SAGES - Predicting GCP slope

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# Goals

## Overall goal

The overall goal is to build a prediction model for delirium and cognitive decline.

## Today’s (2024-02-02) goal

Review the variables that made it through our selection process for inclusion into the model.

# Background

There are many interesting variables that could possibly included in our model. There are too many to reasonably include in any type of model given our sample size. So, we need a process to trim down our candidate variable list. The process we will use involves two (three?, four?) steps.

1. Variables with more than 50% missingness will be dropped. Those with less than 50% missingness will have values imputed using predictive mean matching.
2. Variables that lack any variability will be dropped. If a variable is an indicator for whether something happened, and only a few participants experienced the event, then even if the indicator is clinically meaningful, it will be dropped because it will make a poor predictor in the model.
3. Variables that are redundant with each other will be dropped. If a variable that can be reasonably well predicted by other variables in the model, then that variable is not providing much more to the model.
4. The remaining variables will be combined into principal components.

# The data

The data comes from the patient interview, the medcial record review, including lab values and peri-operative data.

# Summary of lab values

## Missing values

These are the lab values that were dropped for having more than 50% missing values:

| **Characteristic** | **N = 566**1 |
| --- | --- |
| ALT (IU/L) (Pre-op) | 19 (15, 23) |
| Unknown | 380 |
| AST (IU/L) (Pre-op) | 21.0 (18.0, 25.0) |
| Unknown | 382 |
| Bilirubin (mg/dL) (Pre-op) | 0.40 (0.30, 0.50) |
| Unknown | 408 |
| Albumin (g/dL) (Pre-op) | 4.20 (4.07, 4.40) |
| Unknown | 410 |
| ABG: pH (POD1) | 7.38 (7.34, 7.43) |
| Unknown | 540 |
| p02 (mmHg) (POD1) | 148 (104, 203) |
| Unknown | 539 |
| pCO2 (mmHg) (POD1) | 42 (37, 43) |
| Unknown | 540 |
| 1Median (IQR) | |

Imputation was done on the remaining lab values using predictive mean matching.

## Indicator variables

Indicator variables for low and high values were created for the lab values.

This section provides summary statistics of whether the lab values met a clinically relevant cutoff.

## Pre-op labs

### Pre-op labs - any abnormality

Note: BUN/CRE ratio and Anion Gap thresholds were not updated and used values from previous work.

| **Characteristic** | **N = 566**1 |
| --- | --- |
| Abnormal labs: WBC <= 2 or WBC >= 15 (Pre-op) |  |
| WBC normal | 561 (99%) |
| WBC abnormal | 5 (0.9%) |
| Abnormal labs: HCT <= 21 or HCT >= 62 (Pre-op) |  |
| HCT normal | 566 (100%) |
| HCT abnormal | 0 (0%) |
| Abnormal labs: BUN >= 50 (Pre-op) |  |
| BUN normal | 559 (99%) |
| BUN abnormal | 7 (1.2%) |
| Abnormal labs: CRE >= 5 (Pre-op) |  |
| CRE normal | 566 (100%) |
| CRE abnormal | 0 (0%) |
| Abnormal labs: SOD <= 120 or SOD >= 160 (Pre-op) |  |
| SOD normal | 566 (100%) |
| SOD abnormal | 0 (0%) |
| Abnormal labs: POT <= 2.9 or POT >= 6.0 (Pre-op) |  |
| POT normal | 563 (99%) |
| POT abnormal | 3 (0.5%) |
| Abnormal labs: CHL <= 85 or CHL >= 115 (Pre-op) |  |
| CHL normal | 566 (100%) |
| CHL abnormal | 0 (0%) |
| Abnormal labs: BIC <= 10 or BIC >= 40 (Pre-op) |  |
| BIC normal | 566 (100%) |
| BIC abnormal | 0 (0%) |
| Abnormal labs: GLU <= 40 or GLU >= 400 (Pre-op) |  |
| GLU normal | 564 (100%) |
| GLU abnormal | 2 (0.4%) |
| Abnormal labs: O2 <= 87 (Pre-op) |  |
| O2 normal | 566 (100%) |
| O2 abnormal | 0 (0%) |
| Abnormal labs: BUN/CRE >= 18 (Pre-op) |  |
| BUN/CRE normal | 135 (24%) |
| BUN/CRE abnormal | 431 (76%) |
| Abnormal labs: Anion Gap >= 16 (Pre-op) |  |
| Anion Gap normal | 459 (81%) |
| Anion Gap abnormal | 107 (19%) |
| 1n (%) | |

