**Supplementary Material S1**: Cohort definition and concept sets.

## [JC] Surgery cohort

### Initial Event Cohort

People having any of the following:

- a drug exposure of flurane[3]
- a drug exposure of propofol[5]

with continuous observation of at least 0 days prior and 0 days after event index date, and limit initial events to: **all events per person.**

### Inclusion Rules

Inclusion Criteria #1: Muscle relaxant use
Having all of the following criteria:

- at least 1 occurrences of a drug exposure of Muscle relaxant [4]

  where event starts between 1 days Before and 1 days After index start date
  **occurring within the same visit**

Inclusion Criteria #2: cardiac or brain surgery
Having all of the following criteria:

- at most 0 occurrences of a procedure of cardiac or brain surgery[2]

  where event starts between 7 days Before and 7 days After index start date

Inclusion Criteria #3: transplant
Having all of the following criteria:

- at most 0 occurrences of a procedure of transplant[7]

  where event starts between 7 days Before and 7 days After index start date

Limit qualifying cohort to: **all events per person.**

### End Date Strategy

### Date Offset Exit Criteria

This cohort defintion end date will be the index event's start date plus 0 days

### Cohort Collapse Strategy:

Collapse cohort by era with a gap size of 0 days.

### Appendix 1: Concept Set Definitions

1. cadaveric

Show 10 entries

Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| No data available in table | | | | | | |

Showing 0 to 0 of 0 entries

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2. cardiac or brain surgery

Show entries

Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 2110581 | Cranioplasty for skull defect with reparative brain surgery | Procedure | CPT4 | NO | YES | NO |
| 4010257 | Valvuloplasty of aortic valve | Procedure | SNOMED | NO | YES | NO |
| 4042676 | Procedure on pericardium | Procedure | SNOMED | NO | YES | NO |
| 4081578 | Coronary artery atherectomy | Procedure | SNOMED | NO | YES | NO |
| 4095407 | Replacement of aortic valve | Procedure | SNOMED | NO | YES | NO |
| 4098191 | Replacement of tricuspid valve | Procedure | SNOMED | NO | YES | NO |
| 4106548 | Aortocoronary bypass of one coronary artery | Procedure | SNOMED | NO | YES | NO |
| 4149930 | Pericardiocentesis | Procedure | SNOMED | NO | YES | NO |
| 4150819 | Operative procedure on coronary artery | Procedure | SNOMED | NO | YES | NO |

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 4163951 | Electrocardiographic procedure | Procedure | SNOMED | YES | YES | NO |

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3. flurane

Show Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 743196 | enflurane | Drug | RxNorm | NO | YES | NO |
| 782043 | isoflurane | Drug | RxNorm | NO | YES | NO |
| 782046 | isoflurane 999 MG/ML | Drug | RxNorm | NO | YES | NO |
| 782047 | isoflurane 999 MG/ML Inhalation Solution | Drug | RxNorm | NO | YES | NO |
| 19002770 | desflurane | Drug | RxNorm | NO | YES | NO |
| 19002793 | desflurane 1 ML/ML | Drug | RxNorm | NO | YES | NO |
| 19002796 | desflurane 1000 MG/ML Inhalation Solution | Drug | RxNorm | NO | YES | NO |
| 19039298 | sevoflurane | Drug | RxNorm | NO | YES | NO |
| 40042723 | Enflurane Inhalant Solution | Drug | RxNorm | NO | YES | NO |
| 40050254 | Isoflurane Inhalant Solution | Drug | RxNorm | NO | YES | NO |

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4. Muscle relaxant

Show entries

Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 836208 | succinylcholine | Drug | RxNorm | NO | YES | NO |
| 19003953 | rocuronium | Drug | RxNorm | NO | YES | NO |
| 19012598 | vecuronium | Drug | RxNorm | NO | YES | NO |

Showing 1 to 3 of 3 entries

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5. propofol

Show entries

Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 753626 | propofol | Drug | RxNorm | NO | YES | NO |

Showing 1 to 1 of 1 entries

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6. Surgery

Show entries

Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 45888085 | Surgery | Procedure | CPT4 | NO | YES | NO |

Showing 1 to 1 of 1 entries

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7. transplant

Show entries

Search:

| Concept Id | Concept Name | Domain | Vocabulary | Excluded | Descendants | Mapped |
|---|---|---|---|---|---|---|
| 2109321 | Liver allotransplantation, orthotopic, partial or whole, from cadaver or living donor, any age | Procedure | CPT4 | NO | YES | NO |
| 4208341 | Solid organ transplant | Procedure | SNOMED | NO | YES | NO |
| 4322471 | Transplant of kidney | Procedure | SNOMED | NO | YES | NO |

