

V O L V O

Children & Cars

A safety manual



Children & Cars

This safety manual helps anyone who drives with children reach a better understanding of child safety matters. For Volvo Cars, it's a topic that has engaged us for over **50 years**. This is what we have learned.

Have a safe journey!

Agenda

1. KNOWLEDGE SAVES LIVES

EASY TO GET IT WRONG	5
CHILD RESTRAINTS	6

2. THE MOTHER TO BE

SAFETY FOR THE UNBORN CHILD	12
MEET HELENA HJORT	15

3. REWARD-FACING CHILD SEATS

BABY'S FIRST JOURNEY	16
MEET THE STRÖMBERG LÖFVENIUS FAMILY	20
WHY REARWARD-FACING CHILD SEATS?	23
DOCUMENTING THE DIFFERENCE	27
MEET THE EXPERT LOTTA JAKOBSSON	30
CRASH-TEST DUMMIES	32
FAQ ON REARWARD-FACING CHILD SEATS	37
MEET THE LEDIN HÖGLUND FAMILY	42

4. BELT-POSITIONING BOOSTERS

FAQ ON BELT-POSITIONING BOOSTERS	48
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REFERENCES



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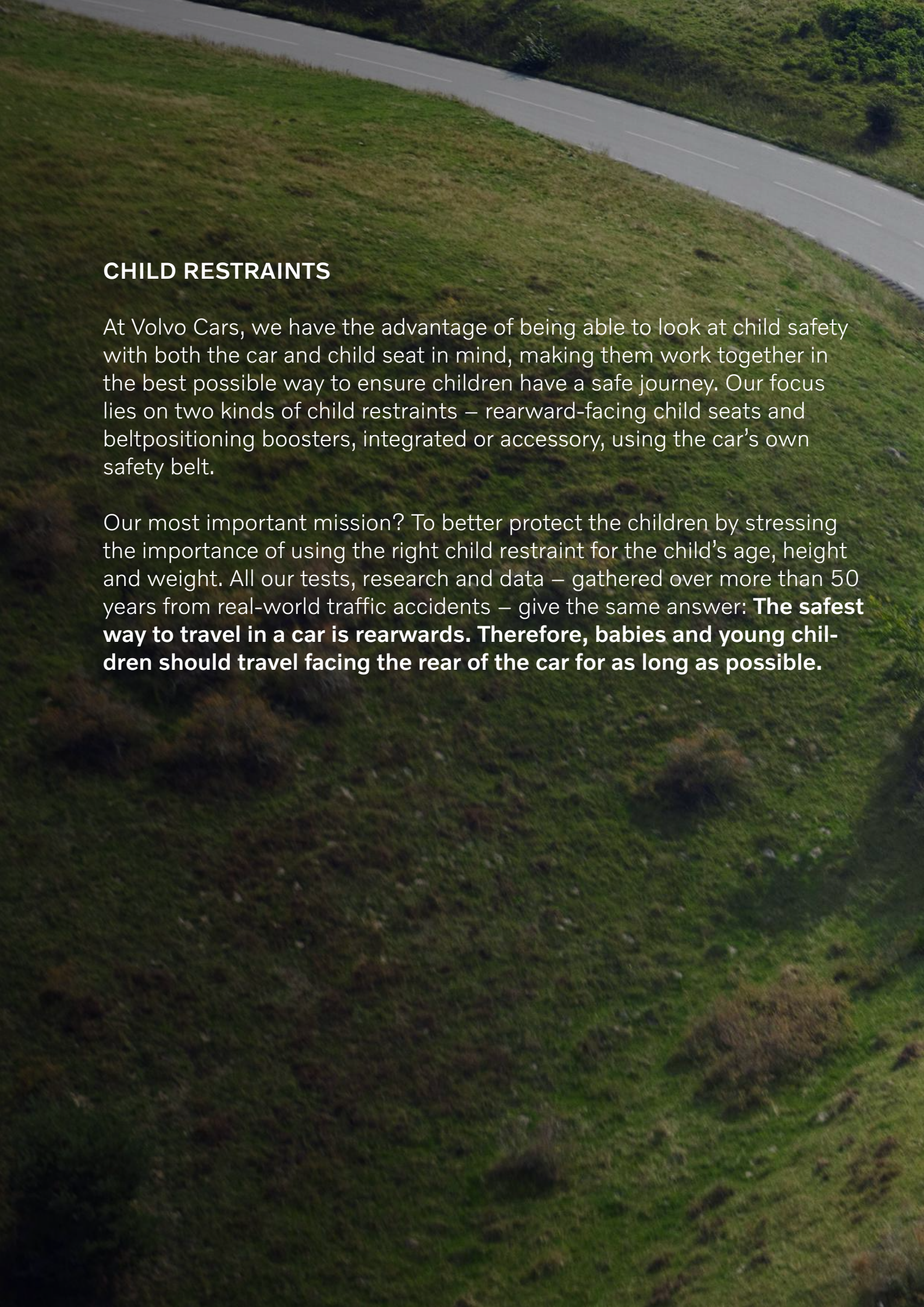
Knowledge saves lives

ALL PARENTS WANT to give their children the best possible protection both in the car and everywhere else. Even so, children are still suffering injuries or even dying because of incorrectly fitted child seats, or because the type of child restraint they were using was wrong for their age, height and weight. Even worse, some children travel completely unrestrained in a car. The cause of the problem is often simply a lack of knowledge.

People sometimes think they have fitted a child seat correctly when, in fact, they haven't. They may believe that a child can safely switch from a rearward-facing seat to a forward-facing seat at the age of just one or two years, when they shouldn't. They may think they have adjusted the safety belt correctly, when they haven't.

EASY TO GET IT WRONG

One Swedish study revealed that only 40 percent of three-year-olds had a rearward-facing child seat, although all three-year-olds should still be using seats which face the back of the car. The same study found that some users of boosters placed the diagonal belt under the arm instead of across the shoulder, as well as incorrectly routing the lap belt. The lap section of the safety belt should go across the top of the child's thighs, not across the stomach. A few children were even sitting on the lap of the driver or other passengers. Airbags were another area where failings were found in usage or behavior. Contrary to recommendations, some children were seated with an active airbag. Children in a rearward-facing child seat must not sit in the front passenger seat with a frontal airbag (unless the airbag has been switched off). This safety manual has been compiled to help parents and others who carry child passengers to become better informed about the safety of children in cars. It should provide answers to many of the questions that new parents and parents-to-be often ask.

An aerial photograph of a two-lane asphalt road that curves through a lush green, grassy hillside. The road has white dashed lines for lane markings. The surrounding vegetation is dense and green, with some darker patches of shadow. The perspective is from a high angle, looking down at the road as it disappears into the distance.

