

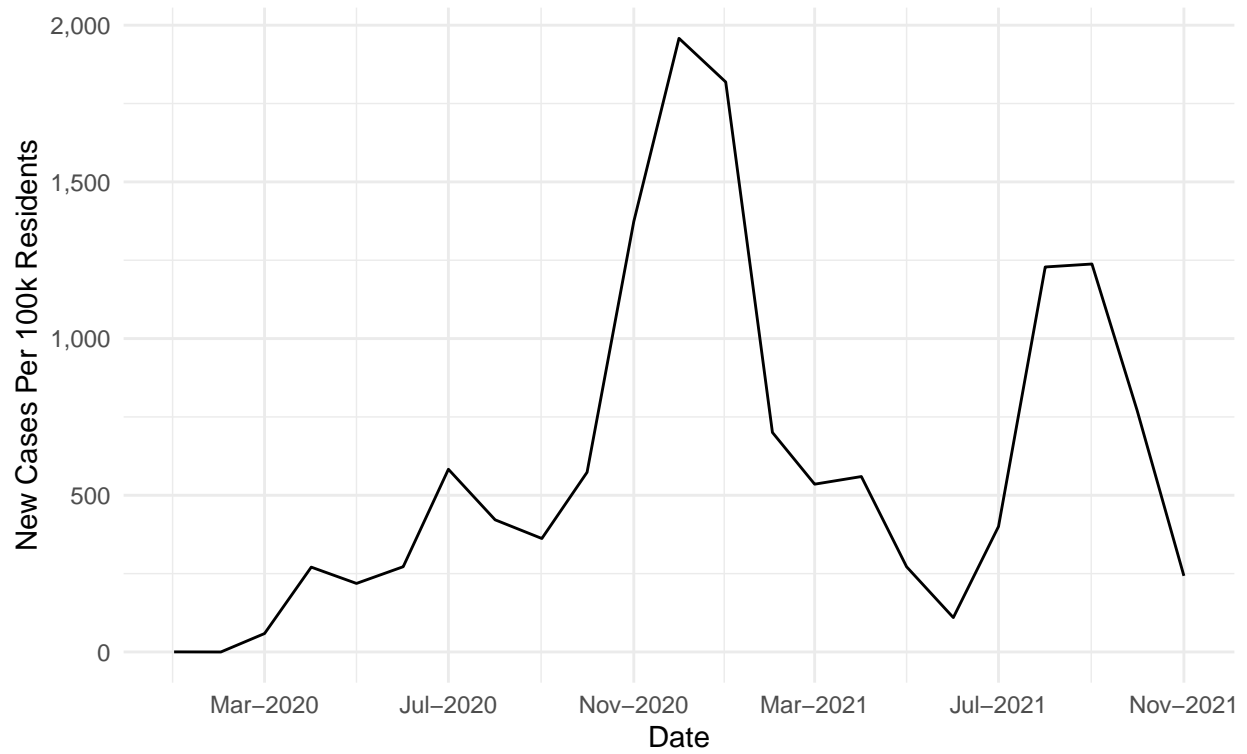
# COVID-19 EDA

Peter O'Brien

10/8/2021

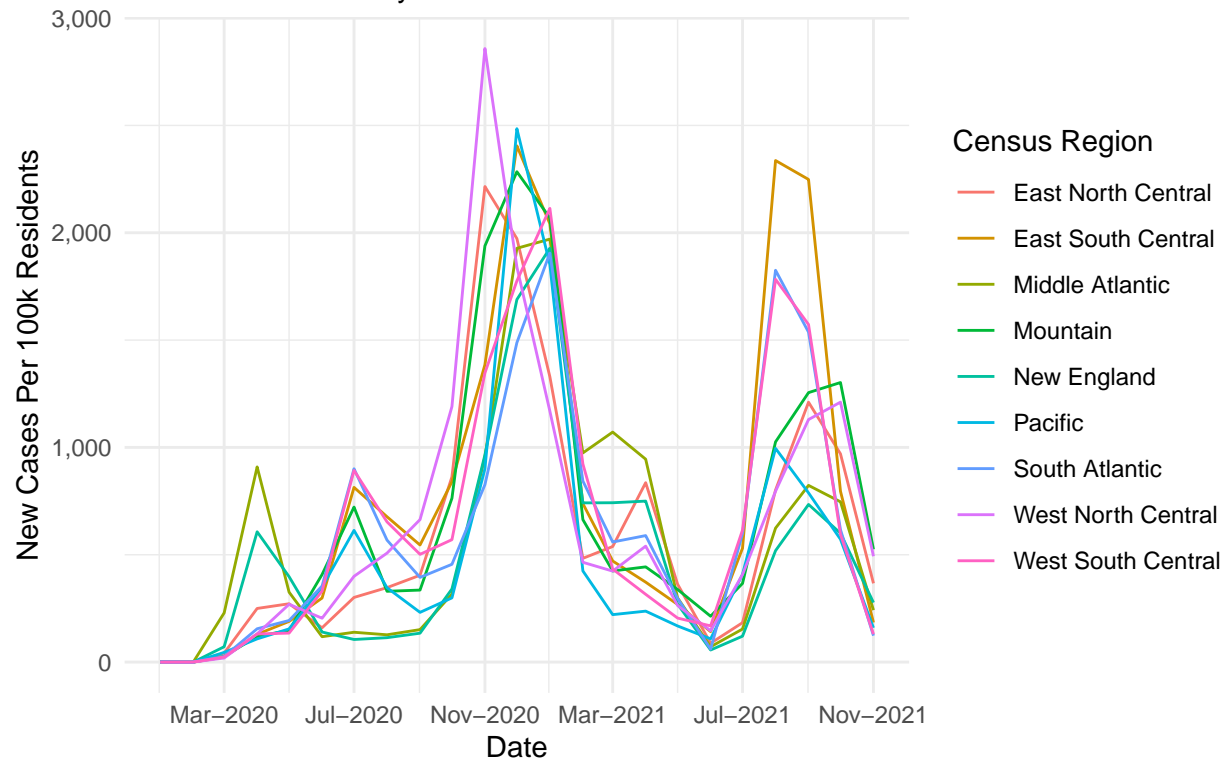
## COVID-19 Monthly Infection Rate in U.S.

January 2020 – November 2021



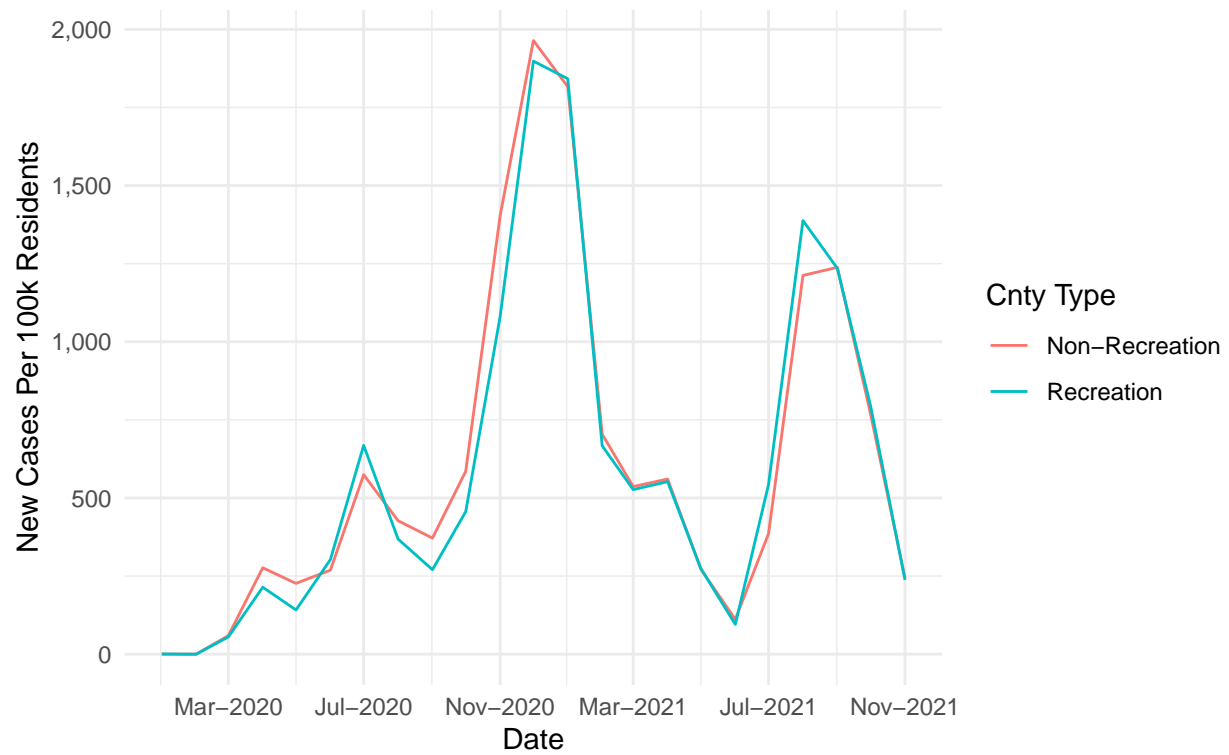
## COVID-19 Monthly Infection Rate in US Census Regions

