Accident analysis in forest operations in an alpine context

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Introduction

Sustainable management of forest resources includes Health and Safety of forest workers

Forest Operation is a very dangerous activity

Worksite environment

• Terrain conditions
• Weather conditions
• Biological agents

Exposure to

• Heavy loads
• Physical agents (noise, vibration)
• Wood dust
• Exhaust fumes

Use of machines and tools

• Chainsaw
• Tractor
• ...

Risks
Introduction

High mechanization reduces risks of accidents

Not always available or applicable

Traditional mechanization very common on steep terrains

Safety for forest workers → needs of deep accident analysis

Accident analysis in forestry

Fragmented information

Mixed with Agriculture

Specific for single operation/machine

Difficults in Private Sector

Lack of information in Italy
Aim

Accident Analysis including all forest operations in a representative Italian forest area

Identify

Causes
频率和严重性

Consequences

Dynamics

Critical factors

Most dangerous operations

Interaction between variables
Data Collection

Data referred to all the public forest workers

Period examined: 1995-2013

All the injuries notifications were collected (385)
Materials and Methods

- **Accident book**
- **Mandatory in Italy**
- **Cause of accident (action)**

**Date**

**Worker’s age**

**Severity**

**Kind of injury**

**Material agent causing injury**

**Part of the body injured**

**Italian standard UNI 7249**

- $H = \text{total n of worked hours}$
- $n_i = \text{number of injuries}$
- $D = \text{total days of prognosis}$

**Severity Index**

$$SI = (D/H) \times 10^3$$

**Frequency Index**

$$FI = (n_i/H) \times 10^6$$

«Chi-squared» test applied for data of frequencies
385 total injuries

FI and SI decreasing trends → no significance
**Results: weekday**

\[ X^2 = 12.62, \ df = 4, \ p < 0.0013 \]

**Results: operation**

\[ X^2 = 163.82, \ df = 6, \ p < 0.000 \]
Results: body parts injured

- Hand, wrist: 22%
- Head, face: 9%
- Back: 6%
- Leg, knee: 23%
- Torax: 5%
- Shoulder, trunk: 5%
- Arm, elbow: 7%
- Foot, ankle: 10%
- Eye: 8%
- Other: 5%
<table>
<thead>
<tr>
<th>Agent cause of the accident</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chainsaw</td>
<td></td>
</tr>
<tr>
<td>Machines and vehicles</td>
<td></td>
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<tr>
<td>Other equipment</td>
<td></td>
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<tr>
<td>Biological agents</td>
<td></td>
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<tr>
<td>Splinter, wood fragment</td>
<td></td>
</tr>
<tr>
<td>Branches, top</td>
<td></td>
</tr>
<tr>
<td>Log, stump, tree</td>
<td></td>
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<tr>
<td>Boulder, stone</td>
<td></td>
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<tr>
<td>Forest ground</td>
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</tbody>
</table>
The role of personal behaviours in workers’ safety

1 Accident → 89 workers

2 Accidents → 28 workers

3 Accidents → 8 workers

5 Accidents → 1 worker

7 Accidents → 1 worker

Survey possible on 175 injuries happened to 121 workers
Workers’ age

- Age of workers
- n injuries (average value)
- Average workdays lost per injury

- ≤20
- 21-30
- 31-40
- 41-50
- 51-60
- >60

n injuries

Average workdays lost per injury
Conclusion

• The high danger of forest operations has been confirmed;

• High rate of injuries, even if the workers were well trained and equipped;

• Personal behaviours of workers should be considered in prevention activities in order to prevent recidivism phenomenon;

• Further studies are recommended regarding the role of weekday in accident probability and the relationship between accident severity and worker’s age.
Thank you for your attention

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