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CPSA 6 (b)(1) Cleared
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Office of the Secretary
U.S. Consumer Products Safety Commission
Washington, DC 20207

Subject: Petition For Rulemaking

Dear Sir or Madam:

This petition requests that the CPSC initiate a new rule requiring that the buckles used to fasten child restraint systems in various products meet a child-resistance standard. Specifically, this petition requests that these buckles be required to employ a double-action release mechanism, in which two separate and distinct actions are needed for release. Currently, there is no such standard, and the lack of one is a contributing factor in many injuries which occur when children fall out of these products.
The products for which this new rule is requested include strollers, high chairs, changing stations, shopping carts, and the like.

Support for this request follows, drawn from 1) my personal experiences and those of my family, friends, and various other child caregivers; 2) injury data from the CPSC's NEISS and other databases; and 3) a recent research study which points up the lack of child-resistance in stroller restraint buckles.

Personal Experiences

While raising my two daughters, I had much personal experience with these restraint systems, and found them to be largely ineffective – primarily because my children, even while quite young, could quickly and easily release the conventional side or center-release buckles on the restraints. They then would stand up in the stroller, high chair, or shopping cart, and were often in danger of falling out. And in fact, they sometimes did fall out, incurring moderately severe injuries. My friends and family have all had similar experiences.

In addition, I have since spoken with many other parents on this subject – primarily after seeing those parents encounter this problem themselves while pushing their children around malls, dining with them in restaurants, and shopping with them in grocery and other stores. To a person, they were very aware of the problem, frustrated by it, and desirous of a more effective, more child-resistant buckle.

Injury Data

Methodology

I examined the NEISS database of stroller, high chair, and shopping cart injuries over the 7/31/98 to 7/31/99 timeframe (a year's worth of the latest available data). For each product, I isolated the injuries that were caused by children falling *out*, such as would occur when the restraint system was not used, or when it was used but was ineffective.

Falls which occurred from children climbing on or into the product were not counted as "falls", nor were falls which were a consequence of the product being first tipped over. More effective restraint systems would not necessarily prevent those types of falls, and thus it seemed prudent to not include them in my results. Said another way, the "children's injuries from falls" numbers shown in my results truly represent the number of injuries which could be prevented by more effective restraint systems.

Once the injuries were tabulated for the NEISS sample of hospital emergency departments, *national* injury estimates were computed using the sample-to-national "gross-up" factors from calendar year 1998 (again, these were the latest available).

Results

The results are summarized in the attached table. A few highlights follow:

- Almost 33,000 injuries/year in the U.S. result from children falling out of strollers, high chairs, or shopping carts – **that's two-thirds to three-quarters of the total children's injuries from these products.**
- These injuries can be very severe – skull fractures, concussions, head wounds, and broken bones often result, because the child usually falls head-first from a significant height to a hard-surface floor.
- Moreover, these are just the reported injuries – it's likely that many more injuries occur, but go unreported due to lack of medical insurance, parental embarrassment at their perceived inattention, etc.

Discussion

Certainly the magnitude of the injury numbers justifies further study of restraint system safety and effectiveness. Clearly, a significant number of injuries could be prevented if a more effective restraint system, which could not be defeated by a child, were a requirement on these products.

I recognize that some portion of these falls occur when a restraint system is not present, or when one is present but is not used. However, from my own personal experiences, those of my family and friends, and those of other parents I've spoken to, I can attest that a major reason for non-use of restraint systems is *ineffectiveness*, not inconvenience. Most people consider the conventional plastic snap buckle used in the restraints to be sufficiently convenient. These buckles are *ineffective*, though, and that leads to non-use. Children as young as 6 months can easily release the buckles, and they often do this repeatedly after an adult has strapped them in. After a while, the adult gives up – after all, why bother using the restraint system if the child can quickly and easily release the buckle and unstrap themselves? In sum, if these restraint systems were more effective, they would undoubtedly enjoy greater use.

