
**INJURIES AND THEIR CONSEQUENCES –
PREVENTION
AS A TASK FOR DOCTORS**

1st Edition

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Bundesärztekammer (German Medical Association)



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**Education and Training Materials
of the German Medical Association**

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I. Foreword

Every year, more than 10 million people in Germany suffer an injury – 34,000 people die of injuries and poisoning. A major portion of these injuries – between 30% and 60% according to estimates – and the enormous consequential costs associated with them could be avoided by preventive measures. There is a great need for action in relation to accidents in the home and during leisure-time activities, as they are very common compared to accidents at work or road traffic accidents and there are no comparable, concentrated prevention measures. Children, young people and the elderly are especially affected by accidents, as are the socially disadvantaged. Based on a knowledge of the causes, prevention measures should be initiated and implemented in targeted fashion, focused on the most affected target groups and in a joint effort by all forces in society. Being particularly motivated by treating the consequences of accidents and having extensive access to the public, doctors are especially suited to effectively preventing injuries.

The 104th German Medical Assembly, held in 2001, adopted 10 concrete proposals in this context on the basis of the present report:

1. Establishment of a national accident prevention programme;
2. Improvement of interdisciplinary research into the causes of accidents and injuries;
3. Documentation and adaptation of successful, international accident prevention programmes;
4. Initiation and support of prevention programmes in collaboration with municipal health conferences, occupational groups, companies, schools;
5. In in-patient and out-patient care: more extensive age group-specific medical diagnosis, counselling and interdisciplinary cooperation regarding the risks resulting from injuries, including the necessary framework conditions;
6. In the public health service: intensified outreach prevention measures by the medical service for children and young people;
7. Preferential employment of scientifically validated prevention measures;
8. Securing the involvement of medical experience and professional medical competence in the production and testing of products constituting a potential accident risk;
9. Greater consideration of the subject of prevention in the basic, advanced and continuing education curricula of the health occupations, primarily in the study of medicine and postgraduate public health courses;
10. Improvement of municipal accident reporting in collaboration with the Länder and municipalities, as well as strengthening of municipal accident prevention measures.

The report entitled "Injuries and their Consequences – Prevention as a Task for Doctors" first presents an analysis of the situation in different age groups (childhood and youth, early and middle adulthood, old age) based on the available data, followed in each case by specific prevention measures derived therefrom. The report thus offers a good basis not only for medical counselling in private practices, hospitals and the public health service, but also for political decision-making among the medical community and the health insurance funds, as well as in health and general policy.

The German Medical Association would like to thank everyone involved in the preparation of this report, especially Prof. Dr. J. Siegrist.

Cologne, June 2001

Prof. Dr. med. Jörg-Dietrich Hoppe

1 Fundamentals

Injuries are a frequent cause of medical treatment. They often lead to lifelong disability and, in patients of working age, frequently to temporary or permanent incapacity for work. Moreover, deaths caused by injury result in a substantial loss of years of life. This figure is higher than the years of life lost as a result of cancer and cardiovascular disease. Accidents account for the greatest percentage of injuries. An accident is defined as an external force suddenly acting on the body. The most important accident locations are 1. the home and domestic environment, 2. traffic routes, 3. the workplace and the route to and from work, 4. recreational and sports facilities, 5. public places.

Information on the number of injuries in Germany is available from a host of administrative data and, more recently, from representative public surveys. The relevant administrative data sources include the cause-of-death statistics, hospital statistics, police reporting statistics and the statistics of the Hauptverband der gewerblichen Berufsgenossenschaften (Association of Commercial and Industrial Workers' Compensation Insurers) and of the accident insurers. Representative survey data are available from the microcensus survey (latest available figures: 1999), the 1998 Federal Health Survey (Bellach 1999) and two household surveys on home and leisure accidents in Germany. The latter were initiated by the European Community at the international level in order to prevent injuries. They were first realised in Germany by the Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (Federal Office for Industrial Safety and Industrial Medicine) in 1996 and 1997. Special attention was paid to accidents involving equipment, insofar as it is subject to the Equipment Safety Act (European Home and Leisure Activities Surveillance System – EHLASS).

There is currently *no uniform data collection method* for different accident categories and age groups in Germany. The data sources listed below are of particular importance in the field of administrative data.

Cause-of-death statistics

Based on all death certificates, the Federal Statistical Office publishes annual cause-of-death statistics. Accidents are documented according to accident category (falls, burns, poisoning, etc.), accident location, accident cause, age and sex.

Traffic accident statistics

The road traffic accidents recorded by the police are published annually, providing information on the accident location, accident category, accident cause, severity of injuries (severely and slightly injured victims; number of fatalities and injuries), as well as the age and sex of the victims.

Hospital diagnosis statistics

All accident-induced hospital admissions are recorded, indicating the main diagnosis for the stay in hospital (according to ICD-9) and stating the duration of treatment, operations performed, age and sex. Epidemiological indicators (national and for the Länder) on the severity of injuries have been available annually through the hospital diagnosis statistics since 1992. However, accident causes and accident locations are not recorded. Consequently, differentiated accident analyses cannot be derived from these statistics.

Accident statistics of the accident insurance providers

The statistics of the statutory accident insurance providers contain data on the accident location and on the occurrence and consequences of the accident, as well as the age and sex of the victims. However, these data are only suitable within limits, as they always refer to the population of insureds (accident rate per 1,000 insureds).

Home and leisure accident statistics

There are representative – albeit sporadic – household surveys on accidents in the home and during leisure-time activities and were conducted by the Bundesanstalt für Arbeitsschutz und Arbeitsmedizin in the late 1980s and early 1990s. Accident data were recorded according to sex, age, accident location, accident category and occurrence of the accident. Cases of poisoning were not recorded in this context, and no information is available on the latest developments (e.g. new leisure sports and product innovations, such as inline skates, rollerblades, snowboards) (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, Henter 1995, 1999; Schlude and Zeifang 1998).

If an attempt is made, using the host of available information and taking its limited information content into account, to obtain a *general overview of the current accident situation* in Germany, it is at least possible to arrive at the findings listed below. The subsequent chapters of the report go into a differentiated description that analyses the risk groups, accident locations and accident causes of particular importance for prevention.

The recently published findings of the 1998 *Federal Health Survey* (Bundesgesundheitsurvey) can be regarded as the relatively most comprehensive and latest information (Casper 2000; for methods and sample, see Bellach et al. 2000). In this context, a representative group of the population between the ages of 18 and 79 was asked, among other things, whether they had suffered an accident or poisoning requiring medical attention within the last 12 months. Information concerning the type of injury, its severity (incapacity for work) and the accident location was also collected.

11.9% of the respondents had suffered injury or poisoning due to an accident within the past year, and another 0.3% due to violence (extrapolated to the population of Germany, this is equivalent to 8.5 million people between the ages of 18 and 79). Accidents are particularly common up to the age of 30 years. They decline with increasing age and then increase again among people over the age of 70 years. Up to the age of 70, men suffer accidents more frequently than women. Up to the age of 50, the accident rate among men is almost twice as high as among women. The accidents occur at home and in the domestic environment (28%), at work or on the way to or from work (24%), during sport and leisure activities (23%) and on roads or footpaths (18%; others: 7%). With a total of 60%, home and leisure accidents are thus a particularly common health problem. The most frequent cause of accidents (two-thirds of all accidental injuries in all sectors) is a fall – especially often in people over 70. The data collected in the survey show that the accident rate has so far been underestimated. This applies not only to home and leisure accidents, but also to traffic accidents.

Men sustain injuries more often than women at work and during sporting activities, while women more frequently suffer accidents in the home (see Fig. 1). A lifetime perspective reveals that men in early adulthood (up to 30 years of age) record the highest proportion of accidents (more than one-third) during sporting activities, followed by accidents at work. The latter account for the greater share in middle adulthood, while accidents in the home predominate with roughly two-thirds upwards of the age of 60 years. Among women, most accidents in early adulthood occur on the road and during sporting activities. Domestic accidents become most important in middle adulthood, while traffic accidents, followed by domestic accidents, are again the most important factor upwards of age 60.

The most frequent consequences of injuries are sprains, strains, open wounds and contusions (66% among the male population and 60% among the female), followed by fractures (20% among the male population, 24% among the female). While concussion accounts for only 6% of the types of injury, it is the most frequent reason for hospitalisation among the consequences of accidents.

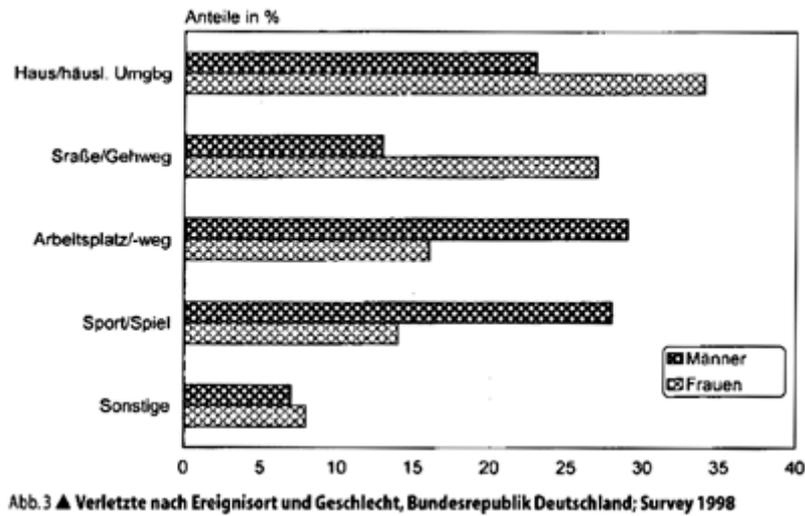


Fig. 1: Men and women each 100% (Source: Casper 2000)

The most interesting official statistics on injuries are those that refer to relatively serious accidents involving extensive consequences. This primarily means the cause-of-death statistics, the police accident statistics and the statistics of the accident insurers regarding reported working accidents, especially those of the Hauptverband der gewerblichen Berufsgenossenschaften. According to data from the Federal Statistical Office for 1998, roughly 34,600 people (4.1% of all deaths) died of injuries or poisoning. Roughly 8,000 deaths occurred in road traffic accidents, about 6,000 were the result of accidents in the home and, exercising the necessary caution as regards the diagnostic classification, some 11,600 deaths were classed as suicide. Owing to demographic ageing, there is a rapidly increasing percentage of accidental falls with a fatal outcome, also outside the home and the domestic environment (see Chapter 4.1.2, below).

The extent of traffic accidents and working accidents, two causes of injury that have been thoroughly documented to date, are described in somewhat more detail below.

In 1999, the police recorded more than 2.4 million *road traffic accidents*, in which over 528,000 people were injured or killed, there being 77.8% minor injuries, 20.7% severe injuries and 1.5% fatalities (BAST Unfallbilanz 1999). In total, more than 49,000 children under the age of 15 were involved in accidents (see Chapter 2.1, below). The 18 to 24 year-olds constitute another high-risk group. This group has by far the highest accident risk on the roads. In 1999, some 116,620 young men and women in this age group suffered an accident, 1,694 dying as a result. Although only 7.7% of the overall population is in this age group, it accounts for 22% of injuries and fatalities recorded on the roads. Thus, the risk of dying in a traffic accident is almost three times higher in this age group than in the other age groups.

The accident severity displays a gender gradient (76% of the passenger car fatalities in this age group were men and 24% women). Another important observation is that a quarter of the accidents involving personal injury were caused by 18 to 24 year-old road users and that, in this context, almost one accident in three involving personal injury was the result of what is known as a "driving accident", i.e. the driver losing control of the vehicle without any external influence (BAST 1999; see also Chapter 3).

In addition to children and young adults, the elderly (people over 65 years of age) are at particular risk. Of the pedestrians and cyclists killed on the roads in 1999, 43% and 39% respectively were over 65. The proportion of over 65 year-olds in relation to the total number of traffic fatalities was 16.8%. In this age group, fatal consequences resulting from traffic accidents most commonly involve pedestrians (37.6%), cyclists (35.8%) and, to an increasing degree, car drivers (11.5%) (see Chapter 4.1 for details).

Mention has already been made of the increasing role of *home and leisure accidents*. According to estimates, this group of accidents grew from approx. 4.6 million cases per year in 1988 to approx. 5 million cases in 1992. If only the gainfully employed population is considered, the estimated accident rate of 53 notifiable injuries caused by home and leisure accidents per 1,000 full-time workers is roughly as high as the rate of notifiable working accidents (54 per 1,000 full-time workers).

Extrapolated on the basis of representative household surveys, this yields an annual total of roughly 26 million days of incapacity for work as a result of home and leisure accidents. Falls are the most common cause of injury in this context (approx. 50%). Football is the most frequent sport leading to injuries (26%), followed by downhill skiing (12%) and inline skating (9%) (see also Chapters 2 and 3). It is particularly interesting to note that ambient influences are only stated as the cause of the accident in 25% of all cases and technical equipment defects in 12%. In the majority of cases, the victims attribute the accident to their own incorrect behaviour or to physical and mental influences.

Besides traffic accidents, the best officially documented type of injury relates to *working accidents*. The rate of working accidents is defined as the number of working accidents per 1,000 full-time workers and year. In this context, a working accident is notifiable if work is interrupted for more than three days as a result. Also counted are pension claims caused by working accidents, as well as fatal working accidents. The most comprehensive statistics come from the Hauptverband der Gewerblichen Berufsgenossenschaften and are based on 41.7 million insureds, this being equivalent to 30.4 million full-time workers.

According to these statistics, 1.2 million notifiable working accidents were recorded in 1998. It should be noted in connection with this figure that the statistics cover "cases", not "persons". Thus, the data also include multiple accidents suffered by one and the same person. These working accidents led to new pension claims in 25,000 cases, while roughly 950 working accidents had a fatal outcome. The majority of the new pension claims were attributable to accidents at work, with only about one-fifth being due to accidents on the way to or from work. As already mentioned, men are more severely affected by working accidents than women. This even applies if only the gainfully employed population is studied. Roughly one-third of the notifiable working accidents involve insureds under the age of 30. In contrast to road traffic accidents, however, the working accidents occurring in this age group are predominantly of a less serious nature. This changes in the age group of 40 to 59 year-olds, where the proportion of accidents with a fatal outcome is 50%. Survived accidents with serious consequences are also recorded much more frequently here than in younger age groups (BGZ-Report 2/99).

Working accidents varied according to sector and company size. For instance, it is hardly surprising that the relatively highest prevalence rates are found in the construction, woodworking, minerals, iron and metalworking sectors, while the relatively lowest are found in the trade, administration and health professions sectors. There is seen to be an inverse relationship to company size in all three areas (notifiable accidents, new pension claims, fatal working accidents): the smaller the company, the higher the risk (Coenen 1999). This situation can partly be explained by the fact that small companies are common in particularly high-risk sectors, such as the building trade, and partly by the fact that the investments in health and safety at work are, on average, lower in small companies than in larger ones.

The trend in Germany's working accident statistics over the past 40 years indicates the success of extensive prevention efforts, which has been achieved on the basis of the dual system of industrial safety that has existed for 100 years. Even taking into account that about 20% of the decline in working accidents has to be credited to the change in working conditions, i.e. the switch from high-accident occupations in the industrial sector to low-accident occupations in the service sector, the steady decline in all three working accident indicators is still impressive: for the period from 1960 to 1998, the decline (per 1,000 full-time workers in each case) is 70% for notifiable working accidents, 75% for new pension claims and 83% for fatal working accidents (Coenen 2000). The efficacy of industrial safety measures, including medical care, the risk groups that still exist and some partly new prevention tasks will be described in detail below (see Chapter 3).

These few indicators alone illustrate that the injury situation in Germany is of a magnitude that urgently necessitates increased, multi-level prevention efforts. As will be shown in the following chapters, this results in important tasks for doctors in the prevention of injuries, most of which can be realised in the framework of the existing health care system. These tasks are described below – against the backdrop of a detailed epidemiological analysis of the injury situation – for each of the three age groups: children and young people; people in young and middle adulthood; the elderly.

