# IS THERE ANY CORRELATION BETWEEN OVER-/UNDER-TRIAGE AND WORKING HOURS IN THE EMERGENCY MEDICAL COMMUNICATION CENTERS?

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## INTRODUCTION

There are many recent articles published in scientific literature on the topic of work-related stress. However, these studies focus on the effects of stress on the workers and not on the impact that stress could have on their work performancemore specifically on the calltaker's (emergency dispatcher (ED)) performance and consequently on the whole Emergency Medical Service (EMS).

## OBJECTIVE

The objective of this study was to assess whether the number of consecutive hours worked (WH) by the EMDs had an impact on their performance, in terms of case evaluations, and on the type (i.e., Advance Life Support [ALS] vs. Basic Life Support [BLS]) and methods/mode (i.e., with/without Lights and Siren [L&S]) of dispatch of emergency vehicles.

## METHODS

The retrospective descriptive study included cases in the Liguria EMS, Italy, database dated from Jan 01, 2011 to Dec 31, 2019. The criticality of priority codes (from the most serious to the least serious: black, red, yellow, green, and white) assigned by the EMDs during the emergency call (EMD criticality; CP) were compared with the priority codes assigned by the field responders (Responder criticality; CR). The data were then analyzed in relation to the number of consecutive hours worked (WH) and descriptive statistics such as sensitivity, relative risk, and predictive values were estimated. Figures 1 represent the correlation method for assessing the correctness, insufficiency, and excessiveness of the associations between CR and CP priority dispatch codes.

**Figure 1A** Matrix used to compare the priorities assigned by calltakers (CP) with the ones assigned by responders (CR).

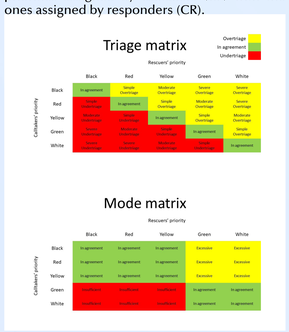


**Figure 1B** Matrix used to evaluate the appropriateness of the resource (ALS or BLS) dispatched.

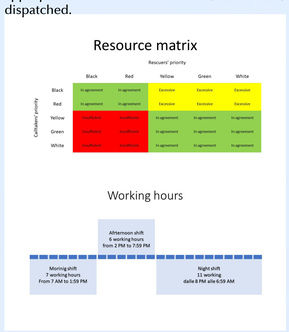


**Figure 1C** Matrix utilized to evaluate the appropriateness of the dispatch mode (with or without lights and siren).

**Figure 1D** Length of work shifts at EMCC of Genoa.

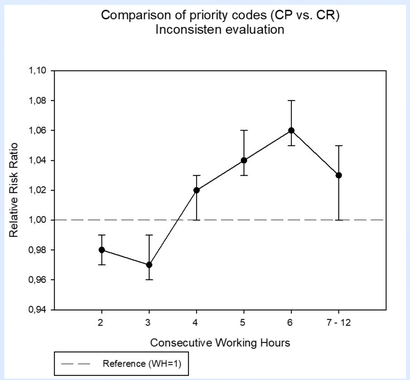


**Figure 2**
Comparison of priority codes (CP vs. CR) inconsistent evaluation. The increase in WHs causes an increased risk (RRR) of inconsistent assessments between CP and CR. For example, after 6th WH this risk is 6% higher than in the first hours (RRR, 95% CI: 1.07; 1.05-1.08).

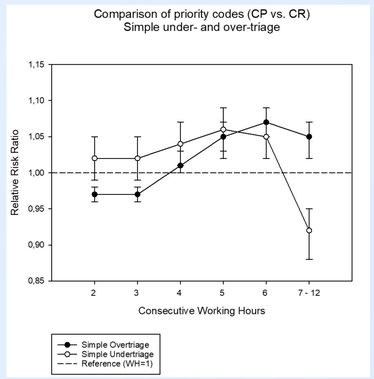


**Figure 3**
Comparison of priority codes (CP vs. CR) simple undertriage and overtriage. Both simple overtriage (i.e.,yellow - green) and simple undertriage (i.e., green - yellow), progressively worsened in relation to increasing WH. The improvement in EMD performance in the 7-12 WHs class is probably due to the reduced volume of triaged calls.

