



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DEPARTMENT OF
AGRICULTURAL, FOOD AND
FORESTRY SYSTEMS



**49th International Symposium on Forestry Mechanization
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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

Risks

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
- ...

Introduction

*High mechanization
reduces risks of accidents*



**Traditional mechanization very
common on steep terrains**

**Not always available
or applicable**

Safety for forest workers → needs of deep accident analysis

**Accident analysis in
forestry**

*Fragmented
information*

*Difficults in
Private Sector*

*Mixed with
Agriculture*

*Specific for single
operation/machine*

*Lack of
information in Italy*

Aim

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

Identify

Causes

Consequences

Dynamics

Frequency and
severity

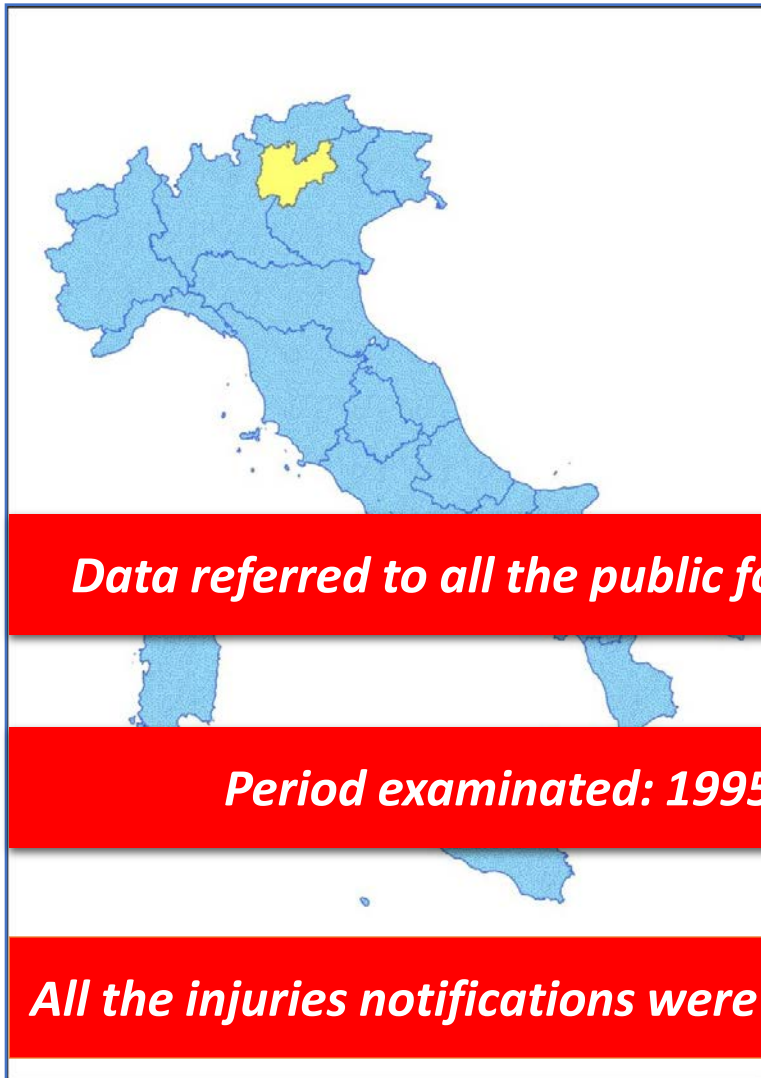
Critical factors

Most dangerous
operations

Interaction
between variables

Data Collection

Public forest properties of the Province of Trento

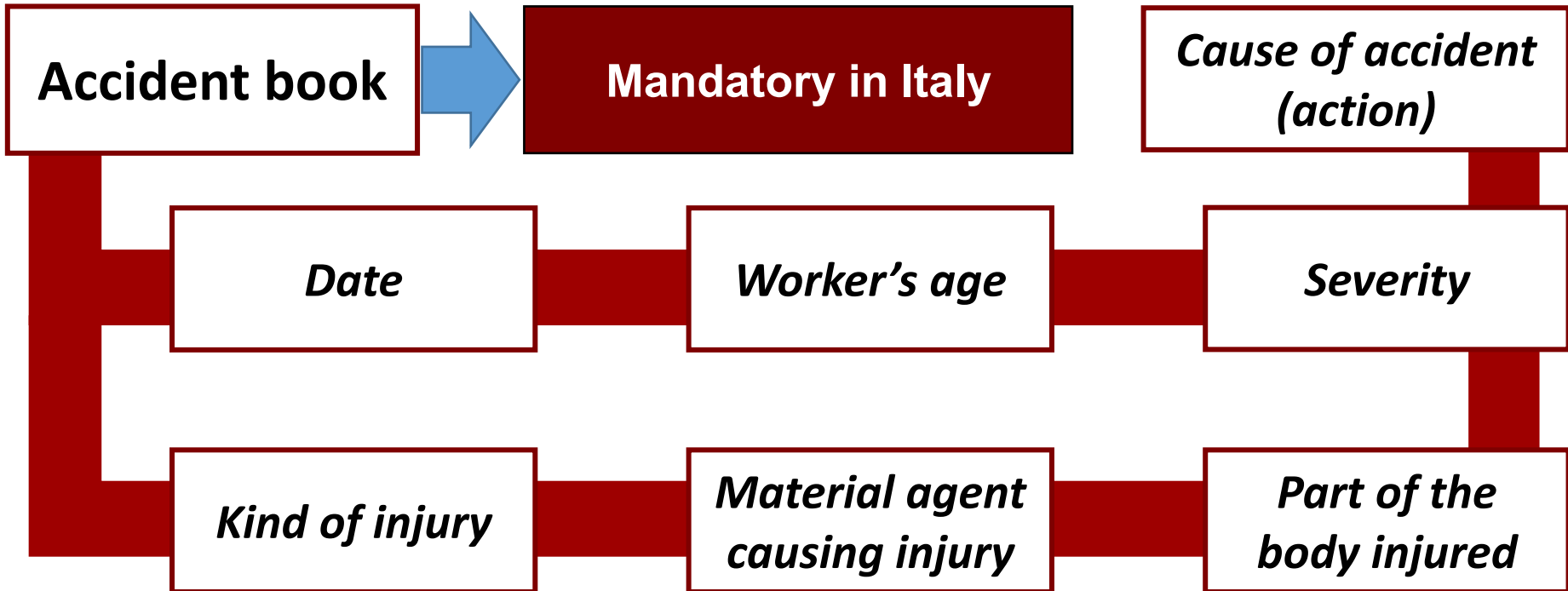


Data referred to all the public forest workers

Period examined: 1995-2013

All the injuries notifications were collected (385)

