

CKME 136 Initial Results

Step 1: Data Description

#Read data into a dataframe

```
data <- read.csv(file="https://data.ontario.ca/dataset/f4112442-bdc8-45d2-be3c-12efae72fb27/resource/455fd63b-603d-4608-8216-7d8647f43350/download/conposcovidloc.csv",header=T,sep=";",na.strings=c("", "","NA"))
```

#summary statistics of dataset

```
summary(data)
```

```
##      Row_ID      Accurate_Episode_Date Case_Reported_Date
## Min.      :    1      2020-04-17:   685      2020-04-17:   753
## 1st Qu.: 8949      2020-04-13:   655      2020-04-15:   614
## Median :17898      2020-04-15:   642      2020-04-20:   612
## Mean    :17898      2020-04-14:   619      2020-04-13:   609
## 3rd Qu.:26846      2020-04-16:   605      2020-05-29:   609
## Max.    :35794      (Other)   :32586      2020-04-18:   603
##      NA's      :    2      (Other)   :31994
##      Test_Reported_Date Specimen_Date      Age_Group      Client_Gender
## 2020-04-17:   690      2020-04-13:   744      50s      :5779      FEMALE      :19094
## 2020-04-20:   612      2020-04-15:   734      20s      :5472      MALE        :16419
## 2020-04-18:   609      2020-04-17:   690      40s      :5097      OTHER        :    9
## 2020-04-13:   606      2020-04-14:   689      30s      :5010      TRANSGENDER:    8
## 2020-04-15:   592      2020-04-16:   667      60s      :4072      UNKNOWN     :   264
## (Other)   :32260      (Other)   :31963      80s      :3472
## NA's      :   425      NA's      :   307      (Other):6892
##      Case_AcquisitionInfo      Outcome1      Outbreak_Related
## CC      :10769      Fatal      : 2689      Yes :14247
## No Epi-link : 6637      Not Resolved: 1839      NA's:21547
## No Info-Missing: 1103      Resolved      :31266
## No Info-Unk : 1289
## OB      :14239
## Travel    : 1757
##
##      Reporting_PHU
## Toronto Public Health      :13372
## Peel Public Health          : 5918
## York Region Public Health Services: 3047
## Ottawa Public Health        : 2109
## Durham Region Health Department : 1710
## Windsor-Essex County Health Unit : 1658
## (Other)                      : 7980
##      Reporting_PHU_Address      Reporting_PHU_City
## 277 Victoria Street, 5th Floor:13372      Toronto      :13372
```

```

## 7120 Hurontario Street      : 5918      Mississauga: 5918
## 17250 Yonge Street         : 3047      Newmarket  : 3047
## 100 Constellation Drive    : 2109      Ottawa     : 2109
## 605 Rossland Road East     : 1710      Whitby     : 1710
## 1005 Ouellette Avenue      : 1658      Windsor    : 1658
## (Other)                    : 7980      (Other)    : 7980
## Reporting_PHU_Postal_Code
## M5B 1W2:13372
## L5W 1N4: 5918
## L3Y 6Z1: 3047
## K2G 6J8: 2109
## L1N 0B2: 1710
## N9A 4J8: 1658
## (Other): 7980
##
## Reporting_PHU_Website
## www.toronto.ca/community-people/health-wellness-care/ :13372
## www.peelregion.ca/health/ : 5918
## www.york.ca/wps/portal/yorkhome/health/ : 3047
## www.ottawapublichealth.ca : 2109
## www.durham.ca/en/health-and-wellness/health-and-wellness.aspx: 1710
## www.wechu.org : 1658
## (Other) : 7980
## Reporting_PHU_Latitude Reporting_PHU_Longitude
## Min. :42.31 Min. : -94.49
## 1st Qu.:43.65 1st Qu.: -79.71
## Median :43.66 Median : -79.38
## Mean :43.74 Mean : -79.52
## 3rd Qu.:43.66 3rd Qu.: -79.38
## Max. :49.77 Max. : -74.74
##

```

```
str(data)
```

```

## 'data.frame': 35794 obs. of 17 variables:
## $ Row_ID : int 1 2 3 4 5 6 7 8 9 10 ...
## $ Accurate_Episode_Date : Factor w/ 150 levels "2020-01-01","2020-01-10",...: 32 35 31 31 33 33 24 32 32 32 ...
## $ Case_Reported_Date : Factor w/ 133 levels "2020-01-23","2020-01-24",...: 15 18 18 17 18 19 19 19 17 18 ...
## $ Test_Reported_Date : Factor w/ 132 levels "2020-01-27","2020-02-03",...: 17 21 17 17 16 20 18 19 18 17 ...
## $ Specimen_Date : Factor w/ 136 levels "2020-01-23","2020-01-24",...: 21 22 21 21 21 23 21 23 21 20 ...
## $ Age_Group : Factor w/ 10 levels "<20","20s","30s",...: 4 6 2 5 1 3 4 6 5 4 ...
## $ Client_Gender : Factor w/ 5 levels "FEMALE","MALE",...: 1 1 1 2 1 1 2 2 1 2 ...
## $ Case_AcquisitionInfo : Factor w/ 6 levels "CC","No Epi-link",...: 6 1 6 6 6 6 6 6 6 6 ...
## $ Outcome1 : Factor w/ 3 levels "Fatal","Not

```

```

Resolved",...: 3 3 3 3 3 3 3 3 3 3 ...
## $ Outbreak_Related      : Factor w/ 1 level "Yes": NA NA NA NA NA NA
NA NA NA NA ...
## $ Reporting_PHU         : Factor w/ 34 levels "Algoma Public Health
Unit",...: 20 28 31 10 31 5 24 31 24 26 ...
## $ Reporting_PHU_Address : Factor w/ 34 levels "100 Constellation
Drive",...: 1 9 23 5 23 2 33 23 33 10 ...
## $ Reporting_PHU_City    : Factor w/ 34 levels
"Barrie","Belleville",...: 17 27 31 8 31 6 32 31 32 1 ...
## $ Reporting_PHU_Postal_Code: Factor w/ 34 levels "K2G 6J8","K6J 5T1",...:
1 30 16 15 16 2 18 16 18 12 ...
## $ Reporting_PHU_Website  : Factor w/ 34 levels
"www.algomapublichealth.com",...: 19 22 31 7 31 5 26 31 26 27 ...
## $ Reporting_PHU_Latitude : num  45.3 46.5 43.7 43.3 43.7 ...
## $ Reporting_PHU_Longitude: num  -75.8 -81 -79.4 -79.9 -79.4 ...

```

Step 1: Data Preparation

#Find missing values in data

```
sapply(data, function(x) sum(is.na(x)))
```

```

##           Row_ID      Accurate_Episode_Date
##           0           2
## Case_Reported_Date      Test_Reported_Date
##           0           425
## Specimen_Date           Age_Group
##          307           0
## Client_Gender      Case_AcquisitionInfo
##           0           0
## Outcome1           Outbreak_Related
##           0           21547
## Reporting_PHU      Reporting_PHU_Address
##           0           0
## Reporting_PHU_City Reporting_PHU_Postal_Code
##           0           0
## Reporting_PHU_Website Reporting_PHU_Latitude
##           0           0
## Reporting_PHU_Longitude
##           0

```

```
sapply(data, function(x) length(unique(x)))
```

```

##           Row_ID      Accurate_Episode_Date
##          35794           151
## Case_Reported_Date      Test_Reported_Date
##           133           133
## Specimen_Date           Age_Group
##           137           10
## Client_Gender      Case_AcquisitionInfo
##           5           6

```

```

##           Outcome1           Outbreak_Related
##           3           2
##           Reporting_PHU           Reporting_PHU_Address
##           34           34
##           Reporting_PHU_City           Reporting_PHU_Postal_Code
##           34           34
##           Reporting_PHU_Website           Reporting_PHU_Latitude
##           34           34
##           Reporting_PHU_Longitude
##           34

#install.packages("Amelia")
library(Amelia)

## Warning: package 'Amelia' was built under R version 3.5.3

## Loading required package: Rcpp

## Warning: package 'Rcpp' was built under R version 3.5.3

## ##
## ## Amelia II: Multiple Imputation
## ## (Version 1.7.6, built: 2019-11-24)
## ## Copyright (C) 2005-2020 James Honaker, Gary King and Matthew Blackwell
## ## Refer to http://gking.harvard.edu/amelia/ for more information
## ##

missmap(data, main = "Missing values vs observed")
#4% of data is missing

#Outbreak Related has "missing values" but should be No
sum(is.na(data$Outbreak_Related) == TRUE)

## [1] 21547

length(data$Outbreak_Related)

## [1] 35794

#Replace NA with No
data$Outbreak_Related <- factor(data$Outbreak_Related, exclude = NULL,
                                levels = c("Yes", NA),
                                labels = c("Yes", "No"))
table(data$Outbreak_Related, useNA = "always")

##
##   Yes   No  <NA>
## 14247 21547    0

str(data$Outbreak_Related)

## Factor w/ 2 levels "Yes","No": 2 2 2 2 2 2 2 2 2 2 ...

```

#summary statistics of clean dataset

summary(data)

```
##      Row_ID      Accurate_Episode_Date Case_Reported_Date
## Min.      :    1      2020-04-17: 685      2020-04-17: 753
## 1st Qu.: 8949      2020-04-13: 655      2020-04-15: 614
## Median :17898      2020-04-15: 642      2020-04-20: 612
## Mean    :17898      2020-04-14: 619      2020-04-13: 609
## 3rd Qu.:26846      2020-04-16: 605      2020-05-29: 609
## Max.    :35794      (Other)   :32586      2020-04-18: 603
##                      NA's      :    2      (Other)   :31994
##      Test_Reported_Date Specimen_Date      Age_Group      Client_Gender
## 2020-04-17: 690      2020-04-13: 744      50s      :5779      FEMALE      :19094
## 2020-04-20: 612      2020-04-15: 734      20s      :5472      MALE        :16419
## 2020-04-18: 609      2020-04-17: 690      40s      :5097      OTHER       :    9
## 2020-04-13: 606      2020-04-14: 689      30s      :5010      TRANSGENDER:    8
## 2020-04-15: 592      2020-04-16: 667      60s      :4072      UNKNOWN    :   264
## (Other)    :32260      (Other)    :31963      80s      :3472
## NA's       :   425      NA's       :   307      (Other):6892
##      Case_AcquisitionInfo      Outcome1      Outbreak_Related
## CC      :10769      Fatal      : 2689      Yes:14247
## No Epi-link : 6637      Not Resolved: 1839      No :21547
## No Info-Missing: 1103      Resolved    :31266
## No Info-Unk : 1289
## OB      :14239
## Travel   : 1757
##
##                      Reporting_PHU
## Toronto Public Health      :13372
## Peel Public Health          : 5918
## York Region Public Health Services: 3047
## Ottawa Public Health        : 2109
## Durham Region Health Department : 1710
## Windsor-Essex County Health Unit : 1658
## (Other)                     : 7980
##                      Reporting_PHU_Address      Reporting_PHU_City
## 277 Victoria Street, 5th Floor:13372      Toronto      :13372
## 7120 Hurontario Street      : 5918      Mississauga: 5918
## 17250 Yonge Street          : 3047      Newmarket   : 3047
## 100 Constellation Drive     : 2109      Ottawa      : 2109
## 605 Rossland Road East      : 1710      Whitby      : 1710
## 1005 Ouellette Avenue       : 1658      Windsor     : 1658
## (Other)                     : 7980      (Other)     : 7980
##      Reporting_PHU_Postal_Code
## M5B 1W2:13372
## L5W 1N4: 5918
## L3Y 6Z1: 3047
## K2G 6J8: 2109
## L1N 0B2: 1710
## N9A 4J8: 1658
```

```
## (Other): 7980
##
## Reporting_PHU_Website
## www.toronto.ca/community-people/health-wellness-care/ :13372
## www.peelregion.ca/health/ : 5918
## www.york.ca/wps/portal/yorkhome/health/ : 3047
## www.ottawapublichealth.ca : 2109
## www.durham.ca/en/health-and-wellness/health-and-wellness.aspx: 1710
## www.wechu.org : 1658
## (Other) : 7980
```

```
## Reporting_PHU_Latitude Reporting_PHU_Longitude
## Min. :42.31 Min. : -94.49
## 1st Qu.:43.65 1st Qu.: -79.71
## Median :43.66 Median : -79.38
## Mean :43.74 Mean : -79.52
## 3rd Qu.:43.66 3rd Qu.: -79.38
## Max. :49.77 Max. : -74.74
##
```

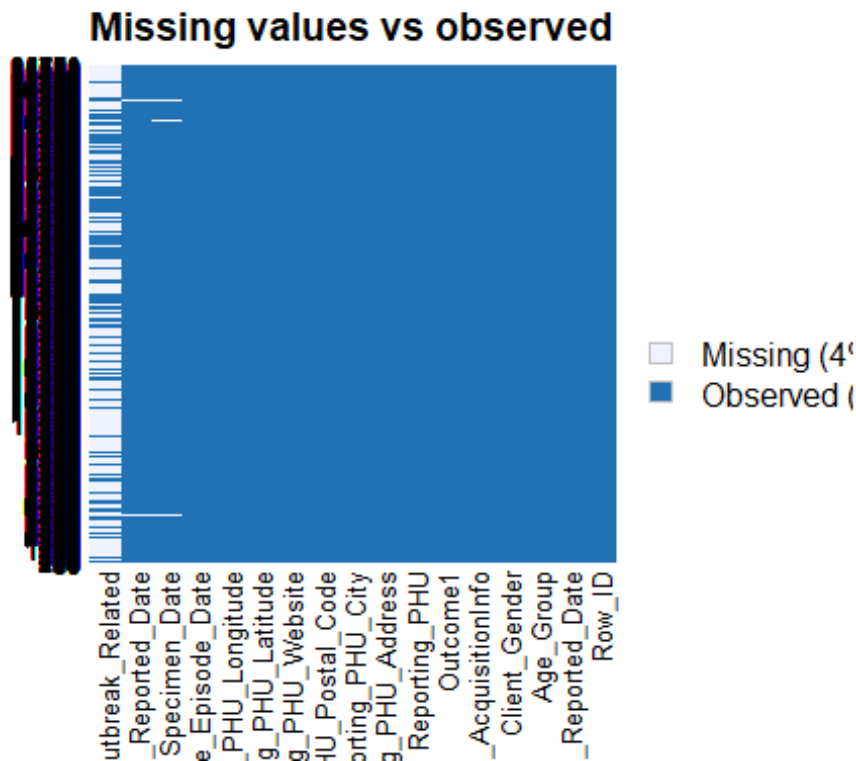
```
str(data)
```

```
## 'data.frame': 35794 obs. of 17 variables:
## $ Row_ID : int 1 2 3 4 5 6 7 8 9 10 ...
## $ Accurate_Episode_Date : Factor w/ 150 levels "2020-01-01","2020-01-10",...: 32 35 31 31 33 33 24 32 32 32 ...
## $ Case_Reported_Date : Factor w/ 133 levels "2020-01-23","2020-01-24",...: 15 18 18 17 18 19 19 19 17 18 ...
## $ Test_Reported_Date : Factor w/ 132 levels "2020-01-27","2020-02-03",...: 17 21 17 17 16 20 18 19 18 17 ...
## $ Specimen_Date : Factor w/ 136 levels "2020-01-23","2020-01-24",...: 21 22 21 21 21 23 21 23 21 20 ...
## $ Age_Group : Factor w/ 10 levels "<20","20s","30s",...: 4 6 2 5 1 3 4 6 5 4 ...
## $ Client_Gender : Factor w/ 5 levels "FEMALE","MALE",...: 1 1 1 2 1 1 2 2 1 2 ...
## $ Case_AcquisitionInfo : Factor w/ 6 levels "CC","No Epi-link",...: 6 1 6 6 6 6 6 6 6 6 ...
## $ Outcome1 : Factor w/ 3 levels "Fatal","Not Resolved",...: 3 3 3 3 3 3 3 3 3 3 ...
## $ Outbreak_Related : Factor w/ 2 levels "Yes","No": 2 2 2 2 2 2 2 2 2 2 ...
## $ Reporting_PHU : Factor w/ 34 levels "Algoma Public Health Unit",...: 20 28 31 10 31 5 24 31 24 26 ...
## $ Reporting_PHU_Address : Factor w/ 34 levels "100 Constellation Drive",...: 1 9 23 5 23 2 33 23 33 10 ...
## $ Reporting_PHU_City : Factor w/ 34 levels "Barrie","Belleville",...: 17 27 31 8 31 6 32 31 32 1 ...
## $ Reporting_PHU_Postal_Code: Factor w/ 34 levels "K2G 6J8","K6J 5T1",...: 1 30 16 15 16 2 18 16 18 12 ...
## $ Reporting_PHU_Website : Factor w/ 34 levels "www.algomapublichealth.com",...: 19 22 31 7 31 5 26 31 26 27 ...
```

```
## $ Reporting_PHU_Latitude : num 45.3 46.5 43.7 43.3 43.7 ...
## $ Reporting_PHU_Longitude : num -75.8 -81 -79.4 -79.9 -79.4 ...
```