I have attached actual verbatim comments, drawn from the NEISS, Accident Investigation, and Reported Incident databases, which vividly illustrate the problem of children unbuckling their restraint straps.

It's interesting to note that the current ASTM standards for strollers, high chairs, and the like devote considerable attention to such matters as structural integrity, gaps between parts, etc. However, those things cause relatively few injuries, as evidenced by the NEISS injury data. *Falls* cause the great majority of injuries, yet there is relatively little in the standards concerning restraint systems, and nothing in them concerning the child-resistance of the restraint system's weak link – the buckle.

Recent Research Study

For further information and reference, I have also attached the results of a study on stroller buckles, done by Marcella Ridenour of Temple University's Biokinetics Research Laboratory. This study points up the lack of child-resistance in these buckles, and the ease with which even very young children can defeat them. The study also notes that safety features on other children's products, such as crib side rails, employ double-action mechanisms to prevent children from inadvertently or intentionally defeating them. The inherent child-resistance of double-action mechanisms is also well established in such devices as medicine bottles and cleaning solution containers.

Importantly, it would not be effective to merely increase the force needed to release a conventional side or center-release buckle. First, it would be difficult to determine just how much to increase the force by. As Ms. Ridenour's study points out, children's automobile seat buckles currently have a force standard, but many children are still able to open those buckles. Second, taking such a "brute force" approach might make the buckles too difficult for older caregivers, or caregivers with reduced hand strength, to operate.

Relevant Current & Upcoming CPSC Studies

Over the past few months, I have spoken informally with a number of CSPC people on the subject of child restraint system safety. The folks I've talked to have been very helpful and informative, and I was pleased to hear that this issue is already on your radar screen. In fact, the Division of Human Factors is about to undertake a comprehensive study of restraint system safety and effectiveness in children's products. Funding has been provided for this study in the current fiscal, and from my discussions with the people involved, it seems like the study will be given high priority when it comes to resources, scheduling, etc.

It seems appropriate that this upcoming study include an examination of two specific issues raised by this petition – first, the significant number of injuries which occur even when a restraint is used, because the restraint buckle is defeated by the child; and second, the degree to which ineffectiveness of the restraint contributes to non-use. A comprehensive examination of these two issues would provide a good basis for determining whether child restraint systems would benefit from having child-resistant buckles.

Separately, Hazard Analysis is currently conducting an update of their 1994 study on shopping cart safety. It also seems appropriate that this update include an examination of the two issues discussed above, with a view towards determining whether shopping cart restraint systems would benefit from having child-resistant buckles.

Summary

Hopefully, your current and upcoming studies, and this petition, will drive a change in the restraint system standards for children's products, thus helping to reduce the large number of injuries caused by children falling out of them. Of note, buckle designs which require two distinct actions for release are already available, and could be quickly adopted by manufacturers in order to meet a child-resistance standard. If you have any questions about this petition, please feel free to contact me at my home number, shown at the top of this letter.

Sincerely,

John Galbreath

STROLLER, HIGH CHAIR, AND SHOPPING CART INJURIES, 7/31/98 TO 7/31/99

	NEISS Sample of Hospital Emergency Depts.			Estimated Total U.S. *			
	Total Injuries	Children's Injuries	Children's Injuries From Falls	Total Injuries	Children's Injuries	Children's Injuries From Falls	% of Children's Injuries From Falls
Strollers	508	469	321	14,944	13,796	9,443	68.4%
High Chairs	263	254	188	8,432	8,143	6,027	74.0%
Shopping Carts	994	781	497	34,524	27,126	17,262	63.6%
Totals	1,765	1,504	1,006	57,900	49,115	32,732	66.6%

* Estimated using NEISS sample of hospital emergency depts. and CY98 sample-to-national "gross-up" factors.