January 2020 – November 2021



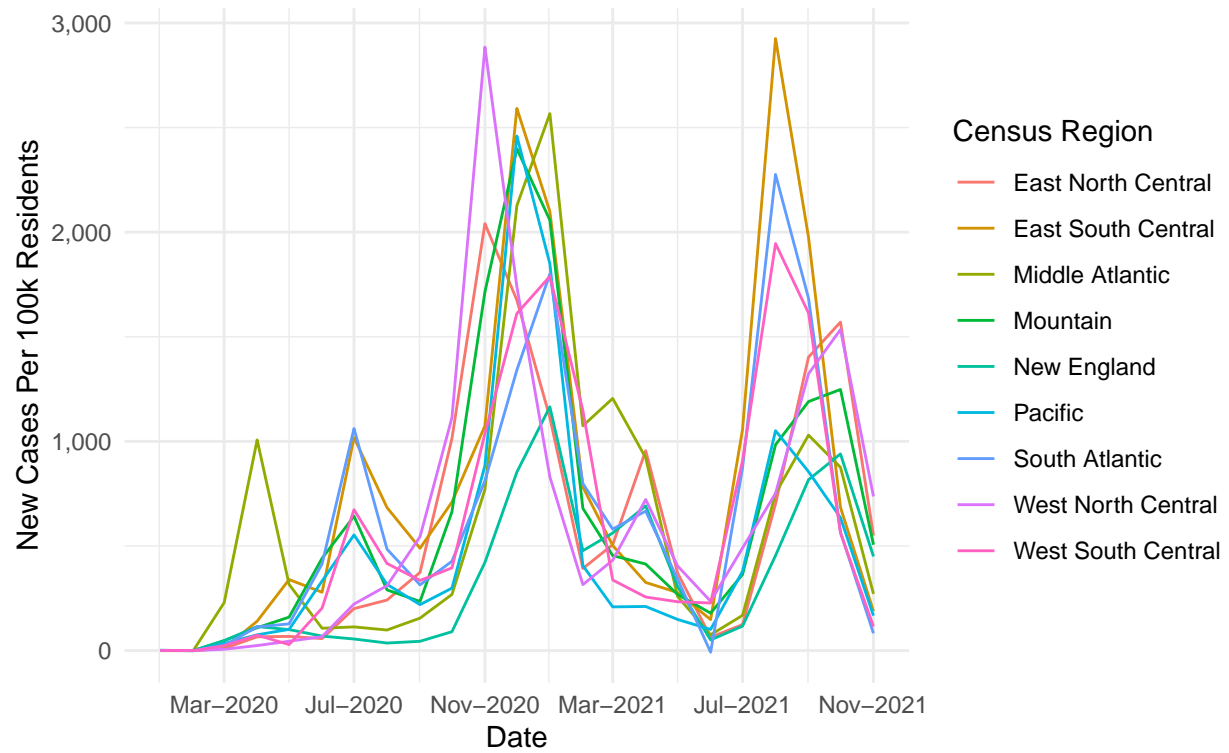
# COVID-19 Monthly Infection Rate in Recreation Counties

January 2020 – November 2021



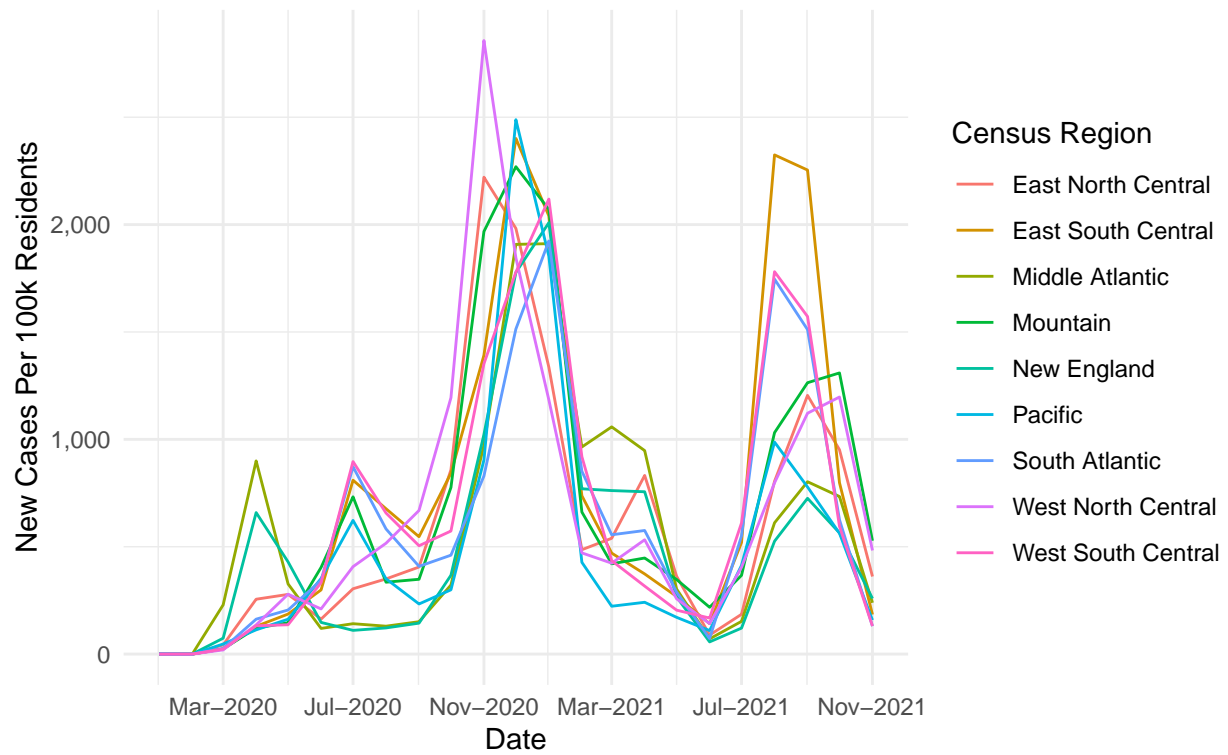
## COVID-19 Monthly Infection Rate in US Recreation Counties

January 2020 – November 2021



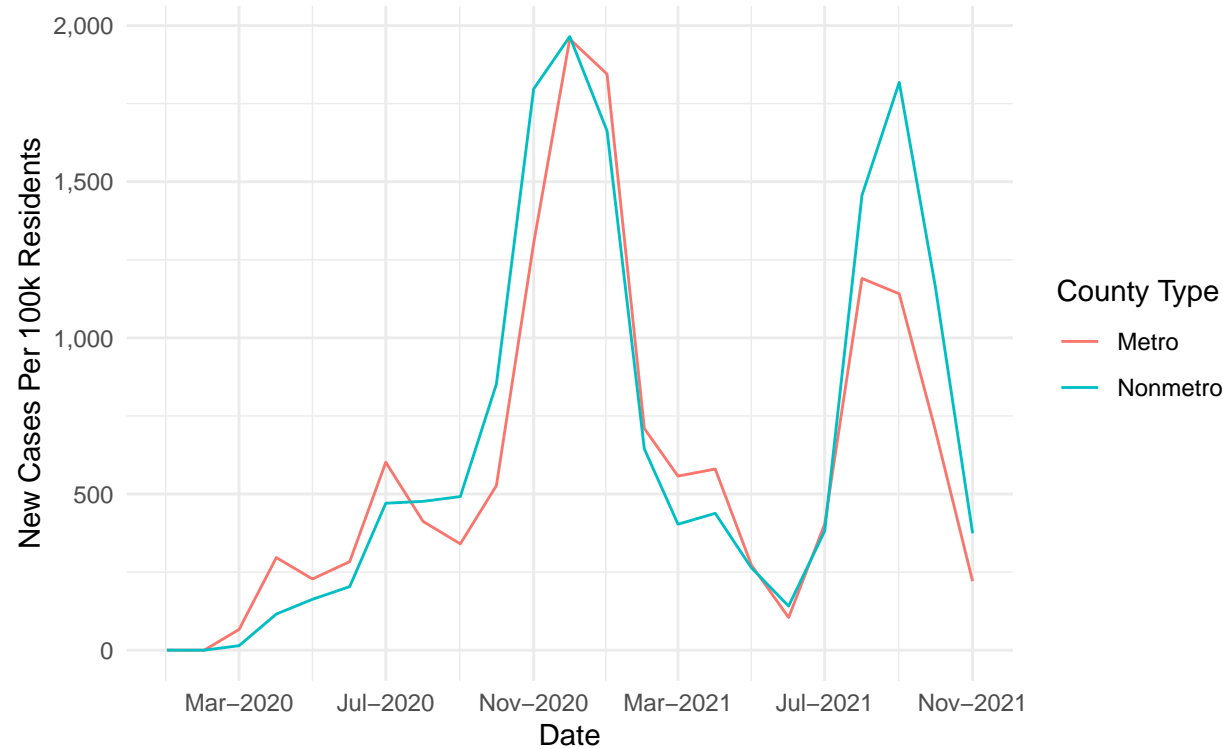
# COVID-19 Monthly Infection Rate in US Non-Rec Counties

