

## Analysis of fatal accidents due to falls from height during trekking and mountaineering in the mountain area of Friuli Venezia Giulia.

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### BACKGROUND

According to annual data of National Alpine Cliff and Cave Rescue Corps (CNSAS), more than 1700 accidents and near 500 deaths annually occur in Italy during trekking and mountaineering; during 2015 a 20% increase of deaths in the Alpine environment was reported. 134 deaths occurred in Friuli Venezia Giulia (North East of Italy) (Figure 1), between 2010 and 2015, within the total amount of 1300 CNSAS interventions.

The great majority of accidents occurs due to fall from a superior to an inferior surface. The most important traumatic mechanism is the impact between body and surface; the violence of impact depends on the distance between the two surfaces and it's proportional to the body mass, but it also depends on the type of surface (rocky, grassy,...) and on the type of clothing of the victim. Another important mechanism is deceleration, that could determinate the breakage or tearing of internal organs.

### AIMS

The aim of the study is a preliminary analysis of fatal accidents in the mountain area of Friuli Venezia Giulia, during the period from 1996 and 2015, focusing on:

- risk factors and circumstances in which the event took place;
- dynamics and modalities of the accident;
- type of lesions, forensic diagnosis;
- work related accidents and attribution of responsibilities.

### MATERIALS AND METHODS

An alphanumeric database (Figure 2) was created with Microsoft Excel. 61 cases were taken from the archive of the Section of Legal Medicine of the Department of Medical and Biological Sciences of the University of Udine; for each case 23 variables were analysed in order to sample and evaluate:

- identifying data of the victim;
- environment and activity (altitude, climbing routes, climbing walls, hiking in woods, in solitude or in group);
- dynamics (slipping, loss of foothold or handhold, sudden illness, avalanche);
- season, time of day or night, ascending or descending phase;
- technical skill (tourist, mountaineer, alpine guide) and equipment (Figure 6);
- injuries, points of impact and final cause of death (Figure 3).

### RESULTS

- From 1995 to 2015 the frequency of fatal accidents has been decreasing;
- the majority of events took place during Summer (36%); 46% of events took place in the morning, 47% in the afternoon;
- the great majority of victims were male (85%);
- the mean age of deceased subjects was 50 years;
- the mean difference of altitude of falls was 87 meters (minimum 5 metres, maximum 200 metres);
- 76% of subjects was practicing a recreational activity, 17% was practicing a sport, 7% was at work;
- 53% of subjects was skilled; 80% had adequate equipment; 61% wasn't alone when the accident took place;
- 59% of events took place during the descending phase, 41% during the ascending phase;
- the majority of subjects slipped (the others fell due to loss of foothold or handhold, avalanche, falling rocks, technical error,...);
- when rescuers arrived, 84% of subjects was already dead;
- the majority of subjects suffered from head-brain traumas (Figure 4), or from polytrauma (Figure 5).



Figure 1: sample area.

Figure 2: database.

