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Concepts towards Reduced Misuse Rates

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1 Introduction

Several studies show the problem of misuse and non-use of child restraint systems (CRS) for children travelling in cars. Although several attempts to improve the situation were made (e.g. consumer information campaigns, improved CRS, improved cars) the big step forward is still missing.

This paper briefly shows the current situation and describes what has been done so far. In addition an outlook to new possibilities is given.

2 Misuse and Non-use of CRS

In this chapter results of field studies showing the non-use and misuse problem are summarised. Then the probable reasons for misuse and non-use and influence of misuse and non-use on child safety are discussed.

2.1 Results of Field Studies

Several studies show that two thirds of the children travelling in cars in Germany are not properly restrained. This includes all kinds of misuse and non-use starting from less severe slight belt slack in the harness system to very severe non-use of any restraint system. In between everything one can imagine happens on the road (e.g. restraining children in unrestrained CRS, placing children in CRS without closing the buckle, etc.).

The non-use of CRS is strongly dependent on the age of the children. While most of the children up to 5 years of age are travelling in child restraint systems, the share of the children from 6 to 11 years using a CRS drops down to less than 50% (in Germany children need to use a CRS up to an age of 12 years or a height of 150 cm), see Figure 1.

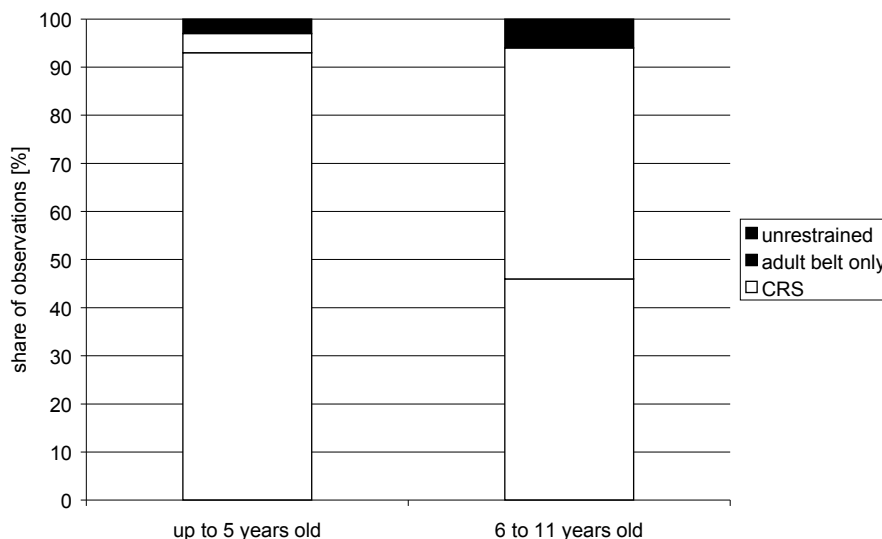


Figure 1: CRS use dependent on age groups [BASt, 2005]

Looking at those children using a CRS one must distinguish between misuse while installing the CRS and while restraining the child. For several CRS these are independent actions resulting in different kind of mistakes. Following a recent German study approx. 30% of the used CRS are installed incorrectly, while approx. 70% of the children are not restrained

properly in their CRS [Fastenmeier, 2006]. For further analysis it is important to distinguish between the different types of CRS. It is obvious that the misuse rate is higher for baby shells and harness type CRS compared to booster type CRS, see Figure 2.

