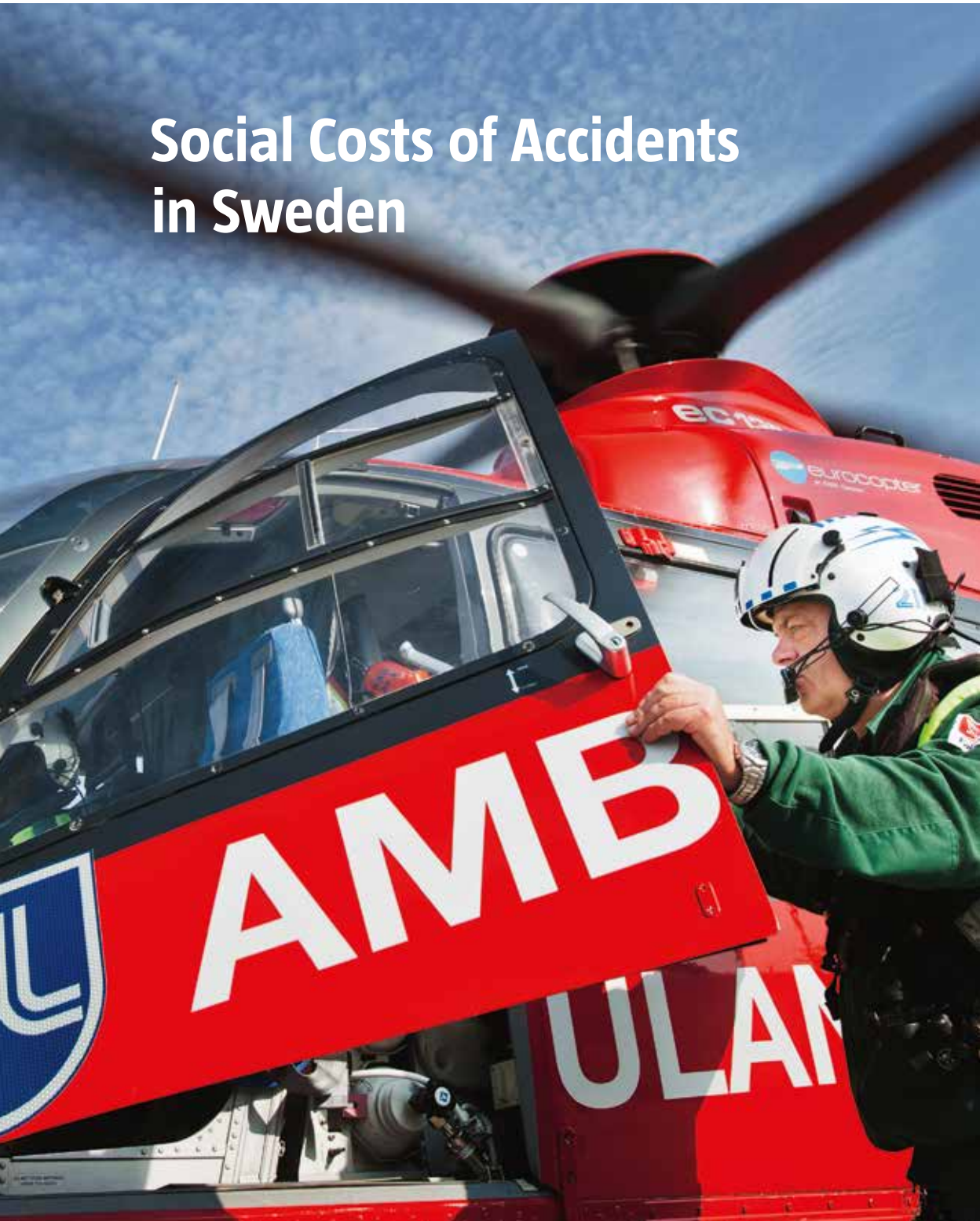
Swedish Civil Contingencies Agency

Social Costs of Accidents in Sweden



Social Costs of Accidents in Sweden

Social costs of accidents in Sweden

Swedish Civil Contingencies Agency (MSB)

MSB:s contact:
Linda Ryen, +46 (0)10-240 56 64

Layout: Advant Produktionsbyrå AB

Order No. MSB492 - December 2012
ISBN 978-91-7383-290-8

Preface

Injuries due to accidents represent a large welfare loss to society. Most of us can on a personal level relate to the human tragedies caused by such injuries. To the individual, accidents may seem random and unpredictable. This is however not the case when the problem is viewed from a societal level. One may be amazed by the predictability of the burden of injury – due to the loss of life, subsequent quality of life, pressure on societal services, and the cost – which is borne by all of us, year after year.

One may also be amazed by the lack of reviews in this area, to guide decisions, resource distribution and prioritizing. Such reviews can be made in different ways and the burden of injury may be quantified by different measures. This report is a summary of the broad work aimed at describing the burden of accidents in monetary terms. Calculations are made using an established method – cost of illness (COI) – where direct as well as indirect costs due to accidents are taken into account.