### POD1 labs

| **Characteristic** | **N = 566**1 |
| --- | --- |
| Abnormal labs: WBC <= 2 or WBC >= 15 (POD1) |  |
| WBC normal | 521 (92%) |
| WBC abnormal | 45 (8.0%) |
| Abnormal labs: HCT <= 21 or HCT >= 62 (POD1) |  |
| HCT normal | 562 (99%) |
| HCT abnormal | 4 (0.7%) |
| Abnormal labs: BUN >= 50 (POD1) |  |
| BUN normal | 562 (99%) |
| BUN abnormal | 4 (0.7%) |
| Abnormal labs: CRE >= 5 (POD1) |  |
| CRE normal | 566 (100%) |
| CRE abnormal | 0 (0%) |
| Abnormal labs: SOD <= 120 or SOD >= 160 (POD1) |  |
| SOD normal | 566 (100%) |
| SOD abnormal | 0 (0%) |
| Abnormal labs: POT <= 2.9 or POT >= 6.0 (POD1) |  |
| POT normal | 558 (99%) |
| POT abnormal | 8 (1.4%) |
| Abnormal labs: BIC <= 10 or BIC >= 40 (POD1) |  |
| BIC normal | 566 (100%) |
| BIC abnormal | 0 (0%) |
| Abnormal labs: O2 <= 87 (POD1) |  |
| O2 normal | 554 (98%) |
| O2 abnormal | 12 (2.1%) |
| 1n (%) | |

### POD2 labs

| **Characteristic** | **N = 566**1 |
| --- | --- |
| Abnormal labs: HCT <= 21 or HCT >= 62 (POD2) |  |
| HCT normal | 555 (98%) |
| HCT abnormal | 11 (1.9%) |
| Abnormal labs: BUN >= 50 (POD2) |  |
| BUN normal | 553 (98%) |
| BUN abnormal | 13 (2.3%) |
| Abnormal labs: CRE >= 5 (POD2) |  |
| CRE normal | 565 (100%) |
| CRE abnormal | 1 (0.2%) |
| Abnormal labs: SOD <= 120 or SOD >= 160 (POD2) |  |
| SOD normal | 564 (100%) |
| SOD abnormal | 2 (0.4%) |
| 1n (%) | |

# Non-lab data

## Missingness

These were the variables that were dropped for having more than 50% missingness: **none**.

Imputation was done on the remaining lab values using predictive mean matching.

# The variables

There are 151 variables being considered for this analysis.