January 2020 – November 2021



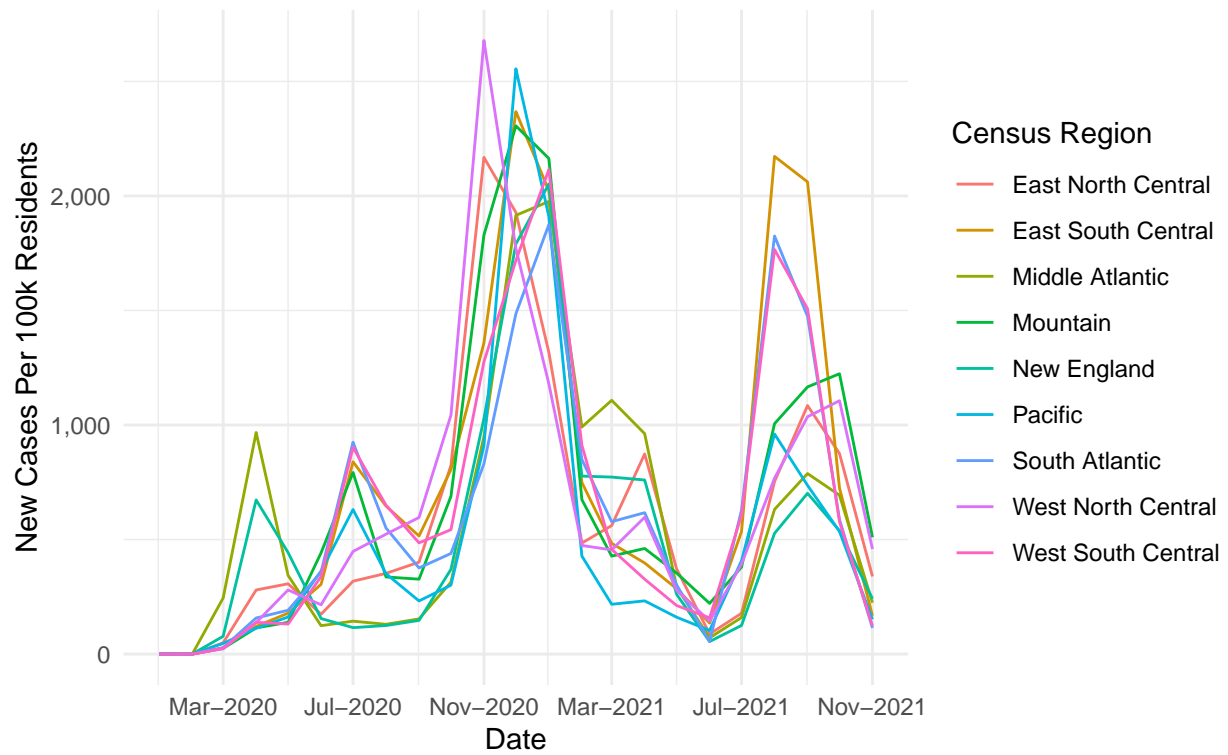
COVID-19 Monthly Infection Rate in Metro vs. Nonmetro US Counties

January 2020 – November 2021



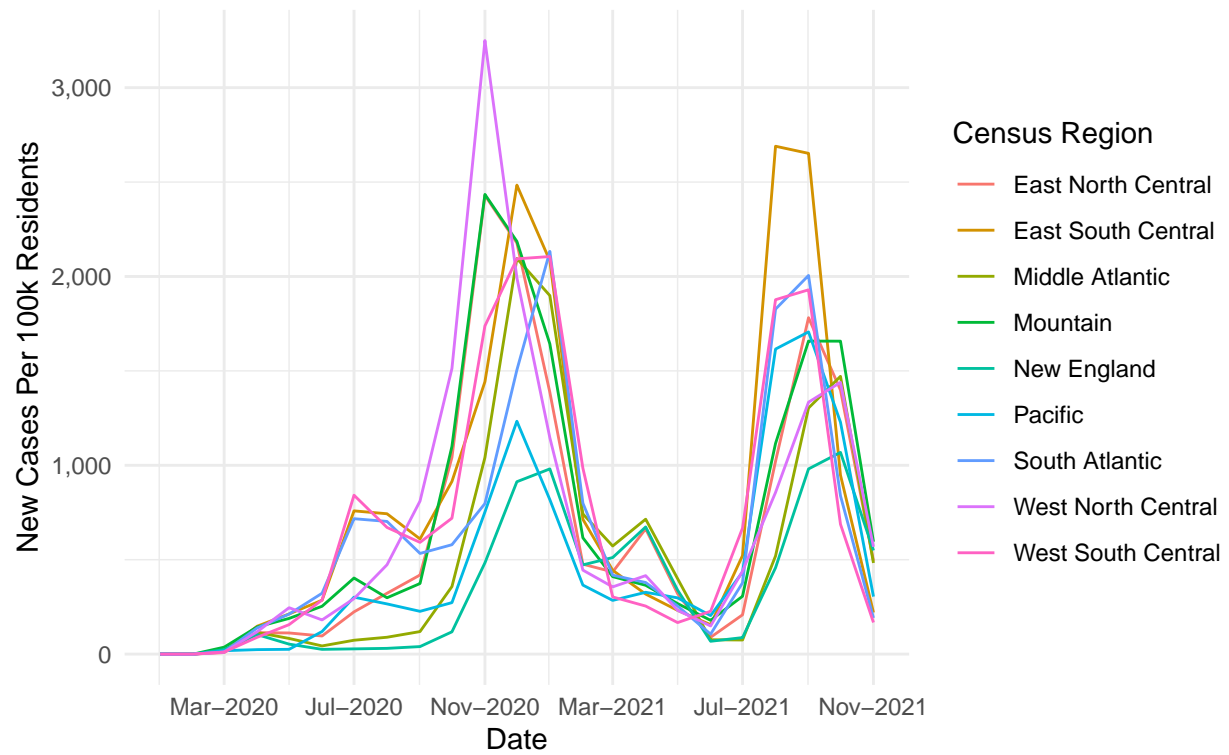
# COVID-19 Monthly Infection Rate in US Metro Counties