Materials and Methods



Italian standard UNI 7249

H =total n of worked hours

n_i =number of injuries

D =total days of prognosis

Severity Index

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

Frequency Index

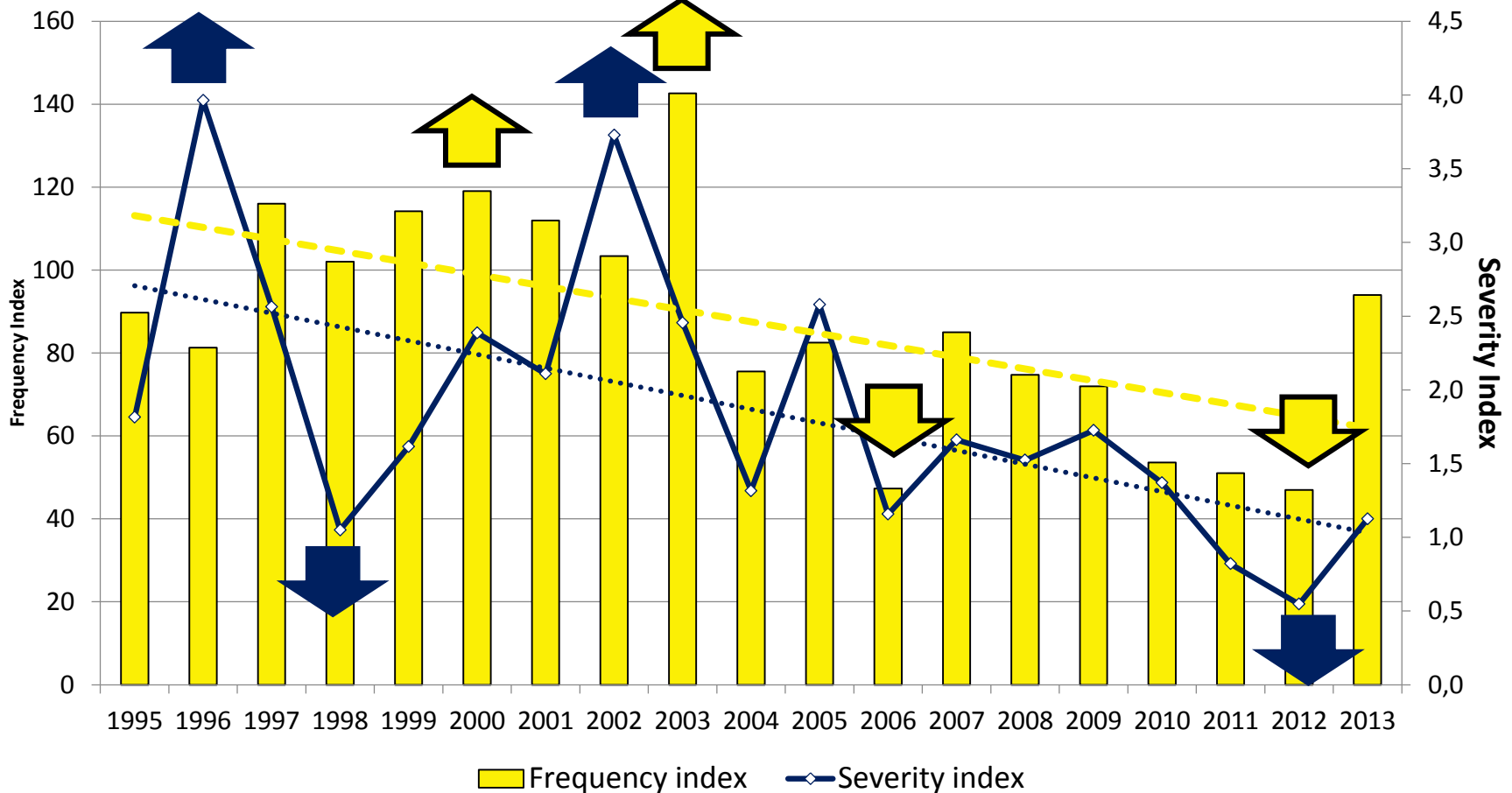