It might be appropriate to stress that the costs included are those that arise due to accidents, after their occurrence. Hence, costs due to societal emergency prevention are not included.

This is a summary of a more comprehensive report published in Swedish: *Samhällets kostnader för olyckor* (MSB 340-11). The full report is available in Swedish at www.msb.se.

Summary

This report describes the costs that arose due to the accidents that occurred in Sweden in 2005. The total cost for these accidents is estimated to €6.4 billion in 2005 prices[1]. Direct costs, i.e. resources used due to these accidents, amounted to €3.7 billion, which is equivalent to 60% of total cost. Indirect costs, i.e. production losses, amounted to €2.7 billion, which is equivalent to 40% of total cost. The distribution of costs by incident type is presented in the table below.

	COSTS (BILLION €)		
	Direct	Indirect	Total
Fires	0.56	0.06	0.62
Road traffic accidents (RTA)	1.31	0.94	2.25
Drownings	0.01	0.07	0.08
Falls	1.36	1.01	2.37
Other incidents	0.43	0.60	1.03
Total	**3.67**	**2.68**	**6.35**

Table 1. Social costs (billion €) by incident type

Cost estimates for injuries are based on the following figures regarding fatalities, major and minor injuries. The choice of base year for estimating total cost has only small significance for the total level, since the number of accidents is relatively stable over time. Separate types of accident or costs can be more or less affected by the development. During the year studied, 3,000 people died following accidents, 110,000 people suffered severe injuries and about half a million suffered minor injuries.

1. The original estimate of SEK 59 billion was converted to euros by the average exchange rate in 2005 of 9.3 €/SEK.

	FATALITIES	SEVERE INJURIES	MINOR INJURIES
Fires	109	604	1,058
RTA*	440	14,063	42,233
Drownings	120	320	-
Falls	1,527	74,875	192,000
Other incidents	814	19,372	263,200
Total	**3,010**	**109,234**	**498,491**

Table 2. Injury statistics used for cost estimation *Road traffic accidents

In an economic societal analysis, like COI, all actors are included in the definition of society - government, municipalities, health authorities, the private sector, and individuals. The cornerstone of all economic analysis is that resources are scarce and that each time resources are used, we are unable to use it for anything else. This is what is called the opportunity cost principle and is the basis for the estimations in this study. Market prices and public sector expenses can often be used as measures of the opportunity cost, which in the short-term might lead to an over-estimation of costs due to the presence of fixed costs. In the long-term, however, all costs are variable.

Accidents generate costs before, during and after their occurrence. In this study, costs generated before the accidents (prevention work) are not included. As a starting point for estimations, an incidence or life time approach is used, which means the sum of costs from the accident and onwards for all accidents happening in a given time period.

Methodology

Cost of illness (COI) is a methodology used to summarize and describe the economic consequences of diseases or injuries, often those occurring in a certain time period, e.g. a specific year. This study presents estimates of the social costs of accidents in 2005. Some important concepts and definitions are summarized here:

Society is more than the public sector
Often the term society is used to describe the public sector activities pursued by the government, county councils and communities. In this social cost estimation for Sweden all costs are included; whether they are carried by the public sector or private actors like industry or individuals.

Opportunity cost principle
The traditional approach to perform a COI is based on the opportunity cost principle, defined as the value of the lost opportunity to use resources consumed or lost by accidents in any other way. All economic analysis is based on the fact that resources are scarce and once a resource is used in one way you have lost the opportunity to use it in any other way. Thus, it is the value of what you have to refrain from due to diseases or accidents that is estimated in COI studies.

The opportunity cost concept entails two important implications: first, it implies both a wider and narrower cost definition than payments. Wider, since there can be costs in the absence of payments. For example, the time lost by individuals due to medical treatments is a cost. Narrower, since there can be payments without costs. Sickness benefits are paid by the Social Insurance Office representing an income to the individual, but from the societal perspective no resources are lost since money only is being transferred.

Secondly, to estimate costs it is necessary to identify an alternative for comparison, i.e. what we would have had if no resources were used or lost due to accidents. Thus, zero accidents are used as the point of comparison, and all cost estimations concerns what resources are sacrificed due to accidents.

One should be aware that the point of comparison, zero accidents, in many aspects is a utopia and that there is no linear relationship between costs and accidents. If the number of accidents is decreased by 50 percent this does not necessarily mean that costs are decreased at the same rate.

The difference between average and marginal costs
The difference between average and marginal costs lies in whether costs are estimated in the short or long run. Marginal cost is the extra cost incurred by one more accident and average cost is calculated by dividing total cost by the number of accidents.

In the long run, all costs are variable. In the short run however, some costs are fixed and do not vary with the number of accidents. In a COI study, the aim is to estimate total cost and thus, the average cost is theoretically correct. When used in economic evaluations however, average costs can be misleading since it does not show the extra cost/benefit resulting from an intervention. In that case, marginal cost is the correct opportunity cost.