January 2020 – November 2021



# COVID-19 Monthly Infection Rate in US Nonmetro Counties

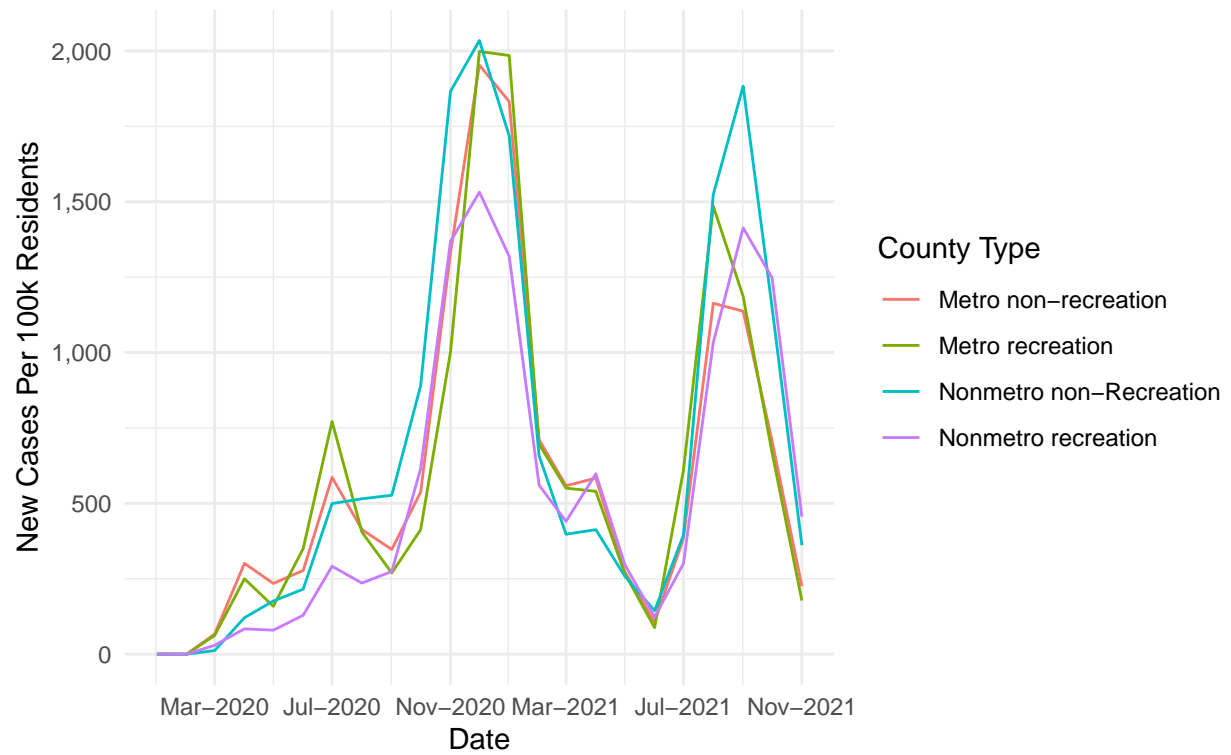
January 2020 – November 2021





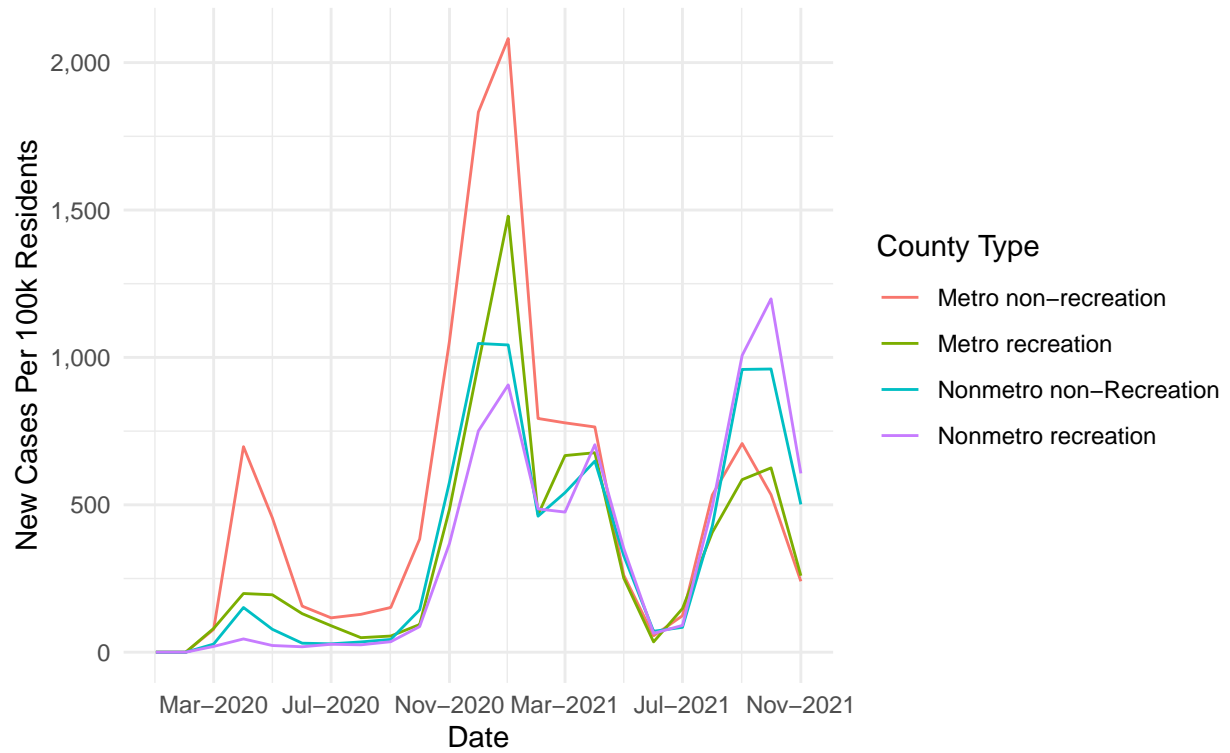
# COVID-19 Monthly Infection Rate US Counties