| variable | label |
| --- | --- |
| vdage | Age at This Visit |
| vdfemale | Female |
| vdnonwhite | Nonwhite |
| vdeduc\_r | Respondent's Education, Years |
| vdlivesalone | Lives alone |
| vdsmokingstatus | Smoking status |
| vdalcohol | Alcohol |
| vdmlta\_metmins | MLTA |
| vdgcp\_rta | Baseline GCP |
| wtar01 | WTAR |
| vdadlany | ADL (any) |
| vdiadlany | IADL (any) |
| vdiadlanyc | IADL cognitive (any) |
| vdgds15 | Geriatric Depression Scale Score (/15 Points) |
| vdsf12pcs | SF12 physical composite T-score |
| vdsf12mcs | SF12 mental composite T-score |
| vdsf12pf | vdsf12pf |
| vdsf12rp | vdsf12rp |
| vdsf12bp | vdsf12bp |
| vdsf12gh | vdsf12gh |
| vdsf12vt | vdsf12vt |
| vdsf12sf | vdsf12sf |
| vdsf12re | vdsf12re |
| vdsf12mh | vdsf12mh |
| vdhearingimp | Hearing impairment |
| vddrisk93\_1 | vdrisk93\_1 |
| vdfriedfrail1 | Fraility - Weight Loss |
| vdfriedfrail2 | Fraility - 2 |
| vdfriedfrail3 | Fraility - 3 |
| vdfriedfrail4 | Fraility - Low Grip Strength |
| vdfriedfrail5 | Fraility - Low Timed Walk |
| vdsurg | Surgery |
| vdcrp\_preop | CRP - preop |
| vdcrp\_pod2 | CRP - POD2 |
| vd3ms | 3MS Score |
| vdbmi3 | BMI |
| vdesl | English is second language |
| apoe4 | APOE 4 |
| vdiqc\_proxy | IQCODE, Proxy Report |
| vdvascom | Vascular Comorbidity |
| ins01 | No Insurance |
| ins02 | Has Medicare |
| ins03 | Has Private Insurance |
| ins04 | Has Medicaid |
| ins05 | Has Other Insurance |
| ci01 | Evidence of Cognitive Impairment |
| dep01 | Evidence of Depression |
| lab.wbc.1.abnormal | Abnormal labs: WBC <= 2 or WBC >= 15 (Pre-op) |
| lab.hct.1.abnormal | Abnormal labs: HCT <= 21 or HCT >= 62 (Pre-op) |
| lab.bun.1.abnormal | Abnormal labs: BUN >= 50 (Pre-op) |
| lab.cre.1.abnormal | Abnormal labs: CRE >= 5 (Pre-op) |
| lab.sod.1.abnormal | Abnormal labs: SOD <= 120 or SOD >= 160 (Pre-op) |
| lab.pot.1.abnormal | Abnormal labs: POT <= 2.9 or POT >= 6.0 (Pre-op) |
| lab.chl.1.abnormal | Abnormal labs: CHL <= 85 or CHL >= 115 (Pre-op) |
| lab.bic.1.abnormal | Abnormal labs: BIC <= 10 or BIC >= 40 (Pre-op) |
| lab.glu.1.abnormal | Abnormal labs: GLU <= 40 or GLU >= 400 (Pre-op) |
| lab.o2.1.abnormal | Abnormal labs: O2 <= 87 (Pre-op) |
| lab.bun.cre.1.abnormal | Abnormal labs: BUN/CRE >= 18 (Pre-op) |
| lab.anion.1.abnormal | Abnormal labs: Anion Gap >= 16 (Pre-op) |
| lab.wbc.2.abnormal | Abnormal labs: WBC <= 2 or WBC >= 15 (POD1) |
| lab.hct.2.abnormal | Abnormal labs: HCT <= 21 or HCT >= 62 (POD1) |
| lab.bun.2.abnormal | Abnormal labs: BUN >= 50 (POD1) |
| lab.cre.2.abnormal | Abnormal labs: CRE >= 5 (POD1) |
| lab.sod.2.abnormal | Abnormal labs: SOD <= 120 or SOD >= 160 (POD1) |
| lab.pot.2.abnormal | Abnormal labs: POT <= 2.9 or POT >= 6.0 (POD1) |
| lab.bic.2.abnormal | Abnormal labs: BIC <= 10 or BIC >= 40 (POD1) |
| lab.o2.2.abnormal | Abnormal labs: O2 <= 87 (POD1) |
| lab.hct.3.abnormal | Abnormal labs: HCT <= 21 or HCT >= 62 (POD2) |
| lab.bun.3.abnormal | Abnormal labs: BUN >= 50 (POD2) |
| lab.cre.3.abnormal | Abnormal labs: CRE >= 5 (POD2) |
| lab.sod.3.abnormal | Abnormal labs: SOD <= 120 or SOD >= 160 (POD2) |
| comorbid.diab\_mod | Diabetes - mild to moderate |
| comorbid.tumor | Tumor |
| comorbid.pvd | Peripheral vascular disease |
| comorbid.mi | Myocardial infarction |
| comorbid.ctd | Connective tissue disease |
| comorbid.crd | Chronic respiratory disease |
| comorbid.cs | Carotid stenosis |
| comorbid.diab\_sev | Diabetes - severe with end organ damage |
| comorbid.chf | Congestive heart failure |
| comorbid.stroke | Stroke |
| vdcci3 | Charlson Comorbidity Index |