2 Childhood and youth

2.1 Epidemiological analysis

2.1.1 Overview and data situation

In Germany, more children die in childhood as a result of accidents (650 in 1999) than of cancer (335) and infectious diseases (114) together. More than 30% of all childhood deaths are attributable to accidents (Federal Statistical Office 1998, 1999). Following a decline in the number of deaths in the early 1990s, the figures have since begun to rise again (reaching 685 deaths in 1999). In terms of the risk of suffering an accident, children must be classified as a risk group. After the first year of life, accidents are the most common cause of death among children and young people. According to a representative survey conducted by the Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) (Henter 1995, 1999), a total of roughly 1.9 million children in Germany were injured so badly in an accident in 1996 that they had to consult a doctor or were impaired for 14 days or more by injuries sustained in an accident. One-third of these accidents occur at home and during leisure time, about 55% at school and approx. 12% are road traffic accidents.

Following diseases of the airways, accidents are the most common reason for children having to see a doctor. Some 3,500 accidents per year result in permanent disability and approx. 700 have a fatal outcome.

According to estimates by the accident insurers (Bundesverband der Unfallkassen 1998, 1999, 2000), the costs resulting from childhood accidents amounted to approx. DM 3.6 billion in 1995. Education, training and appropriate structural measures help reduce the number of accidents and thus a central threat to the health of children.

Empirical reports and measures in the USA (National Safe Kids Campaign) (Onuwachi-Saunders et al. 1999, National SAFE KIDS Campaign 2000), Sweden (Berfenstam 1995; Centre for Epidemiology, National Board of Health and Welfare 1995; Ekman et al. 1996; Sweden's National Institute of Public Health 1994), Switzerland (Hubacher 1994), Spain (Navascues del Rio 1997), the Netherlands and a growing number of other countries (Bener et al. 1998) document the international significance of the problem and the efforts being undertaken in this respect. It would appear that effective measures are capable of reducing the number of accidents involving children by more than 30%. According to US reports, roughly 80% of all accidents involving children are avoidable (see Chapter 2.2, below). Although, as previously mentioned, Germany has no uniform method for collecting data for the different accident categories in individual age groups, the following data sources can be consulted for estimating the injury situation in childhood and youth:

1. cause-of death statistics, 2. traffic accident statistics, 3. hospital diagnosis statistics, 4. accident

statistics of the accident insurance providers, 5. home and leisure accident statistics, 6. European Home and Leisure Activities Surveillance System (EHLASS).

2.1.2 Accident and injury categories

The *hospital diagnosis statistics* indicate that, since 1993, at least 240,000 children per year have required in-patient treatment because of an accident. This figure is increasing steadily. It is also striking to note that injuries sustained in an accident are the second most common reason for hospitalisation in infancy, and even the commonest reason at school age.

Risk groups, accident locations and typical types of accident

The main risk groups are babies and toddlers (1 to 4 years of age). They primarily suffer accidents in the home and leisure sector, where they are affected 2.5 to 3.5 times more frequently than children of school age. The main danger for schoolchildren is that of being involved in a traffic accident. They are most frequently involved in accidents in built-up areas and in the afternoon, either as pedestrians or as cyclists.

Considering the complete age group of the under-fifteens, home and leisure accidents today exceed traffic accidents, having done so for the first time in Germany in 1997. There is a need to re-think prevention in this context in the future.

Examining the proportions of the three most common types of accident (home and leisure accidents, traffic accidents and drowning) in relation to accident mortality as a whole since 1980, it can be seen that there is a difference in the trends for 1 to 4 year-olds and 5 to 14 year-olds. In the toddler age group, there has been a marked drop in the proportion of traffic accidents, while home and leisure accidents increased accordingly. Cases of death by drowning remained at a high level of roughly a quarter of all accident deaths. Among schoolchildren, traffic accidents have accounted for a relatively constant share of approx. 60% since 1980. The remainder is split among home and leisure accidents (approx. 20%) and drowning accidents (approx. 10%).

Research into the causes of accidents in childhood and youth is relatively rudimentary in Germany. The *social situation* of the family is known to have an influence on the occurrence of accidents. For instance, an extensive analysis of the accident-related admission of children and young people to hospital as a function of the social status of their parents indicates a 40% higher accident rate among children and young people from the lowest social stratum compared to the highest (four social strata) (Geyer and Peter 1998). This risk is particularly high between the ages of 6 and 10 years. As the majority of accidents in this age group occur in traffic (as pedestrians, as cyclists),

socio-ecological analyses should identify stratum-specific accident risks more accurately. One study pointed out that children and young people from worker households spend more time in public places (parks, playgrounds), and especially often also without parental supervision (Zinnecker 1979). Another study demonstrated that children at socially disadvantaged schools cross 50% more roads each day on their way to and from school than children at non-disadvantaged schools, the accident risk increasing with the number of roads to be crossed. Main roads are a particular danger (Macpherson et al. 1998). It is known from non-German studies that children living in socially disadvantaged residential areas clearly run a higher risk of becoming victims of fatal traffic accidents (cf. McLure and Steward 1984; Roberts and Power 1996; Cubbin et al. 2000). Children from families in which neither the mother nor the father is in regular employment are particularly vulnerable representatives of the large group of members of a low social stratum (Östberg 1996). This higher vulnerability can at least partly be explained by the fact that children living in a domestic environment characterised by chronic anxieties and worries (poverty of the parents, marital conflicts or incomplete families, unemployment) are less attentive on the way to and from school and in road traffic (see also Chapter 2.2).

Home and leisure accidents

An analysis of *equipment accidents* according to the age of the accident victims yields the following picture: in children under the age of six, one equipment accident in five involves toys. Playground apparatus also plays a major role in the accidents suffered in this age group. More than one equipment accident in ten happens with (children's) furniture or bicycles.

The connection between accident activity and accident process also has an influence on the distribution of accidents according to age and sex. As many equipment accidents occurring when playing end with a fall, the under-sixes are particularly affected by this accident mechanism. Compared to all other age groups, injuries caused by thermal influences are most common (16%) in toddlers under two years of age. In contrast, children and young people injure themselves at an above-average rate by colliding with objects.

The age-based differentiation between the types of injury indicates that the injuries sustained by children under the age of 6 years primarily involved open wounds, as well as craniocerebral traumas and burns.

The great majority of accidents (61%) occurs on *public playgrounds*, 26% in the gardens of residential buildings and 7% in shops, shopping centres or public buildings. An analysis of accident records shows that a fall from some height was involved in more than half the accidents (57%).

Slipping, missing one's step and taking risky jumps as causes of injury are often a result of carelessness, high spirits and inattentiveness, but also of clumsiness.

Differentiating the types of injury according to two age groups (under 6 year-olds and 6 to 14 year-olds) shows different incidences that can be preventively influenced in different ways: in the first group, open wounds – essentially caused by pointed objects – are most common, followed by contusions and craniocerebral traumas. Fractures and grazes follow with equal incidences. Among the 6 to 14 year-olds, fractures are predominant, followed by contusions and open wounds. These are followed by grazes and craniocerebral traumas which, however, only account for 3% of the accidents in this age group.

Traffic accidents

A total of roughly 49,000 children under the age of 15 were involved in road traffic accidents in Germany in 1999. This was 5.8% more than in the previous year. The increase in the number of accident victims related almost exclusively to children as cyclists. Some 17,657 children had an accident with a bicycle, this being 15% more than in 1998.

The number of children killed ($n = 317$) rose by 4.3%, while the number of severely injured children ($n = 10,405$) remained unchanged compared to the previous year. Of all the children dying in traffic accidents, 44% were car passengers, 26% pedestrians and 25% cyclists.

If not only mortality is considered, but all accidents involving injuries, children were most frequently involved in accidents as cyclists, namely in 36% of all cases. In 33% of cases, they became the victims of traffic accidents as car passengers and in 26% as pedestrians. These percentages differ in the individual age groups. For example, children under the age of 10 are more frequently involved in accidents as pedestrians or car passengers, whereas children aged 10 and above are more frequently cyclists. The majority of cycling accidents involving children occur on public traffic routes (77%), this also applying to adults.

Boys are generally at greater risk on the roads than girls. 58% of the children involved in accidents were boys, 42% girls. The difference between the sexes is particularly pronounced in connection with the accident risk as a cyclist.

In road traffic in built-up areas, inline skates are becoming increasingly important alongside bicycle accidents. Almost one-third of all inline skating accidents involve the age group of 6 to 14 year-olds.

Key data on road traffic accidents involving children in 1999:

- A total of 49,184 children suffered road traffic accidents in Germany in 1999.
- In Germany, a child is hurt in a traffic accident every 11 minutes.
- The increase in the number of accidents is almost exclusively attributable to bicycle accidents, in which a total of 17,657 were injured.
- 44% of all children killed on the roads died as car passengers.
- Boys have a generally higher accident risk than girls; this also applies to bicycle accidents (68% vs. 32%), which have particularly dangerous consequences in the age groups 8 to 9 and 14 to 15 years.
- As regards the time of day, the highest accidents rates among children and young people are recorded between 7 and 8 o'clock in the morning and between 4 and 6 o'clock in the afternoon.

Severity of the accidents and injuries

At this point, it is important to consider the latest cause-of-death statistics of the Federal Statistical Office by accident categories in childhood. Of the 650 children between the ages of 0 and 15 years killed in 1999 (402 boys, 248 girls), 322 died in traffic accidents, 146 in domestic accidents, 47 in play/sport accidents and 127 in other accidents. A total of 109 children died by drowning, more than half of the victims being between the ages of 1 and 5 years. Roughly 7% of the fatalities were caused by burns. Babies are at particular risk.

Additional relevant information can be found in the hospital statistics. 85% of the admissions of babies for in-patient treatment are attributable to head injuries (including concussion and skull fractures). Together with skull fractures and concussion, cerebrocranial traumas are also the commonest reason for hospitalisation (72%) in the group of 1 to 5 year-old children. Burns and poisoning are other important diagnoses upon admission of babies and toddlers.

Targeted prevention measures can already be derived from these few official figures (see Chapter 2.2, below).

Accidents in schools and kindergartens (mainly sport accidents)

According to the latest data from the statutory accident insurance statistics, accidents in schools and kindergartens take first place, followed by domestic, leisure-time and traffic accidents. In 1998, 10.6% of the children under the age of 15 living in Germany injured themselves in this way in an absolute total of roughly 1,100,000 accidents. Of these accidents, 92.2% occurred in the institutions and 7.8% *en route*.

The data of the Bundesverband der Unfallkassen are not provided in age group-specific form, but according to types of institution for all children under the age of 15 years. The data for special schools, comprehensive schools and other schools providing general education were excluded from the following compilation (1998: 127,450 accidents, 1,454,460 insureds) because the age group cannot be delimited (primary school age/older school age). The trend from 1989 to 1998 shows that accidents increased by 15.8% in all institutions, but particularly rapidly in secondary schools, where the increase was 27.5%.

At a rate of 2.2/1,000 insureds, accidents *en route* play virtually no quantitative role as regards kindergarten children. However, the rate of 18.3/1,000 insureds among 12 to 15 year-olds is almost 8 times higher and continuing to rise.

Accidents during breaks declined from 47% in 1989 to 36.8% in 1998. Sport accidents reveal a slight increase from 39.1% to 42.6%, although this is probably not statistically significant. Classroom accidents rose from 10.6% to 16.9% during the same period.

Every year, approx. 5% of all schoolchildren suffer an injury during *physical education classes*. The accident risk is highest in the group of 11 to 15 year-olds (Kelm 1996), more than half of all the accident victims being members of a sports club and engaging in regular sporting activities (58.9%), 61.4% of them being male and 36.6% female. 62.2% of all accidents occur in connection with team games, such as football (21.2%) and basketball (19.8%), or gymnastics (16.5%).

Roughly one-third of the accidents suffered by boys and girls are caused by exercising the basic motor skills of running/jumping/catching, while another third results from the use of certain ball and sport-specific techniques, particularly overarm passing and bouncing, and in special parts of gymnastic exercises, where girls are affected far more frequently. With a total of 55%, the upper limbs are clearly the main location of the injuries. The hand and fingers were most often affected (41%). Ankle injuries were the second most common category (20%). In-patient treatment is required in 3.7% of all cases. The average period spent in hospital is 12 days. The mean duration of the inability to attend school is 19.5 days for boys and 16.3 days for girls.

Injuries in public places

Among the types of injury suffered in public places, two are particularly topical and important: 1. Injuries caused by dog bites, 2. Injuries resulting from interpersonal violence. In connection with *injuries caused by dog bites*, a publication from the Department of Paediatric Surgery in Greifswald (Kempe et al. 2000) contains the results of retrospective case studies from the period 1980 to 1998. All these cases involve severe injuries requiring hospitalisation. A significant increase in the num-

ber of victims was demonstrated in the period up to 1998: 30 children had to be admitted between 1980 and 1989, as compared to 145 between 1990 and 1998. It was found in this context that the duration of hospitalisation also increased, presumably as a result of the severity of the injuries. There was a particularly marked increase in the number of severe face injuries. The incidence was highest among 5 to 9 year-old boys.

The number of unreported cases is high in this sector. According to estimates from the USA, however, it can be assumed that, given a total of roughly 4.8 million dogs in Germany in 1998, there are approximately 30,000 cases of dog bites resulting in injuries each year. More than half of the victims are children, with babies and toddlers being affected particularly frequently.

Violence as a cause of injuries plays a role that should not be underestimated in today's society. Crimes of violence in the strict sense of the word only represent the tip of a social iceberg that is characterised by a large number of unreported cases. Crimes of violence encompass the following: murder, manslaughter and mercy killing, rape and sexual coercion, robbery, robbery by blackmail, predatory assault on drivers, fatal injury, dangerous and grievous bodily harm, kidnapping for ransom, taking of hostages, aggressive acts against air and sea transport.

Children and young people are primarily involved as victims, but increasingly also as perpetrators, of *acts of violence* in public places and in the family environment. The latest police crime statistics can be used to obtain a rough picture of serious crimes of this nature that shows children and young people to be the *victims*. According to the figures, just under 10% of all cases of actual or attempted murder and manslaughter are directed against children and young people.

The frequency of crimes committed against children and young people is particularly noticeable in connection with sexual abuse (111 per 100,000 young people) and bodily injuries that fulfil the definition of the crime (335 per 100,000 children and 1,515 per 100,000 young people). It is almost exclusively girls and young women who are affected by these crimes (age group 14 to 18 years) (Polizeiliche Kriminalstatistik 1999).

However, children and young people are not only the subject of epidemiological and preventive analyses of the violence situation as victims, but also as *perpetrators*. According to the above-mentioned police crime statistics, no less than 22% of all crimes of dangerous and grievous bodily harm are committed by children and young people. International studies indicate that roughly 4% of all young people over the age of 12 must be expected to have at least a latent tendency towards acts of violence. There is extensive scientific literature on the developmental psychology, sociological and genetic background of this situation (cf., for example, Rutter et al. 1998; Stone et al. 2000). Very recent findings are available from the USA, indicating that the incidence of homicide in the

group of 14 to 17 year-olds has increased substantially in the course of the last 10 years (Stone et al. 2000). Also worrying are reports of an increase in acts of violence in the school environment and in public places.

The official data from the police crime statistics covering the period from 1992 to 1999 show a similar trend in Germany. Figures 2.1 and 2.2 give an impressive illustration of the situation.