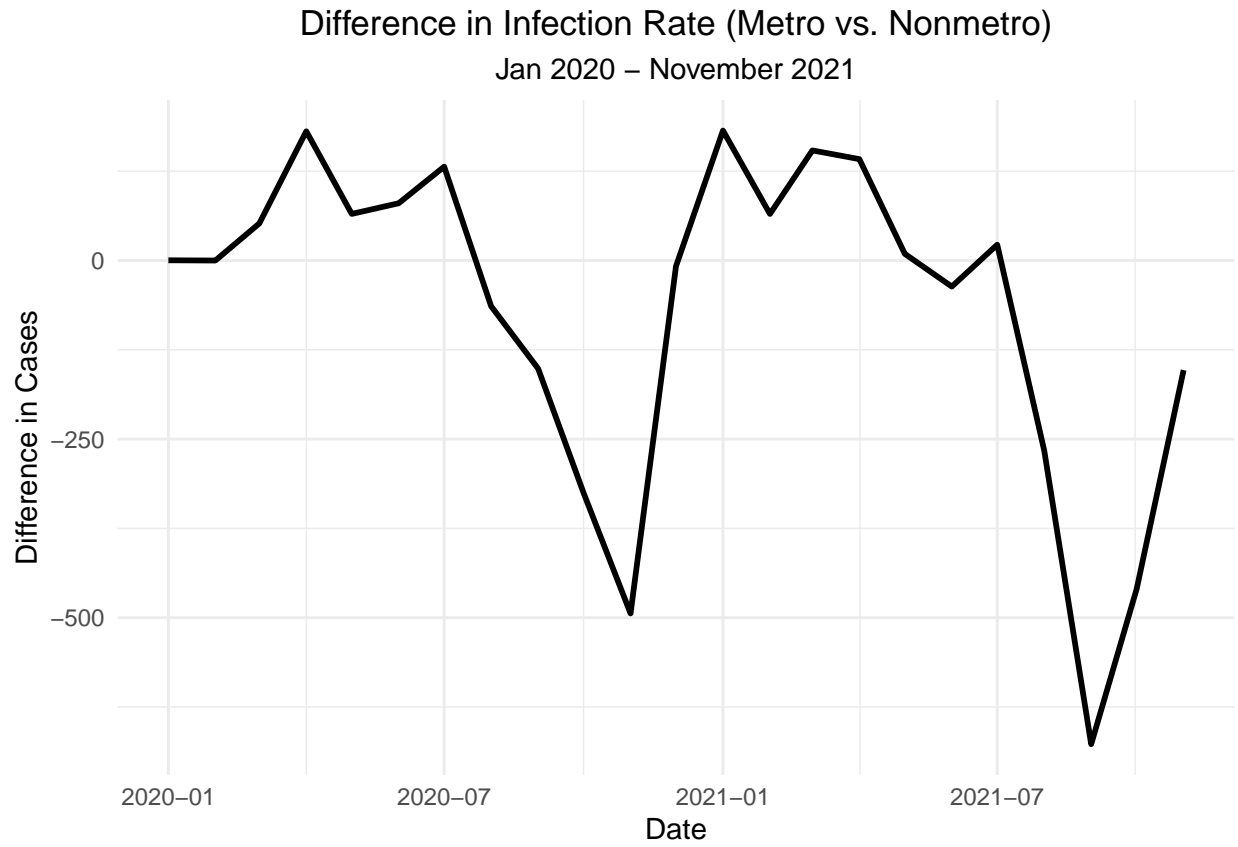
January 2020 – November 2021

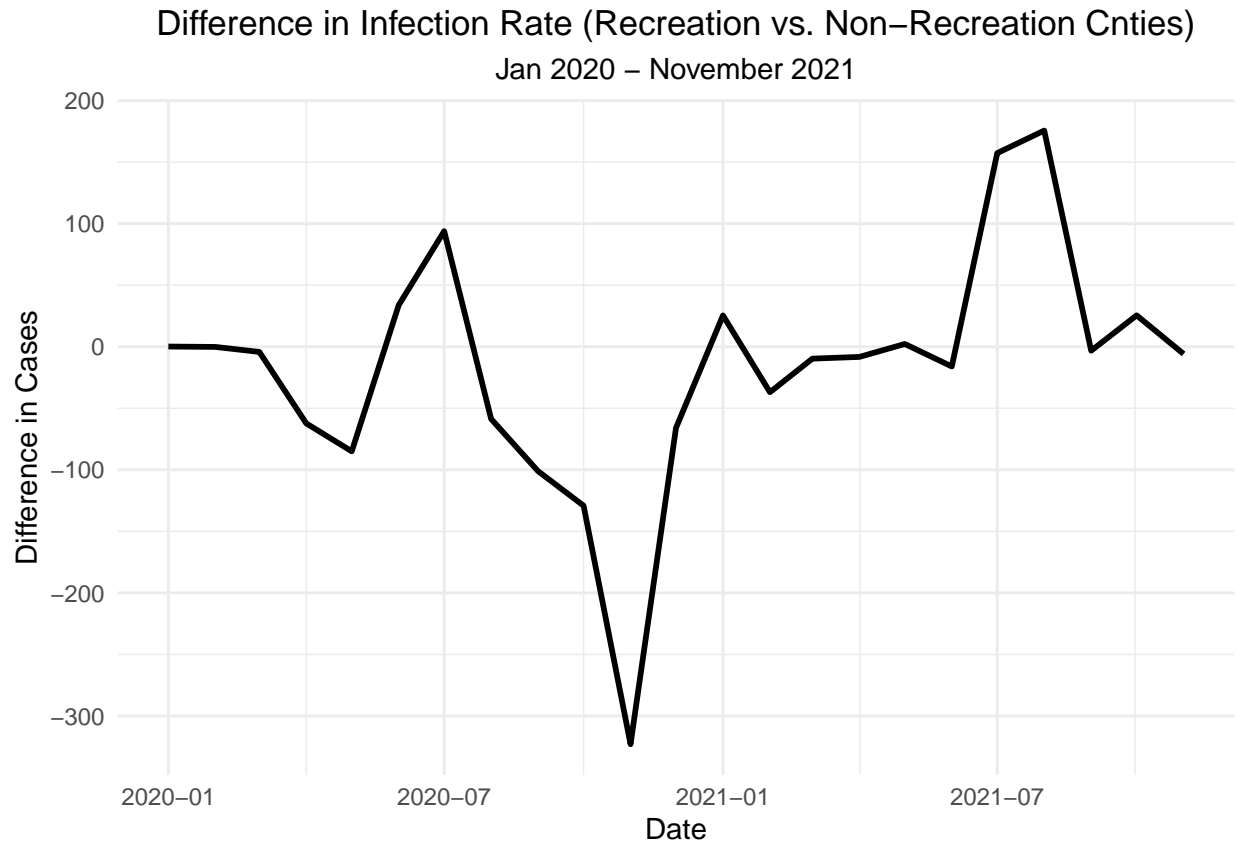


## COVID-19 Monthly Infection Rate in New England Counties

January 2020 – November 2021

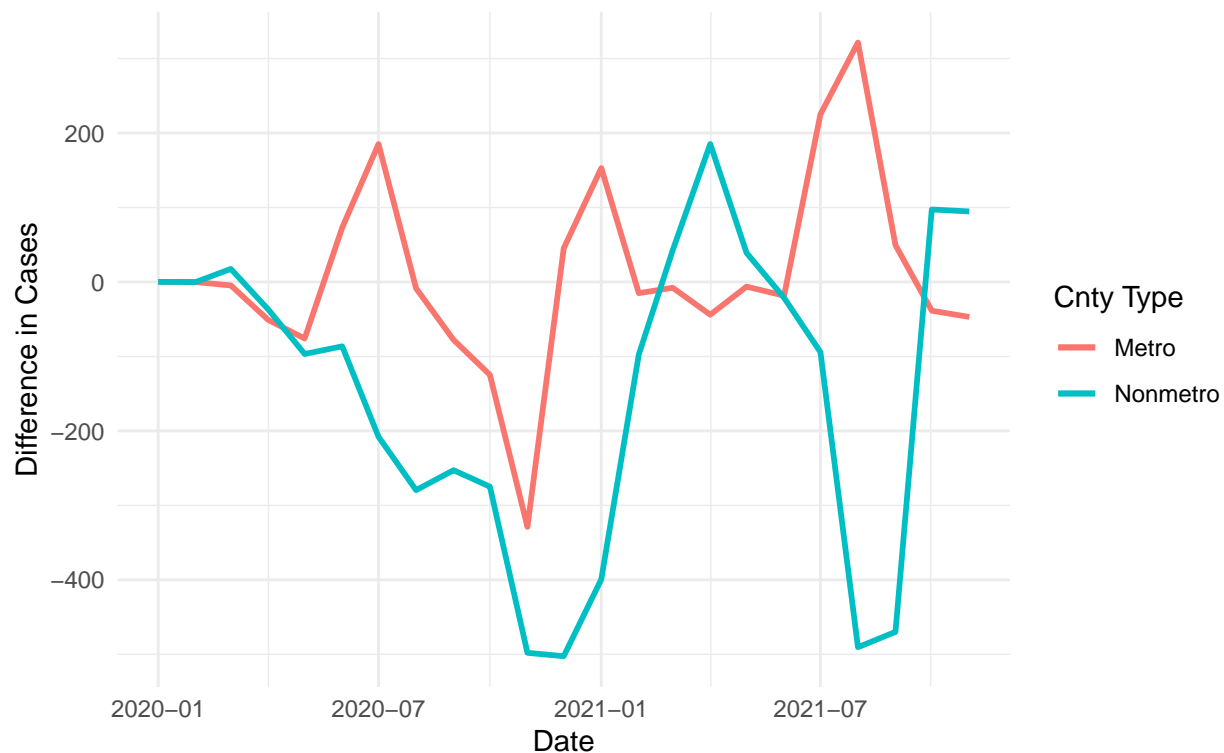






## Difference in Infection Rate (Recreation vs. Non-Recreation Cnties)

Jan 2020 – November 2021



```
## [1] 19
##
## Call:
## lm(formula = cumulative_cases_per_1k ~ census_region + county_type +
##     recreation + doses_per_100k, data = regression_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -118.02  -20.21   -0.34   18.69   598.94
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)    197.98053311  12.62465945  15.682
## census_regionEast South Central    25.47037233   2.49847221  10.194
## census_regionMiddle Atlantic    -8.38677842   4.52428435  -1.854
## census_regionMountain    -0.50782281   2.72434240  -0.186
## census_regionNew England   -42.94437226   5.37807926  -7.985
## census_regionPacific   -22.87721938   3.66689945  -6.239
## census_regionSouth Atlantic    -8.78103872   2.49248909  -3.523
## census_regionWest North Central    3.77782516   2.20341220   1.715
## census_regionWest South Central    9.10502369   2.32708231   3.913
## county_typeNonmetro     6.79351440   1.36640238   4.972
## recreationRecreation   -17.33689614   2.16858601  -7.995
## doses_per_100k    -0.00031582   0.00008079  -3.909
##
##              Pr(>|t|)
## (Intercept) < 0.0000000000000002 ***
```

```

## census_regionEast South Central < 0.0000000000000002 ***
## census_regionMiddle Atlantic          0.063877 .
## census_regionMountain                 0.852142
## census_regionNew England              0.00000000000000198 ***
## census_regionPacific                  0.00000000050307139 ***
## census_regionSouth Atlantic           0.000433 ***
## census_regionWest North Central       0.086534 .
## census_regionWest South Central      0.00009332984532758 ***
## county_typeNonmetro                  0.00000070069689844 ***
## recreationRecreation                  0.00000000000000184 ***
## doses_per_100k                       0.00009475007508036 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 34.62 on 2987 degrees of freedom
## Multiple R-squared:  0.2237, Adjusted R-squared:  0.2208
## F-statistic: 78.23 on 11 and 2987 DF,  p-value: < 0.00000000000000022
##
## Call:
## lm(formula = ln_cum_cases_per_cap ~ census_region + county_type +
##     recreation, data = regression_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.2171  -0.1177   0.0220   0.1446   1.9545
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)      4.997151   0.022075 226.375
## census_regionEast South Central  0.154975   0.029336   5.283
## census_regionMiddle Atlantic    -0.110910   0.048172  -2.302
## census_regionMountain           -0.028331   0.032313  -0.877
## census_regionNew England        -0.479198   0.054538  -8.787
## census_regionPacific            -0.412128   0.038639 -10.666
## census_regionSouth Atlantic     -0.115069   0.026433  -4.353
## census_regionWest North Central  0.005522   0.026032   0.212
## census_regionWest South Central  0.037079   0.027451   1.351
## county_typeNonmetro             0.049755   0.016207   3.070
## recreationRecreation            -0.183480   0.025663  -7.150
##              Pr(>|t|)
## (Intercept)      < 0.0000000000000002 ***
## census_regionEast South Central  0.00000013641082 ***
## census_regionMiddle Atlantic      0.02138 *
## census_regionMountain             0.38068
## census_regionNew England          < 0.0000000000000002 ***
## census_regionPacific              < 0.0000000000000002 ***
## census_regionSouth Atlantic       0.00001386111185 ***
## census_regionWest North Central    0.83204
## census_regionWest South Central    0.17688
## county_typeNonmetro               0.00216 **
## recreationRecreation              0.000000000000109 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```
##
## Residual standard error: 0.4106 on 2988 degrees of freedom
## Multiple R-squared:  0.1366, Adjusted R-squared:  0.1337
## F-statistic: 47.28 on 10 and 2988 DF,  p-value: < 0.00000000000000022

##
## Call:
## lm(formula = cumulative_cases_per_1k ~ census_region + county_type +
##     recreation + median_inc + college_degree_more + ages_18_64 +
##     p_vacant + proportion_white + doses_per_100k, data = regression_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -119.31  -19.25   -1.13   18.36   617.00
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)    133.70970321  17.60888459   7.593
## census_regionEast South Central    21.45732007   2.51856105   8.520
## census_regionMiddle Atlantic   -10.34701496   4.41863444  -2.342
## census_regionMountain         7.29489199   2.71688705   2.685
## census_regionNew England    -40.10778600   5.27661542  -7.601
## census_regionPacific    -24.69276640   3.69335106  -6.686
## census_regionSouth Atlantic  -12.05495520   2.62838298  -4.586
## census_regionWest North Central  10.36710132   2.20263917   4.707
## census_regionWest South Central   8.25690201   2.38138872   3.467
## county_typeNonmetro         6.85511360   1.59421102   4.300
## recreationRecreation        -1.84903678   2.48249967  -0.745
## median_inc        -0.00019858   0.00016731  -1.187
## college_degree_more    -89.43461844   9.80797153  -9.119
## ages_18_64        131.19969519  19.04973856   6.887
## p_vacant        -56.94095416   7.46740005  -7.625
## proportion_white        1.84849747   4.33139420   0.427
## doses_per_100k    -0.00014730   0.00008073  -1.825
##
##              Pr(>|t|)
## (Intercept)    0.0000000000000415 ***
## census_regionEast