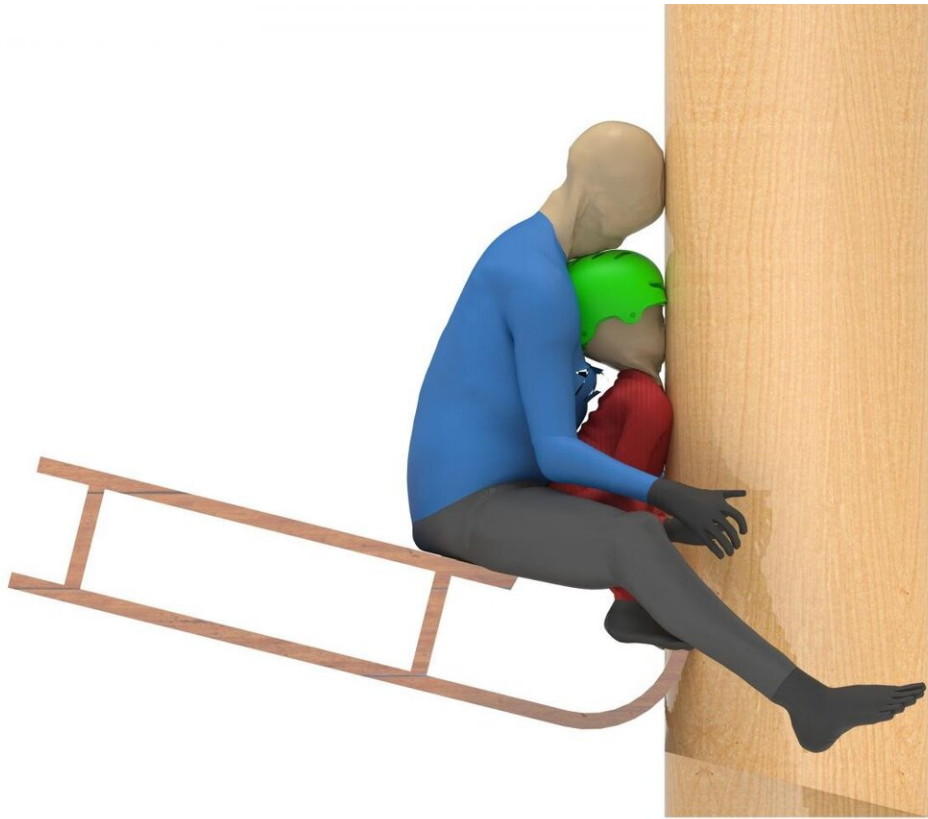


# Toboggan accident crash test: Without helmet, serious injuries even at low speeds

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Computer-simulated crash tests at the Vehicle Safety Institute demonstrate the risk of injury when tobogganing. Credit: TU Graz - VSI

More than 2,200 people are injured in toboggan accidents in Austria every year. On average, annually two accidents are fatal. In the 2019/20 toboggan season, as many as five people died. Collisions with stationary obstacles such as trees are among the most frequent causes of death. Researchers from the KFV (Austrian Road Safety Board) and the Vehicle Safety Institute at Graz University of Technology have now performed computer simulations using virtual human models to investigate which measures can reduce the risk of injury when tobogganing.

"Tobogganing is popular, year after year, many serious accidents occur. Detailed investigations, e.g. which speeds cause which injuries, are essential for prevention work. The results of our crash-simulations are alarming. Because the safety of a simple toboggan jaunt is deceptive, at least if you hit an almost rigid obstacle like a tree without wearing a helmet," says KFV spokeswoman Dr. Johanna Trauner-Karner.

## **Safety factor helmet**

The simulations clearly show that [children](#) tobogganing without helmets are at considerable risk of serious head [injury](#) from around 10 km/h. From a speed of about 20km/h, the risk of rib and femur fractures increases in addition to head injuries. "The research shows that a helmet significantly reduces the risk of head injury, regardless whether the person hits an obstacle head-on or sideways," says Stefan Smit, a researcher at the Vehicle Safety Institute.

## **Two on the toboggan: The safest place for children is BEHIND the adult**

The degree of injury in children is also influenced by their sitting position when they are tobogganing together with adults. If the [child](#) sits

in the front of the adult, there is a significant risk of injury to the child's thorax and thighs in addition to the risk of head injury, according to KFV and TU Graz: "In all of our simulation scenarios, the child was literally 'pushed' into the tree by the adult sitting behind. While impacting the tree is critical for the head, the thorax and thigh are subjected to high additional loads due to the weight of the adult and interaction with the sled." The child is trapped between the tree and the adult. If, on the other hand, the child sits in the back, the head has more or less additional impact protection from the adult's back, especially since the back is naturally softer than a tree or a lift column.

## **More details on the simulation method**

The researchers used virtual models (finite element models) of the human body for their investigations. These were placed on a toboggan model in a typical tobogganing posture. The chosen accident scenario was hitting a tree, one of the most common causes of serious and fatal injury in tobogganing accidents. This accident situation was simulated with different impact speeds and different impact angles. To evaluate the protective effect of a helmet, simulations of a child riding alone were performed with and without a helmet. In the simulations in which the child used the toboggan together with an adult, the child sat once in the front and once in the back. Injury risk was assessed based on established injury criteria.

**Expert conclusion: Only go tobogganing with a helmet! Children sit in the back!**

Wearing a helmet is especially important when tobogganing. The correct seating position—children behind the adult—greatly reduces the risk of injury when tobogganing.

Provided by Graz University of Technology

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