# A Study of Post Operation Hypotension Burden Model in Korea using HIRA National Inpatient Sample (HIRA-NIS) DATA

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## INTRODUCTION & OBJECTIVE

- Intraoperative hypotension (IOH) is a common issue for patients undergoing non-cardiac surgeries.
- It can increase the risk of side effects and prolong intensive care unit (ICU) stay.
- This study aimed to estimate the economic burden of IOH during non-cardiac surgeries in Korea, thereby bridging the corresponding knowledge gap.

## METHODS

### Data source

- HIRA-NIS is a 10% sample of total inpatients, which is stratified by sex and age intervals without identification information from patients' claim data.
- These data consist of four tables: "200" table for general information of statements, "300" table for treatment records, "400" table for "diagnosis records," and "530" table for out-of-hospital prescription.
- The most recent 3-year HIRA-NIS data (2017-2019) at the time of this study were used to compare the disease burden between the IOH group and the control group among non-cardiac surgery patients.

### Analysis method

- **Target population selection:**
  - If the value of a variable "surgery/non-surgery" in the "200" table was "9" (surgery), then the patient was classified as a surgery patient.
- **Operational definition of IOH:**
  - If a patient had a record of ingredient codes of vasopressors (dobutamine, dopamine, epinephrine, norepinephrine, phenylephrine, and vasopressin), then the patient was regarded as having IOH.
- **Included types of surgery:**

**Table1. Included types of non-cardiac surgery**

| Types | | Notes |
|---|---|---|
| Vascular | Abdominal aortic aneurysm open repair | From Michard et al. (2015) |
| | Aorto-iliac and peripheral bypass | |
| Gastro-Intestinal | Esophagectomy | |
| | Gastrectomy | |
| | Colectomy | |
| | Resection of rectum | |
| | Hepatectomy | |
| | Pancreatectomy | |
| Urologic | Total cystectomy | |
| Thoracic | Pneumonectomy | Association with hypotension |
| Obstetrics | Cesarean section | Association with hypotension |
| Orthopedic | Femur and hip fracture repair | From Michard et al. (2015) |
| | Replacement arthroplasty - hip or knee | High frequency within three-year HIRA-NIS |

- **Operational definition of outcome variables**

**Table2. Operational definition of outcome variables**

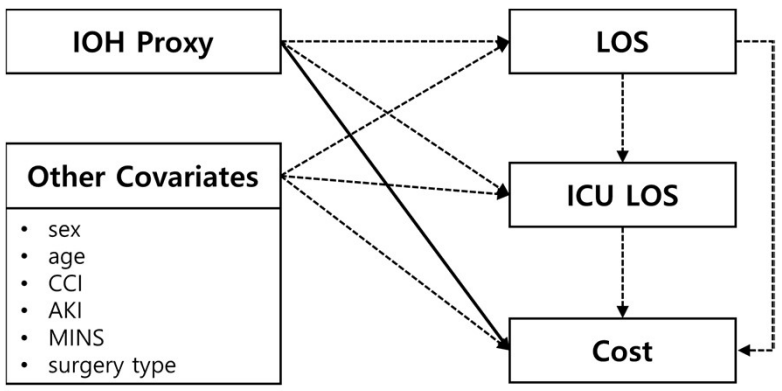
| Outcome variables | Operational definition |
|---|---|
| AKI (Acute Kidney Injury) | No records related to the diagnosis of acute renal failure and no procedure codes of renal ultrasonography and hemodialysis/peritoneal dialysis indicated in the statements prior to surgery but mentioned in the statements after surgery |
| MINS (Myocardial injury in non-cardiac surgery) | Unstable angina pectoris or cardiac infarction not mentioned in the statements before surgery but any of these followings indicated in the statements after surgery<br>– Procedure codes of cardiac marker testing, angiography, or coronary CT<br>– Diagnosis of angina pectoris or cardiac infarction |
| ICU LOS (ICU length of stay) | The value of a variable "the total usage" when the value of "CZ_ITEM_CD" variable is "02031" which means hospitalization fee/intensive care unit(western medicine) |
| Hospital LOS (Hospital length of stay) | The value of a variable "the number of hospitalization days" |
| Costs | The value of a variable "the total amount of medical care benefit expenses determined by assessment" |

- **Detailed analysis method:**
  - Analysis tool: SAS Enterprise Guide (version 9.4.2)
  - Analysis design: .
    - Comparison in total surgery patients between the IOH group and control group
    - Comparison between IOH group and control group by surgical type
  - Propensity Score Matching:
    - Matching method: Caliper matching (range of error: 0.005)
    - Covariates to calculate propensity scores: age, sex, CCI, and surgical types (only in the comparison in the total surgery patients)

### Hypotension Burden Model

- To estimate the budget impact of the IOH considering the endogeneity of three dependent variables (LOS, ICU LOS, and costs), a simultaneous equations model (SEM) using a three-stage least square regression analysis was set (Ahn, 2002; Wooldridge, 2002).
- In every regression analysis, only variables that were significant at the 5% level were included to fulfill the identification condition.