South Central < 0.0000000000000002 ***
## census_regionMiddle Atlantic      0.019263 *
## census_regionMountain      0.007293 **
## census_regionNew England    0.0000000000000391 ***
## census_regionPacific    0.0000000000273224 ***
## census_regionSouth Atlantic 0.0000046941614102 ***
## census_regionWest North Central 0.0000026327150303 ***
## census_regionWest South Central 0.000533 ***
## county_typeNonmetro    0.0000176274332822 ***
## recreationRecreation    0.456434
## median_inc      0.235350
## college_degree_more    < 0.0000000000000002 ***
## ages_18_64      0.0000000000069108 ***
## p_vacant      0.0000000000000325 ***
## proportion_white    0.669580
## doses_per_100k    0.068166 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 33.51 on 2982 degrees of freedom
## Multiple R-squared:  0.274, Adjusted R-squared:  0.2701
## F-statistic: 70.33 on 16 and 2982 DF,  p-value: < 0.00000000000000022

##
## Call:
## lm(formula = ln_cum_cases_per_cap ~ census_region + county_type +
##      recreation + median_inc + college_degree_more + ages_18_64 +
##      p_vacant + proportion_white, data = regression_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.4722  -0.1200   0.0110   0.1336   2.6816
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)      5.892297483  0.160463923  36.720
## census_regionEast South Central  0.121786097  0.029907955   4.072
## census_regionMiddle Atlantic  -0.062218369  0.046951552  -1.325
## census_regionMountain      0.017263947  0.032339226   0.534
## census_regionNew England    -0.374019000  0.054096418  -6.914
## census_regionPacific      -0.374765836  0.038467203  -9.742
## census_regionSouth Atlantic -0.099263503  0.027313943  -3.634
## census_regionWest North Central  0.023852322  0.026171546   0.911
## census_regionWest South Central  0.052557336  0.028001490   1.877
## county_typeNonmetro      0.040711437  0.018968419   2.146
## recreationRecreation    -0.029988897  0.029545007  -1.015
## median_inc        -0.000013597  0.000001985  -6.851
## college_degree_more  -0.187119086  0.116450180  -1.607
## ages_18_64        -0.718411844  0.226700640  -3.169
## p_vacant          -0.957254558  0.088622313 -10.802
## proportion_white      0.140394029  0.050812419   2.763
##              Pr(>|t|)
## (Intercept)      < 0.0000000000000002 ***
## census_regionEast South Central  0.00004781713750 ***
## census_regionMiddle Atlantic      0.185219
## census_regionMountain      0.593493
## census_regionNew England    0.00000000000574 ***
## census_regionPacific      < 0.0000000000000002 ***
## census_regionSouth Atlantic      0.000284 ***
## census_regionWest North Central  0.362167
## census_regionWest South Central  0.060623 .
## county_typeNonmetro      0.031932 *
## recreationRecreation      0.310177
## median_inc        0.000000000000890 ***
## college_degree_more  0.108191
## ages_18_64        0.001545 **
## p_vacant          < 0.0000000000000002 ***
## proportion_white      0.005763 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3988 on 2983 degrees of freedom
```



```

## Multiple R-squared:  0.1868, Adjusted R-squared:  0.1827
## F-statistic: 45.69 on 15 and 2983 DF,  p-value: < 0.00000000000000022

##
## Call:
## lm(formula = cumulative_cases_per_1k ~ recreation + county_type +
##     recreation:county_type + census_region + median_inc + college_degree_more +
##     ages_18_64 + p_vacant + proportion_white + doses_per_100k,
##     data = regression_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -119.46  -19.34   -0.90   18.43  616.23
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)    133.17707265   17.60902182    7.563
## recreationRecreation      2.46384857    3.82488123    0.644
## county_typeNonmetro      7.43025893    1.64045898    4.529
## census_regionEast South Central    21.20962325    2.52359697    8.405
## census_regionMiddle Atlantic    -10.55025715    4.41987660   -2.387
## census_regionMountain      7.10090190    2.71949442    2.611
## census_regionNew England    -39.97548752    5.27631262   -7.576
## census_regionPacific    -24.87406045    3.69463629   -6.732
## census_regionSouth Atlantic    -12.30285414    2.63317450   -4.672
## census_regionWest North Central    10.13488977    2.20776485    4.591
## census_regionWest South Central     8.05062457    2.38497634    3.376
## median_inc      -0.00020324    0.00016730   -1.215
## college_degree_more    -88.37383046    9.83209481   -8.988
## ages_18_64     131.65692071   19.04841741    6.912
## p_vacant      -55.74668783    7.50926840   -7.424
## proportion_white     1.89528768    4.33064076    0.438
## doses_per_100k    -0.00014950    0.00008073   -1.852
## recreationRecreation:county_typeNonmetro    -6.58181780    4.44123580   -1.482
##
##              Pr(>|t|)
## (Intercept)    0.0000000000000521 ***
## recreationRecreation      0.519519
## county_typeNonmetro      0.0000061479826319 ***
## census_regionEast South Central < 0.0000000000000002 ***
## census_regionMiddle Atlantic      0.017048 *
## census_regionMountain      0.009070 **
## census_regionNew England    0.0000000000000471 ***
## census_regionPacific      0.0000000000199302 ***
## census_regionSouth Atlantic    0.0000031111675578 ***
## census_regionWest North Central    0.0000046033025763 ***
## census_regionWest South Central      0.000746 ***
## median_inc      0.224548
## college_degree_more < 0.0000000000000002 ***
## ages_18_64      0.0000000000058330 ***
## p_vacant      0.0000000000001478 ***
## proportion_white      0.661675
## doses_per_100k      0.064145 .
## recreationRecreation:county_typeNonmetro      0.138452
## ---