Showing 1 to 3 of 3 entries

Previous1Next

**Supplementary Material S2**: The settings and results of experimental models.
**RF**

$keep_cross_validation_models
[1] TRUE

$keep_cross_validation_predictions
[1] FALSE

$keep_cross_validation_fold_assignment
[1] FALSE

$score_each_iteration
[1] FALSE

$score_tree_interval
[1] 0

$fold_assignment
[1] "Random"

$ignore_const_cols
[1] TRUE

$balance_classes
[1] FALSE

$max_after_balance_size
[1] 5

$max_confusion_matrix_size
[1] 20

$ntrees
[1] 100

$max_depth
[1] 20

$min_rows
[1] 1

$nbins

[1] 30

$nbins_top_level
[1] 1024

$nbins_cats
[1] 1024

$r2_stopping
[1] 1.797693e+308

$stopping_rounds
[1] 0

$stopping_metric
[1] "AUC"

$stopping_tolerance
[1] 0.001

$max_runtime_secs
[1] 0

$seed
[1] 29

$build_tree_one_node
[1] FALSE

$mtries
[1] 5

$sample_rate
[1] 0.75

$binomial_double_trees
[1] FALSE

$col_sample_rate_change_per_level
[1] 1

$col_sample_rate_per_tree
[1] 1

$min_split_improvement
[1] 1e-05

$histogram_type
[1] "UniformAdaptive"

$categorical_encoding
[1] "Enum"

$calibrate_model
[1] FALSE

$distribution
[1] "multinomial"

$check_constant_response
[1] TRUE

$gainslift_bins
[1] -1

$x
 [1] "Albumin" "Alkaline.phosphatase" "BUN" "Bilirubin..total" "Calcium" "Chloride" "Creatinine"
 [8] "GOT..AST." "GPT..ALT." "Hb" "Hct" "PLT" "Phosphorus" "Potassium"
[15] "Protein..total" "Sodium" "Uric.Acid" "WBC" "hs.CRP.quantitation"

$y
[1] "death_inhosp"

**XGBoost**

$keep_cross_validation_models
[1] TRUE

$keep_cross_validation_predictions
[1] FALSE

$keep_cross_validation_fold_assignment
[1] FALSE

$score_each_iteration
[1] FALSE

$ignore_const_cols
[1] TRUE

$stopping_rounds
[1] 5

$stopping_metric
[1] "AUC"

$stopping_tolerance
[1] 1e-04

$max_runtime_secs
[1] 1.797693e+308

$seed
[1] 12345

$distribution
[1] "bernoulli"

$tweedie_power
[1] 1.5

$categorical_encoding
[1] "OneHotInternal"

$quiet_mode
[1] TRUE

$ntrees
[1] 10000

$max_depth
[1] 1

$min_rows
[1] 1

$min_child_weight

[1] 1

$learn_rate
[1] 0.05

$eta
[1] 0.05

$sample_rate
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$subsample
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$col_sample_rate
[1] 0.8

$colsample_bylevel
[1] 0.8

$col_sample_rate_per_tree
[1] 1

$colsample_bytree
[1] 1

$colsample_bynode
[1] 1

$max_abs_leafnode_pred
[1] 0

$max_delta_step
[1] 0

$score_tree_interval
[1] 10

$min_split_improvement
[1] 0

$gamma
[1] 0

```
$nthread
[1] -1

$build_tree_one_node
[1] FALSE

$calibrate_model
[1] FALSE

$max_bins
[1] 256

$max_leaves
[1] 0

$sample_type
[1] "uniform"

$normalize_type
[1] "tree"

$rate_drop
[1] 0

$one_drop
[1] FALSE

$skip_drop
[1] 0

$tree_method
[1] "exact"

$grow_policy
[1] "depthwise"

$booster
[1] "gbtree"

$reg_lambda
[1] 1
```

$reg_alpha
[1] 0

$dmatrix_type
[1] "dense"

$backend
[1] "cpu"

$gpu_id
[1] 0

$gainslift_bins
[1] -1

$x
 [1] "caseid"                "Albumin"               "Alkaline.phosphatase" "BUN"                   "Bilirubin..total"      "Calcium"               "Chloride"
 [8] "Creatinine"            "GOT..AST."             "GPT..ALT."            "Hb"                    "Hct"                   "PLT"                   "Phosphorus"
[15] "Potassium"             "Protein..total"        "Sodium"               "Uric.Acid"             "WBC"                   "hs.CRP.quantitation"

$y
[1] "death_inhosp"

**DNN**

$keep_cross_validation_models
[1] TRUE

$keep_cross_validation_predictions
[1] FALSE

$keep_cross_validation_fold_assignment
[1] FALSE

$ignore_const_cols
[1] TRUE

$score_each_iteration
[1] FALSE

$balance_classes
[1] FALSE

$max_after_balance_size
[1] 5

$max_confusion_matrix_size
[1] 20

$overwrite_with_best_model
[1] TRUE

$use_all_factor_levels
[1] TRUE

$standardize
[1] TRUE

$activation
[1] "Tanh"