SAMPLE OF VERBATIM COMMENTS FROM STROLLER, HIGH CHAIR, & SHOPPING CART INJURIES

DATE	AGE	INJURY	VERBATIM COMMENTS
9/1/98	2 years	Head hematoma	A girl, age 2, was hospitalized for an epidural hematoma received in a fall from a shopping cart onto a tiled floor in a store. Victim was able to unbuckle the seatbelt in the shopping cart.
5/18/98	9 months	Head wound	A 9 month old female was placed in a high chair for feeding. Victim was able to unbuckle the seatbelt and slid out between the seat and tray. Victim landed feet first and fell into cupboard drawer. Victim lacerated forehead and was treated and released receiving 12 stitches.
1/18/99	2 years	Dislocated jaw	A 2 year old female unbuckled seat belt of shopping cart twice in video store. After second time, she fell from shopping cart to floor.
7/2/99	21 months	Facial hematoma	The 21 month old male victim was injured while on a shopping trip with his mother at a grocery store. The victim was seated in the seat of the basket when he undid his seat belt and fell out of the basket. He hit his forehead on the concrete floor and sustained a bump. He was transported to the hospital in an ambulance where he was treated for the hematoma and then released from the hospital.
3/17/99	7 months	Head cuts and scrapes	A 7 month old female sustained a minor contusion to her head. While she was riding in her stroller, she was able to open the restraint straps and fell out of the stroller, striking her head on a concrete sidewalk.
10/6/98	9 months	Facial cuts and scrapes	Patient's 3 year old sibling unbuckled seatbelt in stroller, and child fell out onto street.
8/25/97	6 months	None	The waist strap unlocked with ease on a baby stroller, during use by a 6 month old male.
6/25/98	17 months	Head injury	A 17 month old male hit his head on the floor after he unfastened one side of the harness on his high chair and tumbled out.
4/1/97	4 years	None	4 year old girl unbuckled safety seat belt in shopping cart. She has done this with other seat belts since she was 1 year old. Consumer feels seat belts should be redesigned.
11/5/98	5 months	Head bruise	A 5 month old female was bruised on her head in a fall from a high chair that has a restraint lock that is easily dislodged.

SAMPLE OF VERBATIM COMMENTS FROM STROLLER, HIGH CHAIR, & SHOPPING CART INJURIES

DATE	AGE	INJURY	VERBATIM COMMENTS
10/28/97	2 years	Head cuts and scrapes	Patient fell out of a shopping cart after unbuckling himself, and struck head on cement floor.
12/14/99	11 months	Internal head injury	The 11 month old male victim sustained a head injury after he fell out of a shopping cart. He unbuckled himself and stood up, losing his balance. He was taken to the hospital, examined, and released.
7/22/99	2 years	Dental injury	The 2 year old female victim was injured while riding in a shopping cart at a grocery store. The victim unbuckled her seat belt and stood up in the seat of the cart. The victim fell to the floor, hitting her face and mouth. The victim was taken to the hospital where the victim was treated for the loose teeth and then released.
5/6/99	3 years	Facial cuts and scrapes	The 3 year old male victim sustained a contusion to his face. The victim, who was seated in a shopping cart, unbuckled the seat belt and fell out, face down. The victim was taken to the hospital, examined and released.
9/3/98	11 months	Head hematoma	An 11 month old male fell from a high chair when the restraining strap buckle released. Although his head hit the floor and a hematoma formed on his forehead, no medical attention was sought.
8/1/98	2 months	None	A 2 month old female defeated the locking strap on her high chair and flipped over the tray, landing on her bottom on the tiled floor.
6/9/98	18 months	None	An 18 month old male is able to unbuckle the lock mechanism on straps in his stroller.
2/1/96	10 months	None	A 10 month old female nearly fell from her highchair after she loosened the strap buckle and stood up.
10/12/98	10 months	Internal head injury	Minor head trauma. Patient fell out of stroller at home. Reported to be buckled in.
12/3/98	11 month	Head cuts and scrapes	An 11 month old male victim was buckled in a cart. While victim's mother and her fiancée were looking at something on an shelf in store, and the next they saw was the victim landed on his head on the floor. The victim was treated in the hospital.

