CHAPTER 3
ROAD TRAFFIC INJURIES

3.1 Introduction

Throughout the European Region, road traffic injuries are a leading cause of death and disability in children (Box 3.1). Children's daily lives include travelling to school, home and play, but this leaves them vulnerable to RTIs in a vast variety of situations. They may be injured as pedestrians while walking to school or playing in the street, as bicyclists enjoying an outing with friends, as motorcyclists while riding to secondary school or as passengers in cars.

This report defines RTIs as fatal or non-fatal injuries resulting from road traffic crashes: collisions or incidents occurring on public roads and involving at least one moving vehicle *(1)*. RTIs remain the leading cause of death among younger Europeans aged 5–19 years, in spite of improvements in traffic safety in many countries (see Annex 4, Table 1).

This chapter augments information in the *World report on child injury prevention (2)* with Europe-specific data, and recommendations relevant to the rich and diverse circumstances in countries.

3.2 Burden in the Region

3.2.1 Mortality

RTIs kill 16 400 children and young people aged under 20 each year in the European Region *(3)*. These deaths comprise 38% of all unintentional injury deaths in this age group (Fig. 2.1), 13% of all RTI deaths for all ages combined in the Region and almost 6% of all child deaths worldwide (262 400) *(2)*. The mortality rates of injury are 10 per 100 000 in males aged 0–19 years and 4.5 per 100 000 in females.

BOX 3.1

Key facts on RTIs

- RTIs are the leading mechanism of fatal injuries in the WHO European Region, killing 16 400 children aged 0–19 years per year.
- There is a threefold difference between the countries with the highest and lowest death rates.
- Children living in LMICs have a 60% higher risk of dying from RTIs than those in HICs.
- RTIs are a leading mechanism of traumatic brain and extremity injuries and subsequent long-term impairment.
- Providing safer environments for pedestrians and cyclists will have other beneficial effects, including to promote physical activity and counteracting noncommunicable disease.

Deaths vary widely in the Region, with an over threefold difference between the country with the highest standardized mortality rate (the Russian Federation, with 10.7 per 100 000) and one of those with the lowest rates and a strong road traffic safety history (Sweden, with 3.3 per 100 000) (Fig. 3.1). Half of the 42 European countries analysed for this report have rates higher than 6 per 100 000. Children living in LMICs in the Region are 1.6 times more likely to die from RTIs than children living in HICs. These differences are highest for infants and lowest for those aged 15–19 years (Table 3.1).

Table 3.1
Age-standardized death rates per 100 000 population from RTIs by age group with rate ratios for LMICs versus HICs

	Age groups (years)					
Rates and rate ratio	<1	1–4	5–9	10–14	15–19	<20
Death rates in:						
HIC	1.19	1.30	1.43	2.24	14.75	5.15
LMIC	6.34	4.64	5.49	4.65	15.83	8.30
Rate ratio	5.34	3.57	3.83	2.07	1.07	1.61

Source: The global burden of disease: 2004 update *(3)*.

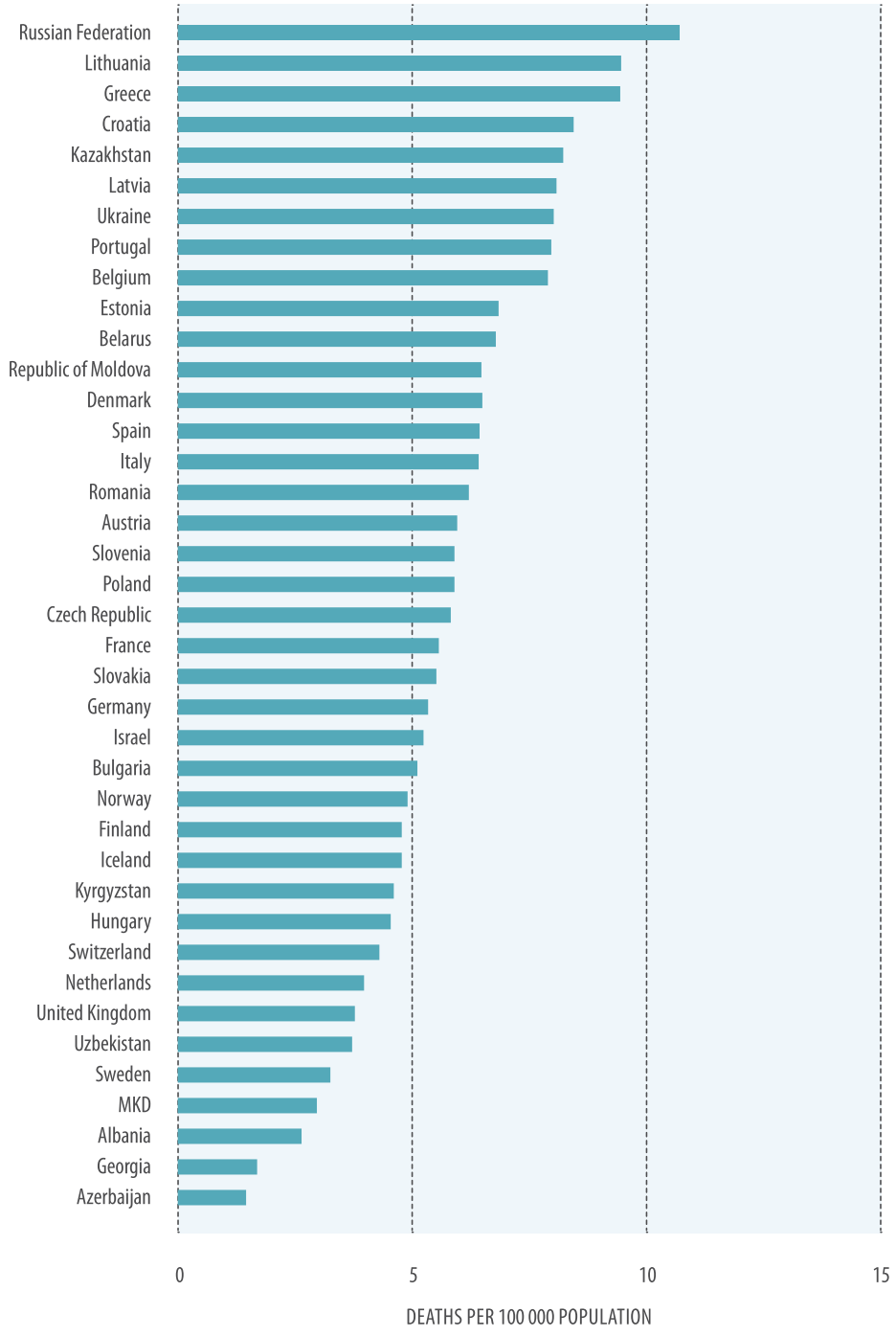
RTIs are the leading cause of unintentional injury death in most of the countries in the Region, but not all. Their share of all deaths ranges from a high of 86% in Italy, to 35% in the Russian Federation, 31% in Romania and 21% in Uzbekistan and Kyrgyzstan (Annex 4 , Fig. 2).

