

ITARDA INFORMATION

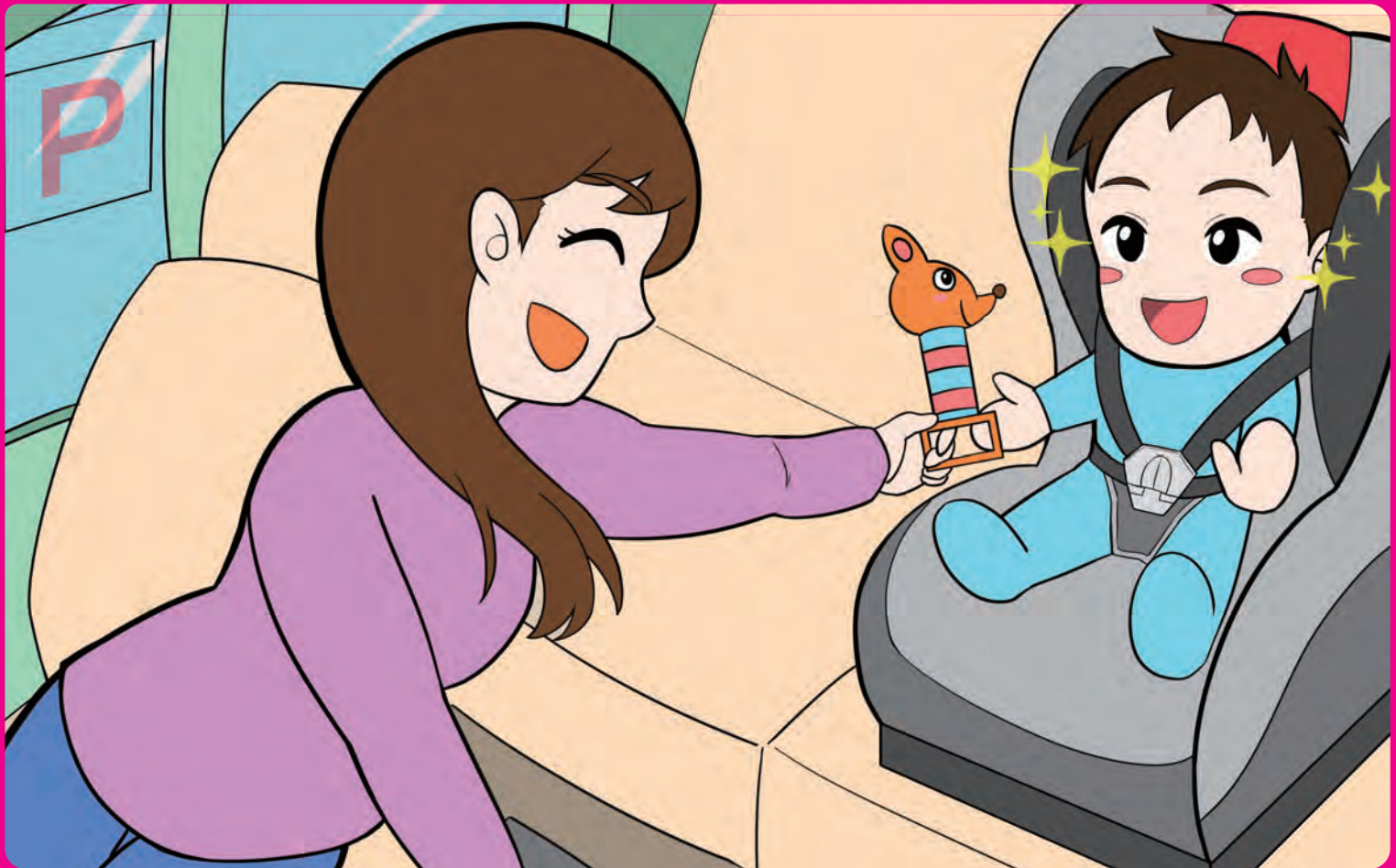
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イタルダ インフォメーション

Special
feature

How to correctly use the child seats that protect children



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1 Introduction

In Japan, the number of births has been following a downward path since 2015, so taking measures against the declining birthrate has become a pressing issue. Thus, supporting childrearing has become a key policy, and society as a whole must protect the precious children who will shoulder the future of Japan.

Investigating the causes of death of such precious children, it appears that “unexpected accidents”¹⁾ account for the top spots in the ranking of all of the causes of death, which include illnesses¹⁾. In the case of “unexpected accidents,” risks of occurrence can be reduced through the prevention of accidents. Table 1 shows a ranking of the causes of death based on five years of data from the “demographic survey: number of deaths from unexpected accidents divided by age and cause of death²⁾.” Looking at the breakdown of this, the first-place cause of death among all of the age groups between age 1 and age 14 is traffic accidents.