Costs emerge before, during and after accidents
Accidents generate costs before, during and after occurrence. All costs are not incurred in connection to the event but years later. Costs emerging in following years are discounted by 4 percent due to the opportunity cost of money spent today.

Before an accident happens, the actual risk leads to resources spent on prevention. Prevention could aim at lowering the risk for the event to happen or at mitigating the consequences when it happens. Prevention costs are not included in the cost estimations in this report.

Costs emerging *during* or in immediate connection to the event are generally labeled *direct costs.* This means that resources are exhausted. Examples are costs for medical treatment or rescue service responses. The ambition is to measure the opportunity cost of these resources which is defined as the value of the alternative use of the resources that would have been possible if the accident had not happened. In other words, resources used to treat someone injured in an accident cannot at the same time be used to treat cancer or other illnesses.

After the accident, *indirect costs* emerge. Indirect costs are resources lost or not developed. One example is production loss as a result of sickness leave, early retirement and fatalities. Another type of cost emerging after the accident is the human cost or human value due to the loss of quality of life experienced by those injured. This loss is however not included here.

Definition of injuries
Based on injury statistics it is difficult to distinguish between minor and severe injuries. Here, severe injuries are those requiring in-patient care whereas minor injuries require out-patient care. This is of course a simplification of reality, since a person can be admitted as an inpatient for observation and thus be considered severely injured whereas a person with a whiplash injury, with lifelong consequences, can be treated as an outpatient.


Olycka

Social costs of accidents

In 2005, more than 3,000 people died as a result of accidents. Almost 110,000 people suffered severe and 500,000 minor injuries. The calculations presented, when it comes to injuries, are based on the following distribution of fatalities, severe and minor injuries.

	FATALITIES	SEVERE INJURIES	MINOR INJURIES
Fires	109	604	1,058
RTA*	440	14,063	42,233
Drownings	120	320	-
Falls	1,527	74,875	192,000
Other incidents	814	19,372	263,200
Total	**3,010**	**109,234**	**498,491**

Table 3. Injury statistics used for cost estimation *Road traffic accidents

Results

The total social cost for accidents occurring in 2005 is estimated at €6.4 billion in the 2005 price level, corresponding to €7 billion in 2011[2, 3]. Almost 60%, €3.7 billion, are direct costs. The remaining €2.7 billion, just above 40%, are indirect costs due to production loss. In table 4, costs distributed by the types of costs included are presented.

2. Using the 2005 exchange rate of 9.3€/SEK.
3. Using the CPI for price level conversion.

	TOTAL COSTS	SHARE
Direct costs		
Property damage	1,337	21%
Residential care/nursing homes	870	14%
Inpatient care	642	10%
Outpatient care	299	5%
Insurance administration	212	3%
Transport	97	2%
Rehabilitation	90	1%
Pharmaceuticals	54	1%
Judicial system	42	1%
Social insurance administration	16	0%
Emergency service	14	0%
Indirect costs		
Production loss	2,683	42%
Total	**6,356**	**100%**

Table 4. Social costs for accidents occurring in 2005 (million €)

The social cost is dominated by falls and road traffic accidents (RTA). Altogether, these accidents represent nearly 75% of total costs. Fires represent 10%, drowning just above 1% and other accidents 16 %. Costs by type of incident are presented in table 5 and percentage shares in figure 1.

	COSTS (BILLION €)		
	Direct	Indirect	Total
Fires	0.56	0.06	0.62
RTA	1.31	0.94	2.25
Drownings	0.01	0.07	0.08
Falls	1.36	1.01	2.37
Other incidents	0.43	0.60	1.03
Total	**3.67**	**2.68**	**6.35**

Table 5. Social costs by incident type

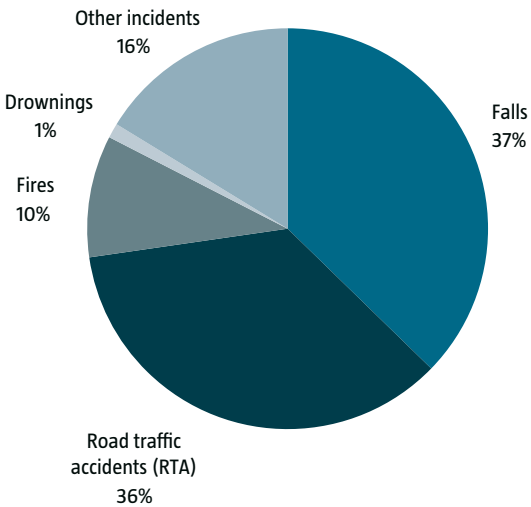


Figure 1. Distribution of social costs by incident type

Accidents differ by type regarding the costs that dominate. A comparison between direct and indirect costs is presented in figure 2. For fires, direct costs represent 90% of total cost which mainly can be explained by property damages. Due to data uncertainty regarding property damages, it is probable that the share of direct costs in reality is even higher. For drowning, it is the opposite case: 90% of costs are indirect. This can be explained by small property damages and low future care costs.

