Boston Children's Hospital Pediatric Blood Pressure Analysis

Aproject to analyze and detect prolonged low blood pressure incidents in pediatric surgeries.





Agenda

Context & Background

Understandingthecontext&background of the project.

× Problem Statement

Defining the scope of intraoperative hypotension.

Objectives

Outline goals and purpose of the analysis.

Data Structure & Methodology

Explainkeydatasources&outlinethe approached used to analyze the data

(III) Key Result Findings & Insights

Present the results/findings.

Recommendations

Next steps for implementation.

Overview

Context

Duringpediatricsurgeries, lowblood pressure can pose serious risks. This project analyzes blood pressure datatodetect cases where the systolic BP dropped below safe thresholds for at least 14 minutes, helping medical teams assess and mitigate risks.

Problem Statement

BCHfacesacomplexchallenge of identifying prolonged periods of low blood pressure across different pediatric age groups. And without analysis, critical periods may be missed, putting young patients at risk.

Objectives

- DevelopanETL process to detect pediatric patients experiencing sustained low blood pressure during surgery for at least 14 minutes
- Create age-specific thresholds for identifying critical BP drops.
- Generate actionable insights for BCH medical team professionals.



Data Structure

Demographics Data

PERSON_ ID	SERVICE_ DATE	AGE_ MONTHS
1	1/12/2016	40

Blood Pressure Data

Row	PERSON_ID	TIME	SYSTOLIC_BP
1	11	1/12/2016 07:05	32
2		1/12/2016 07:06	54

Key assumptions: PERSON_ID identifies the patient, and blood pressure is only measured during surgery.

Data Sources & Methodology

Our analysis integrated patient demographics withintraoperative blood pressuremeasurements to create a comprehensive picture of hypotensive episodes. We employed a multi-step process to identify patients at risk and quantify the duration of low blood pressure incidents.

Note: Age-based thresholds determine what constitutes "low blood pressure" in pediatric patients:

Data Collection & Preprocessing

- Demographics.csv (Patient ID, Surgery Date, Age in Months)
- BloodPressure.csv (Patient ID, Time of Reading, Systolic Blood Pressure)
- Converted date fields (SERVICE_DATE, TIME) to datetime format.
- Converted PERSON_ID to **integer** to ensure proper merging.
- Removed rows with missing values (NaN or ERROR entries in blood pressure readings)

Data Integration & BP Identification

- Merged datasetsusing PERSON_IDand SERVICE_DATE
- Created unified timeline of BP readings per patient

Defined low blood pressure thresholds

- Systolic BP f 46 mmHg is considered low, if AGE_MONTHS < 44
- Systolic BP f 55 mmHg is considered low, if AGE_MONTHS g 44
- Flagged readings **below these threshold**.

Consecutive BP Duration Analysis:

- Sorteddataby**PERSON_ID**and **TIME**.to track consecutive low readings
- Identified continuous low blood pressure / episodes lasting 14+ minutes or more

Key Result Findings & Insights

PERSON_ID	SERVICE_DATE	DURATION (MINUTES) 24 20 16 14
987	2016-10-17	14
456	2015-05-21	
789	2017-07-07	
123	2016-01-05	
567	2019-05-10	



Executive Summary: Incidence & Impact

Our analysis identified five uniquepatients who experienced dangerouslylowbloodpressure for 14 minutes or longer during surgical procedures. These hypotensive episodes represent significant clinical events that warrant further investigation and preventive measures.

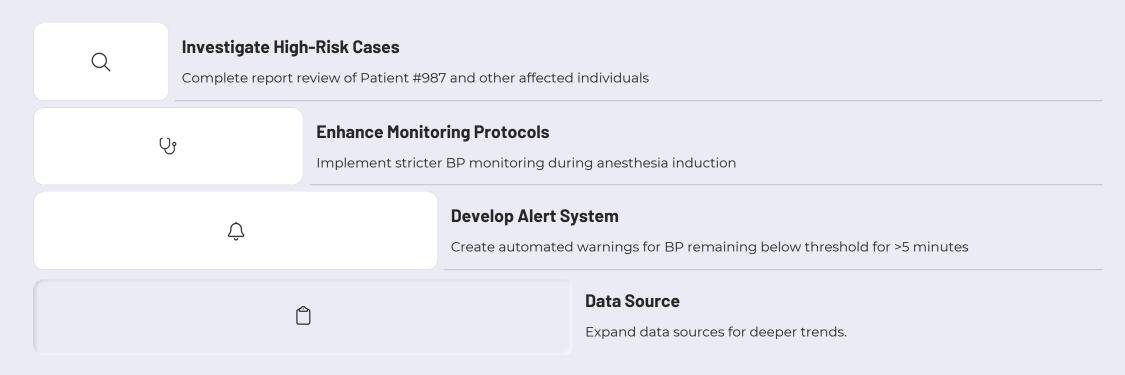
Patient #987 experienced the most severe case, with blood pressure remaining critically low for 24 minutes during a 2016 procedure. This patient also had a separate 16-minute episode during an earlier surgery that same year, suggesting possible physiological predisposition to intraoperative hypotension.



Recommendations & Implementation Strategy

Based on our findings, we recommend a multi-faceted approach to address intraoperative hypotension and minimize patient risk. Immediate attention should focus on Patient #987, who experienced multiple prolonged episodes and may have underlying physiological factors predisposing them to intraoperative hypotension.

Beyond individual case management, systemic improvements in monitoring technology and staff training will help reduce the incidence and duration of hypotensive episodes during future surgical procedures. Real-time alerts represent a particularly promising intervention that could allow for immediate corrective action.



Project Summary

ETL PipelineComplete

Successfully created a data pipeline that extracts, transforms, and loads pediatric blood pressure data.

Clinical Insights

Identified patients
experiencing sustained low
blood pressure episodes
during surgery based on agespecific thresholds.

Deliverables Provided

Original Pythoncode and final report (CSV) containing all required information about low blood pressure episodes.