Table 1. Among deaths caused by unexpected accidents, top five causes of deaths divided by age group

(Rankings, composition ratios, and numbers of fatalities obtained from total values of 2017 through 2021)

| | First place | Second place | Third place | Fourth place | Fifth place | Fatalities |
|--------------|------------------------------|-----------------------|-------------------------------|------------------------------|---|------------|
| Below age 1 | Asphyxiation 78.4% | Drowning 7.1% | Traffic accident 6.8% | Other ^{*2} 3.0% | Tumbling/ falling 1.8% | 338 |
| Age 1 to 4 | Traffic accident 33.7% | Asphyxiation 28.9% | Drowning 19.3% | Tumbling/ falling 8.1% | Natural disaster 3.9% | 332 |
| Age 5 to 9 | Traffic accident 43.5% | Drowning 29.1% | Asphyxiation 9.1% | Smoke, fire, etc. 6.3% | Natural disaster 5.3% | 285 |
| Age 10 to 14 | Traffic accident 31.8% | Drowning 31.4% | Tumbling/ falling 11.3% | Asphyxiation 11.3% | Natural disaster, etc. 3.6% ^{*3} | 274 |

Created based on “demographic survey: annual number of deaths from unexpected accidents divided by cause of death” for 2017 to 2021

*1: This refers to sudden, unforeseeable accidents that are caused by external mechanisms, such as asphyxiation, drowning, falling, and traffic accidents.

*2: Unexpected exposure to other or unknown factors

*3: In the case of fifth place for “age 10 to 14,” “natural disaster” and “smoke, fire, etc.” accounted for the same ratio as “other” so this is marked as “natural disaster, etc.”

Table 2 shows the number of traffic accident casualties among children age 12 or below, and this includes the number of slight injuries. According to this, in 2017, the annual number of casualties amounted to approximately 29,000. Even in 2020, when travel decreased due to the COVID-19 crisis, this number amounted to approximately 16,000, and among these casualties, nearly 8,000 were riding in a vehicle^{*4}.

*4: In this paper, the number of “children riding in a vehicle” is limited to the number riding in an ordinary passenger car or light passenger car.

Table 2 Number of traffic accident casualties age 12 or below (number of people)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|-------------------|--------|--------|--------|--------|--------|
| All accidents | 28,710 | 25,097 | 22,044 | 16,410 | 16,426 |
| Riding in vehicle | 14,140 | 12,395 | 10,847 | 7,562 | 7,088 |

According to traffic accident statistics

In order to reduce damage to children from traffic accidents during which the child is riding in a vehicle, it seems that the number-one countermeasure is the use of a child seat. Figure 1 shows a comparison of the fatality & serious injury rates when a child seat is being used versus not. When a child seat is not being used, the fatality & serious injury rates increase by approximately 2.4-fold to approximately 5-fold.

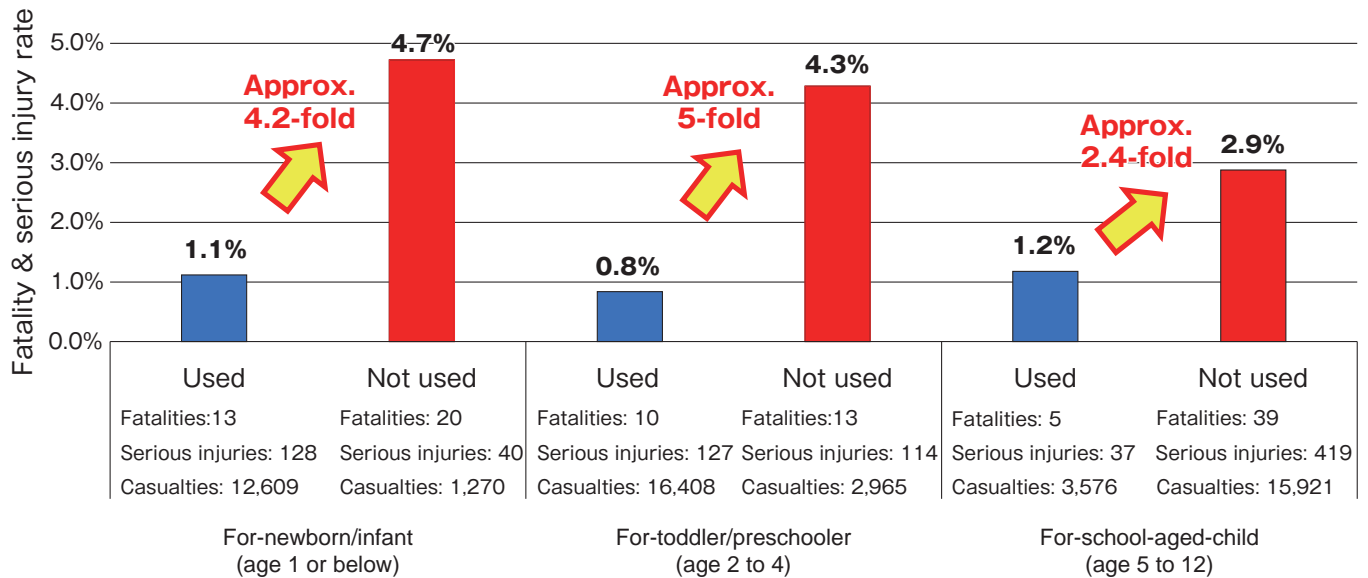


Figure 1. Fatality & serious injury rates of children riding in vehicle divided by child seat use (2013 to 2022)

Fatality & serious injury rate:

"(number of fatalities + number of serious injuries) / number of casualties"

"Child seat being used" includes cases of both proper and improper usage.

