The power of safety data to prevent work related accidents: empirical evidences from pilot projects in Italy

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Agenda

1. The power of safety data for supporting effective prevention activities at work
2. Analysis of historical structured and unstructured data to understand real causes of accidents/injuries
3. Analysis of real time structured and unstructured data
4. Conclusions

The importance of analysing safety data for supporting prevention at workplace

- Observing emerging trends outlined by historical and real time safety data could support companies as well as institutions for improving their prevention strategies
- Cross analysis carried out at national and company level could outline root causes of injuries, most critical sources of hazards.
- Currently, collection of safety data is improving due the increasing diffusion of digital technologies.
- Results obtained from an analysis of pilot projects regarding the Italian construction sectors is proposed.

Crossing structured and unstructured safety data

Target 1: analysing structured and unstructured data to understand real causes of accidents/injuries based on historical data

Time horizon: **2015- 2019**

Two database sources:

- The first one* collecting data and information on multiple aspects characterizing injury phenomenon collected in Italian Companies. The total width of the sample is about 160.000 records.
- The second one** collecting structured information about root causes of severe fatal injuries occurred in companies. The total width of the sample is about 600 records.

97% of the injured person are male, 3% female

60% of injured workers were between the ages of 30 and 60, and the most exposed group is 40-50 years old

*Database Statistical of the Italian National Institute for Insurance against Accidents at Work (Inail)

*Database of the Italian national surveillance system for occupational fatal injuries Infor.Mo

Analyzing most hazardous activities

Professional specialization	Occurred injury events	Additional notes
Bricklayer	18 %	Very critical activities refer to using specific materials as brick, stone or concrete materials
Manual workers	10 %	A critical group is construction workers, who carried out make up 87% of total data in this cluster
Electrician	9%	A critical activity highlighted is outdoor installations, which contributes to 52% total data in this cluster
Carpenter	6%	A critical activity highlighted is construction, which contributes to 73% total data in this cluster
Plumbing	5%	-

30% of total accidents occurred during the **performance of manual activities** - such as picking up, grasping, tearing, holding in the hand, laying - on a **horizontal plane**, or working with hand tools, or in handling activities (e.g., moving heavy loads, handling objects)

Cross analysis on historical data

Overlapping data about specific sub-sector inside the construction one: building construction, civil engineering and specialised construction work

Evaluating most hazardous activities in each specific subsector



Evaluating the three most exposed professions (i.e., bricklayers, manual workers and electricians)

Walking, running, climbing, descending, represent about 22% of the analyzed cases

For specialized construction work and civil engineering: operations developed with a transport means or a specific movement equipment
For building construction: the vertical transport of an object

- *Construction for brick layer;*
- *Excavation, construction, maintenance and demolition of buildings for manual workers;*
- *Moving activities- with or without means of transport - for electricians.*

Applying Natural Language Processing (NLP) techniques for analyzing safety data

Target 2: NLP has been applied to text description of each event in the Italian database of severe injuries in order to better understand its actual causes and related dynamics

Outlying most frequent words in Italian and US datasets

Databases derived from Bureau of Labour Statistics (BLS) has been used

Comparing information about accidents between the two datasets

It emerges a common strong prevalence of accidents due to:

- *falls, towards lower levels.*
- *contact with objects, in particular "crushing due to falling objects".*

Comparing information about accidents in specific subsector

In both cases, the specialized construction sector is the most exposed to accidents, while the civil engineering sector is the least exposed

Predictive analytics trough safety data management

Target 3: applying the safety data analysis to practical incident/injury prevention solutions through the intensive use of digital technologies

Time horizon: 6 month in 2021

Data have been collected on a complex construction site, i.e., construction of railway infrastructure.

The experimental activity started by acquiring all safety documents and analyses regarding risk assessment.

7 workers of different companies working in the construction site (one contractor and one executor) were involved.