The distribution of road deaths by mode of road user varies with age (Fig. 3.2). Most of the deaths in children aged 0–14 years in the WHO European Region occur to pedestrians (48%), followed by car occupants (32%), cyclists (9%) and motorcyclists (6%) *(5)*. In contrast, young people aged 15–17 are more likely to die in car crashes or on motorized two-wheelers than as pedestrians and bicyclists. This reflects the differences in exposure to risk; older children are more exposed to cars and motorized two-wheelers than walking and cycling.

Analyses of police-reported fatalities in people under age 17 years for 36 countries, by type of road user, indicate that 36% of these deaths occur to occupants of passenger vehicles, 35% to pedestrians, 18% to drivers and riders of motorized two-wheelers (mopeds and motorcycles), 4% to cyclists and the remaining 7% as other road user types, including lorries, trucks and public transportation. The

Fig. 3.1

Average standardized mortality rates for transport injuries in children aged 0–19 years in the WHO European Region, 2003–2005 or most recent three years



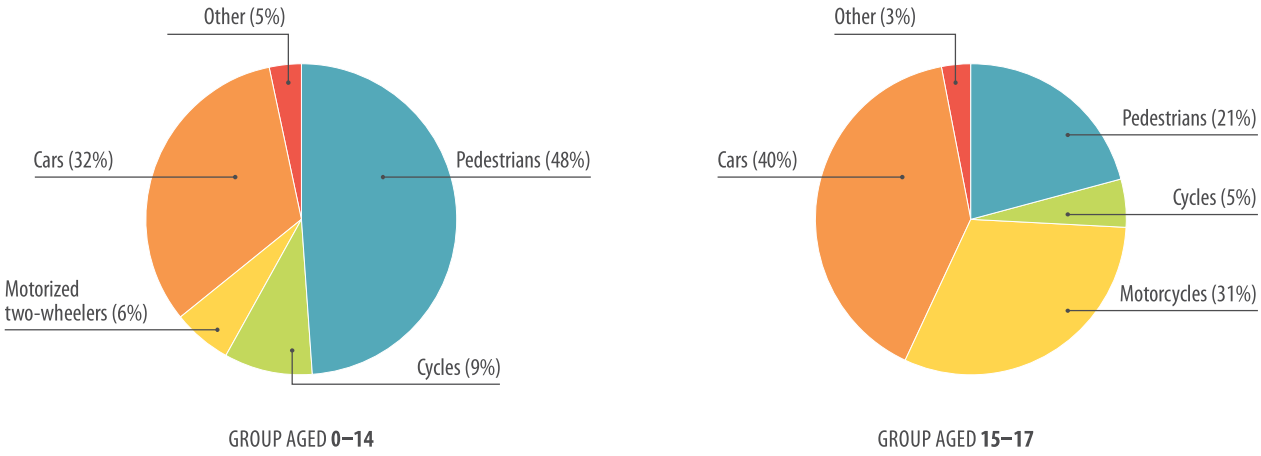
Source: European detailed mortality database *(3)*.

exact distribution changes by country, as shown in Fig. 3.3, with pedestrians representing as much as 72% of the total in Kyrgyzstan and as little as 13% in Denmark, while motorized two-wheelers accounted for 33% of victims in France and cyclists up to 30% in the Netherlands *(7)*.

3.2.2 Sociopolitical and economic change in the Region

The change to market economies in eastern Europe and the CIS accompanied an unprecedented increase in motorization in many countries *(8–10)*. Changes in infrastructure, safety standards, laws and regulations, however, have not kept pace

Fig. 3.2
Road deaths by mode of road transport in children aged 0–14 and 15–17 years, averages for 2002–2004 or most recent years



Note. The average annual number of deaths is 4304 in children aged 0–14 and 3565 in those aged 15–17 years.
Source: *Handbook of transport statistics in the UNECE region (6)*.