According to traffic accident statistics

Starting in 2002 (when national surveys on the rate of usage of child seats began), Figure 2 shows the trend regarding the population of children age 12 or below, and the numbers of fatalities & serious injuries among such children when they were riding in a vehicle, with the level in 2002 set as 100. As the rate of usage of child seats increases, fatalities & serious injuries among children age 12 or below substantially decrease, even taking into account the decline in population, and thus the effect of child seats can be seen. In order to further boost the effect of child seats, this paper introduces the correct way to use child seats and the effects of doing so.

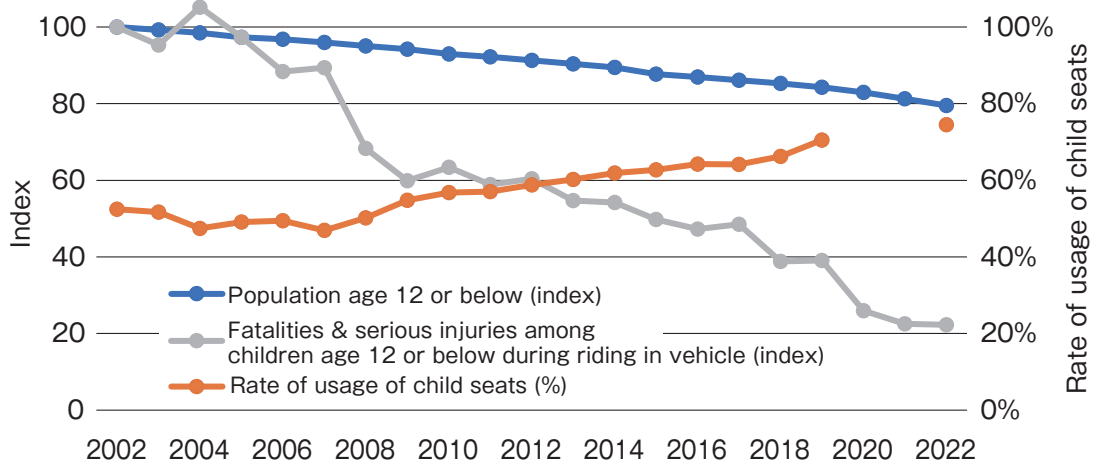


Figure 2. Trend regarding population age 12 or below, fatalities & serious injuries during riding in vehicle, and rate of usage of child seats (2002 to 2022)

Excluding "person-to-vehicle" accidents

Created based on Population Estimates (Statistics Bureau of Japan), National Survey on the Use of Child Seats (National Police Agency/JAF), and traffic accident statistics

*In 2020 and 2021, the National Survey on the Use of Child Seats was not carried out due to the impact of the infectious disease COVID-19.

2 Types of child seats

There are three different types of child seats, which are used in accordance with the level of growth of the child: “for-newborn/infant,” “for-toddler/preschooler,” and “for-school-aged-child” (hereinafter referred to as “booster seat”).

“For-newborn/infant” child seats are used for newborns and infants up to around age 1⁵. Table 3 shows the fatality & serious injury rates of vehicle-to-vehicle accidents in which children age 12 or below became casualties while riding in a vehicle. The fatality & serious injury rate of “head-on collision (frontal collision)” is substantially higher than that of the other accident types. Newborns and infants have a skeletal structure that is still undeveloped, so the seat belt for children that is installed in child seats (hereinafter referred to as “harness”) is not able to receive the impact of frontal-collision accidents. As such, in the case of for-newborn/infant child seats, installation is rear-facing⁶ relative to the forward direction of the vehicle as shown in Figure 3. As shown in Figure 4, the child seat is set up so that the impact during accidents is received over the wide surface area with which the child is in contact with the child seat, which extends from the back of the head to the shoulders and back.



For-newborn/infant child seat
(Rear-facing relative to forward direction)

Figure 3

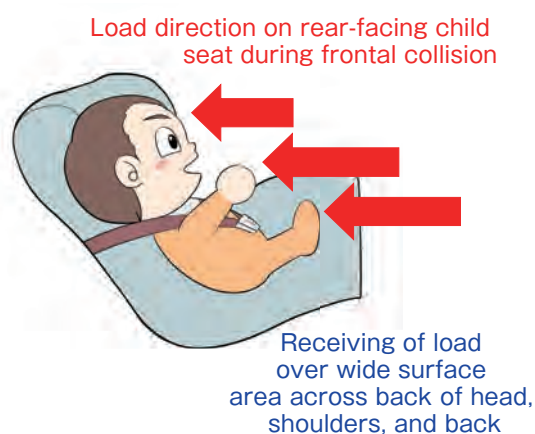
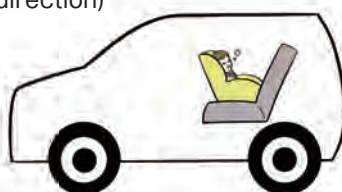