$$FI = (n_i/H) \times 10^6$$

**«Chi-squared»
test applied for
data of
frequencies**

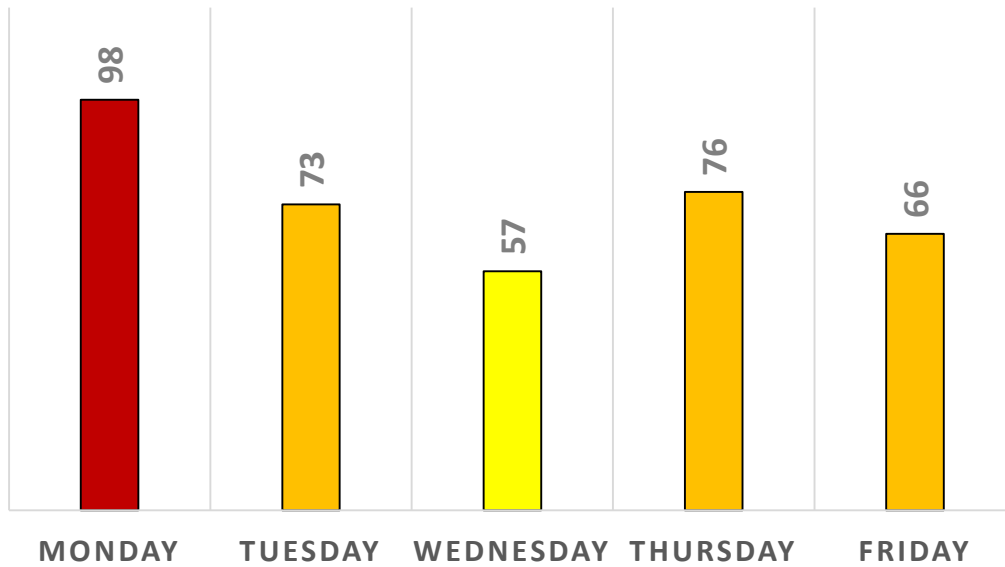
Results: Frequency and Severity Indexes

385 total injuries

FI and SI decreasing trends → no significance



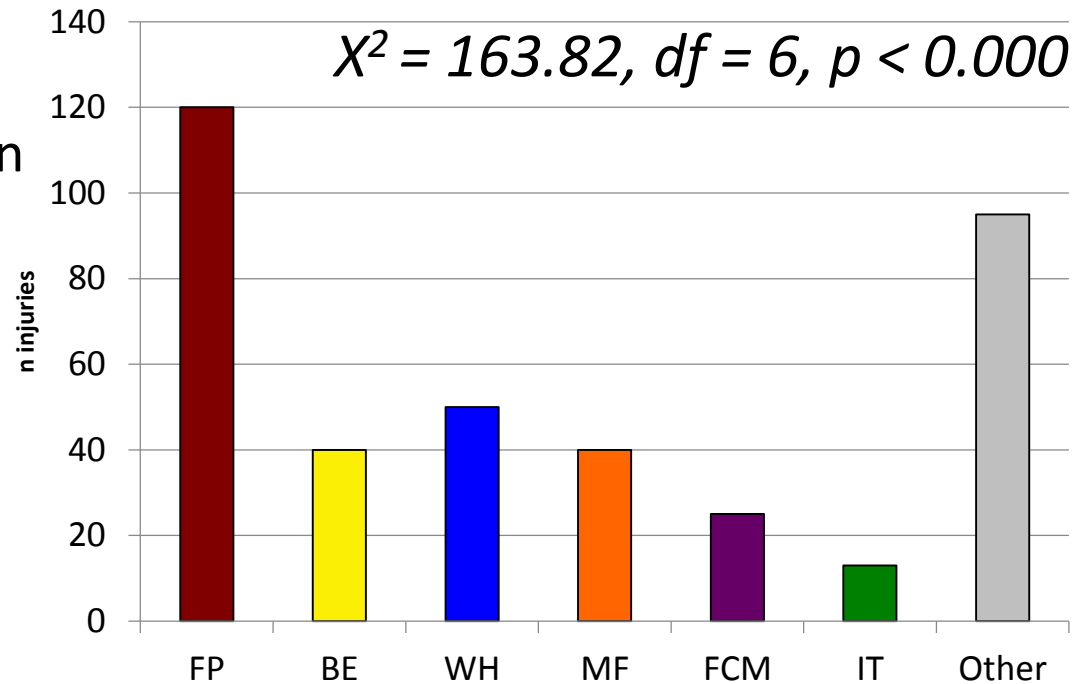