$hidden
[1] 30 30 30

$epochs
[1] 1

$train_samples_per_iteration
[1] -2

$target_ratio_comm_to_comp
[1] 0.05

$seed
[1] 1234747

$adaptive_rate
[1] TRUE

$rho
[1] 0.99

$epsilon
[1] 1e-08

$rate
[1] 0.005

$rate_annealing
[1] 1e-06

$rate_decay
[1] 1

$momentum_start
[1] 0

$momentum_ramp
[1] 1e+06

$momentum_stable
[1] 0

$nesterov_accelerated_gradient
[1] TRUE

$input_dropout_ratio
[1] 0

$l1
[1] 9.8e-05

$l2
[1] 2.1e-05

$max_w2
[1] 10

$initial_weight_distribution
[1] "UniformAdaptive"

$initial_weight_scale
[1] 1

$loss
[1] "Automatic"

$distribution

[1] "bernoulli"

$quantile_alpha
[1] 0.5

$tweedie_power
[1] 1.5

$huber_alpha
[1] 0.9

$score_interval
[1] 5

$score_training_samples
[1] 10000

$score_validation_samples
[1] 10000

$score_duty_cycle
[1] 0.025

$classification_stop
[1] 0

$regression_stop
[1] 1e-06

$stopping_rounds
[1] 2

$stopping_metric
[1] "logloss"

$stopping_tolerance
[1] 0.01

$max_runtime_secs
[1] 327.026

$score_validation_sampling
[1] "Uniform"

$diagnostics
[1] TRUE

$fast_mode
[1] TRUE

$force_load_balance
[1] TRUE

$variable_importances
[1] TRUE

$replicate_training_data
[1] TRUE

$single_node_mode
[1] FALSE

$shuffle_training_data
[1] FALSE

$missing_values_handling
[1] "MeanImputation"

$quiet_mode
[1] FALSE

$autoencoder
[1] FALSE

$sparse
[1] FALSE

$col_major
[1] FALSE

$average_activation
[1] 0

$sparsity_beta
[1] 0

$max_categorical_features
[1] 2147483647

$reproducible
[1] FALSE

$export_weights_and_biases
[1] FALSE

$mini_batch_size
[1] 1

$categorical_encoding
[1] "OneHotInternal"

$elastic_averaging
[1] FALSE

$elastic_averaging_moving_rate
[1] 0.9

$elastic_averaging_regularization
[1] 0.001

$x
 [1] "Albumin" "Alkaline.phosphatase" "BUN" "Bilirubin..total" "Calcium" "Chloride" "Creatinine"
 [8] "GOT..AST." "GPT..ALT." "Hb" "Hct" "PLT" "Phosphorus"
"Potassium"
[15] "Protein..total" "Sodium" "Uric.Acid" "WBC" "hs.CRP.quantitation"

$y
[1] "death_inhosp"

**GLM**

$keep_cross_validation_models
[1] TRUE

$keep_cross_validation_predictions
[1] FALSE

$keep_cross_validation_fold_assignment

[1] FALSE

$fold_assignment
[1] "Random"

$ignore_const_cols
[1] TRUE

$score_each_iteration
[1] FALSE

$score_iteration_interval
[1] -1

$family
[1] "binomial"

$tweedie_variance_power
[1] 0

$tweedie_link_power
[1] 1

$theta
[1] 1e-10

$solver
[1] "IRLSM"

$lambda
[1] 0.000143091

$lambda_search
[1] FALSE

$early_stopping
[1] TRUE

$nlambdas
[1] -1

$standardize
[1] TRUE

$missing_values_handling
[1] "MeanImputation"

$compute_p_values
[1] FALSE

$remove_collinear_columns
[1] FALSE

$intercept
[1] TRUE

$non_negative
[1] FALSE

$max_iterations
[1] 50

$objective_epsilon
[1] 1e-04

$beta_epsilon
[1] 1e-04

$gradient_epsilon
[1] 1e-04

$link
[1] "logit"

$calc_like
[1] FALSE

$HGLM
[1] FALSE

$prior
[1] -1

$cold_start
[1] FALSE

$lambda_min_ratio
[1] 1e-04

$max_active_predictors
[1] 5000

$obj_reg
[1] 0.0003487967

$stopping_rounds
[1] 0

$stopping_metric
[1] "AUTO"