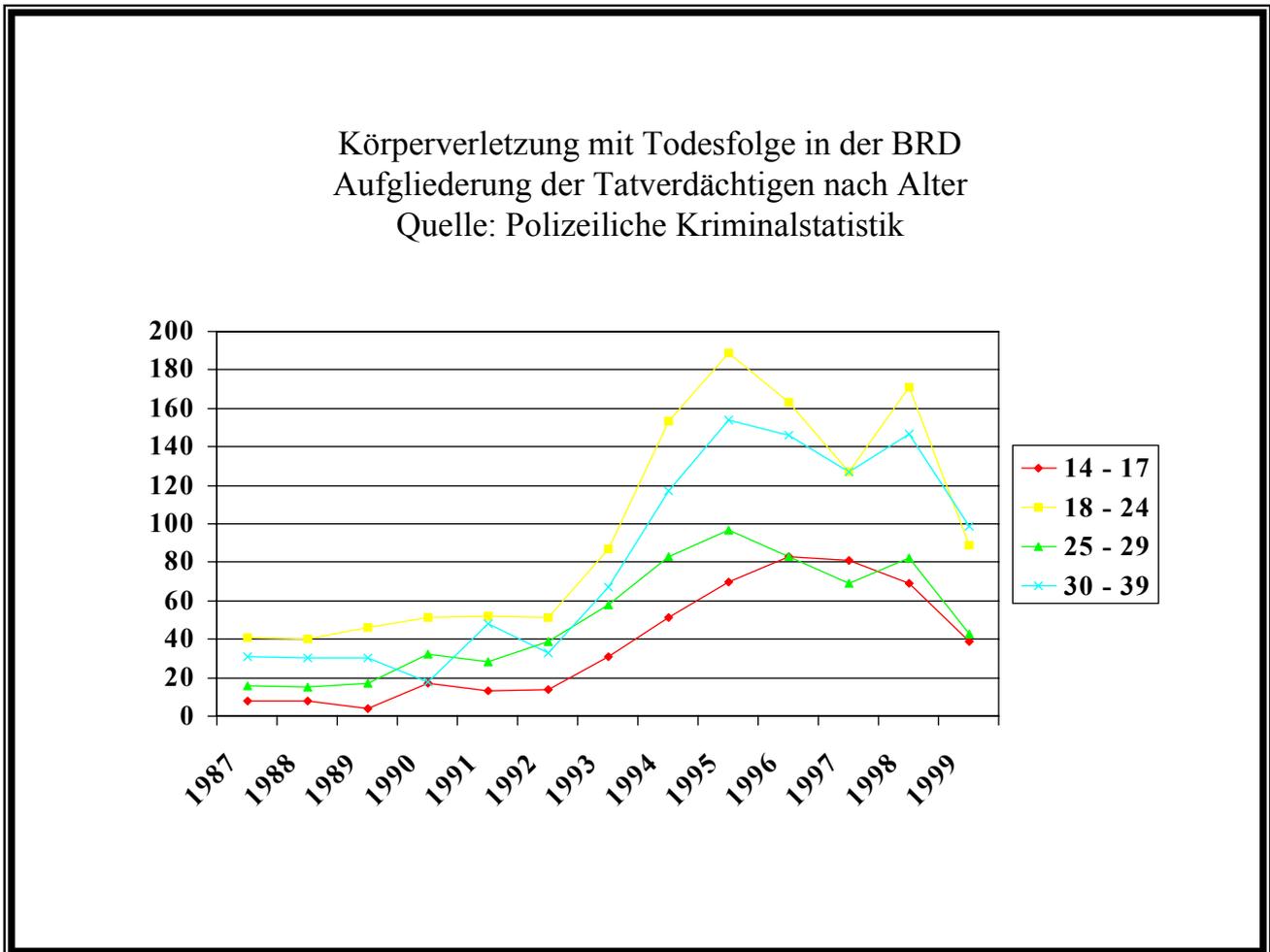


Fig. 2.1

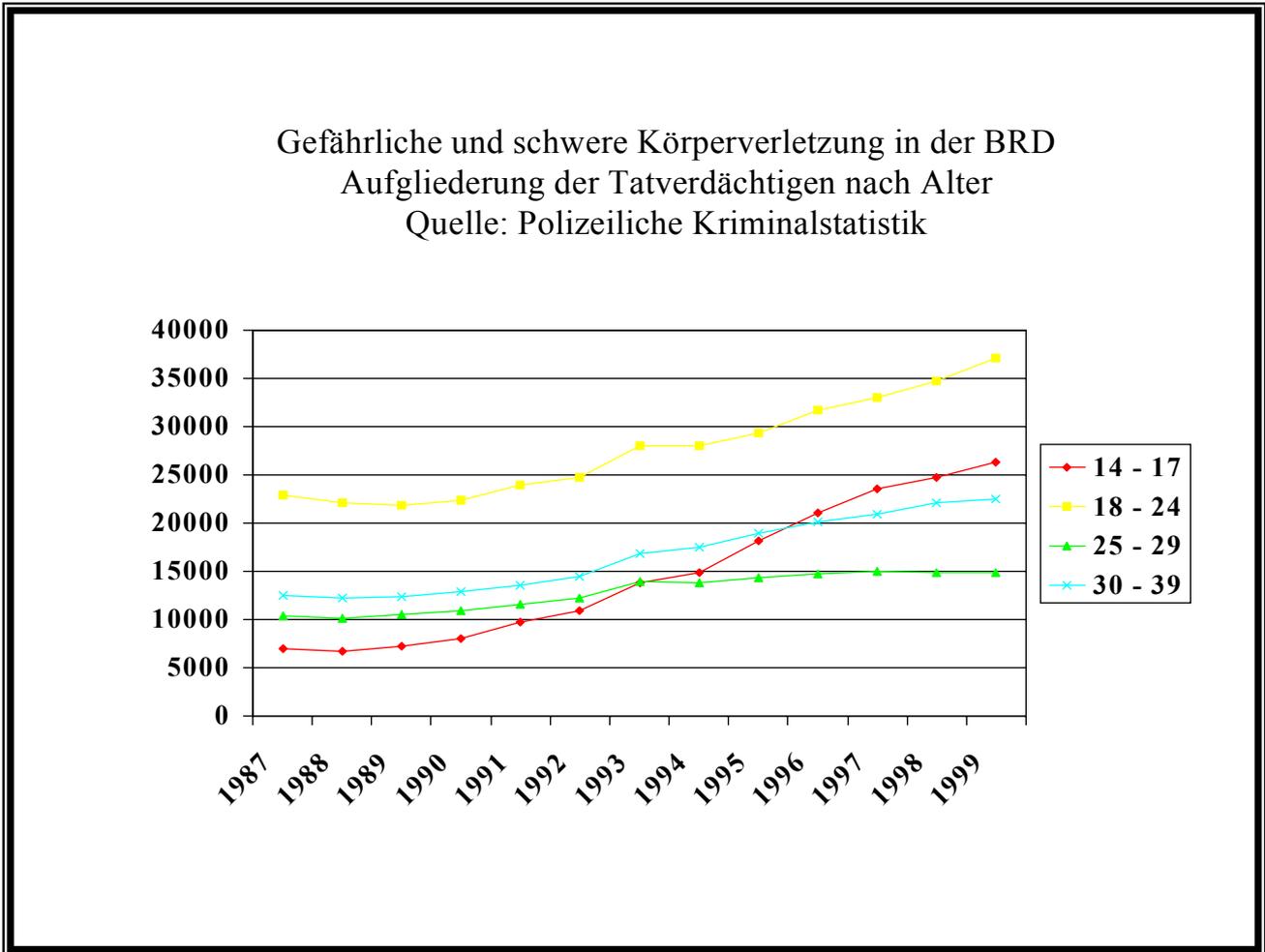


Fig. 2.2

2.2 Preventive measures

2.2.1 General measures

The most important strategy for ensuring the effectiveness of prevention measures is a joint effort on the part of all those who have an influence on the causes of childhood accidents and the founding of so-called regional alliances for accident prevention or "Accident Prevention" working groups made up of people bearing political responsibility, people who are affected or at risk and people who are committed to the health of children. The effectiveness of preventive measures must be constantly reviewed and statistically evaluated (Bundesarbeitsgemeinschaft Kindersicherheit 2000). Suitable measures for reducing the incidence and severity of accidents (Haas and Gurte 1996; Limbourg et al. 1997; Shafi et al. 1998) resulting in the death of, or permanent damage to, children are the combination of education, improvements in children's environment, technical modifications, changes in laws and regulations, financial support, activities on the part of society and programme evaluations. Medical counselling of parents regarding the prevention of accidents involving children has been demonstrated to be effective (critical review of available studies in Bass et al. 1993).

As long ago as the early 1990s, the European Association for Consumer Safety and the Foundation for the Prevention of Childhood Accidents held a conference in Brussels with the title "Communicating Child Safety: European Approaches to Accident Prevention Campaigns", at which guidelines were developed and published for stimulating activities in the field of child safety. One extremely successful campaign for preventing accidents involving children is the "Safe Kids Campaign" in the *USA*, which led to the founding of a worldwide organisation (Safe Kids Worldwide) in 1999. *Sweden* has had a central organisation for the prevention of accidents involving children since 1954. It initially operated on a voluntary basis, but has been a government authority since 1980 and has established a broad-based cooperation network. It is remarkable that the government in the Netherlands defined its prevention goals in 1992: via an institute specifically commissioned and financed for this purpose, the "Consumer Safety Institute", a neutral institution has been created that not only initiates campaigns, but is also responsible for product safety and standards.

A wide variety of laws and regulations have been initiated in order to establish a safe environment that is better adapted to children. Moreover, strategies had to be developed to communicate relevant information to parents and educators. Cooperation with the mass media is of great importance for this objective. Similarly, local activities on the part of doctors, district nurses, teachers and educators are also of great value, as they give consideration to important local requirements (in this context, see also Bundesärztekammer et al. 1999).

Preventive action has different key fields in the individual age groups. For instance, babies and toddlers are exposed to particular risks as regards domestic accidents. Toddlers and preschool children suffer accidents when playing and during leisure activities, as well as on the roads and at kindergarten. Road traffic accidents and sport injuries play the leading role in children of school age and in adolescence. There follows a description of preventive measures for the individual causes of injuries and accidents in specific risk groups.

2.2.2 Measures for specific risk groups

Babies, toddlers and children of preschool age

Parents should receive targeted advice from doctors in order to avoid falls in babies and toddlers. Information sheets on the prevention of accidents and injuries are already handed out and explained as part of the standard medical checkups. The existence of conditions involving a high accident risk should be examined in the talk with the doctor, so that targeted action can be taken. Examples of circumstances involving a high accident risk are: baby-changing tables without high edges, unsecured cots, unstable high-chairs, baby-walkers, missing safety devices on stairs, balconies and windows, freely accessible power sockets.

To avoid burns and poisoning, it should be ensured that appliances like electric ovens and irons are inaccessible to children. The same applies to matches and cigarette lighters. Parents should take particular care when handling hot liquids. Toxic substances and medicines should not be kept within reach of babies and toddlers.

To avoid drowning accidents, babies and toddlers should be kept under close supervision in hazard areas (garden ponds, streams, rivers. etc.). If constant supervision is impossible, it must be ensured that intact life-jackets are worn or that the pond is covered. Swimming lessons should be offered for children over the age of 4 to avoid fatal drowning accidents.

As a British intervention study was able to demonstrate that targeted house calls by district nurses (health visitors) significantly increased the implementation of accident prevention measures, thought should also be given to carrying out corresponding house calls in Germany, at least to risk families. This prevention measure has already been successfully practised in Sweden for quite some time. In Germany, good experience has been gained with the outreach services of individual public health offices. In addition, social workers in youth welfare offices, for example, could assume an

additional task of this kind in the framework of their child and youth welfare work (Ehiri 1995). Another British study indicated that advice provided by a doctor, particularly if coupled with access to government-subsidised safety equipment (cupboard locks, safety guards for power sockets, smoke detectors, etc.), improves the safety behaviour of socially disadvantaged families (Clamp and Kendrick 1998).

As injuries caused by toys and play equipment are common in this age group, manufacturers of toys and play equipment, as well as the operators of playgrounds, are obliged to take special care in the development and testing of their products, as well as in the installation, maintenance and repair of play equipment. Corresponding standards to DIN EN 1176-7 must be observed. Similarly, acceptable space dimensions also have to be taken into account (freedom of movement between equipment, cf. DIN 18034). Studies have revealed that the safety standards on playgrounds run by day-care facilities and schools are considerably higher than on playgrounds operated by municipal or private sponsors.

One focal point of medical advice in this sector is the movement behaviour of hyperactive children and of children whose mobility is restricted in a specific way (retarded movements due to lack of exercise, e.g. as a result of spending too much time watching television/playing computer games). This is effectively supported by the health-promoting exercise offered by gym and sports clubs. The "Sport for Health" seal of quality, awarded by the German Sports Federation in collaboration with the German Medical Association (Deutscher Sportbund 2000), is intended to ensure that an offer of this kind is available to everyone throughout Germany in the medium term.

The avoidance of bicycle accidents primarily requires road safety education measures at preschool age. This also includes wearing bicycle helmets and checking safety systems on the bicycle. Training in attentiveness, dexterity and appropriate movement behaviour also help improve road safety. Wearing helmets is also recommendable for other leisure-time risks, especially skiing.

A whole package of measures should be taken to reduce the number of injuries caused by dog bites. Incorrect handling of the animals and a lack of understanding for the reactions occurring when handling dogs indicate a lack of knowledge among dog-owners and children alike. Prevention measures must therefore include targeted education of dog-owners, as well as parents and children. There are now signs of the first legislative steps being taken at the Länder level.

A special challenge arises for both parents and children, especially in this age group, as regards the avoidance of experiences of sexual abuse. If appropriate, this risk should be pointed out to parents when talking to the doctor and their sense of responsibility for ensuring the well-being of the child should be strengthened (e.g. in the case of "latchkey children" whose parents both work and in case of limited supervision by single mothers). However, children themselves can also be prepared to meet the risk of sexual abuse by being taught how to recognise potentially dangerous situations. This presupposes not only sex education, but also children's ability to express their own feelings and wishes and to assert themselves. In this context, the focus is not on rigidly communicating stereotypical "good" and "bad" behavioural patterns, but on strengthening the child's ability to act independently. The Child Assault Prevention Project launched in the USA in 1978 provides a comprehensive approach for the prevention of child abuse and sexual abuse by means of school-based and municipal prevention measures.

It is not uncommon for doctors to witness actual child abuse or the suspicion of child abuse by parents. This puts them in a difficult conflict of roles. The available offers of training and counselling should be intensified to counteract the risk of them reacting inappropriately in such cases (ways of handling parents, initiation of the reporting procedure, etc.). In this context, doctors have the possibility of cooperating with youth welfare offices and criminal prosecution authorities in order to be able to react competently in the event of suspected child abuse. The curriculum of the German Medical Association entitled "The Problem of the Abuse of Minors from the Medical Standpoint – Diagnosis and Intervention Options" (Bundesärztekammer 1998 b) and the guidelines issued by many Länder medical associations offer a comprehensive concept for action. A number of big cities in North Rhine-Westphalia additionally have medical counselling centres for cases of child abuse and sexual abuse.

Schoolchildren, young people

Measures aimed at preventing road traffic accidents continue to be of the greatest importance in this age group. As far as these relate to structural measures, such as the securing of school routes, the creation of speed-restricted zones, the provision of crossing aids or the favourable timing of traffic lights, an in-depth analysis of accident black-spots is a primary prerequisite. As it has been found that police statistics underestimate the actual frequency of accidents on school routes by roughly 50 to 80%, additional methods are needed for determining the hazard potential for children on the way to and from school. Various studies have shown that the method of questioning schoolchildren about subjectively experienced dangers yields valid results, as independent traffic conflict observations have indicated a high degree of correspondence.

The subject matter of advice provided by doctors on avoiding accidents on the way to and from school particularly focuses on informing parents about cognitive, motivational and motor developments of children and their impact on participation in road traffic and thus on the accident risk.

In line with what was said in Section 2.1, particularly intensive advice should be given to schoolchildren from socially disadvantaged families. The focus in this context is on training the children to be attentive, as well as educating the parents regarding the effect of domestic worries on attention deficits in children. Here, there are time-proven programmes for the field of school and road traffic in collaboration between doctors and teachers or the German Road Safety Council (Ärzttekammer Nordrhein 1997; Bundesärztekammer et al. 1999).

Sport accidents (apparatus, types of sport, leisure accidents)

The predisposed age for sport accidents (11 to 13 years) coincides with the time of puberty. Hormonal changes lead to psychological instability and marked shifts in proportions with disturbed motor coordination. Conceit, concentration deficits and reduced coordination skills as a result of overtiring are the main reasons for the high accident rate in this stage of development. Consequently, forms of competition specific to given types of sport should be avoided until a homogeneous level of skill has been reached.

Up to now, safety aspects have mainly been addressed in connection with one-man sports, while team games have not been given adequate consideration. Deficits in handling sports equipment (especially balls) could be compensated for even at primary school by intensive training of coordinative abilities. Rule changes in line with the requirements of school sport, such as adaptation of the number of players to the size of the field in order to avoid collisions and falls (head injuries!), as well as methodological and organisational measures for improving the clarity of game situations, should be given greater attention in lesson planning. The excessive efforts of individuals to perform well, and the associated aggression, should give way to cooperative forms of action and socially competent behaviour.