#bar charts

```
library(ggplot2)
```



#Access ggplot-colors

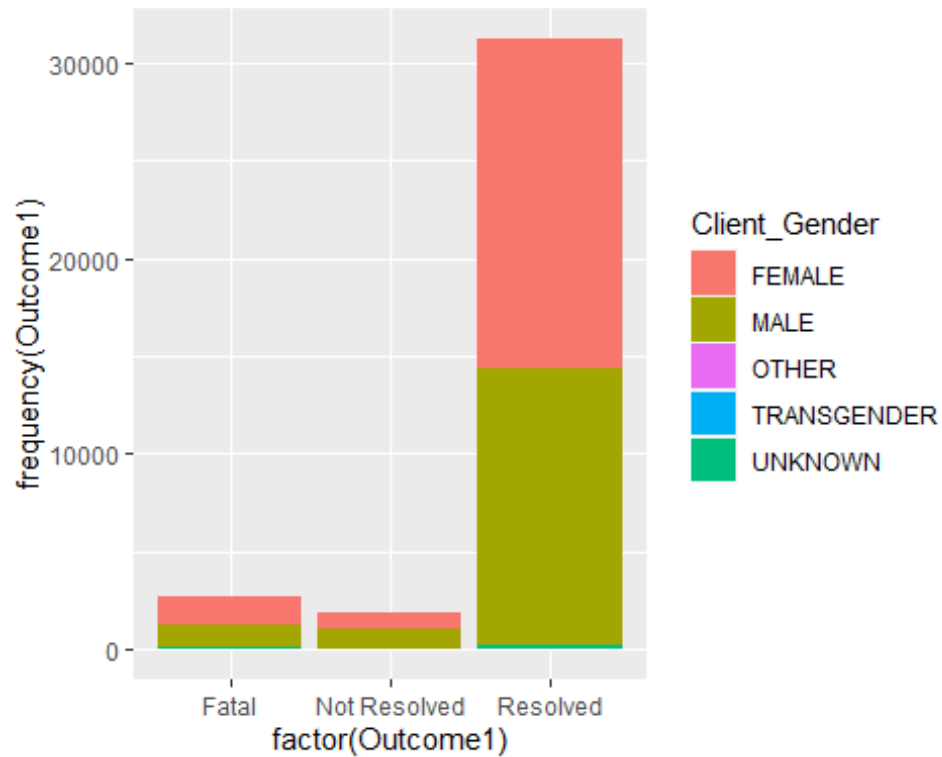
```
gg_color_hue <- function(n) {
  hues = seq(15, 375, length=n+1)
  hcl(h=hues, l=65, c=100)[1:n]
}
```

#create custom palette for Client Gender

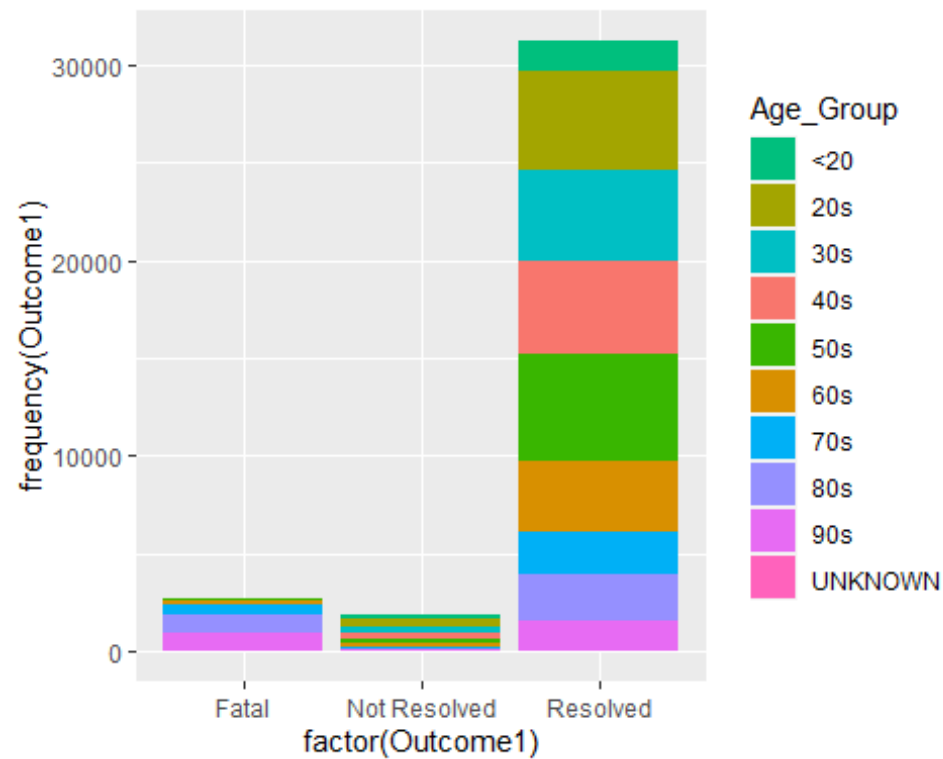
```
mycols <- gg_color_hue(length(unique(data$Client_Gender)))
names(mycols) <- unique(data$Client_Gender)
```

#stacked bar chart for Client Genders in Outcome

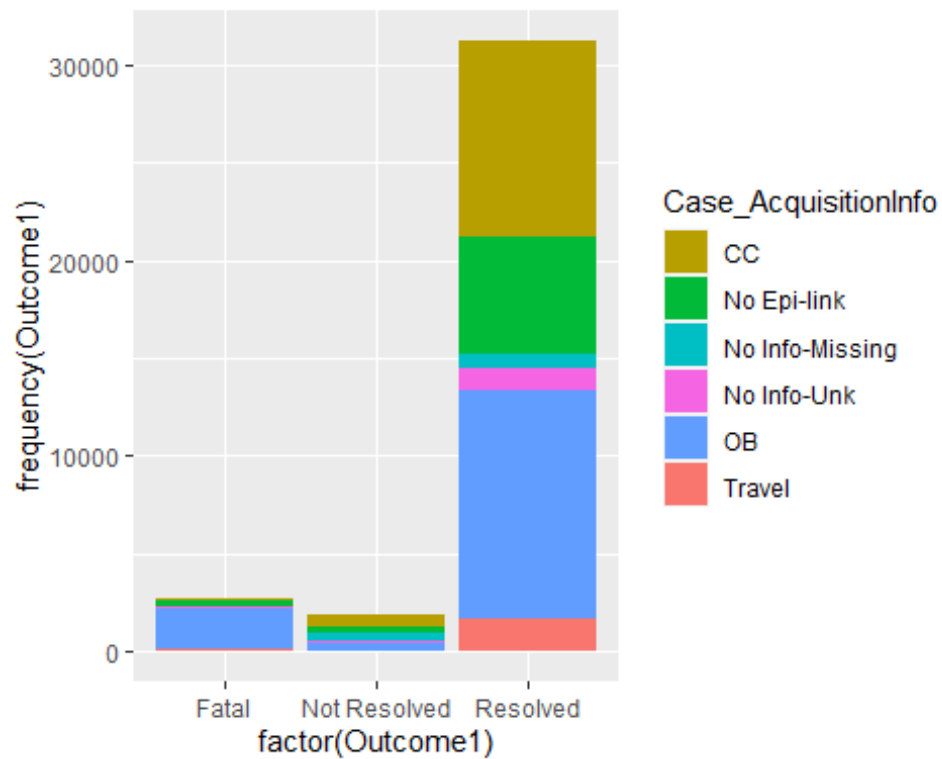
```
ggplot(data, aes(x = factor(Outcome1), y = frequency(Outcome1),
fill=Client_Gender)) + geom_bar(stat = 'identity') + scale_fill_manual(values
= mycols)
```



```
#Age Group stacked bar chart
mycols <- gg_color_hue(length(unique(data$Age_Group)))
names(mycols) <- unique(data$Age_Group)
ggplot(data, aes(x = factor(Outcome1), y = frequency(Outcome1),
fill=Age_Group)) + geom_bar(stat = 'identity') + scale_fill_manual(values =
mycols)
```

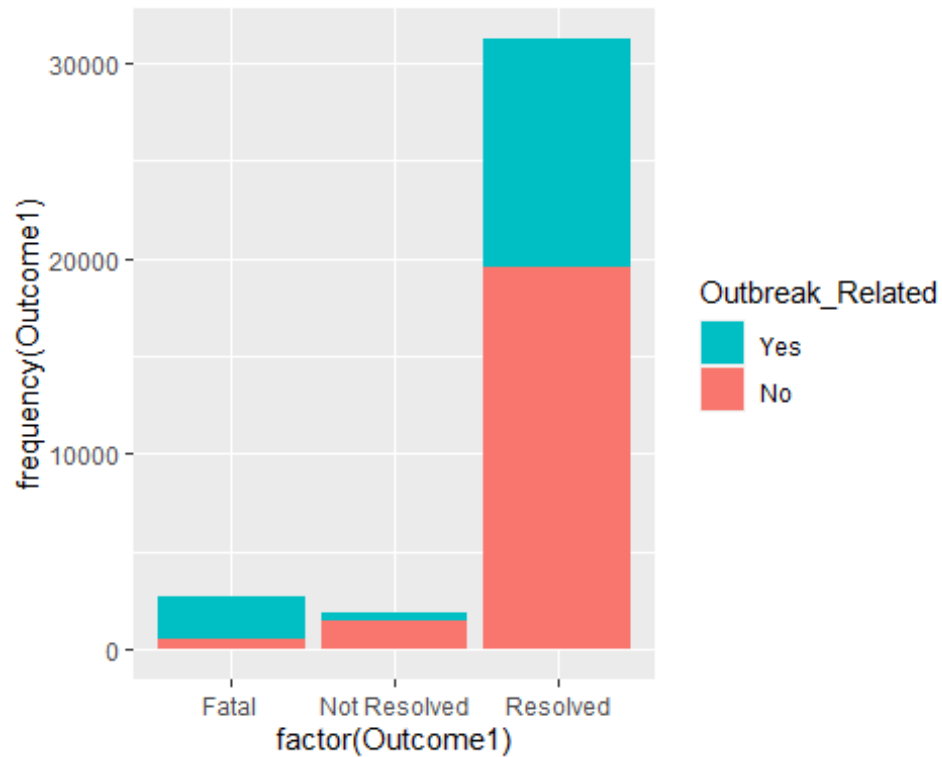



```
#Case Acquisition Info stacked bar chart
mycols <- gg_color_hue(length(unique(data$Case_AcquisitionInfo)))
names(mycols) <- unique(data$Case_AcquisitionInfo)
ggplot(data, aes(x = factor(Outcome1), y = frequency(Outcome1),
fill=Case_AcquisitionInfo)) + geom_bar(stat = 'identity') +
scale_fill_manual(values = mycols)
```



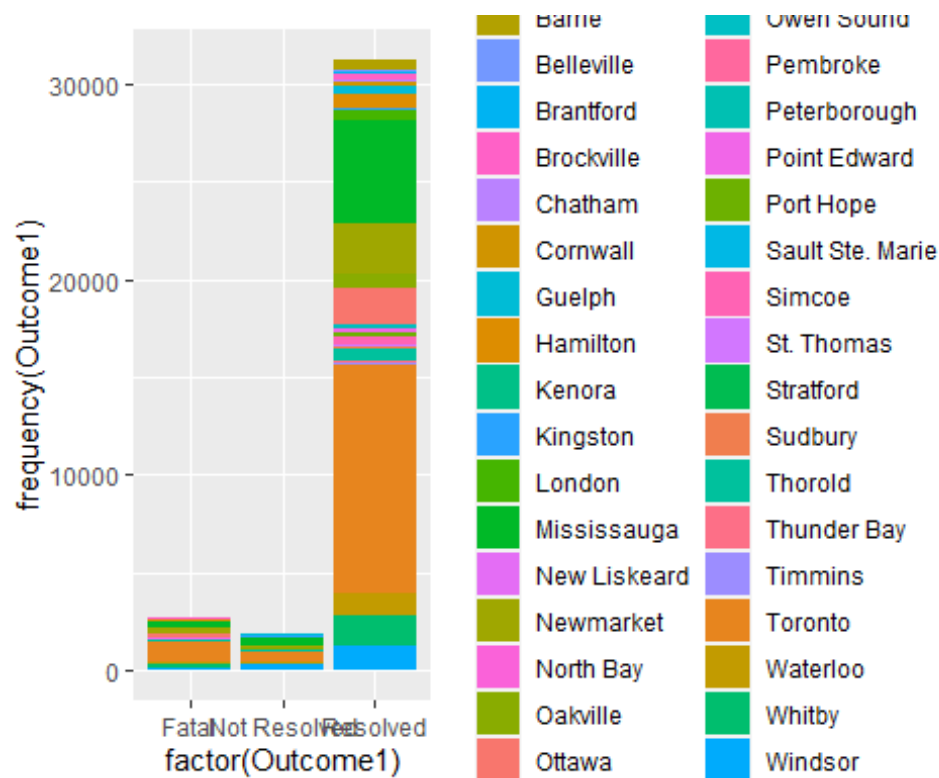
#Outbreak Related stacked bar chart

```
mycols <- gg_color_hue(length(unique(data$Outbreak_Related)))
names(mycols) <- unique(data$Outbreak_Related)
ggplot(data, aes(x = factor(Outcome1), y = frequency(Outcome1),
fill=Outbreak_Related)) + geom_bar(stat = 'identity') +
scale_fill_manual(values = mycols)
```