(11–13). Increased levels of alcohol intake, another RTI risk factor, plus heavy marketing by the alcohol industry, has meant more drink–driving. Coupled with this are insufficient capacity of road safety experts and changes in governance that have led to inadequate enforcement of safety standards and laws *(14)*. Trends show an increase in RTIs in children in the early 1990s with a second peak in the mid-2000s. For example, the transition to a market economy in Lithuania resulted in peaks during the periods of greatest change. Although downward trends followed, Lithuania's RTI rates are still among the highest in the Region, and deaths from road traffic crashes have not shown significant declines, in contrast to other causes of child mortality *(15)*.

3.2.3 Changing patterns of transport and exposure

Even the EU has seen a 37% increase in cars on the roads, from 160 million in 1990 to 220 million in the 25 Member States in 2005. This is equivalent to 476 passenger cars per 1000 inhabitants. In contrast, the number of buses rose by only an estimated 6%, suggesting greater reliance on private cars for transport *(16)*.

Trend data show falling child RTI mortality in the EU, with much of this decrease due to reduced exposure as pedestrians and bicyclists. In other words, rates have been reduced mostly at the expense of moving children off the pavement and bicycle and into private cars or on motorized two-wheelers. Studies have documented this shift; for example, one on child road use in England and Wales between 1985 and 1995 found that the average distances walked and cycled each year by children under 14 fell by 20% and 26%, respectively *(17)*. Factors underlying this shift include the much wider availability of cars, an increase in parental choice in education (leading to longer journeys to school), the increased pace of family life (with more activities in limited time) and the exaggerated fear of strangers by children out alone *(18)*. Further, the net good of some of the reductions may be questionable, as they do not take account of the negative effects on exercise (and its impact on obesity), pollution (and its asthma-related consequences), changes in urban planning or climate change.

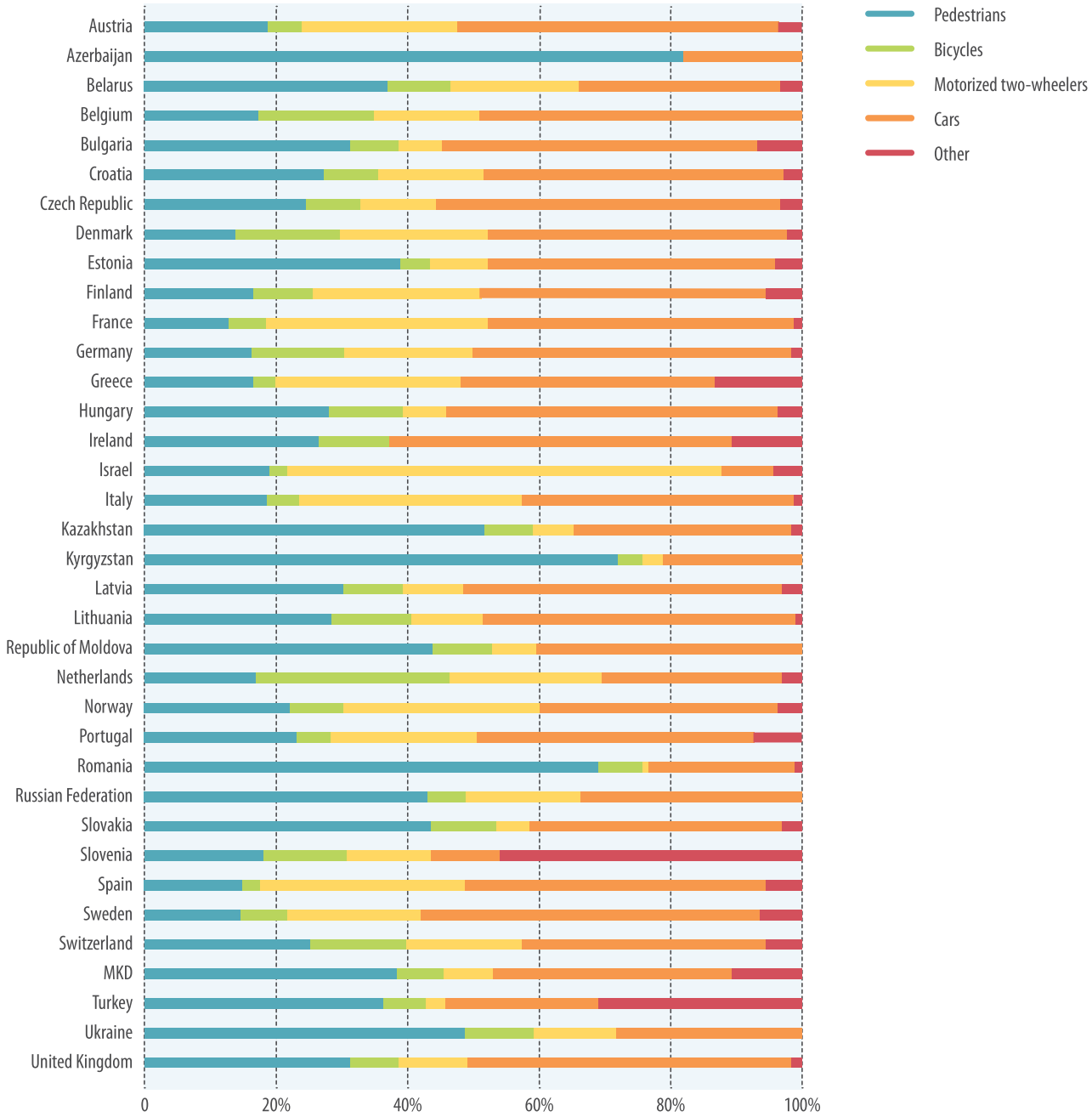
Thus, the shift in transportation modes may not be the most efficient way to meet the population's health and transportation needs, in view of the growing epidemic of obesity, or the best example for countries and regions that have fewer resources and are on the cusp of motorization *(9,19)*. Further, the shift in transport modes may confound commonly performed comparisons of rates between countries *(20)*.

