Accident analysis during the chainsaw use: prevention and protection measures to reduce injuries

Cividino S.R.S. a, Maroncelli E. a, Vello M. a,c, Gubiani R. a, Snidero I. a, Pergher G. a, Colantoni A.b

(a) DiSA, Department of Agriculture and Environmental Sciences, University of Udine, Via delle Scienze, 208, 33100 Udine, ITALY
(b) DAFNE, Department of Agriculture, Forestry, Nature and Energy, University of Tuscia, Via San Camillo De Lellis, 01100 Viterbo, ITALY
(c) CIRMONT, International Research Centre for the Mountain, via Linussio 1, 33020 Amaro (Ud) Italy, tel and fax: +39 0433 467124
Email corresponding Author: rino.gubiani@uniud.it

Abstract
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. As far as its methodologies are concerned, this study analyses and compares several data (including domestic data, statistical data, non-conventional data as well as news stories documenting chainsaw-related injuries). Our results are going to define and emphasise two key points: 40% of injuries are either serious or mortal, causing an average of 40 days of prognosis and permanent disabilities (including finger and toe amputation). 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 as sudden contact with sharp parts of the plant). In conclusion, this article develops and proposes a fast-running software tool for evaluating competences both in forestry and in hobby-related matters. This software tool can be seen as a propaedeutic tool for risk management, both for professional and domestic uses.

Keywords: statistics data, chainsaw and electric saw, software

Introduction

Preliminary Remarks
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).

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. (Refer to http://www.bafu.admin.ch/wald/01248/01253/index.html?lang=it)

Hence there was the need to develop a software tool that, through several tests – either theoretical or practical – might prove the level of hobby-related and professional knowledge as well as background of the person who is going to use a chainsaw.

**Materials & Methods**

The research focused on web-based pieces of news published between 2007 and 2011 about mortal and non-mortal accidents occurred in Italy and involving people who were using a chainsaw. On the whole, 118 cases were collected over a 5-year period. The following parameters were identified for each single accident and later analysed 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>
<thead>
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<th>DEATH/WOUNDED</th>
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<tbody>
<tr>
<td>WOUNDED</td>
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</tr>
<tr>
<td>DEAD</td>
<td>2.00</td>
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<table>
<thead>
<tr>
<th>SEAT OF INJURY</th>
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<tbody>
<tr>
<td>HAND</td>
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</tr>
<tr>
<td>ARM</td>
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<td>LEG</td>
<td>3.00</td>
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<tr>
<td>FOOT</td>
<td>4.00</td>
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<tr>
<td>HEAD</td>
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<tr>
<td>BODY TRUNK</td>
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<tr>
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<td>RUMANIAN</td>
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<td>3.00</td>
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<tr>
<td>ALBANIAN</td>
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</table>
Some news reported partially uncompleted data. Thus, we were not able to analyse each parameter for all 118 accidents.

**Results**

Consider each age group of persons involved in fatal accidents. It can be deduced that they mainly involve elderly people (aged 60 years or over) while using a chainsaw. All other age groups, 30 to 60 years, show a still high number of accidents, over 9 units. Consider that those figures also include several hobbyists and persons who use a chainsaw for unprofessional purposes.

As far as wounded persons are concerned, two peaks involved age groups between 30 and 40 years (9 wounded persons) and between 60 and 70 years (12 wounded persons). Probably, the former age group (30-40 years) includes several skilled loggers, whereas the latter one (60-70 years) involves several pensioners who use a chainsaw for hobby-related purposes.

| MOROCCAN | 5.00 |
| FOREIGNER | 6.00 |
| CONTACT WITH MOVING ELEMENTS OF CHAINSAW | 1.00 |
| CONTACT/BLOW/SQASHING DUE TO BRANCHES OR TREE TRUNK PARTS | 2.00 |
| INFARCT | 3.00 |
| FALLING | 4.00 |
| FULGURATION | 5.00 |
| BURNING | 6.00 |

**Table 1. Numeric Codes**
The sum of serious and mortal accidents per age group confirms that the age groups 30 to 40 and 60 to 70 years are the most prone to risks.