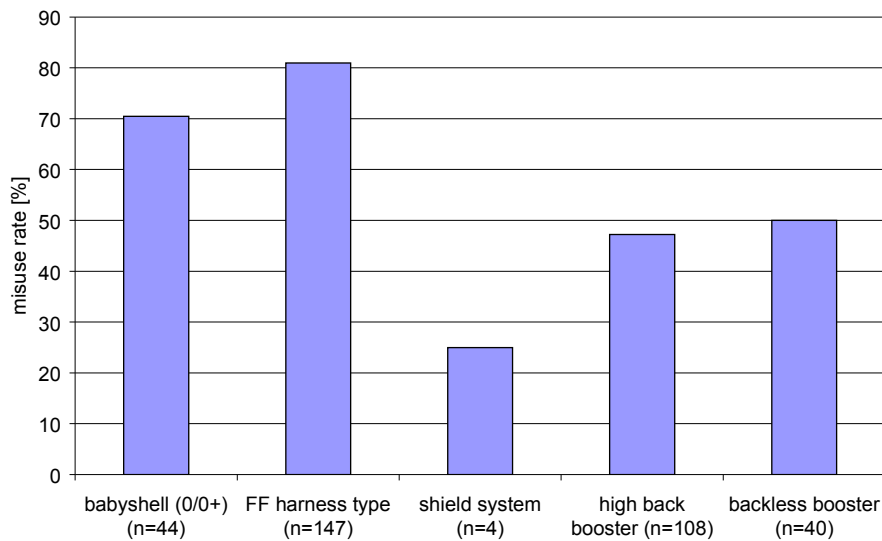


Figure 2: Misuse rates depending on CRS type [Fastenmeier, 2006]

This does not necessarily mean that parents of younger children, who are travelling in these kinds of CRS, do care less than those of older children. There are more possibilities to make mistakes with these CRS as installing the CRS and restraining the child are two independent actions, while it is only one for booster type CRS.

When analysing the details of the misuse it becomes evident that belt slack either in the vehicle's belt or in the harness are happening most often (approx. 40 to 60%) [Fastenmeier, 2006].

The field studies were performed three times showing the same overall share of misuse for all studies, see Figure 3.

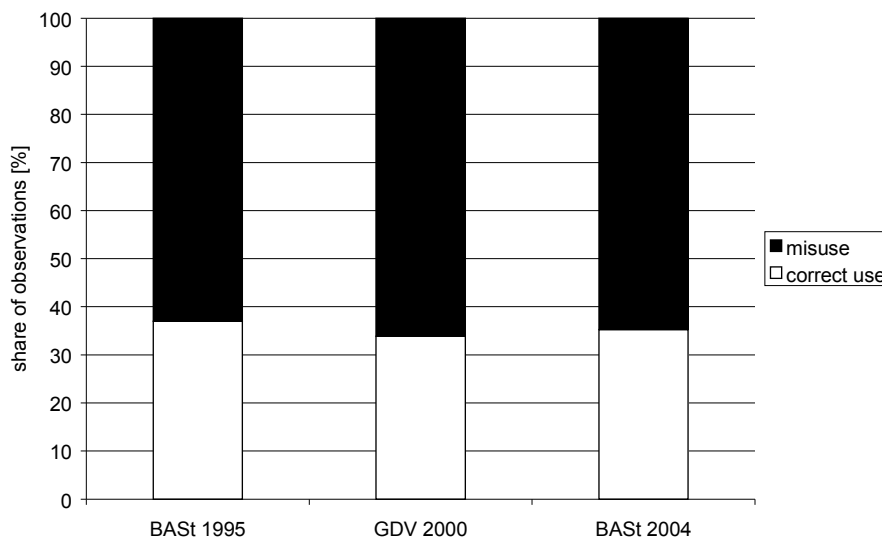


Figure 3: Overall misuse rate in different studies [Fastenmeier, 2006]

However, the severity of misuse has been reduced during the last ten years, see Figure 4.