**Figure 1. Simultaneous equations model**




IOH Proxy; being assumed as IOH based on the use of vasopressors. LOS; hospital length of stay. ICU LOS; intensive care unit length of stay. CCI; charlson comorbidity index. AKI; acute kidney injury. MINS; myocardial injury in non-cardiac surgeries.

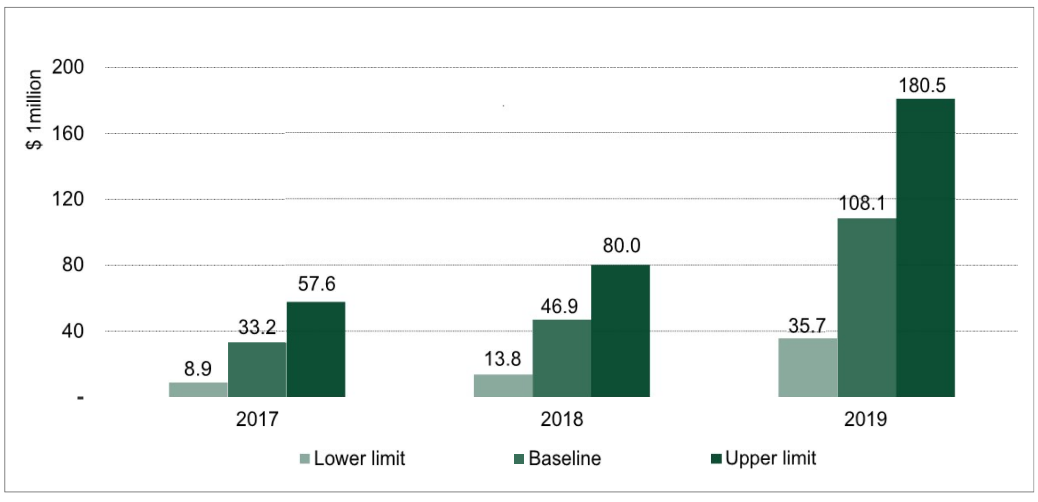
## RESULTS

- A total of 499,627, 512,020, and 435,884 patients in 2017, 2018, and 2019, respectively, were included in the analysis.
- The percentages of IOH were 40.25%, 41.35%, and 38.98%, for three years respectively.
- The average total cost of the IOH group was higher than that of the control group ($P$<.001), and the IOH impact per patient was estimated, based on 3SLS regression analysis, as $299.8, $384.6, and $819.9, respectively.
- By multiplying the estimated number of IOH patients each year, the burden of IOH was estimated to be $33.2 million in 2017, $46.9 million in 2018, and $108.1 million in 2019.

**Table3. Estimated number of IOH patients and budget impact**

| | 2017 | | 2018 | | 2019 | |
|---|---|---|---|---|---|---|
| | **Cost increase per patient**: ₩374,717 ($299.8) | | **Cost increase per patient**: ₩480,740 ($384.6) | | **Cost increase per patient:** ₩1,024,873 ($819.9) | |
| | Estimated no. of IOH patients | Estimated budget impact | Estimated no. of IOH patients | Estimated budget impact | Estimated no. of IOH patients | Estimated budget impact |
| Baseline | 110,832 | ₩41.5 billion ($33.2 million) | 121,942 | ₩58.6 billion ($46.9 million) | 131,801 | ₩135.1 billion ($108.1 million) |
| Lower limit | 29,571 | ₩11.1 billion ($8.9 million) | 35,899 | ₩17.3 billion ($13.8 million) | 43,483 | ₩44.6 billion ($35.7 million) |
| Upper limit | 192,092 | ₩72.0 billion ($57.6 million) | 207,984 | ₩100.0 billion ($80.0 million) | 220,119 | ₩225.6 billion ($180.5 million) |

**Figure 2. Estimated budget impact from 2017 to 2019**




## CONCLSUIONS

- This study revealed a significant association between IOH and greater disease burden and elucidated the estimated budget impact of IOH in Korea.
- Despite some limitations derived from the use of claims data, this study is significant in that it was the first to estimate the disease burden and budget impact of IOH in Korea
- It is necessary to conduct prospective further research on the burden of IOH to overcome the limitations of this study, which would lead to the accumulation of decisive grounds to develop and introduce interventions to prevent IOH and its financial burden.

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