

Predicting return to the pediatric emergency department within 3 days: a systematic review

Rainer Spiegel^{1, 2}

1. BG Trauma Centre Tübingen, Division of Anaesthesiology, Intensive Care and Pain Management, Tübingen, Germany
2. Tübingen University Hospital, Department of Anaesthesiology and Intensive Care, Tübingen, Germany

Take home messages:

- When releasing a child from the pediatric emergency department (PED), it is important that the child is safe and the parents feel comfortable.
- Return to the PED causes distress among the child, the parents and PED-personnel.
- To support clinicians, prediction models based on artificial intelligence (AI) were analyzed in their success to predict PED-return.
- The success of these prediction models range from accurate predictions around chance level to reasonable accuracy of around 80 %.
- Considering the currently published literature, no definitive conclusions are possible, because of the retrospective nature of the datasets.
- Only up to 5 percent of children were re-admitted to the PED within 3 days. It remains questionable whether artificial intelligence currently offers something beyond clinical judgment in this context.

Introduction

In the pediatric emergency department (PED), it is important to decide whether a child needs to be admitted to the Children's Hospital. Making the right decision avoids stressful return visits to the PED. Different machine learning models exist for predicting return within 3 days. An analysis of factors being associated with PED return is provided.

Method

A PubMed literature search included all articles until 28 February 2020 with no restriction to language. Search terms were: ("machine learning" OR "artificial intelligence") AND (pediatric emergency department) AND (return prediction). Articles with a total database size of 192801 cases were found (66861 in database 1 [1], 125940 in database 2 [2]). The primary endpoint was return to the PED within 3 days. After comparing prediction success of various machine learning approaches in the past [3], the current focus was to identify factors that contribute to PED return.

Results

There was return of up to 5 percent of children within 3 days. Machine learning predicted return with 58 percent (naïve Bayes) to 81 percent (discriminant analysis/particle swarm optimization) accuracy [1]-[3]. Reasons for return from both prior publications [1]-[2] were integrated. They involved but were not restricted to:

Number of prior PED visits per year.

Cardinal symptom.

Diagnosis (including acuity level, chronic disease, etc.).

Diagnostic tests (consultations of specialists and complete blood count making return more likely, ultrasound making return less likely).

Treatment (e.g. intravenous rehydration or antibiotics make return more likely).

PED visit on a Saturday (making return more likely).

Time until a PED bed was available.

Provider type and number of other pediatric facilities in the region.

Having been discharged from hospital within the week before the PED visit.

Conclusions

Knowing the reasons for return visits can have advantages on planning admissions. Causal judgments, however, must be avoided, because the data are retrospective and there is the potential for confounders. The number of prior PED visits per year, whether a complete blood count is taken, whether specialists are involved in the PED, might all be linked to the severity of illness. In addition, it remains questionable whether AI models currently add valuable information beyond clinical judgment, because maximally 5 percent of children returned to the PED and prediction accuracy of the most successful models was hardly better than 80 %.

References

- [1] Lee et al. AMIA Annu Symp Proc. 2012;2012:495-504.
- [2] Hu et al. Comput Methods Programs Biomed. 2017 Jun;144:105-112.
- [3] Spiegel et al. Crit. Care Med. 2019 Jan;47(1):662.

Disclosures

The author owns a limited number of stocks from a respirator/ventilator company.