DECODING PEDIATRIC OUTCOMES FOR INFORMED HEALTHCARE DECISIONS AND PAIN MANAGEMENT

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INTRODUCTION

In **neonates** requiring urgent surgical intervention and **Neonatal Intensive Care Unit (NICU)** admission, the decisions and actions of healthcare professionals, particularly concerning essential yet **painful procedures**, have a **profound impact on the newborns' condition** and **chances of survival**.

The Electronic Health Records (EHR) data are crucial for assessing responses to treatment, predicting recovery trajectories, and making necessary adjustments to care plans.

Challenges:
- Time Constraints
- Organizational Issues
- Competency Gaps

Figure 1: NICU at Hospital in Dnipro, Ukraine

Potential of Machine Learning (ML)
ML frameworks present a **promising solution** to **identify patterns** and **predictive factors** that might be overlooked due to human limitations (2).

OBJECTIVE

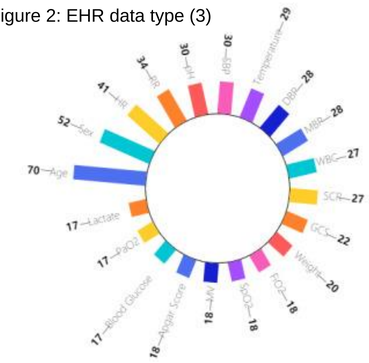
This study aims to **identify** and **assess predictive factors**, including **pain management** strategies, that enhance the **likelihood of survival in neonates** with urgent surgical needs. By leveraging ML, the study seeks to provide actionable insights to improve clinical outcomes and support healthcare professionals in making informed decisions.

METHODS

Dataset from EHR Multidisciplinary Clinical Hospital for Mothers and Children in Dnipro, Ukraine:

- **Day-to-day** collected **newborn's health data**
- **Data analysis** carried out for **each day** of
- the **infant's life**
- **Predict survival** outcome on first **7 days of life**
- Use of **ML framework** to predict

Figure 2: EHR data type (3)



The data analysis comprised two phases:

Phase 1:

Different pre-processing techniques were applied to adapt and transform for ML modeling the manually entered data, including handling missing values, eliminating outliers and redundant features, and encoding categorical data.

Final dataset: N= 250 survived newborns

N= 190 not survived

Phase 2:

Developing an ML framework to predict a child's daily outcome using EHR data. Eight classification models were built employing the XGBoost algorithm.

Each relative to a different age (0-7 days). The algorithm was chosen within a preliminary modeling study, based on parameter values' stability across various training sets.

RESULTS

Prediction Model Performance:
Precision Score: 83.37% ± 0.07%
High discriminative power of EHR data in the first seven days.

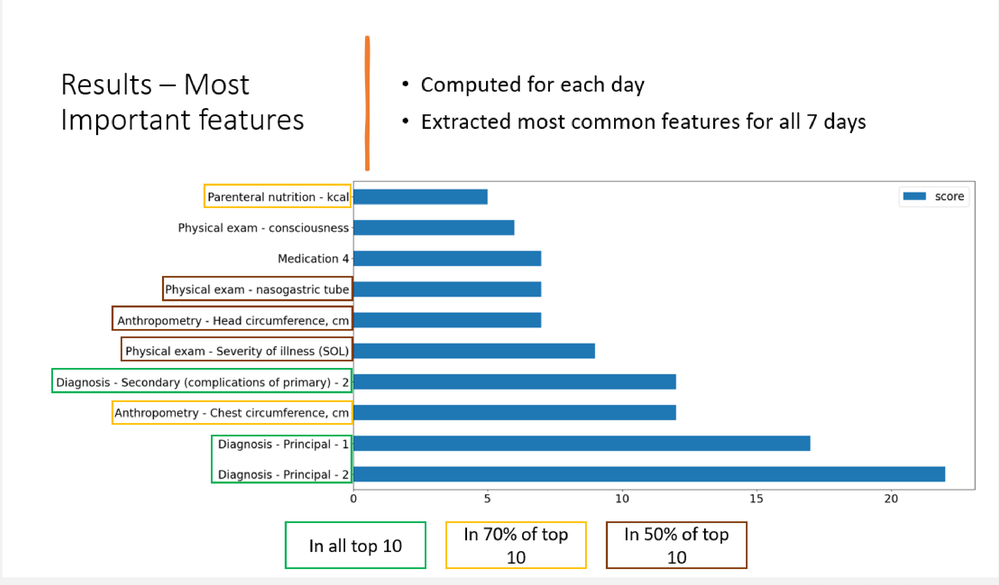


Figure 3: Main results

Daily Metrics and Outcomes:
- **Day 0:** Chest circumference had the strongest impact.
- **Days 1 & 2:** Key features included chest and head circumference, principal diagnoses, and patient response to examination.
- **Day 3:** Muscle tone was most significant.
- **Day 4:** Parenteral nutrition and respiratory patterns were critical.
- **Consistent Features:** Nasogastric tube presence, head circumference, and severity of illness were influential in at least 50% of the days.

CONCLUSIONS

Reliability of Medical Actions:
Diagnoses and interventions by medical professionals are the most reliable predictors of a child's survival, confirming the effectiveness of clinical decisions.

Predictive Power of ML:
- ML techniques can accurately predict newborn outcomes using longitudinal EHR data, supporting data-driven decision-making.
- Each day's metrics uniquely contribute to outcome determination, emphasizing the need for meticulous daily data evaluation.
- Identified significant features align with medical expertise, validating the model's predictive foundation.
- Standardizing data collection and employing robust pre-processing steps are crucial for achieving reliable prediction accuracy.

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