

AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Restraint Use on Aircraft

ABSTRACT. Occupant protection policies for children younger than 2 years on aircraft are inconsistent with all other national policies on safe transportation. Children younger than 2 years are not required to be restrained or secured on aircraft during takeoff, landing, and conditions of turbulence. They are permitted to be held on the lap of an adult. Preventable injuries and deaths have occurred in children younger than 2 years who were unrestrained in aircraft during survivable crashes and conditions of turbulence. The American Academy of Pediatrics recommends a mandatory federal requirement for restraint use for children on aircraft. The Academy further recommends that parents ensure that a seat is available for all children during aircraft transport and follow current recommendations for restraint use for all children. Physicians play a significant role in counseling families, advocating for public policy mandates, and encouraging technologic research that will improve protection of children in aircraft.

ABBREVIATIONS. AAP, American Academy of Pediatrics; CSSs, child safety seats; FAA, Federal Aviation Administration; NTSB, National Transportation Safety Board; CFR, Code of Federal Regulations; CAMI, Civil Aeromedical Institute; SAE, Society of Automotive Engineers.

INTRODUCTION

Children younger than 2 years are the only occupants who, under current federal regulation, are not required to be restrained or secured on aircraft during takeoff, landing, and conditions of turbulence; even items such as coffee pots must be secured. This practice relating to nonrestraint of children on airplanes is inconsistent with all occupant protection recommendations of the American Academy of Pediatrics (AAP) in which priority has been placed on safe transportation of children. Many child safety seats (CSSs) used in motor vehicles are also approved for use on aircraft. The Federal Aviation Administration (FAA) has stated that proper use of an approved CSS for aircraft enhances child safety in the event of turbulence or a crash, and the FAA informs parents that a "safety seat can be the most important carry-on item of all."¹ The FAA strongly recommends but has not yet mandated that all children who fly, regardless of age, should be restrained in the appropriate CSS for their weight and size used in conjunction with the aircraft seat belt.

In a 1996 report to the President of the United

States, the White House Commission on Aviation Safety and Security stated that it is inappropriate for infants to be afforded a lesser degree of protection than that for older passengers.² The Commission recommended that the FAA revise its regulations to require that all occupants be restrained in aircraft during takeoff, landing, and conditions of turbulence and that all infants and small children whose weight is less than 40 lb and whose height is less than 40 in be restrained in an aircraft-approved CSS. The Association of Flight Attendants and the National Transportation Safety Board (NTSB) have called for federal regulation requiring appropriate restraint use.³⁻⁵ The NTSB has also called for the FAA to develop standards for CSS use in aircraft. The FAA has argued that a mandatory requirement for CSS use on aircraft will result in more injuries and deaths to infants and toddlers because parents would not be willing to buy a ticket to reserve a seat for the infant and would opt to travel by car instead⁶; however, no data support this argument.

CURRENT POLICY FOR CHILDREN

Children younger than 2 years are currently allowed to be held in an adult's lap throughout a commercial aircraft flight, as stipulated by the US Code of Federal Regulations (CFR).⁷ Alternatively, parents may choose to use a CSS certified under the Federal Motor Vehicle Safety Standards and Regulations for travel in aircraft and motor vehicles.⁸ Airlines are required to accommodate the use of approved CSSs for young children with tickets; however, the child must occupy a window seat in a nonexit row. Although many airlines offer discounted rates for children younger than 2 years, these rates are often not advertised, and parents must ask to receive a reduced-rate ticket. If parents want to ensure that the child has a passenger seat in which the CSS can be used, they must purchase a ticket. If the child is held on the lap of an adult, no fare is charged for the child. Children 2 years and older are required to sit in their own passenger seat under the same regulations that apply to all other passengers.

