566 Project Modeling Part 1

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```
### CSSS/Stat 566 Project: Exploratory Data Analysis
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# 5/16/21
# This R script continues the data processing portion of our project,
# performing model fitting, model selection, and model diagnostics.

rm(list = ls())

# run exploratory data analysis
source('566_exploratoryDataAnalysis.R')
```

```
## Warning: package 'ggplot2' was built under R version 4.0.5

## Warning: package 'ggpubr' was built under R version 4.0.5

## Warning: package 'plyr' was built under R version 4.0.5

##
## Attaching package: 'plyr'

## The following object is masked from 'package:ggpubr':
##
##     mutate
```

```
# access to stepAIC() function
library(MASS)

# convert variables to factors
for (i in 1:k) {
  dat[, i] <- as.factor(dat[, i])
}

## 3. Fitting our Model (Logistic Regression)

# full model
glm.full <- glm(h1n1_vaccine ~ ., family = binomial(link = 'logit'), data = dat)

## 4. Variable Selection

# Akaike Information Criterion (AIC)
```

```r
# backwards, forwards, and best stepwise selection

backward.AIC <- stepAIC(glm.full, direction = "backward", trace = FALSE, k = 2)
forward.AIC <- stepAIC(glm.full, direction = "forward", trace = FALSE, k = 2)
best.AIC <- stepAIC(glm.full, direction = "both", trace = FALSE, k = 2)

# Bayesian information criterion (BIC)
# backwards, forwards, and best stepwise selection

backward.BIC <- stepAIC(glm.full, direction = "backward", trace = FALSE, k = log(n))
forward.BIC <- stepAIC(glm.full, direction = "forward", trace = FALSE, k = log(n))
best.BIC <- stepAIC(glm.full, direction = "both", trace = FALSE, k = log(n))
```

Akaike Information Criterion (AIC)

Backwards AIC

```r
summary(backward.AIC)
```

```
##
## Call:
## glm(formula = h1n1_vaccine ~ h1n1_knowledge + behavioral_large_gatherings +
##     doctor_recc_h1n1 + doctor_recc_seasonal + child_under_6_months +
##     health_worker + health_insurance + opinion_h1n1_vacc_effective +
##     opinion_h1n1_risk + opinion_h1n1_sick_from_vacc + opinion_seas_vacc_effective +
##     opinion_seas_sick_from_vacc + age_group + education + race +
##     sex + marital_status + census_msa + household_adults + seasonal_vaccine,
##     family = binomial(link = "logit"), data = dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8138  -0.5206  -0.2615   0.4371   3.5093
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    -5.603546   0.355529 -15.761  < 2e-16 ***
## h1n1_knowledge1                 0.112729   0.116293   0.969 0.332369
## h1n1_knowledge2                 0.285288   0.122744   2.324 0.020112 *
## behavioral_large_gatheringsYes -0.158376   0.061483  -2.576 0.009997 **
## doctor_recc_h1n1Yes             2.355743   0.078701  29.933  < 2e-16 ***
## doctor_recc_seasonalYes        -1.151214   0.076804 -14.989  < 2e-16 ***
## child_under_6_monthsYes         0.343562   0.099811   3.442 0.000577 ***
## health_workerYes                0.702551   0.083514   8.412  < 2e-16 ***
## health_insuranceYes             0.635319   0.109883   5.782 7.39e-09 ***
## opinion_h1n1_vacc_effective2   -0.017316   0.313121  -0.055 0.955898
## opinion_h1n1_vacc_effective3    0.563215   0.290050   1.942 0.052163 .
## opinion_h1n1_vacc_effective4    0.861504   0.278134   3.097 0.001952 **
## opinion_h1n1_vacc_effective5    1.797839   0.279921   6.423 1.34e-10 ***
## opinion_h1n1_risk2              0.557364   0.076252   7.310 2.68e-13 ***
## opinion_h1n1_risk3              0.980820   0.182561   5.373 7.76e-08 ***
```