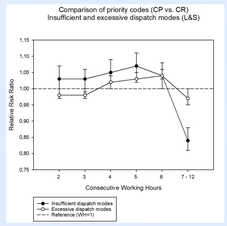


**Figure 4b**
Comparison of priority codes (CP vs. CR)—insufficient and excessive dispatch modes (Lights-and-Siren). According to the Italian legislation, the use of lights and sirens (L&S) is envisaged to be exclusive for the red and yellow priority codes.

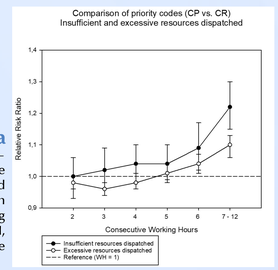


**Figure 4a**
Comparison of priority codes (CP vs. CR)—insufficient and excessive resources dispatched. The appropriateness of the type of resource (advanced or basic) sent to the scene progressively worsens in relation to the increase in WH. The risk (RRR) of sending insufficient resources is, compared to the first WH, greater than 22% (RRR, 95% CI: 1.22; 1.15-1.30) in the 7-12 WHs class.

## RESULTS

A total of 1,599,809 cases were analyzed. Sensitivity for patients with impaired vital functions (red codes) was 76.4% (95% CI: 75.2-77.4) with a positive predictive value of 20.3% (95% CI: 19.2-21.9) and specificity was 87.8% (95% CI: 87.1-88.8) with a negative predictive value of 98.9% (95% CI: 98.8-99.0). The relative risk ratio (RRR) of inconsistent assessments improves in the first three WHs: -3% at the third WH (0.97, 0.96-0.99) and progressively worsens in the following hours, reaching +6% (1.06; 1.05 - 1.08) at the sixth WH. In the first three WHs, there was also an improvement in the appropriateness of the resources sent: -4% at the third WH (0.96, 0.94 - 0.98) which then progressively worsens thereafter, reaching + 11% (1.11, 1.07 - 1.14) in 7 -12 WH range.

### LIMITATION

First, the WHs are based on the shift schedule, without taking into account any double shifts (e.g.: morning and afternoon). Second, the period from the seventh to the twelfth WH falls into the the very early morning hours (from 2 am to 8 am) where the volumes of emergency calls are definitely significantly reduced (1st WH: n = 221,826; 12th WH: n = 16,018). Third, as part of the methodological choice, CR was used as a "golden/standard/truth test" since it was not possible to consider the possible and natural evolution (improvement/worsening) of the patient's condition in the time between the call (CP) and the arrival of the responders on the scene (CR), as well as any therapies administered before transporting the patient to hospital. Finally, the emergency calls in this study were not reviewed using the IAED's case review quality assurance standards.

## DISCUSSION

The distribution of CP and CR codes is substantially in line with other publications at national and international levels. All the analyses relative to the WH, with some marginal variations in the different subgroups, show an improvement in performance in the first three hours of work and a subsequent and progressive worsening up to 6 WH. The results of the 7-12 WH period generally, with the exception of the analysis on the type of resource sent (Figure 4a), show an improvement. This could be the result of a reduced volume of calls during the night hours.

## CONCLUSION

The performance of the EMDs, in terms of predictive ability improved within the first three WHs, then progressively worsened up to the sixth WH. As the number of WHs increased, overtriage and dispatch of emergency vehicles with L&S also increased.

## ACKNOWLEDGEMENTS

The authors would like to thank Giuditta Easthope, Italian Translator, Priority Dispatch Corp.™, Salt Lake City, Utah, USA, for her immense work in translating the Italian version of the paper to English.

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## PUBLISHED

Annals of Emergency Dispatch & Response.
2021; 9(1):12-17. https://www.aedrjournal.org/