#Reporting City stacked bar chart

```
mycols <- gg_color_hue(length(unique(data$Reporting_PHU_City)))  
names(mycols) <- unique(data$Reporting_PHU_City)  
ggplot(data, aes(x = factor(Outcome1), y = frequency(Outcome1),  
fill=Reporting_PHU_City)) + geom_bar(stat = 'identity') +  
scale_fill_manual(values = mycols)
```



```
#install.packages("maps")
#install.packages("mapdata")
#install.packages("mapproj")
library(maps)

## Warning: package 'maps' was built under R version 3.5.3

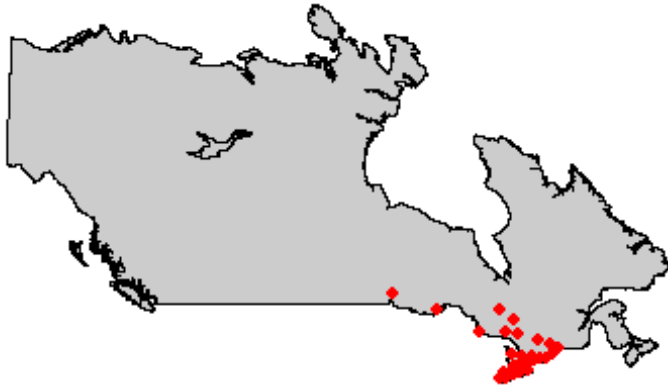
library(mapdata)

## Warning: package 'mapdata' was built under R version 3.5.3

library(mapproj)

## Warning: package 'mapproj' was built under R version 3.5.3

map(database = "worldHires", "Canada", xlim=c(-140,-110),ylim=c(48,64),
col="grey80", fill=TRUE, projection="gilbert", orientation= c(90,0,225))
lon <- c(data$Reporting_PHU_Longitude)
lat <- c(data$Reporting_PHU_Latitude)
coord <- mapproject(lon, lat, proj="gilbert", orientation=c(90, 0, 225))
#convert points to projected Lat/Long
points(coord, pch=20, cex=1.2, col="red")
```



Step 3:

Experimental Design

```
#Split data into training (10%) and test (90%) sets  
#createDataPartition function does stratified random sampling  
set.seed(100)  
#install.packages("caret")  
library(caret)  
  
## Warning: package 'caret' was built under R version 3.5.3  
  
## Loading required package: lattice  
  
trainingRows <- createDataPartition(data$Outcome1, p = 0.9, list = FALSE)  
training <- data[trainingRows,]  
test <- data[-trainingRows,]
```

Step 4: Modeling - (1) Logistic Regression

```
#install.packages("nnet")  
library(nnet)  
  
## Warning: package 'nnet' was built under R version 3.5.3  
  
#Fit training data into Multinomial Logistic Regression Model  
model.LogReg <- multinom(Outcome1 ~ Client_Gender + Age_Group +  
Case_AcquisitionInfo + Outbreak_Related + Reporting_PHU_City, data=training)
```

```
## # weights: 162 (106 variable)
## initial value 35393.992104
## iter 10 value 12203.153571
## iter 20 value 11683.294940
## iter 30 value 11492.264420
## iter 40 value 11347.664900
## iter 50 value 11286.504708
## iter 60 value 11254.197227
## iter 70 value 11249.511338
## iter 80 value 11249.000797
## iter 90 value 11248.816360
## iter 100 value 11248.620496
## final value 11248.620496
## stopped after 100 iterations
```

summary (model.LogReg)

```
## Call:
## multinom(formula = Outcome1 ~ Client_Gender + Age_Group +
## Case_AcquisitionInfo +
## Outbreak_Related + Reporting_PHU_City, data = training)
##
## Coefficients:
## (Intercept) Client_GenderMALE Client_GenderOTHER
## Not Resolved 1.316666 -0.3690098 8.542830
## Resolved 14.469468 -0.5798067 7.744573
## Client_GenderTRANSGENDER Client_GenderUNKNOWN Age_Group20s
## Not Resolved -9.907930 0.39945559 -0.435396862
## Resolved -1.759647 -0.08431415 -0.005267868
## Age_Group30s Age_Group40s Age_Group50s Age_Group60s
## Not Resolved -0.9605209 -2.344847 -3.727005 -5.109211
## Resolved -0.3834099 -1.443040 -2.884269 -4.242468
## Age_Group70s Age_Group80s Age_Group90s Age_GroupUNKNOWN
## Not Resolved -6.245917 -6.769204 -6.866834 1.003290
## Resolved -5.416182 -5.867802 -6.287048 1.381671
## Case_AcquisitionInfoNo Epi-link
## Not Resolved -0.1604545
## Resolved -0.4524177
## Case_AcquisitionInfoNo Info-Missing
## Not Resolved 1.610238
## Resolved -0.529744
## Case_AcquisitionInfoNo Info-Unk Case_AcquisitionInfoOB
## Not Resolved -0.9011508 2.325617
## Resolved -1.1873714 -7.538378
## Case_AcquisitionInfoTravel Outbreak_RelatedNo
## Not Resolved -0.8448559 3.596780
## Resolved -0.1306957 -6.629142
## Reporting_PHU_CityBelleville Reporting_PHU_CityBrantford
## Not Resolved -9.5791197 -1.37954811
## Resolved -0.3122412 0.03264614
```

##	Reporting_PHU_CityBrockville	Reporting_PHU_CityChatham
## Not Resolved	-0.9361308	0.3237805
## Resolved	0.2124727	0.5902903
##	Reporting_PHU_CityCornwall	Reporting_PHU_CityGuelph
## Not Resolved	-0.51796861	0.8088539
## Resolved	0.07591717	-0.2166028
##	Reporting_PHU_CityHamilton	Reporting_PHU_CityKenora
## Not Resolved	0.7860437	10.093886
## Resolved	0.3515068	8.638697
##	Reporting_PHU_CityKingston	Reporting_PHU_CityLondon
## Not Resolved	13.22794	-0.1395204
## Resolved	10.21758	-0.3111410
##	Reporting_PHU_CityMississauga	Reporting_PHU_CityNew Liskeard
## Not Resolved	0.5865141	-2.137882
## Resolved	-0.1604127	9.586475
##	Reporting_PHU_CityNewmarket	Reporting_PHU_CityNorth Bay
## Not Resolved	0.54544584	2.3880743
## Resolved	-0.08953953	0.1009735
##	Reporting_PHU_CityOakville	Reporting_PHU_CityOttawa
## Not Resolved	1.1564713	-0.5959582
## Resolved	0.8415999	-0.3657157
##	Reporting_PHU_CityOwen Sound	Reporting_PHU_CityPembroke
## Not Resolved	12.37066	0.9718843
## Resolved	11.68892	0.2965006
##	Reporting_PHU_CityPeterborough	Reporting_PHU_CityPoint Edward
## Not Resolved	-11.618828	-2.0667906
## Resolved	1.547266	0.3142791
##	Reporting_PHU_CityPort Hope	
## Not Resolved	0.7269378	
## Resolved	0.1109945	
##	Reporting_PHU_CitySault Ste. Marie	Reporting_PHU_CitySimcoe
## Not Resolved	-1.788859	-1.1173546
## Resolved	10.510121	-0.2714987
##	Reporting_PHU_CitySt. Thomas	Reporting_PHU_CityStratford
## Not Resolved	-11.5199890	0.20388863
## Resolved	-0.2623126	-0.01995707
##	Reporting_PHU_CitySudbury	Reporting_PHU_CityThorold
## Not Resolved	-10.164420	0.3042464
## Resolved	1.022511	0.3614197
##	Reporting_PHU_CityThunder Bay	Reporting_PHU_CityTimmins
## Not Resolved	0.5369380	-11.3301147
## Resolved	0.7663787	-0.8896818
##	Reporting_PHU_CityToronto	Reporting_PHU_CityWaterloo
## Not Resolved	0.41985335	0.1561283
## Resolved	0.08584245	-0.1168793
##	Reporting_PHU_CityWhitby	Reporting_PHU_CityWindsor
## Not Resolved	-0.29026447	1.67395052
## Resolved	-0.03484414	-0.03978036
##		
## Std. Errors:		

##	(Intercept)	Client_GenderMALE	Client_GenderOTHER	
## Not Resolved	0.7031159	0.07320519	0.6302715	
## Resolved	0.6806636	0.05070673	0.6303351	
##	Client_GenderTRANSGENDER	Client_GenderUNKNOWN	Age_Group20s	
## Not Resolved	0.0003133364	0.3672989	1.123099	
## Resolved	1.4549889951	0.2117739	1.119021	
##	Age_Group30s	Age_Group40s	Age_Group50s	Age_Group60s
## Not Resolved	1.086538	1.036115	1.013231	1.010549
## Resolved	1.081887	1.030571	1.007832	1.003944
##	Age_Group70s	Age_Group80s	Age_Group90s	Age_GroupUNKNOWN
## Not Resolved	1.013281	1.014906	1.018654	22.39512
## Resolved	1.003189	1.003159	1.003651	22.35889
##	Case_AcquisitionInfoNo	Epi-link		
## Not Resolved		0.1364127		
## Resolved		0.1166962		
##	Case_AcquisitionInfoNo	Info-Missing		
## Not Resolved		0.2662715		
## Resolved		0.2571109		
##	Case_AcquisitionInfoNo	Info-Unk	Case_AcquisitionInfoOB	
## Not Resolved		0.2169348	0.3585102	
## Resolved		0.1643624	0.3447266	
##	Case_AcquisitionInfoTravel	Outbreak_RelatedNo		
## Not Resolved		0.2451744	0.3555886	
## Resolved		0.1724755	0.3436293	
##	Reporting_PHU_CityBelleville	Reporting_PHU_CityBrantford		
## Not Resolved	8.225314e-05	1.1653341		
## Resolved	6.378003e-01	0.5424635		
##	Reporting_PHU_CityBrockville	Reporting_PHU_CityChatham		
## Not Resolved	0.7963749	1.220814		
## Resolved	0.2663277	1.047300		
##	Reporting_PHU_CityCornwall	Reporting_PHU_CityGuelph		
## Not Resolved	0.8506512	0.4162801		
## Resolved	0.4026662	0.2864442		
##	Reporting_PHU_CityHamilton	Reporting_PHU_CityKenora		
## Not Resolved	0.403323	0.2962885		
## Resolved	0.270151	0.2963189		
##	Reporting_PHU_CityKingston	Reporting_PHU_CityLondon		
## Not Resolved	0.1729544	0.4322507		
## Resolved	0.1729701	0.2633414		
##	Reporting_PHU_CityMississauga	Reporting_PHU_CityNew Liskeard		
## Not Resolved	0.3338842	2.134634e-06		
## Resolved	0.2150778	2.452414e-05		
##	Reporting_PHU_CityNewmarket	Reporting_PHU_CityNorth Bay		
## Not Resolved	0.3413635	1.159547		
## Resolved	0.2185826	1.071724		
##	Reporting_PHU_CityOakville	Reporting_PHU_CityOttawa		
## Not Resolved	0.4458554	0.3695467		
## Resolved	0.3204229	0.2190467		
##	Reporting_PHU_CityOwen Sound	Reporting_PHU_CityPembroke		
## Not Resolved	0.2657228	1.335343		


```
## Resolved          0.2657369          1.116615
## Reporting_PHU_CityPeterborough Reporting_PHU_CityPoint Edward
## Not Resolved      7.011485e-06          1.0887675
## Resolved          1.052258e+00          0.3220908
## Reporting_PHU_CityPort Hope
## Not Resolved      0.5711521
## Resolved          0.3523380
## Reporting_PHU_CitySault Ste. Marie Reporting_PHU_CitySimcoe
## Not Resolved      1.369768e-06          0.6326856
## Resolved          1.630906e-05          0.2935717
## Reporting_PHU_CitySt. Thomas Reporting_PHU_CityStratford
## Not Resolved      2.484413e-05          0.9729314
## Resolved          6.517635e-01          0.6138580
## Reporting_PHU_CitySudbury Reporting_PHU_CityThorold
## Not Resolved      5.322367e-05          0.442853
## Resolved          1.060374e+00          0.259424
## Reporting_PHU_CityThunder Bay Reporting_PHU_CityTimmins
## Not Resolved      1.290549          5.239533e-05
## Resolved          1.056733          4.887331e-01
## Reporting_PHU_CityToronto Reporting_PHU_CityWaterloo
## Not Resolved      0.3282228          0.3755570
## Resolved          0.2075661          0.2354008
## Reporting_PHU_CityWhitby Reporting_PHU_CityWindsor
## Not Resolved      0.3851506          0.3596785
## Resolved          0.2245777          0.2498593
##
## Residual Deviance: 22497.24
## AIC: 22709.24
```

#Predict on test data

```
predicted.scores.test <- predict (model.LogReg, test, "probs")
head(predicted.scores.test)
```

```
##          Fatal Not Resolved Resolved
## 3  0.0004039774  0.023258031 0.9763380
## 5  0.0003968945  0.035316805 0.9642863
## 39 0.0310438087  0.008203117 0.9607531
## 55 0.0144650226  0.010528071 0.9750069
## 60 0.0975046058  0.019068142 0.8834273
## 69 0.0036053015  0.024108996 0.9722857
```

```
predicted.class.test <- predict (model.LogReg, test)
head(predicted.class.test)
```

```
## [1] Resolved Resolved Resolved Resolved Resolved Resolved
## Levels: Fatal Not Resolved Resolved
```

#Confusion Matrix

```
confusion.matrix.table <- table(predicted.class.test, test$Outcome1)
confusion.matrix.table
```

```
##
## predicted.class.test Fatal Not Resolved Resolved
##      Fatal      8      0      14
##      Not Resolved  0      13      5
##      Resolved    260     170    3107
```

Precision and Recall for Fatal Class

#precision = 8/(8+14) = 0.3636364

#recall = 8/(8+260) = 0.02985075

Precision and Recall for Resolved Class

#precision = 3107/(260+170+3107) = 0.878428

#recall = 3107/(14+5+3107) = 0.9939219

Step 4: Modeling - (2) Naive Bayes Classifier

```
#install.packages("e1071")
```

```
library(e1071)
```

```
## Warning: package 'e1071' was built under R version 3.5.3
```

```
#install.packages("gmodels")
```

```
library(gmodels)
```