```

```

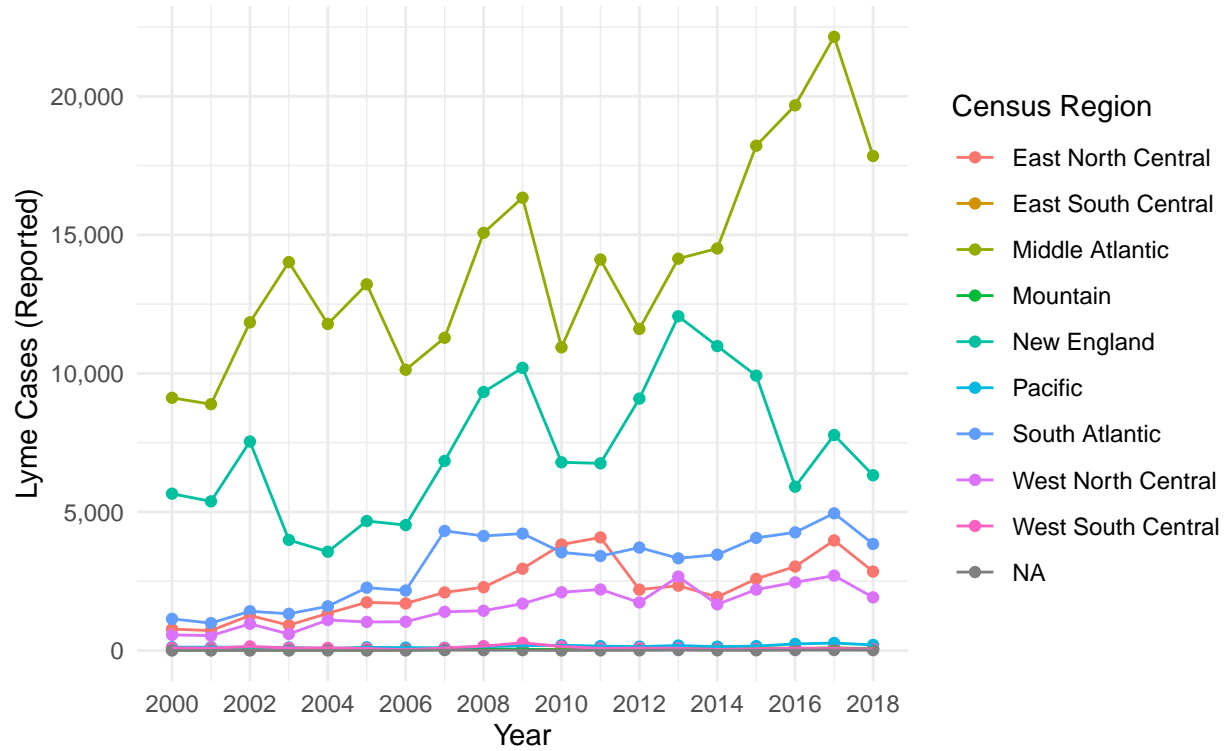
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 33.5 on 2981 degrees of freedom
## Multiple R-squared:  0.2745, Adjusted R-squared:  0.2704
## F-statistic: 66.34 on 17 and 2981 DF,  p-value: < 0.00000000000000022
##
## Call:
## lm(formula = ln_cum_cases_per_cap ~ recreation + county_type +
##     recreation:county_type + census_region + median_inc + college_degree_more +
##     ages_18_64 + p_vacant + proportion_white, data = regression_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.3451  -0.1194   0.0093   0.1343   2.7027
##
## Coefficients:
##              Estimate Std. Error t value
## (Intercept)      5.916039241  0.160300091  36.906
## recreationRecreation -0.151767217  0.045449986  -3.339
## county_typeNonmetro  0.024510641  0.019483342   1.258
## census_regionEast South Central  0.128645379  0.029914473   4.300
## census_regionMiddle Atlantic -0.054950787  0.046907535  -1.171
## census_regionMountain  0.022736457  0.032315012   0.704
## census_regionNew England -0.375693097  0.053995452  -6.958
## census_regionPacific -0.368274068  0.038438159  -9.581
## census_regionSouth Atlantic -0.091280693  0.027356012  -3.337
## census_regionWest North Central  0.030508157  0.026189989   1.165
## census_regionWest South Central  0.058664605  0.028001913   2.095
## median_inc -0.000013455  0.000001981  -6.791
## college_degree_more -0.216528128  0.116528035  -1.858
## ages_18_64 -0.731624633  0.226299864  -3.233
## p_vacant -0.990525901  0.088956742 -11.135
## proportion_white  0.139636859  0.050716072   2.753
## recreationRecreation:county_typeNonmetro  0.185793844  0.052765263   3.521
##              Pr(>|t|)
## (Intercept) < 0.0000000000000002 ***
## recreationRecreation 0.000850 ***
## county_typeNonmetro 0.208479
## census_regionEast South Central 0.00001759303385 ***
## census_regionMiddle Atlantic 0.241503
## census_regionMountain 0.481744
## census_regionNew England 0.00000000000423 ***
## census_regionPacific < 0.0000000000000002 ***
## census_regionSouth Atlantic 0.000858 ***
## census_regionWest North Central 0.244161
## census_regionWest South Central 0.036253 *
## median_inc 0.00000000001343 ***
## college_degree_more 0.063244 .
## ages_18_64 0.001238 **
## p_vacant < 0.0000000000000002 ***
## proportion_white 0.005935 **
## recreationRecreation:county_typeNonmetro 0.000436 ***
## ---

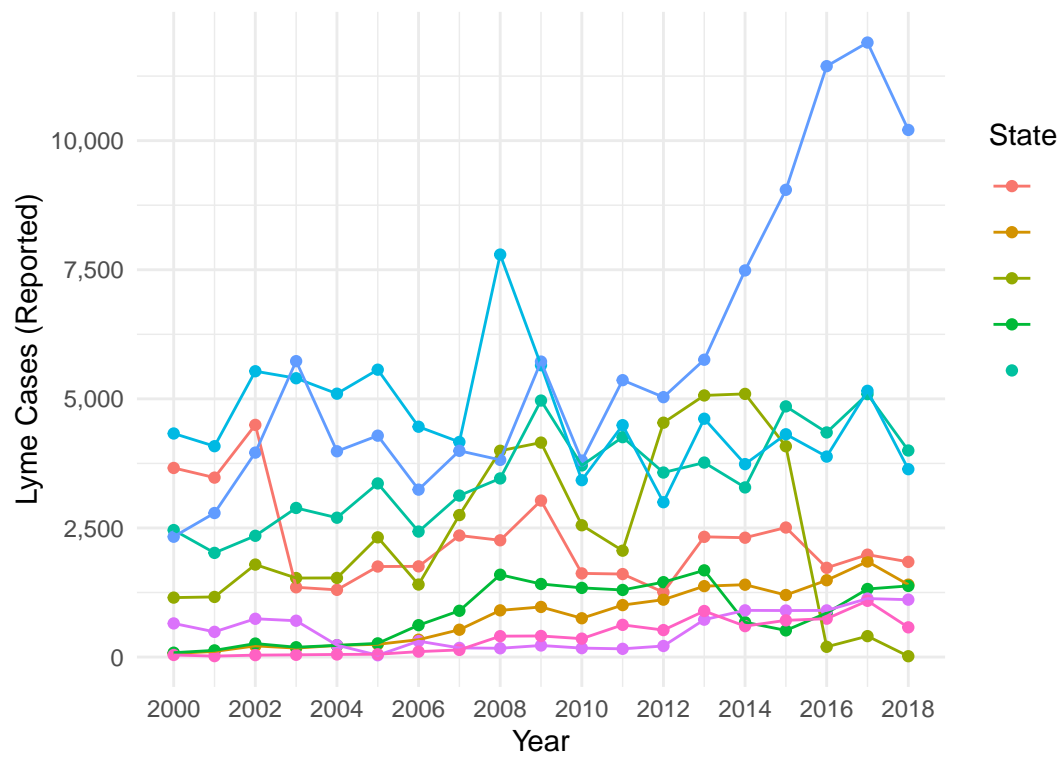
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Residual standard error: 0.3981 on 2982 degrees of freedom  
## Multiple R-squared:  0.1902, Adjusted R-squared:  0.1859  
## F-statistic: 43.77 on 16 and 2982 DF, p-value: < 0.00000000000000022  
##  
## \begin{table}[!htbp] \centering  
##   \caption{Impact of Cnty Typology and Demographics on COVID-19 Infection Rates}  
##     \label{}  
## \begin{tabular}{@{\extracolsep{-10pt}}lccc}  
## \hline[-1.8ex]  
## \hline \hline[-1.8ex]  
## \hline[-1.8ex] & \multicolumn{3}{c}{cumulative\_cases\_per\_1k} \\ ##  
## \hline[-1.8ex] & (1) & (2) & (3) \\ ##  
## \hline \hline[-1.8ex]  
## county\_typeNonmetro & 6.794$^{***}$ & 6.855$^{***}$ & 7.430$^{***}$ \\ ##  
## & (1.366) & (1.594) & (1.640) \\ ##  
## & & & \\ ##  
## recreationRecreation & $-$17.337$^{***}$ & $-$1.849 & 2.464 \\ ##  
## & (2.169) & (2.482) & (3.825) \\ ##  
## & & & \\ ##  
## median\_inc & & $-$0.0002 & $-$0.0002 \\ ##  
## & & (0.0002) & (0.0002) \\ ##  
## & & & \\ ##  
## college\_degree\_more & & $-$89.435$^{***}$ & $-$88.374$^{***}$ \\ ##  
## & & (9.808) & (9.832) \\ ##  
## & & & \\ ##  
## ages\_18\_64 & & 131.200$^{***}$ & 131.657$^{***}$ \\ ##  
## & & (19.050) & (19.048) \\ ##  
## & & & \\ ##  
## p\_vacant & & $-$56.941$^{***}$ & $-$55.747$^{***}$ \\ ##  
## & & (7.467) & (7.509) \\ ##  
## & & & \\ ##  
## proportion\_white & & 1.848 & 1.895 \\ ##  
## & & (4.331) & (4.331) \\ ##  
## & & & \\ ##  
## doses\_per\_100k & $-$0.0003$^{***}$ & $-$0.0001$^{*}$ & $-$0.0001$^{*}$ \\ ##  
## & (0.0001) & (0.0001) & (0.0001) \\ ##  
## & & & \\ ##  
## recreationRecreation:county\_typeNonmetro & & & $-$6.582 \\ ##  
## & & & (4.441) \\ ##  
## & & & \\ ##  
## Constant & 197.981$^{***}$ & 133.710$^{***}$ & 133.177$^{***}$ \\ ##  
## & (12.625) & (17.609) & (17.609) \\ ##  
## & & & \\ ##  
## \textit{N} & 2,999 & 2,999 & 2,999 \\ ##  
## R$^2$ & 0.224 & 0.274 & 0.274 \\ ##  
## Adjusted R$^2$ & 0.221 & 0.270 & 0.270 \\ ##  
## \hline  
## \hline \hline[-1.8ex]  
## \textit{Notes:} & \multicolumn{3}{r}{$^{***}$Significant at the 1 percent level.} \\ ##  
## & \multicolumn{3}{r}{$^{**}$Significant at the 5 percent level.} \\ ##  
## & \multicolumn{3}{r}{$^{*}$Significant at the 10 percent level.}
```

```
## \end{tabular}  
## \end{table}
```