Results: weekday



$$\chi^2 = 12.62, df = 4,$$
$$p < 0.0013$$

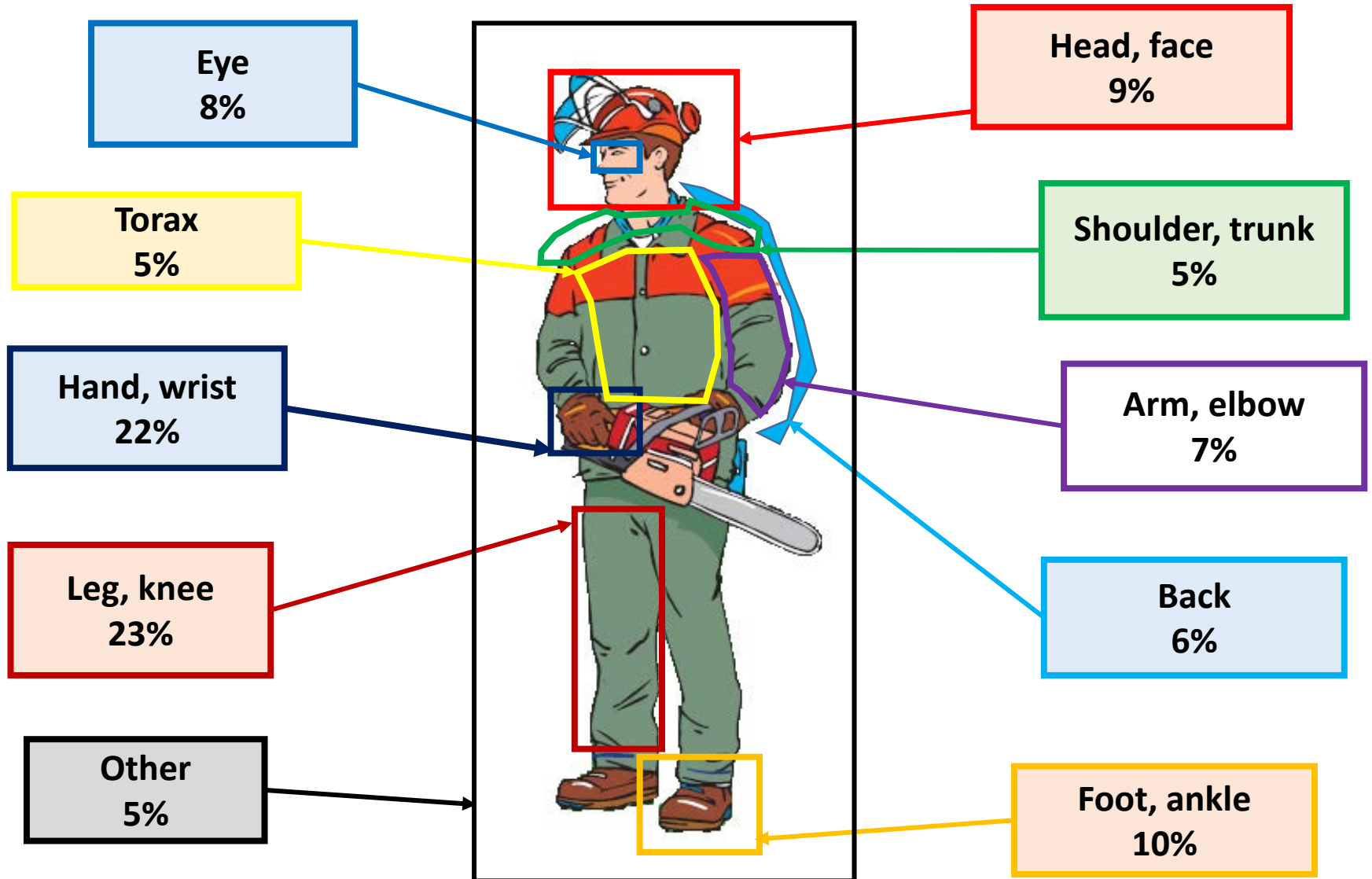
Results: operation

- FP** Felling and Processing
- BE** Bunching and Extraction
- WH** Wood handling
- MF** Moving in forest
- FCM** Forest Road maintain.
- IT** In itinere



