



**CHILDREN INSIDE CARS AND HEAT STROKE  
IN CHILDREN**  
Info dossier

Fundación  
**MAPFRE**



**CSPLNII**  
Comité de Seguridad y Prevención de  
Lesiones No Intencionadas en la Infancia

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# CHILDREN INSIDE CARS AND HEAT STROKE IN CHILDREN

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# 1. Definition of heat stroke

A heat stroke -or thermal shock- is one of the most serious cases of hyperthermia. It occurs when the body overheats due to high temperatures or physical overexertion. Insufficient hydration halts the normal functioning of different organs.

Heat stroke arises as a consequence of the acute failure of thermoregulation and entails an extreme medical emergency, given that it simultaneously has a very fast onset (a few minutes suffice) and may end in fatality (death is possible in a very brief time period) if not treated urgently. An elevated temperature causes loss of water and electrolytes, both of which are required for different organs to function normally.

Heat stroke may occur in different circumstances. For example, if a child is left alone inside a vehicle in the sun, or, in general, if a child is exposed to situations of high humidity and temperature without adequate protection or hydration.

The underlying factors for suffering a heat stroke are: extreme ages such as elderly persons, children under 4 years of age, and, especially, babies under the age of 1, and suffering certain chronic illnesses such as kidney, neurological, endocrine (diabetes, for example) or cardiac diseases. Furthermore, treatment with certain medications, such as diuretics or antihistamines, may interfere with the body's regulation of its temperature and liquids.

A major proportion of victims of hyperthermia are aged between 0 and 5. Given that children have a lower water reserve, their body temperature rises 3 to 5 times faster than that of an adult. In addition, children's still developing respiratory systems make them more vulnerable to heat exhaustion.

The main symptoms of heat stroke are the rising body temperature above 40 °C (fever or hyperthermia), abnormal state of consciousness that may be accompanied by convulsions and, different from sun stroke, dry and very hot skin.

Other premature symptoms may include:

- Fatigue and weakness.
- Dizziness, nausea and even vomiting.
- Muscle cramps.
- Intense headache and confusion.
- Superficial, fast breathing.
- Tachycardia (accelerated heart rate) and weak pulse.

## 2. Effects of high temperatures on people

A person's normal temperature should be between approximately 36.6 and 37.5 °C, thanks to the so-called thermoregulation mechanisms that keep body temperature within such a narrow range.

When we are exposed to heat, or when exercising and generating a large amount of heat, a reflex mechanism called **vasodilation** is triggered at the level of the skin's blood vessels and we immediately start sweating to remain cool. As a result, an immediate reaction causes heat loss and helps the organism to recover its normal temperature.

When the outdoor temperature is very high, the working thermoregulation functions cannot dissipate heat fast enough because the blood volume is insufficient for distribution to the skin, and if the appropriate measures are not implemented, the body is unable to cool down.

If the body reaches a high level of dehydration and an elevated temperature (above 40 °C), some organs start working erratically and different symptoms appear.

**Heat stroke** and the failure of these mechanisms result in a critical state that may lead to that person's death. It is necessary to mention that, at very high temperatures (above 41-42 °C), the neurons in general, and those located in the cerebral cortex in particular, are the cells that suffer the most harm during **hyperthermia**.

### 3. Progress of temperatures inside a vehicle

The change of temperature inside a vehicle depends on many factors, especially: thermal insulation, outdoor temperature, direct solar radiation and exposure time.

After performing tests with a mid-size vehicle exposed to sunlight, we observed that:

- With an ambient temperature of 29 °C, the temperature inside the vehicle rises almost 20 °C in the first 45 minutes of exposure.
- With an ambient temperature of 39 °C, certain areas inside the vehicle may reach a temperature of 70 °C.
- Inside a vehicle, depending on height, the temperature may vary 13 °C.
- In 2.5 hours, without ventilation, the temperature inside the vehicle is 88 percent higher than the temperature outside.