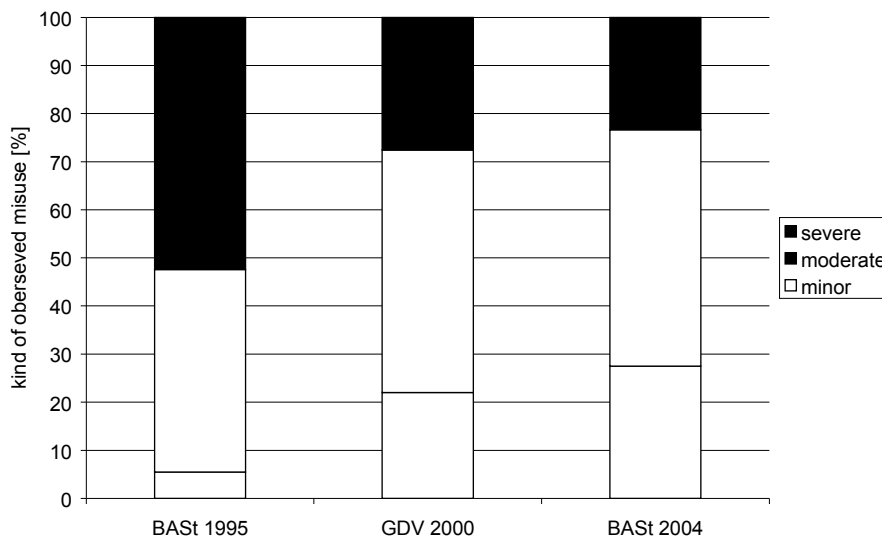


Figure 4: Severity of observed misuse in different studies [Fastenmeier, 2006]

2.2 Possible Reasons for Misuse and Non-use

Based on the findings of Fastenmeier et al. [Fastenmeier, 2006] most of the misuse cases are resulting from unconscious and conscious carelessness, technical reasons, lack of knowledge, changes of clothes and assumed improvement of the child's comfort.

Another interesting result is coming from ADAC. They asked parents for their opinion, regarding the risk of children up to an age of six of suffering from road accidents depending on the modal choice. They do expect the main risk for pedestrians, while they believe that the risk for cyclists and car occupants is nearly equal, see Figure 5.

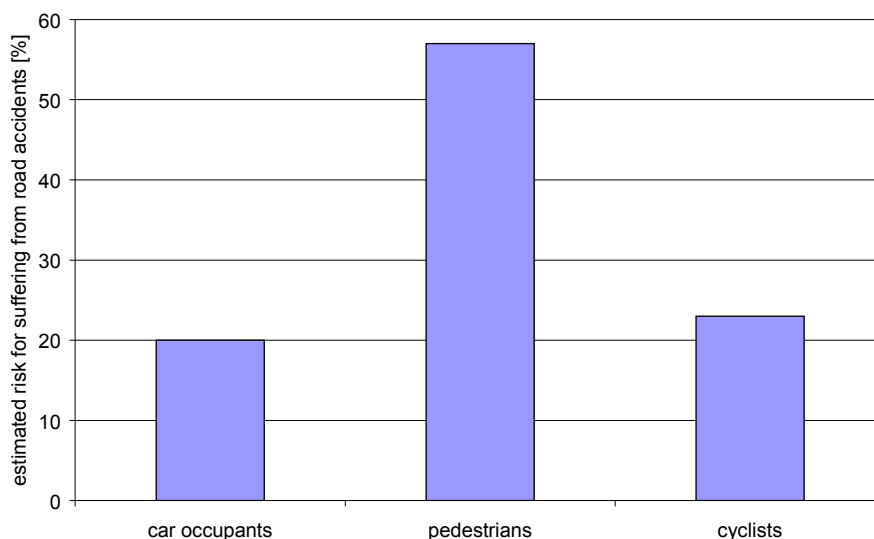


Figure 5: Parent's estimation of risk of suffering from road accidents up to an age of six [Briter, 2007]

However, the accident statistics is telling another story. While the share of children below 6 years of age being seriously injured is almost the same for car occupants and pedestrians (see

Figure 6), the risk of being killed in road accidents is much higher for car occupants than for pedestrians and cyclists (Figure 7).

