Anticipating Intensive Care Needs Based on Surgical Activity: The Example of Anesthesia Data

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Introduction

Utilizing a DataWarehouse in intensive care based on the methodology in anesthesia, knowledge of the data.

Every day, artificial intelligence is featured in the media across all domains of human activity. The fundamental work and analytical rigor beforehand are essential before leading to believe in a magical extrapolation of the clinical organization of a care unit or the future of patients. Through this excerpt, we quantify the flow of patients and their characteristics over 10 years of data exploitation from the surgical department. Indeed, the operating block puts pressure on the intensive care units that can be evaluated, followed, and hopefully for all, anticipated.

Objectives

1. Forecasting and resource management: Improve operation planning and also contribute to reducing waiting times for patients requiring post-operative intensive care.
2. Optimizing patient flow: Understanding and predicting the flow of patients from the operating block to the ICUs allows for better management of available beds and a more balanced staff distribution, thereby improving the quality of care

3. Application of AI models: Predictive modeling using AI techniques such as neural networks, support vector machines, or random forests could offer valuable insights for forecasting intensive care needs. Integrating clinical and operational variables would increase the accuracy of forecasts
4. Impact on clinical decision-making: Use real-time clinical decision support tools, assisting anesthesiologists-intensivists and ICU staff in making informed decisions on patient and resource management.

Materials and Methods

After obtaining approval from the Ethics Committee of Charleroi University Hospital, we exploited the database from the computerized anesthesia protocol.

The institutional integration of information from the electronic medical record associated with the national death registry from the health data interchange allows for the evaluation of care quality.

This database records all information related to the anesthesia of all patients treated by our team, such as physical status according to the American Society of Anesthesiologists classification (ASA PS), administered medications, duration of the surgical procedure, and patient's vital parameters. It also collects other perioperative data such as the reason for hospitalization, various classifications of the stay (APR-DRG, severity score, mortality score), the origin and duration of the hospital stay, mortality, etc.

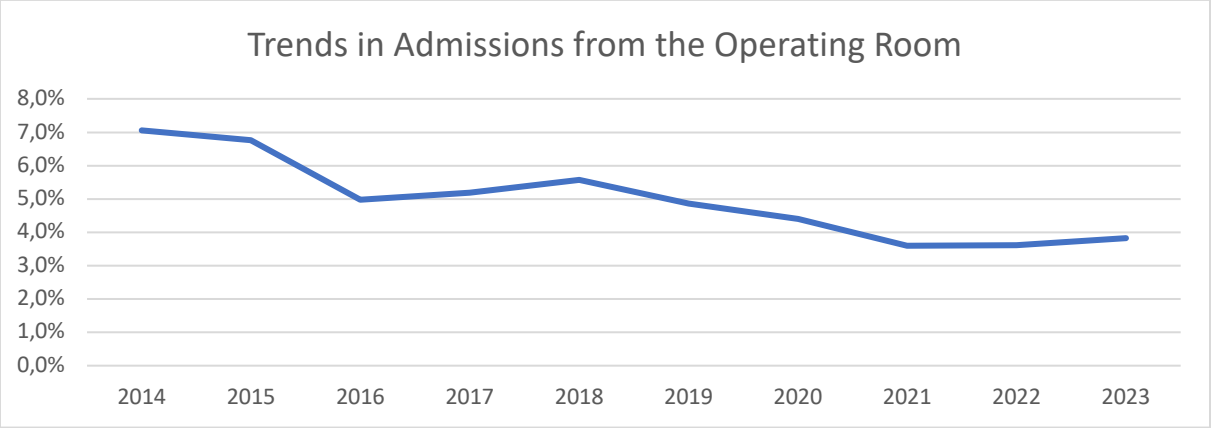
The database is stored on hospital servers with restricted access for confidentiality reasons. Data anonymization is performed during extraction. Data are extracted using Microsoft SQL Server, data preparation in SPSS (IBM), and statistical analyses using STATA and SPS.

Results are presented in Microsoft Excel without any personal information on patients.

This document adheres to applicable STROBE guidelines.

Results

Service	USI	N-OR	%	Time- M Mean ± SD	Séjour H med ± SD	Asa Mean ± SD	BMI	Score Sev Mean ± SD	Dc30 N (%)
USI									
2014	314	4451	7,1%	143 ± 230,9	11 ± 11,4	2,7 ± 0,9	27,7 ± 7,6	3,6 ± 0,6	7,6%
2015	611	9046	6,8%	169 ± 276,2	11 ± 14,3	2,8 ± 0,7	28,2 ± 6,2	3,6 ± 0,5	7,9%
2016	668	13436	5,0%	196 ± 269,4	10 ± 11,4	2,8 ± 0,7	28 ± 6,4	-	6,1%
2017	741	14265	5,2%	143 ± 259,1	9 ± 8,7	2,7 ± 0,7	27,9 ± 6	3,7 ± 0,6	6,5%
2018	829	14874	5,6%	158 ± 263,6	8 ± 8,8	2,8 ± 0,7	27,9 ± 6,2	3,5 ± 0,7	6,6%
2019	743	15281	4,9%	149 ± 243,8	8 ± 7,2	2,8 ± 0,7	28 ± 6	3,7 ± 0,6	7,3%
2020	543	12357	4,4%	137 ± 238,4	8 ± 6,4	2,7 ± 0,8	27,8 ± 6,2	3,5 ± 0,7	8,5%
2021	593	16492	3,6%	132 ± 260,5	8 ± 6,6	2,8 ± 0,7	28 ± 6,1	3,5 ± 0,7	8,4%
2022	690	19102	3,6%	142 ± 260,6	8 ± 6,8	2,9 ± 0,7	27,7 ± 5,9	3,7 ± 0,6	7,1%
2023	794	20762	3,8%	147 ± 261,1	8 ± 7,3	2,7 ± 0,7	27,8 ± 6,3	3,5 ± 0,7	7,2%
2024	122	3077	4,0%	134 ± 253,4	0 ± 0	0 ± 0	26,5 ± 4,6	3,5 ± 0,7	5,7%



Discussion & Conclusion

The operating room acts as a supplier of patients for the intensive care units, catering to patients who did not previously require ICU stay.

Quantification of this activity reveals that 4% of operating room activity results in ICU admissions, with a stable severity score and a mortality rate of about 7%, justifying the patients' risk (average perioperative non-ICU rate of 1 to 2%).

The admission percentage was halved from 7% to 3.6%, with identical severity scores and ASA classes. Discharge times from the operating room during night periods are critical, and higher mortality rates are observed; ICU admission protects these patients.

All this data should be leveraged in advance to assess the human resources needed based on the reading of surgical activities, and this in an anticipatory manner, in order to avoid the disorganization of structures as much as possible

Conflict of Interest Statement

The authors declare no financial, personal, or other conflicts of interest that could inappropriately influence their work. All sources of research funding are mentioned, and no external support that could lead to a conflict of interest was received for the realization of this project.

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Imagery - Presentation Poster

Graph 1. Trend of Surgical Patient Admissions to Intensive Care.

Graph 2. Mortality Incidence Based on the Non-Elective Timing of the Procedure.

Graph 3. Length of Stay for Surgical Patients Following Admission to Intensive Care.