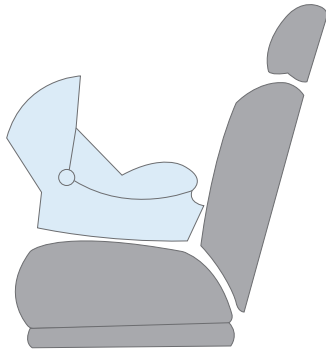
CHILD RESTRAINTS

At Volvo Cars, we have the advantage of being able to look at child safety with both the car and child seat in mind, making them work together in the best possible way to ensure children have a safe journey. Our focus lies on two kinds of child restraints – rearward-facing child seats and belt-positioning boosters, integrated or accessory, using the car's own safety belt.

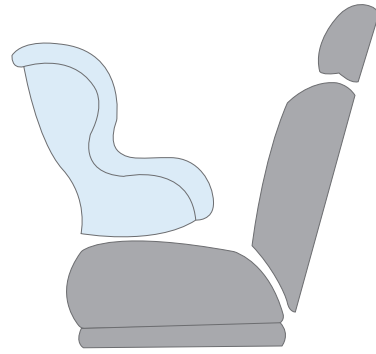
Our most important mission? To better protect the children by stressing the importance of using the right child restraint for the child's age, height and weight. All our tests, research and data – gathered over more than 50 years from real-world traffic accidents – give the same answer: **The safest way to travel in a car is rearwards. Therefore, babies and young children should travel facing the rear of the car for as long as possible.**



REARWARD-FACING SEATS: NEWBORN UP TO AT LEAST 4 YEARS

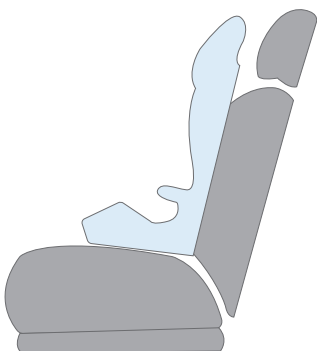


Rearward-facing baby seat

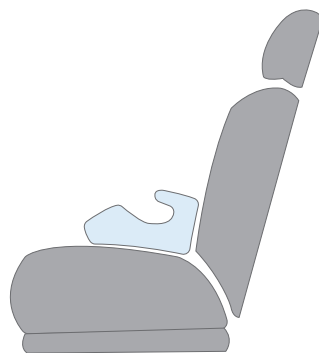


Rearward-facing child seat

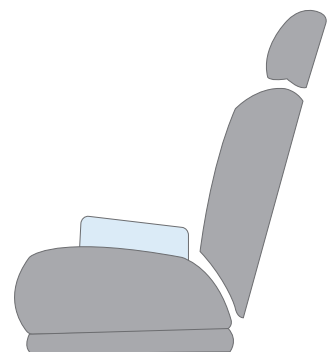
BELT-POSITIONING BOOSTERS: 4 TO APPROX 10 YEARS



Booster seat



Booster cushion



Integrated booster





2.

The mother-to-be

Women sometimes ask whether it would be better not to use a safety belt when they're pregnant. They fear that the belt could harm their unborn baby in some way. The answer to this question is that they should always use a safety belt, right up until birth. Equally important is to wear it correctly.

- Position the safety belt snugly, untwisted and close to the body. Open thick jackets and position the safety belt towards the body.
- The lap belt should be flat against the side of the thigh, low below the belly. The belt should not slide up across the belly.
- The diagonal belt should be placed on your shoulder, optimally in the middle of the shoulder.
- Make sure you are sitting in a comfortable position – you should be able to easily reach the steering wheel and the pedals, while maintaining as much distance as possible between the steering wheel and your upper body (torso).

Add-on devices are available to help position the safety belt for pregnant women. However, they are not developed in conjunction with the car's restraint systems, and there is no evidence that improve safety in crashes. In fact, they might even be dangerous by adding slack to the safety belt.

SAFETY FOR THE UNBORN CHILD

Today, researchers and car makers have comprehensive knowledge about how to best protect adults and children in the event of road accidents. There is also research into how to best protect an unborn baby in an accident, although there is still more to learn in this area.

For decades, researchers at Volvo Cars have been studying the specific needs of pregnant women regarding safety and comfort. One result of this pioneering work was the development of a unique virtual model of a pregnant woman in 2001. This computer model is one tool used to increase the understanding of how a pregnant woman and her unborn child can be protected in a collision. Together with data from real-life accidents, this model has helped in the development and evaluation of car safety. Head injuries are one of the injury categories noted in unborn babies involved in car crashes, both fatal and non-fatal. The most frequently documented cause of death in the unborn, however, is the partial or total detachment of the placenta from the wall of the uterus, which prevents the fetus from getting enough oxygen.

The question is, why? Researchers think that the uterus itself is elastic enough to withstand the deformation caused by crash forces, but that the placenta is not equally elastic and therefore not as resilient. What is perfectly clear, however, is that pregnant women should always use their safety belts.





‘There’s another life inside of me that needs protection’

Helena Hjorth, Stockholm, Sweden

How have you found driving a car while pregnant?

‘Initially, there was no big difference. But as my belly has grown, it has become harder to get in and out of the car, and harder to get the safety belt to sit right and to find a comfortable position in the seat. Now that I’m at the end of the pregnancy, I’m very conscious of the fact that there’s another life inside of me that needs protection too. But the thought has also crossed my mind that the safety belt may harm my child if it is positioned incorrectly in the event of a crash.’

Have you found out what position the safety belt should be in?

‘A friend of mine who was a bit ahead of me in her pregnancy got an add-on that fixed the belt to stop it sliding up onto the belly. But the information I found was that a properly positioned safety belt offers more protection. And I found out what position the safety belt should be in the lap belt should be under the belly against the thighs and the diagonal belt across the shoulder. That was useful to find out.’

Is there anything else you have changed when driving pregnant?

‘Yes, trying to sit as far from the wheel and airbag as possible while still being able to reach everything.’

How are you going to get home from the maternity ward?

‘We’re actually going to take a taxi with our baby in a baby seat. It feels like a good time not to be driving ourselves. We’ll have plenty of other things to think about!’



3.

Rearward-facing child seats

BABY'S FIRST JOURNEY

For most babies, their first car ride is the drive home from the maternity unit. It's an exciting but rather jittery time for most. A new little person has come into the world, and a new life is beginning for the parents and any older siblings too. Ahead of you is a new routine, punctuated by feeds, sleeps both short and long, and nappy changing. Most things will have been planned and prepared for, but there will always be a few details to iron out. One thing that really must be planned for is the first journey home. Right from the start, your baby needs to have his or her own baby seat properly anchored, correctly fitted and facing the rear of the car. This baby seat will provide good protection for the first few months of the baby's life.

The seat should always be the right size for the baby. When the baby has grown to such an extent that its head reaches the top of its seat or beyond, it's time to change to a larger rearward-facing child seat. You can move your baby to a larger rearward-facing child seat earlier than this. These rearward-facing child seats provide equally good protection for a growing baby. But they must always be of a suitable size for your baby at the time.





GABRIA

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TESTED CHILD SEATS

Any parent who has ever chosen a child seat will agree that it is no easy task. Before you buy one of the many child seats available on the market, make sure that the seat is optimal for your car and that you know how to install it. Volvo Cars has its own range of child seats that are tried and tested in cars to ensure that they meet strict requirements on safety, usage and installation.