```
## opinion_h1n1_risk4              1.614170   0.085354  18.911  < 2e-16 ***
## opinion_h1n1_risk5              2.168720   0.129791  16.709  < 2e-16 ***
## opinion_h1n1_sick_from_vacc2   -0.278675   0.073570  -3.788 0.000152 ***
## opinion_h1n1_sick_from_vacc3   -2.346291   1.202404  -1.951 0.051017 .
## opinion_h1n1_sick_from_vacc4    0.201771   0.085342   2.364 0.018066 *
## opinion_h1n1_sick_from_vacc5    0.230317   0.131889   1.746 0.080760 .
## opinion_seas_vacc_effective2   -0.135807   0.229935  -0.591 0.554768
## opinion_seas_vacc_effective3    0.307300   0.267910   1.147 0.251371
## opinion_seas_vacc_effective4   -0.129901   0.202979  -0.640 0.522189
## opinion_seas_vacc_effective5   -0.304792   0.204999  -1.487 0.137069
## opinion_seas_sick_from_vacc2   -0.169111   0.071627  -2.361 0.018225 *
## opinion_seas_sick_from_vacc3    1.614904   0.854085   1.891 0.058651 .
## opinion_seas_sick_from_vacc4   -0.291682   0.084907  -3.435 0.000592 ***
## opinion_seas_sick_from_vacc5   -0.292320   0.140988  -2.073 0.038139 *
## age_group35 - 44 Years         -0.143311   0.102096  -1.404 0.160413
## age_group45 - 54 Years         -0.169379   0.094299  -1.796 0.072465 .
## age_group55 - 64 Years          0.077821   0.092067   0.845 0.397965
## age_group65+ Years              0.069287   0.096049   0.721 0.470679
## education12 Years               0.233716   0.121242   1.928 0.053894 .
## educationCollege Graduate       0.360663   0.120270   2.999 0.002711 **
## educationSome College           0.202291   0.120102   1.684 0.092119 .
## raceHispanic                    0.355751   0.159316   2.233 0.025550 *
## raceOther or Multiple           0.530616   0.160615   3.304 0.000954 ***
## raceWhite                       0.343436   0.118488   2.898 0.003750 **
## sexMale                         0.411488   0.058096   7.083 1.41e-12 ***
## marital_statusNot Married      -0.178681   0.081329  -2.197 0.028018 *
## census_msaMSA, Principle City   0.141072   0.066078   2.135 0.032765 *
## census_msaNon-MSA               0.122871   0.068540   1.793 0.073024 .
## household_adults1               0.002295   0.091093   0.025 0.979900
## household_adults2               0.148358   0.110510   1.342 0.179438
## household_adults3              -0.363859   0.154843  -2.350 0.018781 *
## seasonal_vaccineYes             2.173018   0.068757  31.604  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 14447.5  on 11793  degrees of freedom
## Residual deviance:  8512.8  on 11747  degrees of freedom
## AIC: 8606.8
##
## Number of Fisher Scoring iterations: 6
```

Forwards AIC

```
summary(forward.AIC)
```

```
##
## Call:
## glm(formula = h1n1_vaccine ~ h1n1_concern + h1n1_knowledge +
##     behavioral_antiviral_meds + behavioral_avoidance + behavioral_face_mask +
```

