

Car Seat Safety

Buckling Up Isn't Always Enough



Photo provided by Doug Henry Design, Nissan North America, Quest for Safety.

Synopsis

According to National Highway Traffic Safety Administration (NHTSA) estimates, as many as 30,500 children under age 5 were injured in motor vehicle collisions during 1997. In that same year, 604 passengers under age 5 were killed. While 200 of these children were strapped in their safety seats, it is likely that many were not properly restrained.

The consequences of failing to use age- and weight-appropriate child safety seats are well known to many health care professionals. Nonetheless, at safety seat “checkups,” child passenger safety experts frequently find that up to 95% of car seats are improperly used by caregivers. To keep a child safe in a moving vehicle, caregivers need to choose the right safety seat, install the seat correctly in the right location of the vehicle, strap the child in properly, and use the seat without fail.

There is no doubt that proper child safety seat use is a complicated issue. However, knowing the best available seat types and how they should be installed for children of various ages and weights will enable the pediatric health care provider to give proper guidance to families who wish their children to ride safely. Moreover, identifying dangerous patterns of child safety seat misuse during routine well child visits can help families correct errors before there is a disaster.

In 1997, 604 passengers under age 5 were killed—even though almost 200 of these children were strapped in their safety seats, albeit incorrectly.



Each year, approximately 1,800 children under age 14 are killed in motor vehicle collisions and more than 280,000 are injured. According to National Highway Traffic Safety Administration (NHTSA) estimates, as many as 30,500 children under age 5 were injured in motor vehicle collisions during 1997. In that same year, 604 passengers under age 5 were killed—even though almost 200 of these children were strapped in their safety seats, albeit incorrectly.

The consequences of failing to use age- and weight-appropriate child safety seats are well known to many health care professionals. Nonetheless, at safety seat “checkups,” child passenger safety experts frequently find that up to 95% of car seats are improperly used by caregivers, reducing the full effectiveness of the seats. It is estimated that close to 70% of deaths and 67% of injuries could have been prevented with correct, consistent use of appropriate restraints. If the 604 children who died in motor vehicle crashes in 1997 had been properly restrained, it is estimated that 420 would likely have survived. Of the 30,500 injuries, 20,000 could have been prevented or their severity reduced.

To keep a child safe in a moving vehicle, caregivers need to choose the right safety seat, install the seat correctly in the right location in the vehicle, strap the child in properly, and use the seat without fail. This article covers the types of safety seats and accessories currently available on the market, guidelines for their proper use, and typical patterns of misuse. Possible solutions to difficult dilemmas (such as the squirming toddler and peer pressure) also are suggested.

Guidelines for Proper Seat Use

A major factor contributing to the misuse of child safety seats is the lack of standardization among vehicle restraint systems and the vast array of seats currently available on the market. More than a dozen manufacturers produce more than 60 different models of safety seats with different design attributes to provide protection for infants and young children at different ages and sizes. This variability necessitates unique instructions for each seat, which caregivers must read thoroughly. In addition, not all safety seats and vehicle restraint systems are well-matched for one another, which means the “fitness” of a specific seat when paired with a specific vehicle must be assessed on a case-by-case basis. Caregivers cannot assume all seats will fit properly in their vehicles when changing from an infant-only seat to a seat for older children, or when borrowing a child safety seat from a relative or friend.

Since misconceptions abound, it is important that pediatric health care providers be familiar with the basic guidelines regarding proper child safety seat use.

Infant-Only Safety Seats

These seats usually can be used from birth until the child weighs 20 or 22 pounds, depending upon the manufacturer’s instructions, unless the child becomes so tall that his or her head approaches within one inch of the top of the plastic seat shell.

Advantages of an infant-only seat include ease of use, better fit for a newborn, and portability (some models can be attached to a frame with wheels and become a stroller).

Is Your Child Riding Safely?

Michael K. Sachs, MD
Stephanie M. Tombrello, LCSW
SafetyBeltSafe U.S.A.

In 1997, 604 children under the age of 5 were killed in motor vehicle collisions, of those, 200 of them were strapped in their child safety seats—many incorrectly. Most caregivers want to do what is best for their children. But a lack of information or misinformation can put children at risk of serious injury or death. You can keep your child safe by:

- a) choosing the right safety seat for your child's age, height and weight,*
- b) installing the seat correctly in the preferred location in the vehicle and facing the right direction,*
- c) strapping your child in properly, and*
- d) using a safety seat each and every time your child rides in a moving vehicle.*

Test your car seat knowledge with our Child Safety Seat Quiz. Then apply the facts that you have learned to assure that your child is riding safely.

1. Does your child's safety seat "fit" properly?

Choose a seat designed for your child's current age and weight. Newborns fit best in an infant-only seat. When strapped into your vehicle, your child's safety seat should not move more than an inch to the front or to the side of the vehicle. In some vehicles, locking clips and/or tether straps may be essential to hold seats securely.

2. When is it permissible to move your baby from a rear-facing to a forward-facing car seat?

Infants must ride in rear-facing seats until they are both 1 year old and weigh at least 20 pounds, preferably longer. Children older than 1 year and weighing 20 to 40 pounds may ride in a forward-facing restraint, ideally one with a five-point harness.

3. Through which slots should the safety seat internal harness be threaded when a convertible seat is turned forward-facing?

The harness should be threaded through the top harness slots for almost all seats. (There are very few exceptions, notably the Britax Roundabout and Early Development Guardian.) Harness straps should be snug enough so that no harness fabric can be "pinched" with the fingers. The chest clip should be placed at armpit level.