Costs due to falls and road traffic accidents are evenly distributed between direct and indirect costs. For other accidents the share of direct costs is somewhat lower and in total, the direct cost share is just below 60%.

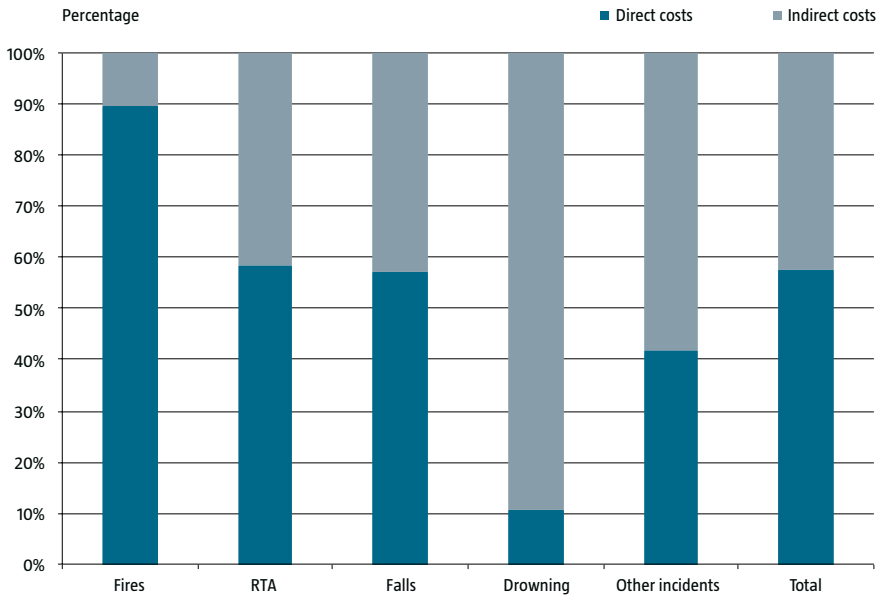


Figure 2. Distribution of direct and indirect costs by incident type

Who bears the cost?

Distributing social costs by cost carrier is a difficult task. There is often an interest of knowing what actors primarily carry the costs due to accidents, but it is at the same time important to be aware that the distribution by cost carrier depends on what time perspective is taken. In the long run, non-incurred costs in the absence of accidents would favor other than those carrying the costs in the first place. In the long run, lower social costs will turn into lower costs for individuals, for example by lower insurance fees or taxes. In the short run however, accidents mean that those carrying the costs in the first place cannot use the resources consumed by accidents to other activities. The final carrier of costs, however, is always the individual as injured, tax payer, employee or relative.

The distribution of total social cost by cost carrier is presented in figure 3. The private sector, i.e. industry and individuals, carry 67% of the cost whereas the public sector costs amount to the remaining 33%. Within the public sector, county councils (responsible for hospital care) carry the largest part.

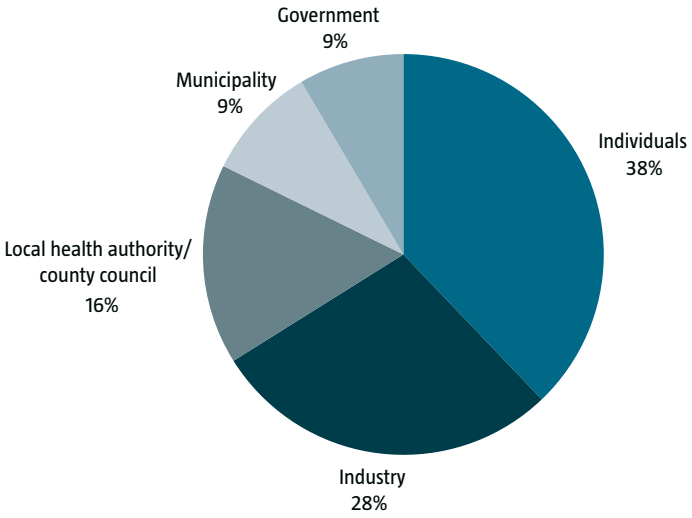


Figure 3. Distribution of social costs by cost carrier

Injury related costs

About €4.8 of €6.4 billion are related to injuries and can be distributed by age and gender. When it comes to property damages there is often no way to link those to individual characteristics, which is also the case for some administrative costs and for rescue services costs.

Gender

From the €4.8 billion that can be related to injuries, 57% are due to injuries suffered by men. If only direct costs are considered, costs are distributed more evenly between men and women. This can be explained by direct costs due to falls among elderly women.