Figure 4

Table 3. Fatality & serious injury rates of vehicle-to-vehicle accidents in which children age 12 or below became casualties (2013 to 2022)

| | Head-on collision | Rear-end collision | Crossing collision | Collision while turning right/left | Other |
|--------------------------------|-------------------|--------------------|--------------------|------------------------------------|-------|
| Fatalities | 35 | 15 | 22 | 8 | 3 |
| Serious injuries | 363 | 209 | 452 | 148 | 92 |
| Slight injuries | 4104 | 70536 | 26852 | 6732 | 15386 |
| Fatality & serious injury rate | 8.8% | 0.3% | 1.7% | 2.3% | 0.6% |

Fatality & serious injury rate:

“(number of fatalities + number of serious injuries) / number of casualties”

According to traffic accident statistics

*5 In September 2023, there was a complete transition to the new safety standard "ECE R129," which states that for-newborn/infant child seats must be used in a rear-facing manner in the case of children up to 15 months after birth. Nevertheless, this paper is written regarding child seats that adhere to the previous standard that is currently commonly in use (rear-facing until around age 1).

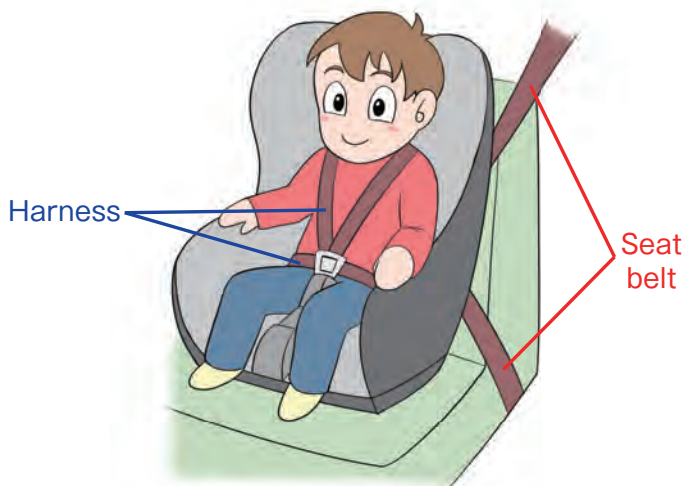
*6 Among for-newborn/infant child seats, in addition to "rear-facing," there are also "bed-type" seats.

"For-toddler/preschooler" child seats are used for toddlers and preschoolers from around age 1 to around age 4, and installation of these child seats is in a forward-facing manner^{*7} relative to the forward direction of the vehicle as shown in Figure 5. Once age 1 has been reached, the toddler/preschooler skeletal structure has started to develop to some degree, so the harness, which functions based the child's skeletal structure, is able to receive the load that is generated during accidents. Nevertheless, since the skeletal structure is still undeveloped compared to that of adults, the impact needs to be received over as much of a surface area (harness) as possible. Therefore, most for-toddler/preschooler child seats^{*8} have two, right & left shoulder harnesses, and impacts can be received by a total of five harnesses: the right & left shoulder harnesses for the rib cage, plus right & left lap harnesses and a crotch harness for the hip bone.

*7 This paper is written regarding child seats that adhere to the previous standard under which front-facing usage is permitted from age 1.

*8 Among for-toddler/preschooler child seats, there are types that, instead of two shoulder harnesses, have a large piece of impact-absorbing material in the front of the chest for receiving impacts.

Booster seats are used for children from around age 4 to around age 12. When around age 4 has been reached, the skeletal structure starts to become sturdy so can withstand a three-point seat belt in the same manner as that of adults. Nevertheless, since the body frame is small and body height is low, the lap belt, which functions on the hip bone in the case of adults, ends up going across the child's abdomen, and the shoulder belt, which functions on the rib cage in the case of adults, ends up going across the child's neck. If a traffic accident were to occur with the seat belt in such a state, the abdomen and neck would end up sustaining substantial damage. Therefore, as shown in Figure 6, it is necessary to raise the child's sitting height using a booster seat, and thereby make an adjustment so that the seat belt can correctly function on the skeletal structure (rib cage and hip bone).



For-toddler/preschooler child seat
(Forward-facing relative to forward direction)

Figure 5



Booster seat

Figure 6



3 Status of usage of child seats

In regard to the status of the usage of child seats, according to a national survey by the National Police Agency and JAF in 2023, the usage rate for all children below age 6 is 76%, and it appears that the usage rate declines as age increases.