$$\chi^2 = 163.82, df = 6, p < 0.000$$

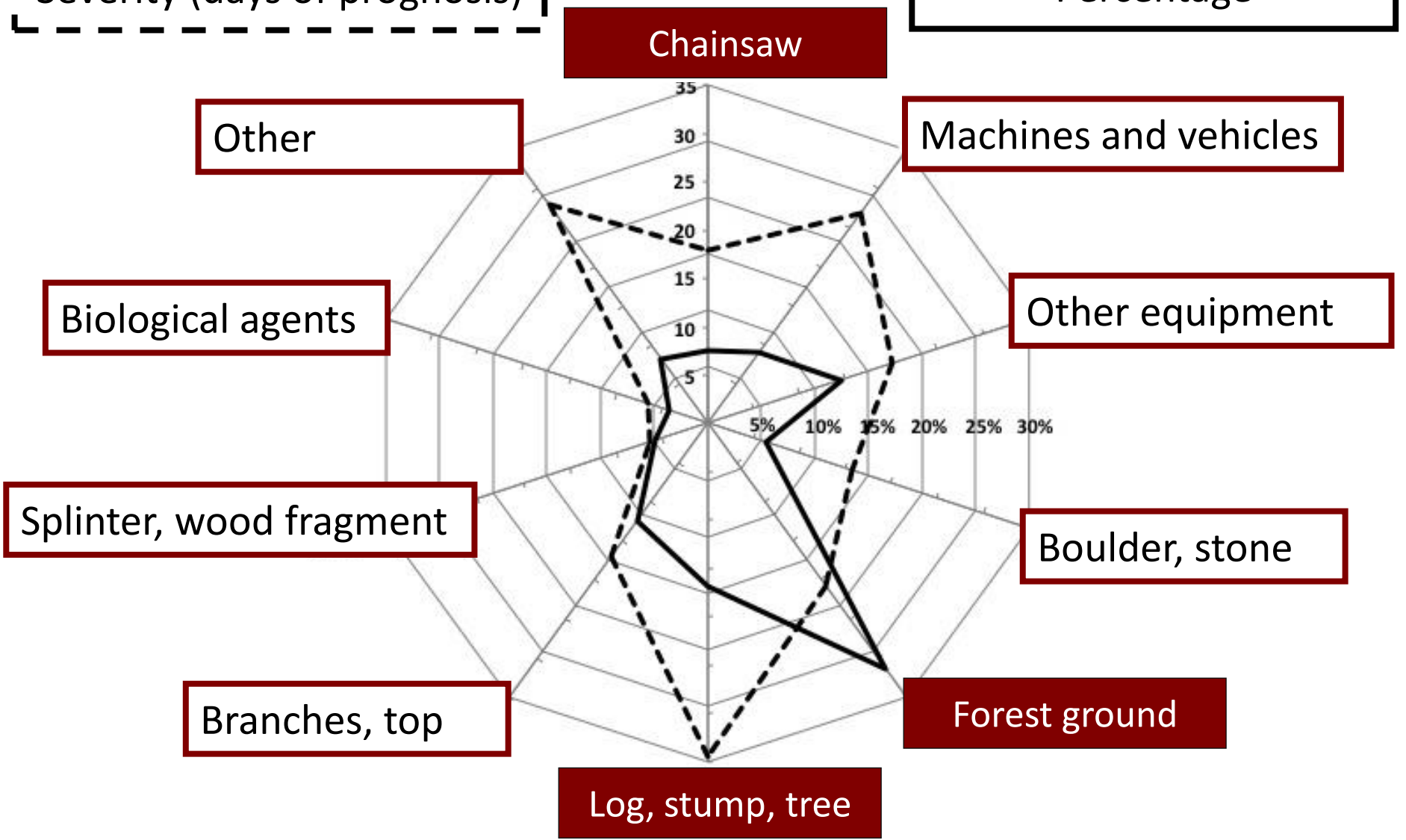
Results: body parts injured



Agent cause of the accident

Severity (days of prognosis)