| op01\_3 | ASA class |
| vdanesth\_spi | Anesthesia Type |
| vdp41101 | (op10) Estimated Blood Loss (EBL) (cc) |
| vdp41301 | Anesthesia-general |
| vdp41302 | Anesthesia-spinal |
| vdp41303 | Anesthesia-regional |
| vdp41304 | Anesthesia-local |
| vdp41305 | Anesthesia time (ln(hours)) |
| vdp41311 | Anesthesia propofol |
| vdp41312 | Anesthesia midazolam |
| vdp41313 | Anesthesia fentanyl |
| vdp41314 | Anesthesia remifentanil |
| vdp41315 | Anesthesia hydromorphone |
| vdp41316 | Anesthesia morphine |
| vdp41317 | Anesthesia nitrous |
| vdp41318 | Anesthesia desflurane |
| vdp41319 | Anesthesia succinycholine |
| vdp41320 | Anesthesia vecuronium |
| vdp41321 | Anesthesia bupivacaine |
| vdp41322 | Anesthesia cefazolin |
| vdp41323 | Anesthesia ephedrine |
| vdp41324 | Anesthesia glycopyrrolate |
| vdp41325 | Anesthesia lidocaine |
| vdp41326 | Anesthesia mepivacaine |
| vdp41327 | Anesthesia neostigmine |
| vdp41328 | Anesthesia ondansetron |
| vdp41329 | Anesthesia phenylephrine |
| vdp41330 | Anesthesia rocuronium |
| vdp41331 | Anesthesia vancomycin |
| vdp41501 | Presence of beta blocker in pre-hospital medication list |
| vdp41502 | Presence of NSAID in pre-hospital medication list |
| vdp41503 | Presence of statin in pre-hospital medication list |
| vdp41504 | Presence of benzodiazepine in pre-hospital medication list |
| vdp41505 | Presence of opioid in pre-hospital medication list |
| vdp41506 | total Anticholinergic Drug Scale (ADS) score |
| vdp41507 | number of medications contributing points to ADS score |
| vdp41508 | total number of pre-hospital medications in patient's record |
| vdp41509 | average ADS score per medication (computed as score/Med\_num) |
| vdp41510 | number of medications with ADS activity >1 |
| vdp41511 | ADS score if excluding medications scoring 1 on the ADS activity scale |
| vdp41512 | total Anticholinergic Cognitive Burden (ACB) scale score |
| vdp41513 | total number of medications contributing to ACB score |
| vdp41514 | average ADS score per medication (computed as ACB/Num\_med) |
| vdp41515 | number of medications with ACB activity >1 |
| vdp41516 | ADS score if excluding medications scoring 1 on the ACB scale |
| vdp41721 | antipsychotics use in days 1-7 |
| vdp41722 | benzodiazepines use in days 1-7 |
| vdp41723 | hydromorphone use in days 1-7 |
| vdp41724 | morphine use in days 1-7 |
| vdp41725 | oxycodone use in days 1-7 |
| vdp41726 | tramadol use in days 1-7 |
| vdp41727 | other opioid use in days 1-7 |
| vdp41901 | ASA Class >=3 (vs <=2) |
| vdp42101 | Surgery time (hours) |
| vdp42303 | Intraop complication - bradycardia requiring new permanent pacemaker |
| vdp42304 | Intraop complication - uncontrolled bleeding |
| vdp42305 | Intraop complication - prolonged severe hypotension |
| vdp42309 | Intraop complication - other |
| vdp42701 | Post-operative hypotension (SBP<90 or DBP<60) |
| vdp42702 | Post-operative hypertension (SBP>140 or DBP>90) |
| vdp42901 | (ptvi01) Post op vital signs temperature (°F) - highest |
| vdp42902 | (ptvi02) Post op vital signs temperature (°F) - lowest |
| vdp42903 | (ptvi03) Post op vital signs pulse (per min) - highest |
| vdp42904 | (ptvi04) Post op vital signs pulse (per min) - lowest |
| vdp42905 | (ptvi09) Post op vital signs Respirations (per min) - highest |
| vdp42906 | (ptvi10) Post op vital signs Respirations (per min) - lowest |
| vdp43101 | Days from surgery to first ambulation |
| vdp43301 | (icu01 recode) Was the patient ever in the ICU or CCU? |
| vdp44701 | Adjudicated risk rating (maximum) from clinical neuroimaging |