In 1995, in the aftermath of serious and sometimes unexpected events of turbulence, the FAA issued a public advisory to airlines urging the use of seat belts at all times when passengers are seated.⁶ Some airlines now comply, but the requirement does not apply to children younger than 2 years because they are not required to be restrained at any time during the flight.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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BACKGROUND

Approximately 25 000 commercial flights depart from and arrive at US airports daily.⁹ Although it is estimated that 4.6 million children younger than 2 years fly on US domestic airlines annually, inaccuracies in the passenger manifest, which contains the names of all passengers as required by the US CFR, make it difficult to obtain precise numbers. The NTSB has issued safety recommendations that require standardized reporting of all passengers.¹⁰

The risk of death or serious injury in an aircraft is exceedingly small. Using data from 1990 forward not controlled for age, the risk of death was calculated at 1 in 8 million.¹¹ During 1996, there were 319 passenger fatalities and 77 serious injuries on US air carriers operating under the CFR. These data are not provided by year of age of passenger but include all scheduled and nonscheduled services on commercial and cargo carriers.¹² Analysis of aircraft crashes from 1976 through 1979 in which there were fatalities and survivors revealed that unrestrained infant passengers had a relative mortality risk of 5.9 (United States) and 9.6 (worldwide), compared with restrained adult passengers. It could not be determined whether the higher risk of mortality for infants was attributable to lack of restraint use, fragility of infants, or both.¹³

In a study comparing persons fatally injured in aircraft in 1980 and 1990, blunt injury (in particular, head injury) from deceleration forces was the most important threat to survival. Head injuries were listed as the immediate cause of death in 33% of those younger than 15 years.¹⁴ As with other forms of transportation, effective restraint systems decrease the probability of head injury.

Turbulence is the leading cause of nonfatal injuries to aircraft passengers and flight attendants. From 1981 through 1997, there were 342 reports of turbulence affecting major airlines. Three passengers died, 80 had serious injuries, and 769 had minor injuries.¹⁵

A child on the lap of an adult cannot be effectively restrained in a motor vehicle or aircraft crash. A child who travels on the lap of another occupant or unrestrained in a motor vehicle has a substantially greater risk of injury and death, compared with a restrained child.^{16–18} Hazards associated with the on-lap position are also well documented in aircraft crash investigations. Three children on the laps of adults were fatally injured and others nonfatally injured in the 1987 crash in Denver, CO, the 1989 crash in Sioux City, IA, and the 1994 crash in Charlotte, NC—which were all caused by turbulence.^{19–21} The NTSB has reported 2 crashes in which CSSs were used and provided protection to children.³

CERTIFICATION OF CSSs FOR USE ON AIRCRAFT

The FAA's Civil Aeromedical Institute (CAMI) has conducted studies on CSSs for use with aircraft seats. Crash testing of CSSs using child dummies in 1993 revealed that rear-facing CSSs performed well and could be installed with contemporary aircraft seat belts. However, 6 of the 8 tests with forward-facing CSSs resulted in Head Impact Criteria values of more

than 1000, which is the threshold for serious head impact in adults. Difficulty was encountered in securing some of the forward-facing CSSs to the aircraft seats. Moving the anchor points rearward resulted in improved performance of many CSSs; however, most aircraft have seats with poor belt anchor geometry.²²

Certain restraints that are approved for use in motor vehicles are prohibited for use in aircraft (14 CFR 121.311).⁷ When tested, vest and harness type systems allowed excessive forward body excursion, causing the test dummy to slide off of the front of the seat, potentially impacting the seat in front and resulting in injuries.^{22,23} Shield type booster seats are incompatible with aircraft seats because of the seat-back breakover feature common on airplanes.

