box 1. Prioritization of hazard warnings should include:

- Knowledge of the user (awareness, familiarity, and understanding)
- Overall importance
- Chances of injury
- Severity/gravity of injury

(Wogalter, 1997a and 1997b)

Kalsher and collegues (2008) conducted a study with adults investigating pictoral symbols associated with warnings for a child choking hazard (i.e. for marshmallows, which are are a choking hazard for children). Their symbols depicted faces and hands which were suggestive of an

individual experiencing choking. They found comprehension estimation as a useful tool for 'down-selecting' potential warning symbols (Kalsher, Brantley, Wogalter, and Snow-Wolff, 2000; Kalsher and Wogalter, 2008), with comprehension of specific symbols ranging from 23.3% to 74.1%. Interestingly, when the same respondents were asked to compile three of the pictorials into a depiction of choking, they selected three pictorials demonstrating the perceived progression one might experience when choking, rather than simply selecting the three with the highest comprehension levels (Ibid).

Warnings for Children. Children's ability to comprehend warnings differs according to their age and their cognitive abilities. The effectiveness of the warning will depend on the child's understanding of the message (written or pictured) and their ability to conceptualize, apply logic, and associate the warning with their own behaviors and consequences of their actions. Those who design warnings must test them with the products' target audience, such as children of a particular age range. Evaluations should determine if a warning is noticed, read, and understood. It is also important to ascertain if they are important and believable (Steward and Martin, 1994; MacKinnon, Pentz, and Stacey, 1993). In addition, several versions of a warning may be necessary to effectively reach children of differing abilities. Little research has been conducted specifically on warnings that target children, and warnings tested for effectiveness with adults may or may not be effective with children (Kalsher and Wogalter, 2008).

Warnings for children should not be subject to individual interpretation, thus they should be explicit and unambiguous. For instance, general warnings were found to be less effective than disease-specific warnings by the Federal Trade Commission (1981). Still, each warning should be tested and then evaluated for most appropriate use. Research indicated that adolescents

remembered the warning “Cigarettes Kill” better than the full US tobacco warning on cigarettes (Fischer, Krugman, Fletcher, Fox and Rojas, 1993 as cited in Duffy and Burton, 2000). Yet, Duffy and Burton (2000) found children rated the warning “Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy” to be more important and more believable than the warning “Smoking Kills”. The effect was stronger for elementary vs. high school youth, girls vs. boys, and whites vs. blacks. In addition, they found that youth who smoked rated all warnings as less important than did non-smokers (Ibid). Designers need to consider what their warning is to convey, that is, whether it is more important for children to notice, read, remember, recognize, understand, believe, think it is important, or adhere to the message. While all may be considered crucial, they are not all the same and there may be times when prioritizing is necessary.

Warnings should be prominent in terms of color, size, contrast, and placement. Before someone can adhere to a warning, they must first be aware of the warning. Warnings for children should be carefully and systematically evaluated to determine whether they are noticed, understood (interpreted as intended), and yielding the anticipated results (i.e., encouraging children to avoid, rather than seek to encounter the hazard) (ANSI, 2002; ISO, 1988). The latter is suggested, but not always possible, as testing risky behaviors can itself yield precarious situations.

Pictures or pictograms may be best for very young children (Kalsher and Wogalter, 2008); however they may still be most effective after they have been explained to children (DeLoache, 1991). Even pictures should be tested both alone and in combination with text and/or instructions, as the issue is complicated. For example, while children rated cartoon characters as more believable than plain text, the effectiveness of the type of character differed according to the age

of respondents (Duffy and Barton, 2000). Elementary school children found penguin cartoon characters more believable than plain text, but high school students did not (Duffy and Burton, 2000).

The most well known pictograph in use for warnings is Mr. Yuk. Caregivers place the bright green and black stickers depicting Mr. Yuk on household or other items to serve as a warning for children. An added benefit for caregivers is the inclusion of the toll-free poison telephone number. Mr. Yuk was created by the Pittsburgh Poison center in 1971 (UPMC, retrieved March 2010). Operative research on the efficacy of Mr. Yuk stickers has not been conclusive, nor has the influence of coupling Mr. Yuk with educating children as to its' meaning been shown (Fergusson, Horwood, Beautrais, and Shannon, 1982; Vernberg, Culver-Dickinson, and Spyker, 1984). The graphic of Mr. Yuk is a registered trademark, as well as a service mark of the Children's Hospital of Pittsburgh of UPMC and protected by copyright.

