

Basic risk assessment

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First read in the data.

```
library(dataPakistan)
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.5.3
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.5.3
```

```
##
```

```
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
```

```
##
```

```
## filter, lag
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
## intersect, setdiff, setequal, union
```

```
file_location <- system.file("extdata", package = "dataPakistan")
```

```
Admin <- readxl::read_excel(path = paste0(file_location, "/Admin-datasheet-year2018.xlsx"))
```

```
AFP <- readxl::read_excel(path = paste0(file_location, "/List of AFP Cases 2015-2019.xlsx"), sheet = "D")
```

```
pop <- readxl::read_excel(path = paste0(file_location, "/Population under 15-estimates 2018-19 as 19051"))
```

```
dat_AFP <- AFP[, c("YRONSET", "MTHONSET", "DISTRICT")]
```

```
AFP_agg <-
```

```
  dat_AFP %>%
```

```
  group_by(YRONSET, MTHONSET, DISTRICT) %>%
```

```
  summarise(cases = n())
```

```
library(lubridate)
```

```
## Warning: package 'lubridate' was built under R version 3.5.3
```

```
##
```

```
## Attaching package: 'lubridate'
```

```
## The following object is masked from 'package:base':
```

```
##
```

```
## date
```

```
Admin$year <- year(Admin$Year)
```

```
Admin$month <- month(Admin$Year)
```

```
dat_Admin <- Admin[, c("year",
```

```
  "month",
```

```
  "District", "Total children vaccinated (Household Vaccination + Other Vaccination)"]
```

```

Admin_agg <-
  dat_Admin %>%
  group_by(year, month, District) %>%
  summarise(vaccinated = sum(`Total children vaccinated (Household Vaccination + Other Vaccination) n`))

alldat <- merge(Admin_agg, AFP_agg,
  by.x = c("year", "month", "District"),
  by.y = c("YRONSET", "MTHONSET", "DISTRICT"))

alldat <- merge(alldat, pop,
  by.x = "District",
  by.y = "DISTRICT")

alldat$yearmonth <- paste(alldat$year, alldat$month, sep = "_")
alldat$notcase <- round(alldat$`POPL15 (2018)` - alldat$cases,0)

glm(formula = cbind(alldat$cases, alldat$notcase) ~ yearmonth + District + vaccinated,
  family = binomial(link="logit"), data = alldat)

##
## Call: glm(formula = cbind(alldat$cases, alldat$notcase) ~ yearmonth +
##   District + vaccinated, family = binomial(link = "logit"),
##   data = alldat)
##
## Coefficients:
##   (Intercept)      yearmonth2018_11      yearmonth2018_12
##   -1.150e+01      1.410e-01      1.342e-01
##   yearmonth2018_2      yearmonth2018_3      yearmonth2018_4
##   -1.271e-01      -2.113e-02      -1.435e-02
##   yearmonth2018_5      yearmonth2018_7      yearmonth2018_8
##   -1.693e-02      -1.400e-01      -1.929e-03
##   DistrictASTORE      DistrictATTOCK      DistrictAWARAN
##   1.099e+00      -3.968e-01      6.462e-01
##   DistrictBADIN      DistrictBAGH      DistrictBAHAWALPUR
##   -3.089e-01      8.792e-01      -3.668e-01
##   DistrictBAHWLNAGAR      DistrictBAJOUR      DistrictBANNU
##   -4.343e-01      8.601e-01      3.134e-01
##   DistrictBARKHAN      DistrictBATAGRAM      DistrictBHAKKAR
##   7.951e-01      6.635e-01      -4.107e-01
##   DistrictBHIMBER      DistrictBOLAN      DistrictBUNER
##   1.627e-01      2.862e-01      2.660e-02
##   DistrictCDA      DistrictCHAGHAI      DistrictCHAKWAL
##   8.775e-02      2.613e-01      2.714e-01
##   DistrictCHARSADA      DistrictCHINIOT      DistrictCHITRAL
##   6.482e-01      1.127e-01      4.728e-01
##   DistrictDADU      DistrictDBUGTI      DistrictDGKHAN
##   -1.816e-01      2.328e-01      5.167e-01
##   DistrictDIAMER      DistrictDIKHAN      DistrictDIRLOWER
##   1.004e+00      -6.052e-02      4.457e-01
##   DistrictDIRUPPER      DistrictDUKKI      DistrictFAISALABAD
##   1.869e-01      7.868e-01      -6.073e-01
##   DistrictFR BANNU      DistrictFR DIKHAN      DistrictFR KOHAT
##   3.023e+00      1.399e+00      1.329e+00
##   DistrictFR LAKKI      DistrictFR PESHAWAR      DistrictFR TANK

