



# Modeling Maternal Mortality Rates (MMR)

Data Science Part Time Course  
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# What factors contribute to global MMR?

## PROBLEM STATEMENT:

Can I predict which socioeconomic and public health initiatives will improve global maternal mortality rates?



# Could other factors contribute to MMR?

## Datasets

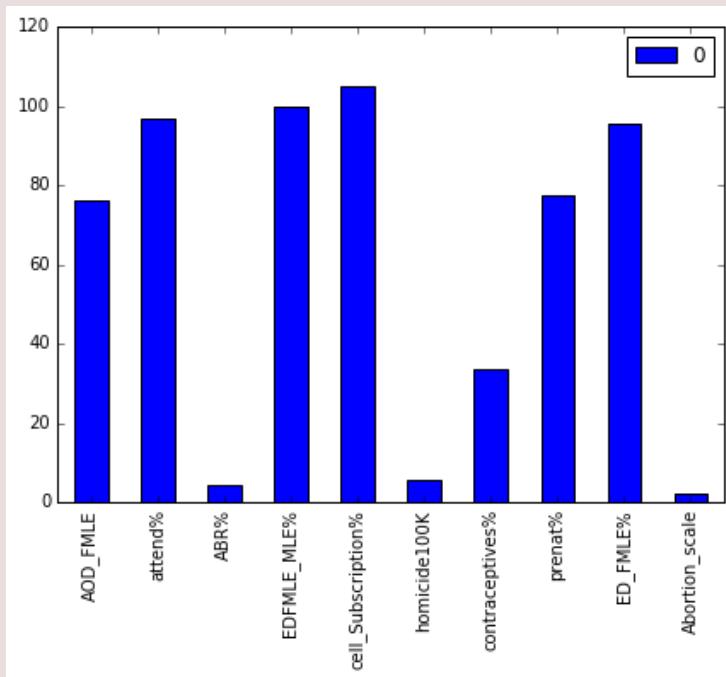
### Maternal Mortality Rates (MMR):

- A. Birth attendant
- B. Antenatal (prenatal) care
- C. Adolescent Birth Rates
- D. Contraceptives modern methods
- E. Abortion policy scale
- F. Education: Primary School Enrollment
- G. Technology: Cellphone Subscribers
- H. War: Homicides
- I. Health: Life Expectancy
- J. Wealth: GNI Per Capita Data by Country(PPP)



# Dataframe and Feature Engineering

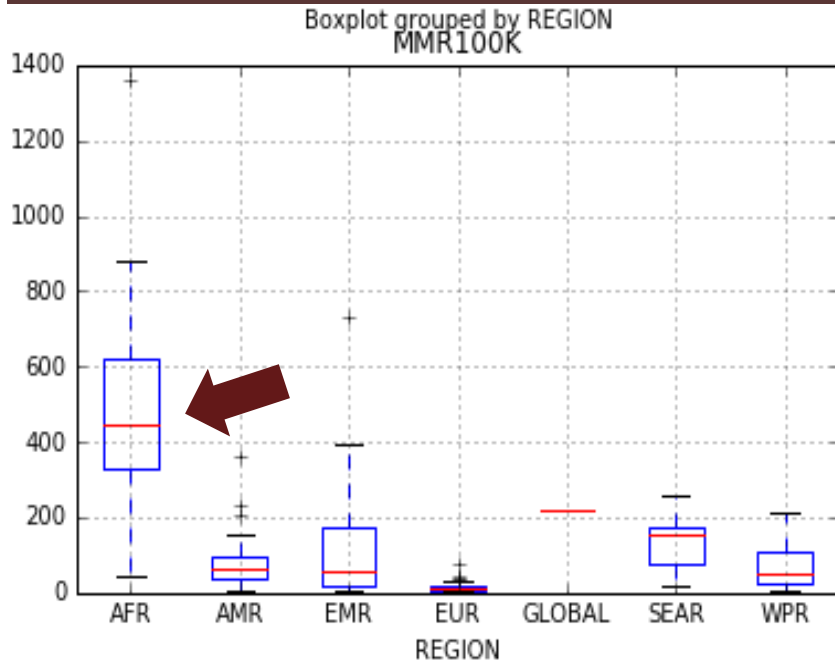
- 190 countries
- 12 different datasets, 33 total columns
- Missing data filled with median values:



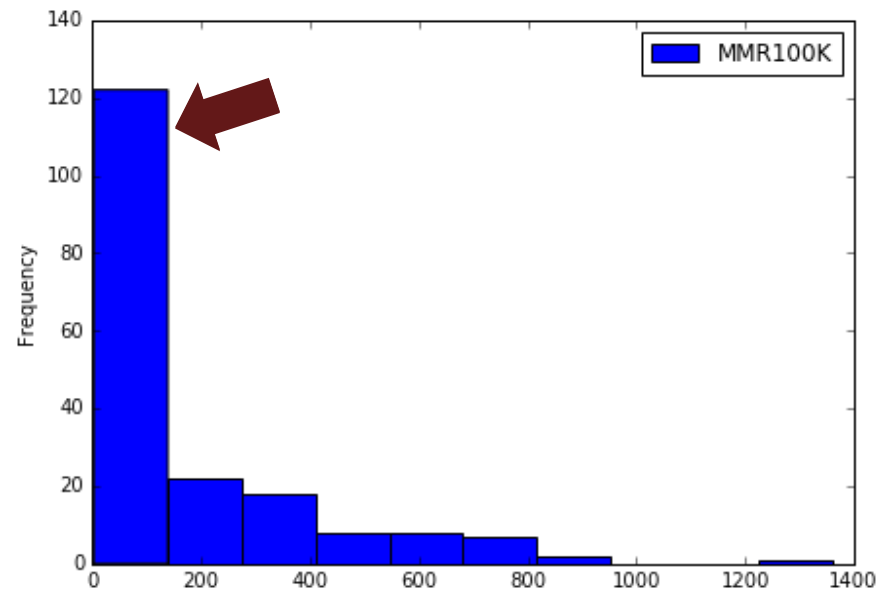
AOD_FMLE	76.06
attend%	96.60
GNI	10080.00
ABR%	4.54
EDFMLE_MLE%	99.82
cell_Subscription%	105.00
homicide100K	5.40
contraceptives%	33.73
prenat%	77.60
ED_FMLE%	95.37
Abortion_scale	2.00