SAMPLE OF VERBATIM COMMENTS FROM STROLLER, HIGH CHAIR, & SHOPPING CART INJURIES

DATE	AGE	INJURY	VERBATIM COMMENTS
5/10/99	10 months	Eye cut and scrape	10 month old male belted in stroller, stood up and fell out. Handle of stroller hit his eye. Corneal abrasion.
10/29/98	9 months	Head cuts and scrapes	The 9 month old victim sustained a contusion to his head when the belt from the cart he was riding in came loose, he stood up and fell. He was taken to the hospital, treated, and released.
3/30/99	10 months	Head cuts and scrapes	The 10 month old male victim was in a shopping cart seat, wearing a seat belt, when his mother turned her back for a moment. The victim somehow got loose from the seat belt and fell out of the cart, landing on the floor and hitting his head. The victim's mother took him to the hospital where he was examined and diagnosed with a contusion to the head and released.

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HOW CHILD-RESISTANT ARE STROLLER BELT BUCKLES?[1]

MARCELLA V. RIDENOUR

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Summary.—70 children, between the ages of 24 and 36 months, participated in the assessment of three different styles of stroller seat buckles representing difficulties for children to disconnect the buckle mechanism in the restraint system. None could prevent all the children from opening the restraint system. One was much easier for children to open than the other two styles. Stroller-restraint buckles provide false security to parents who use strollers, as there are no published standards regarding the use of children's stroller seat-belt buckles as a safety device.

Most strollers for transporting young children have a restraint system to assure the children do not get out of the device at unpredictable times. An effective restraint system is necessary for safe use of a stroller because they may be used in hazardous locations such as streets with automobiles and bridges and docks over water. If the caretaker cannot maintain constant eye contact with the child, during a brief simultaneous event such as counting money, it is assumed the restraint system will prevent the child from escaping from the stroller during this momentary lapse of visual monitoring. Child safety experts recommend use of a seat belt but they do not warn about older children in the stroller who may quickly open the buckle and escape from the stroller (3).

Strollers come in a variety of sizes and styles. Those meeting the American Society of Testing and Materials Standard Consumer Safety Specification for Carriages and Strollers must have a restraint system (1). This standard does not evaluate the child-resistance of the restraint-system buckle based on the problem solving and manipulative skills within the age range of the children using the stroller. Most caretakers assume, if the child meets the recommended age and physical size provided in the instructions, then the restraint system will hold the child until the caretaker decides to open the restraint system. Almost all stroller restraints are only activated when a parent or caretaker closes a belt with a buckle. If this belt buckle is part of the restraining system and if it is opened by the child, then the stroller restraining system is ineffective. If these belt buckles can be opened by children within the recommended age range described in the instructions, then restraint systems will provide false security to parents who are transporting

[1]The author expresses appreciation to Andrea Hoffman for assisting with data collection. Address enquiries to M. V. Ridenour, Biokinetics Research Laboratory, Pearson Hall, Temple University, Philadelphia, PA 19122.

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their children in a stroller through unsafe areas such as busy streets or near water.

American Society of Testing and Materials has published a safety standard for infant and children's strollers since the late 1970s (1). This standard does not address the child resistance of the belt buckles. The standard has a procedure to evaluate the restraint system to assure the child cannot accidentally fall out when the restraint is used according to manufacturer's instructions providing the child does not manipulate the closure device. All testing methods for the effectiveness of the stroller-restraint system involve the use of a CADI dummy. This dummy is very different from a child because the dummy cannot explore and manipulate the buckle. Testing of the restraint system also involves a minimum force test to evaluate the attachment points between the restraint system and the stroller.

