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# Stroke and the need for immediate assistance at the place of onset: the future of mandatory training for lay people in Italy

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*Key words: Stroke, Workplace, Training, Emergency Medical System*
*Parole chiave: Ictus, Luogo di lavoro, formazione, Sistema Emergenza Urgenza*

**Abstract**

***Introduction.*** *Lay training is essential to manage emergencies properly, although patients or bystanders need increased recognition of medical urgencies such as strokes. In Italy, as defined by Legislative Decree 81/08, all companies must train employees responsible for correctly recognizing and managing medical emergencies. Our study aims to evaluate the characteristics of medical emergencies concerning patients with a possible stroke in the Lombardy Region.*

***Methods.*** *A retrospective observational study was conducted. All missions performed by Regional Agency for Emergencies and Urgencies (Agenzia Regionale Emergenza Urgenza – AREU) in which the patient presented a possible stroke, recorded in the SAS-Areu database, were analyzed. The study period was from January 1, 2019, to December 31, 2019.*

***Results.*** *10,201 patients with possible stroke were rescued, of whom only 540 (5.3%) occurred in workplaces. In workplaces, the percentage of males with a possible stroke was higher (62.2% vs 45.2%; $p<0.01$) and the mean age of rescued patients was lower (64.7 vs 77.5; $p<0.01$).*

***Conclusions.*** *A stroke occurs less frequently in the workplace, while most events occur at home. Mandatory training on early stroke recognition should be extended to schools and conveyed through a media information campaign. Lay training is the first point in the chain of survival; redefining training is critical for the future.*

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## Introduction

The Legislative Decree (D Lgsl) 81/08 requires the introduction within workplaces of first responders, who must be specifically trained in the management of medical emergencies, such as Out of Hospital Cardiac Arrest (OHCA), and recognition of urgencies such as stroke. Following the D Lgsl 81/08, D Lgsl 158/12 and D Lgsl 116/21 have expanded the training requirements for the management of OHCAs (1). However a correct recognition of medical urgencies (such as stroke) by laypeople remains controversial. Campaigns for correctly identifying stroke have shown that it is difficult for laypersons to classify it correctly and immediately, and the use of private cars to the hospital is still excessive (3). Correct recognition of medical urgencies is essential as they are time-dependent pathologies and because the patient must be transported to the right hospital in the right way. For this reason, the 118 rescuers use the Cincinnati Prehospital Stroke Scale (CPSS), which, through three clinical signs, allows to identify a possible stroke; CPSS does not allow a diagnosis of certainty, but provides high sensitivity (4-7).

In Lombardy, the *Regional Agency for Emergencies and Urgencies* (Agenzia Regionale Emergenza Urgenza – AREU) takes care of all pre-hospital emergency medical services (EMS) through ambulances: the vehicles are divided into *(a)* basic life-support medical vehicles (BMV) with crews trained in Basic Life Support (BLS) manoeuvres, *(b)* Intermediate life Support (ILS) medical vehicles with nurses (IMV) and *(c)* Advanced Life Support (ALS) medical vehicles with doctors and nurses (8saas-AEREUAMV); all IMV and AMV crews are trained in ALS. All interventions performed by the EMS teams are recorded on the Emma portal, and the data are available for analysis on the SAS-AREU (Statistical Analysis System-AREU) portal. The Lombardy Region has a population of 10 Mln and is divided into four *Regional Operations Rooms for Emergencies and Urgencies (*Sale Operative Regionali Emergenza Urgenza - SOREU), which coordinate as many specific areas (8-9).

The purpose of this article is to analyze the first part of the *Stroke Survival Chain* (6) in Lombardy before the Covid-19 outbreak (10-11). The work policy changed profoundly (12) during the pandemic years. We highlight the behavior and decisions in different settings to call EMS by laypersons at the onset of medical urgency. An analysis of this phenomenon is central for future campaigns; in fact, proper training is essential for adequately managing clinical emergencies by laypeople and the health professionals (13). We focus on the rescues performed in the workplace to highlight the usefulness of first aid responders.

## Methods

This is a retrospective observational cohort study. The study was conducted following the principles of the Declaration of Helsinki and was approved by AREU Data Protection Officer in December 2021.