4. When is it time to move your young child to a belt-positioning booster seat?

Once your child is at least 3 years old and 40 pounds, he or she should ride in a belt-positioning booster which requires the use of the vehicle shoulder/lap belt.

5. Is it safe for young children to ride in the back seat with just a lap/shoulder belt?

Usually not. Most children do not fit properly in a lap/shoulder belt without a belt-positioning booster until they are at least 8 years old. In fact, having a lap belt crossing over the stomach can pose a dangerous hazard. Also, using just the lap portion of the lap/shoulder belt, with the shoulder belt tucked behind the back or under the arm, can cause serious internal injuries during a crash.

6. When is your child old enough to ride without a booster?

That depends on how your child fits in the vehicle and its belt system. Your child is ready to move from the booster seat to a lap/shoulder belt only if, while sitting against the vehicle seat back, your child's:

- a) knees bend at the edge of the seat cushion,
- b) lap belt fits over the thighs (not the abdomen),
- c) shoulder belt crosses the shoulder or collar bone (not the neck), and
- d) position can be maintained throughout the trip.



7. At what age can your child start riding in the front seat?

Children should ride in the back seat until they are at least 12 years old—whether or not there is a passenger air bag in the front. Sitting in the front seat reduces protection by 27%, nearly a third!

8. Does the passenger air bag provide protection for a baby in a rear-facing seat?

No. Never place a child in a rear-facing safety seat in the front seat of a vehicle if there is a passenger air bag. Air bags significantly increase a rear-facing child's risk of injury or death. Even in vehicles without a passenger air bag, the back seat is safest for all passengers.

9. Can your baby ride on someone's lap for short trips?

No. Infants and children are never safe riding in another passenger's lap. Most crashes happen close to home and at low speeds, not during long trips.

10. Is it okay to buckle two people in the same safety belt?

Never double-buckle. Buckling two children in one belt isn't safe. Their heads can strike one another at the speed the vehicle was traveling during a crash, causing serious injury or death. A child riding on an adult's lap could be crushed by the magnified force of the adult's body which equals more than one ton of force at just 30 mph.

11. Should a car seat be used after it has been in a crash?

No. Child safety seats must be replaced after a collision. In fact, many auto insurance companies will pay for a new seat—but you need to ask. In California, mandatory insurance coverage for seat replacement has been legislated as of January 1, 2000.

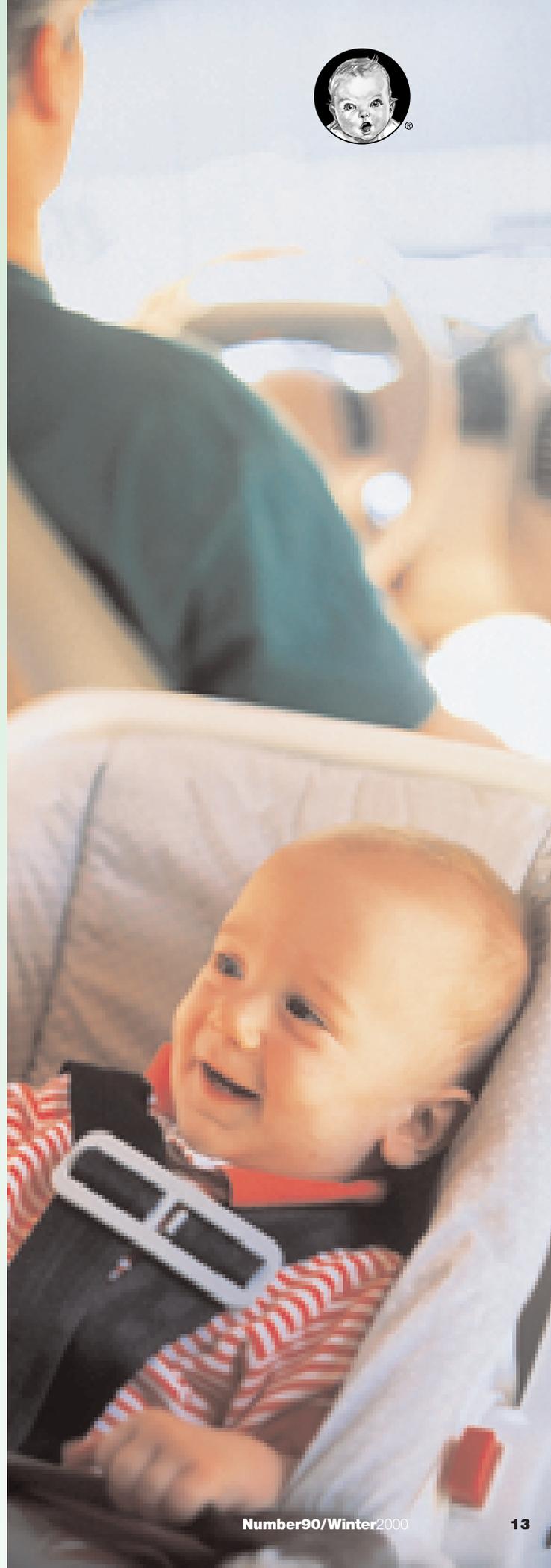
12. Have you read your child's safety seat instruction manual lately?

Much of the information that parents need to properly restrain their children in their car seats can be found in the instruction manual that comes with the seat. It is very important to read the manual before using the seat and to refer back to it as your child grows and the seat needs to be adjusted.

Children are more likely to buckle up if their parents do, so be sure you always wear your safety belt.

Your children need you!

For more information about child passenger safety—including a listing of safety seat recalls—contact SafetyBeltSafe U.S.A. on the Internet at www.carseat.org, or by calling 800-745-SAFE or 800-747-SANO (Spanish).