Other juvenile product standards address the design of child-resistant latches and buckles. The mandatory crib standard requires locking or latching devices used to secure dropside rails to open only if there is a minimum force of 10 pounds to activate the release mechanism or there is a double-action release mechanism requiring two distinct actions for release (6, 7). The mandatory standard for buckles on children's automobile seats requires a minimum of 9 pounds to release the buckle and a maximum of 14 pounds. Many children are able to open the buckles on car seats. Hunter reported 15% of the 2-yr.-old children and 26% of the 3-yr.-old children were able to open the buckles on their car seats (4). Stroller standards do not have a minimum requirement for child-resistance of the belt buckle in the restraining system.

There are other locking products intended for adult-use only such as medicine containers, and these products have standards to assure the latching mechanisms are easily opened by adults and are designed to be difficult for children to open. The testing methods for child-resistance packaging for medicine containers requires testing with actual children and older adults to meet the requirements published by the federal government (1). Child-resistant packaging has reduced child mortality from the unintentional ingestion of oral prescription drugs by children 5 years and younger. From 1974, the first year oral prescription drugs were subject to child-resistant packaging requirements, until 1992, there has been an estimated reduction of about 460 child deaths (5).

The purpose of this study was to examine whether closing mechanism of restraint systems on strollers were effective and could not be opened by the oldest group of children who frequently use strollers, children who are between 2.0 and 2.9 years old. The average age of children was 2.5 years old. Both boys and girls were included in the study: 39 boys and 31 girls. All 70 children were enrolled in day-care situations which were the sites for

this study. All day-care centers were affiliated with a university and included faculty, staff, and students' children. These 70 children were divided into three groups, each group had 15 opportunities to attempt to open one of three closing mechanisms for the stroller waist-belt component of the restraining system. Three folding strollers were identical but for the buckle device on the belt of the restraint system. Each child was randomly assigned to one of three style groups. The 15 observations were within a 3-wk. period. The maximum number of observations per day was two. When the child was observed for two sessions, one session was a morning and one session was in the afternoon. These sessions provided repeated opportunities for each child to attempt to open the buckle device. Children in homes and child-care centers have many opportunities to manipulate the same styles of buckle devices since they typically use the same stroller over a long period of time. For each session, the child was placed in the assigned stroller, and the experimenter attached the belt-buckle device and then immediately opened the buckle device to provide a demonstration for each child. This was to simulate opportunities for demonstrating release of the belt buckle within the child's environment. Then the child was asked to get out of the stroller. Each child had to attempt to get out of the stroller at least once by manipulating the buckle during the daily session. The child had a maximum of 5 minutes during a session to open the buckle on the restraining system. Each buckle required a different hand manipulation to open the device. The buckles, Styles 1, 2, and 3, are illustrated in Fig. 1.

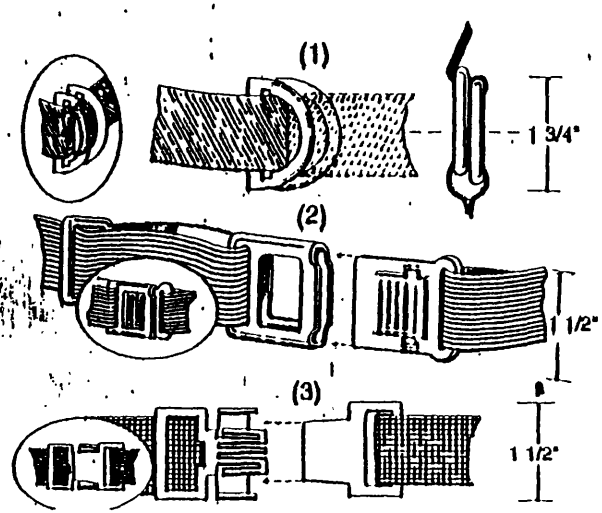

FIG. 1. Three styles of stroller buckles, with clasps at the (1) top, (2) middle, and (3) bottom

The data, number of children successfully opening the stroller belt buckle, were examined with a 3 by 15 analysis of variance. The nonrepeated factor was the three styles of devices. The repeated factor was the 15 observation sessions. The analysis indicated a significant main effect for device ($F_{2,28}=3.16$, $p=.01$). The style of buckle influenced the child's ability to open the buckle. Only 27% of the children, 12 boys and 9 girls, were able to open any of the three buckles. The Newman-Keuls *post hoc* test was used to locate significant differences among the styles of buckles. Differences were found among all comparisons between any two of three buckle styles ($p<.05$). Style 1, the D-rings and flexible strap, was opened less frequently than Styles 2 and 3. Style 1 was opened during 12 (1%) of the 1050 test sessions. One child opened Style 1 in 10 of the 15 sessions, and two other children opened Style 1 once in the 15 sessions.