AN INTERNATIONAL STANDARD

Given the vast number of child restraints on the market and the danger of not fitting them correctly in the car, many stakeholders early saw the need for a joint effort. In 1999, international cooperation between car makers, child seat manufacturers, public authorities and other stakeholders resulted in ISOFIX – an international standard for anchoring child seats in vehicles. ISOFIX includes standards for attaching child seats and matching vehicle anchor points. Two anchor points are built into the car between the seat backrest and seat cushion. A seat base can be securely attached using these anchor points, and the baby or child seat can then be quickly and easily attached or detached. Some ISOFIX child seats can be attached to the anchorages without a separate base. Depending on the market, ISOFIX child seat connectors are rigid, allowing for a click-in installation, or non-rigid, using latches for attachment, called LATCH or UAS. A third anchorage point, called “top tether”, enables the connection of straps routed over the seat backrest. In addition, specifically for large rearward-facing child seats, anchorages in the floor area, called “lower tether anchorages”, may be available for straps routed forward. The anchorages used for each child seat may vary and must be followed. ISOFIX anchor points are found in all new cars. The number of different child seats available with ISOFIX attachments is steadily increasing, but there is still a wider range of seat types secured by the car’s safety belts on offer.

‘As a new parent you really become conscious of safety’

Daniel Strömberg and Anna Löfvenius with their daughter Ingrid, 6 months old, Gothenburg, Sweden

How did you prepare for Ingrid’s arrival?

‘We test drove the route to the hospital and tried to keep track of when during the day there was congestion. We had also bought a baby seat with ISOFIX. We thought the baby seat was a bit loose when we fitted it, so we had to check with a dealer how it was supposed to be fitted before we felt safe. Then we were ready.’

Tell us about your journey home from the maternity ward.

‘Well, we were obviously pretty nervous about leaving the safe bubble of the hospital and taking responsibility for our own child. In a car, no less! You’re completely convinced that someone is going to drive into you. We’ve never driven more carefully than we did that time. We took extra care looking at every crossroads and trying to brake as gently as possible. You realise how vulnerable babies are – they have no control over their necks. A small thing like how tight the belt in the baby seat should be turns into a big thing when you’re doing it for the first time. But everything went fine!’

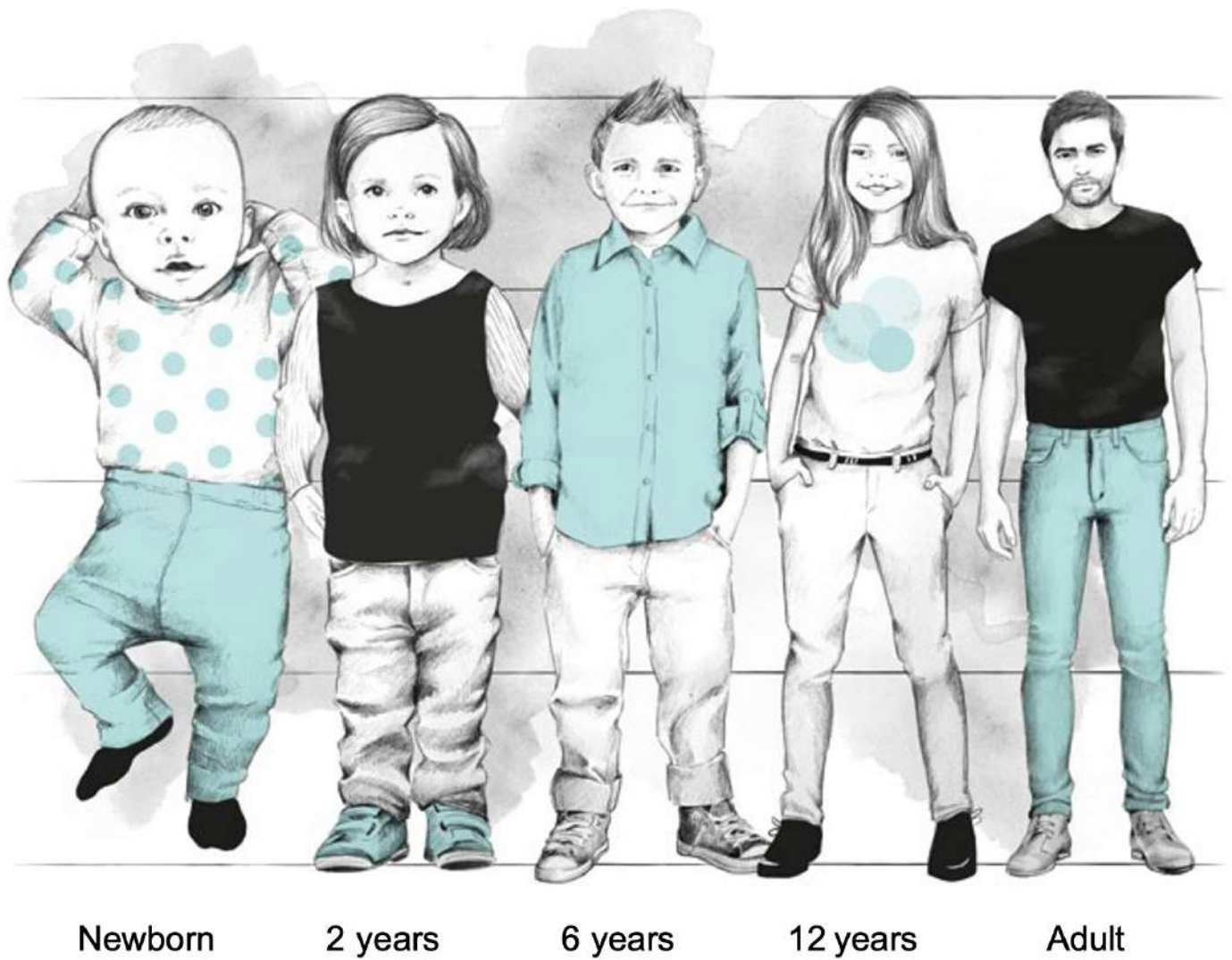
How did you position the baby seat?

‘We positioned it on the back seat behind the passenger seat, with a mirror on the head restraint of the back seat so that whoever is driving can look over their shoulder and see Ingrid. We chose that position because we thought it was the least distracting for the driver. As a new parent, you really become conscious of safety – you don’t mess around with it.’



BODY PROPORTIONS

Birth to adulthood



Source: Burdi et al, 1969

WHY REARWARD-FACING CHILD SEATS?

Babies and children are especially fragile passengers. Relative to the rest of their bodies, their heads are large and heavy. The head of a nine-month-old baby, for instance, makes up 25 per cent of its total weight.

In comparison, the head of an adult male constitutes only six per cent of the total body weight. A baby's head has quite different proportions too; its face is relatively small compared to the rest of its head.

If a baby or child suffers head injuries, it often entails brain damage, which is usually much more serious than facial injuries. Head injuries in babies are often more severe because their skulls are thinner than an adult's.

