

## Decrease of morbidity in road traffic accidents in a high income country – an analysis of 24,405 accidents in a 21 year period

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### KEYWORDS

road traffic accident  
passenger car accident  
multiple trauma  
seriously injured  
accident research  
accident analysis

### ABSTRACT

**Background:** The WHO initiated the “Decade of Action for Road Safety” because the fatality on road traffic accidents could become the fifth leading cause of death in 2030. On the contrary, fatalities continue to decrease in high income countries. The aim of the study was to find evidence for changes in injury severity of passenger car occupants after road traffic accidents in Germany over time, and to find contributing factors.

**Methods:** Data from the German In Depth Accident Study (GIDAS), representative for Germany, was used. A total of 24,405 accidents, reported from 1991 until 2011. 44,503 adult passenger car occupants were examined. A multivariable logistic regression model was developed to find reasons for observed trends over time.

**Results:** The relative decrease in mortality was 68.8% from 1991 until 2011. Between 2006 and 2011, the percentage of severely injured traffic victims was less than half, both in terms of the whole body and individual body regions. For injuries with an Abbreviated Injury Scale (AIS)  $\geq 2$ , the percentage of persons with lower leg injuries declined by 72.5%, followed by the percentage of persons with pelvic injuries (61.5%), upper extremity injuries (57.7%), head injuries (54.3%), thorax injuries (50.0%), and abdomen injuries (40.0%).

The multivariable regression model found 13 independent variables associated with injury prevention (e.g. seat belt use: OR 0.41, CI 95% 0.32–0.49; airbag: OR 0.86, CI 95% 0.75–0.99). The implementation of protective factors increased over time while accident constellations with a high probability for severe injury decreased over time.

**Conclusion:** The decrease of severe injuries after road traffic accidents can be only attributed to a comprehensive approach including the enforcement of road safety policies and innovations in car engineering and emergency medicine. Traffic related measures and alcohol level control, and seat belt usage enforcement next to other technical advances are considered especially important.

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### Introduction

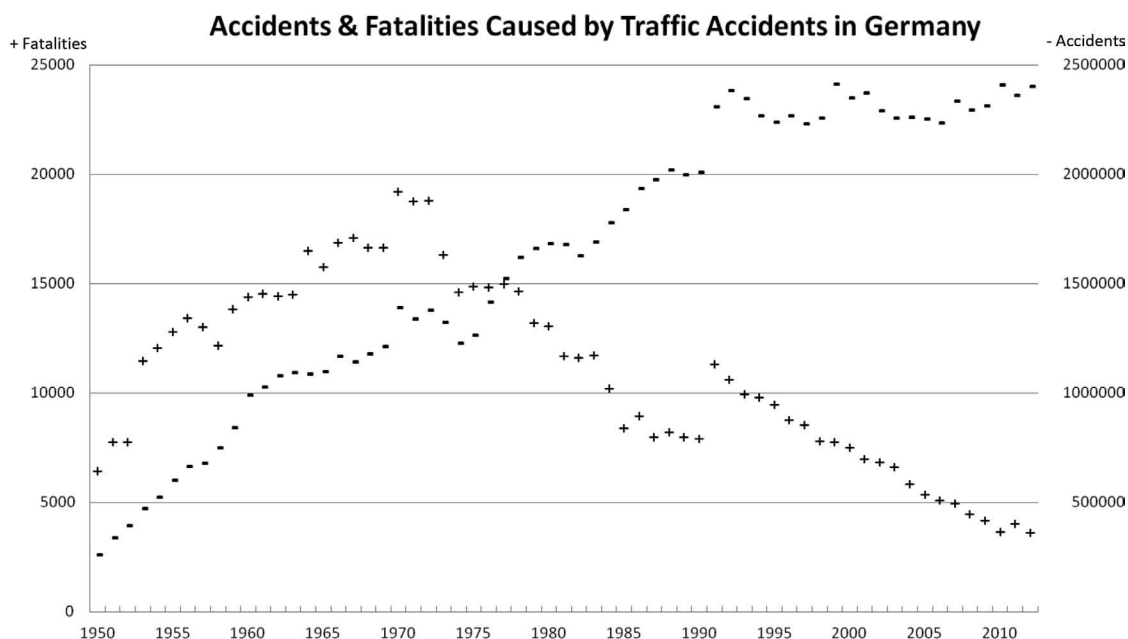
According to the WHO, in 2010 worldwide more than 1.24 million people were killed in traffic accidents. Road traffic accidents (RTAs) were the eight leading cause of death and even the leading cause of death for young people aged between 15 and 29 years. The current trend suggests that until 2030 RTAs will become the fifth leading cause of death worldwide. Increasing motorization, especially in the middle and low income countries, is one reason for this development. Due to these circumstances the WHO initiated the “Decade of Action for Road Safety (DARS)” [1–3].