$stopping_tolerance
[1] 0.001

$balance_classes
[1] FALSE

$max_after_balance_size
[1] 5

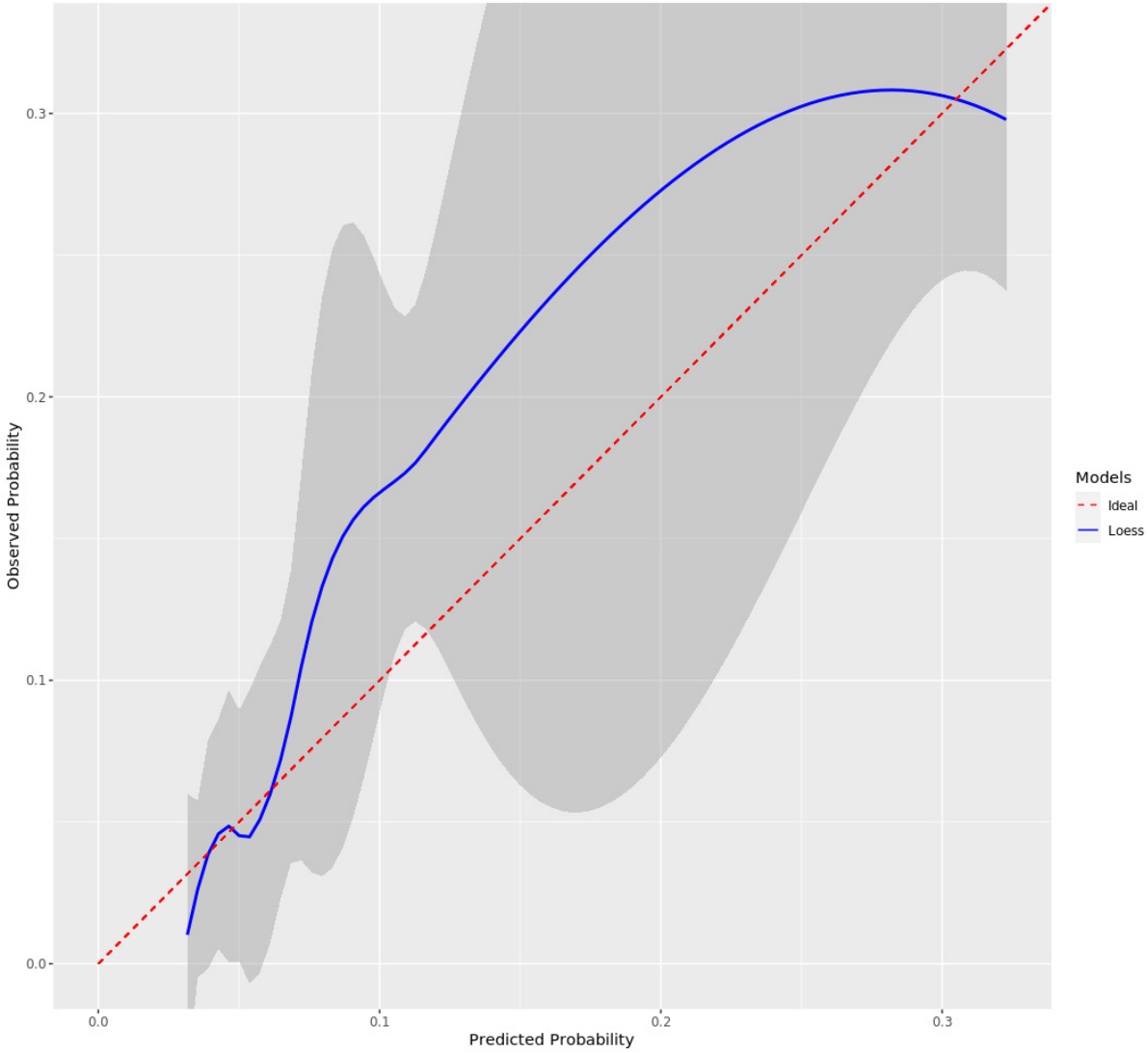
$max_confusion_matrix_size
[1] 20

$max_runtime_secs
[1] 0

$x
 [1] "Albumin"  "Alkaline.phosphatase" "BUN"  "Bilirubin..total"  "Calcium"  "Chloride"  "Creatinine"
 [8] "GOT..AST."  "GPT..ALT."  "Hb"  "Hct"  "PLT"  "Phosphorus"
"Potassium"
[15] "Protein..total"  "Sodium"  "Uric.Acid"  "WBC"  "hs.CRP.quantitation"

$y
[1] "death_inhosp"

**Supplementary Material S3**: A calibration plot comparing the predicted probability computed by the random forest model with the fraction of observed outcome.




**Linear Model:**

| Intercept | Gradient |
|---|---|
| 0.001901101 | 0.981541599 |

**Hosmer–Lemeshow test:**

| | Xsquared | df | pvalue |
|---|---|---|---|
| 1 | 10.51912 | 8 | 0.2304626 |