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

#Building model on training set

```
NBC.classifier <- naiveBayes(training, training$Outcome1, laplace = 1)
```

```
NBC.classifier
```

```
##
```

```
## Naive Bayes Classifier for Discrete Predictors
```

```
##
```

```
## Call:
```

```
## naiveBayes.default(x = training, y = training$Outcome1, laplace = 1)
```

```
##
```

```
## A-priori probabilities:
```

```
## training$Outcome1
```

```
##      Fatal Not Resolved      Resolved
```

```
##  0.07514666  0.05140143  0.87345190
```

```
##
```

```
## Conditional probabilities:
```

```
##      Row_ID
```

```
## training$Outcome1      [,1]      [,2]
```

```
##      Fatal      14258.54  9956.064
```

```
##      Not Resolved 25851.16  5145.327
```

```
##      Resolved    17768.82 10357.055
```

```
##
```

```
##      Accurate_Episode_Date
```

```
## training$Outcome1 2020-01-01 2020-01-10 2020-01-21 2020-01-22
```

```
##      Fatal      3.889537e-04 3.889537e-04 3.889537e-04 3.889537e-04
```

```

##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved    1.060520e-04 7.070136e-05 7.070136e-05 7.070136e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-01-24 2020-02-01 2020-02-05 2020-02-07
##      Fatal        3.889537e-04 3.889537e-04 3.889537e-04 3.889537e-04
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     7.070136e-05 7.070136e-05 7.070136e-05 7.070136e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-02-10 2020-02-14 2020-02-15 2020-02-16
##      Fatal        3.889537e-04 3.889537e-04 3.889537e-04 3.889537e-04
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     1.060520e-04 1.060520e-04 7.070136e-05 7.070136e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-02-17 2020-02-19 2020-02-20 2020-02-21
##      Fatal        3.889537e-04 3.889537e-04 3.889537e-04 3.889537e-04
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     7.070136e-05 7.070136e-05 1.414027e-04 7.070136e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-02-22 2020-02-23 2020-02-24 2020-02-25
##      Fatal        3.889537e-04 3.889537e-04 3.889537e-04 3.889537e-04
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     1.767534e-04 1.767534e-04 1.414027e-04 1.414027e-04
##      Accurate_Episode_Date
## training$Outcome1 2020-02-26 2020-02-27 2020-02-28 2020-02-29
##      Fatal        3.889537e-04 3.889537e-04 3.889537e-04 3.889537e-04
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     7.070136e-05 3.535068e-05 2.474548e-04 2.121041e-04
##      Accurate_Episode_Date
## training$Outcome1 2020-03-01 2020-03-02 2020-03-03 2020-03-04
##      Fatal        1.166861e-03 3.889537e-04 3.889537e-04 7.779074e-04
##      Not Resolved 5.537099e-04 1.107420e-03 5.537099e-04 5.537099e-04
##      Resolved     4.595588e-04 4.242081e-04 5.302602e-04 3.535068e-04
##      Accurate_Episode_Date
## training$Outcome1 2020-03-05 2020-03-06 2020-03-07 2020-03-08
##      Fatal        3.889537e-04 1.555815e-03 1.166861e-03 1.555815e-03
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     8.130656e-04 1.060520e-03 9.544683e-04 1.732183e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-03-09 2020-03-10 2020-03-11 2020-03-12
##      Fatal        1.166861e-03 1.166861e-03 1.166861e-03 7.779074e-04
##      Not Resolved 5.537099e-04 1.107420e-03 1.107420e-03 5.537099e-04
##      Resolved     1.979638e-03 3.216912e-03 3.429016e-03 4.100679e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-03-13 2020-03-14 2020-03-15 2020-03-16
##      Fatal        2.333722e-03 2.333722e-03 3.889537e-03 4.667445e-03
##      Not Resolved 5.537099e-04 5.537099e-04 5.537099e-04 5.537099e-04
##      Resolved     4.843043e-03 4.277432e-03 5.408654e-03 8.024604e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-03-17 2020-03-18 2020-03-19 2020-03-20
##      Fatal        5.834306e-03 5.445352e-03 7.779074e-03 7.779074e-03

```

```

##      Not Resolved 5.537099e-04 5.537099e-04 1.107420e-03 1.107420e-03
##      Resolved      8.130656e-03 8.095305e-03 7.953903e-03 1.049915e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-03-21 2020-03-22 2020-03-23 2020-03-24
##      Fatal      5.445352e-03 7.001167e-03 8.168028e-03 6.223259e-03
##      Not Resolved 5.537099e-04 1.107420e-03 1.107420e-03 1.107420e-03
##      Resolved      8.166007e-03 7.635747e-03 1.003959e-02 7.989253e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-03-25 2020-03-26 2020-03-27 2020-03-28
##      Fatal      1.050175e-02 1.205757e-02 1.011280e-02 8.168028e-03
##      Not Resolved 5.537099e-04 1.661130e-03 5.537099e-04 2.214839e-03
##      Resolved      8.766968e-03 7.635747e-03 9.332579e-03 8.766968e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-03-29 2020-03-30 2020-03-31 2020-04-01
##      Fatal      1.439129e-02 1.672501e-02 1.011280e-02 2.839362e-02
##      Not Resolved 5.537099e-04 5.537099e-04 1.107420e-03 1.107420e-03
##      Resolved      7.989253e-03 9.968891e-03 9.155826e-03 1.325650e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-02 2020-04-03 2020-04-04 2020-04-05
##      Fatal      1.789187e-02 2.139245e-02 1.983664e-02 1.828082e-02
##      Not Resolved 5.537099e-04 5.537099e-04 1.661130e-03 2.214839e-03
##      Resolved      9.898190e-03 1.216063e-02 1.127687e-02 9.721437e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-04-06 2020-04-07 2020-04-08 2020-04-09
##      Fatal      1.944769e-02 2.061455e-02 2.489304e-02 1.983664e-02
##      Not Resolved 1.107420e-03 1.661130e-03 1.107420e-03 1.107420e-03
##      Resolved      1.251414e-02 1.194853e-02 1.170107e-02 1.297370e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-10 2020-04-11 2020-04-12 2020-04-13
##      Fatal      2.489304e-02 2.800467e-02 2.411513e-02 3.111630e-02
##      Not Resolved 5.537099e-04 1.661130e-03 1.107420e-03 2.214839e-03
##      Resolved      1.463518e-02 1.555430e-02 1.350396e-02 1.845305e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-14 2020-04-15 2020-04-16 2020-04-17
##      Fatal      2.333722e-02 2.878257e-02 2.644885e-02 3.072734e-02
##      Not Resolved 2.768549e-03 1.107420e-03 1.661130e-03 2.768549e-03
##      Resolved      1.749859e-02 1.728648e-02 1.707438e-02 1.873586e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-18 2020-04-19 2020-04-20 2020-04-21
##      Fatal      2.489304e-02 1.905873e-02 2.100350e-02 1.789187e-02
##      Not Resolved 2.214839e-03 1.107420e-03 1.661130e-03 1.661130e-03
##      Resolved      1.619061e-02 1.021635e-02 1.459983e-02 1.205458e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-22 2020-04-23 2020-04-24 2020-04-25
##      Fatal      2.372618e-02 2.022559e-02 1.516919e-02 1.400233e-02
##      Not Resolved 5.537099e-04 2.214839e-03 2.214839e-03 1.107420e-03
##      Resolved      1.325650e-02 1.240809e-02 1.141827e-02 1.244344e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-26 2020-04-27 2020-04-28 2020-04-29
##      Fatal      1.127966e-02 1.400233e-02 1.089070e-02 1.555815e-02

```

```

##      Not Resolved 1.661130e-03 3.322259e-03 2.768549e-03 1.107420e-03
##      Resolved      9.792138e-03 1.350396e-02 1.141827e-02 1.117081e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-04-30 2020-05-01 2020-05-02 2020-05-03
##      Fatal      9.723843e-03 7.779074e-03 7.390121e-03 2.722676e-03
##      Not Resolved 5.537099e-04 1.661130e-03 1.661130e-03 1.661130e-03
##      Resolved      1.216063e-02 1.336256e-02 9.862839e-03 8.272059e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-05-04 2020-05-05 2020-05-06 2020-05-07
##      Fatal      6.612213e-03 7.779074e-03 9.723843e-03 7.779074e-03
##      Not Resolved 1.107420e-03 1.107420e-03 1.661130e-03 1.661130e-03
##      Resolved      9.049774e-03 9.827489e-03 7.741799e-03 9.827489e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-05-08 2020-05-09 2020-05-10 2020-05-11
##      Fatal      9.723843e-03 8.556982e-03 3.500583e-03 7.390121e-03
##      Not Resolved 2.214839e-03 5.537099e-04 5.537099e-04 1.661130e-03
##      Resolved      1.064055e-02 8.554864e-03 8.378111e-03 1.124152e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-05-12 2020-05-13 2020-05-14 2020-05-15
##      Fatal      6.612213e-03 6.223259e-03 5.445352e-03 7.390121e-03
##      Not Resolved 1.107420e-03 5.537099e-04 2.214839e-03 5.537099e-04
##      Resolved      1.035775e-02 9.509333e-03 1.102941e-02 1.449378e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-05-16 2020-05-17 2020-05-18 2020-05-19
##      Fatal      6.223259e-03 8.945935e-03 5.445352e-03 7.001167e-03
##      Not Resolved 1.661130e-03 1.661130e-03 5.537099e-04 5.537099e-04
##      Resolved      1.018100e-02 9.120475e-03 1.120617e-02 1.173643e-02
##      Accurate_Episode_Date
## training$Outcome1 2020-05-20 2020-05-21 2020-05-22 2020-05-23
##      Fatal      5.056398e-03 5.834306e-03 3.111630e-03 3.111630e-03
##      Not Resolved 1.107420e-03 1.107420e-03 1.107420e-03 5.537099e-04
##      Resolved      1.152432e-02 1.095871e-02 8.625566e-03 8.696267e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-05-24 2020-05-25 2020-05-26 2020-05-27
##      Fatal      2.333722e-03 2.722676e-03 3.500583e-03 4.667445e-03
##      Not Resolved 1.107420e-03 1.107420e-03 1.661130e-03 1.107420e-03
##      Resolved      8.590215e-03 1.170107e-02 9.862839e-03 8.943722e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-05-28 2020-05-29 2020-05-30 2020-05-31
##      Fatal      2.333722e-03 3.111630e-03 1.944769e-03 1.555815e-03
##      Not Resolved 1.107420e-03 2.214839e-03 5.537099e-04 1.107420e-03
##      Resolved      7.635747e-03 1.117081e-02 8.696267e-03 7.246889e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-06-01 2020-06-02 2020-06-03 2020-06-04
##      Fatal      1.944769e-03 1.166861e-03 1.555815e-03 1.555815e-03
##      Not Resolved 1.107420e-03 1.661130e-03 1.107420e-03 5.537099e-04
##      Resolved      1.117081e-02 7.070136e-03 7.458993e-03 7.317590e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-06-05 2020-06-06 2020-06-07 2020-06-08
##      Fatal      2.333722e-03 1.944769e-03 1.555815e-03 7.779074e-04