# Variable reduction

This section details the variable reduction technique from Harrell’s Regression Modeling Strategies that we used to reduce the number of variables used in the analysis.

The data was split into training (80%) and testing (20%) sets.

Of the 151 variables we start with, we dropped 55 of them for not having a lot of variability.

These are the variables that were dropped:

| **Characteristic** | **N = 560**1 |
| --- | --- |
| IADL cognitive (any) |  |
| No\_impairment | 533 (95%) |
| Impairment | 27 (4.8%) |
| vdrisk93\_1 |  |
| No\_impairment | 557 (99%) |
| Impairment | 3 (0.5%) |
| No Insurance |  |
| Insurance | 560 (100%) |
| No Insurance | 0 (0%) |
| Has Medicaid |  |
| No Medicaid | 552 (99%) |
| Medicaid | 8 (1.4%) |
| Evidence of Cognitive Impairment |  |
| No Cognitive Impairment | 558 (100%) |
| Cognitive Impairment (Chart) | 2 (0.4%) |
| Abnormal labs: WBC <= 2 or WBC >= 15 (Pre-op) |  |
| WBC normal | 555 (99%) |
| WBC abnormal | 5 (0.9%) |
| Abnormal labs: HCT <= 21 or HCT >= 62 (Pre-op) |  |
| HCT normal | 560 (100%) |
| HCT abnormal | 0 (0%) |
| Abnormal labs: BUN >= 50 (Pre-op) |  |
| BUN normal | 553 (99%) |
| BUN abnormal | 7 (1.3%) |
| Abnormal labs: CRE >= 5 (Pre-op) |  |
| CRE normal | 560 (100%) |
| CRE abnormal | 0 (0%) |
| Abnormal labs: SOD <= 120 or SOD >= 160 (Pre-op) |  |
| SOD normal | 560 (100%) |
| SOD abnormal | 0 (0%) |
| Abnormal labs: POT <= 2.9 or POT >= 6.0 (Pre-op) |  |
| POT normal | 557 (99%) |
| POT abnormal | 3 (0.5%) |
| Abnormal labs: CHL <= 85 or CHL >= 115 (Pre-op) |  |
| CHL normal | 560 (100%) |
| CHL abnormal | 0 (0%) |
| Abnormal labs: BIC <= 10 or BIC >= 40 (Pre-op) |  |
| BIC normal | 560 (100%) |
| BIC abnormal | 0 (0%) |
| Abnormal labs: GLU <= 40 or GLU >= 400 (Pre-op) |  |
| GLU normal | 558 (100%) |
| GLU abnormal | 2 (0.4%) |
| Abnormal labs: O2 <= 87 (Pre-op) |  |
| O2 normal | 560 (100%) |
| O2 abnormal | 0 (0%) |
| Abnormal labs: HCT <= 21 or HCT >= 62 (POD1) |  |
| HCT normal | 556 (99%) |
| HCT abnormal | 4 (0.7%) |
| Abnormal labs: BUN >= 50 (POD1) |  |
| BUN normal | 556 (99%) |
| BUN abnormal | 4 (0.7%) |
| Abnormal labs: CRE >= 5 (POD1) |  |
| CRE normal | 560 (100%) |
| CRE abnormal | 0 (0%) |
| Abnormal labs: SOD <= 120 or SOD >= 160 (POD1) |  |
| SOD normal | 560 (100%) |
| SOD abnormal | 0 (0%) |
| Abnormal labs: POT <= 2.9 or POT >= 6.0 (POD1) |  |
| POT normal | 552 (99%) |
| POT abnormal | 8 (1.4%) |
| Abnormal labs: BIC <= 10 or BIC >= 40 (POD1) |  |
| BIC normal | 560 (100%) |
| BIC abnormal | 0 (0%) |
| Abnormal labs: O2 <= 87 (POD1) |  |
| O2 normal | 548 (98%) |
| O2 abnormal | 12 (2.1%) |