Infant-only seats are designed to be used rear-facing only and generally should be placed in the back seat. The center of the rear seat is, in most cases, the safest location for any child.

Infant-only seats are designed to be used rear-facing only and generally should be placed in the back seat. If there is a passenger air bag, rear-facing infant seats *must* be placed in the back seat. The center of the rear seat is, in most cases, the safest location for any child. However, when two child safety seats will be installed next to each other facing opposite directions (as happens in families with both an infant and a toddler), the rear-facing (infant) restraint should be placed next to the window and the forward-facing (toddler) restraint in the center. The rationale is that since a child riding rear-facing is better protected in a crash, the forward-facing—relatively less-protected—child should be placed in the center, a relatively safer seating position. If the caregiver is not comfortable with the two children riding in adjacent seats, they may need to be separated and ride on opposite sides, each next to a window.

Infant-only seats are installed by threading the vehicle safety belt either through slots in the seat itself or through a separate base (to which the seat is attached) that may be left strapped in the vehicle. There has been controversy in the past regarding which form of installation is safer, but currently there are no firm recommendations. Caregivers should choose whichever method permits them to get the tightest fit and most appropriate angle. For most models, the safety seat carrying handle should be rotated behind the child's head while in the vehicle, but, once again, the manufacturer's recommendation should be followed.

The seat generally should be installed reclined no more than halfway back. If caregivers comment that their infant's head appears to flop forward uncomfortably, it is likely that the seat is too upright. Some seats have an indicator on the side to show when the angle is correct. If necessary, a

folded towel or pool "noodle" may be placed under the front of the infant seat to compensate for the slope of the vehicle seat cushion.

To provide additional support and reduce slumping, a "sausage-roll" may be made from a diaper or receiving blanket and placed along each side of the newborn, and a wedge of folded diaper may be used to fill space between the crotch and crotch strap. Many store-bought head supports, chosen to re-position the head and improve comfort, are too thick, leading to loose and misdirected harness straps. With the forces exerted in a crash, this can lead to partial ejection. Thick head supports also can push a newborn's head forward, compromising the airway.

The internal harness straps should be threaded through the slots which bring the harness closest to the baby's body, preferably at or below the shoulders. A frequent mistake is leaving these harness straps too loose. Without causing physical discomfort, the harness straps should be so snug that caregivers cannot "pinch" any harness fabric with their fingers. The chest clip should be at armpit level. In an effort to improve comfort, soft harness strap covers are sometimes used. These covers should be short enough that the chest clip can be placed at armpit level.

The child should be transitioned to a convertible seat either when the baby is close to the upper weight limit listed for the seat or before the child's head is within an inch of the top of the seat shell, whichever occurs first.

Convertible Safety Seats

Once the infant-only seat is outgrown, older infants or small toddlers should ride in a convertible seat. Although some convertible seats may be used for newborns, most neonates and young infants will fit better in an infant-only seat.

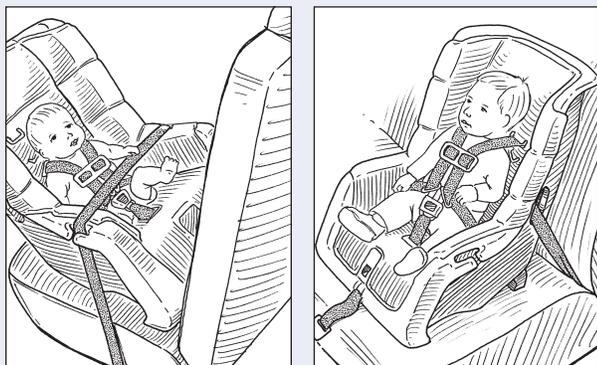


Types of Safety Seats

Child safety seats are specifically designed to protect children within certain weight, height, physical, and developmental parameters. Some seats only accommodate infants, while others protect older toddlers, preschoolers, and school-age children, as well as children with special needs. The following is a brief description of the types of safety seats currently available.

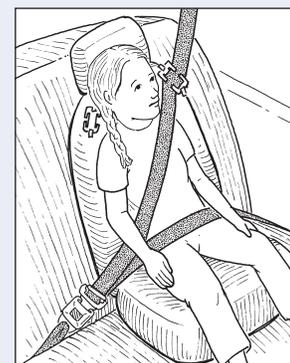


Infant-only. These seats are designed to be used from birth until 20 to 22 pounds (depending upon the model) or until the top of the child's head is within one inch of the top of the seat shell, whichever occurs first. An infant-only seat must never be used forward-facing.



Convertible. Before the weight or height limit of an infant-only seat has been reached, the child should be switched to a convertible seat, generally to continue rear-facing. Weight limits for rear- and forward-facing vary by seat model, but all models can be used only until a child weighs 40 pounds. Convertible seats are so named because they can face either toward the front or back of the vehicle. The safer, rear-facing position is recommended for as long as possible.

Built-in Seats. A forward-facing seat with a full internal harness that fits children at least 1 year old and more than 20 pounds may be part of the vehicle seat design. Some vehicles have a built-in belt-positioning booster which may be used by children at least 3 years old who weigh at least 30 to 50 pounds, depending upon the manufacturer's recommendations.



Booster Seats are available in two types:

- Removable-shield boosters, which are not recommended unless the shield is removed and the base alone is used with a shoulder/lap belt, and
- Belt-positioning boosters, which come in two styles: high-back and backless.

