

Long Term Consequences of Road Accidents

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Abstract

When assessing the consequences of accidents normally the injury severity and the damage costs are considered. The injury severity is either expressed within the police categories (slight injury, severe injury or fatal injury) or the AIS code that rates the fatality risk of a given injury. Both injury metrics are assessing the consequences of the accident directly after the accident. However, not all consequences of accidents are visible directly after the accident and the duration of the consequences are different. Besides a physiological reduction of functionality social and psychological implications such as reduced mobility options, problems to continue the original job etc. are happening.

In order to assess long term consequences of accidents the MHH Accident Research Unit established a brief questionnaire that is distributed to accident involved people of the Hannover subset of the GIDAS data set approx. one year after the accident beginning with the accident year 2013. The basic idea of using a brief questionnaire (in fact only one page) is to obtain a relatively large return rate because the questionnaire appears to be simple and quickly answered. This appears to be important because it is believed that the majority of accident involved people will not report long term consequences. In order to allow a more detailed survey amongst those responders that are reporting long term consequences they are asked for a written consent for the additional questionnaire that will be distributed at a time that is not yet defined.

Long term consequences are reported for all addressed areas, medical, physiological, psychological and sociological by people without injuries, with minor injuries and with severe injuries.

NOTATION

<i>HGV</i>	<i>Heavy Goods Vehicle</i>
<i>PTW</i>	<i>Powered Two-Wheeler</i>
<i>RTC</i>	<i>Road Traffic Casualties</i>

INTRODUCTION

Historically the severity of the consequences of road traffic accidents is assessed by the injury severity. However, this approach normally considers the short term consequences only. It remains unclear whether the victims are completely recovering from the accident or long term consequences will remain (except for fatal accidents). Long term consequences can generally be distinguished into medical, physiological, psychological, mental and social burden. In the last years a number of long term studies have been conducted [1-7]. However, most of these studies were focussing on severely injured Road Traffic Casualties (RTC). By focussing on severely injured people long term consequences of uninjured and slightly injured people are neglected. This appears to be a problem because the large majority of people being involved in road traffic accidents are not injured or only slightly injured. In order to get an impression of the kind of long term consequences and the extend of the problem the Hannover team of the GIDAS accident collection project started with the accident year 2013 a survey amongst the accident involved people asking for long term consequences by a brief questionnaire.

STUDY DESIGN

The Hannover team of GIDAS [8] collects accidents as a representative sample of the Region of Hannover. In this 2,291 square meter large region there are 1.1 million inhabitants living. Approx. 10% of the region is urban area what is comparable to Germany. In addition the distribution of different road types (urban, rural, highway etc.) of the road net in the collection region is comparable to the German road map. This is important to facilitate a representative data collection for Germany. The data collection takes place in in two alternating shifts every day in order to address all weekdays, and all day times in the same way.

Since the accident year 2013 all people being involved in any of the collected accidents in the Hannover area that declared their informed consent for the collection of personal data are approached approx. one year after the accident by a one page interview sheet sent by normal mail. The questionnaire is designed as a very short questionnaire on purpose in order to increase the number of returns. It is planned to contact the people with reported long term consequences later with a more comprehensive questionnaire. This step has not yet begun.

It has to be noted that since 2014 the written consent was collected directly at the scene when possible. Before, it was collected by return mail. The step towards collecting the consent at the accident scene increased the number of returns and thus for this study the number of people being included in the study.

The distribution of addressees across the years is as follows:

2013: 603

2014: 1046

1st quarter of 2015: 330

According to the GIDAS accident collection requirements the inclusion criteria for the long term consequence study are:

- having been in a road traffic accident (according to the German definition of road traffic accidents involving at least one moving vehicle on a public accessible road);
- at least one injured accident participant;
- the crash having occurred in the Hannover Region (population of 1,1 million inhabitants);
- informed consent available of the receiver of the questionnaire

The questionnaire could be answered by the addressees via a paper version or an online version of the questionnaire. In addition there was the possibility to answer by phone.

The questionnaire covers the main topics of the standard SF36 questionnaire but in less detail. Besides questions to the duration of consequences and sick leaves, people were also asked whether or not they are still using medication because of the accident, whether or not they needed to move house or to modify their home and concerning their health status, their performance compared to before the accident and disabilities resulting from the accident etc.