| Abnormal labs: HCT <= 21 or HCT >= 62 (POD2) |  |
| HCT normal | 549 (98%) |
| HCT abnormal | 11 (2.0%) |
| Abnormal labs: BUN >= 50 (POD2) |  |
| BUN normal | 547 (98%) |
| BUN abnormal | 13 (2.3%) |
| Abnormal labs: CRE >= 5 (POD2) |  |
| CRE normal | 559 (100%) |
| CRE abnormal | 1 (0.2%) |
| Abnormal labs: SOD <= 120 or SOD >= 160 (POD2) |  |
| SOD normal | 558 (100%) |
| SOD abnormal | 2 (0.4%) |
| Carotid stenosis |  |
| No CS | 533 (95%) |
| Carotid stenosis | 27 (4.8%) |
| Diabetes - severe with end organ damage |  |
| No diabetes | 535 (96%) |
| Diabetes - Severe with end organ damage | 25 (4.5%) |
| Congestive heart failure |  |
| No CHF | 540 (96%) |
| Congestive heart failure | 20 (3.6%) |
| Stroke |  |
| No stroke | 546 (98%) |
| Stroke | 14 (2.5%) |
| Anesthesia-local |  |
| 0 | 543 (97%) |
| 1 | 17 (3.0%) |
| Anesthesia propofol |  |
| 0 | 535 (96%) |
| 1 | 25 (4.5%) |
| Anesthesia midazolam |  |
| 0 | 539 (96%) |
| 1 | 21 (3.8%) |
| Anesthesia remifentanil |  |
| 0 | 557 (99%) |
| 1 | 3 (0.5%) |
| Anesthesia hydromorphone |  |
| 0 | 539 (96%) |
| 1 | 21 (3.8%) |
| Anesthesia nitrous |  |
| 0 | 558 (100%) |
| 1 | 2 (0.4%) |
| Anesthesia desflurane |  |
| 0 | 553 (99%) |
| 1 | 7 (1.3%) |
| Anesthesia succinycholine |  |
| 0 | 554 (99%) |
| 1 | 6 (1.1%) |
| Anesthesia vecuronium |  |
| 0 | 556 (99%) |
| 1 | 4 (0.7%) |
| Anesthesia bupivacaine |  |
| 0 | 545 (97%) |
| 1 | 15 (2.7%) |
| Anesthesia cefazolin |  |
| 0 | 542 (97%) |
| 1 | 18 (3.2%) |
| Anesthesia ephedrine |  |
| 0 | 541 (97%) |
| 1 | 19 (3.4%) |
| Anesthesia glycopyrrolate |  |
| 0 | 537 (96%) |
| 1 | 23 (4.1%) |
| Anesthesia lidocaine |  |
| 0 | 551 (98%) |
| 1 | 9 (1.6%) |
| Anesthesia mepivacaine |  |
| 0 | 559 (100%) |
| 1 | 1 (0.2%) |
| Anesthesia neostigmine |  |
| 0 | 539 (96%) |
| 1 | 21 (3.8%) |
| Anesthesia ondansetron |  |
| 0 | 534 (95%) |
| 1 | 26 (4.6%) |
| Anesthesia phenylephrine |  |
| 0 | 536 (96%) |
| 1 | 24 (4.3%) |
| Anesthesia rocuronium |  |
| 0 | 545 (97%) |
| 1 | 15 (2.7%) |
| Anesthesia vancomycin |  |
| 0 | 555 (99%) |
| 1 | 5 (0.9%) |
| Intraop complication - bradycardia requiring new permanent pacemaker |  |
| 0 | 559 (100%) |
| 1 | 1 (0.2%) |
| Intraop complication - uncontrolled bleeding |  |
| 0 | 558 (100%) |
| 1 | 2 (0.4%) |
| Intraop complication - prolonged severe hypotension |  |
| 0 | 555 (99%) |
| 1 | 5 (0.9%) |
| Intraop complication - other |  |
| 0 | 548 (98%) |
| 1 | 12 (2.1%) |
| Post-operative hypertension (SBP>140 or DBP>90) |  |
| 0 | 554 (99%) |
| 1 | 6 (1.1%) |
| 1n (%) | |

Of the 96 variables retained, 14 were dropped due to redundancy.