```

```

##      Not Resolved 1.107420e-03 5.537099e-04 1.107420e-03 1.107420e-03
##      Resolved    6.716629e-03 6.151018e-03 4.807692e-03 6.964084e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-06-09 2020-06-10 2020-06-11 2020-06-12
##      Fatal      1.555815e-03 1.166861e-03 1.166861e-03 3.889537e-04
##      Not Resolved 2.214839e-03 1.107420e-03 5.537099e-04 1.107420e-03
##      Resolved    5.550057e-03 6.681278e-03 5.762161e-03 5.938914e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-06-13 2020-06-14 2020-06-15 2020-06-16
##      Fatal      7.779074e-04 7.779074e-04 7.779074e-04 1.944769e-03
##      Not Resolved 1.107420e-03 1.661130e-03 1.107420e-03 1.107420e-03
##      Resolved    3.747172e-03 4.454186e-03 6.292421e-03 5.055147e-03
##      Accurate_Episode_Date
## training$Outcome1 2020-06-17 2020-06-18 2020-06-19 2020-06-20
##      Fatal      1.166861e-03 1.944769e-03 3.889537e-04 7.779074e-04
##      Not Resolved 5.537099e-04 1.661130e-03 5.537099e-04 7.032115e-02
##      Resolved    5.514706e-03 4.595588e-03 5.656109e-03 5.302602e-04
##      Accurate_Episode_Date
## training$Outcome1 2020-06-21 2020-06-22 2020-06-23 2020-06-24
##      Fatal      3.889537e-04 3.889537e-04 7.779074e-04 1.166861e-03
##      Not Resolved 6.367663e-02 9.357697e-02 7.530454e-02 6.644518e-02
##      Resolved    3.181561e-04 3.181561e-04 7.070136e-05 7.070136e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-06-25 2020-06-26 2020-06-27 2020-06-28
##      Fatal      7.779074e-04 3.889537e-04 3.889537e-04 3.889537e-04
##      Not Resolved 1.218162e-01 4.429679e-02 5.370986e-02 5.537099e-02
##      Resolved    1.414027e-04 3.535068e-05 1.414027e-04 3.535068e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-06-29 2020-06-30 2020-07-01 2020-07-02
##      Fatal      3.889537e-04 7.779074e-04 3.889537e-04 3.889537e-04
##      Not Resolved 6.312292e-02 6.644518e-02 3.377630e-02 3.322259e-02
##      Resolved    1.060520e-04 3.535068e-05 7.070136e-05 3.535068e-05
##      Accurate_Episode_Date
## training$Outcome1 2020-07-03 2020-07-04
##      Fatal      3.889537e-04 3.889537e-04
##      Not Resolved 8.859358e-03 5.537099e-03
##      Resolved    3.535068e-05 3.535068e-05
##
##      Case_Reported_Date
## training$Outcome1 2020-01-23 2020-01-24 2020-02-21 2020-02-25
##      Fatal      3.915427e-04 3.915427e-04 3.915427e-04 3.915427e-04
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    1.061083e-04 7.073887e-05 7.073887e-05 7.073887e-05
##      Case_Reported_Date
## training$Outcome1 2020-02-26 2020-02-27 2020-02-28 2020-02-29
##      Fatal      3.915427e-04 3.915427e-04 3.915427e-04 3.915427e-04
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    7.073887e-05 7.073887e-05 1.768472e-04 1.768472e-04
##      Case_Reported_Date
## training$Outcome1 2020-03-01 2020-03-03 2020-03-04 2020-03-05

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##      Fatal      3.915427e-04 3.915427e-04 3.915427e-04 3.915427e-04
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    7.073887e-05 1.061083e-04 7.073887e-05 1.768472e-04
##      Case_Reported_Date
## training$Outcome1 2020-03-06 2020-03-07 2020-03-08 2020-03-09
##      Fatal      3.915427e-04 3.915427e-04 7.830854e-04 3.915427e-04
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    1.414777e-04 1.414777e-04 2.122166e-04 2.475860e-04
##      Case_Reported_Date
## training$Outcome1 2020-03-10 2020-03-11 2020-03-12 2020-03-13
##      Fatal      3.915427e-04 3.915427e-04 3.915427e-04 1.174628e-03
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    2.829555e-04 6.366498e-04 1.237930e-03 1.273300e-03
##      Case_Reported_Date
## training$Outcome1 2020-03-14 2020-03-15 2020-03-16 2020-03-17
##      Fatal      3.915427e-04 3.915427e-04 7.830854e-04 1.174628e-03
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    9.196053e-04 1.237930e-03 1.626994e-03 1.768472e-03
##      Case_Reported_Date
## training$Outcome1 2020-03-18 2020-03-19 2020-03-20 2020-03-21
##      Fatal      1.174628e-03 1.174628e-03 1.957713e-03 3.132341e-03
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    1.980688e-03 2.299013e-03 3.112510e-03 2.016058e-03
##      Case_Reported_Date
## training$Outcome1 2020-03-22 2020-03-23 2020-03-24 2020-03-25
##      Fatal      1.566171e-03 3.523884e-03 2.740799e-03 4.698512e-03
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    2.511230e-03 4.491918e-03 5.022460e-03 4.067485e-03
##      Case_Reported_Date
## training$Outcome1 2020-03-26 2020-03-27 2020-03-28 2020-03-29
##      Fatal      4.698512e-03 5.873140e-03 6.264683e-03 9.788567e-03
##      Not Resolved 5.589715e-04 2.235886e-03 5.589715e-04 5.589715e-04
##      Resolved    7.498320e-03 8.524034e-03 7.073887e-03 6.331129e-03
##      Case_Reported_Date
## training$Outcome1 2020-03-30 2020-03-31 2020-04-01 2020-04-02
##      Fatal      8.222396e-03 1.292091e-02 1.096319e-02 1.918559e-02
##      Not Resolved 5.589715e-04 1.117943e-03 1.676914e-03 3.353829e-03
##      Resolved    1.308669e-02 1.213172e-02 1.308669e-02 1.273300e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-03 2020-04-04 2020-04-05 2020-04-06
##      Fatal      2.819107e-02 1.409554e-02 1.605325e-02 2.740799e-02
##      Not Resolved 5.589715e-04 5.589715e-04 5.589715e-04 1.117943e-03
##      Resolved    1.245004e-02 1.000955e-02 1.015103e-02 1.294521e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-07 2020-04-08 2020-04-09 2020-04-10
##      Fatal      2.349256e-02 2.310102e-02 1.722788e-02 1.996868e-02
##      Not Resolved 5.589715e-04 1.117943e-03 2.235886e-03 1.117943e-03
##      Resolved    1.234393e-02 1.340502e-02 1.407703e-02 1.096452e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-11 2020-04-12 2020-04-13 2020-04-14

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##      Fatal      2.427565e-02 2.819107e-02 2.701644e-02 2.897416e-02
##      Not Resolved 1.117943e-03 1.676914e-03 1.117943e-03 1.676914e-03
##      Resolved    1.276837e-02 1.499664e-02 1.687122e-02 1.535033e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-15 2020-04-16 2020-04-17 2020-04-18
##      Fatal      3.171496e-02 3.093187e-02 3.915427e-02 2.779953e-02
##      Not Resolved 1.676914e-03 1.117943e-03 1.676914e-03 2.794857e-03
##      Resolved    1.690659e-02 1.577477e-02 2.083260e-02 1.658826e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-19 2020-04-20 2020-04-21 2020-04-22
##      Fatal      2.075176e-02 1.761942e-02 2.349256e-02 2.545027e-02
##      Not Resolved 1.676914e-03 1.676914e-03 2.235886e-03 2.235886e-03
##      Resolved    1.619920e-02 1.733102e-02 1.496127e-02 1.446610e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-23 2020-04-24 2020-04-25 2020-04-26
##      Fatal      2.545027e-02 1.605325e-02 2.036022e-02 1.448708e-02
##      Not Resolved 1.117943e-03 1.676914e-03 1.676914e-03 1.676914e-03
##      Resolved    1.421851e-02 1.230856e-02 1.177802e-02 1.018640e-02
##      Case_Reported_Date
## training$Outcome1 2020-04-27 2020-04-28 2020-04-29 2020-04-30
##      Fatal      1.801096e-02 1.487862e-02 1.448708e-02 1.174628e-02
##      Not Resolved 1.676914e-03 5.030743e-03 1.117943e-03 2.235886e-03
##      Resolved    1.390019e-02 1.163654e-02 1.145970e-02 1.149507e-02
##      Case_Reported_Date
## training$Outcome1 2020-05-01 2020-05-02 2020-05-03 2020-05-04
##      Fatal      1.487862e-02 8.222396e-03 9.397024e-03 6.656226e-03
##      Not Resolved 1.676914e-03 1.676914e-03 1.117943e-03 2.235886e-03
##      Resolved    1.379408e-02 9.974180e-03 1.000955e-02 9.974180e-03
##      Case_Reported_Date
## training$Outcome1 2020-05-05 2020-05-06 2020-05-07 2020-05-08
##      Fatal      9.397024e-03 1.096319e-02 7.439311e-03 6.656226e-03
##      Not Resolved 1.117943e-03 1.117943e-03 2.235886e-03 1.117943e-03
##      Resolved    1.237930e-02 1.015103e-02 8.700881e-03 8.665511e-03
##      Case_Reported_Date
## training$Outcome1 2020-05-09 2020-05-10 2020-05-11 2020-05-12
##      Fatal      9.005482e-03 9.397024e-03 6.264683e-03 8.613939e-03
##      Not Resolved 1.117943e-03 1.676914e-03 5.589715e-04 5.589715e-04
##      Resolved    9.089944e-03 8.382556e-03 6.331129e-03 7.533689e-03
##      Case_Reported_Date
## training$Outcome1 2020-05-13 2020-05-14 2020-05-15 2020-05-16
##      Fatal      7.439311e-03 7.830854e-03 1.057165e-02 5.873140e-03
##      Not Resolved 5.589715e-04 1.676914e-03 1.117943e-03 1.117943e-03
##      Resolved    1.089379e-02 9.797333e-03 1.170728e-02 1.156580e-02
##      Case_Reported_Date
## training$Outcome1 2020-05-17 2020-05-18 2020-05-19 2020-05-20
##      Fatal      9.005482e-03 7.439311e-03 4.698512e-03 7.830854e-03
##      Not Resolved 2.235886e-03 5.589715e-04 5.589715e-04 5.589715e-04
##      Resolved    1.287447e-02 1.163654e-02 1.022177e-02 1.184876e-02
##      Case_Reported_Date
## training$Outcome1 2020-05-21 2020-05-22 2020-05-23 2020-05-24

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##      Fatal      5.090055e-03 7.047768e-03 6.264683e-03 4.698512e-03
##      Not Resolved 1.117943e-03 5.589715e-04 5.589715e-04 1.117943e-03
##      Resolved    1.004492e-02 1.237930e-02 1.131822e-02 1.008029e-02
##      Case_Reported_Date
## training$Outcome1 2020-05-25 2020-05-26 2020-05-27 2020-05-28
##      Fatal      5.481597e-03 2.349256e-03 2.740799e-03 4.306969e-03
##      Not Resolved 1.117943e-03 2.794857e-03 1.117943e-03 5.589715e-04
##      Resolved    1.234393e-02 8.594772e-03 9.797333e-03 9.903441e-03
##      Case_Reported_Date
## training$Outcome1 2020-05-29 2020-05-30 2020-05-31 2020-06-01
##      Fatal      6.264683e-03 3.915427e-03 3.523884e-03 2.349256e-03
##      Not Resolved 5.589715e-04 1.676914e-03 1.676914e-03 1.117943e-03
##      Resolved    1.920560e-02 1.054009e-02 1.283910e-02 1.276837e-02
##      Case_Reported_Date
## training$Outcome1 2020-06-02 2020-06-03 2020-06-04 2020-06-05
##      Fatal      3.915427e-04 2.349256e-03 1.957713e-03 1.566171e-03
##      Not Resolved 5.589715e-04 1.676914e-03 1.676914e-03 1.117943e-03
##      Resolved    1.174265e-02 1.099989e-02 8.594772e-03 8.736250e-03
##      Case_Reported_Date
## training$Outcome1 2020-06-06 2020-06-07 2020-06-08 2020-06-09
##      Fatal      1.957713e-03 7.830854e-04 1.957713e-03 2.349256e-03
##      Not Resolved 5.589715e-04 1.117943e-03 1.117943e-03 1.117943e-03
##      Resolved    7.144626e-03 6.826301e-03 6.826301e-03 6.967778e-03
##      Case_Reported_Date
## training$Outcome1 2020-06-10 2020-06-11 2020-06-12 2020-06-13
##      Fatal      1.566171e-03 2.349256e-03 7.830854e-04 1.174628e-03
##      Not Resolved 1.676914e-03 5.589715e-04 2.235886e-03 5.589715e-04
##      Resolved    7.533689e-03 5.588371e-03 7.675167e-03 5.517632e-03
##      Case_Reported_Date
## training$Outcome1 2020-06-14 2020-06-15 2020-06-16 2020-06-17
##      Fatal      3.915427e-04 7.830854e-04 1.566171e-03 1.174628e-03
##      Not Resolved 5.589715e-04 5.589715e-04 1.676914e-03 1.676914e-03
##      Resolved    4.704135e-03 5.340784e-03 5.694479e-03 5.942065e-03
##      Case_Reported_Date
## training$Outcome1 2020-06-18 2020-06-19 2020-06-20 2020-06-21
##      Fatal      2.740799e-03 7.830854e-04 1.957713e-03 1.174628e-03
##      Not Resolved 1.676914e-03 1.676914e-03 4.471772e-03 2.068195e-02
##      Resolved    6.260390e-03 5.835957e-03 4.951721e-03 4.244332e-03
##      Case_Reported_Date
## training$Outcome1 2020-06-22 2020-06-23 2020-06-24 2020-06-25
##      Fatal      7.830854e-04 7.830854e-04 7.830854e-04 1.174628e-03
##      Not Resolved 3.689212e-02 3.912800e-02 5.925098e-02 5.701509e-02
##      Resolved    3.926007e-03 2.581969e-03 1.556255e-03 1.202561e-03
##      Case_Reported_Date
## training$Outcome1 2020-06-26 2020-06-27 2020-06-28 2020-06-29
##      Fatal      1.174628e-03 3.915427e-04 3.915427e-04 3.915427e-04
##      Not Resolved 7.434321e-02 1.028508e-01 8.999441e-02 6.428172e-02
##      Resolved    1.025714e-03 9.196053e-04 8.842358e-04 4.244332e-04
##      Case_Reported_Date
## training$Outcome1 2020-06-30 2020-07-01 2020-07-02 2020-07-03

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##      Fatal      7.830854e-04 3.915427e-04 7.830854e-04 3.915427e-04
##      Not Resolved 8.049189e-02 7.154835e-02 6.428172e-02 7.266629e-02
##      Resolved     6.012804e-04 4.598026e-04 5.305415e-04 7.073887e-05
##      Case_Reported_Date
## training$Outcome1 2020-07-04
##      Fatal      3.915427e-04
##      Not Resolved 2.850755e-02
##      Resolved     3.536943e-05
##
##      Test_Reported_Date
## training$Outcome1 2020-01-27 2020-02-03 2020-02-24 2020-02-25
##      Fatal      3.971406e-04 3.971406e-04 3.971406e-04 3.971406e-04
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     1.073922e-04 7.159477e-05 7.159477e-05 7.159477e-05
##      Test_Reported_Date
## training$Outcome1 2020-02-27 2020-02-28 2020-02-29 2020-03-01
##      Fatal      3.971406e-04 3.971406e-04 3.971406e-04 3.971406e-04
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     7.159477e-05 1.789869e-04 7.159477e-05 2.505817e-04
##      Test_Reported_Date
## training$Outcome1 2020-03-02 2020-03-03 2020-03-04 2020-03-05
##      Fatal      3.971406e-04 3.971406e-04 3.971406e-04 3.971406e-04
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     7.159477e-05 7.159477e-05 1.073922e-04 1.789869e-04
##      Test_Reported_Date
## training$Outcome1 2020-03-07 2020-03-08 2020-03-09 2020-03-10
##      Fatal      3.971406e-04 3.971406e-04 3.971406e-04 3.971406e-04
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     1.073922e-04 1.431895e-04 2.147843e-04 1.073922e-04
##      Test_Reported_Date
## training$Outcome1 2020-03-11 2020-03-12 2020-03-13 2020-03-14
##      Fatal      3.971406e-04 3.971406e-04 1.191422e-03 3.971406e-04
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     3.221765e-04 7.159477e-04 8.949347e-04 1.467693e-03
##      Test_Reported_Date
## training$Outcome1 2020-03-15 2020-03-16 2020-03-17 2020-03-18
##      Fatal      3.971406e-04 7.942812e-04 1.191422e-03 1.588562e-03
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     1.002327e-03 8.949347e-04 1.252909e-03 1.718275e-03
##      Test_Reported_Date
## training$Outcome1 2020-03-19 2020-03-20 2020-03-21 2020-03-22
##      Fatal      3.971406e-04 1.191422e-03 1.985703e-03 1.588562e-03
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved     1.718275e-03 2.577412e-03 1.360301e-03 2.291033e-03
##      Test_Reported_Date
## training$Outcome1 2020-03-23 2020-03-24 2020-03-25 2020-03-26
##      Fatal      3.177125e-03 1.191422e-03 5.559968e-03 4.765687e-03
##      Not Resolved 5.636979e-04 5.636979e-04 1.127396e-03 1.127396e-03
##      Resolved     4.188294e-03 4.975837e-03 4.761052e-03 7.481654e-03
##      Test_Reported_Date

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## training$Outcome1  2020-03-27  2020-03-28  2020-03-29  2020-03-30
##      Fatal      5.559968e-03 5.162828e-03 6.751390e-03 1.151708e-02
##      Not Resolved 5.636979e-04 5.636979e-04 1.127396e-03 5.636979e-04
##      Resolved    8.698765e-03 6.443530e-03 6.944693e-03 1.381779e-02
##              Test_Reported_Date
## training$Outcome1  2020-03-31  2020-04-01  2020-04-02  2020-04-03
##      Fatal      1.111994e-02 1.389992e-02 1.945989e-02 2.700556e-02
##      Not Resolved 5.636979e-04 2.254791e-03 3.382187e-03 1.127396e-03
##      Resolved    1.170575e-02 1.188473e-02 1.270807e-02 1.252909e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-04  2020-04-05  2020-04-06  2020-04-07
##      Fatal      2.184273e-02 1.588562e-02 2.462272e-02 2.343129e-02
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 5.636979e-04
##      Resolved    1.134777e-02 9.486307e-03 1.156256e-02 1.306605e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-08  2020-04-09  2020-04-10  2020-04-11
##      Fatal      1.826847e-02 2.263701e-02 1.985703e-02 2.859412e-02
##      Not Resolved 1.127396e-03 1.691094e-03 1.127396e-03 1.127396e-03
##      Resolved    1.410417e-02 1.417577e-02 1.131197e-02 1.295865e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-12  2020-04-13  2020-04-14  2020-04-15
##      Fatal      1.906275e-02 2.621128e-02 2.819698e-02 2.978554e-02
##      Not Resolved 1.691094e-03 5.636979e-04 1.691094e-03 1.691094e-03
##      Resolved    1.399678e-02 1.729014e-02 1.610882e-02 1.628781e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-16  2020-04-17  2020-04-18  2020-04-19
##      Fatal      3.177125e-02 3.772836e-02 3.018268e-02 2.065131e-02
##      Not Resolved 1.691094e-03 2.254791e-03 3.945885e-03 1.127396e-03
##      Resolved    1.628781e-02 1.882943e-02 1.657419e-02 1.521389e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-20  2020-04-21  2020-04-22  2020-04-23
##      Fatal      1.945989e-02 2.184273e-02 2.382844e-02 2.660842e-02
##      Not Resolved 1.127396e-03 1.691094e-03 2.254791e-03 1.691094e-03
##      Resolved    1.757652e-02 1.510650e-02 1.385359e-02 1.492751e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-24  2020-04-25  2020-04-26  2020-04-27
##      Fatal      1.707705e-02 2.541700e-02 1.231136e-02 1.866561e-02
##      Not Resolved 1.127396e-03 1.691094e-03 1.127396e-03 2.254791e-03
##      Resolved    1.252909e-02 1.431895e-02 9.629497e-03 1.335243e-02
##              Test_Reported_Date
## training$Outcome1  2020-04-28  2020-04-29  2020-04-30  2020-05-01
##      Fatal      1.231136e-02 1.191422e-02 1.310564e-02 1.310564e-02
##      Not Resolved 3.945885e-03 1.127396e-03 2.254791e-03 1.691094e-03
##      Resolved    1.070342e-02 1.106139e-02 1.120458e-02 1.424736e-02
##              Test_Reported_Date
## training$Outcome1  2020-05-02  2020-05-03  2020-05-04  2020-05-05
##      Fatal      8.737093e-03 9.531374e-03 7.148531e-03 1.072280e-02
##      Not Resolved 1.691094e-03 1.127396e-03 2.254791e-03 2.254791e-03
##      Resolved    1.009486e-02 1.023805e-02 1.052443e-02 1.181314e-02
##              Test_Reported_Date

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## training$Outcome1  2020-05-06  2020-05-07  2020-05-08  2020-05-09