In total 1979 people were approached – of them 608 answered so far.

The distribution of traffic participation and injury severity for all people involved in the collected GIDAS accidents in Hannover between 2013 and 1st quarter of 2015 as well as the approached people and the people that answered the questionnaire are shown in Table 1..

Table 1: Distribution of traffic participation and MAIS of the collected accidents in the study time, included people and people that answered the questionnaire

	mode of transport								total
	car	HGV	bus/coach	PTW	bicycle	pedestrian	tram	other	
all	4,703	445	54	412	1,079	371	58	21	7,143
uninjured	2,961	326	32	22	88	34	44	17	3,524
MAIS 1	1,554	92	21	280	817	229	12	3	3,008
MAIS 2	76	8	0	71	101	58	2	0	316
MAIS 3	26	9	0	23	25	22	0	0	105
MAIS 4	7	1	0	1	1	5	0	0	15
MAIS 5	4	2	0	2	2	6	0	0	16
MAIS 6	1	2	0	0	1	1	0	0	5
MAIS 9	74	5	1	13	44	16	0	1	154
included in survey	1,066	86	6	143	364	114	13	8	1,800
uninjured	545	54	3	6	14	6	7	6	641
MAIS 1	458	27	3	92	291	64	5	2	942
MAIS 2	41	1	0	29	42	29	1	0	143
MAIS 3	16	3	0	13	14	13	0	0	59
MAIS 4	1	0	0	1	0	0	0	0	2
MAIS 5	0	1	0	0	0	0	0	0	1
MAIS 6	0	0	0	0	0	0	0	0	0
MAIS 9	5	0	0	2	3	2	0	0	12
responded to survey	338	19	2	60	151	33	2	3	608
uninjured	170	10	1	3	5	1	1	1	192
MAIS 1	144	7	1	35	116	16	1	2	322
MAIS 2	17	0	0	15	20	10	0	0	62
MAIS 3	4	2	0	5	9	6	0	0	26
MAIS 4	1	0	0	1	0	0	0	0	2
MAIS 5	0	0	0	0	0	0	0	0	0
MAIS 6	0	0	0	0	0	0	0	0	0
MAIS 9	2	0	0	1	1	0	0	0	4

RESULTS

It appears sensible to relate the answers to the number of approached people – it is expected that the number of returns is considerably higher for people with long term consequences than for those without. Following that percentages are calculated based on the number of approached people except for the questions concerning sick leave and the duration of consequences.

In total 362 people reported that they were still suffering from the accident one year after the accident. The duration of suffering generally depends on the injury severity using the MAIS metrics, see Table 2. It is sensible to note that even initially uninjured people did suffer from the accident with a median duration of 14 days. For the more severe injuries the duration of suffering increases drastically for MAIS 2+ injured RTC.

Table 2: Average duration of suffering dependent on MAIS (average based on no. of people that reported suffering)

MAIS	average duration of suffering [days]	median duration of suffering [days]	no. of people with reported suffering time	no. of people asked	no. of people responded
uninjured	43	14	25	641	189
MAIS 1	107	45	253	942	314
MAIS 2	247	360	56	143	59
MAIS 3	287	360	23	59	24
MAIS 4	225	225	2	2	2
unknown MAIS	260	360	3	12	3
all	138	60	362	1,800	591

Regarding sick leave times there are answers of 578 people available of which 225 reported on sick leave. Again also people that are initially not injured reported on sick leaves with a median duration of 3 days. In total sick leave time increases with injury severity, see Table 3.

Table 3: Average duration of sick leave dependent on MAIS (average based on no. of people that reported sick leave) (* no. of responses is too low for further processing)

MAIS	average duration of sick leave [days]	median duration of sick leave [days]	no. of people with reported sick leave	no. of people asked	no. of people responded
uninjured	7	3	9	641	189
MAIS 1	27	14	155	942	307
MAIS 2	120	67	42	143	56
MAIS 3	183	182	15	59	21
MAIS 4	*	*	1	2	2
unknown MAIS	51	28	3	12	3
all	54	14	225	1,800	578

In average 2.5% of the people being involved in an accident were not able to return to their old job (related to the number of approached people). If relating the percentage to the responders it would increase up to 7.8%. Generally the percentage increases with injury severity, see Table 4.