3.2.4 Socioeconomic determinants

Children of lower socioeconomic class are at much greater risk of RTIs than the more advantaged. Reducing this risk is particularly important because socioeconomic inequality is increasing in many countries in the Region *(10,21,22)*. Studies from the United Kingdom showed that, among children aged 0–15 years, those in the lowest socioeconomic class were four times more likely to die from RTIs and five times more likely to die as pedestrians than those in the highest class *(23)*. A more recent study showed that children of unemployed parents were 5.5 times more likely to die as car occupants, but more than 20 times more likely to die as pedestrians or bicyclists as those in the highest social class *(22)*. Socially disadvantaged children are more likely to live in neighbourhoods with unsafe roads, high-speed traffic and few safe areas to play; their families find safety equipment less affordable and have less access to high-quality emergency trauma services *(24)*.

Fig. 3.3

Proportion of deaths by mode of road transport among children aged 0–17 years in selected European countries, average for 2002–2004 or most recent three years



Source: UNECE transport database *(7)*.

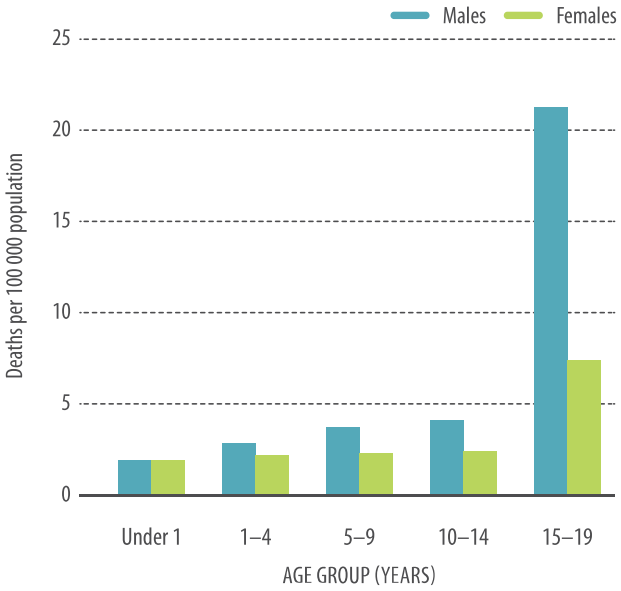
Children of families in higher socioeconomic groups disproportionately reap the benefits of safer environments, behaviour and vehicles, and access to safety equipment. In fact, a study in Scotland suggests that unintentional injuries (and road traffic is the leading injury mechanism) are the largest contributors to inequalities in childhood *(25)*. In the United Kingdom, where one can get a driver's licence at 17, young drivers from deprived backgrounds are more likely to have driven without a licence, and to drive recklessly and without wearing a seat-belt *(26, 27)*.

3.2.5 Gender

The shift in transport mode affects gender-based injury and death rates. In the European Region, these differences are somewhat larger than those described in the *World report on child injury prevention*, and this probably reflects European males' greater uptake of motorized two-wheelers and cars *(2)*.

As seen in Fig. 3.4, the largest difference in female-to-male death ratios is 1:3 and arises in the group aged 15–19 years. Although the requirements vary from country to

Fig. 3.4
Age- and gender-specific mortality rates for RTIs in children in the WHO European Region, 2003–2005 or last available three years



Source: The global burden of disease: 2004 update *(3)*.

country, the minimum age for riding a motorized two-wheeler is 14 years in France, Spain and Switzerland, but 15 or 16 in other countries *(28)*. Although Region-wide figures on motorcycle licences are elusive, there are 2.5 boys with licences for every girl among those aged 14–17 years in Spain; this ratio rises to 5:1 if only moped licences are considered *(29)*. Unsurprisingly, the female:male ratio in motorcycle fatalities among those aged 15–24 years is 1:14.5, while the corresponding average ratio in 18 selected EU countries is 1:9 *(29)*.

3.2.6 Morbidity

Measuring the non-fatal burden of RTIs in children is more difficult, mostly as a consequence of less developed information systems. According to some country-specific studies, for every person who dies, 20 more require hospital admission for serious injuries, 70 attend an emergency department and many are seriously disabled *(30,31)*. Health service and vital registration data may be more complete than police data, since police reports have been proved to underestimate non-fatal and fatal injuries (by 40% and 3–7%, respectively) *(30,32)*. The data from police, emergency departments and hospitals need to be linked to develop more comprehensive surveillance systems. In some countries, underreporting is considerable, and correcting this is a priority to improve understanding of the scale of the RTI problem in children in the Region.