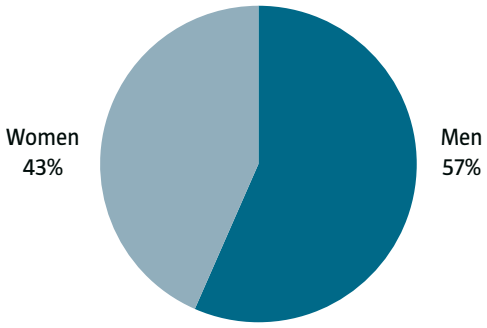


Figure 4. Injury related costs by gender

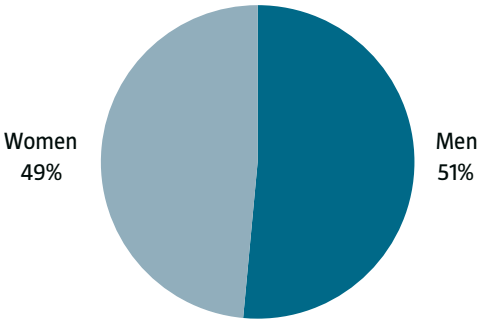


Figure 5. Injury related direct costs by gender

In figure 6, costs are distributed by gender and type of incident. Except for falls, accidents suffered by men generate the highest costs. Only studying direct costs (figure 7) does not change the conclusions.

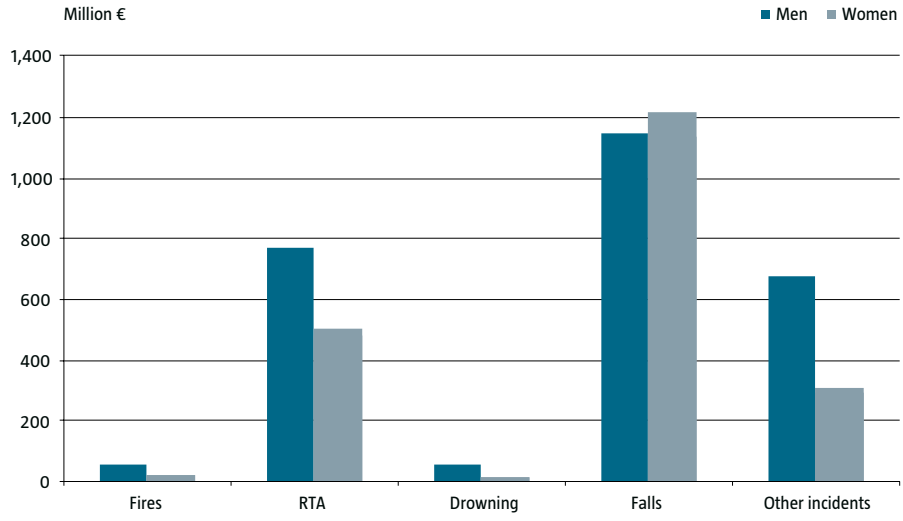


Figure 6. Injury related costs (million €) by gender and incident type

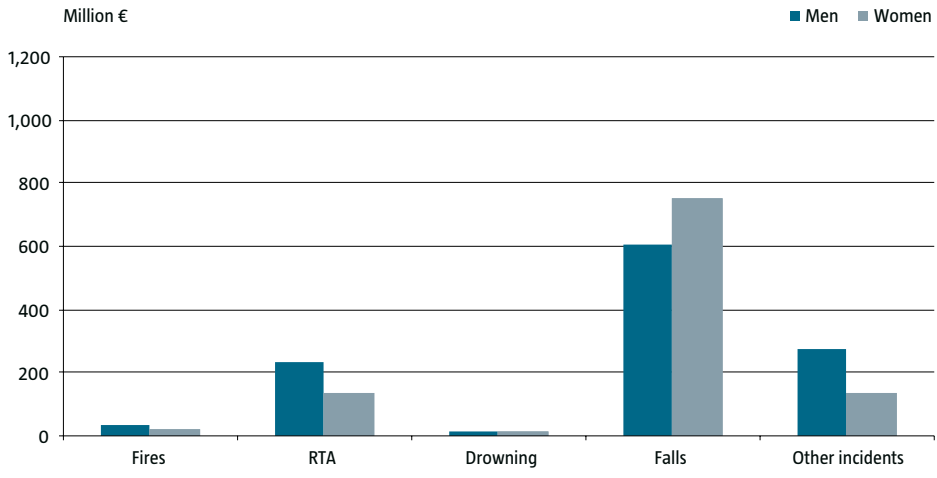


Figure 7. Injury related direct costs (million €) by gender and incident type

Age

Distributing costs by age (figure 8), accidents suffered by children and teenagers (0-19 years) answered for 14% of the costs, adults between 20-64 years 60% and those above 65 years of age 26%. In this study, production loss from engaging in work at home is

included, but the cost for accidents among elderly is still affected by the fact that no production loss from paid work is included. If only direct costs are considered (figure 9), costs are divided more evenly between the age groups 20-64 years and 65+ years with about 40% each, while accidents in the youngest age group give rise to 20% of the costs.