Table 4: Return to old job etc. possible?

MAIS	yes	no	slow restart needed	no. of people asked	percentage of people not being able to return to old job related to number of people asked
uninjured	184	3	0	641	0.5
MAIS 1	257	19	24	942	2.0
MAIS 2	31	13	12	143	9.1
MAIS 3	10	9	4	59	15.3
MAIS 4	1	0	1	2	0.0
unknown MAIS	1	1	0	12	8.3
all	484	45	41	1,800	2.5

No clear injury pattern can be detected for people that were unable to return to their old job, see Figure 1.

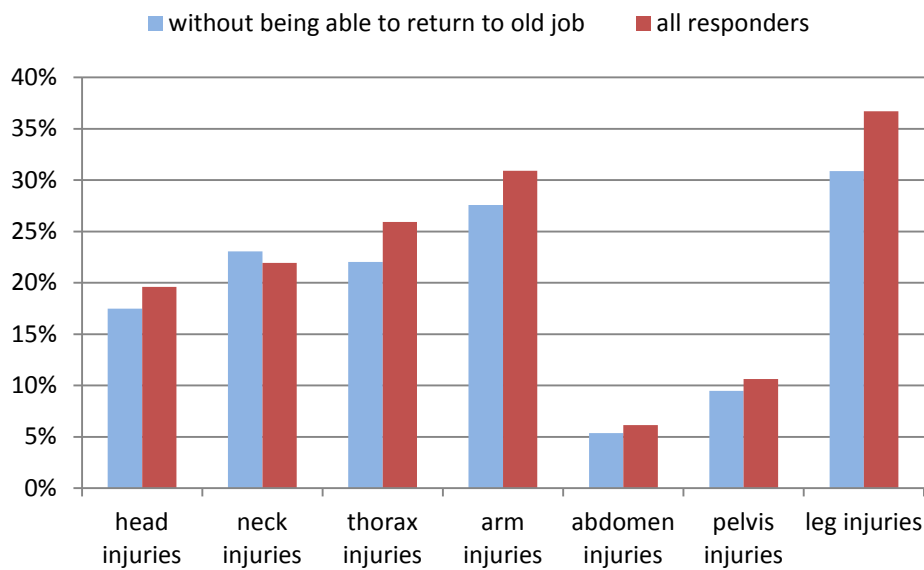


Figure 1: Injured body regions for people not being able to return to old job

Moving house or modifying the home was necessary in 1.1% of all RTC. The influence of injury severity on the need to modify the home or to move houses is smaller than for sick leave or the possibility to return to the old job, see Table 5. While the percentage related to the number of approached people is 1.2% for MAIS 1 injured it increases up to 5.1% for MAIS 3 injured RTC.

Table 5: Was it necessary to move house or to modify your home?

MAIS	yes	no	no. of people asked	percentage of people that needed to move house or modify home related to number of people asked
uninjured	0	190	641	0.0
MAIS 1	11	304	942	1.2
MAIS 2	5	56	143	3.5
MAIS 3	3	23	59	5.1
MAIS 4	0	2	2	0.0
unknown MAIS	0	4	12	0.0
all	19	579	1,800	1.1

Figure 2 indicates a clear injury pattern for people that needed to move house or modify their home however only the result for the leg injuries is statistically significant ($p < 0.05$, chi square test).