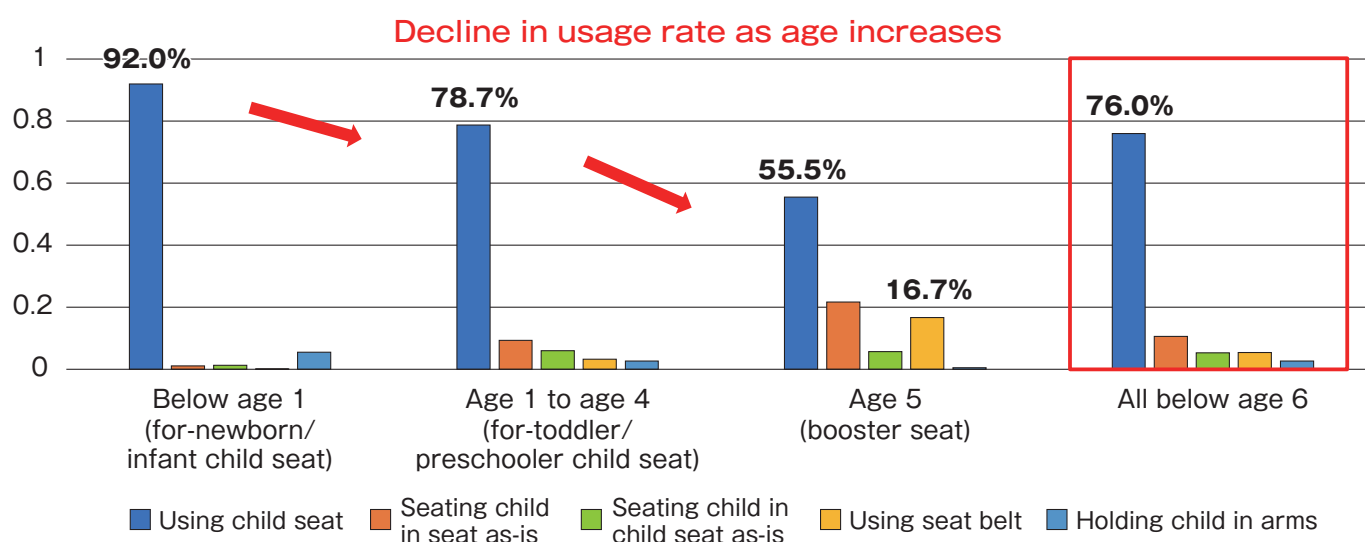


Figure 7. Ratios of child seat usage and non-usage

According to National Survey on the Use of
Child Seats (2023) by National Police Agency/JAF

The usage rate is high for below age 1 because newborns often ride quietly even after being placed in a child seat. The usage rate regarding “for-toddler/preschooler” is lower than it is for “for-newborn/infant” because during the transition period after “for-newborn/infant,” self-awareness starts to develop and likes and dislikes become more distinct. There are also other factors, such as the fact that the first period of rebelliousness starts and children begin to show resistance to parents’ actions. The usage rate of booster seats then further drops by more than 20 percentage points, and this seems to be because making a replacement purchase of a booster seat⁹ is required during the transition period.

⁹ There are some child seats that can be used over long periods of time, from the toddler/preschooler phase up to the school-aged-child phase.

In Japan, the period during which the use of a child seat is obligatory is up to “below age 6,” so if a for-toddler/preschooler child seat is used up to and including age 4, only one year remains for the obligatory period. Even though a booster seat should be provided to children even if it is just for one year, there appears to be a situation in which booster seats are not being provided. According to the abovementioned survey by the National Police Agency and JAF, 16.7% of the children in question are not using a booster seat, but rather wearing a seat belt that is for adults and does not fit their body.

4 Improper use of child seats

■ Improper use during installation

Seat belts are firmly attached to vehicles, so passengers only need to pull out the belt and put it on. In the case of child seats, however, the user needs to use the seat belt, etc. of the vehicle to firmly attach the child seat to a seat of the vehicle. If a child is riding in a child seat that has not been properly installed, during an accident, the child seat could substantially move causing the child's head and so on to strike against structures inside the vehicle.

In the aforementioned survey by the National Police Agency and JAF, the status of child seat installation was investigated, and the results of this are shown in Table 4. It appears that installation is not being properly carried out regarding 32.7% of for-newborn/infant child seats and 43.2% of for-toddler/preschooler child seats.

The most common type of improper use during installation was the case in which the seat belt failed to be sufficiently tightened during the installation. When installing a child seat using a seat belt, it is necessary to learn certain “tricks,” such as attaching the child seat by putting one's body weight onto the child seat in order to remove slack from the seat belt. As such, it is often difficult for adults to install child seats on their own if they have a light body weight. As a measure against this, in recent years, child seats have been introduced onto the market that do not make use of seat belts, and can be easily and reliably installed using specialized metal fittings.

Table 4. List of results of survey on installation status (partially modified)

| | For-newborn/infant | | For-toddler/preschooler | | Total | |
|--------------------|--------------------|--------------|-------------------------|--------------|-------|-------|
| Proper use | 142 | 67.3% | 125 | 56.8% | 267 | 61.9% |
| Improper use | 69 | 32.7% | 95 | 43.2% | 164 | 38.1% |
| Total (percentage) | 211 | 100% | 220 | 100% | 431 | 100% |

According to National Survey on the Use of Child Seats (2023) by National Police Agency/JAF

■ Improper use during seating of child

Care needs to be taken both when installing child seats into vehicles, and when putting children into child seats. Within the abovementioned national survey by the National Police Agency and JAF, a survey was carried out on the improper use of child seats during the seating of children. In the case of for-newborn/infant and for-toddler/preschooler child seats, the rate of improper use stood at approximately 55%, and a breakdown of the types of such improper use is shown in Figure 8. As shown in Figure 8, the most common form of improper use is insufficiently tightening the harnesses that the child is wearing (improper tightening). If the degree of tightening of the harnesses is too loose, even if the child seat is firmly attached to the vehicle, in the event of an accident, there is a possibility that the child could fly out from child seat and be severely injured.