We extrapolated the data from the Lombardy's AREU headquarters register. The data analysis process was conducted employing the SAS-AREU portal, which contains all data regarding emergency calls and involving patients with a positive Cincinnati Prehospital Stroke Scale (CPSS), which tests three signs including facial droop, arm drift, and speech. The test is considered positive for possible stroke in case of one or more out of three signs.

We analyzed different rescues of all possible strokes rescued by AREU in Lombardy from January 1 2019 to December 31 2019.

*Workplaces* were defined as rescues performed in railways, factories, sports

facilities, schools, and public offices, which are the places where emergency training is mandatory. All other places were categorized as *Other settings*.

Categorical variables are presented as numbers and percentages, and continuous variables as mean and standard deviation (SD). Categorical variables were analyzed using the $\chi^2$ test, continuous variables were tested for normality, and the Z test was performed for means. Differences were considered significant (S) when p was <0.05; otherwise, they were considered non-significant (NS).

## Results

In 2019, the 118 AREU system recorded 10,201 patients registered with the stroke code. 52% (5,333) were females, 46% (4,703) were males, and for 2% (165) sex has not been indicated; the average age was 76.8 (SD: 13.6).

The average arrival time of the first vehicle on site was 13.6 (SD: 7.2) minutes, and the overall mission time was 46.4 (SD: 22.7) minutes.

As for the reason of call, performed by bystanders or the patients, 8,741 (86%) events were recognized as "medical events" by the AREU system. The second reason was "falls", with 1,182 (12%) events.

The calls for "Medical event" were divided into 5,571 (64% of all medical events) classified as "Neurological disease", while 2,017 (23%) cases were recognized as "heart disease". Globally, including the calls for "trauma events", such as car accidents or fall, the "neurological disease" was recognized in 5,571 (55%) cases of the total of calls.

Out of these, 540 (5.3%) rescues occurred in a workplace, while 9,631 (94.4%) took place in "other settings" and the remaining 30 (0.3%) in undefined places.

The BMVs were dispatched for 9,991 (98%) events, while the IMVs were dispatched for 599 (5.9%) events and the AMVs for 1,216 (12%) events.

Table 1 highlights the five locations defined as workplaces, where training on medical emergencies is mandatory for employees. In the group "other setting", we included Hospitals and Nursing homes, where there is no mandatory training for employees, but for a nurse or a doctor working full-time or part-time.

Table 2 analyzes the characteristics of the rescue carried out in the five workplaces

Table 1 - Places of stroke diagnosis.

| Place | Number | Percentage | Workplace |
|---|---|---|---|
| Home | 8,317 | 81.5% | No |
| Nursing Home | 891 | 8.7% | No |
| Public Office | 425 | 4.2% | Yes |
| Street | 377 | 3.7% | No |
| Work Facility | 72 | 0.7% | Yes |
| Hospital | 43 | 0.4% | No |
| Railway/Subway | 13 | 0.1% | Yes |
| School | 15 | 0.1% | Yes |
| Sport Facility | 15 | 0.1% | Yes |
| Mountain | 3 | 0.0% | No |
| Undefined | 30 | 0.3% | Excluded |

Table 2 - Demographic characteristics of the population and characteristics of rescue

| | Workplace | Other setting | P value |
|---|---|---|---|
| Male (%) | 336 (62.2%) | 4,367 (45.2%) | <0.01± |
| Age (SD) | 64.7 (16.2) | 77.5 (13.1) | <0.01* |
| Average time first vehicle on the spot in minutes (SD) | 12.7 (7.2) | 13.7 (7.2) | <0.01* |
| Average arrival time at the hospital in minutes (SD) | 46.4 (22.8) | 47.8 (16.0) | 0.80* |

± Chi-square test; * Z test between means

compared to non-workplaces; we collected demographic characteristics of the patients rescued and the time of rescue.

## Discussion and conclusions

As shown in Table 1, 540 subjects were rescued at the workplace, accounting for about 5.3% of possible stroke diagnoses, which shows that training in medical emergencies is crucial. In addition to making the workplace safer, trained operators maintain their competence even outside working hours. Indeed, the chain of survival of the patient starts with early recognition and goes through the rapid transport of the patient to a hospital with competence in performing fibrinolysis; however, the essential thing is time, and any delay or failure in activating the 118 service could slow down the process.