Belt-positioning booster seats are designed to be used with the vehicle shoulder/lap belt, elevating the child so the safety belt fits properly over the thighs and shoulders (rather than the abdomen and neck). A belt-positioning booster is not recommended until a child is at least 3 years old and weighs 30 to 40 pounds. Children are generally safest using safety seats with full harness systems until they are more than 40 pounds or their shoulders are above the top harness slots of both convertible and combination child seat/booster seats.

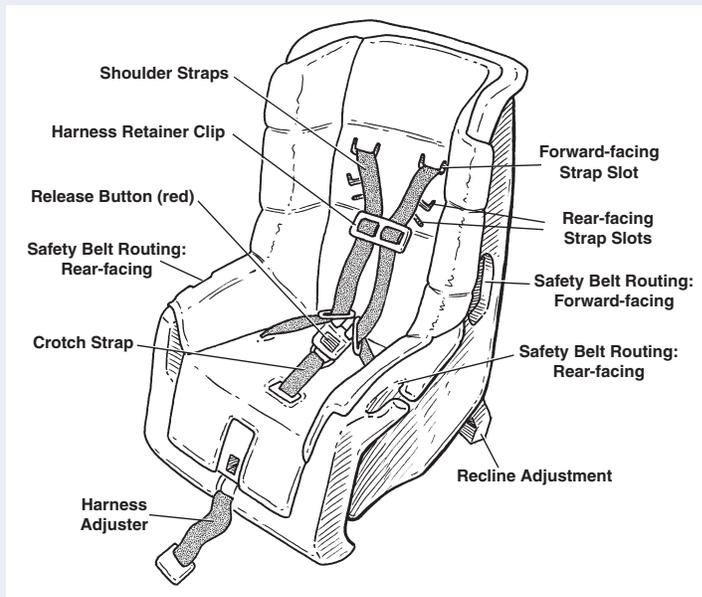


Combination Child Seat/Booster. Some child safety seats are designed to function as a forward-facing seat with an internal harness when a child is under 40 pounds and then as a belt-positioning booster (with the harness removed) when the child reaches 40 pounds. Both lower and upper weight limits vary among models.

Illustrations courtesy of Transportation Safety Training Center, Virginia Commonwealth University.

Harness Types

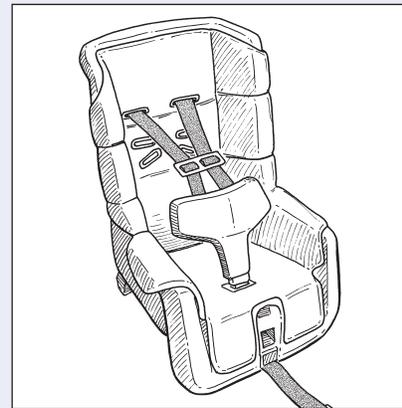
There are four basic designs of internal harness systems that secure children in their safety seats. If the seat meets or exceeds all applicable U.S. Federal Motor Vehicle Safety Standards, then the type of harness chosen becomes a matter of personal preference, although most child passenger safety experts agree that the five-point harness generally provides the best protection for the widest range of children.



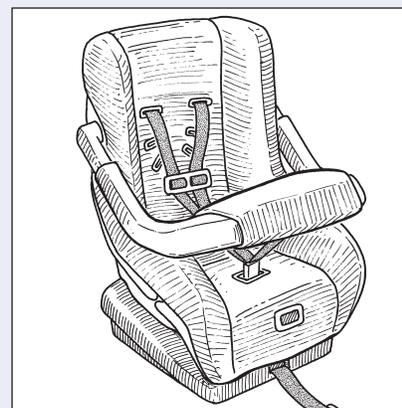
Five-Point. This harness has straps that are worn over each shoulder, over each hip, and midline over the crotch where they meet and are buckled together. Because child safety seats with a five-point harness are frequently less expensive than ones with a tray-shield, caregivers might mistakenly believe that this indicates that five-point harness seats are of “lesser quality” or provide less protection. In fact, purchasing a seat with a five-point harness could be considered a situation where “you get more than you pay for.” The straps on these seats do tend to twist, however, making it very important to be sure they are lying flat during use.



Three-Point. Found on most infant-only seats, this harness system features a strap worn over each shoulder and midline over the crotch.



T-Shield. This harness has two straps that are worn over the shoulders and attached to a flat, plastic “shield” that fits over the lower torso. The straps tend to lie flat, and the harness is easily buckled with one hand. The T-shield cannot be adjusted properly to fit a newborn since the shield is in front of the baby’s face or chest instead of the hips.



Tray-Shield. With this system, the shoulder harness straps are attached to a wide, padded shield that snaps into the seat at the crotch. Since the shoulder straps loosen each time the shield is brought over the child’s head, caregivers need to be certain to adjust the straps for a snug fit each time their child is buckled into the seat. This style also does not fit infants well.

Illustrations courtesy of Transportation Safety Training Center, Virginia Commonwealth University.

The primary reason an infant should remain rear-facing until the child is both 1 year old and 20 pounds is neck bone rigidity and ligament strength, not muscle control, as is commonly believed.



Convertible seats may be installed either rear- or forward-facing. The direction is determined by a combination of the child's weight, age, and the manufacturer's instructions. One myth which persists among caregivers and health care providers is that a child should be turned forward-facing once he or she reaches 20 pounds, regardless of age. The correct advice is that a child should remain rear-facing for as long as possible, but *at least* until the child is both 1 year old *and* 20 pounds. The primary reason an infant should remain rear-facing is not muscle control, as is commonly believed, but neck bone rigidity and ligament strength. The shearing forces applied in a crash are much more likely to result in a spinal cord injury to a forward-facing infant compared to a child over 1 year of age. According to Huelke et al,¹ "In autopsy specimens, the elastic infantile vertebral bodies and ligaments allow for column elongation of up to two inches, but the spinal cord ruptures if stretched more than 1/4 inch." Because it is significantly safer for children under 1 year old to remain rear-facing, even after reaching 20 pounds, it is important that the convertible seat be able to accommodate a heavier infant while still in the rear-facing position.