Soft skeleton

The neck vertebrae of a newborn baby are composed of separate portions of bone joined by cartilage. In other words, the baby's skeleton is still soft. This cartilage turns into bone over the first three to four years of the baby's life. The process of cartilage hardening into bone continues right up until puberty. There is similar gradual development of the muscles and ligaments in the neck. Human neck vertebrae also change shape progressively throughout the years as a person grows, from the horizontal vertebrae of the small child to the saddle-shaped ones of the adult. Being saddle-shaped also means that the vertebrae interlock and support each other if the head is forced forward in relation to the torso. The young child lacks this extra protection. [See illustration on page 25]

Rearwards is safer

The safest way of travelling in a car is rearwards. Therefore, babies and young children should travel facing the rear of the car for as long as possible. In a frontal impact collision, the head of a restrained forward-facing car occupant is thrown forward with considerable force. The only thing restraining the head is the neck. An adult neck can withstand this strain relatively well, but a small child's neck cannot. Given that frontal impact collisions are the most common and the most serious type of crash, it is particularly important for very young children to sit in rearward-facing seats.

Sweden first with child safety ideas

The idea of rearward-facing car seats for children came from Sweden in the 1960s, developed by Professor Bertil Aldman of Chalmers University of Technology in Gothenburg.

Professor Aldman took his inspiration from the special seats used by Gemini mission astronauts during take-off and landing, which were molded to distribute G forces across the whole back. The principle behind rearward-facing child seats is the same. In the event of a frontal impact collision, the whole of the child's back and head takes the strain of the impact, not just its much weaker neck. Thanks to Professor Aldman, rearward-facing child seats came into widespread use in Sweden much earlier than elsewhere. The benefits are reflected in crash statistics.

DEVELOPMENT OF THE NECK VERTEBRAE

■ Cartilage ■ Bone

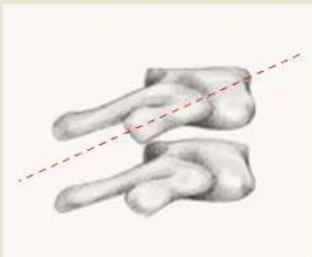
Side view

Top view

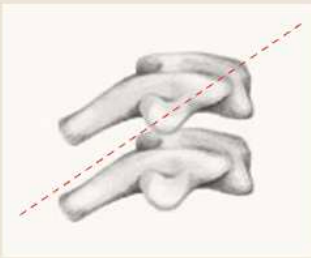
0–12 months



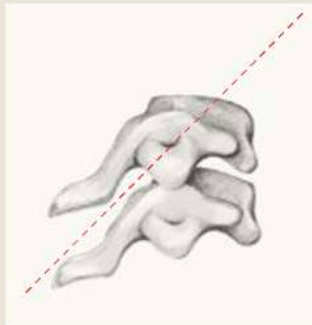
1–3 years



3–6 years



Adult

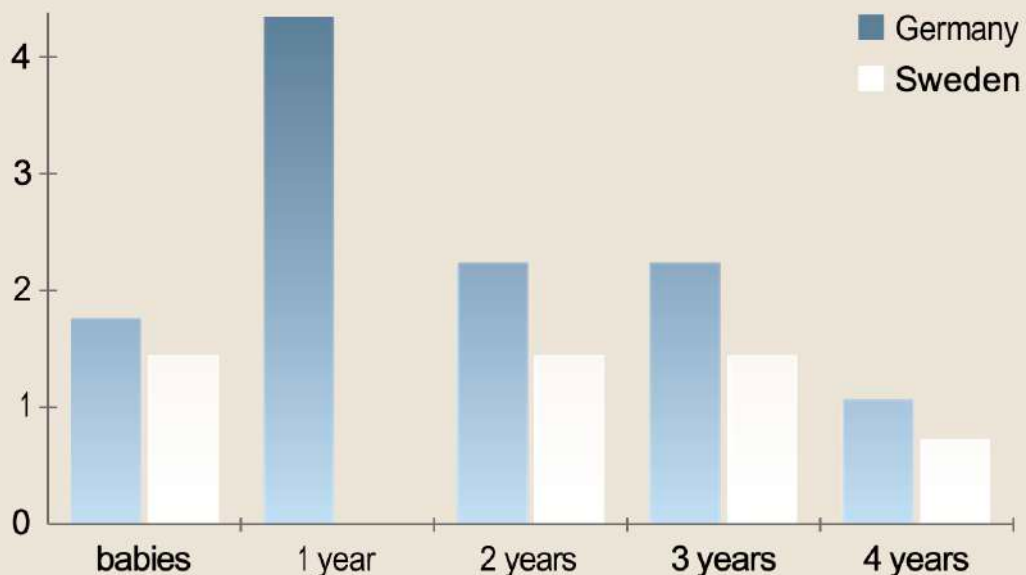


Source: Burdi et al, 1969

Research on data from insurance company Folksam, for instance, shows that the risk of a young child being killed or seriously injured is five times greater in a forward-facing seat than in a rearward-facing one. If you compare Swedish crash statistics with those of countries where most children travel facing forwards, the differences are striking. One example is a study comparing child car occupant fatalities between 2006 and 2011 in Sweden and Germany. Note in particular the differences at one-year-olds. During the studied years, it was the age when German children started using forward-facing child seats, whereas 97 per cent of Swedish children traveled in rearward-facing child seats until turning two years old, and 72 per cent of the two- and three-year-olds.