POTENTIAL NEW TECHNOLOGY

Testing has shown that aircraft seat belts alone do not adequately protect a child younger than 3 years.^{22,23} The CAMI has developed and fully tested a prototype aircraft seat insertion platform, which can be inserted under the CSS and secured to the aircraft seat with the seat belt. Seat belts attached to the platform are used to secure the CSS. The platform improves ease of installation and decreases the forward excursion of the CSS. A CSS designed for use in aircraft that could be used forward or rear facing is a second alternative. One such device is already approved and is being sold. A third alternative is modifying a certain number of passenger seats on each aircraft to accommodate and ensure adequate performance of CSSs. A relatively simple and low-cost modification has been successfully demonstrated at CAMI. The Society of Automotive Engineers (SAE) has recently adopted a performance standard for CSSs installed on airplane passenger seats.²⁴ The objective of this standard is to establish performance criteria for CSSs when installed in airplane seats. The methods of meeting the SAE standard and the pass/fail criteria are similar to those already imposed on CSSs by automotive regulations (49 CFR 571.213). Inclusion of the SAE standard in automotive regulations for CSSs should be considered.

A national symposium was held by the NTSB in 1999 to explore operation, design, regulations, and experience with CSSs nationally and internationally.²⁵ At this meeting, FAA Administrator Jane Garvey announced "... We [FAA] are committed to 2 things—mandating the use of child restraint systems in aircraft and assuring that children are accorded the same level of safety as are adults." This statement clearly implies the FAA plans to move forward with regulatory actions mandating the use of effective CSSs in airplanes.

ENFORCEMENT OF EXISTING RESTRAINT REQUIREMENTS FOR CHILDREN

The NTSB has documented events in which children 2 years and older have been transported on the lap of an adult. The NTSB has been concerned about the inadequacy and lack of enforcement of passenger protection regulations and has recommended that

the FAA implement measures for enforcing restraint regulation for children 2 years and older.²⁶

RECOMMENDATIONS

Consistent with national policies requiring restraint use in all vehicles, the AAP recommends that regulations be promulgated to ensure that all passengers, including those younger than 2 years, are afforded optimal protection during all phases of commercial and general aircraft flights. The AAP believes that children should be afforded the same protection as other passengers and that restraint use in aircraft for children younger than 2 years should be mandatory during takeoff, landing, and conditions of turbulence and should be recommended as much as feasible during flight as it is for all other passengers.

Pediatricians, federal agencies, and airlines are encouraged to work together to accomplish the following:

1. Implement mandatory restraint use requirements using aircraft-approved restraint systems and discontinue the policy of allowing children younger than 2 years to be held on the lap of an adult on aircraft.
2. Enforce current requirements for children older than 2 years, some of whom travel unrestrained and without tickets.
3. Establish standards for appropriate restraint use in aircraft for all children. Amend the CFR⁷ by adding a section on child restraint requirements on aircraft providing intrastate, interstate, or overseas transportation. Establish age and weight recommendations for use of CSSs similar to those for motor vehicles.
4. Provide information on current recommendations for the restraint of children younger than 4 years similar to AAP recommendations for restraint use in motor vehicles as follows²⁷:
 - Children should be placed in a rear-facing CSS that is properly secured and installed until they are at least 1 year old *and* at least 20 lb in body weight.
 - A forward-facing seat labeled for use on aircraft should be used for children at least 1 year old and 20 to 40 lb in body weight. The AAP is aware of the problems found by the CAMI study with forward-facing seats but believes that these seats afford more protection to children than do seat belts alone, no restraint use, or being held on a lap. The CSS manufacturers label seats that fit and can be satisfactorily restrained to an aircraft seat.
 - According to the FAA, CSSs should not exceed 16 in wide for best fit in aircraft seats; this is especially important in small commuter aircraft.
 - Children who weigh more than 40 lb can be secured in the aircraft seat belt.²⁸
5. Establish international standards through the International Civil Aviation Organization requiring that passengers on civil aircraft be restrained during takeoff and landing and when directed by the captain of the aircraft.

6. On all types of passenger aircraft, pursue technologic solutions for improving restraint systems for children who are inadequately protected by existing child restraints or seat belt systems.
7. Educate all airline personnel who have contact with families regarding the importance of, and the requirements for, age-appropriate restraint use on aircraft. This includes travel agents, reservation/gate agents, and cabin crew.
8. The airlines should make available to families CSSs that are compatible and effective in aircraft.
9. Encourage airlines to offer a discounted fare (or a rebate) for restrained children.