```
##     behavioral_wash_hands + behavioral_large_gatherings + behavioral_outside_home +
##     behavioral_touch_face + doctor_recc_h1n1 + doctor_recc_seasonal +
##     chronic_med_condition + child_under_6_months + health_worker +
##     health_insurance + opinion_h1n1_vacc_effective + opinion_h1n1_risk +
##     opinion_h1n1_sick_from_vacc + opinion_seas_vacc_effective +
##     opinion_seas_risk + opinion_seas_sick_from_vacc + age_group +
##     education + race + sex + income_poverty + marital_status +
##     rent_or_own + employment_status + census_msa + household_adults +
##     household_children + seasonal_vaccine, family = binomial(link = "logit"),
##     data = dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8370  -0.5230  -0.2594   0.4380   3.4970
##
## Coefficients:
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                     -5.612278   0.375697 -14.938  < 2e-16 ***
## h1n1_concern1                   -0.137685   0.104548  -1.317 0.187853
## h1n1_concern2                   -0.009113   0.107578  -0.085 0.932490
## h1n1_concern3                   -0.005038   0.127568  -0.039 0.968501
## h1n1_knowledge1                  0.118390   0.117723   1.006 0.314573
## h1n1_knowledge2                  0.289534   0.124396   2.328 0.019938 *
## behavioral_antiviral_medsYes    -0.009552   0.122277  -0.078 0.937732
## behavioral_avoidanceYes         -0.018976   0.070809  -0.268 0.788711
## behavioral_face_maskYes          0.114646   0.109790   1.044 0.296377
## behavioral_wash_handsYes         0.088615   0.086560   1.024 0.305957
## behavioral_large_gatheringsYes  -0.154842   0.073409  -2.109 0.034919 *
## behavioral_outside_homeYes      -0.028088   0.074507  -0.377 0.706185
## behavioral_touch_faceYes        -0.094701   0.067795  -1.397 0.162451
## doctor_recc_h1n1Yes              2.349820   0.078915  29.777  < 2e-16 ***
## doctor_recc_seasonalYes         -1.157526   0.077410 -14.953  < 2e-16 ***
## chronic_med_conditionYes         0.060391   0.062591   0.965 0.334619
## child_under_6_monthsYes          0.345283   0.100116   3.449 0.000563 ***
## health_workerYes                 0.719558   0.085519   8.414  < 2e-16 ***
## health_insuranceYes              0.630525   0.112450   5.607 2.06e-08 ***
## opinion_h1n1_vacc_effective2    -0.022076   0.313739  -0.070 0.943904
## opinion_h1n1_vacc_effective3     0.549136   0.291010   1.887 0.059160 .
## opinion_h1n1_vacc_effective4     0.854659   0.279012   3.063 0.002190 **
## opinion_h1n1_vacc_effective5     1.784489   0.280963   6.351 2.13e-10 ***
## opinion_h1n1_risk2               0.521433   0.080334   6.491 8.54e-11 ***
## opinion_h1n1_risk3               0.896441   0.196449   4.563 5.04e-06 ***
## opinion_h1n1_risk4               1.589966   0.094200  16.879  < 2e-16 ***
## opinion_h1n1_risk5               2.191856   0.140563  15.593  < 2e-16 ***
## opinion_h1n1_sick_from_vacc2    -0.278288   0.074720  -3.724 0.000196 ***
## opinion_h1n1_sick_from_vacc3    -2.432134   1.218597  -1.996 0.045951 *
## opinion_h1n1_sick_from_vacc4     0.184513   0.086925   2.123 0.033781 *
## opinion_h1n1_sick_from_vacc5     0.205639   0.134681   1.527 0.126795
## opinion_seas_vacc_effective2    -0.144171   0.231567  -0.623 0.533554
## opinion_seas_vacc_effective3     0.279137   0.272212   1.025 0.305157
## opinion_seas_vacc_effective4    -0.151565   0.205697  -0.737 0.461224
## opinion_seas_vacc_effective5    -0.316109   0.208297  -1.518 0.129119
## opinion_seas_risk2               0.126954   0.097477   1.302 0.192781
## opinion_seas_risk3               0.286972   0.243493   1.179 0.238573
```