Children's injuries in road traffic crashes vary considerably in type and severity. Table 3.2 shows data on 1304 children aged less than 12 years discharged from hospitals in 10 countries due to injuries as car occupants in 2004. The most common type was traumatic brain injury, followed by fractures of the limbs and injuries to organs in the abdomen and chest. A large proportion of children suffered from multiple trauma, which is associated with higher death rates. The high severity of injuries to children in road traffic crashes *(33)* underlines the need for high-quality paediatric trauma care. In some countries, only 10% of such hospitalized cases were completely coded to show the cause of injuries.

Studies using emergency-based data are scarce in Europe. A study in the Lazio region, Italy, found incidence rates of 1000, 1500, 3000 and 7200 injuries per 100 000 boys aged 1–4, 5–9, 10–14 and 15–19 years, respectively. Incidence for girls also increases with age, but, unlike the threefold

Table 3.2
RTIs to 1304 children younger than 12 years, discharged from hospitals in 10 European countries, 2004

	Type									
Site	Fracture	Dislocation	Internal	Open wound	Amputations	Blood vessels	Contusion/ Superficial	Crush	Burns	Total (%)
Traumatic brain injury	124	0	531	142	0	0	0	99	0	896 (43)
Other head	72	10	0	71	26	1	156	0	0	336 (16)
Neck	0	0	0	0	1	0	13	0	0	14 (1)
Neck and head other	0	0	0	0	0	0	44	0	1	45 (2)
Spinal cord	3	0	0	0	0	0	0	0	0	3 (0)
Vertebral column	16	1	0	0	0	0	0	0	0	17 (1)
Thorax	14	0	18	1	9	1	57	0	0	100 (5)
Abdomen, pelvis, trunk and lower back	20	1	73	6	22	1	114	0	0	237 (11)
Upper extremity	143	2	0	28	4	0	28	1	1	207 (10)
Lower extremity	134	1	0	25	9	0	47	1	1	218 (10)
Hip	17	3	0	0	4	0	3	0	0	27 (1)
TOTAL	543	18	622	273	75	3	462	101	3	2100 (100)

Source: Lopez-Valdes et al. *(33)*.

difference in fatality rates, the female-to-male ratios increase from one at 1–4 years to 1.7 in 15–19-year-olds, suggesting that adolescent girls are less likely than boys to be fatally injured in a car crash *(34)*. A study in Romania indicates that the most common injuries in paediatric RTI victims seen in the emergency department are to the head and upper and lower extremities *(35)*.

More data are needed on the longer-term consequences of RTIs to children. The lack of data is related to both the lack of sufficiently appropriate measurement scales and the absence of long-term follow-up studies. WHO estimates that RTIs account for 2% of all DALYs lost in children younger than 15 years, and rank ninth among causes in the Region (Table 2.3).

3.2.7 Psychological and social effects

Many children develop post-traumatic stress disorder and anxiety after a road traffic crash. These are common and may be short lived, although reports suggest that they may still be present 12 months later in a about a third of children, with flashbacks, fears of being injured again, sleep disturbances and anxiety *(36)*. Psychological upset is likely to be worse if a relative is also injured in the crash and if the injuries lead to loss of work and family position.

3.2.8 Costs

Although the literature includes a number of cost estimates for RTIs *(1,37)*, none is specific to child victims or derived from representative European data *(38,39)*. Thus, additional work needs to be done to identify direct medical and non-medical costs, as well as indirect costs related to both the possible present or future productivity losses from injured children and the impact of the care given them by family members.

3.3 Risk factors for RTIs

Several risk factors for RTIs in children have been identified *(2)*. Children are vulnerable road users, owing to not only their particular circumstances but also the actions of adult road users in unsafe environments. Some risk factors are related to children's developmental characteristics. For example, their small stature makes them more susceptible to injuries in both number and severity for a given amount of mechanical energy. Their cognitive development limits their capacity to evaluate risks. These factors become less important as children mature, and are superseded by risk-taking behaviour and peer influence in adolescents.

The environment and vehicles with which children interact as pedestrians and bicyclists are critical. Societal norms for transportation play a strong role. The provision of sufficient safe and efficient public transportation systems reduces the volume of private vehicles on the road. Street and road design influence risk. In particular, the provision of safe areas to play and walk and roadside barriers to separate cars from children, and the use of road designs forcing lower travel speeds or of raised pedestrian crossings are protective factors.

Controlling vehicle speed is the most important factor in preventing serious injury to child pedestrians and cyclists, as the risk of fatal injury increases exponentially with speed *(9)*. Having safer vehicle bumpers and front ends can also markedly reduce harm by reducing damage to the lower and upper legs and heads of children and adults in the event of a collision. The differential tolerance of children to mechanical force resulting in injury deserves further attention, since knowledge is limited and European regulations need to be better informed by scientific knowledge *(40)*.

Failure to use seat-belts and child restraints is a major hazard, and is more likely to occur after alcohol use in adolescents and adults *(41,42)*. Seat-belts and child restraints are essential for improving the safety of car occupants, reducing injury by 45–55% and 60–95%, respectively *(43)*. Car manufacturers have only recently started incorporating the aim of protecting children (as passengers and pedestrians) in vehicle design. Issues include ensuring that child safety seats are compatible with vehicle interiors and dealing with the differences in safety seats and their placement to protect children as they grow; the latter is such a complex task that many children ride inadequately protected *(44)*. Box 3.2 highlights the effect of alcohol on road injuries.