If you get a closer look at the Regions where the accidents took place, the highest distribution is registered in Lombardy (23 accidents), followed by Tuscany, Trentino Alto-Adige and Liguria. In Southern-Italy, fewer accidents are registered. The only Regions where no accident took place over the five-year period considered are Valle D’Aosta and Basilicata.
The distribution of serious or mortal accidents shows a peak between January and April. 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 drops again in winter.

As far as the days of the week are concerned, Monday and Thursday (i.e. at the beginning and in the middle of the work-week) show the highest peaks; the lowest values are registered over the weekend.
The highest number of accidents is registered late in the morning, when, after working for a couple of hours, our attention may reduce, and after lunch, when digestion weighs us down and reduces our clear-headedness.

By analysing web-based data about the seat of the body which is mostly lesioned after non-mortal accidents, it is brought out that the use of chainsaw involves lower arts in 37% of cases and the head in 32% of cases. Furthermore, the number of cases due to accidents lesioning lower arts appears very high, with particular regard to hands.

On the other hand, if you get a look at total, serious or mortal accidents and compare them to the French Safety Institute’s data, it is highlighted that legs are the mostly lesioned part of the body (30% of accidents), followed by hands (27% of accidents). The head and the arms then follow, each of them showing values around 14% and 12%, respectively. The comparison with French data seems to be quite consistent with.

The only differences are to be found in injuries involving hands, which, according to French statistical data, are not so high (22%), and feet, which, on the contrary, involve 15% of cases.
Conclusions
Firstly, we deeply analysed and searched for accidents taking place in Italy between 2007 and 2011. 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 the level of learning quickly, using Forestry Evaluation 1.0 Programme.

By doing this, whoever is going to use a chainsaw might previously evaluate, through a series of tests, his or her theoretical background and technical capabilities before using a chainsaw.

Our aim is to standardise a test in order to validate training and information pertaining the use of this tool in safe conditions.

The programme is made up of five sessions. Those sessions assign a score. This indicates whether the minimum level of knowledge required has been achieved or not in order to be able to use a chainsaw.

After the welcoming screen, you have access to the programme and can choose among the following options:
- programme instructions
- information key
- test on formal, technical aspects
- test on safety and PPI
- test on chainsaw components
- two practical tests.

As previously pointed out, the test is composed of five sections. On the one hand, three sections are theoretical and deal with safety, chainsaw and general working methods. On the other hand, the remaining two sections are merely practical and require the implementation of specific tests. The first section is a test for verifying the correct use and maintenance of the chainsaw from an operational point of view. For each test, the candidate has to indicate whether the tree questions are true or false.

After answering each question, the programme indicates if the test has been passed and if the candidate is allowed to have access to the following section.
The following section, containing several questions, aims at evaluating the operators’ level of knowledge on legal aspects, systems of prevention and protection as well as safety of the person who is going to use the chainsaw.

Even in this case, three answers are indicated for each single question. The candidate has to indicate if the questions are true or false. Basing on the number of correct answers, the test will be considered as passed or not.

The third section contains a test for recognising the parts of which a chainsaw is made up: the candidate has to combine words to numbers associated to chainsaw components. After answering the first three sections and passing each test, the candidate undergoes two practical tests.

Both technical tests are evaluated by the instructor through a series of given parameters, which are still present in the programme. By looking at the operation in the section and by analysing the information contained in the handbook on the operations, the tests can be assessed.

After passing all five sections, the candidate will receive a certificate attesting him or her to have passed the tests as well as the level of training he or she has achieved.

This will allow him or her to assess his or her capabilities – both practical and theoretical – on the use of the chainsaw, thereby preventing accidents.

References


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