# Response Variable Engineering

## Regional MMR



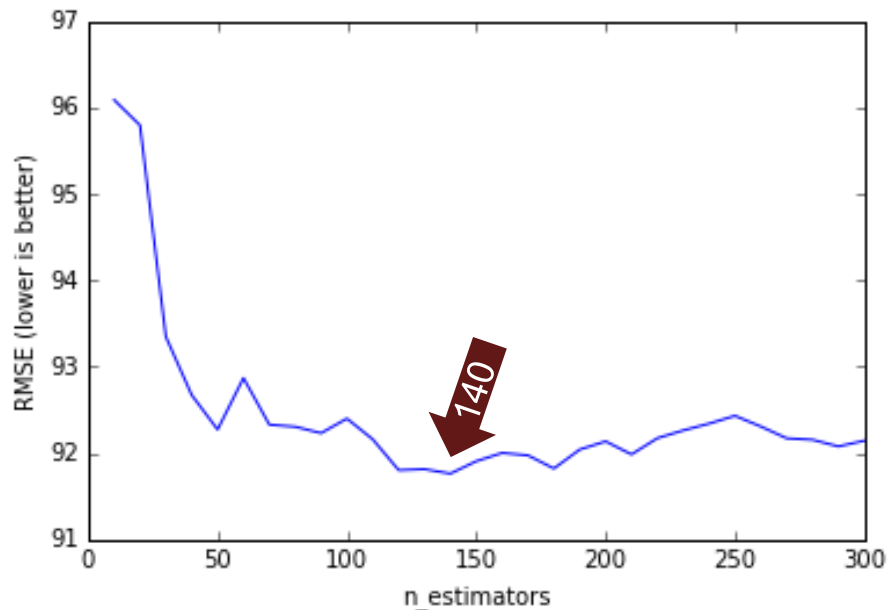
## MMR Frequency



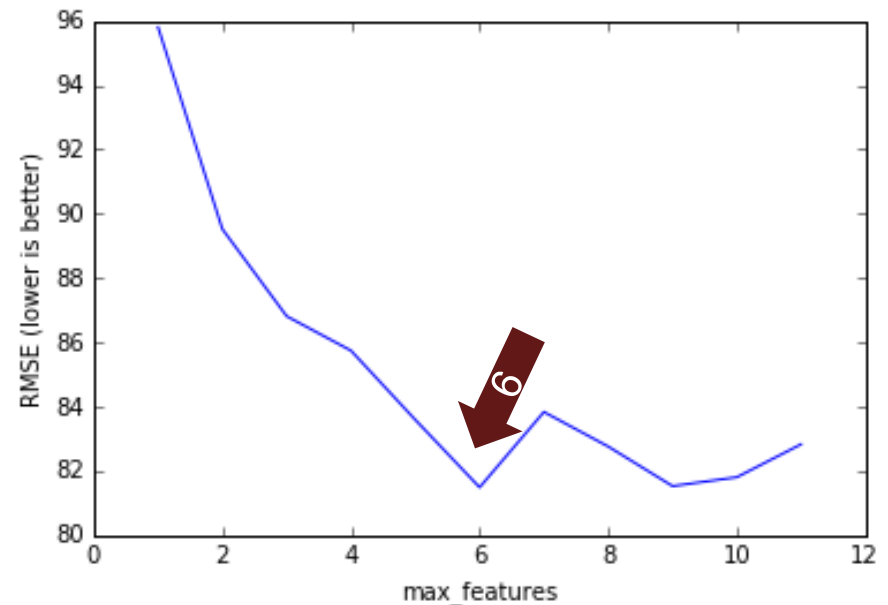
1. MMR100K - Maternal deaths per 100,000 births
2. MMRClassifier - Created for logistic regression model based on min, max and 25, 50, 75% of MMR.
3. MMRBinary - Binary variable for logistic regression model.

# Optimizing Features: Random Forest Regressor

## Estimator Tuning



## Feature Tuning



	RMSE Null	RMSE Total	RMSE Optimized
MMR100K	228.39	91.88	82.65

Table 2: Optimized demographics include: 'ABR%', 'AOD\_FMLE', 'GNI', 'EDFMLE\_MLE%', 'cell\_Subscription%', 'attend%'. The Random Forest Regressor model was. Null RMSE is with  $y\_predict = \text{mean}$ .

# Model Comparisons

	Null	Log Reg	Log Reg (Optimized)	Ran For	Ran For (Optimized)
MMRBinary	<b>0.526316</b>	0.873684211	0.857894737	0.8895	0.8947
MMRClassifier	<b>0.268421</b>	0.692464986	0.674336644	0.7558	0.7482
MMR100K ( <u>oob</u> )	<b>0.052632</b>	Na	Na	<u>0.815*</u>	<u>0.8348*</u>

Table 2: Optimized demographics include: 'ABR%', 'AOD\_FMLE', 'GNI', 'EDFMLE\_MLE%', 'cell\_Subscription%', 'attend%'. The Random Forest Classifier model was used for MMRBinary and MMRClassifier. \*Random Forest Regressor was used as the model for MMR100K. Null accuracy scores are the percent chance of selecting the most frequent value (MMRBinary = 1, MMRClassifier = 2, MMR100K = 54).

- All of the models improve null accuracy.
- The random forest classifier performs better than the logistic regression model.
- Reducing the number of demographics improves model accuracy.

*\*The random forest regressor model was used for MMR100K and is the only model run that produces MMR predictions.*

# Conclusions

OPTIMIZED FEATURES included in the model:

- \* AOD\_FMLE - 0.810598
- \* attend% - 0.077110
- \* GNI - 0.029861
- \* ABR% - 0.019747
- \* EDFMLE\_MLE% - 0.012234
- \* cell\_Subscription% - 0.011530

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Features excluded from the model:

- \* ED\_FMLE% - 0.011345
- \* prenat% - 0.010079
- \* homicide100K - 0.008285
- \* contraceptives% - 0.006246
- \* Abortion\_scale - 0.002966

Demographic contributions to model:

- Successful hypothesis: Education
- Surprising outcomes: Abortion policy, cell phone subscriptions

## Future Work

- Build a model that lacks well known causal demographics and determine the predictability.
- Add more demographics from the WHO website.