```
## opinion_seas_risk4                   0.092877   0.103426   0.898 0.369183
## opinion_seas_risk5                  -0.045979   0.126735  -0.363 0.716756
## opinion_seas_sick_from_vacc2        -0.179404   0.072232  -2.484 0.013002 *
## opinion_seas_sick_from_vacc3         1.618037   0.865722   1.869 0.061622 .
## opinion_seas_sick_from_vacc4        -0.301168   0.085867  -3.507 0.000453 ***
## opinion_seas_sick_from_vacc5        -0.273245   0.142647  -1.916 0.055424 .
## age_group35 - 44 Years              -0.147755   0.104347  -1.416 0.156779
## age_group45 - 54 Years              -0.189408   0.098465  -1.924 0.054404 .
## age_group55 - 64 Years               0.055701   0.101743   0.547 0.584057
## age_group65+ Years                   0.020371   0.112264   0.181 0.856008
## education12 Years                    0.242768   0.122542   1.981 0.047580 *
## educationCollege Graduate            0.356291   0.125015   2.850 0.004372 **
## educationSome College                0.205381   0.122431   1.678 0.093440 .
## raceHispanic                         0.362893   0.159807   2.271 0.023158 *
## raceOther or Multiple                0.528095   0.161237   3.275 0.001056 **
## raceWhite                            0.351247   0.120455   2.916 0.003545 **
## sexMale                              0.414761   0.059929   6.921 4.49e-12 ***
## income_poverty> $75,000              0.040959   0.069895   0.586 0.557872
## income_povertyBelow Poverty          0.016175   0.104908   0.154 0.877464
## marital_statusNot Married           -0.178434   0.084163  -2.120 0.033998 *
## rent_or_ownRent                     -0.011508   0.075857  -0.152 0.879418
## employment_statusNot in Labor Force  0.056859   0.071334   0.797 0.425405
## employment_statusUnemployed          0.058842   0.132800   0.443 0.657703
## census_msaMSA, Principle City        0.145489   0.066521   2.187 0.028735 *
## census_msaNon-MSA                    0.128211   0.068887   1.861 0.062720 .
## household_adults1                   -0.004460   0.092013  -0.048 0.961340
## household_adults2                    0.134027   0.112145   1.195 0.232039
## household_adults3                   -0.379011   0.156998  -2.414 0.015774 *
## household_children1                  0.077045   0.094743   0.813 0.416100
## household_children2                 -0.014573   0.105227  -0.138 0.889852
## household_children3                 -0.046273   0.130529  -0.355 0.722960
## seasonal_vaccineYes                  2.172493   0.071007  30.596  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 14447.5  on 11793  degrees of freedom
## Residual deviance:  8496.9  on 11725  degrees of freedom
## AIC: 8634.9
##
## Number of Fisher Scoring iterations: 6
```

Best AIC

```
summary(best.AIC)
```

```
##
## Call:
## glm(formula = h1n1_vaccine ~ h1n1_knowledge + behavioral_large_gatherings +
##     doctor_recc_h1n1 + doctor_recc_seasonal + child_under_6_months +
```