##      Fatal          9.531374e-03 9.928515e-03 5.162828e-03 1.032566e-02
##      Not Resolved 5.636979e-04 1.691094e-03 1.691094e-03 5.636979e-04
##      Resolved      1.020226e-02 8.161804e-03 9.271523e-03 8.304994e-03
##              Test_Reported_Date
## training$Outcome1  2020-05-10  2020-05-11  2020-05-12  2020-05-13
##      Fatal          5.559968e-03 6.354249e-03 8.737093e-03 5.957109e-03
##      Not Resolved 1.691094e-03 5.636979e-04 1.127396e-03 5.636979e-04
##      Resolved      8.591373e-03 6.694111e-03 8.126007e-03 1.070342e-02
##              Test_Reported_Date
## training$Outcome1  2020-05-14  2020-05-15  2020-05-16  2020-05-17
##      Fatal          1.151708e-02 1.072280e-02 6.354249e-03 9.134234e-03
##      Not Resolved 1.691094e-03 1.127396e-03 1.127396e-03 2.254791e-03
##      Resolved      1.013066e-02 1.170575e-02 1.152676e-02 1.360301e-02
##              Test_Reported_Date
## training$Outcome1  2020-05-18  2020-05-19  2020-05-20  2020-05-21
##      Fatal          6.751390e-03 6.751390e-03 7.148531e-03 5.957109e-03
##      Not Resolved 5.636979e-04 5.636979e-04 5.636979e-04 1.691094e-03
##      Resolved      1.127618e-02 9.880079e-03 1.184894e-02 1.045284e-02
##              Test_Reported_Date
## training$Outcome1  2020-05-22  2020-05-23  2020-05-24  2020-05-25
##      Fatal          5.957109e-03 7.545671e-03 5.957109e-03 7.148531e-03
##      Not Resolved 5.636979e-04 5.636979e-04 1.127396e-03 1.691094e-03
##      Resolved      1.242169e-02 1.209952e-02 9.915876e-03 1.560766e-02
##              Test_Reported_Date
## training$Outcome1  2020-05-26  2020-05-27  2020-05-28  2020-05-29
##      Fatal          7.942812e-04 2.779984e-03 4.368546e-03 6.354249e-03
##      Not Resolved 1.691094e-03 1.127396e-03 5.636979e-04 1.127396e-03
##      Resolved      7.875425e-03 9.307321e-03 1.034544e-02 1.822087e-02
##              Test_Reported_Date
## training$Outcome1  2020-05-30  2020-05-31  2020-06-01  2020-06-02
##      Fatal          4.368546e-03 2.779984e-03 3.574265e-03 7.942812e-04
##      Not Resolved 1.691094e-03 5.636979e-04 1.127396e-03 5.636979e-04
##      Resolved      1.277967e-02 1.134777e-02 1.131197e-02 1.213531e-02
##              Test_Reported_Date
## training$Outcome1  2020-06-03  2020-06-04  2020-06-05  2020-06-06
##      Fatal          1.985703e-03 1.588562e-03 1.588562e-03 1.985703e-03
##      Not Resolved 1.691094e-03 1.691094e-03 1.127396e-03 1.127396e-03
##      Resolved      1.213531e-02 8.591373e-03 8.662968e-03 7.123680e-03
##              Test_Reported_Date
## training$Outcome1  2020-06-07  2020-06-08  2020-06-09  2020-06-10
##      Fatal          3.971406e-04 3.177125e-03 1.985703e-03 1.985703e-03
##      Not Resolved 5.636979e-04 1.127396e-03 1.127396e-03 2.254791e-03
##      Resolved      6.980490e-03 7.302667e-03 7.266870e-03 7.660641e-03
##              Test_Reported_Date
## training$Outcome1  2020-06-11  2020-06-12  2020-06-13  2020-06-14
##      Fatal          1.985703e-03 7.942812e-04 1.191422e-03 3.971406e-04
##      Not Resolved 5.636979e-04 1.127396e-03 1.127396e-03 1.127396e-03
##      Resolved      5.799177e-03 7.338464e-03 5.548595e-03 5.154824e-03
##              Test_Reported_Date

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## training$Outcome1  2020-06-15  2020-06-16  2020-06-17  2020-06-18
##      Fatal      7.942812e-04 1.985703e-03 1.191422e-03 2.382844e-03
##      Not Resolved 5.636979e-04 1.691094e-03 1.691094e-03 1.691094e-03
##      Resolved    5.190621e-03 5.799177e-03 5.584392e-03 6.336137e-03
##                      Test_Reported_Date
## training$Outcome1  2020-06-19  2020-06-20  2020-06-21  2020-06-22
##      Fatal      7.942812e-04 1.985703e-03 1.191422e-03 7.942812e-04
##      Not Resolved 1.691094e-03 5.636979e-03 2.311161e-02 3.325817e-02
##      Resolved    6.013961e-03 4.546268e-03 4.367281e-03 4.224092e-03
##                      Test_Reported_Date
## training$Outcome1  2020-06-23  2020-06-24  2020-06-25  2020-06-26
##      Fatal      7.942812e-04 1.191422e-03 7.942812e-04 1.191422e-03
##      Not Resolved 4.227734e-02 5.862458e-02 5.524239e-02 7.553551e-02
##      Resolved    2.577412e-03 1.610882e-03 1.073922e-03 1.181314e-03
##                      Test_Reported_Date
## training$Outcome1  2020-06-27  2020-06-28  2020-06-29  2020-06-30
##      Fatal      3.971406e-04 3.971406e-04 3.971406e-04 7.942812e-04
##      Not Resolved 1.003382e-01 9.244645e-02 6.989853e-02 7.328072e-02
##      Resolved    8.591373e-04 8.949347e-04 4.653660e-04 6.085556e-04
##                      Test_Reported_Date
## training$Outcome1  2020-07-01  2020-07-02  2020-07-03  2020-07-04
##      Fatal      3.971406e-04 7.942812e-04 3.971406e-04 3.971406e-04
##      Not Resolved 7.328072e-02 6.651635e-02 7.046223e-02 2.705750e-02
##      Resolved    5.011634e-04 5.369608e-04 7.159477e-05 1.073922e-04
##
##                      Specimen_Date
## training$Outcome1  2020-01-23  2020-01-24  2020-01-25  2020-02-20
##      Fatal      3.957262e-04 3.957262e-04 3.957262e-04 3.957262e-04
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    7.131905e-05 7.131905e-05 7.131905e-05 7.131905e-05
##                      Specimen_Date
## training$Outcome1  2020-02-22  2020-02-23  2020-02-25  2020-02-26
##      Fatal      3.957262e-04 3.957262e-04 3.957262e-04 3.957262e-04
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    1.069786e-04 7.131905e-05 7.131905e-05 7.131905e-05
##                      Specimen_Date
## training$Outcome1  2020-02-27  2020-02-28  2020-02-29  2020-03-01
##      Fatal      3.957262e-04 3.957262e-04 3.957262e-04 3.957262e-04
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    1.426381e-04 1.426381e-04 1.782976e-04 1.069786e-04
##                      Specimen_Date
## training$Outcome1  2020-03-02  2020-03-03  2020-03-04  2020-03-05
##      Fatal      3.957262e-04 3.957262e-04 3.957262e-04 3.957262e-04
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    3.565952e-05 1.426381e-04 2.496167e-04 7.131905e-05
##                      Specimen_Date
## training$Outcome1  2020-03-06  2020-03-07  2020-03-08  2020-03-09
##      Fatal      3.957262e-04 3.957262e-04 3.957262e-04 3.957262e-04
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    1.069786e-04 1.782976e-04 2.139571e-04 2.496167e-04

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##                               Specimen_Date
## training$Outcome1  2020-03-10  2020-03-11  2020-03-12  2020-03-13
##      Fatal      3.957262e-04 3.957262e-04 7.914523e-04 1.187178e-03
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    5.348928e-04 8.914881e-04 2.068252e-03 1.426381e-03
##                               Specimen_Date
## training$Outcome1  2020-03-14  2020-03-15  2020-03-16  2020-03-17
##      Fatal      3.957262e-04 1.187178e-03 1.582905e-03 1.187178e-03
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 5.614823e-04
##      Resolved    1.747317e-03 1.390721e-03 2.959740e-03 3.672931e-03
##                               Specimen_Date
## training$Outcome1  2020-03-18  2020-03-19  2020-03-20  2020-03-21
##      Fatal      1.978631e-03 1.978631e-03 3.561535e-03 1.978631e-03
##      Not Resolved 5.614823e-04 5.614823e-04 1.122965e-03 5.614823e-04
##      Resolved    3.993867e-03 4.778376e-03 6.454374e-03 5.313269e-03
##                               Specimen_Date
## training$Outcome1  2020-03-22  2020-03-23  2020-03-24  2020-03-25
##      Fatal      3.957262e-03 6.331619e-03 3.165809e-03 5.935892e-03
##      Not Resolved 5.614823e-04 5.614823e-04 1.122965e-03 5.614823e-04
##      Resolved    5.206290e-03 6.989266e-03 5.883821e-03 8.094712e-03
##                               Specimen_Date
## training$Outcome1  2020-03-26  2020-03-27  2020-03-28  2020-03-29
##      Fatal      7.914523e-03 6.727345e-03 9.101702e-03 9.497428e-03
##      Not Resolved 1.122965e-03 5.614823e-04 1.684447e-03 5.614823e-04
##      Resolved    7.131905e-03 7.987733e-03 8.914881e-03 6.525693e-03
##                               Specimen_Date
## training$Outcome1  2020-03-30  2020-03-31  2020-04-01  2020-04-02
##      Fatal      1.226751e-02 1.622477e-02 2.572220e-02 2.413930e-02
##      Not Resolved 5.614823e-04 3.368894e-03 5.614823e-04 1.684447e-03
##      Resolved    1.119709e-02 1.219556e-02 1.066220e-02 1.319402e-02
##                               Specimen_Date
## training$Outcome1  2020-04-03  2020-04-04  2020-04-05  2020-04-06
##      Fatal      1.978631e-02 1.820340e-02 1.939058e-02 2.651365e-02
##      Not Resolved 5.614823e-04 5.614823e-04 5.614823e-04 1.684447e-03
##      Resolved    1.062654e-02 9.093178e-03 9.307135e-03 1.326534e-02
##                               Specimen_Date
## training$Outcome1  2020-04-07  2020-04-08  2020-04-09  2020-04-10
##      Fatal      2.018203e-02 2.611793e-02 2.572220e-02 2.572220e-02
##      Not Resolved 5.614823e-04 1.684447e-03 1.122965e-03 1.684447e-03
##      Resolved    1.419249e-02 1.237385e-02 1.387155e-02 1.618942e-02
##                               Specimen_Date
## training$Outcome1  2020-04-11  2020-04-12  2020-04-13  2020-04-14
##      Fatal      2.651365e-02 1.899486e-02 3.482390e-02 2.967946e-02
##      Not Resolved 1.684447e-03 5.614823e-04 2.245929e-03 2.807412e-03
##      Resolved    1.640338e-02 1.212424e-02 2.082516e-02 1.932746e-02
##                               Specimen_Date
## training$Outcome1  2020-04-15  2020-04-16  2020-04-17  2020-04-18
##      Fatal      3.640681e-02 3.798971e-02 2.216066e-02 2.334784e-02
##      Not Resolved 2.245929e-03 1.122965e-03 2.807412e-03 1.684447e-03
##      Resolved    2.032593e-02 1.829334e-02 1.957708e-02 1.422815e-02

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##                               Specimen_Date
## training$Outcome1  2020-04-19  2020-04-20  2020-04-21  2020-04-22
##      Fatal      8.310249e-03  2.295212e-02  2.018203e-02  2.532647e-02
##      Not Resolved 1.122965e-03  1.684447e-03  1.122965e-03  1.122965e-03
##      Resolved    9.592412e-03  1.679564e-02  1.383589e-02  1.372892e-02
##                               Specimen_Date
## training$Outcome1  2020-04-23  2020-04-24  2020-04-25  2020-04-26
##      Fatal      1.741195e-02  1.701622e-02  1.464187e-02  9.893154e-03
##      Not Resolved 1.684447e-03  1.684447e-03  1.684447e-03  1.122965e-03
##      Resolved    1.358628e-02  1.408551e-02  1.251649e-02  7.880755e-03
##                               Specimen_Date
## training$Outcome1  2020-04-27  2020-04-28  2020-04-29  2020-04-30
##      Fatal      2.216066e-02  1.543332e-02  1.503759e-02  8.310249e-03
##      Not Resolved 4.491859e-03  3.368894e-03  1.122965e-03  5.614823e-04
##      Resolved    1.376458e-02  1.233819e-02  1.433513e-02  1.369326e-02
##                               Specimen_Date
## training$Outcome1  2020-05-01  2020-05-02  2020-05-03  2020-05-04
##      Fatal      9.497428e-03  6.331619e-03  4.748714e-03  9.497428e-03
##      Not Resolved 2.245929e-03  1.122965e-03  1.122965e-03  2.807412e-03
##      Resolved    1.173198e-02  8.629605e-03  7.452840e-03  1.137539e-02
##                               Specimen_Date
## training$Outcome1  2020-05-05  2020-05-06  2020-05-07  2020-05-08
##      Fatal      9.101702e-03  9.101702e-03  1.068461e-02  9.101702e-03
##      Not Resolved 1.122965e-03  1.122965e-03  2.245929e-03  1.122965e-03
##      Resolved    1.201726e-02  9.485433e-03  1.109011e-02  1.091181e-02
##                               Specimen_Date
## training$Outcome1  2020-05-09  2020-05-10  2020-05-11  2020-05-12
##      Fatal      1.187178e-02  4.748714e-03  1.226751e-02  1.108033e-02
##      Not Resolved 5.614823e-04  5.614823e-04  5.614823e-04  1.122965e-03
##      Resolved    7.488500e-03  5.313269e-03  1.244517e-02  1.048390e-02
##                               Specimen_Date
## training$Outcome1  2020-05-13  2020-05-14  2020-05-15  2020-05-16
##      Fatal      6.331619e-03  5.935892e-03  4.352988e-03  5.935892e-03
##      Not Resolved 1.122965e-03  2.245929e-03  1.122965e-03  1.122965e-03
##      Resolved    1.055522e-02  9.735050e-03  1.283743e-02  9.877688e-03
##                               Specimen_Date
## training$Outcome1  2020-05-17  2020-05-18  2020-05-19  2020-05-20
##      Fatal      7.518797e-03  4.748714e-03  5.540166e-03  9.893154e-03
##      Not Resolved 1.122965e-03  5.614823e-04  5.614823e-04  1.122965e-03
##      Resolved    8.807902e-03  7.666797e-03  1.401419e-02  1.301573e-02
##                               Specimen_Date
## training$Outcome1  2020-05-21  2020-05-22  2020-05-23  2020-05-24
##      Fatal      4.352988e-03  4.748714e-03  6.727345e-03  3.561535e-03
##      Not Resolved 1.122965e-03  1.122965e-03  5.614823e-04  1.684447e-03
##      Resolved    1.265913e-02  1.026994e-02  8.451307e-03  9.342795e-03
##                               Specimen_Date
## training$Outcome1  2020-05-25  2020-05-26  2020-05-27  2020-05-28
##      Fatal      4.352988e-03  2.770083e-03  4.748714e-03  3.561535e-03
##      Not Resolved 1.684447e-03  1.122965e-03  5.614823e-04  1.122965e-03
##      Resolved    1.191028e-02  1.183896e-02  9.699390e-03  1.098313e-02

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##                               Specimen_Date
## training$Outcome1  2020-05-29  2020-05-30  2020-05-31  2020-06-01
##      Fatal      2.374357e-03  3.957262e-03  7.914523e-04  1.978631e-03
##      Not Resolved 2.807412e-03  5.614823e-04  5.614823e-04  1.122965e-03
##      Resolved    1.440645e-02  8.914881e-03  7.738116e-03  1.330100e-02
##                               Specimen_Date
## training$Outcome1  2020-06-02  2020-06-03  2020-06-04  2020-06-05
##      Fatal      1.187178e-03  1.978631e-03  1.978631e-03  1.582905e-03
##      Not Resolved 1.684447e-03  1.122965e-03  5.614823e-04  1.122965e-03
##      Resolved    8.522626e-03  7.666797e-03  8.914881e-03  8.237350e-03
##                               Specimen_Date
## training$Outcome1  2020-06-06  2020-06-07  2020-06-08  2020-06-09
##      Fatal      1.187178e-03  1.978631e-03  1.187178e-03  1.582905e-03
##      Not Resolved 1.122965e-03  1.122965e-03  1.122965e-03  1.684447e-03
##      Resolved    6.454374e-03  4.564419e-03  7.488500e-03  6.490033e-03
##                               Specimen_Date
## training$Outcome1  2020-06-10  2020-06-11  2020-06-12  2020-06-13
##      Fatal      1.582905e-03  7.914523e-04  1.187178e-03  1.582905e-03
##      Not Resolved 1.122965e-03  1.122965e-03  1.122965e-03  5.614823e-04
##      Resolved    7.238883e-03  6.953607e-03  5.705524e-03  4.493100e-03
##                               Specimen_Date
## training$Outcome1  2020-06-14  2020-06-15  2020-06-16  2020-06-17
##      Fatal      7.914523e-04  7.914523e-04  2.770083e-03  3.957262e-04
##      Not Resolved 1.122965e-03  2.807412e-03  1.684447e-03  1.122965e-03
##      Resolved    3.993867e-03  6.846628e-03  5.634205e-03  6.204757e-03
##                               Specimen_Date
## training$Outcome1  2020-06-18  2020-06-19  2020-06-20  2020-06-21
##      Fatal      1.582905e-03  7.914523e-04  7.914523e-04  7.914523e-04
##      Not Resolved 1.684447e-03  7.860752e-03  4.604155e-02  3.537339e-02
##      Resolved    5.170631e-03  5.099312e-03  2.888421e-03  1.390721e-03
##                               Specimen_Date
## training$Outcome1  2020-06-22  2020-06-23  2020-06-24  2020-06-25
##      Fatal      7.914523e-04  7.914523e-04  1.187178e-03  7.914523e-04
##      Not Resolved 6.288602e-02  6.457047e-02  7.467715e-02  1.532847e-01
##      Resolved    1.961274e-03  1.141105e-03  1.497700e-03  1.034126e-03
##                               Specimen_Date
## training$Outcome1  2020-06-26  2020-06-27  2020-06-28  2020-06-29
##      Fatal      3.957262e-04  3.957262e-04  7.914523e-04  3.957262e-04
##      Not Resolved 6.176305e-02  5.446378e-02  4.211117e-02  8.927569e-02
##      Resolved    5.348928e-04  3.565952e-04  1.782976e-04  4.635738e-04
##                               Specimen_Date
## training$Outcome1  2020-06-30  2020-07-01  2020-07-02  2020-07-03
##      Fatal      7.914523e-04  3.957262e-04  3.957262e-04  3.957262e-04
##      Not Resolved 7.860752e-02  3.874228e-02  4.604155e-02  7.860752e-03
##      Resolved    3.209357e-04  1.426381e-04  7.131905e-05  7.131905e-05
##
##                               Age_Group
## training$Outcome1  <20      20s      30s      40s
##      Fatal      0.0008227067 0.0020567668 0.0028794735 0.0074043603
##      Not Resolved 0.0978391357 0.2340936375 0.1854741897 0.1332533013

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##      Resolved      0.0506571936 0.1608525755 0.1502309059 0.1537477798
##      Age_Group
## training$Outcome1      50s      60s      70s      80s
##      Fatal      0.0329082682 0.0896750309 0.1781160016 0.3591114768
##      Not Resolved 0.1416566627 0.0930372149 0.0456182473 0.0390156062
##      Resolved      0.1737833037 0.1173357016 0.0674245115 0.0779040853
##      Age_Group
## training$Outcome1      90s      UNKNOWN
##      Fatal      0.3266145619 0.0004113534
##      Not Resolved 0.0288115246 0.0012004802
##      Resolved      0.0477797513 0.0002841918
##
##      Client_Gender
## training$Outcome1      FEMALE      MALE      OTHER      TRANSGENDER
##      Fatal      0.5350370981 0.4501236603 0.0004122012 0.0008244023
##      Not Resolved 0.4358819988 0.5544852498 0.0012040939 0.0006020470
##      Resolved      0.5378219932 0.4547166459 0.0002487120 0.0002842423
##      Client_Gender
## training$Outcome1      UNKNOWN
##      Fatal      0.0136026381
##      Not Resolved 0.0078266105
##      Resolved      0.0069284065
##
##      Case_AcquisitionInfo
## training$Outcome1      CC No Epi-link No Info-Missing No Info-Unk
##      Fatal      0.061804697 0.083230326      0.008652658 0.030078286
##      Not Resolved 0.308062575 0.216606498      0.208182912 0.035499398
##      Resolved      0.320933703 0.191608044      0.022312229 0.036204079
##      Case_AcquisitionInfo
## training$Outcome1      OB      Travel
##      Fatal      0.793984343 0.022249691
##      Not Resolved 0.208784597 0.022864019
##      Resolved      0.375826050 0.053115896
##
##      Outcome1
## training$Outcome1      Fatal Not Resolved      Resolved
##      Fatal      9.991749e-01 4.125413e-04 4.125413e-04
##      Not Resolved 6.027728e-04 9.987945e-01 6.027728e-04
##      Resolved      3.553281e-05 3.553281e-05 9.999289e-01
##
##      Outbreak_Related
## training$Outcome1      Yes      No
##      Fatal      0.7952951 0.2047049
##      Not Resolved 0.2092883 0.7907117
##      Resolved      0.3761637 0.6238363
##
##      Reporting_PHU
## training$Outcome1 Algoma Public Health Unit Brant County Health Unit
##      Fatal      0.0004073320      0.0024439919
##      Not Resolved 0.0005917160      0.0011834320