For many years, almost all available convertible seats were only certified for use rear-facing up to 20 pounds, so for a health care provider to recommend that the child remain rear-facing after that point would have contradicted the manufacturer's instructions. While most convertible seats in use have a maximum rear-facing limit of 20 to 22 pounds, several seats certified for rear-facing use until a child is 30 or 35 pounds have recently become available (see Table 1). In Sweden, rear-facing child seats hold children up to 55 pounds. That nation has the lowest highway fatality rate of children under age 6 in the world, 6.8 per million compared to 24.8 per million in the United States.² Health care providers can provide a major service by identifying early those children who are likely to weigh more than 22 pounds before their first

Table 1: List of Convertible Safety Seats Certified for Rear-Facing Use up to 30-35 Lbs.

SafetyBeltSafe U.S.A. recommends that infants ride facing the rear of the car as long as possible (at least until a minimum age of 1 year) to protect them in a crash from severe spinal injury. The following convertible safety seats are certified for rear-facing use up to 30-35 lbs. and for forward-facing use up to 40 lbs. Only models with a 5-point harness are recommended for newborns; some of the models listed have a tray-shield. Since products may stay on store shelves for several months, it is important to check the sticker on the seat to verify the maximum rear-facing weight.

Britax

Roundabout (all certified to face rear up to 30 lbs.)

Century

Bravo (all certified to face rear up to 30 lbs.)
SmartMove (seats dated after 3-31-97 modified and certified to face rear up to 30 lbs.)

Cosco

Alpha Omega (all certified to face rear up to at least 30 lbs; labels and instructions changed after 9-1-99 to face rear up to 35 lbs.)
Touriva and Olympian (seats dated after 3-1-99 modified and certified to face rear up to 30 lbs; labels and instructions changed after 9-1-99 to face rear up to 35 lbs.)

Evenflo

Horizon (all certified to face rear up to 30 lbs.)
Medallion (labels and instructions changed after 1-4-99 to face rear up to 30 lbs.; no structural modifications)

Reference: SafetyBeltSafe U.S.A. Document #626 (9/3/99)

birthday and encouraging their caregivers to choose a convertible seat with a higher rear-facing limit. Such seats provide an opportunity for children to continue riding rear-facing even beyond their first birthday, increasing their protection until they are 30 to 35 pounds.

Most convertible seats have three sets of slots for the internal harness straps which are placed over the child's shoulders. When a convertible seat is in the rear-facing position, these harness straps should be threaded through the slots which bring the harness closest to the child's body, preferably the uppermost slots that are still at or below shoulder level. For newborns, even the lowest slots available in a convertible seat may be quite a bit above the shoulders. This is acceptable as long as the straps go across the baby's shoulders and chest. For the snuggest fit, however, it is preferable to use an infant-only seat for newborns and young infants during the first few months.

Some caregivers will place the shoulder belt under the child's arm or behind the back, both of which are very dangerous.

In almost all brands and models of convertible seats, only the top slots are reinforced. Therefore, when the seat is in the *forward-facing* position, the harness straps must be threaded through the *top* slots. Harness straps threaded through the bottom or middle slots could tear through the seat during a frontal collision, leading to the child being ejected or striking the vehicle interior with substantial force. Notable exceptions are the Britax Roundabout and Early Development Guardian Folder, in which all three slot positions are reinforced. However, because of the risk involved, health care providers should recommend that caregivers thread the harness straps through the top slots when the child is turned forward, unless it has been verified in the manufacturer's instructions that the seat has reinforced slots at all positions.

In the forward-facing position, straps should be at or above the child's shoulders. As with an infant-only seat, the harness straps should be as snug as possible without pressing into the skin and causing physical discomfort. The caregiver should not be able to pinch any harness fabric between the fingers.

Built-in Seats

Some vehicles now have built-in child safety seats. Some function like forward-facing car seats with harness straps while others are built-in boosters, which position the child in the shoulder/lap belt for correct fit. Lower and upper weight limits vary by seat type and manufacturer, but none are for children under 1 year old or under 20 pounds. Their main advantages are convenience and eliminating troublesome installation problems.

Booster Seats

Generally, children should remain in a convertible seat until they have reached 40 pounds or their shoulders are above the top harness slots. After that, the child should ride next in a booster seat

or combination child seat/booster. The health care provider can introduce this concept to caregivers at well-child visits, long before the child has reached 40 pounds. Because of misinformation regarding the fit of the vehicle safety belt system, many children ride using only a shoulder/lap belt (which has been designed to fit adults) once they have outgrown the convertible seat. This leads to the shoulder belt not fitting correctly over the clavicle and center of the chest, and the lap belt not fitting correctly across the top of the thighs. Such misuse often leads to serious injuries during a collision. Some caregivers will place the shoulder belt under the child's arm or behind the back, both of which are very dangerous. Safety belt positioners also are commonly used. These devices, which are designed to pull the shoulder belt down, also pull the lap belt up and across the abdomen. To date, no certification is required for safety belt positioners. In government testing, however, even a fifth-percentile female dummy was ejected from the shoulder belt when restrained using this type of device. Safety belt positioners are *not* an adequate substitute for booster seats. The only type of shoulder belt guide that is recommended is attached to the shoulder belt portion alone. It is appropriate for adults and children who are too large for belt-positioning boosters.

