Accident investigation related to the use of chainsaw

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Abstract

Operating in woods might be highly dangerous as it takes place in hard environments because of slopes, uneven ground and the presence of the underwood that may prevent machines and operators from moving. The chainsaw is a widely-used tool in agriculture, in forestry as well as for professional and hobby-related purposes. This article has the aim to highlight the state of injuries both for professional and domestic uses. The research focused on web-based report of news published between 2007 and 2012 about mortal and non-mortal accidents occurred in Italy and involving people who were using a chainsaw. On the whole, 336 cases were collected over a 5-year period. The results of the work are represented by a series of thematic maps related to the causative agent, the age of the injured and the seat of the injury. Furthermore, it is confirmed that the operator's head is the most exposed area of the body and is often correlated with the death of the operator (death is often due to collision against the chainsaw blade, facial traumas as well sudden contact with parts of the plant). The study shows the dangers of chainsaw. Even workers experts are involved in serious injury and death. The study highlights the needing of looking for technical solutions and specific procedures for training unskilled worker.

Introduction

Operating in woods might be highly dangerous as it takes place in hard environments because of slopes, uneven ground and the presence of the underwood that may prevent machines and operators from moving. This requires the use of highly dangerous machines and equipment, including sharp tools. The frequency of injuries is, therefore, 1.5 times higher (and their gravity is four times higher) than the average value in domestic industry and tertiary sectors, with an average value of four injuries causing permanent disability or death for every million of hours worked (I.N.A.I.L. source, 1996). Medical costs for chainsaw injuries based amount to about 350 million dollars per year only in U.S. After a web-based research, this study considers all pieces of news concerning the use of a chainsaw. These include mortal and non-mortal deaths involving both skilled woodcutters and unskilled hobbyists. Moreover, this research has included both direct injuries (*i.e.* cuts) and indirect injuries that may be due to a fall from a ladder while trimming a hedge using a chainsaw. The chainsaw as well as all cutting tools may be a highly dangerous source of risk, both for foresters, farm operators as well as hobbyists because of possible contacts with moving parts (Cavazza, 2009). According to FOEN, the Swiss Confederation's Federal Office for the Environment, several accidents occur each year while using a chainsaw and timber harvesting. Several of them are mortal. The main cause is often to be found in lack of knowledge, carelessness and lack of exercise. Most injuries involve persons without any background in forestry-related matters, who were working in woods during their free-time, or farmers who were carrying out complementary activities. In privately owned forests, the frequency of accidents is four times higher than the frequency in firms and logging companies; Very serious injuries have involved persons using a chainsaw for professional purposes or in their free-time, in particular during construction works, gardening, horticulture, maintenance and demolition. Aim of the research is divided into two parts:

- creating a database about accidents with chainsaws;
- propose of management tools for safety. (software PPE safe)

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Materials and methods

The methodology used for the study wanted to define a database, in literature and in official databases (INAIL), there are no aggregated data on accidents with chainsaw. There are only cumulative data associated with professional workers.

The research focused on web-based pieces of news published between 2007 and 2012 about fatal and non-fatal accidents occurred in Italy and involving people who were using a chainsaw. On the whole, 336 cases were collected over a 5 year period. The data source is the web, they are used:

- unofficial database;
- statistics of agricultural unions;
- on-line journals;
- newspaper online;
- blog.

The following parameters were identified for each single accident and later analyzed in an Excel file:

- number of accident per year;
- year in which the accident took place;
- date;
- Region, Province and cause of the accident;
- age, profession and nationality of the injured person;
- seat of the injury;

- link with the news.

The analysis of some parameters required us to assign numeric codes reported as follows in order to allow your faster reading and data analysis (Table 1) (Pessina 2011). Data analyzed were compared with other scientific work. Were excluded from this analysis suicides and homicides with the use of chainsaw.

The second part of the paper analyzes and develops software for the management of risk in forestry work.

The software is divided into three parts:

- type of worker (farmer, gardener, woodcutter, non-professional worker);
- type of activity (use of chainsaw, use tractor, limbing, logging);
- type of workplace (wood, field) .

The program automatically producing devices for the worker and their costs.

Results

The main results are shown in Table 2. The analysis of the data shows that about half of the accidents are fatal. The people involved in accidents are mainly Italian (88,6%) and non-professionals (59.9%).

Areas of the body most vulnerable to injury were: head (34,8 %); trunk (25,0%); and leg (16,8%). This last element is confirmed by the type of event. They are in fact fatal injuries caused by contact / collision with tree or parts of tree, events primarily involving the head, trunk and legs. Contact with moving elements of chainsaw is the second leading cause of injury (39,3%), the other events are more rare.

If you get a closer look at the Regions where the accidents took place, the highest distribution is registered in Lombardia (77 accidents), followed by Toscana, Trentino Alto- Adige and Liguria. In Southern-Italy, fewer accidents are registered. The only Region where no accident took place over the five-year period is Valle D'Aosta.

The distribution of serious or mortal accidents shows a peak between January and April (Figure 1).

This is mostly due to trimming and cleaning and maintenance of green areas as well as loggers' professional activities, which is about to start. The number of accidents is expected to reduce in summer, whereas it strongly increases in autumn and decreases again in winter (December).

Analyzing Table 4 you can see that they are mainly involved in this type of accident the age group 60 - 70

As far as the days of the week are concerned, Friday and Thursday show the highest peaks; the lowest values are registered on Monday.