```

##	Resolved	0.0007808618	0.0041882587
##	Reporting_PHU		
##	training\$Outcome1 Chatham-Kent Health Unit Durham Region Health Department		
##	Fatal	0.0008146640	0.0655804481
##	Not Resolved	0.0023668639	0.0171597633
##	Resolved	0.0048626393	0.0475970753
##	Reporting_PHU		
##	training\$Outcome1 Eastern Ontario Health Unit Grey Bruce Health Unit		
##	Fatal	0.0048879837	0.0004073320
##	Not Resolved	0.0017751479	0.0035502959
##	Resolved	0.0049336267	0.0030879534
##	Reporting_PHU		
##	training\$Outcome1 Haldimand-Norfolk Health Unit		
##	Fatal	0.0142566191	
##	Not Resolved	0.0029585799	
##	Resolved	0.0126357635	
##	Reporting_PHU		
##	training\$Outcome1 Haliburton, Kawartha, Pine Ridge District Health Unit		
##	Fatal		0.0069246436
##	Not Resolved		0.0047337278
##	Resolved		0.0053595514
##	Reporting_PHU		
##	training\$Outcome1 Halton Region Health Department		
##	Fatal	0.0081466395	
##	Not Resolved	0.0183431953	
##	Resolved	0.0223255484	
##	Reporting_PHU		
##	training\$Outcome1 Hamilton Public Health Services		
##	Fatal	0.0167006110	
##	Not Resolved	0.0224852071	
##	Resolved	0.0247746149	
##	Reporting_PHU		
##	training\$Outcome1 Hastings and Prince Edward Counties Health Unit		
##	Fatal		0.0020366599
##	Not Resolved		0.0005917160
##	Resolved		0.0012777738
##	Reporting_PHU		
##	training\$Outcome1 Huron Perth District Health Unit		
##	Fatal	0.0020366599	
##	Not Resolved	0.0017751479	
##	Resolved	0.0017036984	
##	Reporting_PHU		
##	training\$Outcome1 Kingston, Frontenac and Lennox & Addington Public Health		
##	Fatal		0.0004073320
##	Not Resolved		0.0207100592
##	Resolved		0.0019521545
##	Reporting_PHU		
##	training\$Outcome1 Lambton Public Health		
##	Fatal	0.0089613035	
##	Not Resolved	0.0011834320	

```

##      Resolved      0.0083410236
##      Reporting_PHU
## training$Outcome1 Leeds, Grenville and Lanark District Health Unit
##      Fatal      0.0191446029
##      Not Resolved      0.0017751479
##      Resolved      0.0097252786
##      Reporting_PHU
## training$Outcome1 Middlesex-London Health Unit
##      Fatal      0.0219959267
##      Not Resolved      0.0112426036
##      Resolved      0.0181017960
##      Reporting_PHU
## training$Outcome1 Niagara Region Public Health Department
##      Fatal      0.0207739308
##      Not Resolved      0.0094674556
##      Resolved      0.0223255484
##      Reporting_PHU
## training$Outcome1 North Bay Parry Sound District Health Unit
##      Fatal      0.0008146640
##      Not Resolved      0.0041420118
##      Resolved      0.0008873429
##      Reporting_PHU
## training$Outcome1 Northwestern Health Unit Ottawa Public Health
##      Fatal      0.0004073320      0.0989816701
##      Not Resolved      0.0029585799      0.0236686391
##      Resolved      0.0012067864      0.0573578477
##      Reporting_PHU
## training$Outcome1 Peel Public Health Peterborough Public Health
##      Fatal      0.1164969450      0.0008146640
##      Not Resolved      0.2153846154      0.0005917160
##      Resolved      0.1669269539      0.0030879534
##      Reporting_PHU
## training$Outcome1 Porcupine Health Unit Region of Waterloo, Public Health
##      Fatal      0.0036659878      0.0419551935
##      Not Resolved      0.0005917160      0.0260355030
##      Resolved      0.0019876482      0.0366295166
##      Reporting_PHU
## training$Outcome1 Renfrew County and District Health Unit
##      Fatal      0.0008146640
##      Not Resolved      0.0017751479
##      Resolved      0.0008873429
##      Reporting_PHU
## training$Outcome1 Simcoe Muskoka District Health Unit
##      Fatal      0.0134419552
##      Not Resolved      0.0100591716
##      Resolved      0.0177468588
##      Reporting_PHU
## training$Outcome1 Southwestern Public Health
##      Fatal      0.0016293279
##      Not Resolved      0.0005917160

```

```

##      Resolved      0.0024845602
##      Reporting_PHU
## training$Outcome1 Sudbury & District Health Unit
##      Fatal      0.0008146640
##      Not Resolved      0.0005917160
##      Resolved      0.0021651168
##      Reporting_PHU
## training$Outcome1 Thunder Bay District Health Unit Timiskaming Health Unit
##      Fatal      0.0008146640      0.0004073320
##      Not Resolved      0.0017751479      0.0005917160
##      Resolved      0.0026975225      0.0006033932
##      Reporting_PHU
## training$Outcome1 Toronto Public Health
##      Fatal      0.3930753564
##      Not Resolved      0.3017751479
##      Resolved      0.3727550224
##      Reporting_PHU
## training$Outcome1 Wellington-Dufferin-Guelph Public Health
##      Fatal      0.0142566191
##      Not Resolved      0.0213017751
##      Resolved      0.0135940938
##      Reporting_PHU
## training$Outcome1 Windsor-Essex County Health Unit
##      Fatal      0.0268839104
##      Not Resolved      0.1692307692
##      Resolved      0.0413856747
##      Reporting_PHU
## training$Outcome1 York Region Public Health Services
##      Fatal      0.0887983707
##      Not Resolved      0.0970414201
##      Resolved      0.0836231987
##
##      Reporting_PHU_Address
## training$Outcome1 100 Constellation Drive 1000 Pitt Street
##      Fatal      0.0989816701      0.0048879837
##      Not Resolved      0.0236686391      0.0017751479
##      Resolved      0.0573578477      0.0049336267
##      Reporting_PHU_Address
## training$Outcome1 1005 Ouellette Avenue 101 17th Street East
##      Fatal      0.0268839104      0.0004073320
##      Not Resolved      0.1692307692      0.0035502959
##      Resolved      0.0413856747      0.0030879534
##      Reporting_PHU_Address
## training$Outcome1 110 King St. West, 2nd Floor 1151 Bronte Road
##      Fatal      0.0167006110      0.0081466395
##      Not Resolved      0.0224852071      0.0183431953
##      Resolved      0.0247746149      0.0223255484
##      Reporting_PHU_Address
## training$Outcome1 12 Gilbertson Drive 1230 Talbot Street 1300 Paris Street
##      Fatal      0.0142566191      0.0016293279      0.0008146640

