

# Predicting cases of violence from repeated admissions in Emergency Departments

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## Abstract.

### Background.

Violence against women is a relevant health problem. Emergency Departments (ED) are ideal settings to identify victims of violence. However, this phenomenon is highly affected by underreporting. Since violence on women is often repeated over time, histories of frequent admissions can be considered as anomalies and may be considered alerts at the moment of triage in ED.

The aim of this thesis is to identify risk factors for violence and to find models useful to predict if an history of admissions in ED can be suspicious of violence.

### Materials and Methods.

Data about admissions in ED were collected in Piedmont and Tuscany during 2011-2015. Risk factors for violence were estimated by means of a case-control study. Women with at least one admission for violence during 2013-2015 were selected as cases. Women with at least one admission for road injury in the same period were selected as controls. The last admission for violence in that period was indicated as index admission. The following variables have been considered as predictors: sex, age at the index admission, citizenship, number of ED admissions in the 24th months before the index admission, number of previous admissions for specific causes (violence, domestic injury, big group of diagnosis).

Furthermore, ED histories of women with an admission in Tuscany during 2013-2015 were labeled as having been victims or not. Four classification algorithms were trained on these data: decision trees, random forests, Naive Bayes and Support Vector Machines. Therefore, they were used to classify ED histories of women with an admission in Piedmont in the same period.

### Results.

In Piedmontese ED, 3939 victims were found during 2013-2015 with respect to the 18645 found in Tuscany. An increase of the number of admissions significantly increases the probability of being victim of violence (OR=1.11,  $p<0.0001$ ). The risk of being victim with past admissions for violence is high (OR=15.5,  $p<0.0001$ ) and foreign women are more at risk than Italian ones (OR=1.7,  $p<0.0001$ ).

Among classification models, decision trees and random forests algorithms gave the highest precision (81.5% for decision trees, 86.8% for random forests) and allowed us to make predictions with an order of magnitude similar to the one found in Tuscany (21536 for decision trees and 14420 for random forests). In general, patients classified as victims have an history of past admissions that distances itself from the normal behaviour.

### Conclusions.

The analysis confirm how much the phenomenon of violence is affected by underreporting. Results of the case control study suggest that violence is often repeated in time. Frequent admissions in ED can suggest the hypothesis of the patient being victim of violence. It could be useful to implement predictive models in ED triage software, in order to return a suspicious index alerting ED specialists.