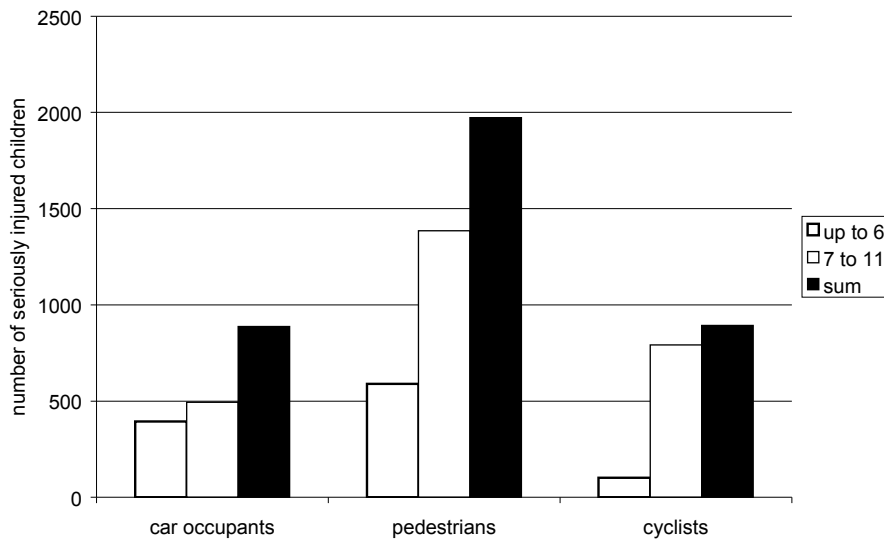


Figure 6: Seriously injured children in Germany in 2006 [STATIS, 2007]

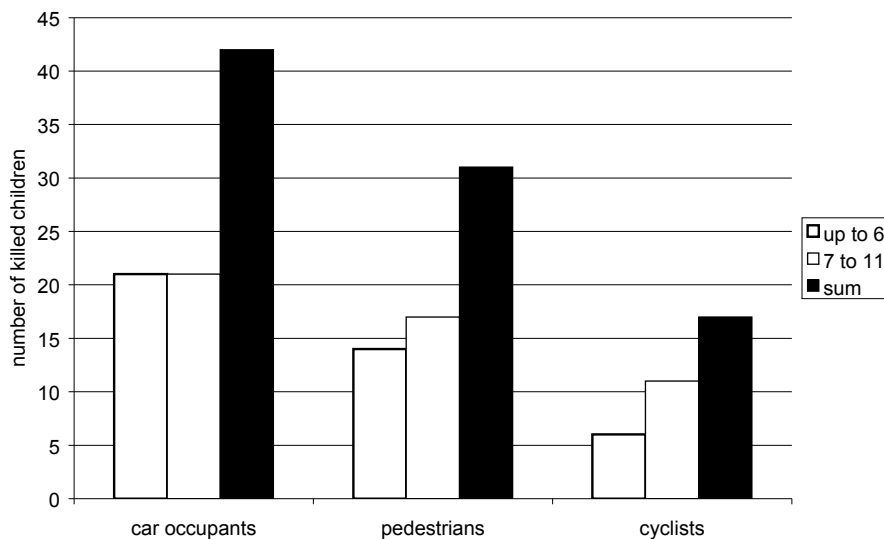


Figure 7: Killed children in Germany in 2006 [STATIS, 2007]

Taking into account this mismatch between estimation and accident statistics, it becomes evident, that a better knowledge transfer is needed.

A TU Berlin study with inexperienced users of CRS showed that a considerable part of them had problems to understand the manual, due to inappropriate order of steps, too small pictures showing only one view angle. In addition most of the test people stated that real colour pictures would be better than grey scale pictures.

2.3 Influence of Misuse and Non-use on Child Safety

Most of the recognised misuse forms lead to increased dummy readings when compared in sled tests [Langwieder, 1997; Lesire, 2007]. However, the correlation between increased dummy readings and increased injury risk has not been finally proven amongst experts.

Weber [Weber, 2007] analysed accidents where children were killed as car occupants. The analysed accidents happened in Germany within the first six months of year 2006. In total 12 fatalities were included which represent approx. a quarter of the child fatalities per year. The results are quite clear. In five of the 12 cases there are clear evidences, that the accident had been survivable by using an appropriate CRS or using the CRS properly. In three cases the accident severity was that high that the injury outcome was independent from quality of restraining. In four cases it was not possible to analyse whether the accident severity or the quality of restraining was responsible for the fatality. That means that approx. half of the children killed as car occupants in Germany could still be alive.

3 Existing Concepts for Reduction of Misuse Rates

During the last decades several attempts for reduction of misuse have been made. These can be divided in technical features, customer information (including manual) and knowledge transfer (including information campaigns).

