

Hermetet C.<sup>1,2</sup>, Laurent E.<sup>1,2</sup>, El Allali Y.<sup>3</sup>, Gaborit C.<sup>1</sup>, Lecuyer AI<sup>1</sup>, Urvois-Grange A.<sup>4</sup>, Saint-Martin P.<sup>5</sup>, Biotteau M.<sup>1,6</sup>, Le Touze A.<sup>7</sup>, Grammatico-Guillon L.<sup>1,8</sup>

<sup>1</sup>Epidemiology and Public Health Unit, Teaching hospital of Tours, Tours, France <sup>2</sup>Research Team « Education, Ethics and Health » (EA 7505), University of Tours, Tours, France <sup>3</sup>Department of paediatrics, Hospital of Blois, Blois, France <sup>4</sup>Paediatric emergency Department, Teaching hospital of Tours, Tours, France <sup>5</sup>Department of legal medicine, Teaching hospital of Tours, Chambray-lès-Tours, France <sup>6</sup>University psychiatric clinic, Teaching hospital of Tours, Saint-Cyr-sur-Loire, France <sup>7</sup>Paediatric burn unit, Teaching hospital of Tours, Tours, France <sup>8</sup>University of Tours, Tours, France

## Highlights

- The performances of an algorithm to detect non-accidental pediatric burns (maltreatment) using the French hospital discharge database **dropped when including neglect**, difficult to diagnose clinically.
- Training for healthcare professionals and qualitative studies on obstacles to the judicial authority (RJA) or worrying information (WI) should be added to this diagnostic study.

## Introduction

- Child maltreatment:
  - Acts of commission: physical, sexual, psychological abuse
  - Acts of omission: physical, emotional, medical, educative neglect; inadequate parental supervision; exposure to violence
- Burns: high morbi-mortality among non-accidental (maltreatment) paediatric injuries
- Objectives:
  - Main: To assess the performance parameters of an algorithm to detect non-accidental paediatric burns (NAB) using the French Hospital Discharge Database (HDD)
  - Secondary: To describe the clinical cases of child maltreatment with no action taken during the analysed hospital stay

## Methods

- Study population: Children aged 0 to 16 years old, with a coded burn (ICD-10) during  $\geq 1$  hospital stay at the Teaching hospital of Tours (France) from 2012 to 2017
- NAB multidisciplinary definition:
  - HDD cases: 2 definitions, « probable » / « possible » (Figure 1 and Table I)
  - Clinical cases: 3 definitions (levels): excluding child neglect, including neglect with restrictive definition, then with broad definition
- Performance parameters
  - Validation study: medical chart review
    - All the HDD cases
    - HDD non-cases matched on sex and age classes, 1:2 ratio
  - Parameters estimated for each of the 3 levels of clinical definition: sensitivity, specificity, positive and negative likelihood ratios
- Clinical cases:
  - Report to the judicial authority (RJA) or worrying information (WI) notified in the medical charts
  - Description of cases with no RJA/WI (type and mode of burn, type of violence)

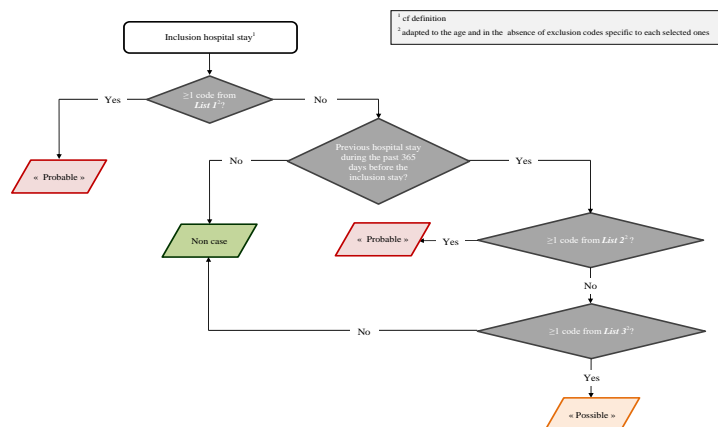


Figure 1 Decision tree

Table I List of codes (extracts)

| Pathology / event                                  | Codes | Elements to associate   |                                 |         | Age  | List_1 | List_2 | List_3 |
|--|-------|---|---------------------------------|---------|------|--------|--------|--------|
|  |       | Exclusion codes<br>(EOSC : excluding other selected codes)          | Codes_1                         | Codes_2 |      |        |        |        |
|  |       |   |                                 |         |      |        |        |        |
| Physical abuse                                     |       |   |                                 |         |      |        |        |        |
| Retinal haemorrhage                                | H356  | Coded etiology (HTD, RVO) EOSC                                      | I10, H348                       |         | 0-2  | 1      | 2      |        |
| Perforation of tympanic membrane                   | H72   | Coded etiology (barotrauma, otitis, foreign body (IE, RTA...)) EOSC | T70, W94, H65-H66, T16, V01-V99 |         | 0-16 | 1      | 2      |        |
| Subarachnoid haemorrhage                           | I60   | Coded etiology (AVM, RTA) EOSC                                      | Q28, V01-V99                    |         | 0-16 | 1      | 2      |        |
| Intracerebral haemorrhage                          | I61   | Coded etiology (AVM, RTA) EOSC                                      | Q28, V01-V99                    |         | 0-16 | 1      | 2      |        |
| Other nontraumatic intracranial haemorrhage        | I62   | Coded etiology (AVM, RTA) EOSC                                      | Q28, V01-V99                    |         | 0-16 | 1      | 2      |        |
| Stroke, not specified as haemorrhage or infarction | I64   | Coded etiology (AVM, Rendu-Osler) EOSC                              | Q28, I780                       |         | 0-16 | 1      | 2      |        |
| Oesophagitis                                       | K20   | Coded etiology (GOR) EOSC   | K21                             |         | 0-1  |        | 2      |        |