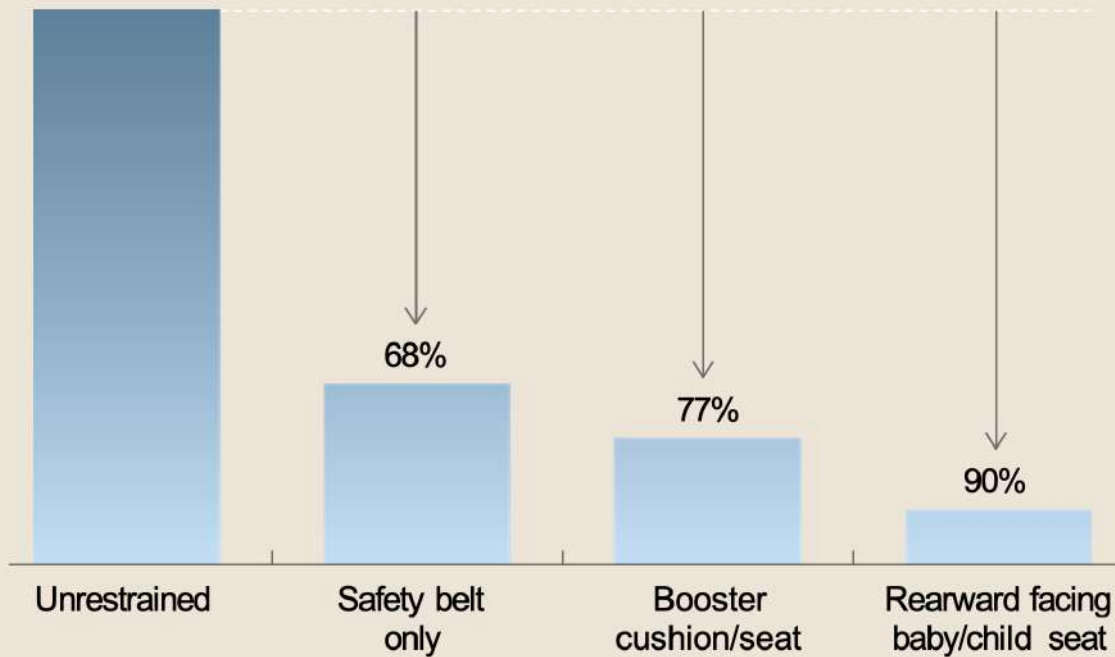
CHILD OCCUPANT FATALITIES

Number of child occupant fatalities per 1,000,000 children



INJURY RISKS PER RESTRAINT TYPE

Children aged 0–15 in Volvo cars in Sweden

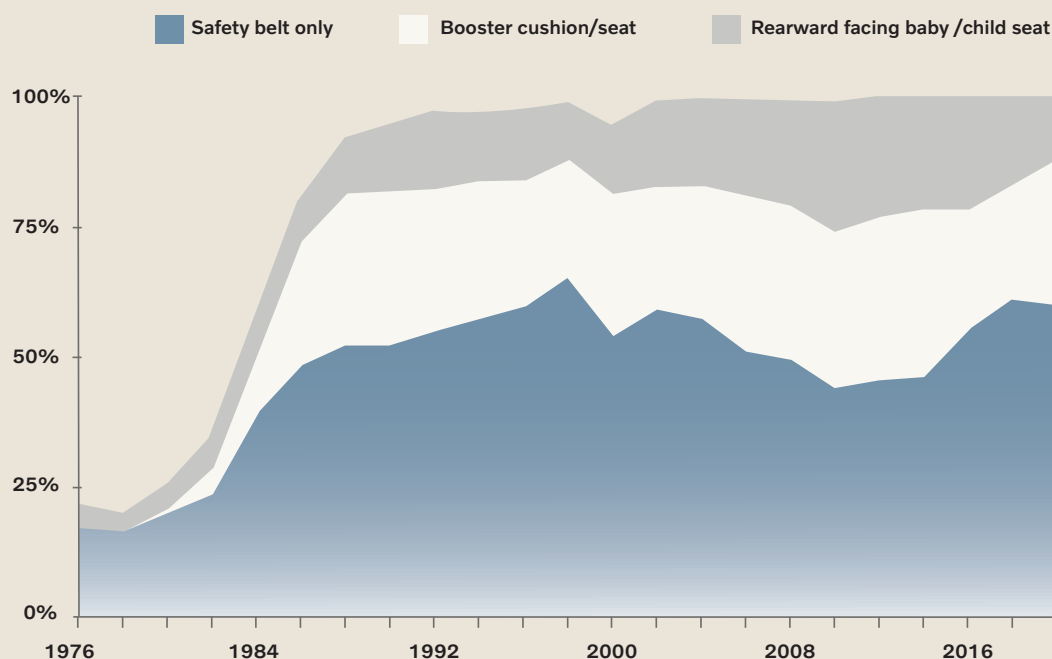


DOCUMENTING THE DIFFERENCE

Volvo researchers worked with Professor Aldman during the 1960s on his child seat prototype, performing crash tests. While his prototype was brought into production in 1967 by Klippan AB in Sweden, Volvo launched a rearward-facing child seat in 1972, a first by a car maker. In 1978, Volvo launched the world's first booster, developed based on knowledge from real-world statistics and investigations. Since 1970, the Volvo Traffic Accident Research Team has been collecting and analysing data from Swedish road crashes involving Volvo cars. The statistical database includes more than 50,000 crashes involving over 80,000 people. It offers a unique resource for researchers wanting to establish more facts about child safety.

Thousands of cases studied

Since 1976, more than 7,000 children aged 0–15 have been involved in car crashes included in the Volvo Cars Traffic Accident Database. Over the same period, the use of safety belts and child restraints increased dramatically, from about 20 per cent in 1976 to almost 100 per cent in the last ten years. The risk of a child sustaining injuries as a car occupant has decreased continuously over the years, which is a result of both increased use of restraints and improved car safety.



Increased protection

The effects of the increased use of restraints are clearly reflected in injury statistics. The type of protection system used is obviously very important. In terms of preventing injuries of moderate level or higher for children aged 0–15, using an adult safety belt provides approximately 68 per cent better protection than using no restraint at all. (See chart on page 27.) The corresponding injury-reducing effect, as compared to those with no restraint, is as high as 90 per cent for children using rearward-facing child seats and 77 per cent for children using boosters. It is also important for children to use a type of child restraint suitable for their current age, height and weight.



‘Rearward-facing child seats dramatically reduce the risk of injuries’

**Lotta Jakobsson,
Senior Technical Specialist at Volvo Cars Safety Centre,
Gothenburg, Sweden**

What is the most important thing to consider when driving with children?