While these measures are beyond the sphere of medical control, doctors whose patients have sport injuries from school that could have been avoided by taking appropriate action should contact the teachers. The exchange of information between doctors and teachers should also be improved in relation to exemption from physical education. In this context, it should be established what the injured pupils can reasonably be expected to do and how they can be reintegrated into physical education lessons, possibly based on adapted performance requirements.

Another preventive measure on the part of doctors relates to vaccination at school age (e.g. against tetanus). In view of documented "vaccination-weariness", and particularly also in view of a social gradient in the field of child vaccination, the school is an appropriate location (e.g. via the child and youth medical service of the public health service) for ensuring that as many children as possible are vaccinated. Similarly, every doctor-patient contact in the GP's surgery should be taken as an occasion for checking the vaccination status.

Sexual violence against girls and young women

Groups that are the preferred victims of sexual violence, i.e. girls and women, not only need to learn concrete self-defence techniques, but must also be given self-confidence. This can start with good physical training of girls in physical education in school, where they can experience that they are a match for the boys and not helpless in the event of an attack. The psychological barriers present in girls as regards launching a physical attack for the purpose of self-defence should be eliminated and they should be taught that they do not have to unconditionally give in to the demands of others (Schwind et al. 1990).

Persons of reference who can help girls in preventing experiences of this kind, and also in coping with them, are mothers, as well as teachers and doctors.

Acts of aggression

As in the case of girls and young women, who may become victims of action of sexual violence, the reference groups of parents, teachers and doctors are also important in relation to the risk of "violence". In this context, however, the main aim is to recognise and prevent crimes of violence in which young people, especially boys, are the perpetrators. A number of risk factors associated with a tendency towards aggressive behaviour are known from delinquency research. The most important of these is the hyperkinetic syndrome (ADHD – attention-deficit hyperactivity syndrome), which, for its part, is favoured by influences in early childhood and genetic influences. In detecting early manifestations of ADHD, and in its treatment using methods of behavioural medicine and possibly also pharmacotherapy, doctors are involved in a central role in the related prevention activities. The period between the ages of 14 and 16 must be given special attention in children with ADHD symptoms, as there is not only an increased likelihood of acts of violence being committed during this period under the influence of alcohol and illegal drugs, but also an intensification of the existing tendency due to social group processes (juvenile gangs). As acts of aggression among young people display a social gradient and occur particularly often in multiply disadvantaged social groups, family and population-related measures (district social work, house call programmes) are

urgently necessary. This opens up an important field of activity for the child and youth medical service in public health offices.

Although primary prevention is the main task, effective and efficient secondary prevention in the post-delinquent phase is likewise of great significance. Doctors and psychologists can provide important assistance in the form of parental training and the teaching of cognitive problem-solving strategies. The elements of programmes of this kind include, for example, the changing of antisocial feelings and views, the strengthening of family ties, the encouragement and monitoring of communication and the development of self-control and self-management.

However, measures of this kind cannot remain in isolation, but need to be consolidated in the day-to-day social context of the school. Consequently, it is not surprising that various school intervention campaigns to prevent the recurrence of violent behaviour by means of prosocial action programmes have been able to achieve substantial success (Krug et al. 1997).

The above informational measures for preventing accidents and injuries involving children have made it clear that numerous starting points, groups of persons and levels of action are involved in efforts of this kind. Although doctors play an important role in this process because of their specific skills and responsibility, the relatively greatest impact comes from structural measures. It should be noted in this context that Germany does not have a general, national accident prevention programme. The Federal Working Group on Child Safety, in which more than 30 nationwide organisations have joined forces, is a pleasing first step in this direction. However, there is still a substantial need for coordination and action which, as illustrated by the examples from Sweden and the Netherlands, is best met in the form of a central institution (see Ellsäcker and Berfenstam 1998). Its task would be to deal not with individual risks, but rather with "age-specific risk patterns, geared to the world and action radius of the child" (Ellsäcker and Berfenstam 1998, p. 192). Accordingly, the creation of a safe environment for children is to be aimed at by way of laws, regulations, control measures, education and training programmes and the transfer of information by the mass media. Equally important is decentralised activity in the Länder, towns and municipalities. One successful concept in this context is the establishment of regional working groups for child safety (Bundesarbeitsgemeinschaft Kindersicherheit 2000).

The above discussion makes it clear that this can only be done successfully if an improved, uniformly designed information basis is created at the same time.

3 Early and middle adulthood

3.1 Epidemiological analysis

3.1.1 Road traffic accidents

Most of the 528,000 road traffic accidents involving personal injury reported each year are caused by road users in early and middle adulthood. Disregarding the risk group of older road users over the age of 65, although it is a significant group, the age group of 18 to 24 year-olds proves to be at especially high risk. As already mentioned in the introduction, the risk of dying in a traffic accident is almost three times higher in this age group than that of all the other age groups. Figure 3.1 shows that not only the risk of being killed, but also the risk of being injured, is generally much higher in this age group and, in turn, more so for men than for women. Analyses of the causes of road traffic accidents indicate that high speed, loss of control of the vehicle and the influence of alcohol play a significant role. Most of the accident victims under the influence of alcohol in Germany were relatively young: while 24% were between 18 and 25 years, 26% belonged to the age group of 25 to 34 year-olds. The recorded influence of alcohol declined with increasing age in the over-45s. Women were far less frequently involved in accidents under the influence of alcohol than men. While, on the average for all accidents causing personal injury, 31% of the persons involved were women, they accounted for only 9.5% of the persons involved in accidents under the influence of alcohol. Other findings of importance for prevention as regards the causing of accidents under the influence of alcohol relate to the time and place of the accident. Most alcohol-induced accidents occurred at the weekend, mainly Saturday and Sunday, between 6 o'clock in the evening and 4 o'clock in the morning. Alcohol played a role in 39% of all accidents between midnight and 4 o'clock in the morning. In contrast, alcohol-related accidents were substantially underrepresented in the period from 6 in the morning to 6 in the evening: while 70% of all accidents involving personal injury occurred during this period, the share of alcohol-related accidents was 28%. 60% of these accidents occurred in built-up areas, predominantly in the form of so-called driving accidents, i.e. accidents resulting from the driver losing control of the vehicle without any involvement of other road users. There are specific starting points for prevention here (see 3.2.1, below).

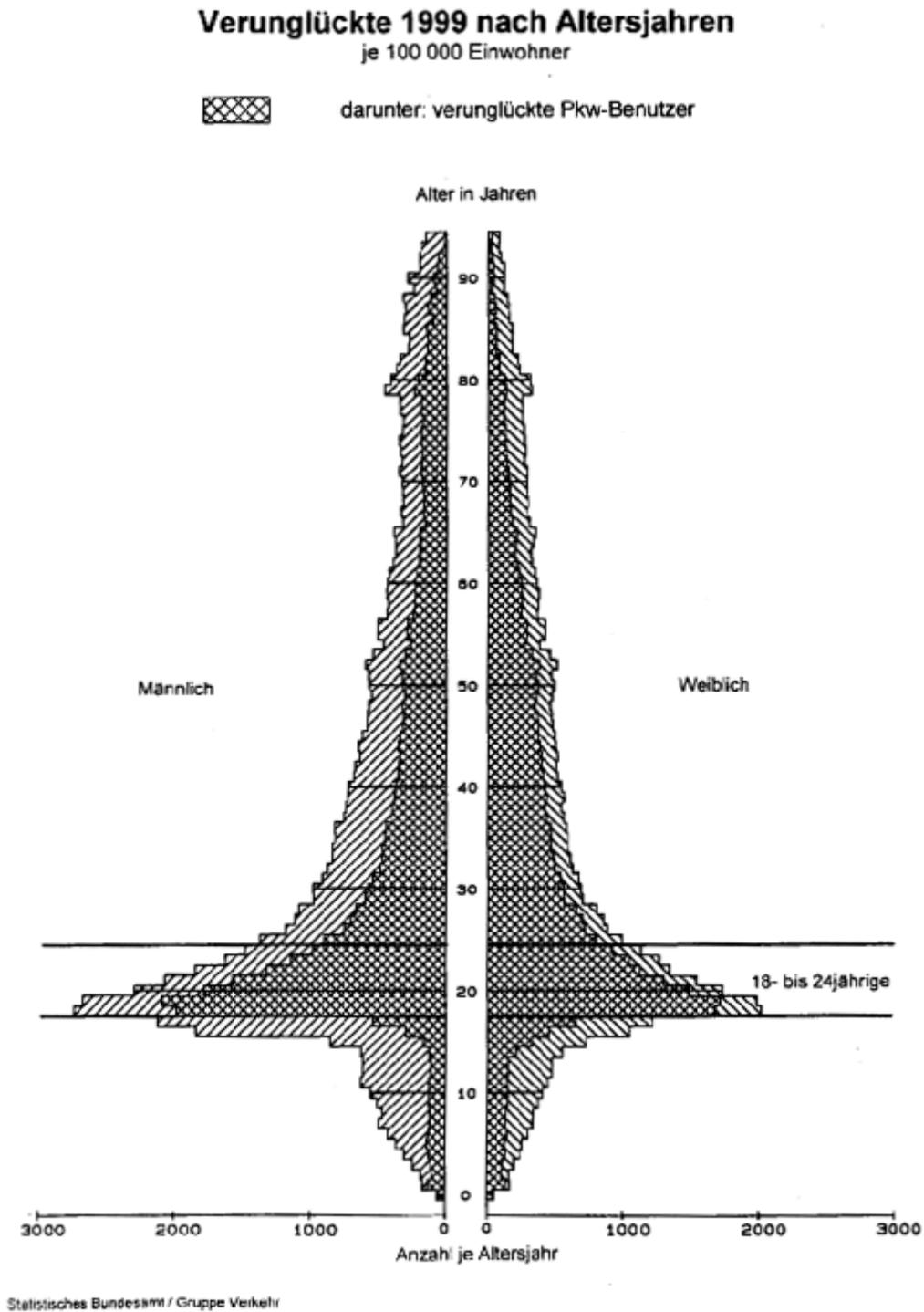


Fig. 3.1 (Source: Federal Statistical Office, 2000)

3.1.2 Sport accidents

It can be seen from the data of the Federal Health Survey that only 18% of all accidents occur on the roads, as opposed to 23% in sports, 24% at work and 28% in the home and domestic environment. Special consideration will be given to sport and work-related accidents below, as these two types of injury are of primary importance, especially in middle adulthood. An age and sex gradient is evident with regard to sport injuries, much as in relation to accidents as a whole: sport injuries

become less significant with increasing age and sport-related accidents are quantitatively more important among men than among women, especially in the group of under 30 year-olds. There are currently no data in Germany regarding the connection between sport accidents and social status. However, a Canadian study concerning the socio-economic distribution of sport injuries indicated that members of the middle class engage in sporting activities more frequently and more persistently, a fact which the authors attribute to socialised ethics of sport, self-discipline and health (McCutcheon et al. 1997). Accordingly, they tend to have a higher risk of injury. Interestingly enough, the study showed that young men chose more dangerous sports than women and took less time out after being injured. Gender role-specific behavioural patterns would appear to influence the accident risk here (see 3.2.1, below). Among the sports resulting in injuries, football is the most common (26%), followed by downhill skiing (12%) and inline skating (9%). Therefore, these three types of accident will be examined in more detail below.

Football

Roughly 80% of all football accidents occurred during activities where a one-to-one duel was a primary element. In a survey, about 70% stated that the main cause of their injury was exaggerated fighting spirit or the behaviour in a duel in combination with failure to comply with sporting rules. In players aged between 22 and 35 years, who account for roughly 50% of all footballers, the knee region was most frequently affected (28%), followed by the ankle (23%). The consequence was a rupture in 56% of the knee injuries and 41% of the ankle injuries. Head and foot injuries played a subordinate role. Ruptures, or sprains as preliminary stages thereof, were recorded in 80% of the knee and ankle cases. A similar picture was found among the 35 to 50 year-olds, with an increasing dominance of knee injuries (26%) as opposed to ankle injuries (15%). Thus, the topographic classification of football-related sport injuries results in dominance of the lower limbs, typically distributed over the thigh, knee, lower leg, heel and foot. The age distribution reveals a concentration in the group of 20 to 25 year-old players; the sport injuries mainly occur in competition situations, whereas they are relatively rare in training.

Skiing

Every year, some 70,000 to 75,000 Germans injure themselves so severely when skiing that they require medical treatment. About 12,000 of these injured skiers even have to spend several days in hospital. More than 1,000 skiers suffer permanent damage to health as a result of their skiing accident and about 25 skiers a year suffer fatal injuries.

Injuries in the knee region are the most common – almost 40% of all serious injuries involve this part of the body. Female skiers over the age of 35 are at particular risk in this context, with these injuries reaching a share of more than 50% in this age group. Shoulder and upper-arm injuries take second place in terms of incidence. Male skiers over the age of 40 lead the field here, injuring themselves in this area of the body three times more often than other skiers. "Skier's thumb" – strain, torn ligament or fracture of the proximal thumb joint – is likewise an injury commonly encountered in alpine skiing. Although it is not generally to be regarded as a serious injury, it can occasionally require surgery or lead to impaired mobility.

Inline skating

Inline skating is currently the most rapidly growing leisure sport. In the USA, the number of inline skaters has increased by 500% since 1989 and has caught up with other sports, such as baseball, American football and football. The number of inline skaters was said to be more than 24 million in 1996. Inline skates have only become widely popular in Germany in the last few years. However, there were already 3.5 million inline skaters in Germany in 1996 and the figure for the year 2000 was estimated at 7 million. This great popularity has, however, also resulted in a rapid increase in the number of injuries due to sport equipment, ranging from minor bruising and grazes all the way to serious joint and bone injuries. Inline skating has now become a significant cost factor for the health system. In the USA, expenditure on the treatment of injuries and the costs incurred for court cases amounted to almost 2 billion dollars in 1995. For instance, the number of inline skaters injured in the USA in 1995 was already estimated at 83,000. In a study conducted in the USA, 626 out of 1,036 respondents stated that they had already been injured on some occasion. This is equal to a 60% injury rate. Of the fractures reported, 78% involved the upper limbs (finger 33%, wrist 25%, forearm 14%, elbow 5%), 5% the head and 14% the knee. 16% stated that they did not wear protective clothing. Knee protectors were most commonly used (66%), followed by wrist protectors (49%), helmets (42%) and elbow protectors (31%). Only 17% wore a complete set of protective clothes – wrist, knee and elbow guards, helmet.

In summary, it can be said that skating on eight rollers may well be healthy, but it is also dangerous. The frequency of injuries is relatively high owing to the comparatively high speeds involved – between 20 and 30 km/h, although up to 50 km/h is possible – and the lack of fundamental knowledge and basic techniques. The upper limbs are at particularly high risk. Studies available to date are unanimous in the view that the willingness to take passive precautionary measures still leaves a great deal to be desired. In the event of falls or collisions with other road users, it is primarily the osseous structures in the wrist region that are at risk. A major potential for injuries lies in the fact

that many inline skaters have no mastery of fundamental knowledge and basic techniques and also fail to wear protectors.

Finally, as regards the completeness and comparability of data on sport accidents, it should be stated that different incidences and recording methods can not least be attributed to corresponding differences in the sport-specific insurance cover.

3.1.3 Work accidents

There has been a steady decline in the rate of notifiable work-related accidents over the last 40 years. Less than 40 work accidents per 1,000 full-time employees were reported in 1998, where as the figure was still as high as 52/1,000 full-time employees in 1990 and more than three times as many in 1960. This downward trend – there is even talk of an all-time low in terms of work accidents and the contributions to the employers' liability insurance associations – should not, however, be allowed to disguise the fact that 1.2 million notifiable work accidents (i.e. accidents resulting in inability to work for more than 3 days) were still recorded in 1998. Employers incurred costs in the region of DM 1.5 and 3.6 billion as a result. Of these 1.2 million work accidents, 25,500 led to new accident pensions, this entailing additional, long-term pension payments of DM 4 to 5 billion. Consequently, it is necessary not only for humanitarian reasons, but also from the economic point of view and particularly in order to relieve the burden on the social insurance systems, "to maintain efforts to achieve effective prevention as a whole and to strengthen them in specific areas" (Coenen 1999, p. 3).