Wearing helmets reduces the risk of serious injury and death from motorcycle and bicycle crashes. Wearing a motorcycle helmet reduces the risk and severity of head injuries by about 72% and the likelihood of death by up to 39%. The evidence for bicycle helmets shows a reduction of 63–88% in head and brain injury *(45–47)*. Adolescents in many countries question the efficacy of helmets, however, and peer pressure reinforces their unacceptability *(43)*.

Poor conspicuity – the inability easily to distinguish and notice road users – makes children more susceptible to being hit by vehicles. This is true for pedestrians, bicyclists and motorcyclists, and particularly at night. In countries such as Estonia and Finland, over half the crashes involving vulnerable road users happen at night.

Given the inequalities in injury rates between and within countries, the availability and affordability of safety equipment are important factors in ensuring children's safety. A study examining this issue in 18 countries in the European Economic Area found that availability was lower in newer EU Member States. Expressed in terms of hours of work for factory workers using local wage rates, the relative prices of bicycle helmets and child restraints were 3–4 times higher and up to 6.5 times higher, respectively, in such countries as the Czech Republic or Hungary than in countries such as Germany and the United Kingdom. Affordability is likely to be even lower in central and eastern countries in the WHO European Region, as illustrated by an earlier global study that found relative prices for cycle helmets and car child restraints to be 20 times higher and 11 times higher, respectively, in Albania than a HIC such as the United Kingdom. Market forces influence intercountry

BOX 3.2

Binge drinking and RTIs in teenagers in Spain

Two minors died early one morning in a road traffic accident in Sarria (Lugo), Spain. The victims were two 15-year-old girls who were in the rear seats and not wearing seat-belts. Another three young people aged 16–18 sustained severe injuries; one was admitted to the intensive care unit of a nearby hospital with severe cranial trauma, as well as pelvis and femur fractures. The 19-year-old male driver was the only uninjured occupant and tested positive for alcohol. The six young people in the car were returning from a *botellón* ("big bottle") in Sarria, which had been organized by high school students from the city.

A *botellón* involves the gathering of a large number of young people aged 16–24, usually in open spaces, to drink alcoholic beverages bought in shops (usually supermarkets), listen to music and talk. Teenagers often organize these events because of the high prices in bars and being too young to enter bars and clubs. Typically, 1 bottle of alcohol (0.75 litres whisky, rum, vodka, etc.) is consumed per 2–4 people, mixed with ice and a soft drink. The drinks are consumed from shared bottles or one-litre plastic glasses.

Drinking on the street has always been permitted in Spain, but the *botellón* phenomenon appeared in the 1990s and has grown gradually since then. The gathering usually lasts 2–4 hours and is the first thing that many young people do each weekend. In some cities, parties attract over 3000 people every Saturday night, but they can be as big as 70 000 people.

Botellón generates problems besides RTIs: noise, dirt, economic losses to legal businesses, other health consequences and legal issues. While the legal age for buying alcohol in Spain is 18 years, minors are allowed to drink if an adult made the purchase.

Other European countries where binge drinking occurs are the Czech Republic, Germany, the Russian Federation and the United Kingdom.

Source: Information from Ojea A. Four adolescents die in two car crashes in Lugo and Hueva. The driver of the vehicle that crashed in Galicia who was returning from a "botellón" had a positive alcohol test and was not injured. DIARIA SUR, Malaga, Diario Sur Digital, SL. 1 October 2007 (http://www.diariosur.es/20071001/espana/fallecen-cuatro-adolescentes-accidentes-20071001.html, accessed 10 November 2008).

differentials in price and availability; subsidies are needed to keep costs down and retailers need to price equipment more competitively *(48,49)*.

Last, timely and age-appropriate medical care and rehabilitation services are essential to reducing the burden of RTIs.

3.4 What can be done

Several authoritative international reports specifically recommend interventions to reduce motor vehicle injuries *(1,50)*. Table 3.3 reproduces the latest WHO recommendations *(2)*, which this report fully endorses and describes in more detail below. In addition, social responsibility and community awareness should be promoted and road design and speed control improved.

3.4.1 Societal responsibility

Countries in the European Region with lower rates of RTIs have "invested in safety as a societal responsibility", rather than delegating this duty to individuals or organizations *(5)*.

One way to address this societal responsibility is to limit exposure to motorized traffic while encouraging walking and cycling, the use of mass transport and safe routes to and from it: in other words, making walking a healthy and safe transportation mode. Reports from the European Region have shown that only one third of children aged 11–15 years are sufficiently physically active *(51)*. Countries such as Denmark and the Netherlands have actively developed policies and infrastructure that encourage cycling and walking *(5)*, which both decrease reliance on private cars and promote alternative, healthier transportation modes (Box 3.3).

Table 3.3
Key strategies to prevent RTIs among children

Strategy	Effective	Promising	Insufficient evidence	Ineffective	Harmful
Zero-tolerance alcohol laws	✖				
Laws on minimum legal drinking age	✖				
Lower blood alcohol concentration levels	✖				
Mass-media publicity	✖				
Child safety seats	✖				
Booster seats	✖				
Seat-belts	✖				
Motorcycle helmets	✖				
Bicycle helmets	✖				
Graduated driver licensing systems[a]	✖				
Rear seating position	✖				
Education-only programmes for child-seat use			✖		
Designated-driver programmes			✖		
Increasing visibility of vulnerable road users			✖		
School-based instruction programmes for drinking and driving			✖		
School-based driver education[a]				✖	
Airbags and children					✖
Early licensure for novice teenage drivers[a]					✖

[a] Graduated driver licensing systems, school-based driver education and early licensure for novice teenage drivers are less relevant in the European context, since driver's licences are granted to 18-year-olds in most countries.
Source: Peden et al. *(2)*.