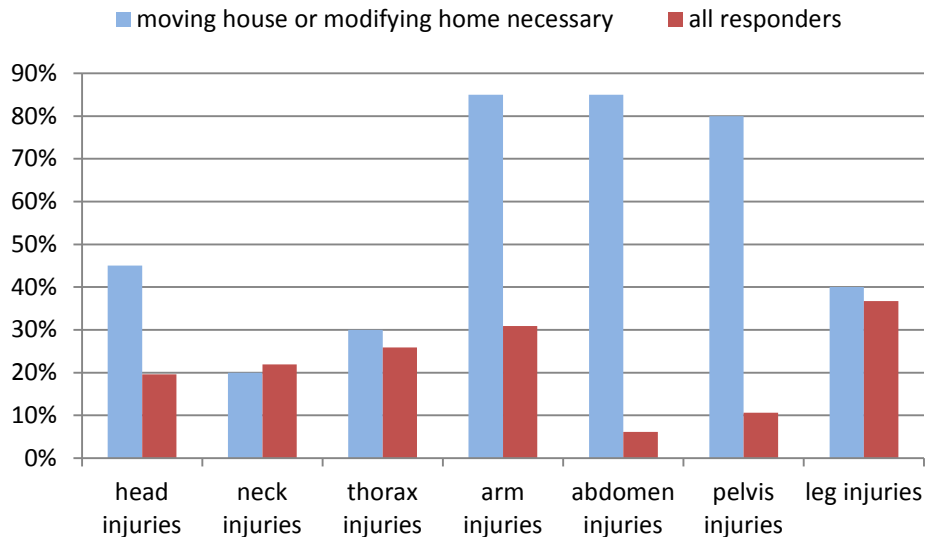


Figure 2: Injured body regions for people that needed to move house or modify their home

A relative large number of RTC are using medication one year after the accident to reduce problems related to the accident. Here even one initially uninjured person said the use medication. The percentage is increasing with injury severity level up to 15.3% for MAIS 3 injured people, see Table 6. Further analysis would be necessary to distinguish between the kind of medication, i.e., painkiller vs. ataractics.

Table 6: Use of medication to lower suffering from accident

MAIS	yes	no	no. of people asked	percentage of people that used medication related to number of people asked
uninjured	1	189	641	0.2
MAIS 1	30	285	942	3.2
MAIS 2	12	46	143	8.4
MAIS 3	9	17	59	15.3
MAIS 4	0	2	2	0
unknown MAIS	0	4	12	0
all	52	543	1,800	2.9

Table 7: Reported pain as a result of the accident

MAIS	yes	no	no. of people asked	percentage of people with pain related to number of people asked
uninjured	2	188	641	0.3
MAIS 1	45	275	942	4.8
MAIS 2	20	40	143	14.0
MAIS 3	12	14	59	20.3
MAIS 4	0	2	2	0
unknown MAIS	0	4	12	0
all	79	523	1,800	4.4

The number of people reporting to suffer from pain (often and high extend according to the questionnaire) is even higher than the number of RTC using medication. When relating to the number of approached people 14% of the MAIS 3 injured people report of pain which increases to 46.2% when relating only to the number of people that responded, see Table 7.

Reported pain is associated with head injuries ($p < 0.000$ chi square test), arm injuries ($p < 0.000$ chi square test), pelvis injuries ($p < 0.02$ chi square test) and leg injuries ($p < 0.002$ chi square test), see Figure 3. Differences for the other body regions are not statistically significant.

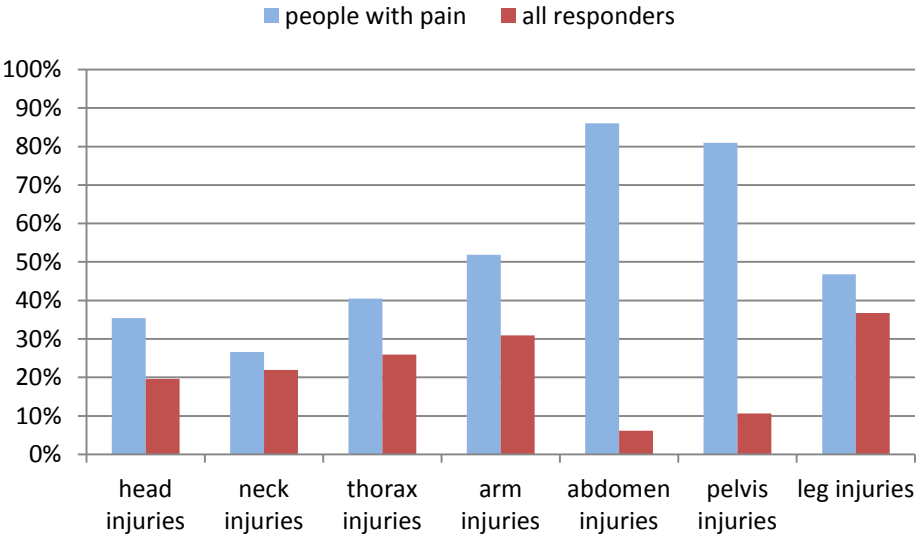


Figure 3: Injured body regions when pain is reported

Deficiency in concentration is reported by 37 people, corresponding to 2.1% when related to all people approached and 6.2% when relating to the number of responders, see Table 8.