The main types of notifiable work accidents most importantly include accidents when handling machinery and tools, whereas falls are dominant as regards work accidents resulting in new pension claims. Most notifiable accidents in 1998 occurred in the building industry with 97/1,000 full-time employees and the wood trade with 84/1,000 full-time workers. The lowest numbers were recorded in the health service with 16/1,000, followed by precision mechanics and electrical engineering with 22/1,000 and commerce, administration and the chemical industry, each with 23 accidents/1,000 full-time employees. The average across all industrial employers' liability insurance associations in 1998 was 39 work accidents/1,000 full-time employees (see Fig. 3.2).

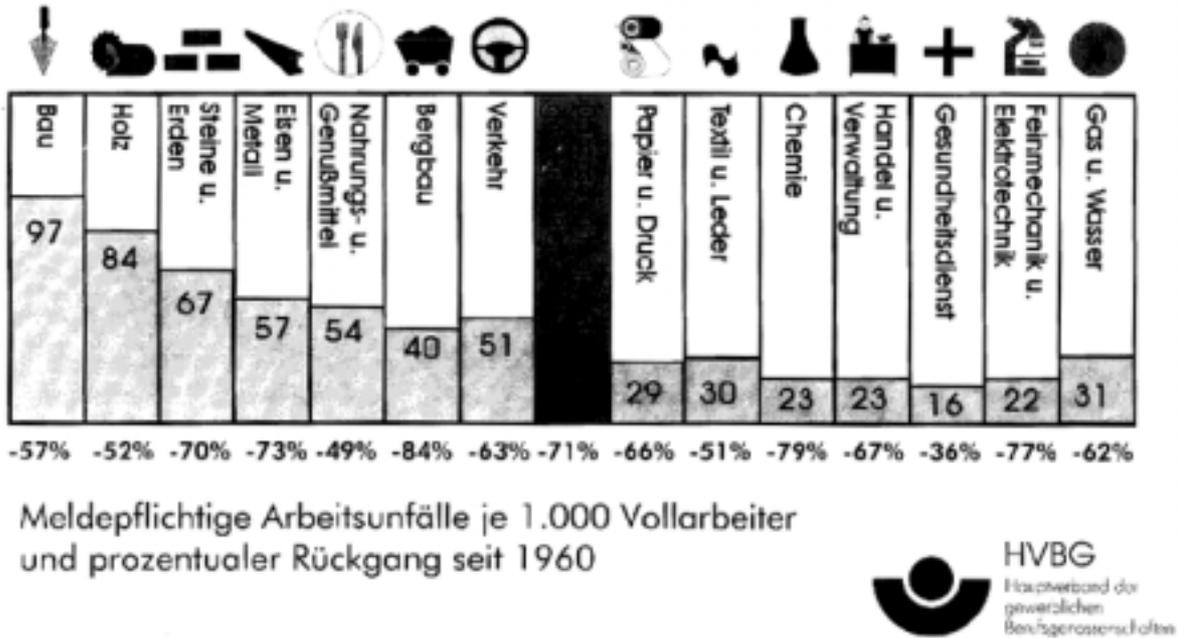


Fig. 3.2 (Source: Hauptverband der gewerblichen Berufsgenossenschaften)

If the companies are divided into four size-based categories (1 to 19, 20 to 199, 200 to 999 and $\geq 1,000$ full-time employees), it can be seen that more than one-third of the notifiable work accidents are reported by companies in the medium size class with 20 to 199 full-time employees. In contrast, serious (and also fatal) work accidents occur most frequently in small businesses with up to 19 full-time employees. This is because accidents of this kind are recorded at an above-average rate in the building trade, which is dominated by small enterprises. Generally speaking, it can be said that, as the size of the companies increases, the proportion of clerical areas increases in relation to the manufacturing areas. The risk potential is lower in clerical areas than in manufacturing areas, meaning that it declines as the size of the company increases (BGZ-Report 1999).

In 1997, the insureds involved in roughly one-third of all notifiable work accidents were under the age of 30 at the time of the accident, whereas this age group accounts for only half as many of the serious accidents. Thus work accidents in the age group of under 30 year-olds are mainly of a minor nature. The trend is reversed in the group of 40 to 59 year-olds. Half of the new accident pensions were attributable to this age group, while they accounted for only about one-third of the total number of notifiable work accidents. The accidents suffered by 40 to 59 year-olds have relatively serious consequences. It may be important in this context that the medical rehabilitation process is less successful in older injured persons. Of the work accidents with a fatal outcome, 14% involve persons under the age of 30, as opposed to 50% in the age group of 40 to 59 year-olds.

Compared to their male colleagues, women were involved in 16.3% of accidents at work in 1997, accounting for 14.5% of the accidents leading to new accident pensions and 4.4% of the fatal accidents. This imbalance is, of course, due to the fact that the sectors with a higher risk of serious accidents are dominated by men, e.g. the building trade, forestry, the minerals industry, mining, transport, etc. (BGZ-Report 1999).

3.1.4 Injuries due to violence

Only a small proportion of the acts of violence experienced by the adult population finds its way into official statistics. There is a particularly high percentage of unreported cases in this quarter. It can be seen from the 1998 Federal Health Survey that 3 respondents in 1,000 have suffered injuries as a result of physical attack, a fight or maltreatment. A recently published study conducted among patients calling on their general practitioner in Great Britain revealed that the main reason for consulting the doctor in 5.4% of the cases was the experience of violence and its physical and psychological consequences (Gulbrandsen et al. 1997).

If the 1999 Police Crime Statistics of the Federal Office of Criminal Investigation are examined, the following statements can be made, although figures relating to absolute incidences have been disregarded in view of the high percentage of unreported crimes that exists. In terms of the *victims*, there are pronounced gender and age-specific differences. Most of the victims were men in cases of robbery (67.3%), bodily harm (66.1%), murder and manslaughter (65.4%), while women were affected extremely often by crimes against sexual self-determination (91.6%). Adult victims between the ages of 21 and 60 predominated among homicide offences (74.1%) and bodily harm (61.3%). People over the age of 60 were relatively seldom recorded as victims, except in connection with murder and manslaughter (9.4%) and robbery (12.0%).

The different degrees to which the individual age groups and genders are at risk becomes apparent when the numbers of victims are referred to the population figures (per 100,000 residents of the respective age group and gender). It can be seen that the risk of the male population is far higher than that of women, except in relation to sex crimes.

The above-mentioned differences according to gender and age also exist as regards the *perpetrators* or suspects. For example, more than half the suspects in crimes of robbery and compound larceny are under the age of 21. The gender ratio (men vs. women) is 3:1 for robbery, 2:1 for grievous bodily harm and 2.2:1 for crimes against personal liberty. On the other hand, crimes of fraud are committed more frequently by women, while there is no difference between the sexes when it comes to misappropriation and embezzlement. However, when considering any of these figures, it must al-

ways be borne in mind that varying percentages of unreported cases may lead to distorted estimates regarding the genders and age groups.

There are no confirmed, representative data in Germany concerning a social gradient in relation to the frequency of injury as a result of violence. It can, however, be assumed that the extensive findings available from other Western industrial nations also apply to Germany. Factors of importance for the higher risk in lower social classes include the greater susceptibility to conflict in conditions of relative and absolute social disadvantage, as well as the class-specifically varying ability to handle impulses to act aggressively. Various US studies have shown that people in neighbourhoods with low family incomes, high poverty levels, low education standards and confined living conditions run a significantly higher risk of being murdered. Single-mother households are a special risk group in this respect (Cubbin et al. 2000).

Particularly in big cities, it can be seen that weakening of social capital, i.e. the availability of community facilities and the dependability of neighbourly relations and contacts in the public sphere, is accompanied by an increase in the homicide rate, as well as the suicide rate (Kawachi and Berkman 2000). The collapse of community functions in combination with social disorganisation – often measured in terms of family structure and residential stability – increases a person's risk of being exposed to injury. Accordingly, social inequality affects not only people, but also places, meaning that injury prevention should consider not only the socio-economic background of individual people, but also the places where they live (Kaplan 1999; Siegrist 2000).

3.2 Preventive measures

3.2.1 Road traffic accidents

The most important consequence for preventive action that results from the data given above relates to modifying the behaviour of predominantly male road users in early adulthood. One objective of behavioural modification is to *reduce the exaggerated feelings of power and dominance in drivers*, as expressed in excessive speed. These exaggerated feelings of power and dominance are often also the expression of a traditional male gender role acquired in the process of socialisation, where such attributes as bravery, willingness to take risks, self-assertion and aggressiveness are one-sidedly emphasised. In this context, changes in attitudes and behaviour require specific skills in behavioural medicine and therapy on the part of medical and non-medical therapists. Primary prevention will probably be especially difficult here, as risk groups are hard to identify before accidents occur. However, there is an important field of diagnostic and interventional activity in secondary prevention after accidents have happened. The same applies to a second goal of behaviour modification in

accident-prone risk groups in early adulthood, i.e. the *reduction of alcohol consumption in road users*.

Various randomised, controlled intervention studies have demonstrated an effect, albeit limited, on accident prevention of brief and early interventions in people with alcohol problems (Persson et al. 1989; Bien et al. 1993; Gentilello et al. 1999). However, behaviour-related prevention measures again need to be supplemented by *situation-related prevention measures* in this case (e.g. an increase in the legal age for drinking alcohol). The importance of the latter is illustrated by a recently published study (Holder et al. 2000), which showed that, compared to three control districts without intervention, a comprehensive, coordinated, municipal prevention programme conducted in three US districts led to a 10% drop in the number of night-time traffic accidents and a 43% decline in the number of injuries due to violence. The main intervention measures consisted in stricter control of the sale of alcohol to road users, an increase in the legal age for drinking alcohol, more police road checks and intensified education work.

3.2.2 Sport injuries

Football

The above-mentioned exaggerated competitive attitude and latent aggressiveness that are of great significance in connection with traffic accidents caused by excessive speed and risky overtaking manoeuvres also play an important role in the case of football injuries caused by frontal collisions. Admittedly, it is very difficult to find a balance between the competitive and performance-oriented nature of the game of football, on the one hand, and a playing style based on caution and cooperation, on the other. Nevertheless, there are psychological and behavioural approaches here in relation both to training work and, to some extent, to giving medical advice during rehabilitation following sport injuries.

In the stricter sense of sports medicine, a training programme designed to stabilise the ankles and knees would primarily be indicated in the group of 22 to 35 year-olds, in whom ruptures of the ankle and sprains are particularly common. In older football players, additional attention should be paid to avoiding irritation and possibly ruptures of the Achilles tendon by way of regular warm-up and stretching phases.

Skiing and snowboarding

When giving medical advice to patients whose regular pastimes include skiing or snowboarding, there are different preventive aspects to be taken into account, depending on age. In young people, the emphasis is on the risk of injury arising from a risky style or risky manoeuvres. In middle

adulthood, attention must especially be drawn to the particular importance of preparatory training (ski gymnastics: in courses, on television or video), as well as the prevention of overstrain or exaggerated assessment of personal skills in sporting activities in the snow. Naturally, this also applies to older skiers, where additional attention needs to be paid to the restricted performance of the sensory organs, attentiveness, mobility, etc. Accident prevention in all age groups includes careful checking of the equipment, including the bindings, and suitable ski boots.

Inline skating

Protectors are the most important part of an inline skater's equipment. Only they can prevent injuries following dangerous falls on hard asphalt. Advice regarding this sport should therefore always include an attempt to increase the willingness to wear protective equipment. Protective clothing includes wrist, elbow and knee protectors. However, these cannot entirely rule out injury. Therefore, skaters should be trained in techniques that additionally minimise the risk of injury (basic techniques of skating, braking and also falling). The protective equipment should also include a helmet, as falls can also result in serious head injuries.

These few, exemplary pointers make it clear that medical action geared to the prevention of accidents and injuries by way of targeted social history questioning opens up starting points for providing advice and possibly training. This also applies to the important field of injuries at work, which will be discussed below.

3.2.3 Work accidents

The prevention of health risks in the occupational field encompasses the prevention of work accidents, occupational illnesses and accidents on the way to and from work, as well as the prevention of all work-related risks that can lead to insurance claims, also beyond the sphere of accident insurance. The *dual system of industrial safety* has existed in Germany for over 100 years, i.e. the *state* and the *accident insurers* each contribute to prevention by performing duties legitimated by law. Doctors with qualifications in industrial and occupational medicine play a key role in their implementation. The instruments of prevention essentially include legislation and regulations, the qualification of industrial safety experts, the advising and monitoring of companies, information and training, industrial safety research and statistical evaluation. Strengthening the personal responsibility motivation and qualification of the responsible persons (company industrial safety officers) is of special importance, taking into account the conditions and possibilities at the respective location. In future, the challenge for companies and industrial safety will increasingly be to ensure that preven-

tion reacts to innovations in the field of technology and the organisation and structures of work (Coenen 1999).

When assessing risks, indications for an (industrial safety) measure to be taken can be obtained on the basis of a checklist that makes it possible to determine all the relevant hazards to life and health at work and to optimise the use of resources by means of risk-oriented priorities:

Hazards to life and health at work – Hazard categories

- Mechanical hazards
- Electrical hazards
- Chemical hazards
- Biological hazards
- Fire and explosion hazards
- Thermal hazards
- Physical hazards
- Hazards from the work environment/multiple burdens
- Physical strains/heavy work
- Stress resulting from perception and handling of situations
- Psychomental and socioemotional strains (e.g. work content, workflow, information and qualification deficits, interpersonal conflicts)
- Hazards caused by organisational, information and management deficits

The core element of industrial medicine is the identification and assessment of physical and chemical noxae or stressors. Extensive scientific findings regarding pollutant concentrations and their biological effects form the basis for the establishment and practical monitoring of noxae or limits for pollutant exposure at the workplace. Industrial medicine and ergonomic studies also provide indispensable starting points for accident prevention at the workplace.

In contrast, neither industrial medicine, nor the medical community in private or hospital practice has so far paid due attention to the field of psychomental work stresses and their impact in terms of reduced well-being and an increased risk of injury and illness. There is a growing number of jobs in areas that are characterised more by psychosocial stresses than by conventional types of workplace risk. A few of the keywords to be mentioned in this context are information overload (e.g. computer work), customer contact in personal service occupations, higher workload due to rationalisation, limited opportunities for qualification and promotion, as well as job insecurity as a result of technological change, economic concentration or international mobility.

Over the past 20 years, great progress has been made in the scientific analysis of connections between chronic stress resulting from these burdening factors and threats to health. In particular, success has been achieved in using theoretical models to more accurately identify psychomental and socioemotional stress configurations and to quantify the associated health risks on the basis of prospective epidemiological studies (cf. Schnall et al. 2000; Siegrist 1996). While there is evidence of exposure to psychosocial stressors in working life leading to an elevated relative risk of cardiovascular disease, depressive disorders, backache, gastro-intestinal disease and a greater tendency towards addiction (cigarette and alcohol consumption), we currently do not yet have sufficient information regarding the direct impact of occupational stress on workplace accidents (or road traffic accidents), except in the case of the overtiring or exhaustion syndrome in accidents, e.g. as a result of driving for too long in transport occupations. Going by what has been said, it is perfectly conceivable that stress-induced cognitive and affective activation states lead to restricted vigilance and reduced perceptive capacity, these in turn increasing the accident risk.

Giving consideration to these relationships in scientific research and, based thereon, in the diagnosis of potentially threatened occupational groups and corresponding prevention measures is an important task of industrial medicine, occupational health promotion and the advising of exposed groups of working patients in talks with doctors.

However, it is again the case here that doctors in private practice find it easier to identify the risk potential of groups and individuals at risk and advise them in the framework of secondary prevention, after a work accident has happened. In this context, doctors should pay special attention to the influence of alcohol on fall-related injuries at work (targeted recording of the case history!). The medical counselling talk and the social history on which it is based should be optimised by means of suitable offers of advanced and continuing training.