BOX 3.3

Safe transportation and promoting physical activity

The National Institute for Health and Clinical Excellence in the United Kingdom has produced evidence-based guidance on promoting and creating built or natural environments that encourage and support physical activity *(52)*. This links wider concerns about physical activity and obesity with road-safety initiatives, ensuring that users of modes of transport that involve physical activity (pedestrians and cyclists) are given the highest priority when streets and roads are developed or maintained. This can be done by:

- reallocating road space to support physically active modes of transport (for example, by widening pavements and introducing cycle lanes);
- restricting motor vehicle access (for example, by closing or narrowing roads to reduce capacity); and
- introducing road-user charging schemes.

3.4.2 Community awareness

Some qualitative studies indicate the importance of community involvement in taking measures to improve safety. For example, adolescents in Barcelona, Spain, are aware of the threat of RTIs and admit that fines, speed-control measures and breath testing for alcohol are effective countermeasures. Nevertheless, they prefer community service to fines, demand information on politicians' decisions on regulations and request increases in public transportation, particularly at night and weekends *(53)*. In the United Kingdom, interviews showed that parents of children aged 9–14 widely appreciate local hazards and support more enforcement and the creation of better pedestrian facilities and safe play areas *(20)*. Boxes 3.4 and 3.5 give examples of community involvement in safety improvements.

3.4.3 Improving road design

Safer road design protects a variety of road users, including the most vulnerable. Area-wide traffic-calming measures have been shown to reduce the number of RTIs by 15% *(56)*. Changes in road design are cost-effective. Estimates based on Norwegian figures show that a variety of road improvements are of proven benefit and that every euro spent on an intervention leads to savings on health care. Table 3.4 shows examples of possible savings *(57)*.

Table 3.4
Possible savings in health care costs from improving road design

Spending of €1 on road design measures	Savings (€)
Simple road markings	1.50
Upgrading marked pedestrian crossings	14.00
Pedestrian bridges or underpasses	2.50
Guard rails along the road side	10.40

Source: data from *Cost effective EU transport safety measures (57)*.

BOX 3.4

The "Streets Ahead on Safety" project, Birmingham, United Kingdom

Birmingham City Council's "Streets Ahead on Safety" project aims to improve road safety and the quality of life in the inner city. Alum Rock is a deprived area in Birmingham, inhabited by people from largely Asian immigrant backgrounds. The area has a poor record of RTIs in children.

This project encouraged a highway authority, engineers and road safety officers to provide local young people with opportunities to participate in decision-making on issues relating to their safe use of the roads and engineering plans for their local community.

The project included 405 young people aged 9–11 years in 5 schools, who conducted environmental audits in the areas near their schools, taking photographs of hazards to pedestrians. Other elements included interactive training in road-safety awareness and citizenship. Road-safety engineers made a video of specific plans for the areas immediately outside schools and the children were able to study maps of the plans. Highway engineers visited the schools, where pupils questioned them on their plans. The children then voted for the plan they thought would be best for their area. Young people were thus encouraged to be stakeholders in their own safety and actively to engage with highway engineers and road-safety officers in developing engineering proposals.

Source: Kimberlee *(54)*.

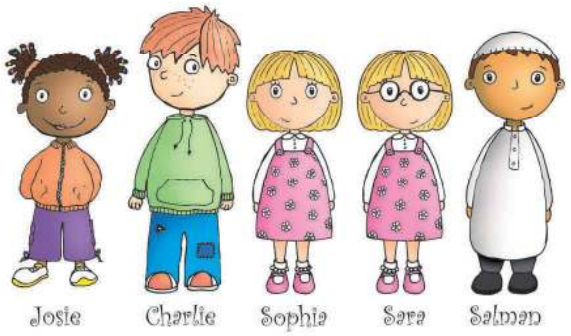
Children questioning road safety engineers on road safety plans in a school

A photograph showing hazards in a road near a school, taken by children conducting a safety audit

BOX 3.5

"Salman and Friends" – involving the local community in developing resources, Blackburn, United Kingdom

"Salman and Friends" offers resources on road safety, designed for children under 5 and created by a group of parents from Blackburn in north-western England, working in partnership with play development workers, the local road safety department and the Neighbourhood Road Safety Initiative funded by the Department for Transport. Blackburn has high levels of social deprivation and child pedestrian injuries.



The resource pack is aimed at parents/carers, who read the stories at home to their children, but any early years' teacher can incorporate it into school sessions. A small group of parents developed the content and format of the books. After an initial ideas session on road-safety issues for this age group, the parents' personal experiences and practical tips were developed into stories.

The pack consists of four storybooks, each conveying a simple but important road-safety message for children to learn and practise as pedestrians when out with their parents or carers. The first book emphasizes the importance of holding hands with a grown-up when out and about, and introduces the concept of the mosque as a setting, as opposed to school. Useful suggestions for parents, carers and teachers and follow-up activities to reinforce each message are given at the back of each book. The books are accompanied by an audio CD containing songs; these are available in English, Urdu, Hindi, Bangla, Punjabi and Gujarati.

Source: Salman and Friends [web site] *(55)*.