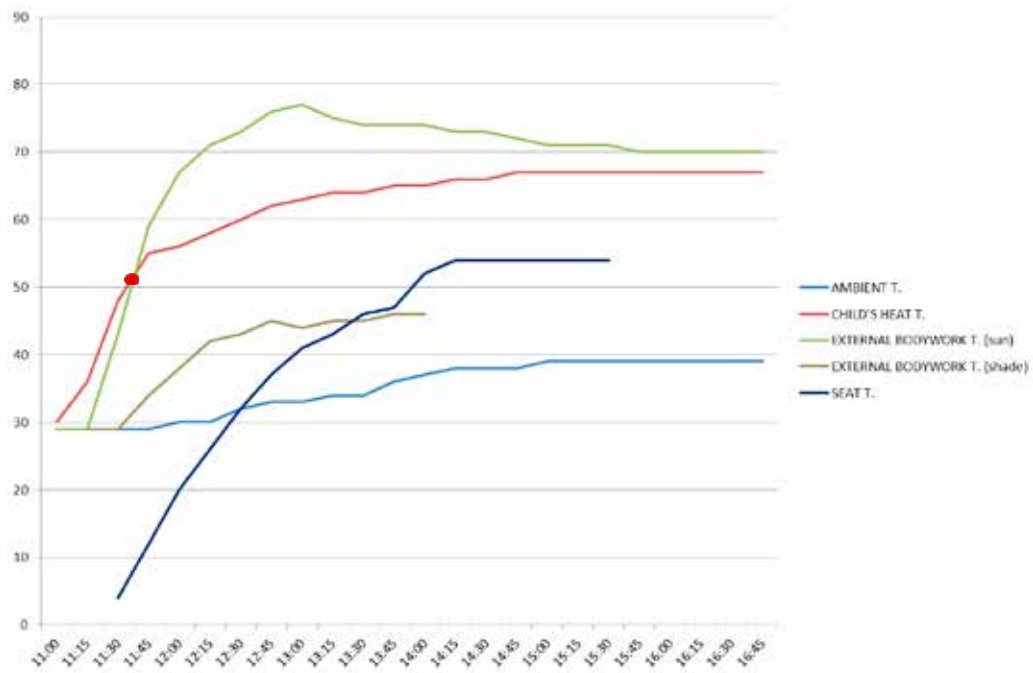
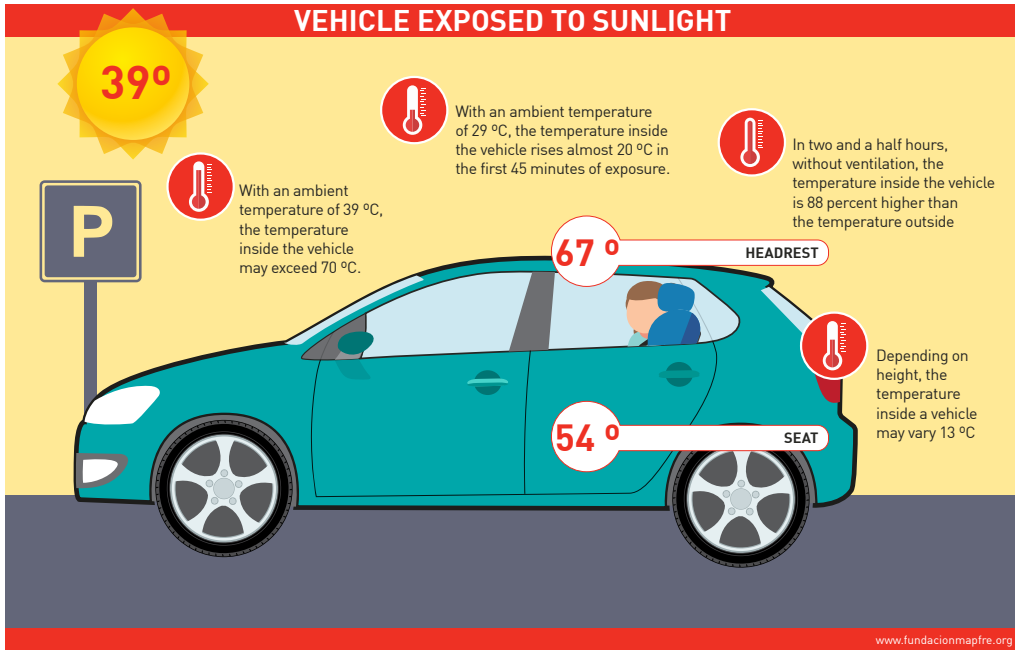


Fig. 1. Graph of the temperature test performed on August 6, 2015.

- (30 minutes of sun exposure with an outdoor temperature [T] of 30 °C entails a temperature inside the vehicle of 50 °C at the height of a child's head)





## 4. General recommendations for avoiding heat stroke

Basic recommendations for preventing heat stroke, according to Fundación MAPFRE and the Spanish Association of Pediatrics, are:

- Be extremely vigilant of small children, especially babies under 1 year of age, persons with a chronic illness that impedes sweating (such as cystic fibrosis), or those taking certain medications, like antihistamines, for example.
- Do not wait until children ask for water. Continuously offer liquids. Offer breastfed babies milk more often.
- When performing activities outdoors that require physical exertion during hot seasons, drink small amounts every 15-30 minutes while exercising.
- Modify your physical activity according to environmental conditions by avoiding exercise at the hottest times of day. During those periods, keep children calm while playing so that they do not get too agitated.
- During high temperatures, remember to always wear loose-fitting, lightweight and light-colored clothing of breathable fabrics (cotton, for example) and don't forget to protect children's heads with a cap. Bathe and wet children's bodies often.
- Refrain from keeping children exposed to the sun and high temperatures, stay in shady areas that are well-ventilated or have air conditioning.
- Never leave a child alone, nor accompanied, inside a parked, closed vehicle.