Table 8: Reported deficiency in concentration

MAIS	yes	no	no. of people asked	percentage of people with deficiency in concentration related to number of people asked
uninjured	0	189	641	0
MAIS 1	19	300	942	2.0
MAIS 2	9	52	143	6.3
MAIS 3	8	18	59	13.6
MAIS 4	0	2	2	0
unknown MAIS	1	2	12	8.3
all	37	563	1,800	2.1

Concentration deficiencies are reported highly significant more often for people with head and thorax injuries ($p < 0.000$ chi square test), see Figure 4. For the other body regions differences are not significant.

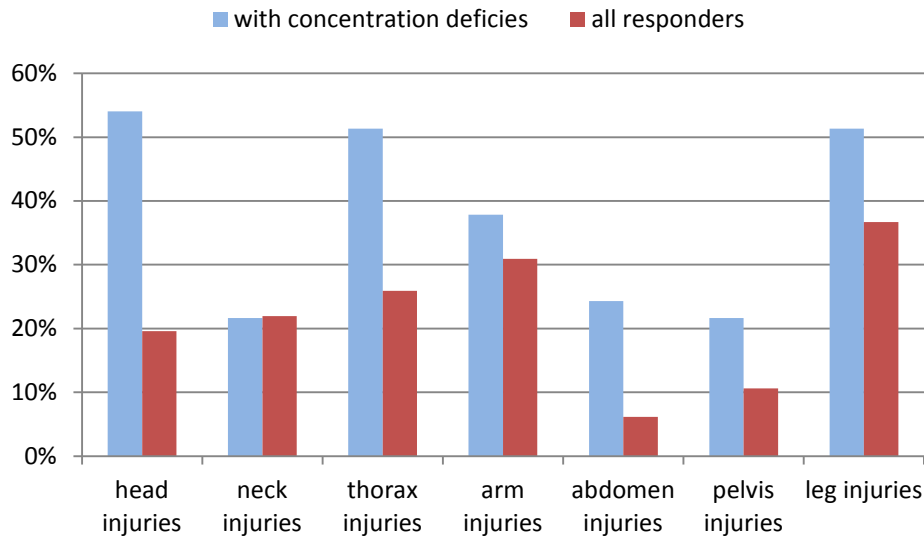


Figure 4: Injured body regions when concentration deficiencies are reported

Fears resulting from being involved in an accident are reported by 114 victims including 10 without initial injuries. In total 6.3% of the approached people and 19% of the responders reported fears as a result from the accident, see Table 9.

Table 9: Reported fears

MAIS	yes	no	no. of people asked	percentage of people with fears related to number of people asked
uninjured	10	179	641	1.6
MAIS 1	75	245	942	8.0
MAIS 2	17	44	143	11.9
MAIS 3	10	16	59	16.9
MAIS 4	0	2	2	0
unknown MAIS	2	1	12	16.7
all	114	487	1,800	6.3

Generally people with injuries suffer more often from fears than those without, almost independent from the injured body region.

Reduced performance at work is reported by 2.4% of the people approached, see Table 10.

Table 10: Reduced performance at work

MAIS	yes	no	no. of people asked	percentage of people with reduced performance at work related to number of people asked
uninjured	0	188	641	0.0
MAIS 1	22	291	942	2.3
MAIS 2	13	44	143	9.1
MAIS 3	7	14	59	11.9
MAIS 4	0	2	2	0.0
unknown MAIS	1	1	12	8.3
all	43	540	1,800	2.4

Especially thorax, arm, leg injuries have a significant influence on reduced performance at work, see Figure 5. Significance levels for these body regions are all below 0.01.

