Boston Children's Hospital Pediatric Blood Pressure Analysis

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

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Agenda

Context & Background

Understanding the context & background of the project.

Problem Statement

Defining the scope of intraoperative hypotension.

Objectives

Outline goals and purpose of the analysis.

Data & Methodology

Explain key data sources & outline the approached used to analyze the data

Key Result Findings & Insights

Present the results/findings.

Recommendations

Next steps for implementation.

Overview

Context

In pediatric surgery, every moment is critical. Monitoring patient vital signs, especially blood pressure, can mean the difference between life and death. However, monitoring these signs presents a complex challenge, especially when dealing with patients across different age groups.

Problem Statement

BCH faces a complex challenge 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

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

Data Structure & Model

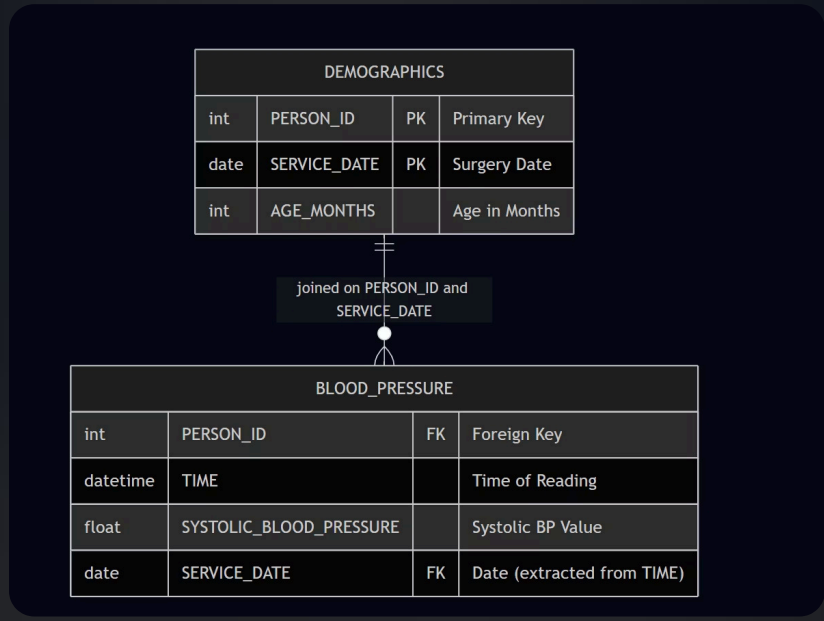
Demographics Data

PERSON_ID	SERVICE_DATE	AGE_MONTHS
1	1/12/2016	40

Blood Pressure Data

Row	PERSON_ID	TIME	SYSTOLIC_BP
1	1	1/12/2016 07:05	32
2	1	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 with intraoperative blood pressure measurements 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

- Demographics.csv (Patient IDs, Surgery Dates, Ages)
- BloodPressure.csv (BP Readings During Surgery)

Data Integration

- Merged datasets using PERSON_ID and SERVICE_DATE
- Created unified timeline of BP readings per patient

Identification

- Applied age-specific BP thresholds
- Flagged readings below critical levels

Duration Analysis

- Tracked consecutive low readings
- Identified episodes lasting 14+ minutes

Key Result Findings & Insights

Our analysis revealed five patients who had prolonged low BP periods. The longest episode, which lasted 24 minutes, presented a significant clinical concern.h

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

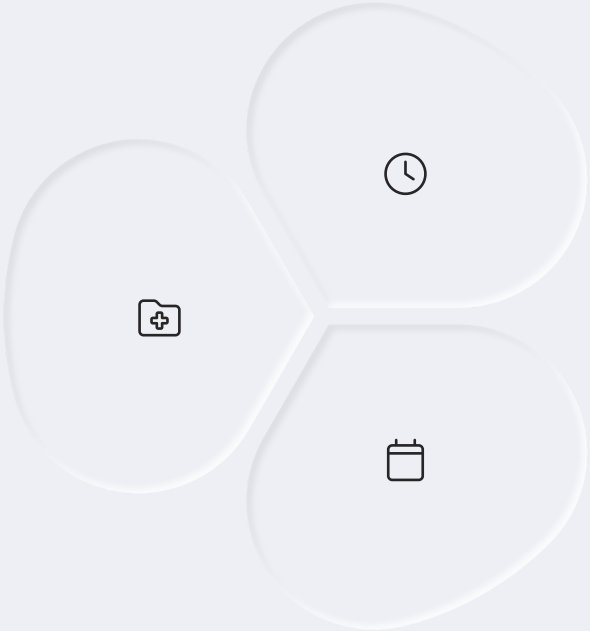
Executive Summary: Incidence & Impact

Our analysis identified five unique patients who experienced dangerously low blood pressure 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.

5 Unique Patients

Experienced prolonged low blood pressure events during surgery



24 Minutes

Longest duration recorded (Patient #987)

BP Period Range

Low BP periods ranging from 14 to 24 continuous minutes.

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.

Investigate High-Risk Cases

Complete report review of Patient #987 and other affected individuals

Enhance Monitoring Protocols

Implement stricter BP monitoring during anesthesia induction

Develop Alert System

Create automated warnings for BP remaining below threshold for >5 minutes

Data Source

Expand data sources for deeper trends.

Project Summary

ETL Pipeline Complete

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 age-specific thresholds.

Deliverables Provided

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