## 5. Specific recommendations for avoiding heat stroke in a vehicle

Basic recommendations for avoiding heat stroke in a vehicle are:

- i. Remember the three letters “**ACT**”:
  - **A:** Anticipate to avoid lesions derived of a heat stroke by never leaving your children alone in a vehicle, not even for one minute. Make sure that your vehicle is closed and locked when it is not in use so that your children cannot access it on their own.
  - **C:** Create your own habits that serve as reminders. For example, leave something that you will need to take with you when you reach your destination in the back of the vehicle next to your child, like your purse, briefcase or cell phone. This is especially important if you are not following the usual routine.
  - **T:** Take measures. If you see a child alone in a vehicle, call **112**. Emergency personnel are trained to take action in these situations. One call can save a life.
  
- ii. Implement other precautions, such as creating additional reminders or alert mechanisms:
  - Generate an alert in your agenda or electronic devices to make sure that you dropped your child off at preschool or school.
  - Establish a procedure with your child’s school so that, if your child does not arrive on time, you will be phoned within minutes. Be especially careful if you change your routine of dropping off the children at preschool or school.
  
- iii. Teach children that they should never play inside a vehicle (nor around it, in case it starts moving):
  - Make sure to lock the vehicle, including doors and the trunk, when it is not in use. Keep the vehicle’s keys and electronic devices out of the sight and reach of children.
  - Remind children that vehicles are used for traveling and that trunks are used for storing baggage, and that they are unsafe for playing.
  - If your children have remained locked inside a vehicle take them out immediately and call the emergency services quickly.

## 6. What should I do if I see a child alone inside a vehicle?

If you see a child at risk of suffering heat stroke inside a vehicle, first check whether the child responds to your signals and immediately call 112.

Then, open the vehicle, always assuring the child's safety (for example, by breaking the window furthest away) and take the child out of the vehicle.

Act quickly by following the instructions for heat stroke.



## 7. What should I do if a child suffers a heat stroke?

Once the child is taken out of the vehicle, and before the transfer to a hospital in the face of a heat stroke, guidelines for action are:

- Lay the child down, face up, in a shady, cool and well-ventilated place.
- Loosen the child's clothes and remove unnecessary garments.
- Place cold water dressings (never ice) on the child's head, face, neck, nape and chest, replacing them when they are no longer cool.
- Evaluate the child's consciousness:
  - o If the child is **CONSCIOUS** and is not vomiting, give the child liquids, cold water or, preferably, an isotonic drink (oral rehydration therapy).
  - o If the child is **UNCONSCIOUS** and is not breathing, immediately call 112 and start basic, pediatric CPR (cardiopulmonary resuscitation).
- Avoid immersing the child directly in freezing water, as the sudden decrease of body temperature could be harmful.
- Do not scrub the child with alcohol, as it could be absorbed through the skin and cause alcohol poisoning.

Even if the victim recovers, it is important to transfer the child to a hospital to undergo medical evaluation.



## 8. Frequently asked questions

Some of the most frequently asked questions as regards heat stroke are:

a. *Does risk of heat stroke only occur during heat waves?*

A: No, even on days in which the temperature is just over 20 °C, the inside of a vehicle may reach 50 °C. During hot months, the temperature inside a vehicle may rise from 10 °C to 15 °C in 15 minutes.

b. *Is it enough to leave the windows slightly open?*

A: No, leaving the windows partially or fully open is unsafe because that natural ventilation cannot counteract the quickly rising temperature inside the vehicle.

c. *Is there a risk of burns due to contact with the inside of the vehicle?*

A: Yes, harm to the skin may occur as of a temperature of 45 °C. The elements inside the vehicle (dashboard, seats, steering wheel, gearshift, etc.) can reach temperatures of close to 70 °C if they are not shielded by a sunshade.

d. *How many people are affected annually?*

A: It is not possible to present specific figures as no general registry of these types of incidents exists. In any case, these incidents occur every year, some of which are extremely serious.