```

##	Not Resolved	0.0029585799	0.0005917160	0.0005917160
##	Resolved	0.0126357635	0.0024845602	0.0021651168
##	Reporting_PHU_Address			
##	training\$Outcome1	15 Sperling Drive	160 Chancellors Way	160 Exmouth Street
##	Fatal	0.0134419552	0.0142566191	0.0089613035
##	Not Resolved	0.0100591716	0.0213017751	0.0011834320
##	Resolved	0.0177468588	0.0135940938	0.0083410236
##	Reporting_PHU_Address			
##	training\$Outcome1	169 Pine Street South	17250 Yonge Street	
##	Fatal	0.0036659878	0.0887983707	
##	Not Resolved	0.0005917160	0.0970414201	
##	Resolved	0.0019876482	0.0836231987	
##	Reporting_PHU_Address			
##	training\$Outcome1	179 North Park Street	1815 Sir Isaac Brock Way	
##	Fatal	0.0020366599	0.0207739308	
##	Not Resolved	0.0005917160	0.0094674556	
##	Resolved	0.0012777738	0.0223255484	
##	Reporting_PHU_Address			
##	training\$Outcome1	185 King Street	194 Terrace Hill Street	
##	Fatal	0.0008146640	0.0024439919	
##	Not Resolved	0.0005917160	0.0011834320	
##	Resolved	0.0030879534	0.0041882587	
##	Reporting_PHU_Address			
##	training\$Outcome1	200 Rose Glen Road	210 First Street North	
##	Fatal	0.0069246436	0.0004073320	
##	Not Resolved	0.0047337278	0.0029585799	
##	Resolved	0.0053595514	0.0012067864	
##	Reporting_PHU_Address			
##	training\$Outcome1	221 Portsmouth Avenue	247 Whitewood Avenue, Unit 43	
##	Fatal	0.0004073320	0.0004073320	
##	Not Resolved	0.0207100592	0.0005917160	
##	Resolved	0.0019521545	0.0006033932	
##	Reporting_PHU_Address			
##	training\$Outcome1	277 Victoria Street, 5th Floor	294 Willow Avenue	
##	Fatal	0.3930753564	0.0004073320	
##	Not Resolved	0.3017751479	0.0005917160	
##	Resolved	0.3727550224	0.0007808618	
##	Reporting_PHU_Address			
##	training\$Outcome1	345 Oak Street West	435 Grand Avenue West	
##	Fatal	0.0008146640	0.0008146640	
##	Not Resolved	0.0041420118	0.0023668639	
##	Resolved	0.0008873429	0.0048626393	
##	Reporting_PHU_Address			
##	training\$Outcome1	458 Laurier Boulevard	50 King Street	
##	Fatal	0.0191446029	0.0219959267	
##	Not Resolved	0.0017751479	0.0112426036	
##	Resolved	0.0097252786	0.0181017960	
##	Reporting_PHU_Address			
##	training\$Outcome1	605 Rossland Road East	653 West Gore Street	
##	Fatal	0.0655804481	0.0020366599	

```

##      Not Resolved      0.0171597633      0.0017751479
##      Resolved          0.0475970753      0.0017036984
##                               Reporting_PHU_Address
## training$Outcome1 7 International Drive 7120 Hurontario Street
##      Fatal          0.0008146640      0.1164969450
##      Not Resolved    0.0017751479      0.2153846154
##      Resolved        0.0008873429      0.1669269539
##                               Reporting_PHU_Address
## training$Outcome1 99 Regina Street South 999 Balmoral Street
##      Fatal          0.0419551935      0.0008146640
##      Not Resolved    0.0260355030      0.0017751479
##      Resolved        0.0366295166      0.0026975225
##
##                               Reporting_PHU_City
## training$Outcome1      Barrie      Belleville      Brantford      Brockville
##      Fatal          0.0134419552 0.0020366599 0.0024439919 0.0191446029
##      Not Resolved    0.0100591716 0.0005917160 0.0011834320 0.0017751479
##      Resolved        0.0177468588 0.0012777738 0.0041882587 0.0097252786
##                               Reporting_PHU_City
## training$Outcome1      Chatham      Cornwall      Guelph      Hamilton
##      Fatal          0.0008146640 0.0048879837 0.0142566191 0.0167006110
##      Not Resolved    0.0023668639 0.0017751479 0.0213017751 0.0224852071
##      Resolved        0.0048626393 0.0049336267 0.0135940938 0.0247746149
##                               Reporting_PHU_City
## training$Outcome1      Kenora      Kingston      London      Mississauga
##      Fatal          0.0004073320 0.0004073320 0.0219959267 0.1164969450
##      Not Resolved    0.0029585799 0.0207100592 0.0112426036 0.2153846154
##      Resolved        0.0012067864 0.0019521545 0.0181017960 0.1669269539
##                               Reporting_PHU_City
## training$Outcome1 New Liskeard      Newmarket      North Bay      Oakville
##      Fatal          0.0004073320 0.0887983707 0.0008146640 0.0081466395
##      Not Resolved    0.0005917160 0.0970414201 0.0041420118 0.0183431953
##      Resolved        0.0006033932 0.0836231987 0.0008873429 0.0223255484
##                               Reporting_PHU_City
## training$Outcome1      Ottawa      Owen Sound      Pembroke      Peterborough
##      Fatal          0.0989816701 0.0004073320 0.0008146640 0.0008146640
##      Not Resolved    0.0236686391 0.0035502959 0.0017751479 0.0005917160
##      Resolved        0.0573578477 0.0030879534 0.0008873429 0.0030879534
##                               Reporting_PHU_City
## training$Outcome1 Point Edward      Port Hope      Sault Ste. Marie      Simcoe
##      Fatal          0.0089613035 0.0069246436      0.0004073320 0.0142566191
##      Not Resolved    0.0011834320 0.0047337278      0.0005917160 0.0029585799
##      Resolved        0.0083410236 0.0053595514      0.0007808618 0.0126357635
##                               Reporting_PHU_City
## training$Outcome1      St. Thomas      Stratford      Sudbury      Thorold
##      Fatal          0.0016293279 0.0020366599 0.0008146640 0.0207739308
##      Not Resolved    0.0005917160 0.0017751479 0.0005917160 0.0094674556
##      Resolved        0.0024845602 0.0017036984 0.0021651168 0.0223255484
##                               Reporting_PHU_City
## training$Outcome1 Thunder Bay      Timmins      Toronto      Waterloo

```

```

##      Fatal      0.0008146640 0.0036659878 0.3930753564 0.0419551935
##      Not Resolved 0.0017751479 0.0005917160 0.3017751479 0.0260355030
##      Resolved    0.0026975225 0.0019876482 0.3727550224 0.0366295166
##
##      Reporting_PHU_City
## training$Outcome1      Whitby      Windsor
##      Fatal      0.0655804481 0.0268839104
##      Not Resolved 0.0171597633 0.1692307692
##      Resolved    0.0475970753 0.0413856747
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      K2G 6J8      K6J 5T1      K6V 7A3      K7M 1V5
##      Fatal      0.0989816701 0.0048879837 0.0191446029 0.0004073320
##      Not Resolved 0.0236686391 0.0017751479 0.0017751479 0.0207100592
##      Resolved    0.0573578477 0.0049336267 0.0097252786 0.0019521545
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      K8A 6W5      K8P 4P1      K9J 2R8      L1A 3V6
##      Fatal      0.0008146640 0.0020366599 0.0008146640 0.0069246436
##      Not Resolved 0.0017751479 0.0005917160 0.0005917160 0.0047337278
##      Resolved    0.0008873429 0.0012777738 0.0030879534 0.0053595514
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      L1N 0B2      L2V 4T7      L3Y 6Z1      L4M 6K9
##      Fatal      0.0655804481 0.0207739308 0.0887983707 0.0134419552
##      Not Resolved 0.0171597633 0.0094674556 0.0970414201 0.0100591716
##      Resolved    0.0475970753 0.0223255484 0.0836231987 0.0177468588
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      L5W 1N4      L6M 3L1      L8P 4S6      M5B 1W2
##      Fatal      0.1164969450 0.0081466395 0.0167006110 0.3930753564
##      Not Resolved 0.2153846154 0.0183431953 0.0224852071 0.3017751479
##      Resolved    0.1669269539 0.0223255484 0.0247746149 0.3727550224
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      N1G 0E1      N2J 4V3      N3R 1G7      N3Y 4N5
##      Fatal      0.0142566191 0.0419551935 0.0024439919 0.0142566191
##      Not Resolved 0.0213017751 0.0260355030 0.0011834320 0.0029585799
##      Resolved    0.0135940938 0.0366295166 0.0041882587 0.0126357635
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      N4K 0A5      N5A 1L4      N5P 1G9      N6A 5L7
##      Fatal      0.0004073320 0.0020366599 0.0016293279 0.0219959267
##      Not Resolved 0.0035502959 0.0017751479 0.0005917160 0.0112426036
##      Resolved    0.0030879534 0.0017036984 0.0024845602 0.0181017960
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      N7M 5L8      N7T 7Z6      N9A 4J8      P0J 1P0
##      Fatal      0.0008146640 0.0089613035 0.0268839104 0.0004073320
##      Not Resolved 0.0023668639 0.0011834320 0.1692307692 0.0005917160
##      Resolved    0.0048626393 0.0083410236 0.0413856747 0.0006033932
##
##      Reporting_PHU_Postal_Code
## training$Outcome1      P1B 2T2      P3E 3A3      P4N 8B7      P6B 0A9
##      Fatal      0.0008146640 0.0008146640 0.0036659878 0.0004073320
##      Not Resolved 0.0041420118 0.0005917160 0.0005917160 0.0005917160
##      Resolved    0.0008873429 0.0021651168 0.0019876482 0.0007808618
##
##      Reporting_PHU_Postal_Code

```

```

## training$Outcome1      P7B 6E7      P9N 2K4
##      Fatal      0.0008146640 0.0004073320
##      Not Resolved 0.0017751479 0.0029585799
##      Resolved      0.0026975225 0.0012067864
##
##      Reporting_PHU_Website
## training$Outcome1 www.algomapublichealth.com www.bchu.org/ www.ckphu.com
##      Fatal      0.0004073320 0.0024439919 0.0008146640
##      Not Resolved 0.0005917160 0.0011834320 0.0023668639
##      Resolved      0.0007808618 0.0041882587 0.0048626393
##      Reporting_PHU_Website
## training$Outcome1 www.durham.ca/en/health-and-wellness/health-and-
wellness.aspx
##      Fatal
0.0655804481
##      Not Resolved
0.0171597633
##      Resolved
0.0475970753
##      Reporting_PHU_Website
## training$Outcome1 www.eohu.ca www.halton.ca/For-Residents/Public-Health/
##      Fatal      0.0048879837      0.0081466395
##      Not Resolved 0.0017751479      0.0183431953
##      Resolved      0.0049336267      0.0223255484
##      Reporting_PHU_Website
## training$Outcome1 www.hamilton.ca/publichealth www.healthunit.com
##      Fatal      0.0167006110      0.0219959267
##      Not Resolved 0.0224852071      0.0112426036
##      Resolved      0.0247746149      0.0181017960
##      Reporting_PHU_Website
## training$Outcome1 www.healthunit.org www.hkpr.on.ca/ www.hnhu.org
##      Fatal      0.0191446029      0.0069246436 0.0142566191
##      Not Resolved 0.0017751479      0.0047337278 0.0029585799
##      Resolved      0.0097252786      0.0053595514 0.0126357635
##      Reporting_PHU_Website
## training$Outcome1 www.hpePublicHealth.ca www.hpph.ca www.kflaph.ca
##      Fatal      0.0020366599 0.0020366599 0.0004073320
##      Not Resolved 0.0005917160 0.0017751479 0.0207100592
##      Resolved      0.0012777738 0.0017036984 0.0019521545
##      Reporting_PHU_Website
## training$Outcome1 www.lambtonhealth.on.ca www.myhealthunit.ca
##      Fatal      0.0089613035      0.0008146640
##      Not Resolved 0.0011834320      0.0041420118
##      Resolved      0.0083410236      0.0008873429
##      Reporting_PHU_Website
## training$Outcome1 www.niagararegion.ca/health www.nwhu.on.ca
##      Fatal      0.0207739308      0.0004073320
##      Not Resolved 0.0094674556      0.0029585799
##      Resolved      0.0223255484      0.0012067864
##      Reporting_PHU_Website

```



```

## training$Outcome1 www.ottawapublichealth.ca www.peelregion.ca/health/
##      Fatal          0.0989816701          0.1164969450
##      Not Resolved    0.0236686391          0.2153846154
##      Resolved        0.0573578477          0.1669269539
##
##      Reporting_PHU_Website
## training$Outcome1 www.peterboroughpublichealth.ca www.phsd.ca
##      Fatal          0.0008146640 0.0008146640
##      Not Resolved    0.0005917160 0.0005917160
##      Resolved        0.0030879534 0.0021651168
##
##      Reporting_PHU_Website
## training$Outcome1 www.porcupinehu.on.ca www.publichealthgreybruce.on.ca/
##      Fatal          0.0036659878          0.0004073320
##      Not Resolved    0.0005917160          0.0035502959
##      Resolved        0.0019876482          0.0030879534
##
##      Reporting_PHU_Website
## training$Outcome1 www.rcdhu.com www.regionofwaterloo.ca
##      Fatal          0.0008146640          0.0419551935
##      Not Resolved    0.0017751479          0.0260355030
##      Resolved        0.0008873429          0.0366295166
##
##      Reporting_PHU_Website
## training$Outcome1 www.simcoemuskokahealth.org www.swpublichealth.ca
##      Fatal          0.0134419552          0.0016293279
##      Not Resolved    0.0100591716          0.0005917160
##      Resolved        0.0177468588          0.0024845602
##
##      Reporting_PHU_Website
## training$Outcome1 www.tbdhu.com www.timiskaminghu.com
##      Fatal          0.0008146640          0.0004073320
##      Not Resolved    0.0017751479          0.0005917160
##      Resolved        0.0026975225          0.0006033932
##
##      Reporting_PHU_Website
## training$Outcome1 www.toronto.ca/community-people/health-wellness-care/
##      Fatal          0.3930753564
##      Not Resolved    0.3017751479
##      Resolved        0.3727550224
##
##      Reporting_PHU_Website
## training$Outcome1 www.wdgppublichealth.ca www.wechu.org
##      Fatal          0.0142566191 0.0268839104
##      Not Resolved    0.0213017751 0.1692307692
##      Resolved        0.0135940938 0.0413856747
##
##      Reporting_PHU_Website
## training$Outcome1 www.york.ca/wps/portal/yorkhome/health/
##      Fatal          0.0887983707
##      Not Resolved    0.0970414201
##      Resolved        0.0836231987
##
##      Reporting_PHU_Latitude
## training$Outcome1      [,1]      [,2]
##      Fatal          43.83316 0.6969235
##      Not Resolved    43.52504 0.7513708
##      Resolved        43.74673 0.7175344

```

```
##
## Reporting_PHU_Longitude
## training$Outcome1 [,1] [,2]
## Fatal -79.20374 1.529972
## Not Resolved -80.07442 1.781179
## Resolved -79.51969 1.556606

#Confusion matrix
NBC.predict <- predict(NBC.classifier, test)
CrossTable(NBC.predict, test$Outcome1, prop.chisq = FALSE, prop.t = FALSE,
prop.r = FALSE,
dnn = c('predicted', 'actual'))
```

```
##
##
## Cell Contents
## |-----|
## | N |
## | N / Col Total |
## |-----|
##
##
## Total Observations in Table: 3577
```

```
##
##
## predicted | actual Fatal | Not Resolved | Resolved | Row Total |
## -----|-----|-----|-----|-----|
## Fatal | 263 | 7 | 0 | 270 |
## | 0.981 | 0.038 | 0.000 | |
## -----|-----|-----|-----|
## Not Resolved | 1 | 170 | 23 | 194 |
## | 0.004 | 0.929 | 0.007 | |
## -----|-----|-----|-----|
## Resolved | 4 | 6 | 3103 | 3113 |
## | 0.015 | 0.033 | 0.993 | |
## -----|-----|-----|-----|
## Column Total | 268 | 183 | 3126 | 3577 |
## | 0.075 | 0.051 | 0.874 | |
## -----|-----|-----|-----|
##
##
```

```
# Precision and Recall for Fatal Class
#precision = 263/(263+7) = 0.9740741
#recall = 263/(263+1+4) = 0.9813433
```

```
# Precision and Recall for Resolved Class
#precision = 3103/(4+6+3103) = 0.9967877
#recall = 3103/(23+3103) = 0.9926424
```

Step 4: Modeling - (3) Random Forest

```
#install.packages("randomForest")
library(randomForest)

## Warning: package 'randomForest' was built under R version 3.5.3

## randomForest 4.6-14

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'

## The following object is masked from 'package:ggplot2':
##
##     margin

#Building Random Forest model on training set
model.randomForest <- randomForest(Outcome1 ~ Client_Gender + Age_Group +
Case_AcquisitionInfo + Outbreak_Related + Reporting_PHU_City, data=training,
importance = TRUE)
model.randomForest

##
## Call:
## randomForest(formula = Outcome1 ~ Client_Gender + Age_Group +
Case_AcquisitionInfo + Outbreak_Related + Reporting_PHU_City,      data =
training, importance = TRUE)
##              Type of random forest: classification
##              Number of trees: 500
## No. of variables tried at each split: 2
##
##              OOB estimate of  error rate: 12.16%
## Confusion matrix:
##              Fatal Not Resolved Resolved class.error
## Fatal          24           1    2396 0.990086741
## Not Resolved    0          259    1397 0.843599034
## Resolved        17          106   28017 0.004371002

#Predicting on test set
predict.RF <- predict(model.randomForest, test, type = "class")
head(predict.RF)

##           3           5          39          55          60          69
## Resolved Resolved Resolved Resolved Resolved Resolved
## Levels: Fatal Not Resolved Resolved

#Confusion Matrix
mean(predict.RF == test$Outcome1)

## [1] 0.8753145
```

```
table(predict.RF, test$Outcome1)

##
## predict.RF      Fatal Not Resolved Resolved
## Fatal           1         0         5
## Not Resolved    0         18        9
## Resolved       267        165       3112

# Precision and Recall for Fatal Class
#precision = 1/(1+5) = 0.1666667
#recall = 1/(1+267) = 0.003731343

# Precision and Recall for Resolved Class
#precision = 3112/(267+165+3112) = 0.8781038
#recall = 3112/(5+9+3112) = 0.9955214

#importance that model has assigned to each variable
varImpPlot(model.randomForest)
```

model.randomForest