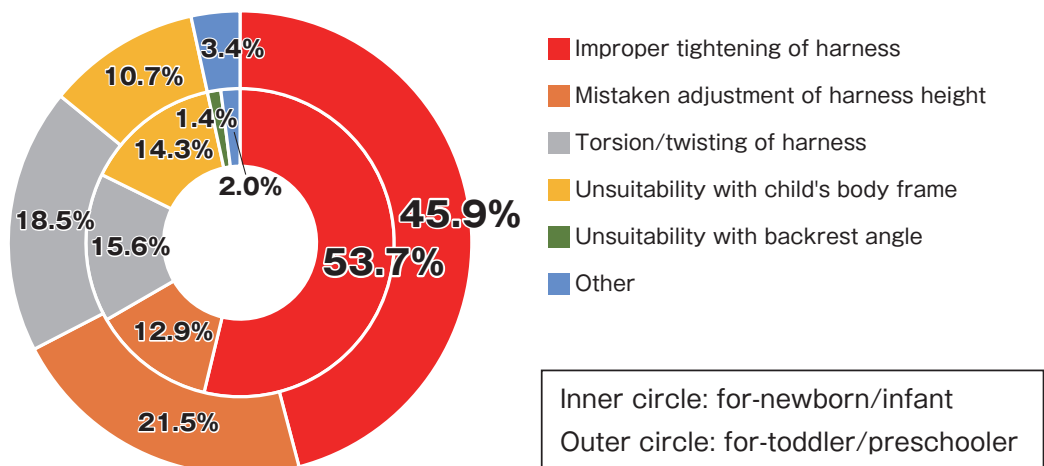


Figure 8. Percentages of types of improper use during seating of child

(There are some cases in which there are multiple types of improper use regarding a single child seat.)

According to National Survey on the Use of Child Seats (2023) by National Police Agency/JAF

■ Improper use at passenger seat^{*10}

Table 5 shows the status of use regarding each type of vehicle seat according to the survey by the National Police Agency and JAF. There are a certain number of cases in which, when there are only a driver and a child who will be riding in a vehicle, the driver will install the child seat in the passenger seat for the reason that this will make it easier to attend to the needs of the child. Nevertheless, the airbag for frontal collisions that is installed for the passenger seat has been outfitted for an adult passenger. Thus, if a for-newborn/infant rear-facing child seat is installed in the passenger seat, the backrest portion of the child seat ends up blocking the exit area of the airbag, so if the airbag is deployed, the strong deployment force of this will end up sending the child seat flying. (Table 5 shows that 123 babies encountered this situation.) In Japan, a tragic accident occurred in which a for-newborn/infant rear-facing child seat was installed in a passenger seat, and an infant lost its life when the airbag was deployed.



Figure 9.
Prior to airbag deployment



Figure 10.
After airbag deployment

Table 5. Results of survey regarding status of child seat use divided by seat (excerpt)

| | Age group | Number of people |
|----------------|-------------|------------------|
| Passenger seat | Below age 1 | 123 |
| | Age 1 to 4 | 1,020 |
| | Age 5 | 430 |
| Rear seat | Below age 1 | 1,517 |
| | Age 1 to 4 | 5,867 |
| | Age 5 | 1,007 |

According to National Survey on the Use of
Child Seats (2023) by National Police Agency/JAF

^{*10} In the case of imported cars, there are models that have a cancel switch for the passenger airbag. Nevertheless, due to factors such as the fact that there is a potential for canceling the airbag to be forgotten, this paper designates use of a rear-facing child seat in a passenger seat as improper use.

5 Effects of proper use

Thus far, we have looked at the improper use of child seats. Failure to correctly use child seats not only renders them ineffective, but could also conversely make them dangerous, as seen in situations such as when child seats are sent flying by the deployment force of airbags. Figure 11 shows a comparison of the fatality & serious injury rates for proper use versus improper use. While Figure 1 shows that failure to use a child seat increases the fatality & serious injury rate by approximately 2-fold to 5-fold, Figure 11 shows that even if a child seat is being used, if the child seat is improperly used, the fatality & serious injury rate is increased by approximately 4.4-fold to approximately 7-fold.