```
##     health_worker + health_insurance + opinion_h1n1_vacc_effective +
##     opinion_h1n1_risk + opinion_h1n1_sick_from_vacc + opinion_seas_vacc_effective +
##     opinion_seas_sick_from_vacc + age_group + education + race +
##     sex + marital_status + census_msa + household_adults + seasonal_vaccine,
##     family = binomial(link = "logit"), data = dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8138  -0.5206  -0.2615   0.4371   3.5093
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    -5.603546   0.355529 -15.761  < 2e-16 ***
## h1n1_knowledge1                 0.112729   0.116293   0.969 0.332369
## h1n1_knowledge2                 0.285288   0.122744   2.324 0.020112 *
## behavioral_large_gatheringsYes -0.158376   0.061483  -2.576 0.009997 **
## doctor_recc_h1n1Yes             2.355743   0.078701  29.933  < 2e-16 ***
## doctor_recc_seasonalYes        -1.151214   0.076804 -14.989  < 2e-16 ***
## child_under_6_monthsYes         0.343562   0.099811   3.442 0.000577 ***
## health_workerYes                0.702551   0.083514   8.412  < 2e-16 ***
## health_insuranceYes             0.635319   0.109883   5.782 7.39e-09 ***
## opinion_h1n1_vacc_effective2   -0.017316   0.313121  -0.055 0.955898
## opinion_h1n1_vacc_effective3    0.563215   0.290050   1.942 0.052163 .
## opinion_h1n1_vacc_effective4    0.861504   0.278134   3.097 0.001952 **
## opinion_h1n1_vacc_effective5    1.797839   0.279921   6.423 1.34e-10 ***
## opinion_h1n1_risk2              0.557364   0.076252   7.310 2.68e-13 ***
## opinion_h1n1_risk3              0.980820   0.182561   5.373 7.76e-08 ***
## opinion_h1n1_risk4              1.614170   0.085354  18.911  < 2e-16 ***
## opinion_h1n1_risk5              2.168720   0.129791  16.709  < 2e-16 ***
## opinion_h1n1_sick_from_vacc2   -0.278675   0.073570  -3.788 0.000152 ***
## opinion_h1n1_sick_from_vacc3   -2.346291   1.202404  -1.951 0.051017 .
## opinion_h1n1_sick_from_vacc4    0.201771   0.085342   2.364 0.018066 *
## opinion_h1n1_sick_from_vacc5    0.230317   0.131889   1.746 0.080760 .
## opinion_seas_vacc_effective2   -0.135807   0.229935  -0.591 0.554768
## opinion_seas_vacc_effective3    0.307300   0.267910   1.147 0.251371
## opinion_seas_vacc_effective4   -0.129901   0.202979  -0.640 0.522189
## opinion_seas_vacc_effective5   -0.304792   0.204999  -1.487 0.137069
## opinion_seas_sick_from_vacc2   -0.169111   0.071627  -2.361 0.018225 *
## opinion_seas_sick_from_vacc3    1.614904   0.854085   1.891 0.058651 .
## opinion_seas_sick_from_vacc4   -0.291682   0.084907  -3.435 0.000592 ***
## opinion_seas_sick_from_vacc5   -0.292320   0.140988  -2.073 0.038139 *
## age_group35 - 44 Years         -0.143311   0.102096  -1.404 0.160413
## age_group45 - 54 Years         -0.169379   0.094299  -1.796 0.072465 .
## age_group55 - 64 Years          0.077821   0.092067   0.845 0.397965
## age_group65+ Years              0.069287   0.096049   0.721 0.470679
## education12 Years               0.233716   0.121242   1.928 0.053894 .
## educationCollege Graduate       0.360663   0.120270   2.999 0.002711 **
## educationSome College           0.202291   0.120102   1.684 0.092119 .
## raceHispanic                    0.355751   0.159316   2.233 0.025550 *
## raceOther or Multiple           0.530616   0.160615   3.304 0.000954 ***
## raceWhite                       0.343436   0.118488   2.898 0.003750 **
## sexMale                         0.411488   0.058096   7.083 1.41e-12 ***
## marital_statusNot Married      -0.178681   0.081329  -2.197 0.028018 *
## census_msaMSA, Principle City   0.141072   0.066078   2.135 0.032765 *
```

```
## census_msaNon-MSA               0.122871   0.068540   1.793 0.073024 .
## household_adults1               0.002295   0.091093   0.025 0.979900
## household_adults2               0.148358   0.110510   1.342 0.179438
## household_adults3              -0.363859   0.154843  -2.350 0.018781 *
## seasonal_vaccineYes             2.173018   0.068757  31.604  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 14447.5  on 11793  degrees of freedom
## Residual deviance:  8512.8  on 11747  degrees of freedom
## AIC: 8606.8
##
## Number of Fisher Scoring iterations: 6
```

Bayesian Information Criterion

Backwards BIC

```
summary(backward.BIC)
```

```
##
## Call:
## glm(formula = h1n1_vaccine ~ h1n1_knowledge + behavioral_large_gatherings +
##     doctor_recc_h1n1 + doctor_recc_seasonal + child_under_6_months +
##     health_worker + health_insurance + opinion_h1n1_vacc_effective +
##     opinion_h1n1_risk + opinion_h1n1_sick_from_vacc + sex + marital_status +
##     seasonal_vaccine, family = binomial(link = "logit"), data = dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8083  -0.5249  -0.2676   0.4414   3.4467
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    -5.213017   0.296248 -17.597  < 2e-16 ***
## h1n1_knowledge1                 0.171455   0.112529   1.524 0.127596
## h1n1_knowledge2                 0.391211   0.116089   3.370 0.000752 ***
## behavioral_large_gatheringsYes -0.192897   0.059863  -3.222 0.001272 **
## doctor_recc_h1n1Yes             2.352241   0.077978  30.166  < 2e-16 ***
## doctor_recc_seasonalYes        -1.156033   0.075838 -15.244  < 2e-16 ***
## child_under_6_monthsYes         0.311522   0.098190   3.173 0.001511 **
## health_workerYes                0.700237   0.081801   8.560  < 2e-16 ***
## health_insuranceYes             0.713608   0.106260   6.716 1.87e-11 ***
## opinion_h1n1_vacc_effective2   -0.068828   0.301320  -0.228 0.819318
## opinion_h1n1_vacc_effective3    0.619413   0.271894   2.278 0.022718 *
## opinion_h1n1_vacc_effective4    0.819453   0.261070   3.139 0.001696 **
## opinion_h1n1_vacc_effective5    1.702391   0.261411   6.512 7.40e-11 ***
## opinion_h1n1_risk2              0.529253   0.075404   7.019 2.24e-12 ***
## opinion_h1n1_risk3              1.041975   0.178190   5.848 4.99e-09 ***
```

