# Eclampsia/Pre-eclampsia summary

## The Problem

Predict eclampsia or pre-eclampsia at the beginning of pregnancy

## General Description

From wikipedia (<https://en.wikipedia.org/wiki/Eclampsia>):

Eclampsia is the onset of [seizures](https://en.wikipedia.org/wiki/Seizures) (convulsions) in a woman with [pre-eclampsia](https://en.wikipedia.org/wiki/Pre-eclampsia)[1]. Pre-eclampsia is a disorder of [pregnancy](https://en.wikipedia.org/wiki/Pregnancy) in which there is [high blood pressure](https://en.wikipedia.org/wiki/High_blood_pressure) and either large amounts of [protein in the urine](https://en.wikipedia.org/wiki/Protenuria) or other organ dysfunction.[[7]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-Lamb2014-7)[[8]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-ACOG2013-8) Onset may be before, during, or after [delivery](https://en.wikipedia.org/wiki/Childbirth).[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) Most often it is during the second half of pregnancy.[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) The seizures are of the [tonic–clonic](https://en.wikipedia.org/wiki/Tonic%E2%80%93clonic) type and typically last about a minute.[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) Following the seizure there is typically either a [period of confusion](https://en.wikipedia.org/wiki/Postictal_period) or [coma](https://en.wikipedia.org/wiki/Coma).[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) Complications include [aspiration pneumonia](https://en.wikipedia.org/wiki/Aspiration_pneumonia), [cerebral hemorrhage](https://en.wikipedia.org/wiki/Cerebral_hemorrhage), [kidney failure](https://en.wikipedia.org/wiki/Kidney_failure), and [cardiac arrest](https://en.wikipedia.org/wiki/Cardiac_arrest).[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) Pre-eclampsia and eclampsia are part of a larger group of conditions known as [hypertensive disorders of pregnancy](https://en.wikipedia.org/wiki/Hypertensive_disorders_of_pregnancy).[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1)

Recommendations for prevention include [aspirin](https://en.wikipedia.org/wiki/Aspirin) in those at high risk, [calcium supplementation](https://en.wikipedia.org/wiki/Calcium_supplementation) in areas with low intake, and treatment of prior hypertension with medications.[[2]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-WHO2011-2)[[3]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-Hend2014-3) Exercise during pregnancy may also be useful.[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) The use of intravenous or intramuscular [magnesium sulfate](https://en.wikipedia.org/wiki/Magnesium_sulfate) improves outcomes in those with eclampsia and is generally safe.[[4]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-BMC2013-4)[[9]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-9) This is true in both the [developed](https://en.wikipedia.org/wiki/Developed_world) and [developing world](https://en.wikipedia.org/wiki/Developing_world).[[4]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-BMC2013-4) Breathing may need to be supported.[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) Other treatments may include blood pressure medications such as [hydralazine](https://en.wikipedia.org/wiki/Hydralazine) and emergency delivery of the baby either vaginally or by [cesarean section](https://en.wikipedia.org/wiki/Cesarean_section).[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1)

Pre-eclampsia is estimated to affect about 5% of deliveries while eclampsia affects about 1.4% of deliveries.[[5]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-Ab2013-5) In the developed world rates are about 1 in 2,000 deliveries due to improved medical care.[[1]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-W2014-1) Hypertensive disorders of pregnancy are one of the most common causes of death in pregnancy.[[10]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-Aru2013-10) They resulted in 46,900 deaths in 2015.[[6]](https://en.wikipedia.org/wiki/Eclampsia#cite_note-GBD2015De-6) Around one percent of women with eclampsia die

## Data & Cohort

Database: THIN\_2018 (TRAIN=1) ( starting from year 2007 and on)

Population: Females aged 18-48. Pregnancy that we can estimate its start date. See below.

Outcome: Pre-eclampsia or eclampsia RC following the pregnancy start date by 280+- 200 days

Date of prediction: Week 10 (LMP-Last Menstrual Period+70 days).

Determination of pregnancy start:

1. 1. LMP signal.
2. 2. RC that is delivery related (from a list) minus 280 days. First among all events of the same level within 200 days.

Counts:

* RC total population: 13121676.
* Female &TRAIN&age in [18-48]: 4476510
* Pregnancies with LMP (from 2007): 300467 (247804 patients)
* Pregnancies by delivery codes (from 2007): 522648 (405955 patients)
* Pregnancies combined: 674263 (505299 patients)
* Eclampsia events after 2007: 4155 (4087 patients).
* Pregnancies with eclampsia: 3350 (3307 patients)

## Initial Quick Modeling

Model: Jason of many signals including 200 leading readcodes and 200 leading drugs (fdr ignored).