However, as in the road traffic sector, the greatest preventive effect in the occupational sector will probably originate from structural measures. In addition to the industrial safety and working time regulations referred to previously, mention should also be made here of restrictions on the availability of alcohol at the workplace and during working hours.

3.2.4 Injuries due to violence

Doctors in private practice play only a limited role in the primary prevention of violence in adulthood. There can be no doubt that the main contributions in this context have to be made by the authorities responsible for public safety and occupational groups involved in social work. Cooperation between doctors with a commitment to health policy and social workers, e.g. in community work or

the care of groups at particularly high social risk, is certainly desirable, but exceeds the scope and capacity of a doctor working in individual medicine.

In contrast, the provision of medical information and counselling regarding the prevention of recurrences, both for the perpetrators and the victims of acts of violence, is of particular importance in every instance where the doctor has corresponding information at his disposal. In this respect, the doctor's psychosocial and anamnestic skills must be systematically optimised, as well as his ability to achieve a promising resolution of conflicts in a talk, as already explained in connection with secondary prevention measures for work-related accidents and hazards (improved offers of advanced and continuing medical training). The great difficulty and subtlety of this subject is illustrated, for example, by a Norwegian study, in which it was demonstrated that only one in five victims of acts of violence informed the general practitioner of the fact, whereas experiences having more the nature of a conflict, which are less stigmatised or produce less strong feelings of shame, were reported in every second case (Gulbrandsen et al. 1997).

4 Old age

4.1 Epidemiological analysis

4.1.1 Road traffic accidents

As mentioned in the introduction, the police recorded more than 2.4 million road traffic accidents in 1999, just under 17% of which resulted in personal injury. Car drivers were the most important group in this context (68%). Pedestrians were involved in 6% of accidents causing personal injury and cyclists in just under 10%.

Relatively young people between the ages of 18 and 24 and road users over the age of 65 are particularly at risk of being involved in accidents, elderly people especially as pedestrians and cyclists. Of the pedestrians and cyclists killed on the roads in 1995, 41% and 37%, respectively, were over 65; the 1999 figures were 43% and just under 39%. In contrast to younger people, in whom the majority of fatal accidents occur outside built-up areas, (1996 ratio 2:1), many elderly people are killed in built-up areas (1996 ratio 0.9:1).

In terms of being to blame for accidents, people aged 75 years and older constitute a relevant risk group among older pedestrians, and much more noticeably so among older cyclists. It has been pointed out that the reason for this trend is essentially the demographic change in the population structure. Senior citizens account for a growing percentage of car owners and their mobility is also increasing. These developments make it appear likely that the share of road traffic accidents caused by older people will continue to increase in the future, even though the personal risk of being the main cause of an accident is lower among elderly individuals than in other age groups. Compared to other age groups, elderly car drivers are less noted for incorrect behaviour due to alcohol or inappropriate speed. In contrast, they are represented particularly often among cases of non-alcohol-induced restriction of fitness to drive, failure to give way and risky turning manoeuvres and U-turns. Mistakes when parking and reversing, as well as incorrect behaviour in relation to pedestrians at pedestrian crossings, are also important causes of accidents among elderly road users, all the more so as the car drivers get older (Emsbach and Friedel 1999).

The intake of information is reduced or impaired by restrictions in sensory functions, which are manifested with increasing age in the form of reduced visual acuity by day, impaired contrast vision, restricted night vision and increased sensitivity to glare, as well as by ophthalmic diseases (increasing prevalence of cataract, glaucoma, macular degeneration and diabetic retinopathy).

Kline et al. (1992) identified five dimensions that characterise the visual capacity of vehicle drivers, in particular: unexpected vehicles, vehicle speed, reading the instruments, problems of vision in connection with the windscreen and the recognition of road signs. In a sample of elderly persons, Owsley et al. (1991) found significant relationships between various parameters of eyesight and accident frequency.

Slower reactions in response to particularly complex demands, and also functional impairments, especially of mobility, can be mentioned as causes, as can the consequences of multiple illnesses. Relatively short green phases of traffic lights at pedestrian crossings can be critical for elderly people whose walking speed is restricted. Consequences of illness that are not immediately apparent include, for example, neuropsychological disorders of the kind that frequently result from cerebral accidents (Bodenburg et al. 2000).

Age-correlated cognitive restrictions (excluding dementia) can impair attentiveness, judgement and the ability to adapt rapidly to the prevailing traffic situation (Di Carlo et al. 2000). A study conducted in the USA reported that 30% of people suffering from Alzheimer-type dementia had at least one accident after the symptoms of their illness had been recognised (Lukas-Blaustein et al. 1988). A study in the United Kingdom determined that 21% of a study population of dementia patients were still driving a car even after an average period of 3.9 years with symptoms of the illness (Lilley et al. 1995). There can be no doubt that the subject of "dementia and driving" will become increasingly important as the percentage of the population over the age of 65 years rises.

Mention should also be made of the possibility of drugs having a negative impact on fitness to drive, although the available data regarding the frequency of the causal relationship with accidents are still very limited for a variety of reasons. The accident records kept by the police make no provision for "unfitness to drive due to drugs" as an accident cause. The average of the available estimates would indicate that roughly 25% of all accidents are partly attributable to drugs (Herberg 2000). However, investigators have also quite rightly pointed out that the accident risk without tranquillisers, for example, i.e. the risk due to the health disorder, might possibly have been even greater without appropriate medication (Skegg et al. 1979).

The probability of requiring some kind of medication, permanent treatment and, above all, multi-medication increases with age (v. Renteln-Kruse 2000; Kruse 1994).

The worldwide data available on medicines in this context were collected in a search initiated by the Dutch Ministries of Health and Transport. The results of this data collection make it possible for the first time to draw up concrete, differentiated assessments of individual substances in different

doses and, in some cases, at different times after intake and, based on this, also of usage groups (Wolschrijn et al. 1991). Based on these individual assessments and taking the customary different dosages into account., the Technical Inspection Agency (TÜV) in Cologne calculated the degree of threat to safety arising from various groups of drugs. Corresponding "total scores" for this threat were determined (Herberg 2000).

In 1999, people over the age of 65 years accounted for 16.8% of the deaths resulting from accidents involving means of transport (Statistisches Bundesamt 2000). Elderly people were most often killed as pedestrians, cyclists and in cars. Except in connection with car accidents, in which more men died than women, more women than men lost their lives in traffic accidents in old age.

The age-specific fatality rate due to injuries rises increases with age.

Elderly pedestrians more frequently suffer severe pelvic and upper-leg injuries as a result of head-on collisions with vehicle bumpers (Mackay 1988). The injuries also often involve the head and lower limbs. Complications, such as infections and phlebothromboses, play a major role in the elevated mortality of elderly accident victims (Bull 1982).

4.1.2 Home and leisure accidents (particularly falls)

What are known as home and leisure accidents head the list of causes of injuries and are generally about ten times more common than traffic accidents (Gesundheitsbericht für Deutschland 1998). One home and leisure accident in two is a fall. The ICD-10 classification defines a fall as a sudden, unintentional change in position causing an individual to land at a lower level, other than as a consequence of an overwhelming force, a loss of consciousness, the sudden onset of paralysis (e.g. stroke) or an epileptic seizure.

Referred to the total of 4.6 million accidents that happen every year, this means 2.21 million falls. Based on available survey data, people over 65 are calculated to suffer roughly 550,000 home and leisure accidents each year that require medical care or result in temporary disability (Henter 1995). Four types of injury are dominant: bruises (31.7%), fractures (26.7%), wounds (25.8%) and sprains (24.6%), followed by tendon/muscle injuries (11.1%) and concussion (4%). Tripping (falling on level ground) causes an above-average number of limb fractures (30%). Just over one-third of all falls result in permanent impairments.

Frequency and causes of falls:

The incidence of falls rises significantly in old age, especially over the age of 70. The available epidemiological data come mainly from Great Britain, Australia, the USA and Scandinavia. A distinction has to be made between people living at home and senior citizens accommodated in residential and nursing facilities.

The rate of falls of approximately 50 per 100 person years among people aged 70 to 74 living at home increases to more than twice this figure for the over-85s and even triples among people over the age of 90 (Blake et al. 1989). It can be assumed that roughly one-third of all people aged 65 or more fall at least once per year on average. In turn, a quarter of these people fall at least three times per year.

The incidence of falls among people over the age of 70 was studied in Oulu in northern Finland (Luukinen et al. 1995). The results indicate that the incidence of falls is two to three times higher among people living in institutions than among those living at home. On average, one nursing home resident in two suffers at least one fall per year.

In hospital, falls are among the most common complications or adverse events in addition to other occurrences, especially adverse drug reactions (v. Renteln-Kruse 2000).

Most domestic falls occur as a result of slipping or stumbling when walking on the flat. According to the result of a relatively recent study, women stumbled more often, while men were more inclined to slip. Men suffered relatively more falls during the winter months, whereas women fell more frequently in summer, this being attributable to men spending more time outdoors (Berg et al. 1997).

A low level of activity is no guard against falls: numerous falls occur when doing very ordinary things, where the body's centre of gravity gets only slightly out of balance. Less frequent among the elderly are falls resulting from risky manoeuvres, for instance when up a ladder or engaging in sporting activities. Most falls in elderly people are recorded at times of normal activity during the day. This also applies to falls among hospital patients and nursing home residents. The latter, however, also quite often suffer falls at night.

A common schematic classification distinguishes between falls with extrinsic and intrinsic causes. Intrinsic factors are based on the current and chronic state of health. Extrinsic factors means (physical) environmental factors in the broadest sense. There are also situative attributes, i.e. the activity performed before or at the time of the fall.

The great majority of falls are of multifactorial origin. It can be assumed that intrinsic factors become more significant with increasing age, the causes of falls becoming generally more complex in this context. Falls that are more extrinsically induced are more common among younger senior citizens (v. Renteln-Kruse 1998).

The knowledge of factors associated with falls in old age is very extensive and covers documented risk factors displaying a strong statistical correlation with falls in studies. The risk of suffering a fall shows a marked rise as the number of risk factors identified increases, much as with a dose-effect relationship (Tinetti et al. 1986, 1995).

Table 4.1 contains independent risk factors (relative risk > 1.0) and Table 4.2 lists reasons for falls that were extracted from 12 studies covering a total of 3,628 recorded falls.

Table 4.1: Intrinsic risk factors for falls in elderly people and statistical relevance (source: Newitt 1997)

Risk factor	Parameter	Statistical correlation
Demographic attributes	Age ≥ 85 years	Strong
	Female	Strong
General state of health, functional status	ADL*, restriction of movement	Strong
Gait, balance, performance	Clinical and functional tests	Strong
Muscular/neuromuscular	Reduced knee, hip or joint strength	Strong
Sensory system	Restricted visual acuity	Moderate
Cognition	Restrictions	Strong
Psychology.	Depression or anxiety	Moderate
Disease, symptom	Parkinson's disease	Strong
	Arthritis	Moderate
	Hemiplegia	Moderate
	Incontinence	Moderate

* Activities of daily living

Table 4.2: Reasons for falls in elderly people (source: Rubenstein and Josephson, 1997)

Cause	Mean (% falls)	Range (%)
Accident environment and situation	31	1 - 53
Gait/balance disorder or weakness	17	4 - 39
Dizziness	13	0 - 30
Drop attack	9	0 - 52
Confusion	5	0 - 14
Postural hypotension	3	0 - 24
Visual disorder	2	0 - 5
Syncope	0.3	0 - 3
Other causes*	15	2 - 39
Unknown	5	0 - 21

* Arthritis, acute illness, medication, alcohol, pain, epilepsy, fall out of bed

The intake of drugs can increase the risk of falls in elderly people (v. Renteln-Kruse et al. 1998; Nikolaus et al. 1999; Schäufele and Weyerer 1999). Causally possible drug reactions mainly relate to central-nervous/neuromuscular and hypotensive effects. One particularly consistent study finding is that multiple prescriptions are associated with a higher risk of falling. There is evidence that the relationships found in connection with the intake of psychotropic drugs, in particular, are also dose-dependent (v. Renteln-Kruse 1997). As multiple causes of falls likewise become more common with an increasing degree of comorbidity and disability, it is often difficult to establish a causal relationship with the medication. A meta-analysis came to the conclusion that there is a positive correlation between the intake of psychotropic medication and falls in people over the age of 60 (Leipzig et al. 1999). The analysis was based on a total of 40 non-randomised, controlled studies, in which, however, confounding factors, such as dose and duration of treatment, were seldom controlled.

A meta-analysis of 29 non-randomised, non-controlled studies on the fall risk when taking cardiac and pain-killing medication (Leipzig et al. 1999) indicated slightly elevated fall risks for digoxin, Type IA anti-arrhythmics and diuretic treatment. Elderly people taking more than three or four drugs had an elevated fall risk.

The first double-blind intervention study focusing specifically on psychotropic medication came from New Zealand and proved effective (Campbell et al. 1999). The reduction of corresponding prescriptions significantly reduced the fall risk by 66%. However, most of the over-65 patients received their old medication again after conclusion of the study. Permanent withdrawal proved to be extremely difficult.

The importance of extrinsic factors is a subject of research. A controversial debate is currently in progress, particularly regarding the extent to which they can be tackled preventively (Clemson et al. 1996; Sattin et al. 1998; Cumming et al. 1999). Table 4.3 lists frequently observed risk conditions (Carter et al. 1997). According to this list, the most important risks are the poor accessibility of utensils in the kitchen, an excessively low or high seat height, missing handles and bathtub board or mat in the bathroom and toilet, handrails on only one side on stairs, insufficient lighting (<150 lux), insufficient night-time lighting, loose carpeting, cables in the room and the inappropriate height of seating furniture and bed.

Table 4.3: Risks in the home and their location for people over 70 years of age
(source: Carter et al. 1997)

Risk	Number of identified risks (%)			
	1	2	3 - 5	> 5
Lighting	14	4	6	1
Floors	21	18	18	6
Accessibility / "bending"	13	6	4	1
Banister/handrail	21	22	17	0.2
Toilet door/arrangement	32	15	2	-
Stairs	14	5	2	-
Unsafe seating furniture	6	2	1	-

Location	Number of identified risks (%)			
	1	2	3 - 5	> 5
Bedroom (422)	14	4	1	-
Hall (343)	9	3	1	-
Living room (408)	12	3	2	-
Dining room (349)	10	2	1	-
Kitchen (416)	19	8	6	1
Bathroom (425)	19	21	23	3
Laundry room (342)	14	2	-	-
Toilet (422)	27	20	12	-
Stairs (364)	20	11	7	2
Outside	11	3	-	-

Consequences and costs:

Only a relatively small proportion of the falls suffered by older people (approx. 20 to 25%) lead to any contact with a doctor or medical personnel (van Weel et al. 1995). In other words, only the tip of the iceberg is seen in doctors' surgeries, outpatient departments and hospital wards.

The majority of falls do not result in obvious injuries, at least externally. One-third of domestic falls is associated with minor injuries, e.g. slight bruising, small haematomas and superficial grazes. Roughly one fall in ten leads to serious injuries entailing immobilisation and admission to hospital. Between 4 and 6% of falls result in fractures (King and Tinetti 1995).

The most common injury treated in hospital is a proximal fracture of the femur, followed by pelvic fractures, the latter particularly among the very old. However, fractures of the humerus, fractures of the axial skeleton and craniocerebral traumas are often the reason for older people being admitted to hospital for treatment.

The mortality rate following a fall increases at an exponential rate over the age of 65 and is higher among men than among women in Germany. The groups of falls with the highest fatality are hip and femoral injuries, as well as skull injuries. The 1-year mortality following a proximal fracture of

the femur is elevated, with a fracture-associated extramortality of 19% for women and 25% for men. Depending on the initial functional and comorbidity status, the extramortality is manifested within the first three years in the group with a less favourable baseline situation, while the initially healthier group is burdened by increasing extramortality over five years (Magaziner et al. 1990; Myers et al. 1991; Schroder and Erlandsen 1993).

Proximal fractures of the femur result in restricted mobility or a greater need for assistance and nursing in more than half of the residents of private households (Koval and Zuckerman 1994). In the case of residents of senior citizens' homes/nursing homes who were previously capable of walking and transfer, the consequence is often a permanent loss of the capacity for self-help. The first data available from Germany regarding developments following a proximal fracture of the femur in older people confirm that there is a substantial degree of functional and social loss (Becker et al. 1999).