```
## opinion_h1n1_risk4              1.547112   0.083725  18.479  < 2e-16 ***
## opinion_h1n1_risk5              2.046038   0.126455  16.180  < 2e-16 ***
## opinion_h1n1_sick_from_vacc2   -0.359306   0.067978  -5.286 1.25e-07 ***
## opinion_h1n1_sick_from_vacc3   -2.310473   1.241994  -1.860 0.062844 .
## opinion_h1n1_sick_from_vacc4    0.055175   0.077320   0.714 0.475480
## opinion_h1n1_sick_from_vacc5   -0.002755   0.116786  -0.024 0.981177
## sexMale                         0.419824   0.057406   7.313 2.61e-13 ***
## marital_statusNot Married      -0.194899   0.055850  -3.490 0.000484 ***
## seasonal_vaccineYes             2.162045   0.064046  33.758  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 14447.5  on 11793  degrees of freedom
## Residual deviance:  8599.8  on 11770  degrees of freedom
## AIC: 8647.8
##
## Number of Fisher Scoring iterations: 6
```

Forwards BIC

```
summary(forward.BIC)
```

```
##
## Call:
## glm(formula = h1n1_vaccine ~ h1n1_concern + h1n1_knowledge +
##     behavioral_antiviral_meds + behavioral_avoidance + behavioral_face_mask +
##     behavioral_wash_hands + behavioral_large_gatherings + behavioral_outside_home +
##     behavioral_touch_face + doctor_recc_h1n1 + doctor_recc_seasonal +
##     chronic_med_condition + child_under_6_months + health_worker +
##     health_insurance + opinion_h1n1_vacc_effective + opinion_h1n1_risk +
##     opinion_h1n1_sick_from_vacc + opinion_seas_vacc_effective +
##     opinion_seas_risk + opinion_seas_sick_from_vacc + age_group +
##     education + race + sex + income_poverty + marital_status +
##     rent_or_own + employment_status + census_msa + household_adults +
##     household_children + seasonal_vaccine, family = binomial(link = "logit"),
##     data = dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8370  -0.5230  -0.2594   0.4380   3.4970
##
## Coefficients:
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                     -5.612278   0.375697 -14.938  < 2e-16 ***
## h1n1_concern1                   -0.137685   0.104548  -1.317 0.187853
## h1n1_concern2                   -0.009113   0.107578  -0.085 0.932490
## h1n1_concern3                   -0.005038   0.127568  -0.039 0.968501
## h1n1_knowledge1                  0.118390   0.117723   1.006 0.314573
## h1n1_knowledge2                  0.289534   0.124396   2.328 0.019938 *
```