- 253 children included
- 236 with sufficient clinical information to be included in the validation study: 83 « probable » HDD cases, 0 « possible »; 153 HDD non-cases (Figure 2)

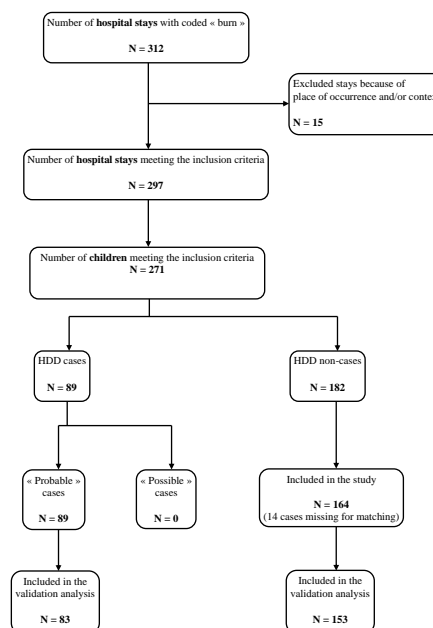


Figure 2 Flow-chart

Table II Estimation of the performance parameters of the algorithm for each of the 3 levels of maltreatment definition

| Definition of child maltreatment                                     | Validation sample (N) | Sensitivity % [95%CI] | Specificity % [95%CI] | LR+ [95%CI]   | LR- [95%CI]   |
|--|-----------------------|-----------------------|-----------------------|---------------|---------------|
| HDD cases including child neglect with a broad definition            | 83                    | 47.9 [36.1-60.0]      | 70.6 [62.9-77.4]      | 1.6 [1.2-2.3] | 0.7 [0.6-0.9] |
| HDD cases including child neglect with a more restrictive definition | 83                    | 63.6 [40.7-82.8]      | 67.8 [61.0-74.0]      | 2.0 [1.4-2.9] | 0.5 [0.3-0.9] |
| HDD cases excluding child neglect                                    | 78*                   | 90.0 [55.5-99.7]      | 67.8 [61.0-74.0]      | 2.8 [2.1-3.7] | 0.1 [0.0-0.9] |

CI: confidence interval; N: number of children; LR: likelihood ratio  
\*exclusion of five cases with isolated clinical child neglect

## Results - Discussion

- Clinical cases with no RJA/WI with no notified reason (Table III):
  - From 0% (excluding child neglect) to >85% (including child neglect with broad definition)
  - All were isolated possible child neglect cases

Table III Description of clinical cases of child maltreatment not reported nor informed, according to the 3 levels of maltreatment definition

|   | With a broad definition of child neglect (N = 73) | With a more restrictive definition of child neglect (N = 22) | Excluding child neglect (N = 10) |
|---|---|--|----------------------------------|
| Number of cases not reported / not informed, n                                    | 67  | 15   | 5                                |
| Reasons for non RJA / non WI, n   |   |  |                                  |
| N   | 67  | 15   | 5                                |
| Clinical cases previously reported / informed                                     | 5   | 5  | 2                                |
| Other action  | 4   | 4  | 3                                |
| No reason   | 58  | 6  | 0                                |
| Description of clinical cases not reported / not informed with no notified reason |   |  |                                  |
| N   | 58  | 6  |                                  |
| Type of burn, n   |   |  |                                  |
| Cautic  | 21  | 4  |                                  |
| Thermal   | 35  | 2  |                                  |
| Electric  | 2   | 0  |                                  |
| Frictional  | 0   | 0  |                                  |
| NS  | 0   | 0  |                                  |
| Mode of burn, n   |   |  |                                  |
| Ignition / flash back   | 15  | 1  |                                  |
| Contact   | 14  | 0  | NA                               |
| Spilling / projection   | 6   | 1  |                                  |
| Immersion   | 1   | 0  |                                  |
| Ingestion   | 20  | 4  |                                  |
| NS  | 2   | 0  |                                  |
| Type of violence, n   |   |  |                                  |
| Physical  | 0   | 0  |                                  |
| Psychological   | 0   | 0  |                                  |
| Sexual  | 0   | 0  |                                  |
| Child neglect   | 58  | 6  |                                  |
| Isolated  | 58  | 6  |                                  |

n: number of children; NA: not applicable; NS: not specified; RJA: report to the judicial authority; WI: worrying information

## Discussion - conclusion

- Performances of the algorithm: tremendous variations, particularly of sensitivity, according to the inclusion or not of child neglect, difficult to assess clinically
- « Child neglect »: no consensual definition, leading in practice to a considerable latitude for the subjective judgment of the physician who examines the child
- This clinical difficulty could moreover explain the absence of actions, judicial or administrative, in the cases of isolated possible child neglect
- Perspectives:
  - Application of the algorithm in other French hospital centres, in order to improve the power of results and to discuss a potential « centre effect » in coding
  - Trainings for healthcare professionals, diffusion of detection tools and qualitative studies on obstacles to RJA/WI