However, the total number of road traffic fatalities has considerably decreased in the last decades, especially in high income countries such as Germany [3–7]. Germany has a long history of motorization. In the 1950s, the government decided (by law) to collect data about road traffic fatalities. From 1953 to 1970, the number of yearly fatalities caused by road traffic accidents increased from 11,500 to nearly 20,000. Since then, a decrease in the number of road traffic fatalities was documented. In 2014, 3,368 people were killed in traffic accidents in Germany (a country with 80.8 million inhabitants), although the number of vehicles (1950: 2.4 million; 2014: 53.7 million) and documented traffic accidents (1950: 260,761; 2014: 2.4 million) had increased over this period [6,7]. Several implementations into the German law, innovations of the automotive industry and improved patient care had contributed to this effect (Fig. 1, Table 1).

Other high income states such as the UK and the USA also provided similar information, i.e. a strong increase in road traffic fatalities in the first decades of motorization followed by a

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**Fig. 1.** Accidents & Fatalities caused by road traffic accidents in Germany from 1950 to 2012. Data-Source: © Statistisches Bundesamt – Wiesbaden 2013.

**Table 1**

Interventions to reduce road traffic fatalities since the 1950ies in Germany.

Year	L	E	M	Innovation
1957	x			Restriction of max. speed in cities to 50 km/h [7,26]
1957			x	First Ambulance in Germany [26,27]
1970			x	First Air Rescue in Germany [26,27]
1970			x	First chair for trauma surgery in Hanover [26]
1972	x			Restriction of max. speed on country roads to 100 km/h [7,26]
1973	x			Alcohol limit set to 0.8 per mill [7,26]
1974	x			Recommendation of a max. speed of 130 km/h on highways [7,26]
1978		x		First fully electronic Anti-Lock Braking Systems (ABS) [26]
1979			x	First pre-clinical emergency physicians vehicles [26,28]
1980	x			Mandatory Helmet Use [7,26]
1980		x		First Driver Front Air-Bag-Systems [26]
1984	x			Mandatory Seat Belt Use [7,26]
1985		x		First Front-Passenger Front Air-Bag Systems [26]
1995			x	First pECLA systems [29]
1995		x		First Electronic Stability Control (ESC) [26]
1997	x			Implementation of Euro NCAP [26,30]
1998	x			Alcohol limit set to 0.5 per mill [7,26]
2006			x	First ECLA systems for transportation [31,32]

E = intervention by engineering, ECLA = extra corporal lung assist, Euro NCAP = Euro New Car Assessment Program, L = intervention by law and consumer protection, M = intervention by medicine, pECLA = pumpless extra corporal lung assist.

decrease [2,4–6]. A thorough knowledge of this history is necessary to develop a worldwide successful policy for road traffic safety.

Furthermore, it is unclear how the number of injured persons has changed over the time. Are there more seriously or multiple injured persons who survived a road traffic accident or did the number of injuries decrease? Statistical data provided by the individual countries did not answer this question.

The aim of this study was to evaluate the changes in injury severity over time of passenger car occupants after RTAs in Germany by using a suitable scoring system. As an RTA is a

multifactorial process, this study focused on car occupants. Secondary aims were to explore how these changes were related to changes in road traffic policies and to innovations in car engineering.

## Methods

### Data gathering

Data from the “German In-depth Accident Study” (GIDAS) database were analyzed [8,9]. This database aims at collecting

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