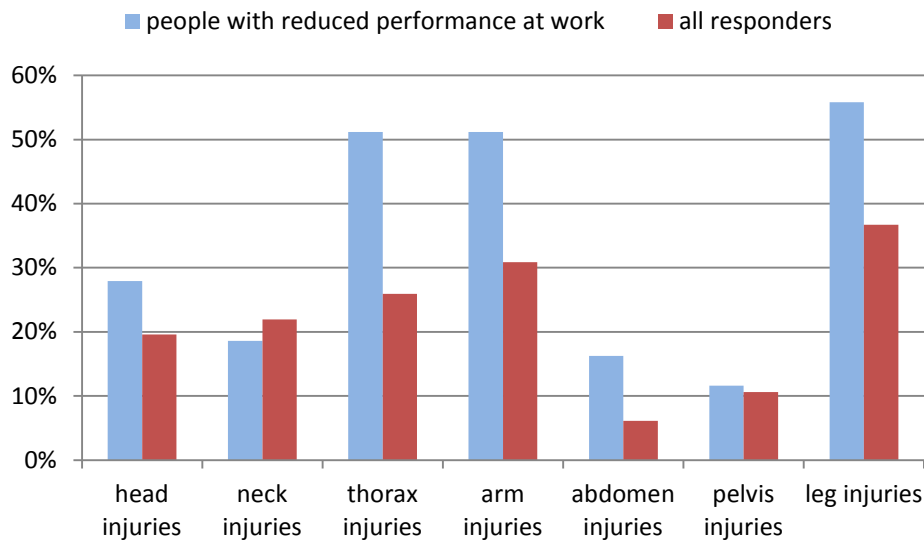


Figure 5: Injured body regions when reduced performance at work is reported

When looking at reduced performance in daily routine tasks the number of people with reported deficiencies is considerable higher than for the people with reduced performance at work, see Table 11. Further analysis is necessary in order to check the responses from people without a job.

Table 11: Reduced performance at daily routine tasks

MAIS	yes	no	no. of people asked	percentage of people with reduced performance in daily routine related to number of people asked
uninjured	0	188	641	0.0
MAIS 1	37	282	942	3.9
MAIS 2	23	38	143	16.1
MAIS 3	14	11	59	23.7
MAIS 4	0	2	2	0.0
unknown MAIS	1	2	12	8.3
all	75	523	1,800	4.2

For reported reduced performance at daily routine tasks no specific injury pattern can be detected, see Figure 6.

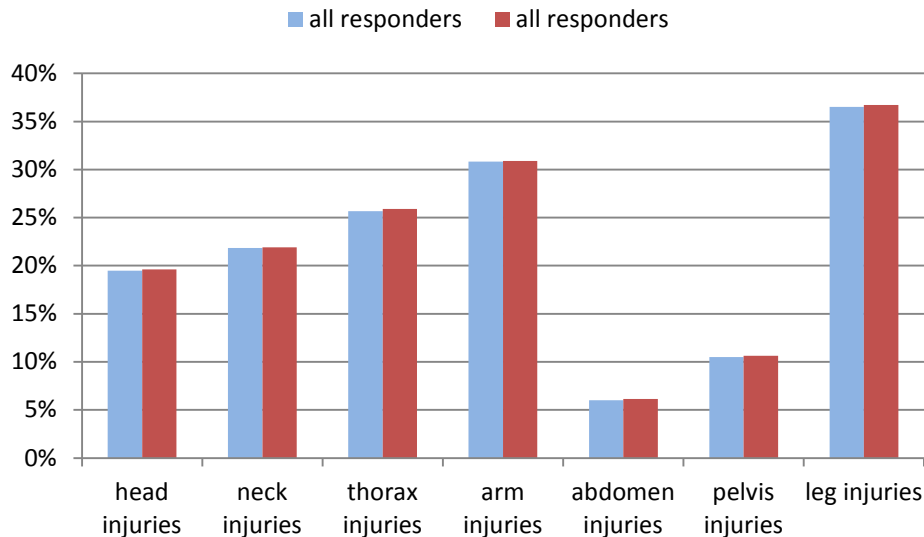


Figure 6: Injured body regions when reduced performance at daily routine tasks

Also reduction of personal mobility which may result from fears, physiological issues or other problems are reported quite often - by 4.3% of the approached people or 13.1% of the responders, respectively, see Table 12.