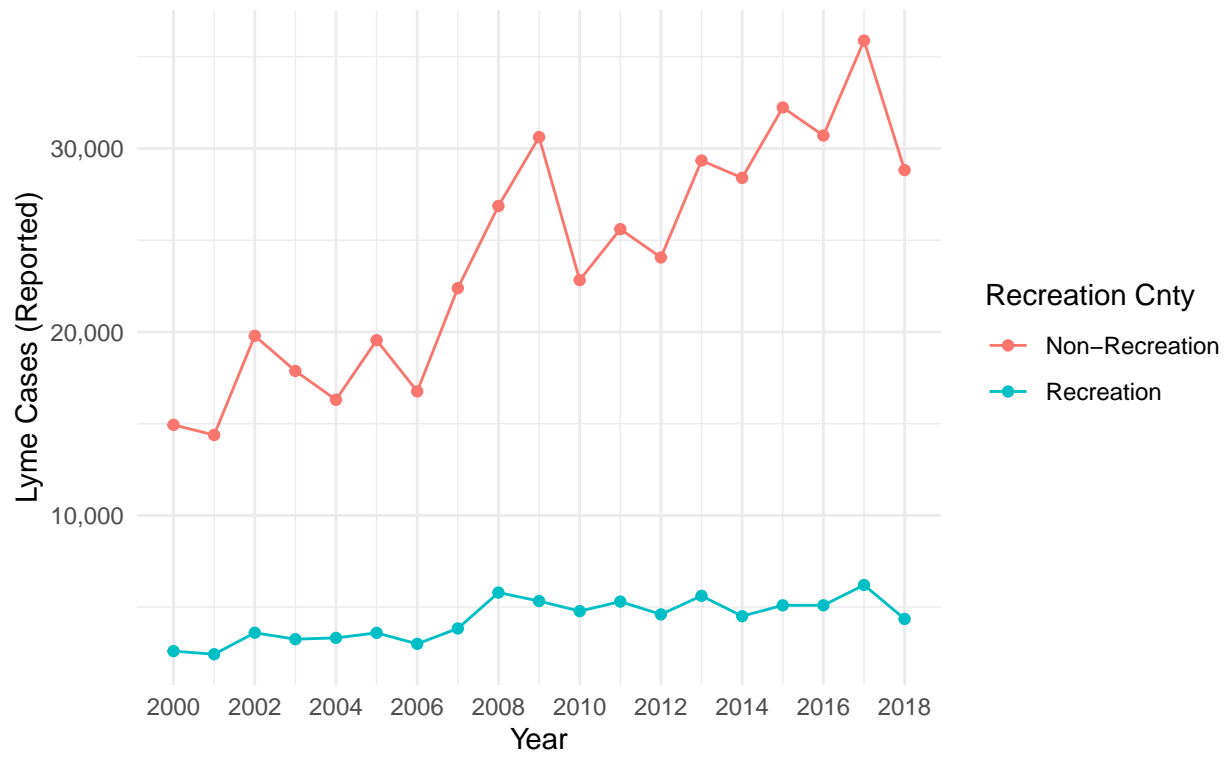
### Lyme Disease Cases by Census Region 2000 – 2018



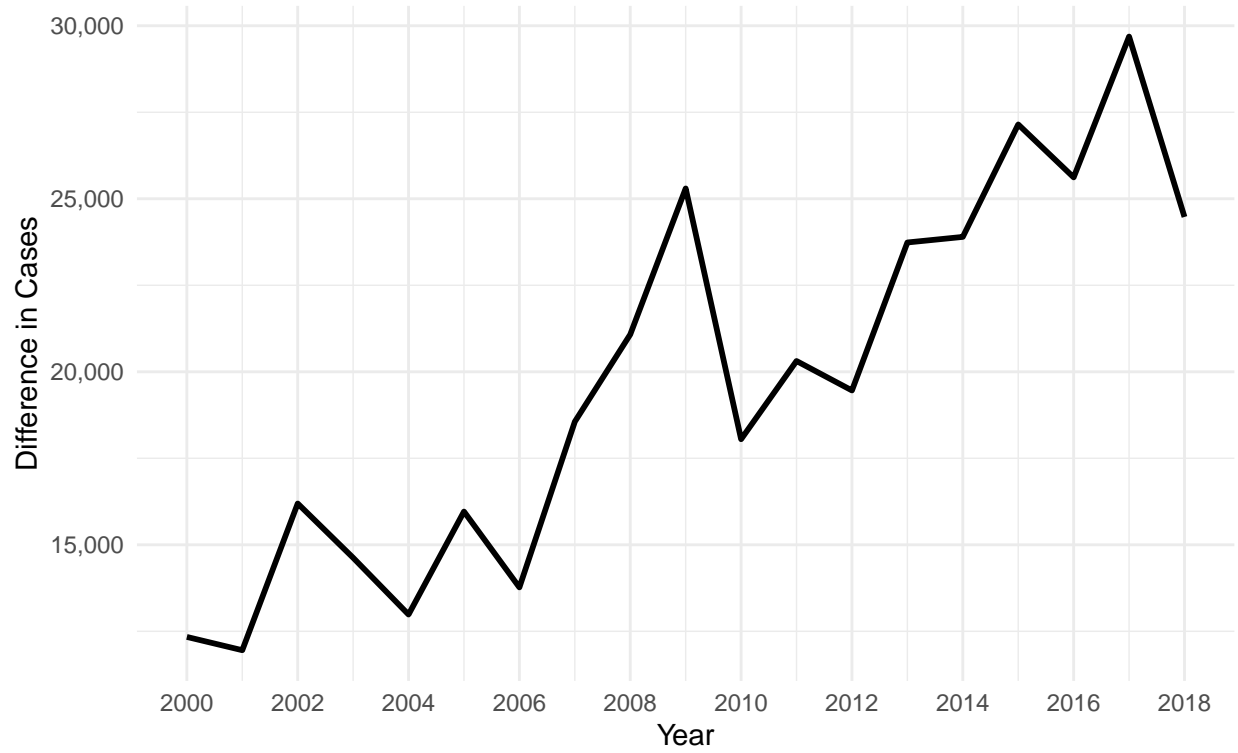


# Lyme Disease Cases in Recreation Counties

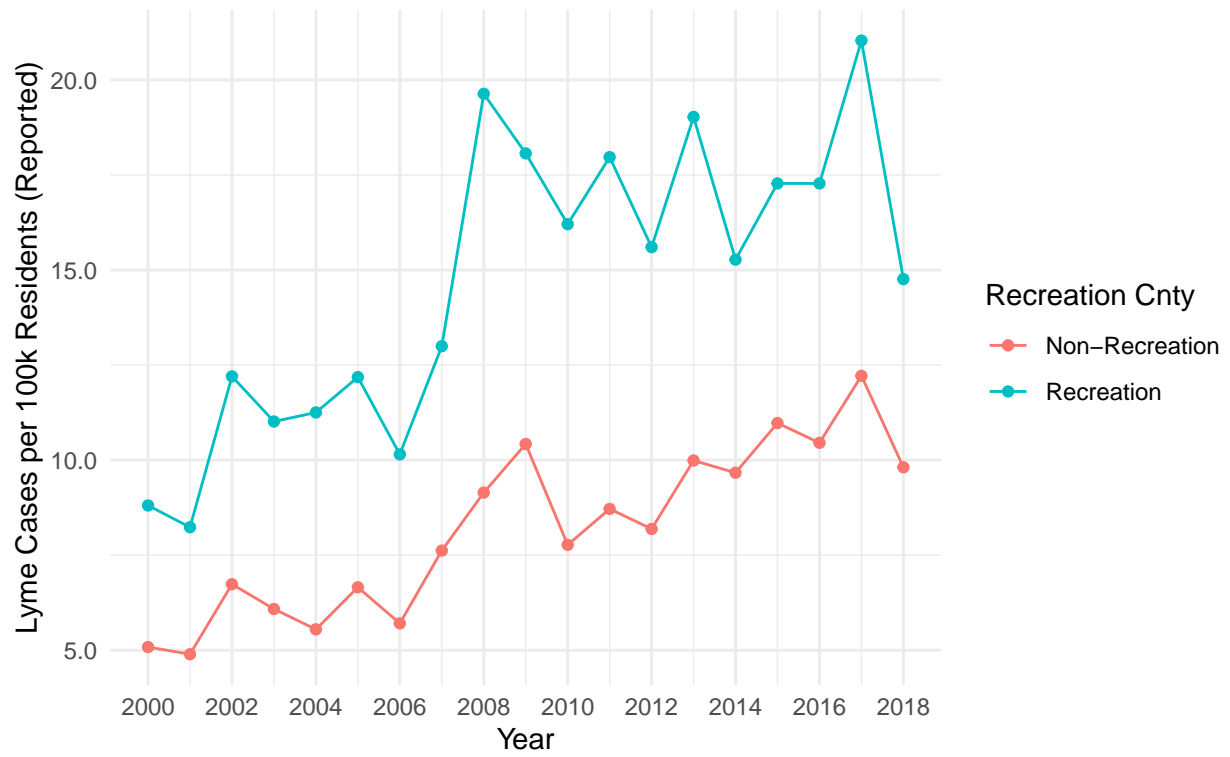
2000 – 2018



Difference in Lyme Disease Cases (NonRec vs. Recreation Counties)  
2000 – 2018



# Lyme Disease Cases in Recreation Counties 2000 – 2018





Difference in Lyme Disease Cases per 100k (Rec vs. Nonrec Counties)  
2000 – 2018