The proper way to protect a child weighing more than 40 pounds who is at least 3 years of age is to use a belt-positioning booster seat which elevates the child, resulting in the shoulder belt fitting over the clavicle and center of the chest and the lap belt placed across the hips or thighs. Although normally a child should transition into a belt-positioning booster at 40 pounds, certain models may be used for children beginning at 30 pounds. These can be used when a child is too tall for a convertible safety seat, but not yet 40 pounds or when a child will be riding in a different car and there is concern that the convertible seat might not be properly installed.

Most children do not fit properly in a shoulder/lap belt until they are 8 to 10 years old and approximately 4'10".



Child Safety Seat Checklist

- ✓ Never put a rear-facing child in front of an air bag.
- ✓ Change from an infant-only to a convertible seat by 20-22 pounds or when the top of the head is within one inch of the top of the infant seat, whichever occurs first.
- ✓ Keep infants rear-facing as long as possible, at least until they are both 20 pounds and 1 year of age.
- ✓ Change to a belt-positioning booster at 40 pounds.
- ✓ Change to a lap/shoulder belt without a booster only when both the vehicle shoulder belt and lap belt fit properly, on average when a child is at least 8 years old and weighs at least 60 to 80 pounds.
- ✓ Keep children in the back seat until they are at least 12 years old.
- ✓ Attend a safety seat “checkup,” where a child passenger safety expert can provide an individualized assessment of the fit, efficacy, and proper use of the child safety seat.

Even when a child has begun riding in a booster at 40 pounds, most caregivers do not keep their children in the booster until a shoulder/lap belt alone will fit properly. This decision results from a combination of misinformation (from both caregivers and health care providers), inadequate state laws, and childhood peer pressure, making it important that the health care provider discuss this issue at all appropriate well child visits. Anticipatory guidance is key to compliance, because once children have begun riding in only shoulder/lap belts, it is less likely that they will switch back to a belt-positioning booster.

There is no single rule to follow when determining if a child may ride safely without a booster. Age is an important factor, because a child must be mature enough to sit still in the proper position. Most children do not fit properly in a shoulder/lap belt until they are 8 to 10 years old and approximately 4'10". (These guidelines can vary depending upon the child's body proportions.) Caregivers may determine that a child is ready to ride in a shoulder/lap belt without a booster if the child's: 1) back and buttocks are against the seat, 2) knees are bent

over the edge of the cushion, 3) shoulder belt is across the shoulder, 4) lap belt is over the thighs, and 5) the child is mature enough to maintain his or her position throughout the ride.

There are two types of belt-positioning boosters: high-back and backless. High-back boosters provide head support, which is necessary if the vehicle has low seat backs. Backless boosters may fit better in certain vehicle seats. It is imperative that a child's head be supported either by the vehicle seat, headrest, or the back of the booster. The maximum weight of belt-positioning boosters ranges from 60 to 100 pounds.

It is recommended that removable shield boosters only be used with the shield removed—which converts them to belt-positioning boosters. In general, boosters with the shield cannot provide equivalent upper body restraint compared with either a child safety seat with a full internal harness or a belt-positioning booster. Currently, boosters with the shield in use are only certified for children up to 40 pounds, and these children are better protected in a safety seat with a full harness system.

The locking clip is designed to prevent the belt from sliding through the latchplate, thus keeping the safety seat tightly secured.

Combination Child Seat/Boosters

Also known as “child seats,” “forward-facing car seats,” “child seat/boosters,” or “combination toddler seat/boosters,” these seats combine features of convertible and booster seats. They are designed to be used only forward-facing with a minimum weight from 20 to 30 pounds, depending upon the model. At the lower weight limits, the child is strapped in using a five-point harness system. All of the internal harness slots are reinforced in seats which are designed to be used forward-facing only. The harness straps should be threaded through the slots just above the child’s shoulders.

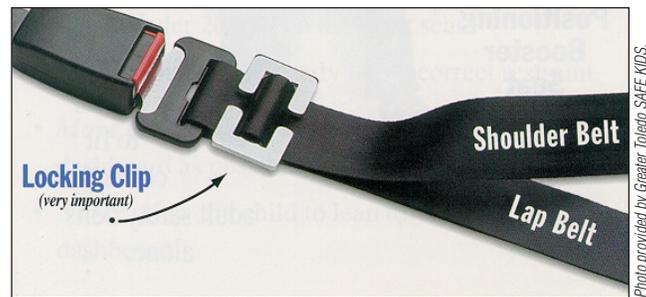
Later, the harness straps are removed, and the seat functions as a belt-positioning booster. Although some models can be used in belt-positioning booster mode with the straps removed as early as 30 pounds, it is generally recommended that the harness straps be used until 40 pounds, at which point they must be removed. Currently, there are no conventional seats available which are certified for use with harness straps for children over 40 pounds, although a child seat with an internal harness certified for use up to 60 pounds should be available in early 2000.

E-Z-On Vest and Y-Harness

The E-Z-On Vest provides a full harness system for passengers from age two to adult and can be used with either a shoulder/lap or lap-only belt. The Y-Harness is designed to provide upper body restraint for older children and adults if only a vehicle lap belt is available. Both products require additional attachment to the vehicle with a tether strap and bolt (see page 21). Either of these will provide a safer way for children over 40 pounds to ride compared to riding in a lap belt only when there is no shoulder/lap belt in the back seat. However, retrofit kits are available for shoulder belt installation in many pre-1989 vehicles and are preferred as a means of permitting a child to use a belt-positioning booster.