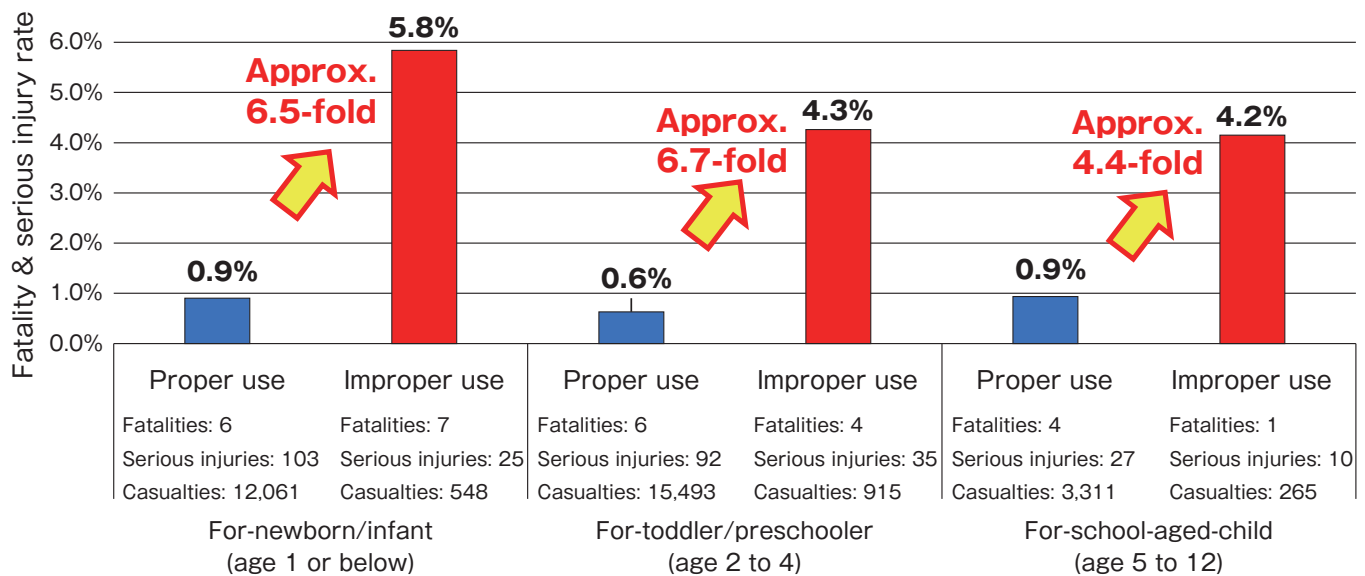


Figure 11. Fatality & serious injury rates of children riding in vehicle divided by status of use of child seat (2013 to 2022)

Fatality & serious injury rate: "(number of fatalities + number of serious injuries) / number of casualties"
According to traffic accident statistics

The following is a calculation of the effects when child seats are used correctly.

Figure 12 show the results of a calculation of the numbers of fatalities and serious injuries in the case that, in traffic accidents from 2013 to 2022, the children who had not been using a child seat, or had been improperly using a child seat, had been properly using a child seat. According to this calculation, over a period of 10 years, the number of fatalities & serious injuries would have been reduced by 555.

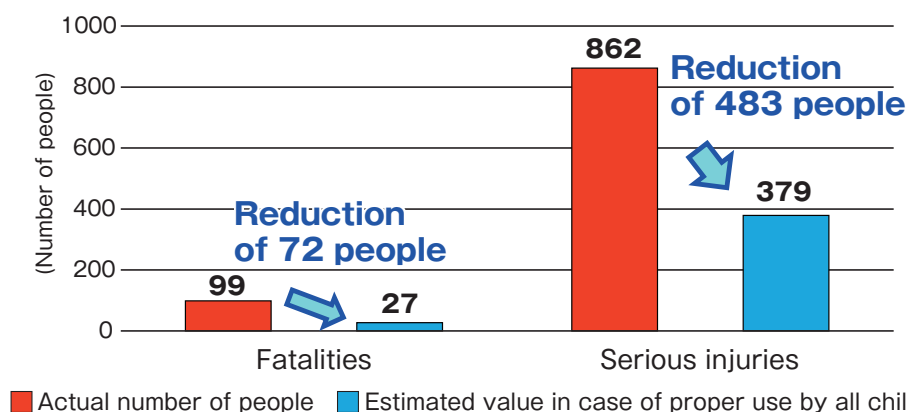


Figure 12. Calculation of effects of proper use of child seats (2013 to 2022)

According to traffic accident statistics

6 Conclusion: the correct way to use child seats

Lastly, we will introduce information on the correct way to use child seats.

■ Using child seats that are suitable for child's body frame and vehicle

In the case of child seats, it is necessary to use a type that matches with the child's body frame. Since it is difficult to separately purchase the three types of for-newborn/infant, for-toddler/preschooler, and for-school-aged-child, there are various methods for addressing this. For example, if outings by vehicle are infrequent during the newborn/infant period, a for-newborn/infant child seat can be rented, and then a type that dually covers the toddler/preschooler and school-aged-child periods can be purchased. If outings by vehicle are frequent even during the newborn/infant period, a type that dually covers the newborn/infant and toddler/preschooler periods can be purchased, and then a booster seat can be purchased. There are some vehicles into which certain types of child seats cannot be installed, so it is important to check the compatibility with vehicles through sources such as the websites of the manufacturers of the child seats. Furthermore, dangerous child seats that do not meet national safety standards are going around in the market via online shopping and so on, so please select child seats that comply with safety standards.

■ Reliably installing child seats in rear seat of vehicle

As mentioned in "improper use during installation," approximately 30% of for-newborn/infant child seats and approximately 40% of for-toddler/preschooler child seats are not being properly fixed in place. Please thoroughly read owner's manuals, and reliably install child seats in such a way that they remain steady even when shaken. Furthermore, as stated under "improper use at passenger seat," for-newborn/infant child seats that have been installed in the passenger seat will end up being sent flying together with any newborn or infant seated in them whenever airbags deploy, so please make sure to never install child seats in a passenger seat.