Table 12: Reduction in personal mobility

MAIS	yes	no	no. of people asked	percentage of people with reduced performance in daily routine related to number of people asked
uninjured	0	187	641	0.0
MAIS 1	46	271	942	4.9
MAIS 2	21	40	143	14.7
MAIS 3	10	16	59	16.9
MAIS 4	0	2	2	0.0
unknown MAIS	1	2	12	8.3
all	78	518	1,800	4.3

Generally people with injuries suffer more often from reduced mobility option, almost independent from the injured body region, see Figure 7.

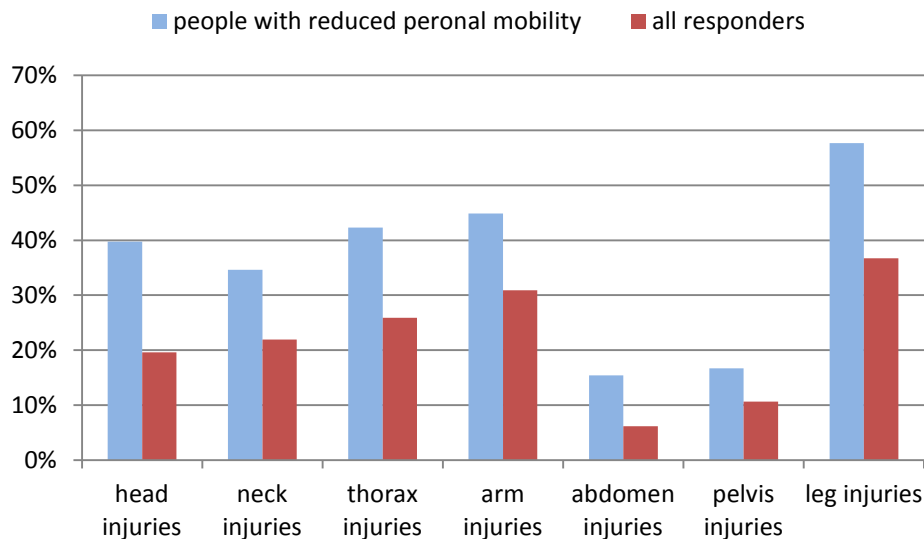


Figure 7: Injured body regions when reduced personal mobility

CONCLUSIONS

Up to now a fourth of the accident involved people of the accidents collected for GIDAS in the Hannover area between January 2013 and March 2015 were approached with a one page written questionnaire asking for long term consequences of the accident. Of the approached people approx. a third answered the questionnaire so far, resulting in approx. 9% responses related to all RTC of the corresponding time. As a next step it is planned to send remainders to those that did not answer in order to increase the return rate. Furthermore changes in the accident collection process that took place in 2014 increased the share of approached people of the year 2014 and following compared to 2013.

In total approx. half of the responders reported on suffering from the accident including people that were initially uninjured. For the majority of people the duration of suffering was shorter than one year. Following that they did not report on any issue related to a time one year after the accident.

More than a third reported on sick leave resulting from the accident with a median duration of 14 days. 41 people needed a slow restart for work and 45 people (2.5% of all approached people) were unable to return to their old job.

Several types of suffering from the accident were reported with a reasonable number of people reporting on problems although being uninjured or only MAIS 1-2 injured. The long term consequences being reported most often are:

- pain (4.4% of all people approached or 13.1% of the responders)
- fears (6.3% of all people approached or 19.0% of the responders)
- reduced performance at daily routine tasks (4.2% of all people approached or 12.5% of the responders)
- reduced performance at daily routine tasks (4.3% of all people approached or 13.1% of the responders)

When analyzing the injury pattern depending on the kind of problem head, thorax, pelvis and legs are often significantly associated with individual problems.

After increasing the number of responses it is planned to ask the people with reported long term consequences for more details. 293 responders gave their informed consent for future studies (people without any problem were not explicitly asked for their consent).

Most of the participants answered by normal mail (87%). However, 10.2% used the option of the online questionnaire and 2.8% answered by phone (mainly those without any problem).

For future studies regarding long term consequences it appears important not to focus on RTC with high injury severity (e.g., MAIS 3+) because an important share of issues was also reported by people without injuries or low injury severity level.

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