## Initial Results

## Discussion & Conclusions

## Additional Information

TT: patients size: 505299 y size: 674264 distribution: 0.000: 670914 1.000: 3350

TT: y size: 674264 , preds size: 674264 , ctrls size: 670914, cases size: 3350, AUC is : 0.697 CORR is: 0.061

TT: size: 0.010 sens: 0.063 spec: 0.990 ppv: 0.031 rr: 6.674

TT: size: 0.050 sens: 0.192 spec: 0.951 ppv: 0.019 rr: 4.511

TT: size: 0.100 sens: 0.284 spec: 0.901 ppv: 0.014 rr: 3.553

TT: size: 0.200 sens: 0.440 spec: 0.801 ppv: 0.011 rr: 3.134

TT: size: 0.500 sens: 0.771 spec: 0.501 ppv: 0.008 rr: 3.359

BootStrap:

All LIFT@FPR\_01.000\_Mean 6.08974

All NPV@FPR\_01.000\_Mean 99.5294

All OR@FPR\_01.000\_Mean 6.60201

All PPV@FPR\_01.000\_Mean 3.02562

All PR@FPR\_01.000\_Mean 1.02608

All RR@FPR\_01.000\_Mean 6.43141

All SCORE@FPR\_01.000\_Mean 0.0205545

All SENS@FPR\_01.000\_Mean 6.2495

After matching for years:

patients size: 505299 y size: 674264 distribution: 0.000: 670914 1.000: 3350

TT: y size: 674264 , preds size: 674264 , ctrls size: 670914, cases size: 3350, AUC is : 0.696 CORR is: 0.060

TT: size: 0.010 sens: 0.062 spec: 0.990 ppv: 0.031 rr: 6.573

TT: size: 0.050 sens: 0.190 spec: 0.951 ppv: 0.019 rr: 4.442

TT: size: 0.100 sens: 0.283 spec: 0.901 ppv: 0.014 rr: 3.538

TT: size: 0.200 sens: 0.441 spec: 0.801 ppv: 0.011 rr: 3.145

TT: size: 0.500 sens: 0.768 spec: 0.501 ppv: 0.008 rr: 3.303

Bootstrap with years matched training set:

All LIFT@FPR\_01.000\_Mean 5.98864

All NPV@FPR\_01.000\_Mean 99.5288

All OR@FPR\_01.000\_Mean 6.48178

All PPV@FPR\_01.000\_Mean 2.97538

All PR@FPR\_01.000\_Mean 1.02555

All RR@FPR\_01.000\_Mean 6.31755

All SCORE@FPR\_01.000\_Mean 0.0178899

All SENS@FPR\_01.000\_Mean 6.14264

Matching did not change results much.

Problems: decline in numbers in later years (seems like a problem in THIN)

Eclampsia without pregnancy timing: about 20%

Separation of pregnancies is not perfect.

Very few repeating eclampsia.

Don’t have sequential number of pregnancy. Could build a feature for existence of any previous pregnancy. There is sequential pregnancy in THIN but value was not loaded.

Leading features of one split:

FEATURE IMPORTANCE Drug.category\_dep\_set\_ATC\_B03A\_\_\_\_.win\_0\_3650 : 19.753 (IRON )

FEATURE IMPORTANCE RC.category\_dep\_set\_G\_662...win\_0\_3650 : 18.973 ) Cardiac\_disease\_monitoring(

FEATURE IMPORTANCE FTR\_000264.HDL.last.win\_200\_3650 : 15.856

FEATURE IMPORTANCE RC.category\_dep\_set\_ICD10\_CODE:Z39.win\_0\_3650 : 15.270 ( mother immediately after delivery)

FEATURE IMPORTANCE RC.category\_dep\_set\_ICD10\_CODE:O16.win\_0\_3650 : 15.089 (Unspecified maternal hypertension, unspecified trimester)

FEATURE IMPORTANCE Drug.category\_dep\_set\_ATC\_C07A\_G\_\_.win\_0\_3650 : 14.845(BETA BLOCKING AGENTS)

FEATURE IMPORTANCE FTR\_000615.TSH.avg.win\_0\_200 : 14.819

FEATURE IMPORTANCE RC.category\_dep\_set\_ICD10\_CODE:I10.win\_0\_3650 : 14.380 (Essential (primary) hypertension)

FEATURE IMPORTANCE RC.category\_dep\_set\_G\_7F19..win\_0\_3650 : 14.352 (Normal\_delivery)

FEATURE IMPORTANCE FTR\_000583.ALKP.avg.win\_0\_200 : 13.720

FEATURE IMPORTANCE RC.category\_dep\_set\_G\_63....win\_0\_3650 : 13.649 (Birth\_details)

FEATURE IMPORTANCE FTR\_000371.Creatinine.last.win\_0\_200 : 13.646

FEATURE IMPORTANCE RC.category\_dep\_set\_G\_62B...win\_0\_3650 : 13.570 (Antenatal\_HIV\_screening)

FEATURE IMPORTANCE Drug.category\_dep\_set\_ATC\_A02\_\_\_\_\_.win\_0\_3650 : 13.075 (DRUGS FOR ACID RELATED DISORDERS)

FEATURE IMPORTANCE RC.category\_dep\_set\_G\_44P...win\_0\_3650 : 12.711 (Biochemical\_test)

FEATURE IMPORTANCE FTR\_000315.Progesterone.last.win\_200\_3650 : 12.662

FEATURE IMPORTANCE FTR\_000273.Urea.last.win\_200\_3650 : 12.655

FEATURE IMPORTANCE Drug.category\_dep\_set\_ATC\_N06A\_B\_\_.win\_0\_3650 : 12.641(Selective serotonin reuptake inhibitors)

FEATURE IMPORTANCE RC.category\_dep\_set\_ICD10\_CODE:O26.win\_0\_3650 : 12.630