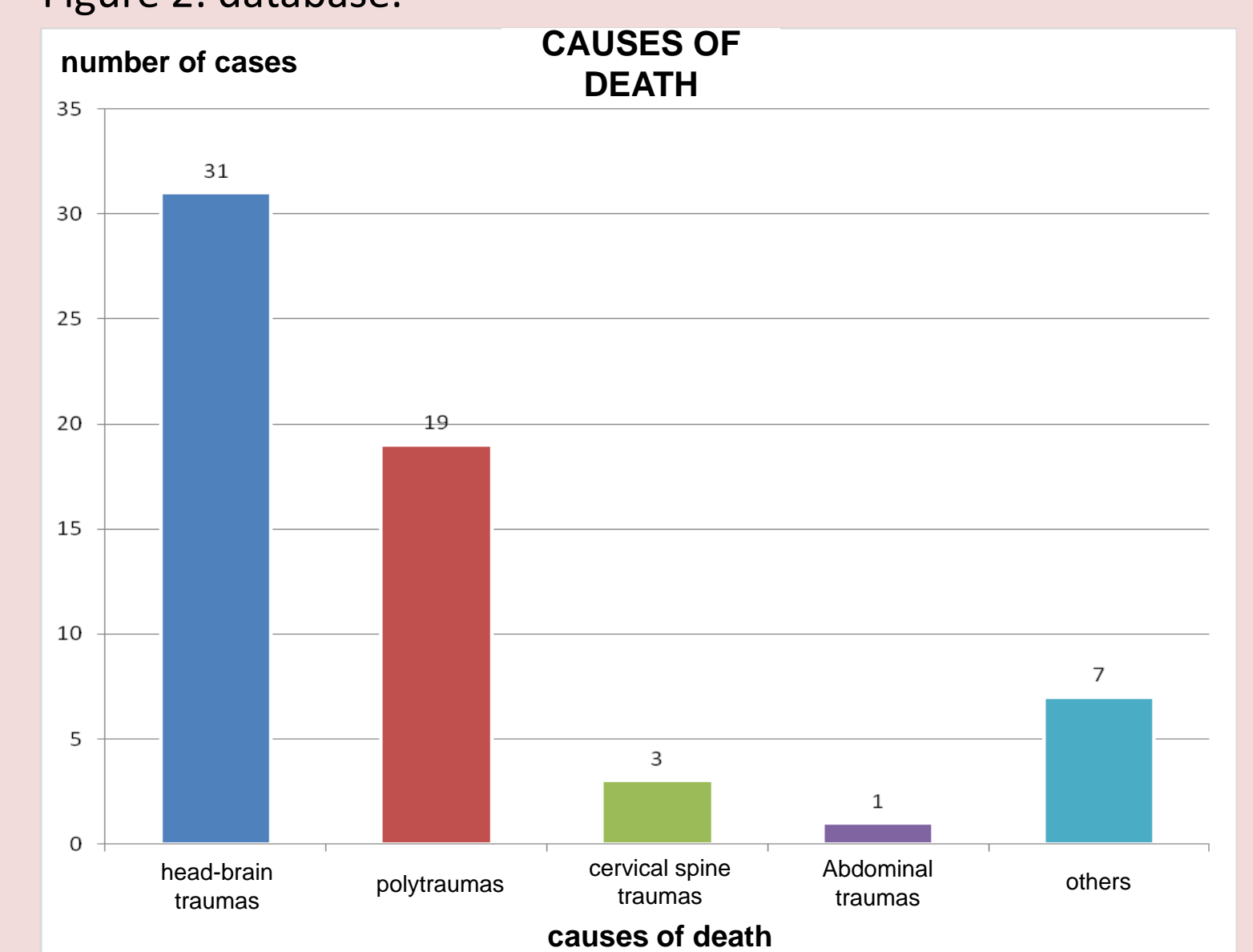


Figure 3: distribution of cases according to causes of death.



Figure 4: head-brain trauma.



Figure 5: polytrauma.



Figure 6: equipment.

### CONCLUSIONS

The amount of fatal accidents occurred in mountain areas is decreasing, despite the number of rescue operations is increasing: probably there is an improvement of outcomes due to the improvement of means of first aid.

There are two populations at risk:

- adult-old subjects, with poor experience and inadequate equipment, who practice recreational activities alone, during every season of the year and they usually slip in critical conditions;
- young subjects, with experience and adequate equipment, who practice sports mainly in Summer and Autumn and usually fall from greater heights during the descending phase; they usually move in group and they could be saved when they are still alive.

Regarding to the accidents occurred at work, 50% of these subjects weren't well equipped (Figure 7).

The great majority of lesions occurred on the head-brain district: this is the region of the body with less impact resistance so it could be injured also in fall from low height.

Further studies should be done about equipment and prevention regarding accident at work.

Moreover, other studies are needed about type of fatal lesions, their classification and their risk rates.