Car Seat Accessories

Many products are used in conjunction with child restraints and vehicle belts, though most of them are not federally regulated. Some, but not all, have been voluntarily tested by their manufacturers. Detailed knowledge regarding these products is not expected of most pediatric health care professionals. However, a basic understanding of locking clips and tethers will facilitate discussions of child passenger safety at well child visits.



Locking Clip. If there is a continuous shoulder/lap belt and a sliding latchplate, the lap portion of the belt is likely to loosen during ordinary driving, permitting the safety seat to move out of position. The locking clip is designed to prevent the belt from sliding through the latchplate, thus keeping the safety seat tightly secured. The slack from the shoulder belt portion should be reeled back into the retractor because in a crash, the retractor locks the complete belt system. Because the need for a locking clip is determined by both the safety seat fit and the type of safety belt mechanism, it may be necessary to consult more than the manuals for both products for proper installation instructions (see list of *Resources* on page 22). Locking clips must be removed when the shoulder/lap belt will be used to secure an older child or adult rather than a child safety seat.

Tether/Bolt. A tether is a strap which connects the top of the child safety seat to a specially installed bolt anchored securely to the frame of the vehicle.

The range of specialized items currently available means that a crash-tested child safety seat or other restraint system is available for virtually all children.



Illustration provided by Virginia Commonwealth University.

Use of a tether can add extra stability and reduce forward travel of the child's head by two to eight inches. Tether straps can be obtained for most convertible and forward-facing child seats. Pre-installed tether anchor hardware is required in most vehicles manufactured after September 1, 1999. Forward-facing seats manufactured since that date must meet a more stringent federal standard for "head excursion" which, for most seats, will require pre-attached tether straps. For older seats and cars, caregivers must contact the seat manufacturer to obtain the tether kit and consult the vehicle manual for information regarding parts and installation locations. Vehicle dealers may be receiving more assistance from the vehicle manufacturers due to the new regulations, but additional advice might be needed from a person knowledgeable about safety seat installation.

Special Needs

A child's needs in the context of the entire family, as well as the available vehicle(s), must be assessed before selecting the best choice of restraint system. Often a "traditional" safety seat will fill the requirements of a child's temporary or permanent special need. For others, the range of specialized items currently available means that a crash-tested child safety seat or other restraint system is

available for virtually all children, although assistance from a child passenger safety expert may be needed.

Vests. Both a tethered vest and a harness for children 25 to 40 pounds that requires use of the vehicle safety belt only (without a tether) are available in sizes to fit passengers from age 2 to adult. The tethered vest may be necessary for children under age 3 who weigh more than 40 pounds. A version of this vest has been modified for use by casted children who must lie flat but are too large for car beds. It can be used in school buses, attached to vehicle-seat-encircling "cam wraps" instead of being tethered. A rear-closing version is available for children who have difficulty complying with the need for child safety restraints.

Car beds. Although the best choice for infants generally is to ride rear-facing and semi-reclined, American Academy of Pediatrics guidelines recommend testing infants born less than 37 weeks gestation for positional apnea and brachycardia with supervised observation in a semi-reclined safety seat. If the infant "fails" the test or has other physical or medical conditions which require the child to lie prone, on the side, or supine, a car bed is a good option. One model is designated for infants less than 9 pounds, while others can accommodate a child up to 20 to 21 pounds.



Photo courtesy of Lockhart Designs.

Some children seem especially adept at unbuckling themselves, even when securely restrained. A very important rule to follow consistently is: If the child unbuckles, the vehicle stops—period.

Seat to accommodate orthopedic casts. A convertible safety seat designed for infants and children weighing up to 40 pounds is available. Its “cut-down” sides and seat area accommodate children in a variety of casts. Since this is a temporary condition, families usually only need access to this product for a short period of time.

Safety seats for children weighing more than 40 pounds who need support when seated. A number of specialized safety seats to serve children up to 100 pounds or more are available. In addition to safety belts, all require additional attachments, such as tether straps.

Wheelchair tie-downs and ambulance transport. With physicians serving in various capacities, it is important to know that crash-tested wheelchairs and their tie-downs are available and that, if children must travel in their wheelchairs, the chair must not be side-facing. There are specialized restraints for ambulance use; however, more research is needed to set definitive standards for this vital area.

Difficult Dilemmas and Possible Solutions

As in most aspects of medicine, there are certain problems in child passenger safety which do not have a single correct answer, and the best solution may vary depending upon a number of factors. Below are common scenarios which families are likely to encounter.

Too many kids and not enough belts in back. The most securely restrained child should sit in the front passenger seat, with the seat pushed back as far as possible. Placing more than one child in a single vehicle safety belt is dangerous and is *never* an acceptable option. If there is a passenger air bag, a rear-facing child must *never* ride in the front.

Resources

SafetyBeltSafe U.S.A.

<http://www.carseat.org>

P.O. Box 553

Altadena, CA 91003

800-745-SAFE (7233) / 800-747-SANO (7266) (Spanish)

American Academy of Pediatrics

<http://www.aap.org>

Safe Ride News

<http://www.saferidenews.com>

Center for Injury Prevention

<http://www.cipsafe.org>

800-344-7580

National Highway Traffic Safety Administration

<http://www.nhtsa.dot.gov>

888-DASH-2DOT (888-327-4236)

The National SAFE KIDS Campaign

<http://www.safekids.org>

800-441-1888

E-Z-On Products

800-323-6598

The squirming toddler (also known as the “Houdini” syndrome). Often harness straps are not correctly snugged, but some children seem especially adept at unbuckling themselves, even when securely restrained. A very important rule to follow consistently is: If the child unbuckles, the vehicle stops—period. The following suggestions can be offered:

- Have the child model the parent by buckling a favorite doll or stuffed animal in the seat while at home.
- Take short trips just for the child—with an abrupt end of the trip if the child unbuckles.
- Allow extra time to account for delays if the child unbuckles.
- Begin discussions of correct car seat safety (for caregivers as well as children) in day care and pre-school.