In the USA, where these types of statistics are collected since almost 20 years ago, at least 623 children have died as a result of a heat stroke when left alone inside a vehicle since 1998. A child dies every ten days in the USA due to having been left alone in a vehicle in the sun; for each death, hundreds more are rescued.

e. *As of what body temperature can heat stroke occur?*

A: A body temperature above 40 °C is already life-threatening (normal human body temperature ranges between 36.6 and 37.5 °C). Brain death starts at 41 °C, and death is certain at 44 °C. Internal body temperature above 50 °C causes muscular rigidity and, certainly, immediate death.

When body temperature increases, the organism tends to sweat to maintain coolness. When the outdoor temperature is very high the body sweats more slowly and is unable to cool down if the appropriate measures have not been implemented. If the body reaches a high level of dehydration and a high temperature (above 40 °C), some organs start working erratically and different symptoms appear.

f. *Can heat stroke occur to elderly people?*

A: Yes. According to data provided by SEMERGEN (Spanish Association of Primary Care Physicians), 80 percent of those people who suffer a heat stroke are over 65 years of age<sup>1</sup>.

Senior citizens (in other words, persons aged 65 and above) are more likely to suffer stress due to heat. With age, the body loses its ability to regulate body temperature. One feels heat differently and sweats less, wherefore the organism cannot defend itself from very high temperatures as efficiently as at younger ages. Furthermore, elderly people have thinner skin that provides less protection from the sun's rays.

Likewise, it is very likely that elderly people have some type of chronic medical condition that affects their body's normal responses unto heat. Moreover, it is quite probable that they take medication that decreases the body's ability to regulate temperature or that inhibits perspiration.

g. *Can a heat stroke affect animals or pets locked inside a vehicle?*

A: Pets and animals are also quite vulnerable to extreme temperatures when inside a vehicle. Compared with humans, dogs and cats, for example, lack the mechanisms to cool the body by sweating because they don't have sweat glands. Their thermoregulation mechanisms are more limited, compared with people. Their organs start to fail after a continuous exposure of over 40 °C.

High temperatures can cause the animal to use all of its sugar and mineral salt reserves, causing internal collapse that may result in death in just 15 minutes.

In addition to temperature, certain settings are more likely to provoke a heat stroke, such as small or poorly ventilated areas, like a vehicle, room, balcony, pet carrier, etc.

Birds like canaries, parakeets and other domestic birds also require great precautionary measures as they are quite sensitive to high temperatures. One must make sure that the place where the cage is located is not at a temperature higher than 20 °C and that it is always in the shade (does not receive direct sunlight).

<sup>1</sup> <http://www.elsevier.es/es-revista-semergen-medicina-familia-40-articulo-golpe-calor-a-proposito-un-13073963>

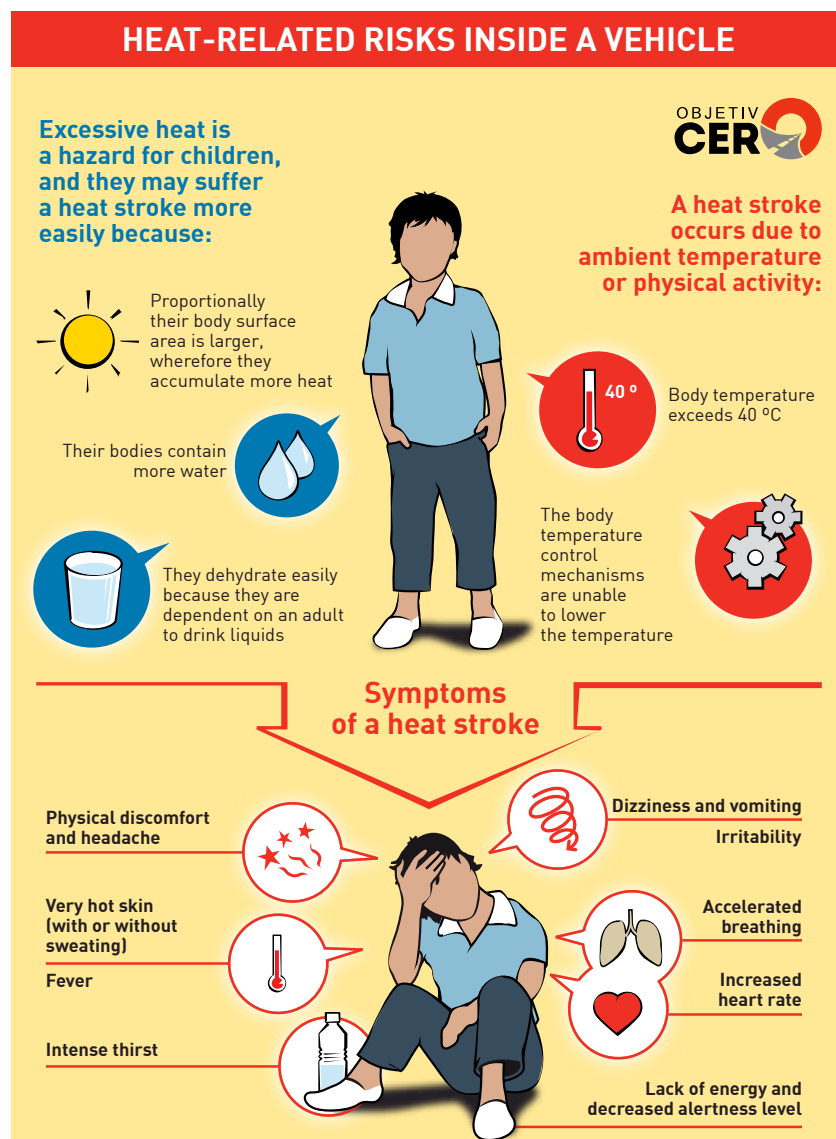
## 9. Additional resources (video and infographic)