Figure 3 notes that areas most exposed to a high risk are the hands and legs. It is also noted that there is a difference between the series of the data presented, this element is determined by the fact that the

Table 1. Numeric codes.

deathly	
no	1
yes	2
Nationality	
Italian	1
Rumenian	2
Macedonian	3
Albanian	4
Moroccan	5
Other	6
Injury location	
Hand	1
Arm	2
Leg	3
Foot	4
Head	5
Trunk	6
Event	
Contact with moving elements of chainsaw	1
Contact / collision with tree or parts of tree	2
Infaction	3
Fall from a height	4
Electric shock	5
Burn	6
Position	
non-professional	1
professional	2

Table 2. Results.

deathly	%
no	50,5
yes	49,5
Nationality	**%**
Italian	88,6
Rumenian	5,1
Macedonian	1,8
Albanian	0,6
Moroccan	0,6
Other	3,3
Injury location	**%**
Hand	13,7
Arm	6,1
Leg	16,8
Foot	3,7
Head	34,8
Trunk	25,0
Event	**%**
Contact with moving elements of chainsaw	39,3
Contact / collision with tree or parts of tree	47,7
Infaction	2,7
Fall from a height	7,5
Electric shock	2,4
Burn	0,6
Position	**%**
non-professional	59,9
professional	40,1

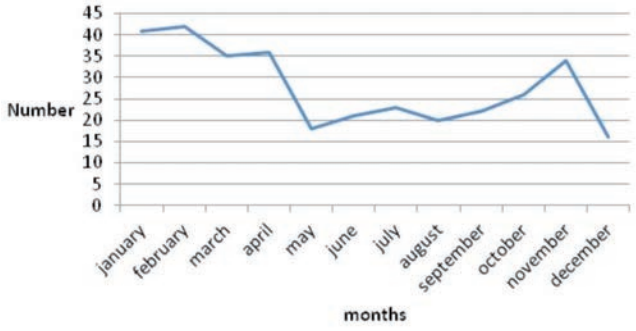

Figure 1. Accident distribution by month.

Table 3. Accident distribution by Region.

Region	Number	%
Abruzzo	15	4,5
Basilicata	1	0,3
Calabria	11	3,3
Campania	12	3,6
Emilia Romagna	24	7,2
Friuli Venezia Giulia	14	4,2
Lazio	11	3,3
Liguria	27	8,1
Lombardia	77	23,1
Marche	9	2,7
Molise	5	1,5
Piemonte	14	4,2
Puglia	4	1,2
Sardegna	5	1,5
Sicilia	8	2,4
Toscana	47	14,1
Trentino Alto Adige	32	9,6
Umbria	3	0,9
Veneto	15	4,5
Valle D'Aosta	0	0,0

Table 4. Victims by age group.

Age	% Wounded	% Dead	Index dead
10 - 20	3,0	2,4	44,4
20 - 30	8,4	9,0	51,7
30 - 40	15,6	14,4	48,0
40 - 50	21,0	17,4	45,3
50 - 60	19,2	15,0	43,9
60 - 70	24,6	25,1	50,6
70 - 80	6,6	13,8	67,6
80 - 90	1,8	1,2	40,0

models presented in the literature do not consider hobbyists. The latter element must be the starting point for new studies that evaluate the overall incidence of accidents related to chainsaw.

Conclusions

Firstly, we deeply analysed and searched for accidents taking place in Italy between 2007 and 2013. By doing this, we were able to perceive how dangerous the chainsaw might be while being used. We later collected a series of key points pertaining education and training within foresters, with an eye to the use of the chainsaw. We started by analysing handbooks by bodies (including Regions, Provinces, Municipalities, several chainsaw manufacturers, Institute of Higher Education for Prevention, Health and Safety at the Workplace, etc.). We later used the information we gathered to develop a model which enables us to verify and to certify correct choice about safety, using PPE Forestry safe 1.1

After the welcoming screen, you have access to the software and can choose among the following options:

- software instructions;
- information key;
- technical aspects;
- personal protective equipment (PPE);
- average cost.

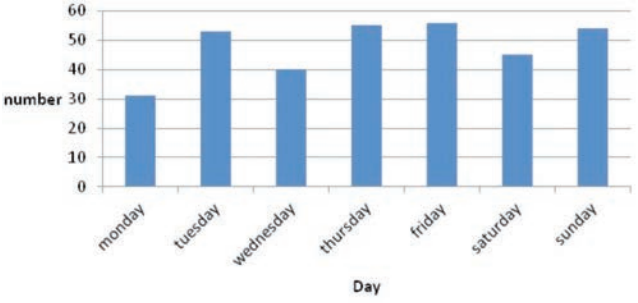

Figure 2. Accident and deaths distribution by day of week.

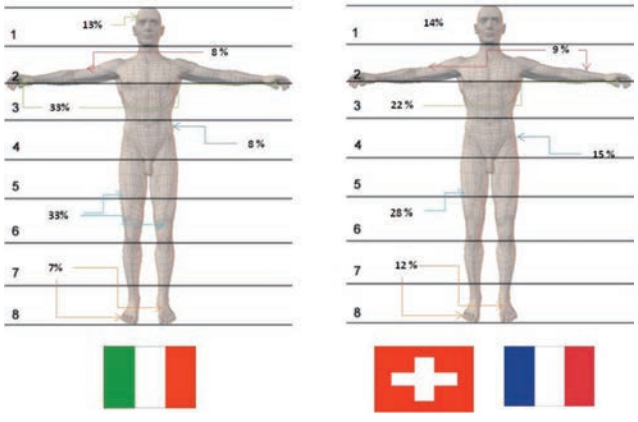

Figure 3. Comparison between the Italian and international data (Suva 2005).

Figure 8. Overwiev PPE safe 1.0.

The program works according to the legislation on safety at workplace 81/2008, the software allows the employer on the basis of precoded parameters (type of chainsaw, chain speed) to choose the correct PPE In conclusion should be underline that employers are required by law to acquaint their workers with any hazards associated with the handling of tools or equipment, such as chainsaws, that they use during their jobs.

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