```

##	2.317e+00	1.734e+00	2.306e+00
##	DistrictGHANCHE	DistrictGHIZER	DistrictGHOTKI
##	5.226e-01	9.449e-01	-9.266e-02
##	DistrictGILGIT	DistrictGUJRANWALA	DistrictGUJRAT
##	-1.299e-01	-1.444e-01	-7.249e-02
##	DistrictGWADUR	DistrictHAFIZABAD	DistrictHANGU
##	4.173e-01	1.492e-01	4.949e-01
##	DistrictHARIPUR	DistrictHARNAI	DistrictHAVELI
##	-7.301e-02	1.309e+00	3.445e-01
##	DistrictHUNZA	DistrictHYDERABAD	DistrictICT
##	1.504e+00	-2.357e-01	3.035e-01
##	DistrictJACOBABAD	DistrictJAFARABAD	DistrictJAMSHORO
##	3.728e-01	1.155e-01	2.998e-01
##	DistrictJHALMAGSI	DistrictJHANG	DistrictJHELMUM
##	8.903e-01	-3.961e-01	-6.543e-02
##	DistrictKABDULAH	DistrictKALAT	DistrictKAMBAR
##	-5.347e-03	1.854e-01	4.648e-01
##	DistrictKARAK	DistrictKASHMORE	DistrictKASUR
##	6.442e-01	-1.175e-01	-7.152e-01
##	DistrictKECH	DistrictKHAIRPUR	DistrictKHANEWAL
##	-1.549e+00	-5.227e-02	-2.969e-01
##	DistrictKHARAN	DistrictKHARMANG	DistrictKHIBALDIA
##	3.568e-01	1.299e+00	-3.029e-01
##	DistrictKHIBINQASIM	DistrictKHIGADAP	DistrictKHIGIQBAL
##	-5.488e-01	-5.740e-01	-6.690e-01
##	DistrictKHIGULBERG	DistrictKHIJAMSHEED	DistrictKHIKAMARI
##	-7.305e-02	-2.852e-01	-2.890e-01
##	DistrictKHIKORANGI	DistrictKHILANDHI	DistrictKHILAYARI
##	-6.261e-01	2.794e-01	-6.375e-01
##	DistrictKHILIAQAT	DistrictKHIMALIR	DistrictKHINNAZIM
##	-2.672e-01	1.986e-02	-1.422e-01
##	DistrictKHINORTH	DistrictKHIORANGI	DistrictKHISADDAR
##	-6.228e-01	-1.836e-01	-4.620e-01
##	DistrictKHISHAHFAISAL	DistrictKHISITE	DistrictKHUSHAB
##	1.185e-01	-1.055e-01	8.611e-02
##	DistrictKHUZDAR	DistrictKHYBER	DistrictKOHAT
##	-4.106e-01	9.787e-01	3.157e-01
##	DistrictKOHISTAN	DistrictKOHLU	DistrictKOTLI
##	-1.404e-01	-1.924e-02	8.135e-02
##	DistrictKSAIFULAH	DistrictKURRAM	DistrictLAHORE
##	3.323e-01	4.112e-01	-7.797e-01
##	DistrictLAKKIMRWT	DistrictLARKANA	DistrictLASBELA
##	1.124e+00	1.972e-01	-4.915e-01
##	DistrictLAYYAH	DistrictLODHRAN	DistrictLORALAI
##	3.219e-03	-5.305e-02	2.191e-01
##	DistrictMALAKAND	DistrictMANSEHRA	DistrictMARDAN
##	4.867e-01	-4.330e-01	5.263e-01
##	DistrictMASTUNG	DistrictMATIARI	DistrictMBDIN
##	8.830e-02	2.352e-01	2.713e-01
##	DistrictMIANWALI	DistrictMIRPUR	DistrictMIRPURKHAS
##	1.291e-01	-2.037e-01	-2.959e-01
##	DistrictMOHMAND	DistrictMULTAN	DistrictMUSAKHEL
##	8.639e-01	-5.987e-01	9.175e-01
##	DistrictMUZAFFARABAD	DistrictMUZFARGARH	DistrictNAGAR

```