Table 4.4: Selected injuries (main diagnoses) and proportion of over 65 year-olds among the patients discharged from hospital in 1997 (source: Statistisches Bundesamt, Fachserie 12, Reihe 6.2., 1997)

ICD 9 category	Total patients	≥ 65 years	65 - <75 years	≥ 75 years
800 – 999 (total)	1,623,940	448,885 (27.6%)	164,516	284,369
810 – 819 Fracture of the upper limb	218,706	70,768 (32.4%)	30,062	40,706
820 – 829 Fracture of the lower limb	343,636	148,174 (43.1%)	44,862	103,312
850 – 854 Intracranial injury without skull fracture	229,749	35,783 (15.6%)	11,967	23,816
924 Contusion of the lower limb and others	34,604	16,982 (49.1%)	3,964	13,018
996 – 999 Complication after surgery and medical treatment, not classified elsewhere	89,569	39,722 (44.3%)	21,335	18,387

The most common fracture up to the age of 70 is the fracture of the radius (Oestern 1999 a), which reaches its incidence maximum in women around the age of 65. The incidence remains relatively constant after this time. This is essentially due to the decline in walking speed and the speed of protective reflexes. Men are less often affected by distal fractures of the radius than women. The gender ratio is 1:10.4. Over 35,000 cases of hospital treatment were recorded in Germany in 1997. In Copenhagen, the incidence in women over the age of 65, including out-patient cases, was 730 per 100,000 inhabitants (Lauritzen et al. 1993).

Subcapital fractures of the humerus are the second-largest group leading to hospitalisation. The incidence is parallel to that of proximal fractures of the femur, but shifted roughly 5 years forward.

The gender ratio (men to women) was 1:5.3 in 1996. In Copenhagen, the incidence in women over the age of 65, including out-patient cases, was 330/100,000 inhabitants (Lauritzen et al. 1993). In Germany, the incidence of proximal fractures of the femur is about 100 to 120 per 100,000 inhabitants (Cöster et al. 1994; AG Qualitätssicherung Chirurgie Baden-Württemberg 1995). The incidence in people over 65 is 660 to 780/100,000 inhabitants (Becker et al. 2000). An age group-related comparison of the incidence of proximal fractures of the femur in the United States (Hinton et al. 1995) arrives at the following conclusion: in every 100,000 inhabitants, 400 in the age group from 65 to 69 years have a fracture of this kind, as compared to 4,600 in the age group over 85 years. In line with the increasing size of the high age groups, a significant increase in the number of proximal fractures of the femur must also be expected in Germany. It was calculated from retrospective, 24-month studies in senior citizens' residential and nursing homes in Ulm that the annual incidence of proximal fractures of the femur is 35 to 40 per 1,000 inhabitants (Becker 1997). The mean age at which the injury is suffered is currently 82 years, while over 40% of those affected are more than 85 years old.

Another possible consequence of a fall is the inability to get back up on one's own. Remaining lying on the ground for an extended period of time is an indicator of a generally relatively poor state of health, the loss of functional competence and increased mortality (King and Tinetti 1995). When examining other risk factors for institutionalisation, there is also a relatively high probability of the move into a nursing home being associated with a fall. Falls can indicate "frailty" as an expression of increased susceptibility to homeostatic disorders in old age. In hospital patients, they were associated, *inter alia*, with an elevated risk of adverse drug reactions (v. Renteln-Kruse et al. 2000).

One common consequence of a fall is the fear of falling again, which lastingly undermines a person's confidence in his or her own ability to do even simple, everyday things safely, without falling. This fear must be expected in between one-third and one-half of all older people who have suffered a fall, more frequently so in women.

People with a pronounced fear of falling can develop further restrictions in balance and mobility in the course of time. These, in turn, increase the risk of falling and can lead to the restriction of activity and the withdrawal of the affected persons from social life (Tinetti et al. 1990, 1993; Velas et al. 1997).

Falls in older people entail the increased availment of health care services. In the USA, the "lifetime costs" associated with fall-related injuries in persons over the age of 65 years have been esti-

mated at 12.6 billion US dollars (quotation in Rizzo et al. 1996). Costs result, inter alia, from accommodation in a home and an increased need for domestic care (Alexander et al. 1992).

The importance of falls in terms of health economics is underlined by the results of a Dutch study on the total healthcare costs in 1994. The costs were examined in relation to the most expensive groups of diagnoses (Meerding et al. 1998). Among the top 15, the "falls" group moved up from 10th place in the age group of 65 to 84 year-olds to 3rd place (behind dementia and stroke) in the group of people aged 85 years and more.

The cost of proximal fractures of the femur were examined in Germany in a cohort of patients over the age of 65 (Pientka and Friedrich (1999). According to the results, the magnitude of the indirect consequential costs probably at least matches that of the direct expense of DM 1 billion per year on treating the fracture in hospital (100,000 fractures/year). Together, the annual costs resulting from proximal fractures of the femur in Germany thus total roughly DM 2 billion.

Other kinds of injury:

Burns are of secondary importance in numerical terms. In the survey of home and leisure accidents, they accounted for 4 and 5% of the recorded injuries, respectively (Henter 1995). Over-65s accounted for 8.7% (1,590/18,212) of the patients primarily treated for burns in hospital in 1997 and 233 of the 522 deaths (44.6%) in 1998 (Statistisches Bundesamt 2000). The death statistics from Germany, as well as statistics for England and Wales, indicate a steep, age-related gradient in the very old. One cause of fire mentioned relatively often is a burning cigarette dropped by the victim, frequently due to suddenly falling asleep or loss of control as a result of the effects of alcohol and/or medication (Sanchez-Hanke and Püschel 1996).

Table 4.5: Selected deaths in 1998 per 100,000 inhabitants, in total and at the age of 65 years or older (source: Todesursachenstatistik der Bundesrepublik Deutschland 1998, Statistisches Bundesamt, Wiesbaden, 2000)

Chapter XX External causes V01 - Y98		Total	65 - < 70	70 - < 75	75 - < 80	80 - < 85	85 - < 90	≥ 95 years
Total:								
	m	55.0	67.2	86.2	126.8	221.9	384.5	660.0
	f	29.9	27.8	39.5	70.8	130.9	247.8	483.6
	z	42.2	46.1	57.9	89.1	156.9	282.0	522.6
Non-pedestrian road traffic accidents:								
	m	14.4	11.5	14.1	17.8	26.1	31.9	27.0
	f	5.3	4.5	6.4	9.1	11.3	11.9	9.1
	z	9.7	7.8	9.4	12.0	15.5	16.9	13.1
Falls:								
	m	7.7	11.7	19.3	36.2	78.2	159.7	345.5
	f	9.9	6.4	10.3	27.2	65.3	144.9	329.8
	z	8.8	8.9	13.8	29.8	69.0	148.6	333.3
Drowning:								
	m	0.9	1.2	1.2	1.8	1.7	1.4	4.0
	f	0.3	0.2	0.5	0.4	1.1	1.4	0.3
	z	0.6	0.7	0.8	0.9	1.3	1.4	1.1
Smoke and fire:								
	m	0.7	1.2	1.3	1.4	3.0	2.9	6.0
	f	0.5	0.7	0.9	1.8	3.4	4.6	5.1
	z	0.6	0.9	1.0	1.7	3.3	4.2	5.3
Deliberate self- mutilation								
	m	21.4	28.6	36.5	46.9	71.0	109.7	129.2
	f	7.3	10.1	12.7	14.6	18.5	22.6	18.5
	z	14.2	18.8	21.7	25.2	33.5	44.4	43.0

Table 4.6: Age-specific mortality (per million inhabitants) due to injuries in England and Wales in 1991 (source: Office of Population Censuses and Surveys; Series DH2, No. 18, 1993; 104-105; Table 3)

	65 - 74 years	75 - 84 years	≥ 85 years
Falls:			
Men	110	351	1393
Women	75	385	1700
Road traffic accidents:			
Men	121	241	242
Women	80	153	140
Fire:			
Men	17	43	124
Women	14	35	82
Total injuries/poisoning:			
Men	496	1031	2392
Women	314	807	2269

The "Health in Old Age" (Gesundheit im Alter) report by the German Medical Association (1998 a) is one document that draws attention to violence and abuse in close social and nursing relationships. According to nationwide data for Germany in this sector based on a criminological study of

the number of unreported cases, roughly 340,000 people between the ages of 60 and 75 suffer physical violence in the private sphere at the hands of relatives and members of the household each year (Wetzels and Greve 1996).

The above facts illustrate that accidents and injuries, especially in the form of falls, constitute an important topic of preventive geriatrics in terms of both epidemiology and health economics. The following section will therefore discuss situation-specific prevention measures, again with special emphasis on the tasks of doctors.

4.2 Preventive measures

4.2.1 Road traffic accidents

It has been pointed out that prevention campaigns aimed specifically at older car drivers tend not to be successful (Clayton 1991, quoted in Lilley et al. 1995), because old drivers do not feel "old". There is a very marked degree of variability among older people and the difference in functional skills between individuals is greater in old and very old age than in any other phase of life. This is why it has been suggested, among other things, that preventive content be communicated to older drivers by younger members of the family/relations, particularly grandchildren (Clayton 1991). Consequently, the period of middle adulthood should be used for communicating and spreading information on accident prevention regarding potential problems in advanced age.

The German Driving Licence Ordinance of 1998 defines the circumstances under which aptitude is to be determined in individual cases and how this is to be done. This is distinct from the situation-related review, which is governed by binding regulations. In the event of doubts regarding physical and mental aptitude, an expert report by a medical specialist is the only option open to consideration. Only if an expert report by a medical specialist is insufficient can an additional assessment by a medical and psychological examination office be required (Emsbach and Friedel 1999).

In Germany, top priority goes to the legally prescribed obligation of self-examination (decision of the Federal Supreme Court of Justice (BGH) of 20.10.1987, cited in Emsbach and Friedel 1999): "A driver who, upon conscientious self-examination, recognises or must recognise age-related peculiarities that are bound to occasion him to doubt that his fitness to drive is guaranteed, is obliged to check – possibly by consulting a doctor – before setting out on a journey whether he is still capable of compensating for the impairment of his fitness to drive by means of his experience, routine and driving style.

In view of the special dangers associated with driving motor vehicles, high demands must be placed on the duties of care of vehicle drivers. These demands relating to care are not limited to the driving of the vehicle itself. Rather, the dangers of road traffic require that the duties of care commence even before setting out on a journey.

The more the driver must reckon with impairment of his fitness to drive in the prevailing situation, the more stringent are the demands regarding the necessary self-observation and self-control. For example, weakness resulting from illness may give grounds for particularly critical self-observation and self-control. The same applies to old age."

A "Checklist for older drivers" is available from the German Road Safety Council (Deutscher Verkehrssicherheitsrat 1992). It contains 14 questions relating, among other things, to current well-being, illnesses, medication and appropriate planning of the journey (e.g. Question 12: If you suffer from diabetes or high blood pressure: Have your blood sugar and blood pressure been effectively stable over the last few days?). The general practitioner is to be consulted in case of doubt. Consequently, general practitioners have an advisory function in this context. The 6th edition, entitled "Examination guidelines for driver fitness" (Begutachtungs-Leitlinien zur Kraftfahrereignung), was published in March 2000 (Bundesanstalt für Strassenwesen) and is available from the publisher. Among other things, it also contains information relating to the problem of dementia.

According to Art. 2 of the German Road Traffic Licensing Regulations (StVZO), there is a need for constant self-examination in relation to the possibility of fitness to drive being impaired by drugs. Prescribing doctors likewise have an obligation to provide medical information in this connection (Weltrich 1997).

General preventive measures include, for example, improving the legibility of road signs and improved street lighting. Calls for regular tests of vision and other capacities give rise to questions of practicability, age limits, etc.

Although top priority is assigned to the conscientious examination of an individual's fitness to drive, certain technical innovations can also help reduce the accident risk of older road users. As regards so-called driver assistance systems, an expert assessment indicates that emergency call systems, systems for improving visibility and parking aids are especially important (Färber 2000). Other technical aids include, for example, the automatic regulation of the distance from the vehicle in front (ACC, Autonomous Cruise Control), antilock systems (ABS), anti-slip control (ASC), electronic stability programmes (ESP), acoustic warning of aquaplaning (AMS, Adhesion Monitoring System), acoustic warning system when coming off the road (HCS, Heading Control System), cornering light and headlight range adjustment, as well as navigation systems, provided they are of user-oriented design, i.e. also appropriate for older people.

Pedestrians and cyclists should be advised to wear reflectors, especially in twilight and in the winter months, and also to wear protective helmets, as there is increasing evidence that they are capable of preventing head injuries in all age groups (Cook and Sheikh 2000; Rivara et al. 2000).

Structural approaches to the prevention of road traffic accidents consist in an age-oriented traffic policy, e.g. in the reduction of the maximum speed in town centres, the extension of the time for

pedestrians to cross at highly frequented junctions and additional acoustic signals at pedestrian crossings.

4.2.2 Falls

As almost all falls in older people are of multifactorial origin, the concept for preventing them is based on eliminating or improving as many of the identified risk factors as possible (principle of risk minimisation). As mentioned, risk factors in older people generally relate to medical, functional, situational and environmental conditions. Optimally, this leads to a multidimensional intervention approach.

Figure 4 shows a checklist containing all the main factors, permitting identification of the majority of people at risk of falling. This gives rise to an important social anamnestic task for doctors. Comprehensive clarification of the situation, leading to the establishment of a risk profile for a patient at risk of falling, can be reliably achieved in a roughly 30 to 40-minute interview.

Fig. 4: Checklist of fall risk factors in old age

- ◆ Female
- ◆ Underweight
- ◆ Age > 80 years
- ◆ Hypotension (systolic < 90 mmHg), postural hypotension
- ◆ Fracture within the last 5 years
- ◆ Need for assistance and nursing (ADL* assistance)
- ◆ Impaired vision (reading of a newspaper headline)
- ◆ Dementia (MMSE¹ < 21 points)
- ◆ Parkinson's disease/parkinsonian syndrome
- ◆ Neurological deficit after stroke
- ◆ Intake of psychotropic drugs/sedatives
- ◆ Balance test
- ◆ Standing on one leg (> 5 sec. not possible, 3 attempts allowed)
- ◆ Timed Up & Go Test²: > 20 sec.
- ◆ Mobility test after Tinetti³ (< 18 points)
- ◆ Sources of danger in the home

* Activities of daily living

¹ Mini-Mental-State Examination after Folstein

² Timed Up & Go Test

³ Mobility test after Tinetti

We currently have more randomised intervention studies in the field of fall prevention than in other accident sectors. Gillespie et al. analysed 18 randomised studies and a meta-analysis (Province et al. 1995) relating to fall prevention in elderly people living at home and those in institutional care and in hospital (Cochrane Review 1997). The results of these studies can be summarised as indicating that a significant reduction in the rate of falls can be achieved by means of a multimodal intervention programme. A programme of this kind encompasses the training of muscular strength and balance, targeted improvements in the residential environment (handles, improved lighting, etc.), the reduction of drug therapy and partly also the padding of the skeleton with so-called hip protectors (Tinetti et al. 1994; Close et al. 1999; Gregg et al. 2000; Buchner et al. 1997).

An American intervention study was subjected to cost analysis and proved to be efficient (Rizzo et al. 1996). The average cost amounted to USD 925 per intervention case (range: USD 588 to 1,346). The programme proved to be most cost-effective in relation to people at particularly high risk of falling, as established by the presence of at least four of the total of eight specifically considered risk factors.

There is strong evidence that a physically active lifestyle, e.g. going for walks, is associated with a lower risk of hip fractures. According to the results of a corresponding review, it is unclear whether physical activity also correlates with the risk of osteoporotic fractures other than hip fractures (Gregg et al. 2000).

There is a need for research into questions concerning what type of physical exercise/training is suitable for which target groups and for fractures other than those of the hip. This must be taken into account before recommendations can be given regarding the nature, intensity and duration of physical trainings/exercise programmes. Another important conclusion to be drawn from previous intervention studies is that concrete preventive effects can most likely be expected if the target group consists of persons unequivocally identified as being at risk.