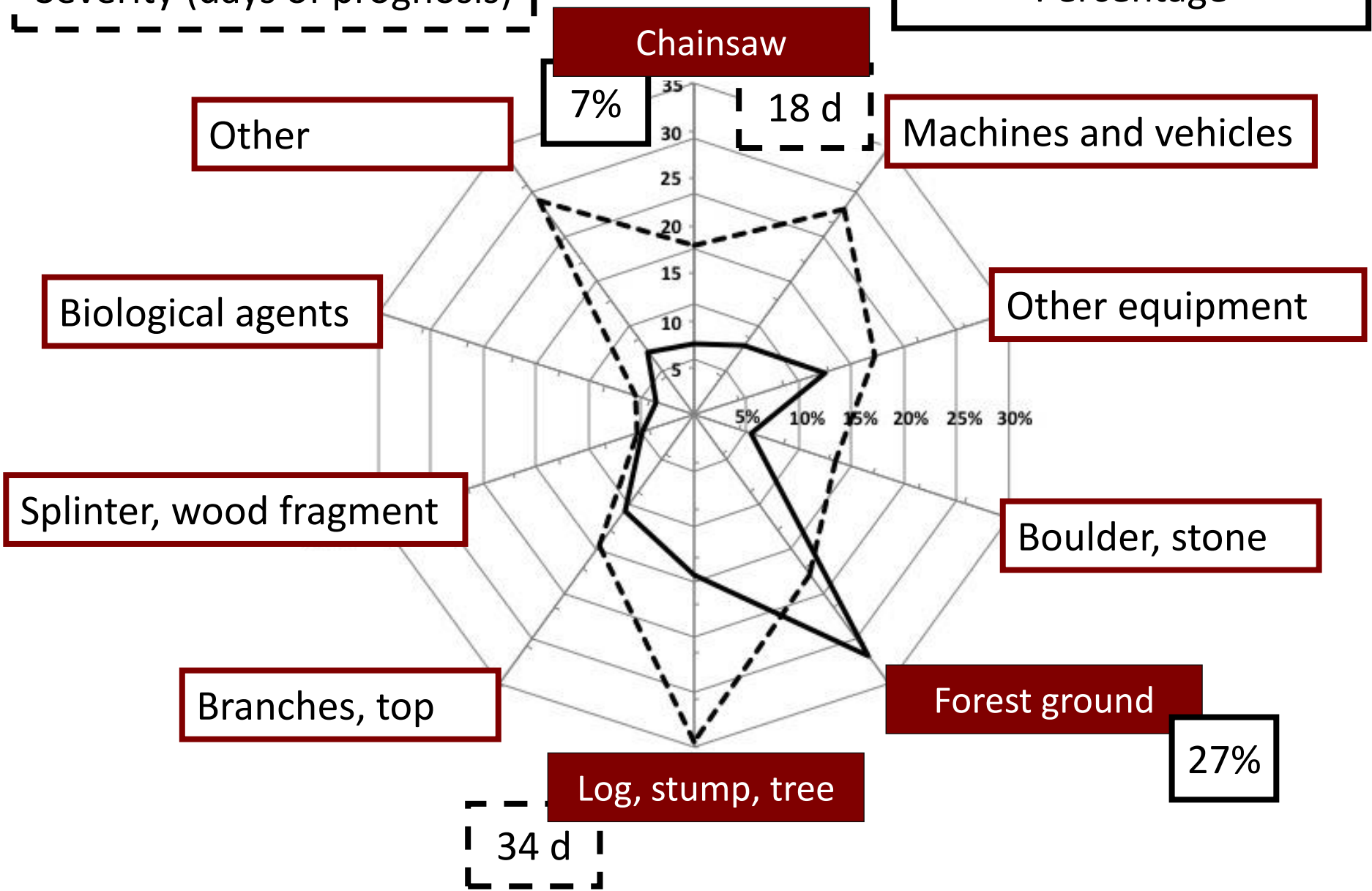
Percentage



Agent cause of the accident

Severity (days of prognosis)