Fundación MAPFRE has created an educational video available for viewing at:

<https://sillasdecoche.fundacionmapfre.org/infantiles/noticias/estas-son-las-razones-para-no-dejar-solo-a-un-nino-en-el-coche.jsp>

Below follows an infographic with a summary of the above.

# Fundación MAPFRE



**A vehicle parked in the sun becomes a greenhouse**

In summer, with an outdoor temperature of 39 °C, the inside of a vehicle heats to over 60 °C in just 15 minutes

A child inside a vehicle can die from a heat stroke in just a few minutes

If a child remains inside a closed vehicle, his or her body temperature can rise to 42 or 43 °C

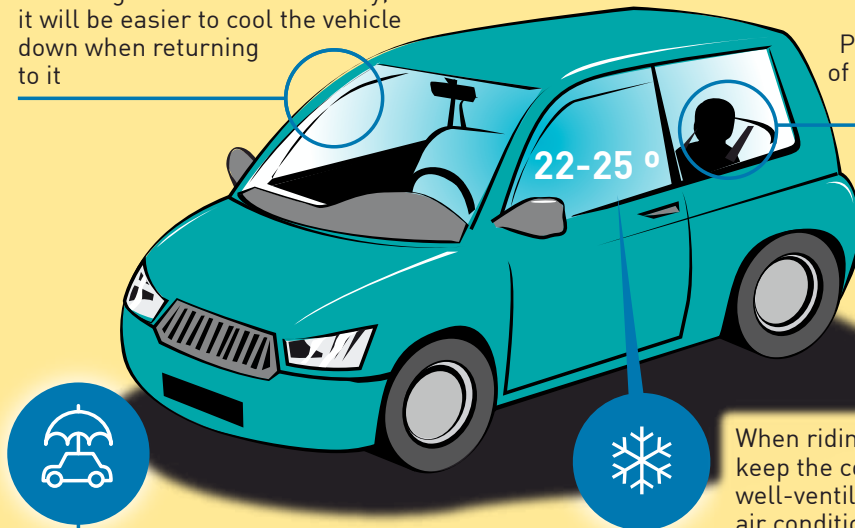
**If a child suffers a heat stroke, fast action is required**

- Move the child to a shady place
- Fan the child to provide air
- Call the emergency services (112)
- Cool the child while waiting for the ambulance to arrive
- Give the child liquids little by little
- Cool the child's skin with fresh water (not cold)



**Remember, under no circumstances forget a child inside a vehicle, and by no means fastened in a child seat and with the vehicle closed. Clothe your child with lightweight, cool clothing**

If the windows are left slightly lowered when a vehicle is left parked, it will become a few degrees less hot. This way, it will be easier to cool the vehicle down when returning to it



Position the child in one of the seats that receives less direct sunlight

Keep children from playing alone in vehicles and their possible entrapment inside

Whenever you can, leave the vehicle in the shade (but remember, **NEVER WITH A CHILD INSIDE**)

When riding in the vehicle, keep the compartment well-ventilated and use air conditioning (there is no need for setting a very low temperature, between 22 and 25 °C suffices)

[www.fundacionmapfre.org](http://www.fundacionmapfre.org)

More information:

- Fundación MAPFRE Children's Road Safety website: [www.seguridadvialinfantil.org](http://www.seguridadvialinfantil.org)
- Fundación MAPFRE website: [www.fundacionmapfre.org](http://www.fundacionmapfre.org)
- Spanish Pediatric Association website: [www.aeped.es](http://www.aeped.es)

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