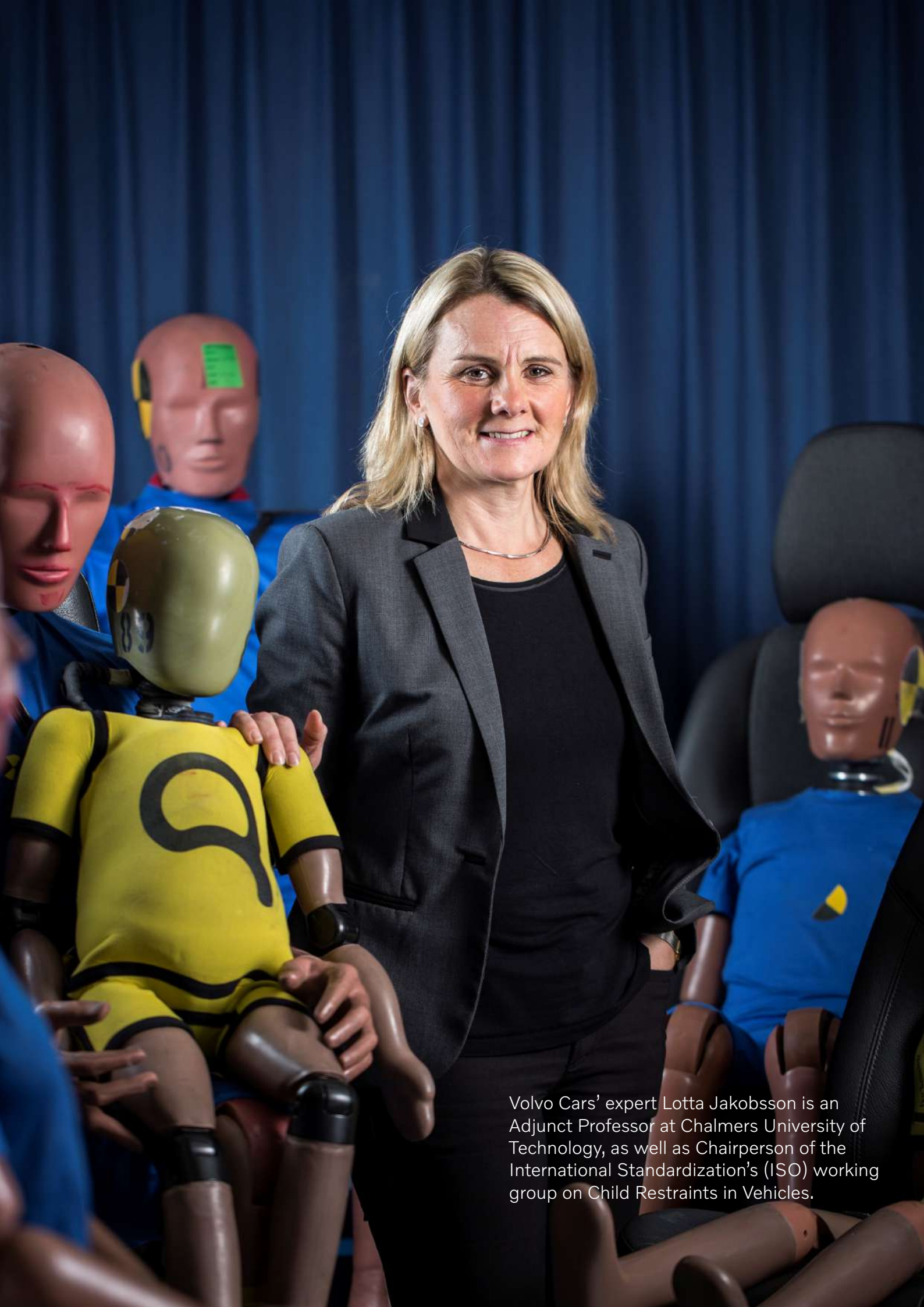
‘Children need specific child restraints; a safety belt isn’t adequate. The child restraint you choose needs to be suited to the child’s size and age, and should be replaced as the child grows. The child restraint is designed to distribute force in the best way possible to the child’s stronger body parts during a crash. Volvo Cars always recommends the use of rearward-facing child seats for as long as possible – at least until the age of 4.’

Why is it so important for children to travel facing backwards?

‘Most parents are aware that children’s neck muscles are weak during the early years. But what many don’t know is that the skeleton isn’t fully developed either. Rearward-facing child seats dramatically reduce the risk of injuries in the event of a crash. In the event of a highly violent frontal impact, it can mean the difference between life and death.’

What is Volvo Cars doing to make children’s car journeys safer?

‘The advantage we have is that we can work with both cars and child restraints, such as integrated boosters in the back seat. We are also pushing issues relating to standardisation and collaboration between the auto industry and child seat manufacturers. We need to get even better at making child restraints lightweight and easy to handle. That will give us an even greater opportunity to get more parents in all countries to use child restraints in the best way possible.’



Volvo Cars' expert Lotta Jakobsson is an Adjunct Professor at Chalmers University of Technology, as well as Chairperson of the International Standardization's (ISO) working group on Child Restraints in Vehicles.

CRASH-TEST DUMMIES

The world's first crash-test dummy was called Sierra Sam. The size of an adult male of large build, he was made in 1949 to test ejector seats for the US Air Force. In 1956 the Air Force shared its findings with the automotive industry. The first dummy to be developed specifically for research on car crashes appeared six years later. Today's crash-test dummies have little in common with Sierra Sam. All the early ones were rather rudimentary, built to confirm that safety systems such as safety belts were effective. They had few measurement points and were not very much like humans at all.

Sophisticated electronics

Modern crash-test dummies, however, are built to respond more like humans. They have the same weight, size and proportions as the type of human they are made to simulate. Their heads, necks, knees and thoraxes are designed to react like real body parts in a crash. On the inside, they have advanced electronic equipment for measuring acceleration and deceleration, displacements, and the various loads and forces affecting the body in a crash.

Today, crash-test dummies come in various sizes and types. Most are used in frontal impact crash tests, but there are also dummies developed for testing in side-on and rear-end impacts. They are available as physical tools as well as virtual counterparts for simulations in a virtual environment. Adult crash-test dummies are developed to represent a mid-sized male, in addition to a large-sized male and a small-sized female. In addition, there are child dummies representing children aged ten, six and three years, as well as babies of eighteen, twelve, nine and six months, and newborn babies. More recently, virtual replicas of human bodies, so called Human Body Models, are developed and used for virtual simulations. With their more anatomically correct design, they help provide more insights into detailed mechanisms.





New cars are safer

Crash-test dummies are one tool the car industry uses to continuously improve safety in cars and traffic. Volvo Cars' own research shows that the risk of injury among people who experience crashes in cars built in the early 2000s or later is two-thirds lower compared to people travelling in cars built 20 or 30 years earlier. The continuous development of car structure as well as developments in advanced restraints contributes to this improvement. Active safety systems with automatic braking at risk of accidents also improve safety by reducing the force of impact or, in the best-case scenario, even entirely avoiding an accident.

None of these improvements would have been possible without research. Crash-test dummies still play an important role in this research, as does all the knowledge collected from studying real-life accidents. crashes.





■ FAQS ON REARWARD-FACING CHILD SEATS

What should I look for when choosing a rearward-facing child seat?

The child seat should suit the size of your child and fit your car. Also make sure that the seat has the requisite type approval. See page 51 for more information on type approval standards and labelling.

What do I need to think about when buying a second-hand rearward-facing child seat?

Don't buy a second-hand child seat unless it is a relatively new one. Make sure that any child seat you buy is undamaged, has the right type approval label, and that all its fittings and installation instructions are supplied with it.

What is ISOFIX?

A standardised anchorage system for baby and child seats. ISOFIX is known as LATCH in the United States and UAS in Canada.

What is i-Size?

i-Size is the latest child restraint type approval standard according to UN R129, introduced in Europe in 2013.

Is a transversal infant bed a safe alternative?

For small children that need to lie down in a flat position at all times (e.g. some premature babies), make sure to use an infant bed that is certified for this purpose. A rearward-facing baby seat should be used unless there are significant medical considerations against this, as facing the rear is always a safer alternative.

Is a rearward-facing lie-flat baby seat a safe alternative?

No, rearward-facing baby seats must always have an upright backrest when used in cars, ensuring the load is distributed over the back and head. Make sure there is sufficient backrest angle to provide such distributed load during the whole trip. Crashes occur in many ways, so it is risky to trust adaptation by a function in a lie-flat baby seat at crash.

Can you be sure that the airbag really has been switched off or disabled?

Yes, the Volvo Passenger Airbag Cut Off Switch (PACOS) is safe and reliable. But you do have to check carefully that the switch is in the OFF position. If you have any doubts about whether the airbag is really disabled, contact your authorised dealership. Check the options for your brand of car and the regulations that apply in your country.