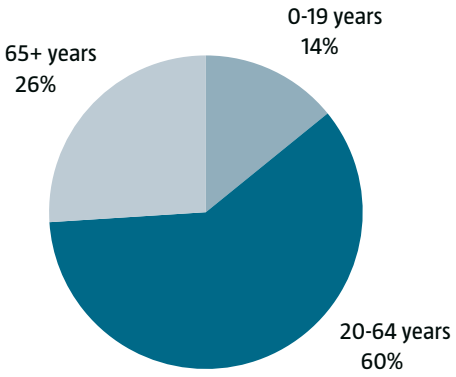


Figure 8. Injury related costs by age

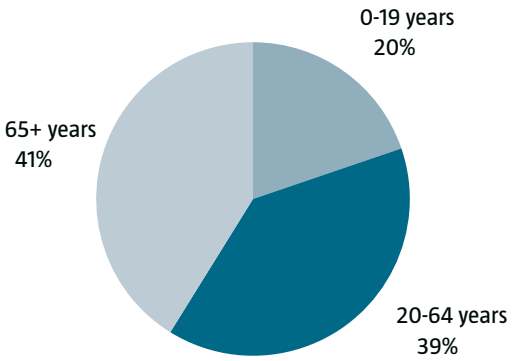


Figure 9. Injury related direct costs by age

In figure 10, injury related costs are distributed by age and type of incident. For all incident types, costs generated by those 20-64 years are the highest, which not least depends on the fact that this is the largest group. For road traffic accidents and other

accidents, costs generated by the young are larger than those generated by the elderly while the opposite is true for falls, fires and drowning. If only direct costs are considered (figure 11), the oldest age group dominates cost for falls. This mirrors the large number of elderly suffering falls, which is not as obvious when production loss is included. For all other types of incident, those between 20-64 years generate the highest direct costs.

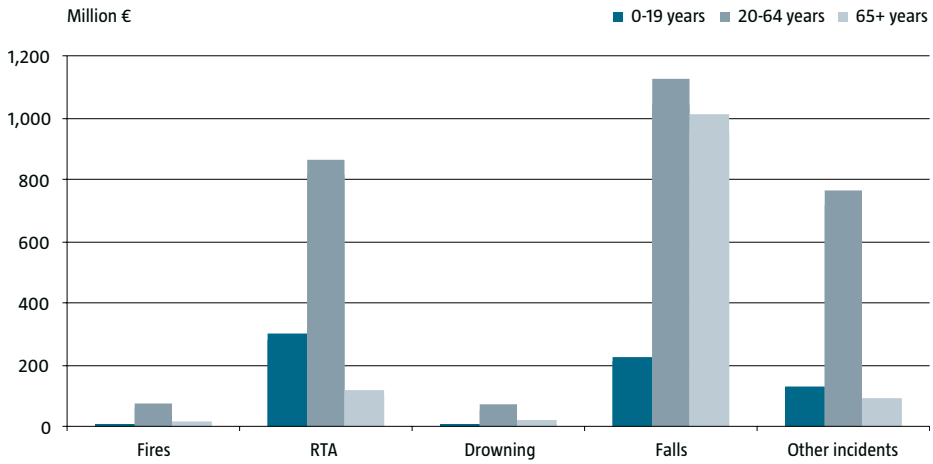


Figure 10. Injury related costs (million €) by age and incident type

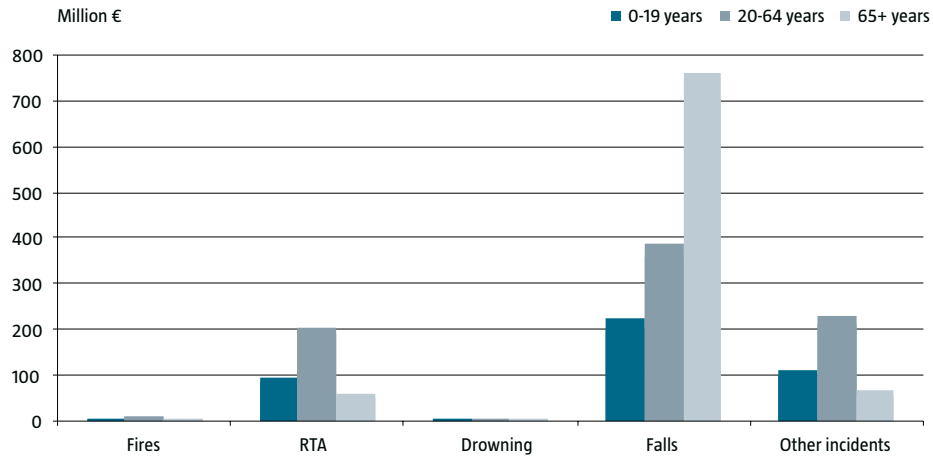


Figure 11. Injury related direct costs (million €) by age and incident type

Severity

Severe injuries, requiring inpatient care, generate almost 70% of total injury related costs. Costs due to fatalities represent 20% of costs and minor injuries 12%.

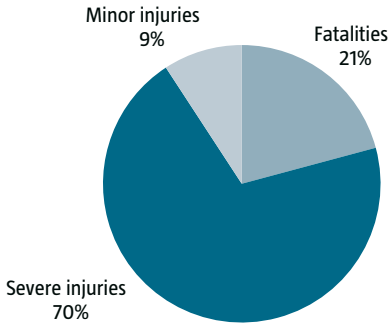


Figure 12. Injury related costs by severity

Figure 13 shows the distribution of costs by injury severity and type of incident. Costs due to severe injuries are the highest for all incident types except for drowning and fires, where costs due to fatalities dominate.