Whenever rear-facing for-newborn/infant child seats are installed in a rear seat, the driver loses the ability to see the condition of the child. As a measure against this, it is recommended to use a "baby mirror," which is attached to the rear window, etc. and makes it possible to check the condition of the child, and also puts the child at ease by making the parent's face visible in the reflection.

Child seats that are for-toddler/preschooler and for-school-aged-child should also be installed in a rear seat whenever possible. When installing a forward-facing child seat in a rear seat, please adjust the seat slide in order to create as wide a gap from the front seat (survival space) as possible.

■ Tightening harnesses to eliminate slack

As was covered in "improper use during seating of child," approximately half of the children riding in child seats have not had their harnesses properly tightened. Although it is necessary to properly tighten harnesses, overtightening them can hurt the child, so they should be tightened to the point where one finger of an adult can fit between the shoulder harness and the child's collarbone.

■ Continuing child seat use even if child dislikes this

If a child who hates the child seat cries a lot, and the parent gives in and takes the child out of the child seat on one occasion, the child will end up learning, "If I cry, I can get taken out of the child seat."

If this happens, it will be very difficult to get the child to ride in the child seat on the next occasion. Having a child ride in a child seat should be thought of like having a child brush his/her teeth, and thus use should be continued based on the idea that, "This is for the sake of this precious child, even though it may make him/her cry." Showing children things such as a DVD of their favorite video seems to be effective for enabling them to ride quietly.

■ Continuing child seat use beyond age 6

The obligatory use of child seats is up to "below age 6," so there is a tendency for people to think that it is acceptable to switch from a booster seat to a seat belt once age 6 has been reached. Nevertheless, since the seat belts of vehicles are targeted at adult passengers with a height of approximately 150 cm or above^{*11}, a booster seat is needed until around age 12 when the child reaches a height of about 150 cm^{*12}. Thus, the use of booster seats should be continued beyond age 6.

^{*11} In the case of seat belts, safety performance is evaluated using dummies that have a height of approximately 150 cm to approximately 190 cm.

^{*12} The timing of switching to a seat belt should be based on the yardstick of whether the seat belt goes across the child's neck.

■ Frequently taking breaks

For children who are at an age when they want to move around a lot, being forced to sit in the same position for long periods of time is simply painful, so even though they may be quietly riding in a child seat, they will begin to increasingly dislike this as more time passes.

If the driver only takes a break after the child has become fed up and starts to cry, this is much too late, so it is important to take a break before the child starts crying. When the child is being observed, he/she will begin to show signs of reaching his/her limit, and this may include losing concentration and starting to feel restless. When such signs have been noticed, a break should be taken as soon as possible. After the child has exited the vehicle, the parent should have him/her walk some and not pick him/her up. The child should be given as much exercise as possible during the break, and then if the child is tired out when he/she returns to the vehicle, he/she will ride quietly even in the child seat.

■ Preventing child from slipping out from harnesses

It seems that in the case of child seats and booster seats, even if the child has been correctly seated at the start of the ride, there is a risk of the child slipping out from the harnesses, or unfastening the seat belt. ^{*13}

Among actual examples of accidents, there was an accident in which a light passenger car carrying two children was being driven, and it collided into a telephone pole due to careless driving. While the driver, who had been correctly using a seat belt, and a child in the rear seat, who had been correctly using a child seat, only incurred slight injuries, the child who was supposed to have been seated in a booster seat in the rear seat, collided with the seat and structure inside the vehicle, and sustained serious injuries that took three months to completely heal. The driver explained this by suggesting that the child had unfastened the seat belt at some point during the ride.

Even though engaging in exchanges with children who are fed up is difficult, doing so is in order to protect the children from potential accidents, so it is important to let children know, "If you slip out from the harnesses or unfasten the seat belt, we will not leave / will go home."

^{*13} Whenever a harness has slack, the child is prone to slip out, so such slack needs to be eliminated.

See "Tightening harnesses to eliminate slack."

As shown in Figure 1, the use of child seats reduces harm during accidents. Moreover, as shown in Figure 11, the proper use of child seats further increases their effectiveness in reducing harm. Aside from reducing harm during accidents, child seats can prevent in-vehicle accidents, such as a child falling off the seat inside the vehicle and getting hurt on the seat rail, or a child getting his/her hand or neck pinched by a window. Furthermore, when children have become accustomed to child seats, they do not have any aversion to the wearing of seat belts even after they grow up, and put on their seat belt regardless of the seat in which they are sitting.

It is the obligation of parents to use child seats for children, who are incapable of protecting themselves. Please correctly use child seats in order to protect the lives of precious children.

(Toyohiro Hishikawa)

References

- 1) Ministry of Health, Labour and Welfare of Japan, 2021, Vital Statistics, "demographic survey: confirmed number of fatalities," number of deaths by cause of death, gender, and age
- 2) Ministry of Health, Labour and Welfare of Japan, 2017 to 2021, Vital Statistics, "demographic survey: confirmed number of fatalities," number and percentage of deaths from unexpected accidents divided by age and cause of death

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