```
## behavioral_antiviral_medsYes        -0.009552   0.122277  -0.078 0.937732
## behavioral_avoidanceYes             -0.018976   0.070809  -0.268 0.788711
## behavioral_face_maskYes              0.114646   0.109790   1.044 0.296377
## behavioral_wash_handsYes             0.088615   0.086560   1.024 0.305957
## behavioral_large_gatheringsYes      -0.154842   0.073409  -2.109 0.034919 *
## behavioral_outside_homeYes          -0.028088   0.074507  -0.377 0.706185
## behavioral_touch_faceYes            -0.094701   0.067795  -1.397 0.162451
## doctor_recc_h1n1Yes                  2.349820   0.078915  29.777  < 2e-16 ***
## doctor_recc_seasonalYes             -1.157526   0.077410 -14.953  < 2e-16 ***
## chronic_med_conditionYes             0.060391   0.062591   0.965 0.334619
## child_under_6_monthsYes              0.345283   0.100116   3.449 0.000563 ***
## health_workerYes                     0.719558   0.085519   8.414  < 2e-16 ***
## health_insuranceYes                  0.630525   0.112450   5.607 2.06e-08 ***
## opinion_h1n1_vacc_effective2        -0.022076   0.313739  -0.070 0.943904
## opinion_h1n1_vacc_effective3         0.549136   0.291010   1.887 0.059160 .
## opinion_h1n1_vacc_effective4         0.854659   0.279012   3.063 0.002190 **
## opinion_h1n1_vacc_effective5         1.784489   0.280963   6.351 2.13e-10 ***
## opinion_h1n1_risk2                   0.521433   0.080334   6.491 8.54e-11 ***
## opinion_h1n1_risk3                   0.896441   0.196449   4.563 5.04e-06 ***
## opinion_h1n1_risk4                   1.589966   0.094200  16.879  < 2e-16 ***
## opinion_h1n1_risk5                   2.191856   0.140563  15.593  < 2e-16 ***
## opinion_h1n1_sick_from_vacc2        -0.278288   0.074720  -3.724 0.000196 ***
## opinion_h1n1_sick_from_vacc3        -2.432134   1.218597  -1.996 0.045951 *
## opinion_h1n1_sick_from_vacc4         0.184513   0.086925   2.123 0.033781 *
## opinion_h1n1_sick_from_vacc5         0.205639   0.134681   1.527 0.126795
## opinion_seas_vacc_effective2        -0.144171   0.231567  -0.623 0.533554
## opinion_seas_vacc_effective3         0.279137   0.272212   1.025 0.305157
## opinion_seas_vacc_effective4        -0.151565   0.205697  -0.737 0.461224
## opinion_seas_vacc_effective5        -0.316109   0.208297  -1.518 0.129119
## opinion_seas_risk2                   0.126954   0.097477   1.302 0.192781
## opinion_seas_risk3                   0.286972   0.243493   1.179 0.238573
## opinion_seas_risk4                   0.092877   0.103426   0.898 0.369183
## opinion_seas_risk5                  -0.045979   0.126735  -0.363 0.716756
## opinion_seas_sick_from_vacc2        -0.179404   0.072232  -2.484 0.013002 *
## opinion_seas_sick_from_vacc3         1.618037   0.865722   1.869 0.061622 .
## opinion_seas_sick_from_vacc4        -0.301168   0.085867  -3.507 0.000453 ***
## opinion_seas_sick_from_vacc5        -0.273245   0.142647  -1.916 0.055424 .
## age_group35 - 44 Years              -0.147755   0.104347  -1.416 0.156779
## age_group45 - 54 Years              -0.189408   0.098465  -1.924 0.054404 .
## age_group55 - 64 Years               0.055701   0.101743   0.547 0.584057
## age_group65+ Years                   0.020371   0.112264   0.181 0.856008
## education12 Years                    0.242768   0.122542   1.981 0.047580 *
## educationCollege Graduate            0.356291   0.125015   2.850 0.004372 **
## educationSome College                0.205381   0.122431   1.678 0.093440 .
## raceHispanic                         0.362893   0.159807   2.271 0.023158 *
## raceOther or Multiple                0.528095   0.161237   3.275 0.001056 **
## raceWhite                            0.351247   0.120455   2.916 0.003545 **
## sexMale                              0.414761   0.059929   6.921 4.49e-12 ***
## income_poverty> $75,000              0.040959   0.069895   0.586 0.557872
## income_povertyBelow Poverty          0.016175   0.104908   0.154 0.877464
## marital_statusNot Married           -0.178434   0.084163  -2.120 0.033998 *
## rent_or_ownRent                     -0.011508   0.075857  -0.152 0.879418
## employment_statusNot in Labor Force  0.056859   0.071334   0.797 0.425405
## employment_statusUnemployed          0.058842   0.132800   0.443 0.657703
```