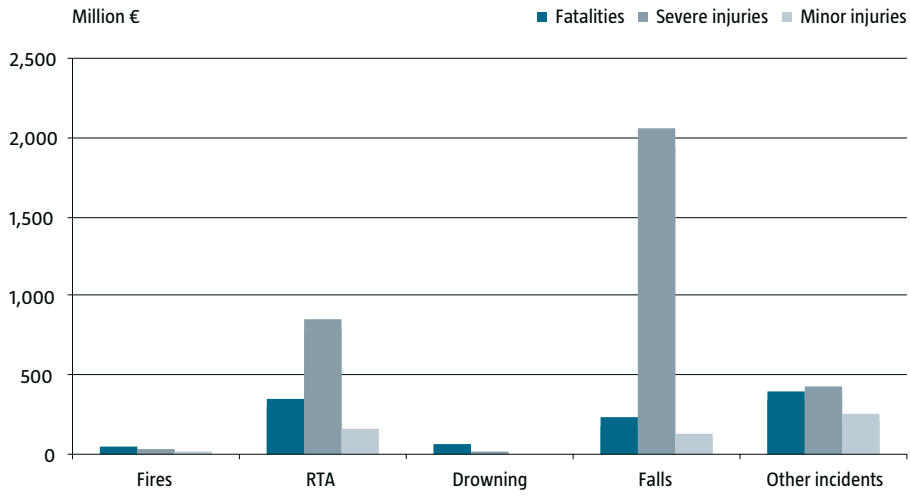


Figure 13. Injury related costs (million €) by severity and incident type

Property damages

Property damages are heavily dominated by costs due to fires and road traffic accidents. Total costs for property damages amount to €1.3 billion. Property damages generated by road traffic accidents amount to €0.85 billion and by fires to €0.45 billion. There is reason to believe that property damages due to fires are underestimated because of problems in gathering reliable data, mainly on the community level. Costs are estimated based on insurance data and the mandatory road traffic insurance makes it easier to find data regarding road traffic accidents. Also for other incident types than fires, there are difficulties finding reliable data regarding property damages.

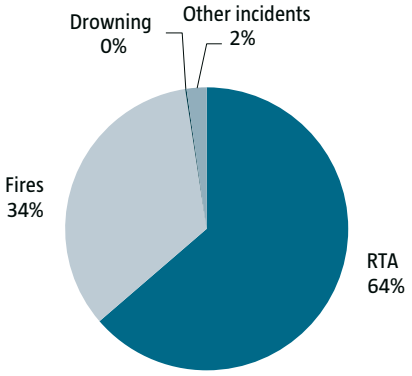


Figure 14. Property damages by incident type

Indirect costs (production loss)

In total, indirect costs due to accidents occurring in 2005 amount to €2.7 billion. About half the costs comes from production loss from paid work and the other half from loss of household work. Figure 15 shows the distribution of production loss between paid work and household work by incident type and in total.

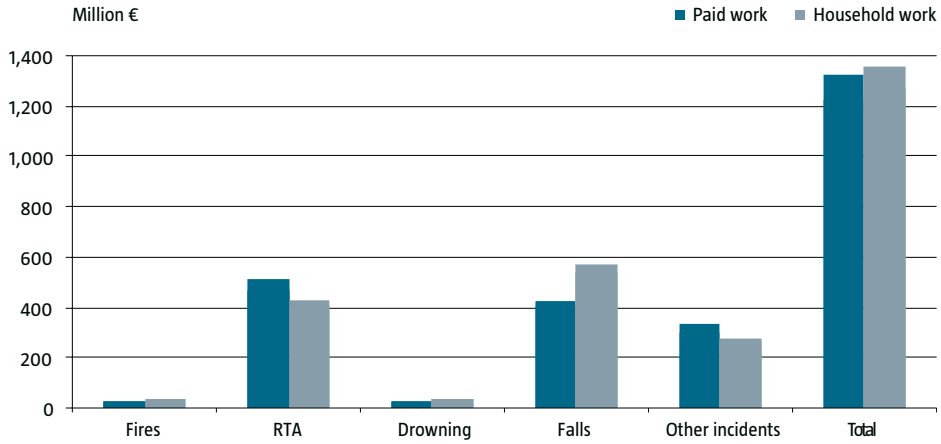


Figure 15. Production loss (million €) from paid work and household work

Figure 16 shows the distribution of total production loss by types of absence. About 50% of the loss is due to long-term absence and 36% of the loss to fatalities.