These are the variables that were dropped:

| **Characteristic** | **N = 560**1 |
| --- | --- |
| SF12 physical composite T-score | 36 (28, 44) |
| SF12 mental composite T-score | 51 (45, 56) |
| vdsf12vt |  |
| 27.6238346099854 | 33 (5.9%) |
| 37.6867065429688 | 86 (15%) |
| 47.7495803833008 | 161 (29%) |
| 57.8124542236328 | 108 (19%) |
| 67.8753280639648 | 137 (24%) |
| 77.9382019042969 | 35 (6.3%) |
| Charlson Comorbidity Index |  |
| cci\_0 | 257 (46%) |
| cci\_1 | 139 (25%) |
| cci\_2\_7 | 164 (29%) |
| Anesthesia Type |  |
| General Anesthesia only | 479 (86%) |
| Any Spinal Anesthesia | 81 (14%) |
| Anesthesia-general |  |
| 0 | 80 (14%) |
| 1 | 480 (86%) |
| Anesthesia time (ln(hours)) | 1.08 (0.86, 1.33) |
| total Anticholinergic Drug Scale (ADS) score |  |
| 0 | 167 (30%) |
| 1 | 165 (29%) |
| 2 | 107 (19%) |
| 3 | 55 (9.8%) |
| 4 | 41 (7.3%) |
| 5 | 13 (2.3%) |
| 6 | 5 (0.9%) |
| 7 | 2 (0.4%) |
| 8 | 5 (0.9%) |
| number of medications contributing points to ADS score |  |
| 0 | 167 (30%) |
| 1 | 189 (34%) |
| 2 | 132 (24%) |
| 3 | 51 (9.1%) |
| 4 | 18 (3.2%) |
| 5 | 2 (0.4%) |
| 6 | 1 (0.2%) |
| ADS score if excluding medications scoring 1 on the ADS activity scale |  |
| 0 | 467 (83%) |
| 2 | 40 (7.1%) |
| 3 | 42 (7.5%) |
| 5 | 5 (0.9%) |
| 6 | 6 (1.1%) |
| total Anticholinergic Cognitive Burden (ACB) scale score | 1.00 (0.00, 2.00) |
| total number of medications contributing to ACB score |  |
| 0 | 145 (26%) |
| 1 | 203 (36%) |
| 2 | 123 (22%) |
| 3 | 57 (10%) |
| 4 | 23 (4.1%) |
| 5 | 7 (1.3%) |
| 6 | 2 (0.4%) |
| number of medications with ACB activity >1 |  |
| 0 | 479 (86%) |
| 1 | 68 (12%) |
| 2 | 12 (2.1%) |
| 3 | 1 (0.2%) |
| ASA Class >=3 (vs <=2) |  |
| 0 | 207 (37%) |
| 1 | 353 (63%) |
| 1Median (IQR); n (%) | |

There are 83 variables retained after the redundancy analysis.

There are 151 variables being considered for this analysis.