Our analysis shows that patients who develop a possible stroke at the workplace have different demographic characteristics than those who develop stroke in other settings. As shown in Table 2, subjects at workplaces are younger (64.7 vs 77.5; p<0.01), since the retirement age in Italy is usually 67 years and the older subjects tend to stay at home much more. Furthermore, the percentage of males is higher (62.2% vs 45.2%; p<0.01). Our analysis reveals that emergency vehicles arrive an average of one minute earlier in case of events that occurred at the workplace (12.7 vs 13.7; p<0.01), while there are no significant differences in terms of arrival to the hospital (46.4 vs 47.8; p=0.80): this may be due to a large number of hospitals in cities.

Regarding the vehicles used for the transport, we underline the high number of BMV transports (98%), which are the most appropriate vehicles for transporting patients. It is crucial to mention the every day's use of IMV (6%) and AMV (12%), due to the relative stability of the patient, who does not require emergency medical interventions, but only transportation to the hospital with a Stroke Unit.

Regarding this subject, little evidence has been presented in the literature on the prehospital setting, considering the place of onset of disease, and especially on the management of possible strokes. The only thing known is that patients fail to recognize medical urgencies clearly and often self-present at the Emergency Department having stroke-like pathologies. This behavior may worsen the patient's outcome.

There are two major limitations in this study, however, identified as sporadic occurrences. The first is the presence of some missing data, as the database collects data marked by the dispatcher, who sometimes may not enter the stroke code even though it is present from a clinical point of view due to a high number of calls. The other limitation may be that the CPSS assessment, in most cases, is carried out by BMV responders,

who are trained operators but are not healthcare providers, so they may miss the suspicion.

It is essential to highlight the rate of correct detection performed by laypersons: in 86% of the events, the caller recognized the medical event. In the 55% of overall calls, patients or laypersons recognized a possible neurological disease, which may be due to the symptomatology of the stroke. It often presents as a syncope, which may also explain why it was classified as a fall in 12% of calls: this is relevant because it shows that it is necessary to increase training programs.

In conclusion, individuals with possible stroke rescued by EMS in the setting of a workplace represent a low percentage of the total and have different demographic characteristics from others. Despite numerous mandatory training campaigns in the workplace, these could be implemented in different settings, and other training campaigns are needed to teach people recognize medical emergencies properly.

**Authors' contributions**

AZ, GMS, CS, AA, GS conceived and designed the study; GS collected and analyzed the data; GS, AA, GMS, CS, RP interpreted the results of the experiments; GS, RP and AA prepared table; GS, EK, RP drafted the first version of the manuscript; all authors edited, revised the manuscript and approved the final version before submission.

## Riassunto


### *Ictus e necessità di assistenza sul luogo di esordio: futuro della formazione obbligatoria dei "laici" in Italia*

**Introduzione**. La formazione dei laici è essenziale per gestire correttamente le emergenze, anche se è necessario un maggiore riconoscimento delle urgenze mediche come l'ictus da parte dei pazienti o degli astanti. In Italia, come definito dal Decreto Legislativo 81/08, tutte le aziende devono formare un gruppo di dipendenti responsabili del corretto riconoscimento e della gestione delle emergenze mediche. Il nostro studio si propone di valutare le caratteristiche delle emergenze mediche riguardanti i pazienti con un possibile ictus nella Regione Lombardia.

**Metodi**. È stato condotto uno studio osservazionale retrospettivo. Sono state analizzate tutte le missioni effettuate da AREU (Agenzia Regionale Emergenza Urgenza) in cui il paziente presentava un possibile ictus, registrate nel database SAS-AREU. Il periodo di studio va dal 1° gennaio 2019 al 31 dicembre 2019.

**Risultati**. Durante il periodo di studio sono stati soccorsi 10201 pazienti con possibile ictus, di cui solo 540 (5.3%) si sono verificati nei luoghi di lavoro. Nei luoghi di lavoro, la percentuale di maschi con possibile ictus era più alta (62.2% vs 45.2%; $p<0.01$) e l'età media dei pazienti soccorsi era più bassa (64.7 vs 77.5; $p<0.01$).

**Conclusioni**. L'ictus si verifica meno frequentemente sul luogo di lavoro, mentre la maggior parte degli eventi si verifica a casa. Pertanto, la formazione obbligatoria sul riconoscimento precoce dell'ictus dovrebbe essere estesa alle scuole e veicolata attraverso una campagna informativa sui media. La formazione dei laici è il primo punto della catena della sopravvivenza; ridefinire la formazione è fondamentale per il futuro.


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