While most warnings can be offered through visual (text and pictures) means they can also be presented through auditory, olfactory, or gustatory (taste) processes. Unpleasant odors or tastes can serve as a guard or warning (Kalsher and Wogalter, 1988). Pleasant odors, such as household cleaners smelling of orange, cinnamon or ginger may make the house smell nice, but they can also be appealing to children. While children are rather proficient at determining whether an item is suitable for eating (Wijk and Cain, 1994), confusing them by making hazardous items smell like food is not advisable!

The message itself is important. Warnings based on long-terms effects do not seem to impact adolescents in the same way they impact adults. This may be because youth tend to see

themselves as less vulnerable, as they have more time to quit before the impact is realized. Younger individuals are also more concerned about the immediate impact of their activities on their social interactions, such as whether it stains their teeth, creates bad breath, or may result in blemishes on their skin (Goldman and Glantz, 1998; Health Canada, 1999).

Finally, while hazardous warnings usually engender connotations of specific labels or conditions, it must be noted that the admonitions and guidance of caregivers also serve as warnings. The stance taken by mentoring adults, along with their teachings, can impact a child's perceptions and reactions (Uchiyama and Ito, 1999; Zeece and Crase, 1982). Large scale outreach programs can also impact children's behaviors (Sibert et.al. 1999).

Such programs can be fun for caregivers and children. Planners can direct education and interventions to caregivers, as well as children (Table 5, Figure 6).

Table 5. Event Ideas for a Community Safety Program.

Events	**Activities**
Poster contests	Children construct safety posters and receive awards for the 'best poster'
Rallys	Children demonstrate their safety knowledge, skills, and equipment
Social Interactions	Older children put on a play to educate younger children

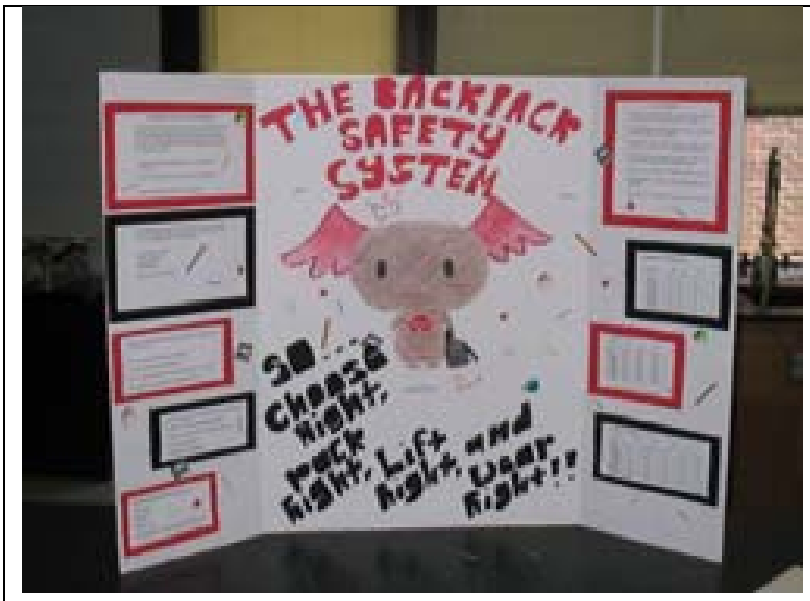

Figure 6. A poster and prop created for a parent-teacher meeting during which the students presented information via lectures and a poster-session. The center of the poster says "The backpack safety system, so…choose right, pack right, lift right, and wear right".

Conclusions

Children are susceptible to injury and in need of guidance to make sound decisions regarding products and product use, even through their teenage years. Most warnings for children will focus on their adult caregivers, as caregivers are responsible for the health and welfare of the children they supervise. Warnings for children should follow or augment other methods of hazard control and injury prevention. While suggestions are made for designing warnings for children, there is little research available that focuses distinctively on the efficacy of hazardous warnings and warning labels for children. Additional research is sorely needed.

Injury prevention requires a broad spectrum approach involving product manufacturers, caregivers, child users, and communities. There are many children and many unforeseen dangers.

Only through resolute effort can we identify methods to keep our children safe, while still promoting their development, learning, and ultimately – their independence into adulthood.

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