##          -7.249e-01          -2.387e-02          1.143e+00
## DistrictNANKANASAHIB      DistrictNAROWAL      DistrictNEELUM
##          1.290e-01          -5.662e-02          4.534e-01
##      DistrictNFEROZ      DistrictNOSHKI      DistrictNOWSHERA
##          -5.273e-01          5.397e-01          5.054e-01
##      DistrictNSIRABAD      DistrictOKARA      DistrictORAKZAI
##          4.330e-01          -4.129e-01          7.096e-01
##      DistrictPAKPATTEN      DistrictPANJGOUR      DistrictPESHAWAR
##          -1.259e-01          7.225e-01          1.794e-01
##      DistrictPISHIN      DistrictPOONCH      DistrictQUETTA
##          1.951e-01          8.049e-01          -6.601e-01
##      DistrictRAJANPUR      DistrictRAWALPINDI      DistrictRYKHAN
##          2.859e-01          -1.623e-01          -1.188e-01
##      DistrictSAHIWAL      DistrictSANGHAR      DistrictSARGODHA
##          -6.765e-02          -4.611e-01          -4.450e-01
##      DistrictSBENAZIRABAD      DistrictSHANGLA      DistrictSHARANI
##          -4.499e-01          4.863e-01          3.279e-01
##      DistrictSHEIKHUPURA      DistrictSHIGAR      DistrictSHIKARPUR
##          -4.351e-01          1.821e+00          2.398e-01
##      DistrictSIALKOT      DistrictSIBI      DistrictSKARDU
##          -2.871e-01          1.162e-01          4.362e-01
##      DistrictSOHBATPUR      DistrictSSIKANDARABAD      DistrictSUDNUTI
##          4.700e-01          7.616e-01          1.338e+00
##      DistrictSUJAWAL      DistrictSUKKUR      DistrictSWABI
##          1.134e+00          5.032e-02          6.567e-01
##      DistrictSWAT      DistrictT.ALLAHYAR      DistrictTANK
##          1.597e-01          -1.396e-01          7.950e-01
##      DistrictTHARPARKAR      DistrictTHATTA      DistrictTMKHAN
##          -2.342e-01          -9.380e-02          -1.106e-01
##      DistrictTORGHAR      DistrictTTSINGH      DistrictUMERKOT
##          7.458e-01          3.098e-03          9.029e-02
##      DistrictVEHARI      DistrictWASHUK      DistrictWAZIR-N
##          -4.866e-01          8.844e-01          8.636e-01
##      DistrictWAZIR-S      DistrictZHOB      DistrictZIARAT
##          3.750e-01          3.676e-01          2.509e-01
##          vaccinated
##          2.027e-07
##
## Degrees of Freedom: 1021 Total (i.e. Null); 844 Residual
## Null Deviance: 2422
## Residual Deviance: 888.5 AIC: 4749

```