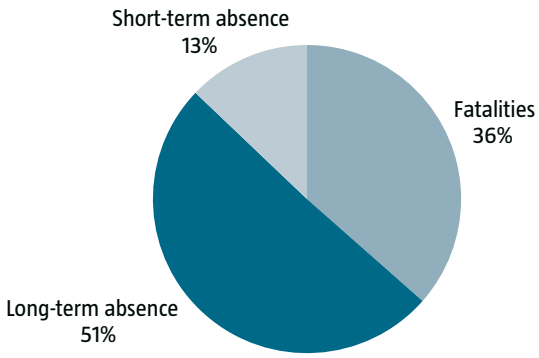


Figure 16. Production loss by type of absence

Incident types differ according to what kind of absence generates the highest cost, as presented in figure 17. In the case of falls and road traffic accidents, the highest loss is due to long-term absence while fatalities cause the highest production loss for other accidents types.

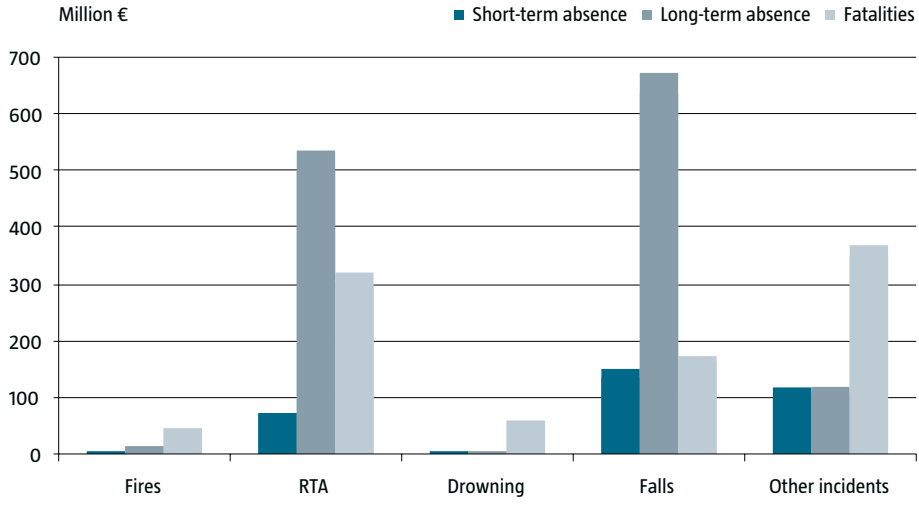


Figure 17. Production loss (million €) by type of absence and incident

Conclusions

Costs presented in this study are estimations of the "true" cost. In a number of cases, data is uncertain and assumptions are made. Estimations regarding different incident types are however based on the same methodology and are, as far as possible, also based on similar assumptions, enabling reliable comparisons between cost and accident types. Thus, relative rather than absolute costs are the most important result in this study.

Social costs resulting from accidents partly paint a different picture regarding the consequences of accidents than do accident statistics. Social costs for falls and road traffic accidents are of similar size according to the estimations in this study. According to injury statistics, falls lead to half of the fatalities due to accidents, to 70% of all severe injuries and to almost 40% of minor injuries. Road traffic accidents are reason to 15% of deaths, 13% of severe injuries and less than 10% of minor injuries. There are several reasons to the fact that social costs despite this are similar:

- The age structure of those affected. Since those killed or injured in road traffic accidents on average are younger than those suffering from falls, the number of years with production loss and other future costs are higher for road traffic accidents.
- Those injured in road traffic accidents suffer relatively more severe injuries, requiring more care for a longer time period which leads to higher medical costs.
- Road traffic accidents also bring about substantial property damages and administration, which is not the case for falls. On the other hand, in- and outpatient care costs and costs for residential care are higher for falls.

This illustrates that the numeracies of fatalities and injuries do not tell the whole story about the burden of accidents to society. It is also of importance which age groups are affected, if injuries lead to hospital care and/or future disability and if there

are property damages as well. The distribution of costs between different cost carriers gives a hint about what actors in the first place benefit from decreasing the number of accidents, which can be important when setting priorities and financing prevention measures.

It deserves to be stressed that human value is not included in the estimations. This means that human life is valued according to the production, in paid work or household work, lost due to premature deaths or injuries. The implication is that the social cost due to loss of life and health is missing.

One should be aware of the fact that there is no linear relationship between the number of accidents and costs. Halving the number of accidents does not necessarily mean that cost is decreased accordingly. Sensitivity analyses show that decreasing the number of fatalities due to falls by 10% decreases the social cost of falls by less than 1%. If the number of severe injuries is decreased by 10%, social cost is decreased by 6%.

The cost estimated here is the total cost and dividing cost by number of accidents results in an average cost per accident. In reality, average cost does not correspond to the marginal cost decrease resulting from one less accident which partly can be explained by the presence of fixed costs.

The fact that accidents give rise to high costs does not automatically imply that there are large economic benefits for society in decreasing the number of accidents. If total social cost should decrease, i.e. the sum of costs for accidents and prevention, the preventive measures taken need to be cost efficient.

Swedish Civil Contingencies Agency (MSB)
SE-651 81 Karlstad Phone +46 (0)771-240 240 www.msb.se/en
Order No. MSB492 - December 2012 ISBN 978-91-7383-290-8