Each worker was equipped with mobile phones for dynamic interaction with the cloud PRESTO platform and smart watches for the collection of biometric data aiming to evaluate real time risk indices.

Results obtained:

- A risk assessment process updated with real time data has been tested;
- Several dynamic alerts have been provided to workers involved in the test;
- An evaluation of the overall level of "perceived usefulness" together with the acceptance level of workers for digital solutions aimed to improve safety at their workplace;
- A good level of appreciation and an ease of use was reported. Some criticalities referred to the use of such technological tools and reporting precursor events (near misses, unsafe conditions).

Collected data type trough digital technologies

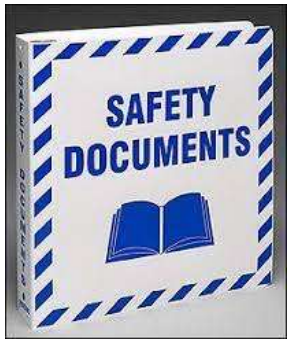
Workplace conditions

Specific worker health parameters

Real time data

Static data

Safety procedures



Risk assesment process

RISK ASSESSMENT MATRIX				
SEVERITY / PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

An example of the cloud platform

Usability

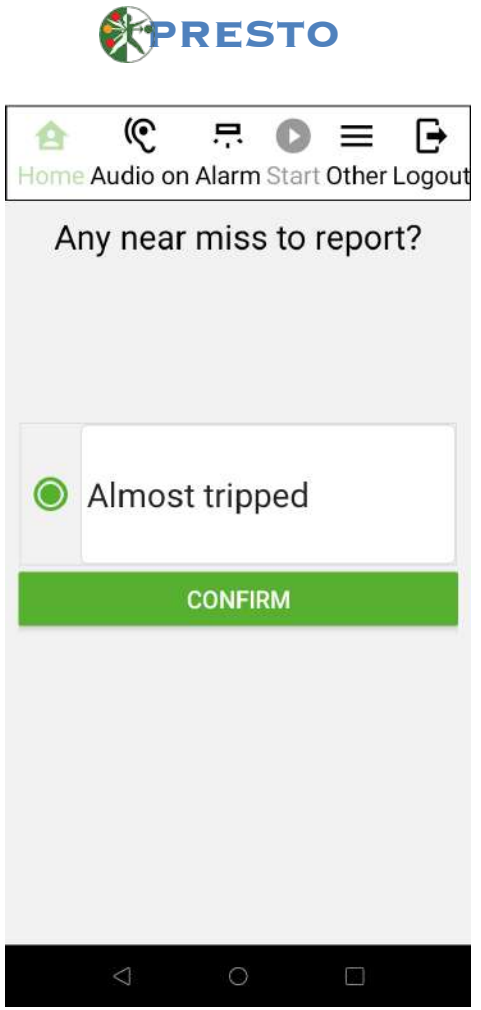
- User friendly application available on smartphone, tablet, smart-watch, browsers
- In the pilot a smartwatch was used

Real time info

- Weather conditions
- Adam Risk Index (based on 45 weighted risk indicators)
- Health indicators (wearable, eg stress level)
- Position (GPS, IoT proximity device)
- Details and time trend of each information

Information gathering

- Quick start-up questionnaire on their heath and confidence
- Near misses and unsafe conditions



Conclusions

- The study has proposed an analysis of how safety data – at different level of aggregation – could support additional knowledge to prevent in a more efficient way accidents at workplace, especially in the construction sector.
- The first statistical analysis has outlined several interesting points for designing more effective prevention activities, starting from workers more exposed to risks, to most frequent accident dynamics and hazard sources.
- The comparison between US and Italian data - developed by adopting natural Processing language - has confirmed several results even if the organization of the construction sector are quite different in the two areas.
- The adoption in a real test case of several digital technologies for both acquiring data about workers health, workplace conditions and analyzing information for providing real time feedbacks, has pointed out positive potentialities and criticalities of managing safety data in real time.

Thank you for your attention

For more information:

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