FAQS

In the baby seat – how tight should the child harness be?

The harness should always be tight to the baby's body. A thumb rule is two fingers, but not more, between the harness and the child for appropriate tightness.

How long should we continue using the baby seat?

The most important thing is that the seat used should be suitable for the size of the baby at the time, in order to give it the support it needs. Once the baby has grown so that its head reaches the top of its baby seat or beyond, the time has come to move it to a rearward-facing seat for a larger child. Don't hesitate to change early, since most large rearward-facing child seats accommodate babies too.

What should I do if my child doesn't want to sit in its seat?

Stop and take a break. For a baby, it might be a good idea to take a brand new baby seat indoors and let the baby get used to it at home.

How long should children continue using rearward-facing child seats?

Young children should continue to use rearward-facing seats for as long as possible. It is recommended that children continue using rearward-facing seats until they are at least 4 years old. The older a child is, the stronger their neck will have grown. In addition, the taller a child is, the smaller their head will be in relation to the rest of their body. Not being able to stretch out their legs fully will not affect the child's safety.

Why is this so important?

Because a child's vulnerable neck cannot withstand the strain involved if the head is forced forward in a frontal impact. In a forward-facing child seat, the neck is subjected to very substantial forces. In a rearward-facing child seat, these forces are distributed across the whole of the child's back and head. The opposite will happen in a rear-end impact; however, the forces arising in rear-end impacts are generally lower and definitely less frequent.



FAQS

How do you fit a rearward-facing child seat?

Follow the specific instructions carefully. ISOFIX/LATCH is a standardised anchorage system which often makes it easier to fit child seats. The rigid ISOFIX attachments provide a confirmation (a clicking sound and green indication) when installed correctly. A child seat secured using the car's safety belt is as safe as one secured using the ISOFIX/LATCH attachments. Just make sure the safety belt is routed correctly and securely tightened. The same applies to child seats with support legs and/or anti-rebound bars. Follow the instructions and ensure they are positioned and adjusted accordingly. Volvo cars also feature additional anchorage points in the front seat floor rails for easy attachment of lower tethers for large rearward-facing child seats.

Which is the safest place in the car for a child?

In a Volvo car, all passenger seat positions are equally safe, other factors may influence your choice of location. Many people prefer to have their child within reach, such as in the front passenger seat. However, if there is a rearward-facing child seat in the front seat, the passenger airbag must be switched off. The rear seat is consequently the only option for rearward-facing child seats if the front seat has a passenger airbag that cannot be switched off. In some cars, the passenger airbag can be turned off when required. Your car may have a switch for this purpose – check the owner's manual for instructions. Please note that regulations vary from country to country. In some countries, children are not allowed to be seated in the front seat.

Can you be sure that the airbag really has been switched off or disabled?

Yes, the Volvo Passenger Airbag Cut Off Switch (PACOS) is safe and reliable. But you do have to check carefully that the switch is in the OFF position. If you have any doubts about whether the airbag is really disabled, contact your authorised dealership. Check the options for your brand of car and the regulations that apply in your country.

Is it all right for a child to sit on an adult's lap instead?

No. Children should never be allowed to travel on laps. Each child needs a place of its own in the car, and a child restraint appropriate for its size and age.

Do side airbags pose any risk to my child?

No- Volvo side airbags are designed to keep your child safe in a collision, as long as he or she is travelling in an appropriate rearward-facing child seat.

Does it pose any harm if for instance a child plays with a doll or watches a film on a hand-held device?

Unsecured items can turn into harmful projectiles in a crash. Avoid heavy and sharp loose objects.

What should I do if my child falls asleep with their head hanging at a sharp angle?

If it appears not to bother the child, it probably looks worse than it is. If it bothers you, you can always stop and prop up the child's head with a pillow or cushion.

In Sweden there is a certification called "Plus test". What is this?

"Plus test" is a voluntary certification which evaluates neck loads in a frontal impact test. By choosing a seat with a "Plus test" label you know that it will protect the neck of the child in a crash, something which is not evaluated in the regulatory testing.

Is a forward-facing child seat with an internal harness or shield system a suitable choice for my two-year-old child?

For best protection, a two-year-old child should travel facing the rear to ensure good support of the neck in case of a crash. In addition, rearward-facing seats are robustly designed, being more forgiving for slack in the harness and similar misuse situations. Shield systems have additional concerns beyond being forward-facing. Several of them lack a harness or other restraint over the shoulder of the child, with risk of ejection. In real traffic, a large variety of crashes occur. Using a rearward-facing child seat will provide the robustness needed to handle such crashes.

‘Our children are going to travel backwards as long as possible’

Klara and Magnus Ledin Höglund with their kids Allan, 3 years old, and Pella, 5½ years old, Stockholm, Sweden

Both of your children use rearward-facing child seats. Why?

‘We are very safety-conscious and try do everything by the book. We carefully checked the facts when we had our first child, and the risk of injury in a collision is five times greater if the child is travelling forwards at an early age. So naturally, Allan and Pella are going to travel backwards for as long as it’s possible.’

Has travelling backwards posed any challenges to you?

‘Allan suffers from motion sickness, so we have considered whether we should turn him around to see if it gets better. But we don’t know whether it will help, so we’ll keep going for a little while longer. Pella is getting bigger, so she sits cross-legged but hasn’t complained about that yet. Some people we meet say “oh, just turn them to face forwards – you’re never going to crash,” but we feel that you can’t just assume that. Safety always comes first.’

Do you have any tricks for using rearward-facing child seats?

‘In terms of motion sickness, it often gets better if Allan is watching a film or if we plan to drive at times when he can fall asleep. We have also chosen our child seats very carefully. Mainly to ensure they meet safety requirements, but also so that they can be tilted backwards a little so that the children can sleep in them. And to make sure that there is space for them to sit cross-legged when they get bigger.’





4.

Belt positioning boosters

SOONER OR LATER, the child will outgrow their rearward-facing child seat and be ready to travel facing forwards. Volvo Cars recommends, in line with the Swedish recommendations and long-term experience, rearward facing until at least 4 years of age.

When travelling forward-facing, the child should use a belt-positioning booster, which helps to raise the child into a good position for the vehicle restraints. The booster serves as an adapter, while the safety belt is the primary restraint for the booster-seated child, restraining the child and booster together. As with adults, the safety belt shall be positioned over the hips, towards the thighs rather than the belly, and across the chest and shoulder. There are three main types of boosters: **booster cushion**, **booster seat** and **integrated booster**. The booster is a Volvo invention from 1978, developed based on learnings from real-world crash data. The booster seat has a backrest, while the booster cushion does not. The backrest of the booster seat may provide sidewise support for comfort and side stability, also helping to keep the shoulder belt on the shoulder by avoiding side leaning. This is beneficial for younger children and during longer trips. The benefit of the booster cushion is mainly its portability, providing equal protection to an upright seated child as the other booster types.