Physicians can use their authority and expertise on child health to encourage caregivers and school personnel to provide leadership aimed at increasing the use of booster seats.



A child has reached 40 pounds, but there are only lap belts in the back seat. In the past, a shield booster would have been recommended, but boosters with a shield are no longer certified for use over 40 pounds, and there are currently no conventional seats on the market which can hold a child over 40 pounds using only a lap belt. The E-Z-On Vest is one solution, provided the caregivers install a tether anchor for attachment. Retrofitted shoulder belts are available for many pre-1989 vehicles, thus allowing a child over age 3 to ride in a belt-positioning booster. If there is no passenger air bag, and the front passenger seat can be pushed all the way back, a child over 3 years old and 30 pounds might ride in a belt-positioning booster in the front seat (not an ideal option). The much-anticipated child seat with an internal harness certified for use up to 60 pounds will be a good option for children of all ages weighing more than 40 pounds.

An air bag in the front passenger seat. The explosive action of an air bag can be fatal to a rear-facing child and can increase the morbidity for a forward-facing child. Children under the age of 12 are always safer in the back seat, but there are occasions when a young child is forced to ride in the front seat. Having an air bag “cut off switch,” which deactivates the air bag, will make it safer for a child riding in the front seat. However, the driver must be certain it is deactivated when there is a young child in that position, and then reactivated when an adult passenger rides in the front.

Jump seats. Although riding rear-facing is generally safer, no safety seats have been tested in any direction except when installed on forward-facing bench seats. Side-facing transport is not ideal for any age.

Peer pressure. Up to 90% of 40- to 60-pound children are riding without a belt-positioning booster in an improperly fitted safety belt, so older

children who continue to ride safely in a booster seat are frequently teased about riding in a “baby seat.” School-age children who continue to ride in boosters should be reassured that their caregivers want them to ride as safely as possible, but caregivers cannot control decisions others make for their own children. However, physicians can use their authority and expertise on child health to encourage caregivers and school personnel to provide leadership aimed at increasing the use of booster seats. Caregivers need to be informed of the increased risk of injuries among improperly restrained school-age children and should resist the temptation to permit their children to ride unsafely “just like the other kids.”

The Future

Within the next few years, new vehicles will be fitted with both lower and upper attachments designed specifically to hold safety seats without requiring a safety belt for installation. This system is designed to overcome the misuse engendered by the current plethora of vehicle seat and belt configurations that lead to so many difficult safety seat installations.

The Futura 20/60, developed by Fisher-Price, is a new concept: a forward-facing-only seat which uses an internal harness system for children weighing up to 60 pounds. Early reports indicate that the seat allows less forward head excursion than the federal government mandates, even without use of a tether. The harness straps may not be removed, and the seat is not intended to be used as a belt-positioning booster. This seat fills the needs of children under 3 years old who have reached 40 pounds, as well as children up to 60 pounds who ride in vehicle seat locations with lap belts only. This will be a portable child restraint that provides the same protection as existing built-in seats which, up until this time, have been the only conventional safety seats to provide such protection for children over 40 pounds.

Education

Increasing the rate of proper child safety seat usage will require significant education of caregivers as well as health care professionals. The observed 95% misuse rate of safety seats frequently quoted by child passenger safety experts primarily comprises caregivers who thought their children were buckled properly. There will always be caregivers who consider the proper use of safety seats “not worth the trouble,” but those who wish their children to ride safely require proper instruction. This should start prenatally and continue throughout childhood. Ideally, every hospital and birthing center should be able to ensure that a child safety seat is installed properly—not just that the family has one available. The health care provider(s) who will be caring for the child through the first several years of life should counsel the caregivers at each visit, making sure that the child is riding in the proper type of seat and facing the proper direction based on the child’s age, weight, and maturity. When questions arise which cannot be answered in the inpatient or outpatient setting, the family should be referred to an appropriate resource, (see *Resources*, page 22).

Conclusion

There is no doubt that proper child safety seat use is a complicated issue. However, knowing the best available seat types and how they should be installed for children of various ages and weights will enable the pediatric health care provider to give proper guidance to families who wish their children to ride safely. Moreover, identifying dangerous patterns of child safety seat misuse during routine well child visits can help families correct errors before there is a disaster.

Dr. Michael Sachs is a general pediatrician in Los Angeles. He is on the attending staff at Cedars-Sinai Medical Center and is an assistant clinical professor of pediatrics at the University of California, Los Angeles. Dr. Sachs serves on the Advisory Board for SafetyBeltSafe U.S.A.

Stephanie Tombrello, LSCW has been active in the field of child passenger safety since 1970. She has been instrumental in major changes in government regulations, such as the passage of HR 4616, which expanded funding for child passenger safety throughout the U.S. She successfully petitioned for the critical change in the National Highway Traffic Safety Administration regulations mandating shoulder/lap belts in rear-seating positions in all cars and light trucks sold in the U.S. since December 1989. As a founder and Executive Director of SafetyBeltSafe U.S.A., Ms. Tombrello has been intimately involved with technical and programmatic approaches to increasing correct, consistent use of safety seats and safety belts by children and their families.

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