Both Styles 2 and 3 had two rigid overlapping components which could not separate and release unless the required directional forces were applied to the buckle. Style 2 required a push force in the center of the buckle when the two overlapping components were in the correct alignment. Style 3 required two simultaneous push forces, from both sides of the buckle toward the center of the buckle, to separate the two components of the buckle. Style 2 was opened during 75 (7%) of the 1050 test sessions. Style 3 was opened during 54 (5%) of the 1050 test sessions. Four children, two assigned to Style 2 and two assigned to Style 3, were able to open these during all 15 sessions. Eleven of the children were not able to open the Style 2 buckles during any of their 15 sessions. Twenty children were not able to open the Style 3 buckles during any of their 15 sessions. Eight of the children assigned to Style 2 opened these buckles between 1 and 14 times during the 15 sessions, and most opened the buckles fewer than five times. Four children assigned to Style 3 buckles opened the buckle between 1 and 7 times during their 15 sessions.

There was no significant difference for sessions; some children opened the buckles a few times during the early sessions and then were not able to open them again. Other children opened the buckles a few times during the later sessions. Most children opened no buckles, and a few children opened buckles every session. Since there is no predictable pattern or trend among the 15 sessions, caretakers of 2-yr.-old children must maintain visual contact at all times because children may open these widely used styles of buckles included in this study at any time. Style 1, a strap threaded through two D-shaped rings, appeared to be the most difficult to open. This buckle may have required more problem-solving skills to unthread the belt than the other two styles which required the execution of one or more directional forces. The easiest buckle to open, Style 2, required only one pushing force when the components of the buckle were in proper alignment. When the belt

does not have tension and is loose, the buckle alignment may be in the opening position and a child who is manipulating the buckle may accidentally apply the appropriate directional force. This may account for successful performance which was not replicated in later sessions. If these openings are accidental rather than based on motor and cognitive skill, this unpredictable opening of buckle could result in the escape of a 2-yr.-old. An extensive study (4) of cognitive skill-based child-resistant safety buckles showed the achievement of 100% child-resistant effectiveness for 3- to 5-yr.-old children, with adults being able to open the same buckle in less than 5 sec. One session was scheduled with each child or adult. Four different buckles were evaluated by the same child or adult. The testing of the buckles was in a laboratory environment in order not to encourage children to open car-seat restraint buckles while traveling in an automobile.

The favorable results obtained in the present study for Style 1, the double-D ring buckle, should be interpreted cautiously because the resistance is not the only factor for establishing the adequacy of the restraint system. The normal movement of a child while restrained in a stroller may cause some slippage of straps through the double-D ring buckle which may loosen the restraint and allow the child to climb out of the restraint without opening the buckle. The unthreading process may be easier for larger children since the threading takes place closer to the end of the strap, making it easier to unthread the strap or for the strap to slip out of the threaded position. The double-D ring buckle requires the caretaker to select the appropriate adjustment and tightness of the restraint system each time the stroller is used. The American Society of Testing and Materials standard for restraints on high chairs does not allow a double-D ring similar to the Style 1 buckle as the device to connect two components of the restraint system. According to American Society of Testing and Materials standards, all restraining systems on high chairs must have connecting and adjustment mechanisms which are independent (1).

Present results indicate some buckles on stroller restraint systems may provide false security to parents and other caretakers. None of the three typical stroller buckles have to meet any performance standard regarding child resistance.

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