Based on updated reviews, guidelines for the prevention of falls in people over 65 were recently published in England, in which context persons with severe dementia were excluded (Feder et al. 2000). The "statements of evidence"* and "recommendations"*** are listed below.

* **Evidence weighting:**

- A Consistent findings in multiple randomised controlled trials or a meta-analysis
- B Single randomised controlled trial or weak inconsistent findings in multiple randomised controlled trials

C Limited scientific evidence, cohort studies, flawed randomised controlled trials, panel consensus

**** Grading of recommendations**

*** Directly based on Grade A evidence

** Directly based on Grade B evidence or extrapolated recommendation from Grade A evidence

* Directly based on Grade C evidence or extrapolated from Grade A or B evidence

1. Multifaceted interventions

Evidence statements:

Programmes that combine interventions (most studies include some form of exercise) reduce falls (A).

Specific factors to target: attention to postural hypotension, number of drugs, balance, transfers and gait is particularly effective (B).

Recommendations:

Prioritise programmes for prevention of falls that include more than one intervention (***).

Specific factors to target: prioritise correction of postural hypotension, rationalisation of drugs where possible, and interventions to improve balance, transfers and gait (**).

2. Assessment in the community

Evidence statements:

Home assessment 1: Home assessment of disability and education in the risk areas and referral to the patient's doctor reduces falls (C).

Home assessment 2: Home assessment of risk and education in these areas without further referral does not reduce falls (A).

Accident and emergency assessment: Identification of persons who attend accident and emergency departments after falls, with subsequent assessment of medical and occupational therapy and referral and follow-up, reduces falls (B).

Recommendations:

Home-based interventions: A programme of medical and environmental assessment, with client education about risks and with referrals to relevant healthcare professionals (for example, general practitioners, occupational therapists) should be established (*).

Accident and emergency departments: A programme of follow-up for medical and occupational therapy for older people who have presented at accident and emergency departments after a fall should be established. A structured interdisciplinary approach to their management should be prioritised (**).

3. Residential settings

Evidence statements:

All residents: Non-selective exercise programmes for residents of nursing homes do not reduce falls (B).

High-risk residents: Assessment of residents after falls, with development of individual treatment plans and staff education, decreases falls (B).

Hip protectors: Neck of femur fractures are prevented by hip protectors being worn by residents of nursing homes (B).

Recommendations:

All residents: Non-selective exercise programmes for prevention of falls should not be implemented (**).

High-risk residents: A programme of risk assessment for residents who have had at least one fall, with referral to their primary physician for specific preventive measures if necessary, should be established (**).

Hip protectors: All residents of nursing homes should be offered hip protectors (**).

These recommendations are in principle applicable to the situation in Germany, at least giving consideration to the content of the measures. It must be borne in mind that the studies on which these recommendations are based were conducted exclusively in the Anglo-American and Scandinavian regions (Poulstrup and Jeune 2000).

There are other possibilities for integrated care in those regions, as the health systems are different. Moreover, the members of the interdisciplinary team include occupational groups that are not known in this form in Germany, such as research nurses.

In Germany, implementation is impeded by various formal and financial limits within the health-care system. In the framework of the reorientation of medical prevention and rehabilitation (Arnold et al. 2000), the field of prevention – and, in view of demographic trends, particularly the field of disability in old age (Bundesärztekammer 1998 a; Stuck et al. 1999; v. Renteln-Kruse 2001) – also requires new concepts for concerted cooperation between different medical disciplines.

As part of the pilot programme of the German Federal Ministry of Health entitled "Promotion of Quality Assurance in Medicine", a guideline for the prevention of falls in the elderly is currently being elaborated in the framework of the development of evidence-based guidelines in general medicine.

The medical counselling of older patients/persons seeking advice on the sense of physical exercise, on a healthy diet appropriate for the elderly, osteoporosis prevention/therapy, etc. should be or become a fundamental element of healthcare for the elderly (Bundesärztekammer 1998 a). In collaboration with the German Medical Association, the German Sports Federation has adopted a "Sport for Health" seal of quality that is intended to facilitate access to health-promoting offers of exercise via sports clubs in a target group-specific manner (Deutscher Sportbund 2000). Details cannot be presented at this point.

Finally, it should be pointed out that so-called hip protectors afford preventive protection of the bones and soft tissue. The effective principle of these devices is based on the absorption and distribution of forces over the surrounding tissue, thereby reducing the force acting on the neck of the femur or the trochanter major in the event of a fall. Evidence of effectiveness was first obtained in residents of senior citizens' homes in Copenhagen (Lauritzen et al. 1993). Wearing the hip protector reduced the risk of a proximal fracture of the femur by approx. 50%. In addition, wearing the device can also increase the feeling of security and reduce the fear of falling (Cameron et al. 2000).

A Cochrane Review (Parker et al. 1999) came to the conclusion that hip protectors reduce the risk of hip fractures in selected risk persons. However, this presupposes high compliance, i.e. acceptance of wearing the device. Furthermore, the question of financing has not yet been definitively clarified. An intervention study by the Geriatric Centre in Ulm, which has not yet been published, was able to demonstrate that hip protectors in combination with strength and balance training, as well as improvements in the residential environment, resulted in the number of fractures of the neck of the femur declining from 40 per year to 23.

4.2.3 Additional preventive measures

In view of the major potential for prevention, reference should finally be made to the field of iatrogenic injury (significant comorbidity factor in old age). It has long been known that adverse events in the broadest sense occur more frequently in the diagnosis/treatment of old patients than in younger patients. Systematic surveys have existed for more than 30 years in one important sub-area, namely adverse drug reactions (v. Renteln-Kruse 2000).

Grounds for concern are given by findings that indicate an increase not only in the total number of adverse events with progressing age, but also in the proportion rated as being a result of neglect (Leape et al. 1991). Possibilities for prevention in this context lie in medical progress (long-term), improved vocational education/more intensive training, the utilisation of technical progress and the improvement of organisational procedures, e.g. following prior system analyses.

5 Recommendations

5.1. Recommendations for the medical community

The existing commitment of doctors – based on their concrete experience in everyday work in view of the avoidable injuries suffered by children, young people, young and older adults – is to be welcomed and should be intensified. Moreover, improved framework conditions must be created in order to enable scientifically well-documented action strategies for the prevention of injuries to take effect. This is beneficial to every one of us, in that suffering, disability and death are prevented, while warding off costs at the same time, and equally to society as a whole. The self-administration bodies of the medical community support this with concrete concepts for the prevention of accidents.

Childhood and youth:

- In-depth recording of case histories, diagnosis and counselling by doctors in out-patient or in-patient care:
 - Talks with mothers or parents about high-risk situations for babies and toddlers. (Doctors already hand out appropriate information sheets as a service in the framework of the early-detection examinations in children.)
 - Paying special attention to conspicuous features in the movement of children of pre-school and school age (hyperactive children, children with inhibited movement); counselling of parents and children as regards elevated accident risks. (Mediation of offers of health-promoting sporting activities, e.g. in a nearby sports club.)
 - Paying special attention to signs of child abuse or corresponding suspicions; appropriate handling of the problem. (Concept of the German Medical Association on the problem of the abuse of minors from the medical point of view, guideline of the Länder Medical Associations on "Violence against Children" for doctors in private practice.)
 - Improved collaboration between doctors and other occupational groups in relation to accident prevention measures.
 - Cooperation with medical and psychological psychotherapists when indicated (need for advanced training).
 - Information flow between doctor's practice and hospital/other addressees in connection with home, leisure and road traffic accidents, and particularly teaching staff in connection with accidents occurring during school sports and on the way to and from school (training of "epidemiological monitoring" skills, i.e. the ability to recognise the frequent

occurrence of certain injuries in everyday working routine and to formulate a corresponding need for a solution to the problem).

- Outreach prevention measures of the child and youth medical service:
 - The task arising for the child and youth medical service of municipal health offices is to cooperate with social workers in examining the residential environment and the accommodation of socially disadvantaged people with numerous children for accident-promoting circumstances (programme of house calls with counselling).
 - The child and youth medical service and social workers should reduce the potential for acts of violence among young people from high-risk families or socially risky residential areas (depressed areas) by way of compensatory programme activities (special target group: 12 to 16 year-olds).
- When counselling any accident victim, thought should also be given to secondary prevention in order to avoid further accidents (impairment of reactions due to the intake of alcohol or medication, sense of responsibility, control of aggression). In the case of road traffic accidents, for instance, it is difficult to accurately determine the group of young adults (mainly men between the ages of 18 and 24) bearing the highest accident risk, this also making primary prevention difficult.
- Doctors need to take corresponding secondary prevention action in connection with injuries caused by high-risk sports. There is additionally a need for a knowledge of appropriate protective equipment for sports and for up-to-date information at short notice when new sports emerge (e.g. inline skating or kick-boarding).
- There is also a need for doctors to become active in secondary prevention in connection with victims of acts of violence. Collaboration in this field has already been initiated with experts in behavioural medicine and psychotherapy (in this context, sensitive and taboo topics should also be addressed in talks between doctor and patient).

Young and middle adulthood:

Doctors in out-patient and in-patient medical care:

- A sports medicine examination is indicated in patients in young and middle adulthood who start new sporting activities or change existing ones, if the doctor has sound reason for suspecting that this may have a negative impact on their state of health. Sports medicine examinations may only be carried out by persons having appropriate, documented qualifications.

- Patients who are employed in occupations with a high accident risk, or work under stressful conditions prone to causing accidents, should have their attention drawn to risks by the doctor and be given appropriate preventive advice (e.g. communication of psychosocial strategies for coping with stress). This likewise applies to measures of secondary prevention. (A manual on occupational and social aspects of diseases should be elaborated, as should guides for medical counselling talks.)
- Improved exchange of information with organisations responsible for the individual types of accident (traffic and transport, industrial safety, company medical service). (Training of skills in "epidemiological monitoring" also applies in this context – see above).

Old age:

Doctors in out-patient and in-patient medical care:

- Check of the fitness to drive of older road users (particularly passenger cars). (Checklist available.)
- Paying special attention to restricted fitness to drive as a result of medication (also watch out for interactions in this context).
- Counselling of older patients as regards the advantages and disadvantages of engaging in sporting activities (collaboration with sports clubs).
- Prevention of falls: recording of the risk profile (guideline available; critical time requirement!).
- Prevention of falls: implementation of the General Medicine guideline (in preparation); points requiring particular consideration in this context:
 - Targeted prescription of hip protectors (compliance!), preferably in conjunction with strength and balance training, paying attention in this context to medication effects and increased cooperation with physiotherapists and ergotherapists.
 - Every accident provides important information for secondary prevention and should be an occasion for individual accident analysis and prevention measured derived therefrom (counselling, age-oriented living).
 - Collaboration of doctors with other occupational groups and with persons responsible for accident prevention, e.g. in order to realise a multimodal prevention approach: exercise training, adaptation of accommodation, reduction of superfluous drug treatment and indication for hip protectors.
 - Consideration of the increased risk of iatrogenic injury in patients of advanced age!

Concepts of the medical self-administration organisations:

- "Accident Prevention in Childhood" brochure – Set of measures for doctors for use in surgeries and kindergartens;
- "On the Problem of the Abuse of Minors from the Medical Point of View (Diagnosis and Intervention Options) – Concept of the German Medical Association;
- "Violence against Children" guidelines for doctors' surgeries in the sphere of many Länder Medical Associations;
- School programmes of doctors in collaboration with teachers, e.g. those of the North Rhine and Westphalia-Lippe Medical Associations;
- "Health in Old Age" – Texts and materials of the German Medical Association for advanced and continuing education;
- "Evidence-based Recommendations for the Prevention and Therapy of Osteoporosis (in preparation by the Drug Commission of the German Medical Profession);
- Participation in the National Working Group on "Child Safety", executive committee of the Bundesvereinigung für Gesundheit e.V.;
- "Sport for Health" seal of quality of the German Sports Federation in collaboration with the German Medical Association: quality-assured, target group-specific courses are to be offered in every municipality in the medium term.

5.2. Recommendation for the establishment of a national accident prevention programme

With the exemplary exception of the field of industrial accidents, the efforts made in Germany to prevent accidents are modest by international standards. The level of information regarding the scope and development of the accident problem is inadequate and there are also major deficits as regards research into accident causes. Prevention programmes aimed at reducing the number of accidents and injuries in specific groups of the population or certain regions are few and far between in Germany, and there is even less documentary evidence of their efficacy in terms of medicine or health economics. It is surprising to note that health policy activities in relation to accidents, a field which causes such extremely high costs to the national economy, have only been implemented at a low level to date. Consequently, a concerted initiative in the form of the establishment of a national accident prevention programme is recommended, the most important tasks of which are listed below. Questions relating to the organisation, the participating partners, funding, competences, etc. of this programme should be discussed in a separate commission report. There is definitely an indispensable need for close links with specifically designated university centres of competence, paying particular attention to public health research, epidemiology and health economics.

Central tasks:

Compilation of quality-assured data regarding the accident and injury situation, including the establishment of a national trauma register; regular statistical surveys of home and leisure accidents; accident reporting by the statutory health insurers; health survey on accidents and injuries, also among the elderly, residents of senior citizens' homes, children and young people.

Improvement of interdisciplinary research into the causes of accidents and injuries; identification of research deficits and requirements, possibly in conjunction with the compilation of a White Paper on accident cause research and prevention; securing of long-term research promotion. In coordination with the Ministry of Transport, it would also be practical to expand the tasks of the Federal Institute for Road Research (bast) to cover general accident safety (especially home and leisure accidents).

1. Documentation and adaptation of successful international accident prevention programmes (establishment of a service and advisory organisation).
2. Initiation and support of prevention programmes in collaboration with municipal health conferences, specific occupational groups, working groups, companies, schools, etc., including monitoring of the quality standards of these programmes. In this context, special importance must be

attached to accompanying scientific research in connection with initiated programmes (structure, process and outcome evaluation, including aspects of health economics).¹

3. Securing the incorporation of the experience of doctors and professional medical competence in the manufacture and testing of potentially hazardous products (e.g. increased cooperation between doctors and safety engineers, e.g. watchdog initiatives, in connection with measures in the transport and construction sectors).
4. Monitoring of the status of implementation of recommendations; establishment of a health policy forum to strengthen accident prevention, including the introduction of a Federal Commissioner for Accident Prevention by the Federal Government; organisation of conferences, events; public relations and education work (in collaboration with the Federal Centre for Health Education and the German Medical Association).
5. Increased consideration of the subject of prevention in the curricula of basic, advanced and continuing vocational training and education in health professions, primarily in the context of the study of medicine and in postgraduate public health study courses (e.g. elaboration of teaching modules, dissemination of teaching materials in collaboration with scientific societies).
6. In cooperation with the Länder and municipalities, an attempt should be made to improve municipal accident reporting and strengthen municipal accident prevention measures.

¹ The Federal "Child Safety" Working Group – supported by the Federal Ministry of Health and Messrs. Johnson & Johnson – is a first step in the right direction, although it is in no way adequately equipped with just one part-time position for coordination work.

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Glossare zu den Tabellen und Diagrammen

Abb. 1:

Share in %

Homes/Domestic environment

Road/Footpath

Workplace/Way to work

Sport/Play

Other

Men

Women

Fig. 3: Injured persons by location and gender, Federal Republic of Germany; 1998 survey

Abb. 2.1:

Fatal injury in the Federal Republic of Germany

Breakdown of suspects by age

Source: Police Crime Statistics

Abb. 2.2:

Dangerous and grievous bodily harm in the Federal Republic of Germany

Breakdown of suspects by age

Source: Police Crime Statistics

Abb. 3.1:

1999 accident victims by age in years
per 100,000 inhabitants

Thereof: passenger car users suffering accidents

Age in years

Male

Female

18 to 24 year-olds

Number per age

Federal Statistical Office / Traffic Group

Abb. 3.2:

Construction

Wood

Minerals

Iron and metal

Food and tobacco

Mining

Transport

Paper and printing

Textiles and leather

Chemistry

Commerce and administration

Health service

Precision mechanics and electrical engineering

Gas and water

Notifiable work accidents per 1,000 full-time employees
and decline in per cent since 1960