3.1 Technical Features

One of the most successful steps forward was the unified use of colour coding for the belt routing. While blue stands for RF CRS belt routing FF CRS belt routing is marked in red based on ECE R44/03. Langwieder et al. [Langwieder, 1997] showed clear reduction of misuse rates for group 0+ baby shells compared to group 0. Group 0+ was introduced at the same time as the unified colour coding. Nowadays first steps to establish yellow as a marking for ISOFIX attachment has been started. Consequent establishment of this colour coding could be a substantial step forward.

ISOFIX is another technical option for reducing the risk of misuse. However, new problems arise in the context with ISOFIX. While the end user needs to check whether the CRS fits physically into his car with conventional CRS, he might not be allowed to use a specific ISOFIX CRS although it fits because of not fitting into the required envelope. Another story is the availability of TopTether anchorages and the possibility to use an ISOFIX CRS without TopTether and support leg.

For addressing the problem of belt slack mechanisms to tension the vehicle's belt working either automatically (e.g., Britax King TS) or manually (e.g., HTS BeSafe X1, CONCORD Ultimax, etc.) have been introduced. In addition several indicator systems presenting sufficient tensioning of the harness system are available (e.g. MaxiCosi Tobi (colour indicator at the buckle), Britax Safe Strap (additional part, which can be used for different CRS / smiley at one of the shoulder straps) or Römer King TS plus (audible indicator), etc.).

3.2 Customer Information

MaxiCosi started to publish animation at their web site how to use the specific CRS. As most of the users of CRS have internet access, this is an appropriate supplement to the paper manual. However, taking into account the results of the TUB study, real videos seem to be better than animation.

3.3 Knowledge Transfer

In Germany information campaigns are organised by DVR (“Kind und Verkehr”), ADAC in cooperation with TOYOTA (“Sicher im Auto”) and several leaflets e.g. published by GDV. While the DVR programme covers all issues of children in road traffic (car occupants, pedestrians and cyclists) the ADAC programme concentrates on children travelling in cars. Although these campaigns play an important role for improving the quality of restraining of children in cars they seem to be unable to reach those parents who do need assistance most [Fastenmeier, 2006].

4 New Concept for Knowledge Transfer

Experts from automobile manufacturers (Audi, BMW, DaimlerChrysler, Ford, Opel, Volkswagen), suppliers (Autoliv), CRS manufacturers (Britax Römer, Chicco, Concord, Fair/Wavo, Recaro) as well as public authorities and organisations (ACE, BAST, Österreichisches Verkehrsministerium, Touring Club Schweiz, TÜV Rheinland) together with the TU Berlin and Verein für Fahrzeugsicherheit Berlin e.V. started to develop a teaching concept aiming (in contrast to the existing concepts) at training of important contact points of parents / multipliers (e.g., police, midwives, teachers, etc.) in child safety. The core of this teaching concept is a unified and commonly accepted compendium of child safety.

Based on the compendium a modular teaching concept will be developed. The teaching programme starts with the education of child safety specialist, being able to train the contact points, see Figure 8. Due to their professional tasks the multipliers have specific contact with the end users (e.g., midwives directly before and after birth, vendor of CRS and cars at the time of buying decision, etc.). Therefore it is possible to disseminate knowledge target oriented and to support the end users based on their special needs.