Percentage



Recidivism

The role of personal behaviours in workers' safety



1 Accident → **89 workers**

2 Accidents → **28 workers**

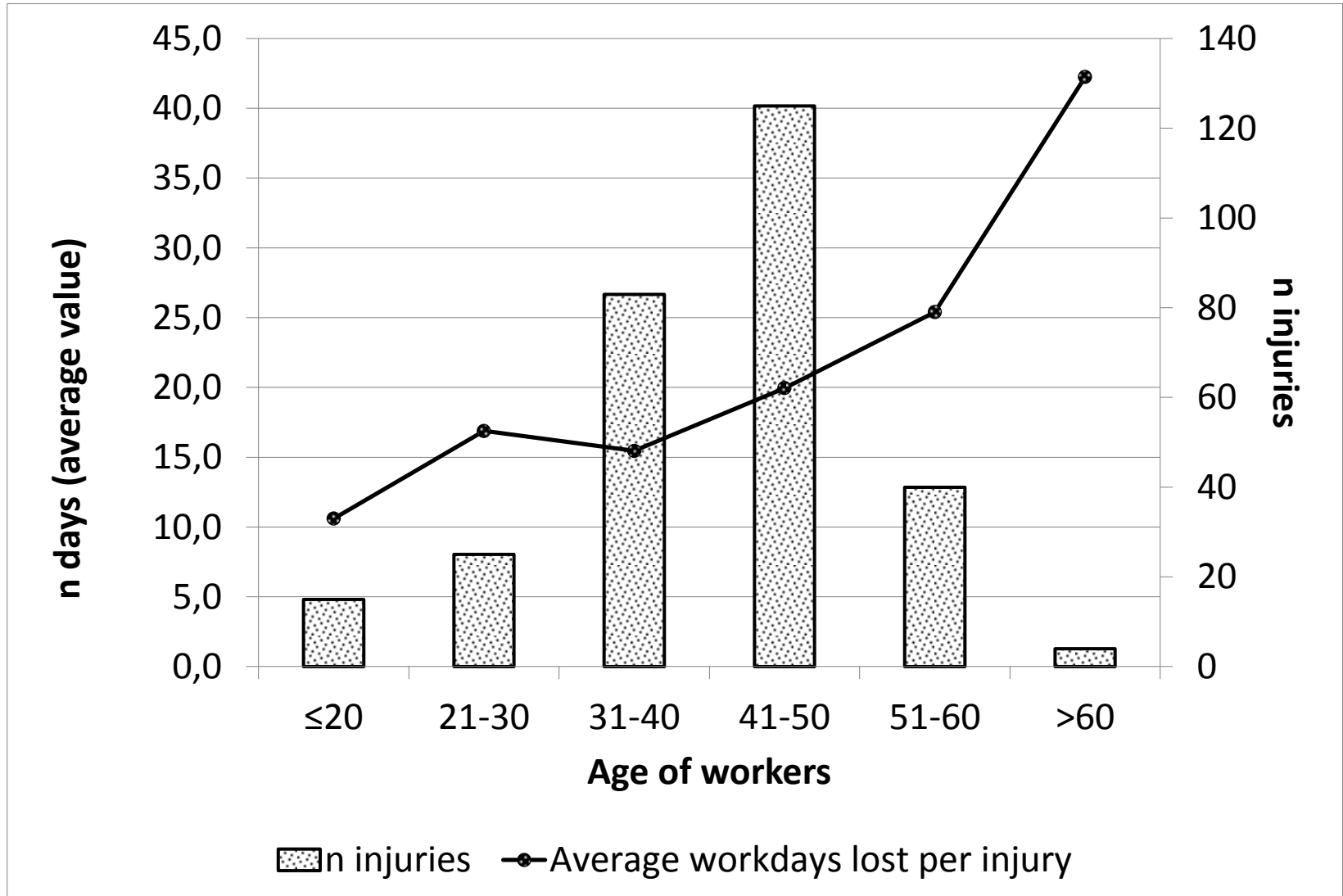
3 Accidents → **8 workers**

5 Accidents → **1 worker**

7 Accidents → **1 worker**

Survey possible on 175
injuries happened to 121
workers

Workers' age



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.



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Thank you for your attention

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