Some boosters can be attached to the vehicle's ISOFIX anchorages. This mainly serves the purpose of restraining the booster when not in use. The integrated booster is built into the vehicle seat. Since pioneering integrated boosters in 1990, a number of Volvo models have been equipped with these. They are a very user-friendly and safe form of child restraint, developed as an integral part of vehicle safety and always available. Volvo Cars recommends children should use a booster until they are 140 centimeters (4' 7") tall and ten years old. Important factors are the child's age, size, height, hip size, and the car's specific safety belt geometry.

Why use a booster?

A child's pelvis is still developing. This, along with the child's shorter legs, are factors that make the child need a booster. The booster elevates the child to achieve a more favorable lap belt position and shortens the seat cushion to allow the child to bend their knees comfortably. Pelvis development influences both the size and the formation of the distinctive pelvic structure called the iliac crest, which is not fully developed until puberty. The shape of the iliac crest when developed (i.e., in older adolescents and adults) helps to keep the lap belt low in the event of a crash, preventing the pelvis from sliding under the belt in a frontal impact, thereby exposing the belly to potential harm. In addition, when seated, the size of a child's pelvis is lower compared to adults, which will negatively influence the lap belt position if the child is not elevated.

The booster allows the safety belt to function in a better for the child occupant. A safe booster raises the child so that the lap part of the safety belt can be positioned over the strong pelvis, towards the thighs rather than the belly. The booster also provides the child with more adapted thigh support, offering a more comfortable leg position and reducing the risk of slouching. Slouching may result in sub-optimal lap belt geometry. The booster will also help position the child occupant in a more comfortable shoulder belt position, when elevated.



Not too far out on the shoulder or under the arms

When a child is buckled in using the safety belt, it is important that the belt is positioned correctly. Tighten up and remove any slack after you have fastened the child's safety belt. The shoulder belt should sit firmly across the chest and shoulder, as they are strong bones of the body. Optimally, the shoulder belt should be placed in a mid-shoulder position. Never position the shoulder belt under the arm or behind the back.

In a crash, the shoulder belt will load into the soft part of the chest and belly, which are not as strong as the ribs and shoulder, and the risk of head impacts is higher. Avoid positioning the shoulder belt far out on the shoulder or off the shoulder and across the upper arm. That could result in similar consequences, whereby the child would not be restrained as well as it should be. It is not harmful if the belt is partly on the child's neck, although it might look uncomfortable. During a crash, the shoulder belt usually slides away from the neck. To improve comfort, if available, adjust the car's shoulder belt adjustment or the booster seat guides. Other alternatives are scooting somewhat sideways or placing a piece of cloth between the belt and shoulder.

■ FAQs ON BELT POSITIONING BOOSTER

When can I move my child to a belt positioning booster?

When the child has grown out of its large rearward facing child seat. The child should be at least four years old, preferably older

What should I look for when choosing a booster, with or without a backrest?

Look for a booster that is suitable for your type of car, comfortable for your child, and labelled with the correct type approval.

Is a booster cushion just as good as a booster seat?

Smaller children will generally find that a booster seat is more comfortable and provides lateral support, helping to keep them in a good safety belt position. The booster seat's backrest can help provide support to a sleeping child. Otherwise, provided the safety belt is correctly positioned on the child's body, the level of protection will be the same, with or without a backrest section of the booster. Since the booster is an adapter, the car's safety sets the performance for the booster-seated child as well.

My booster seat backs up against the head restraint, creating a gap between the two. Is this still safe?

Yes, it is the car's safety belt that protects the child during harsh braking or in a frontal impact crash. The head restraint's position might place the booster seat into a more upright stance, which may be perceived as less comfortable, but from a safety viewpoint, it is equally effective provided the safety belt is correctly positioned. In a rear-end impact, the car's head restraint will provide protection for the child in the booster, so it is not a safe alternative to remove the car's head restraint.

How do you position the safety belt correctly?

The lap belt should be worn across the hips, towards the thighs. For boosters equipped with lap belt guides, make sure to route the lap belt under these. The shoulder belt should be positioned across the chest and shoulder. Aim for a mid-shoulder position, closer to the neck than the edge of the shoulder. Tighten up and remove any slack after you fasten the child's safety belt. If the child is wearing a bulky jacket, open the jacket and position the safety belt close to the body.

Are boosters attached to the ISOFIX anchors better than those without?

The attachments mainly help secure the booster when it is not being used. Irrespective of the ISOFIX attachments, it is the safety belt that secures the child in the restraint, so there is no need to attach the booster to the ISOFIX anchorages when a child is using the booster. In most modern cars with safety belt pretensioners, the attachment does not influence safety. However, in cars without pretensioners and if the child is not restrained tightly (e.g., wearing a bulky jacket), the child might slide off an attached booster. In such cases it would be better not to use the attachment and let the booster slide with the child forward in the event of a crash.

Could a child ever use an ordinary cushion instead of a booster cushion, perhaps in someone else's car?

No. An ordinary cushion is too soft. In a crash, it would simply be flattened, causing the child to slip forward, out under the lap belt. The child should always use a certified booster.

Is it safe to use a flat no-boost booster, or strap-solutions that positions the safety belt on the child's body?

No. Devices that adjust the belt instead of elevating the child into the safety belt are not safe and shall not be used. They are likely not certified either.

Which seat in the car is safest for a booster-seated child?

In a Volvo car, all seats are equally safe for children, given that an appropriate child restraint is used.

What should I do if my child won't sit on the booster?

You must persuade him or her. You could also try out another booster.

Should the airbag of the front passenger seat always be switched off if there is a child restraint installed in the front seat?

The frontal airbag should always be switched off if there is a rearward-facing child seat installed in the front passenger seat. However, recent research shows that when a forward-facing child (in appropriate restraints) is positioned in the front passenger seat, the airbag (in some car models) should not be switched off. This recommendation is due to the development of frontal airbags. Always check your car's manual to see what applies to your car.

How long should children continue using a booster?

It is difficult to give a precise limit. Volvo Cars recommends that children use a booster until they are 140 centimeters (4' 7") tall and ten years old. Volvo Cars' accident research shows that children aged up to ten need a booster, but that eleven- and twelve-year-olds also benefit from using one. The regulated height recommendations or regulations vary from country to country. The most important thing is that the lap belt can be worn correctly across the hips. This is important even after the child has been travelling for a time and has moved about in the safety belt.

Is a booster as safe as a forward-facing child seat with internal harness for my four-year-old child?

The booster, together with the car's safety belt, provides good protection for the child, given that the belt stays in a good position over the shoulder and hip during the ride. Choose a booster seat that helps to ensure good belt fitment for your child. If the child is small and not fitting well, a child seat should be considered, but use a rearward-facing child seat for the best protection.





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The descriptions and facts in this publication relate to Volvo Cars international model range. The cars, baby and child seats and other accessories available may differ from country to country. The manufacturer reserves the right to make changes at any time and without prior notice.

Produced by Volvo Cars to help all those who carry child passengers – parents, taxi drivers, or anyone else – gain a better understanding of child safety matters.