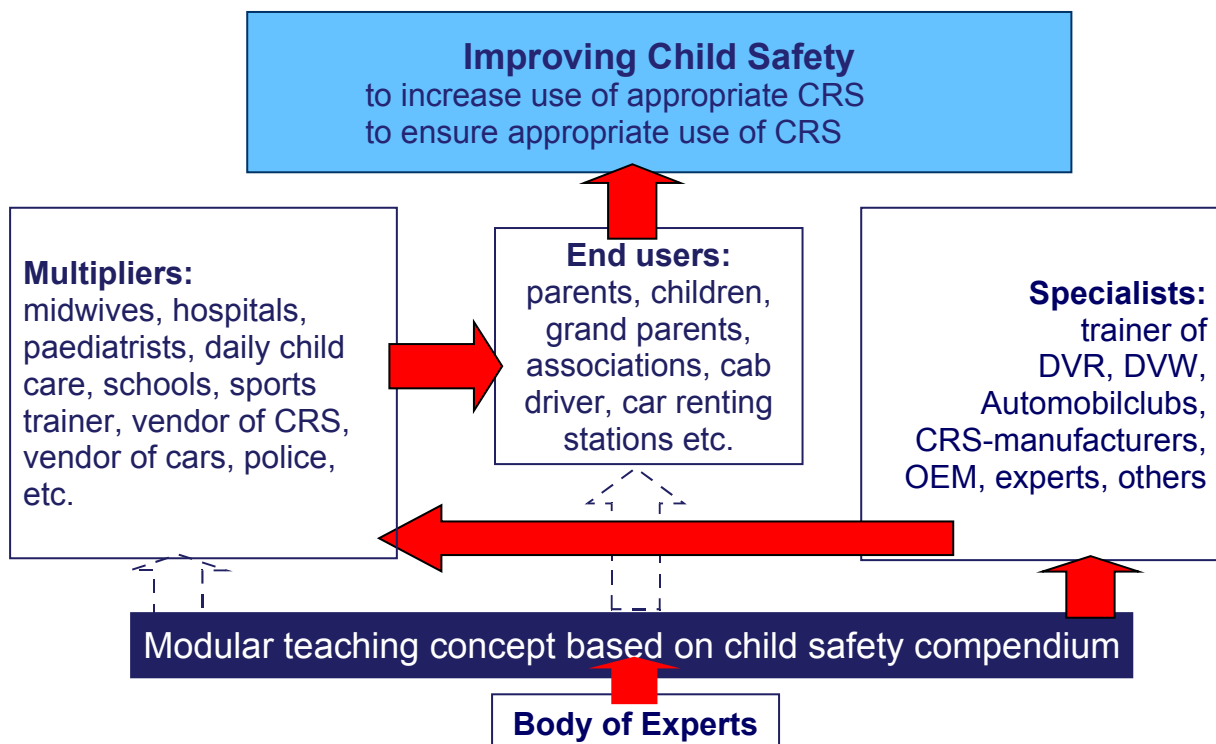


Figure 8: New teaching concept

Due to the decentralised style of the teaching concept it is possible to address more parents than by the existing concepts and to sensitise the public to this important topic.

First trainings with Berlin policemen showed considerable need for additional information before being able to assess the quality of restraining of children in cars. A two and a half day training will allow these people to address child safety in the future.

It is planned to realise the teaching concept by beginning of 2008 mainly with industrial funding. For the first stage it is planned to limit the concept to German speaking countries for practical reasons. However, later expansion is possible.

5 Recommendations

Dedicated and unified colour coding has proven to reduce the risk of misuse. The next step is to establish a unified colour coding for ISOFIX.

As belt slack is one of the most often recognised forms of misuse everything reducing the belt slack is important. Taking into account the car related possibilities, equipment of belt pretensioners in the second row would be desirable. In addition one may think about possibilities to introduce a harness pretensioner which is activated in the event of an accident. However, this is not a simple task as the use of pyrotechnics, which is the state of the art in cars, seems not to be a suitable solution for CRS.

The improvement of manuals (of CRS and cars) is possible and necessary. Looking at car manuals it seems to be important, that the information given in the manual is mainly the same independent from the manufacturer. Currently this is even not always true for all cars of one manufacturer. Looking at the CRS manual the order of steps seems to be a crucial point. One example are harness type CRS which are used the first time. Before installing the CRS it is important to know whether or not the harness height needs to be adjusted before installation. It is clear that this information is not relevant at a later stage. However, the manual may not be as important for later installations as for the first time. Users without any experience often complained about the illustration. It seems to be important to visualise several view angles showing real pictures. Videos presenting installation of CRS could help to be better prepared for the installation.

It is important to sensitise the public to child safety. As long as people believe that travelling in cars is not dangerous for children non-use and misuse will still happen frequently.

In addition it is important to assist end users in a decentralised way by multipliers. However, these multipliers need to have appropriate background knowledge before they are able to assist.

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