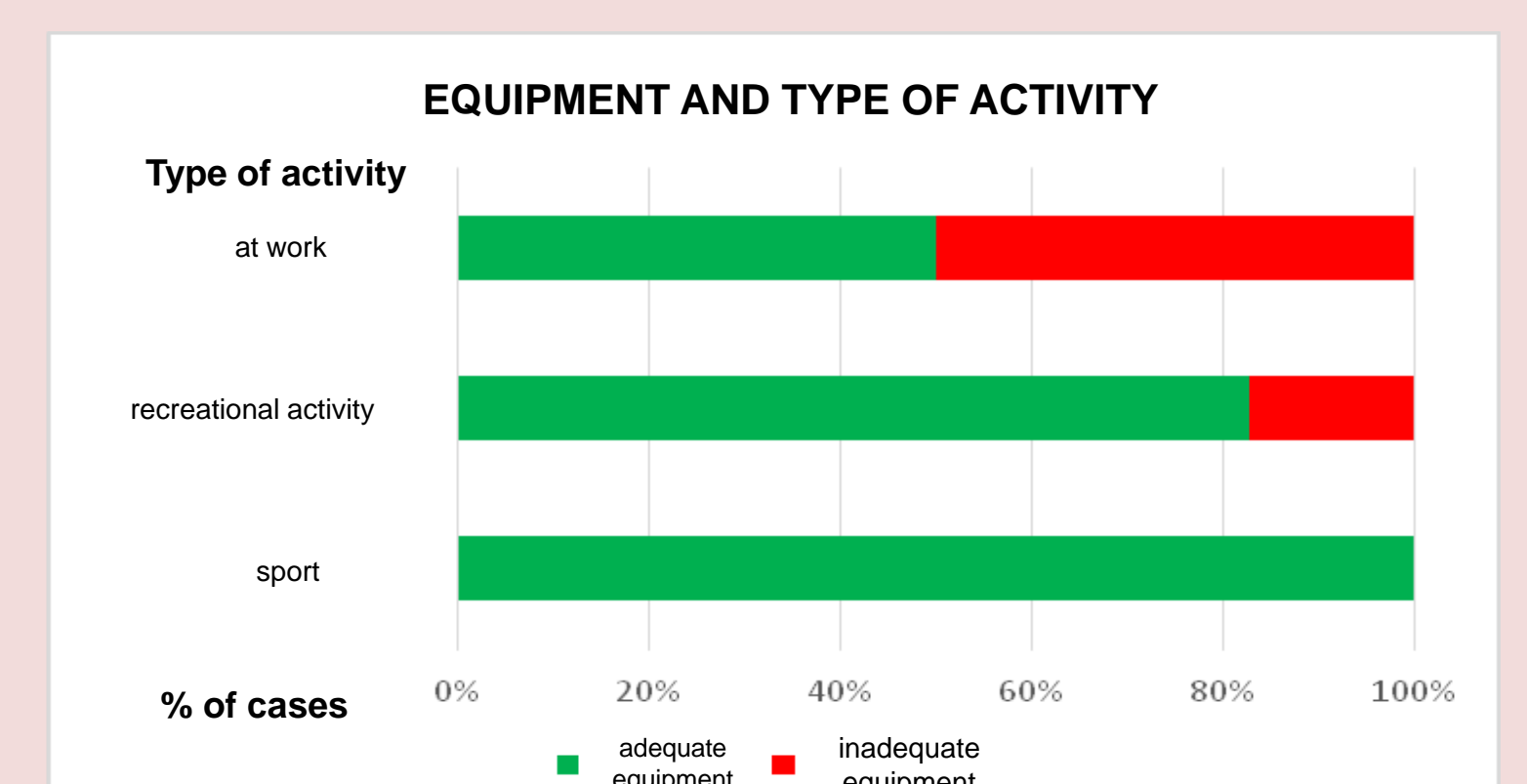


Figure 7: distribution of cases according to equipment and type of activity.