Pediatricians should convey the following information to parents:

1. All children should travel properly restrained on aircraft.
2. Similar to travel in motor vehicles, a child is best protected when properly restrained in a CSS appropriate for the age, weight, and height of the child, meeting standards for aircraft until the child weighs more than 40 lb and can use the aircraft seat belt. Child safety seat systems manufactured to US standards for aircraft use after February 26, 1985, bear the label: "This restraint is certified for use in motor vehicles and aircraft" in red letters.²⁸
3. Families should explore options for ensuring that each child has an aircraft seat. Currently, to ensure that a child has a seat for the CSS, families must purchase a ticket and should specify a window seat next to the parent in a nonexit row for the CSS. However, it is suggested that parents ask the airline whether the purchase of a seat is required to use a CSS and consider asking for the information in writing. Parents should also ask and be advised about discounted fares and compare the benefits of various airlines. If no discounted or free fare is offered by any airline and it is not feasible to purchase a ticket, parents should select flights that are likely to have empty seats. Parents should inquire about the carrier's policy regarding use of empty seats. Parents who are traveling with CSSs should be reminded that they can request assistance from the airlines between connecting flights.
4. Parents can obtain additional information on safe air travel for children from the FAA (1-800-FAA-SURE and <http://www.faa.gov/>).

There is a need for accurate exposure data. Accurate passenger manifests should be generated to include all passengers on all flights. Standard reporting for all passenger injuries should be established and made available by age of passenger and restraint use. Epidemiologic studies and the evaluation of preventive measures may thus be conducted.