| variable | label |
| --- | --- |
| vdage | Age at This Visit |
| vdfemale | Female |
| vdnonwhite | Nonwhite |
| vdeduc\_r | Respondent's Education, Years |
| vdlivesalone | Lives alone |
| vdsmokingstatus | Smoking status |
| vdalcohol | Alcohol |
| vdmlta\_metmins | MLTA |
| vdgcp\_rta | Baseline GCP |
| wtar01 | WTAR |
| vdadlany | ADL (any) |
| vdiadlany | IADL (any) |
| vdgds15 | Geriatric Depression Scale Score (/15 Points) |
| vdsf12pf | vdsf12pf |
| vdsf12rp | vdsf12rp |
| vdsf12bp | vdsf12bp |
| vdsf12gh | vdsf12gh |
| vdsf12sf | vdsf12sf |
| vdsf12re | vdsf12re |
| vdsf12mh | vdsf12mh |
| vdhearingimp | Hearing impairment |
| vdfriedfrail1 | Fraility - Weight Loss |
| vdfriedfrail2 | Fraility - 2 |
| vdfriedfrail3 | Fraility - 3 |
| vdfriedfrail4 | Fraility - Low Grip Strength |
| vdfriedfrail5 | Fraility - Low Timed Walk |
| vdsurg | Surgery |
| vdcrp\_preop | CRP - preop |
| vdcrp\_pod2 | CRP - POD2 |
| vd3ms | 3MS Score |
| vdbmi3 | BMI |
| vdesl | English is second language |
| apoe4 | APOE 4 |
| vdiqc\_proxy | IQCODE, Proxy Report |
| vdvascom | Vascular Comorbidity |
| ins02 | Has Medicare |
| ins03 | Has Private Insurance |
| ins05 | Has Other Insurance |
| dep01 | Evidence of Depression |
| lab.bun.cre.1.abnormal | Abnormal labs: BUN/CRE >= 18 (Pre-op) |
| lab.anion.1.abnormal | Abnormal labs: Anion Gap >= 16 (Pre-op) |
| lab.wbc.2.abnormal | Abnormal labs: WBC <= 2 or WBC >= 15 (POD1) |
| comorbid.diab\_mod | Diabetes - mild to moderate |
| comorbid.tumor | Tumor |
| comorbid.pvd | Peripheral vascular disease |
| comorbid.mi | Myocardial infarction |
| comorbid.ctd | Connective tissue disease |
| comorbid.crd | Chronic respiratory disease |
| op01\_3 | ASA class |
| vdp41101 | (op10) Estimated Blood Loss (EBL) (cc) |
| vdp41302 | Anesthesia-spinal |
| vdp41303 | Anesthesia-regional |
| vdp41313 | Anesthesia fentanyl |
| vdp41316 | Anesthesia morphine |
| vdp41501 | Presence of beta blocker in pre-hospital medication list |
| vdp41502 | Presence of NSAID in pre-hospital medication list |
| vdp41503 | Presence of statin in pre-hospital medication list |
| vdp41504 | Presence of benzodiazepine in pre-hospital medication list |
| vdp41505 | Presence of opioid in pre-hospital medication list |
| vdp41508 | total number of pre-hospital medications in patient's record |
| vdp41509 | average ADS score per medication (computed as score/Med\_num) |
| vdp41510 | number of medications with ADS activity >1 |
| vdp41514 | average ADS score per medication (computed as ACB/Num\_med) |
| vdp41516 | ADS score if excluding medications scoring 1 on the ACB scale |
| vdp41721 | antipsychotics use in days 1-7 |
| vdp41722 | benzodiazepines use in days 1-7 |
| vdp41723 | hydromorphone use in days 1-7 |
| vdp41724 | morphine use in days 1-7 |
| vdp41725 | oxycodone use in days 1-7 |
| vdp41726 | tramadol use in days 1-7 |
| vdp41727 | other opioid use in days 1-7 |
| vdp42101 | Surgery time (hours) |
| vdp42701 | Post-operative hypotension (SBP<90 or DBP<60) |
| vdp42901 | (ptvi01) Post op vital signs temperature (°F) - highest |
| vdp42902 | (ptvi02) Post op vital signs temperature (°F) - lowest |
| vdp42903 | (ptvi03) Post op vital signs pulse (per min) - highest |
| vdp42904 | (ptvi04) Post op vital signs pulse (per min) - lowest |
| vdp42905 | (ptvi09) Post op vital signs Respirations (per min) - highest |
| vdp42906 | (ptvi10) Post op vital signs Respirations (per min) - lowest |
| vdp43101 | Days from surgery to first ambulation |
| vdp43301 | (icu01 recode) Was the patient ever in the ICU or CCU? |
| vdp44701 | Adjudicated risk rating (maximum) from clinical neuroimaging |