```
## census_msaMSA, Principle City        0.145489   0.066521   2.187 0.028735 *
## census_msaNon-MSA                    0.128211   0.068887   1.861 0.062720 .
## household_adults1                   -0.004460   0.092013  -0.048 0.961340
## household_adults2                    0.134027   0.112145   1.195 0.232039
## household_adults3                   -0.379011   0.156998  -2.414 0.015774 *
## household_children1                  0.077045   0.094743   0.813 0.416100
## household_children2                 -0.014573   0.105227  -0.138 0.889852
## household_children3                 -0.046273   0.130529  -0.355 0.722960
## seasonal_vaccineYes                  2.172493   0.071007  30.596  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 14447.5  on 11793  degrees of freedom
## Residual deviance:  8496.9  on 11725  degrees of freedom
## AIC: 8634.9
##
## Number of Fisher Scoring iterations: 6
```

Best BIC

```
summary(best.BIC)
```

```
##
## Call:
## glm(formula = h1n1_vaccine ~ h1n1_knowledge + behavioral_large_gatherings +
##     doctor_recc_h1n1 + doctor_recc_seasonal + child_under_6_months +
##     health_worker + health_insurance + opinion_h1n1_vacc_effective +
##     opinion_h1n1_risk + opinion_h1n1_sick_from_vacc + sex + marital_status +
##     seasonal_vaccine, family = binomial(link = "logit"), data = dat)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8083  -0.5249  -0.2676   0.4414   3.4467
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    -5.213017   0.296248 -17.597  < 2e-16 ***
## h1n1_knowledge1                 0.171455   0.112529   1.524 0.127596
## h1n1_knowledge2                 0.391211   0.116089   3.370 0.000752 ***
## behavioral_large_gatheringsYes -0.192897   0.059863  -3.222 0.001272 **
## doctor_recc_h1n1Yes             2.352241   0.077978  30.166  < 2e-16 ***
## doctor_recc_seasonalYes        -1.156033   0.075838 -15.244  < 2e-16 ***
## child_under_6_monthsYes         0.311522   0.098190   3.173 0.001511 **
## health_workerYes                0.700237   0.081801   8.560  < 2e-16 ***
## health_insuranceYes             0.713608   0.106260   6.716 1.87e-11 ***
## opinion_h1n1_vacc_effective2   -0.068828   0.301320  -0.228 0.819318
## opinion_h1n1_vacc_effective3    0.619413   0.271894   2.278 0.022718 *
## opinion_h1n1_vacc_effective4    0.819453   0.261070   3.139 0.001696 **
## opinion_h1n1_vacc_effective5    1.702391   0.261411   6.512 7.40e-11 ***
```

```
## opinion_h1n1_risk2              0.529253   0.075404   7.019 2.24e-12 ***
## opinion_h1n1_risk3              1.041975   0.178190   5.848 4.99e-09 ***
## opinion_h1n1_risk4              1.547112   0.083725  18.479  < 2e-16 ***
## opinion_h1n1_risk5              2.046038   0.126455  16.180  < 2e-16 ***
## opinion_h1n1_sick_from_vacc2   -0.359306   0.067978  -5.286 1.25e-07 ***
## opinion_h1n1_sick_from_vacc3   -2.310473   1.241994  -1.860 0.062844 .
## opinion_h1n1_sick_from_vacc4    0.055175   0.077320   0.714 0.475480
## opinion_h1n1_sick_from_vacc5   -0.002755   0.116786  -0.024 0.981177
## sexMale                         0.419824   0.057406   7.313 2.61e-13 ***
## marital_statusNot Married      -0.194899   0.055850  -3.490 0.000484 ***
## seasonal_vaccineYes             2.162045   0.064046  33.758  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 14447.5  on 11793  degrees of freedom
## Residual deviance:  8599.8  on 11770  degrees of freedom
## AIC: 8647.8
##
## Number of Fisher Scoring iterations: 6
```