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REFERENCES

1. US Department of Transportation, Federal Aviation Administration. *Are You Sure You Have Everything Baby Needs for the Flight?* Washington, DC: Federal Aviation Administration. Pamphlet available from the FAA Consumer Hotline at 1-800-322-7873
2. White House Commission on Aviation Safety and Security. *Final Report to President Clinton*. Washington, DC: White House Commission on Aviation Safety and Security; February 12, 1997
3. Legislation to Require the Use of Child Safety Restraint Systems Aboard Aircraft. Hearings before the Subcommittee on Aviation of the Senate Committee on Transportation and Infrastructure, 104th Congress, 2nd Session (1996) (testimony of Barry Sweedler, Director, Office of Safety, Recommendations)
4. Hall J. Safety recommendation. [Letter to the Federal Aviation Administration]. Washington, DC: National Transportation Safety Board; May 16, 1995
5. Association of Flight Attendants. *Position on Child Restraint Seats*. Washington, DC: Association of Flight Attendants; 1997
6. National Transportation Safety Board. NTSB recommendations to the FAA with FAA responses 4/24/98. Washington, DC: Federal Aviation Administration, Office of System Safety; 1998
7. 14 CFR §121 (2000)
8. Federal Motor Vehicle Safety Standards and Regulations. 49 CFR §571.213 (1998)
9. Air Transportation Association. *Year 2000 Annual Report*. Washington, DC: Air Transportation Association; 2000
10. Barksdale BC. Child safety restraints: a controversy over safe infant air travel. *J Air Law Commc.* 1991;57:201-255
11. US Department of Transportation, Federal Aviation Administration. Aviation safety data [database]. Available at: <http://nasdac.faa.gov/internet/>. Accessed October 1, 2001
12. US Department of Transportation, Bureau of Transportation Statistics. Aviation safety data [database]. Available at: <http://www/bts.gov/ntda/sdafa/>. Accessed October 1, 2001
13. Fife D, Rosner B, McKibben W. Relative mortality of unbelted infant passengers and belted non-infant passengers in air accidents with survivors. *Am J Public Health.* 1981;71:1242-1246
14. Li G, Baker SP. Injury patterns in aviation-related fatalities. Implications for preventive strategies. *Am J Forens Med Pathol.* 1997;18:265-270
15. Federal Aviation Administration. Facts about turbulence. Available at: <http://www.faa.gov/apa/TURB/Facts/fact.htm>. Accessed August 8, 2001
16. Mohan D, Schneider LW. An evaluation of adult clasping strength for restraining lap-held infants. *Hum Factors.* 1979;21:635-645
17. Agran PF, Winn DG, Castillo DN. On-lap travel: still a problem in motor vehicles. *Pediatrics.* 1992;90:27-29
18. Agran PF, Anderson CL, Winn DG. Factors associated with restraint use of children in fatal crashes. *Pediatrics.* 1998;102(3). Available at: <http://www.pediatrics.org/cgi/content/full/102/3/e39>
19. National Transportation Safety Board. Continental Airlines Flight 1713, McDonnell Douglas DC-9-14, Stapleton International Airport, Denver, Colorado, November 15, 1987. Washington, DC: NTSB Report No. AAR-88-09; September 27, 1988
20. National Transportation Safety Board. United Airlines Flight 232, McDonnell Douglas DC-10-10, Sioux Gateway Airport, Sioux City, Iowa, July 19, 1989. Washington, DC: NTSB Report No. AAR-90-06; November 1, 1990
21. National Transportation Safety Board. Flight into terrain during missed approach, US Air Flight 1016, DC-9-31, N954VJ, Charlotte/Douglas International Airport, Charlotte, North Carolina, July 2, 1994. Washington, DC: NTSB Report No. AAR-95-03; April 4, 1995
22. US Department of Transportation, Federal Aviation Administration, Office of Aviation Medicine, Civil Aeromedical Institute. *The Performance of Child Restraint Devices in Transport Airplane Passenger Seats*. Washington, DC: Civil Aeromedical Institute; 1994
23. US Department of Transportation, Federal Aviation Administration, Office of Aviation Medicine, Civil Aeromedical Institute. *Final Report to Congress on CSR Performance and Cost Effectiveness*. Washington, DC: Civil Aeromedical Institute; 1995
24. Society of Automotive Engineers. *Aerospace Standard 5276/1*. Warrendale, PA: Society of Automotive Engineers; November 2000
25. Federal Aviation Administration. *Child Restraint Roundtable*. Arlington, VA; December 15-16, 1999. Available at: <http://www.faa.gov/apa/speeches/1215spjg.htm>. Accessed September 25, 2001
26. National Transportation Safety Board. Uncontained Engine Failure/Fire, ValuJet Airlines Flight 597, Douglas DC-9-32, N908VJ, Atlanta, Georgia, June 8, 1995. Washington, DC: NTSB Report No. AAR-96-03; July 30, 1996
27. American Academy of Pediatrics, Committee on Injury and Poison Prevention. Selecting and using the most appropriate car safety seats for growing children: guidelines for counseling parents. *Pediatrics.* 1996;97:761-763
28. US Department of Transportation, Federal Aviation Administration. *Tips for Safe Air Travel with Children*. Washington, DC: Federal Aviation Administration. Pamphlet available from the FAA Consumer Hotline at 1-800-322-7873 or at <http://www.faa.gov/apa/TURB/CRSTips/FRCRS>. Accessed August 8, 2001

ERRATUM

In the policy statement "Human Embryo Research," published in the September issue of *Pediatrics* (2001;108:813-816), 2 errors occurred. In the first paragraph under "Introduction," the second sentence should read:

"Pluripotent stem cells are a specialized subpopulation of cells capable of developing into most (ectoderm, mesoderm, and endoderm), but not all, human tissue and may be derived from human embryos."

On the roster for the Committee on Bioethics, one of the liaison's credentials were listed erroneously. His name should read "Ernest F. Krug III, MDiv, MD, American Board of Pediatrics."