3.4.4 Speed

Setting and enforcing speed limits, regulating traffic and making the overall speed more consistent have been shown to help prevent crashes involving pedestrians and cyclists (43). In determining speed limits, consideration needs to be given to road function, traffic composition, types of road user and road design. In this respect, controlling the speed and volume of traffic in urban areas and separating traffic from vulnerable road users are critical factors. This can be achieved by setting and enforcing speed limits of less than 30 kph in heavy pedestrian areas *(58)*, reducing traffic volume, using physical traffic-calming measures such as speed bumps or building cycle lanes and pedestrian walkways.

Concern has been expressed in many countries about reducing mortality and disability in pedestrians and cyclists *(59,60)*. Local knowledge and action are needed to develop measures for traffic calming and volume reduction around schools and residential areas, especially in low-income neighbourhoods.

3.4.5 Alcohol

Most EU countries have an upper limit of blood alcohol concentration of 0.05 g/dl or less, with exceptions at 0.08 mg/dl: Malta and the United Kingdom *(61)*. Most countries in the CIS have a limit of zero *(14)*. This limit is recommended for drivers under 21 years *(62)*. High-visibility random breath testing, as part of enforcement, is highly cost-effective in discouraging drink–driving: estimates suggest that every euro spent on this would save €36 *(57)*.

Tolerance limits vary in practice, however, with some countries reporting poor enforcement and penalties too light to act as deterrents *(14)*. Variation is also found in the visibility of public awareness campaigns, police jurisdiction to undertake testing without due cause and controlling of sales of alcohol to young people.

3.4.6 Child car restraints, seat-belts and seating position

Cost–effectiveness studies show that every euro spent on child restraints saves €32 in health care spending *(63)*. The use of seat-belts and child seats has been widely proven to lead to economic savings *(64,65)*, and it can be maximized through legislation and enforcement, accompanied by educational campaigns. Legislation, parental knowledge, availability, cost and accessibility influence the use of child restraints. Community-based approaches – consisting of educational initiatives and loan schemes or subsidization – ensure the inclusion of lower-income families. Proper use of restraints according to children's height or age may be a problem even in countries with high usage, and appropriate instruction is required.

Legislation in the 1980s and early 1990s in Europe promoted placing children in vehicles' rear seats. Although most recent regulations only emphasize the need for appropriate restraint, until recently children in Europe were more likely than those in other developed countries to be placed so *(66)*. Many studies, although none specific to Europe, assess the improved safety of rear-seat placement, even when children and adolescents are appropriately restrained, and this is particularly true for vehicles equipped with airbags for front-seat passengers *(44)*.

3.4.7 Helmets

While wearing a helmet when riding a motorcycle is a legal requirement in many countries, enforcement is required to increase rates of use and supplementing enforcement by educational campaigns leads to further gains. Helmet distribution programmes, to help meet the costs for schoolchildren from lower-income households, have been shown to increase uptake among those difficult to reach.

Cycle helmets are of proven efficacy in reducing head injury *(67)*. Estimates show that each euro spent on cycle helmets leads to a saving €29 in health care spending *(63)*. A range of measures in different contexts is used to promote cycle-helmet use, including both non-legislative and legislative approaches. Among the former, community-based approaches including the free provision of helmets and an educational component are somewhat more efficacious than school-based education and subsidized helmets for schoolchildren *(68)*. Legislation, especially in conjunction with information campaigns, has been shown to be effective in increasing helmet use *(67)*.

3.4.8 Conspicuity

Specific measures to increase conspicuity improve detection by drivers *(69)*. For pedestrians, measures include people's wearing reflective strips or light clothing and walking facing oncoming traffic. Cyclists can wear reflective clothing and use bicycle lamps, and front, rear and wheel reflectors. Motorcycle riders can use daytime running lights, and wear reflective clothing and white or light-coloured helmets.

Improving street lighting benefits all vulnerable road users; urban and road planners should improve lighting, particularly in areas of high traffic and population density. Every euro spent on road lighting is estimated to save €10.70 in health care spending *(57)*. Motor vehicles' using running lights in daytime eases detection by other road users, with a 15% and 10% reduction, respectively, in pedestrians and cyclists hit by cars after introduction of the measure *(38)*.

3.5 Conclusions

Children need special consideration as vulnerable and inexperienced road users. A failure to safeguard the roads compromises their fundamental right to safety. The European Region shows large disparities in deaths from RTIs, with a threefold difference between the countries with the highest and lowest rates. Inequalities in RTIs by socioeconomic class within countries are a growing concern. The inequalities in the Region reflect important differences in exposure to risk, environmental risk factors and enforcement practices. Such inequities in health should be addressed as a matter of social justice.

In the WHO European Region, RTIs are the leading cause of death and disability in children and adolescents, and have significant and substantial non-fatal and long-term consequences. The challenge to reduce the inequalities is also an opportunity to tackle the problem as a societal responsibility and by introducing structural community-based interventions that will provide efficient solutions to all, regardless of class (Box 3.6).

BOX 3.6

Key policy messages

- RTIs are a leading cause of death in children in the Region, and large variations exist both between and within countries, largely related to socioeconomic status.
- Unsafe road design, speed, excessive alcohol intake and failure to use safety devices are the leading risk factors.
- Preventing RTIs requires action from different actors and the integration of safety measures into broader transport and urban development policies.
- Promoting cycling and walking as part of transport policy has other health and environmental benefits.

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