Chicago Domestic Crimes During Pandemic

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INTRODUCTION AND DATA

-introduce your general research question and your data (where it came from, how it was collected, what are the cases, what are the variables, etc.). -Define what we mean by domestic violence

METHODOLOGY

-variables used to address your research question -useful visualizations or summary statistics -introduce and justify the statistical method(s) that you believe will be useful in answering your research question.

```
## Rows: 231,002
## Columns: 21
## $ CASE.                  <chr> "JD163753", "JD212847", "JC497784", "JC459410...
## $ DATE..OF.OCCURRENCE    <chr> "02/24/2020 08:15:00 PM", "04/10/2020 10:56:0...
## $ BLOCK                  <chr> "031XX W LEXINGTON ST", "005XX W 103RD ST", "...
## $ IUCR                   <chr> "1153", "0560", "0860", "0560", "0810", "0820...
## $ PRIMARY.DESCRIPTION    <chr> "DECEPTIVE PRACTICE", "ASSAULT", "THEFT", "AS...
## $ SECONDARY.DESCRIPTION <chr> "FINANCIAL IDENTITY THEFT OVER $ 300", "SIMPL...
## $ LOCATION.DESCRIPTION   <chr> "", "RESIDENCE", "DEPARTMENT STORE", "SIDEWAL...
## $ ARREST                 <chr> "N", "N", "N", "N", "N", "N", "N", "N", "N", ...
## $ DOMESTIC               <chr> "N", "N", "N", "N", "N", "N", "N", "N", "N", ...
## $ BEAT                   <int> 1134, 2232, 1924, 122, 123, 2433, 312, 914, 3...
## $ WARD                   <int> 24, 9, 44, 4, 25, 48, 20, 11, 5, 26, 27, 37, ...
## $ FBI.CD                 <chr> "11", "08A", "06", "08A", "06", "06", "08A", ...
## $ X.COORDINATE           <int> NA, 1174583, NA, NA, NA, NA, 1180030, 1171590...
## $ Y.COORDINATE           <int> NA, 1836593, NA, NA, NA, NA, 1862317, 1887793...
## $ LATITUDE               <dbl> NA, 41.70700, NA, NA, NA, NA, 41.77747, 41.84...
## $ LONGITUDE              <dbl> NA, -87.63629, NA, NA, NA, NA, -87.61556, -87...
## $ LOCATION               <chr> "", "(41.707000821, -87.636288063)", "", "", ...
## $ MONTH                  <int> 2, 4, 11, 10, 5, 12, 5, 5, 4, 5, 4, 5, 5, 5, ...
## $ DAY                    <int> 24, 10, 3, 4, 24, 5, 7, 3, 28, 7, 25, 7, 7, 5...
## $ YEAR                   <int> 2020, 2020, 2019, 2019, 2020, 2019, 2020, 202...
## $ DATEINT                <int> 20200224, 20200410, 20191103, 20191004, 20200...
```

```
## # A tibble: 430 x 2
##    SECONDARY.DESCRIPTION                n
##    <chr>                            <int>
##  1 $500 AND UNDER                   20888
##  2 ABUSE / NEGLECT - CARE FACILITY      5
##  3 ABUSE/NEGLECT: CARE FACILITY        10
##  4 AGG CRIM SEX ABUSE FAM MEMBER       78
##  5 AGG CRIMINAL SEXUAL ABUSE           63
##  6 AGG PO HANDS ETC SERIOUS INJ         8
##  7 AGG PO HANDS NO/MIN INJURY         593
```

```
##  8 AGG PRO EMP HANDS SERIOUS INJ      16
##  9 AGG PRO.EMP: HANDGUN               26
## 10 AGG PRO.EMP: OTHER DANG WEAPON     85
## # ... with 420 more rows
```

```
##   isbeforecovid      n
## 1             0  90305
## 2             1 140697
```

```
##   isprelockdown      n
## 1             0 196383
## 2             1  34619
```

```
##   islockdown      n
## 1          0 214160
## 2          1  16842
```

```
##   isphase2      n
## 1        0 212424
## 2        1  18578
```

```
##   isphase3      n
## 1        0 218280
## 2        1  12722
```

```
##   isphase4      n
## 1        0 223458
## 2        1   7544
```

```
##   isdomviolence      n
## 1             0 206105
## 2             1  24897
```

```
## [1] isdomviolence n
## <0 rows> (or 0-length row.names)
```

```
##   isdomviolence     n
## 1             0 15502
## 2             1  1842
```

RESULTS

-Showcase how -Provide the main results from your analysis

```
##
##               0    1
##   20190710  664   70
##   20190711  675   89
##   20190712  702   82
##   20190713  778  112
##   20190714  664  124
##   20190715  755   65
##   20190716  671   83
##   20190717  730   71
##   20190718  673   83
##   20190719  692  105
##   20190720  736   87
##   20190721  658  114
```

```
##   20190722  725   64
##   20190723  719   63
##   20190724  681   58
##   20190725  723   75
##   20190726  736   75
##   20190727  718  106
##   20190728  723  106
##   20190729  721   88
##   20190730  707   63
##   20190731  651   59
##   20190801  813   64
##   20190802  805   69
##   20190803  779   85
##   20190804  732  106
##   20190805  728   78
##   20190806  697   78
##   20190807  695   66
##   20190808  738   78
##   20190809  714   80
##   20190810  699   98
##   20190811  698  104
##   20190812  630   77
##   20190813  696   62
##   20190814  721   68
##   20190815  729   76
##   20190816  707   62
##   20190817  713   94
##   20190818  650  107
##   20190819  703   78
##   20190820  638   84
##   20190821  654   61
##   20190822  683   68
##   20190823  700   69
##   20190824  706  107
##   20190825  646  118
##   20190826  649   75
##   20190827  658   71
##   20190828  679   67
##   20190829  689   81
##   20190830  694   69
##   20190831  691   81
##   20190901  787   84
##   20190902  680   94
##   20190903  610   59
##   20190904  623   57
##   20190905  571   71
##   20190906  696   69
##   20190907  638   90
##   20190908  614  105
##   20190909  700   69
##   20190910  641   75
##   20190911  670   73
##   20190912  712   71
##   20190913  715   94
```

```
##   20190914  664   91
##   20190915  663  117
##   20190916  736   68
##   20190917  705   70
##   20190918  686   60
##   20190919  711   70
##   20190920  734   76
##   20190921  675   79
##   20190922  573   83
##   20190923  705   61
##   20190924  678   67
##   20190925  641   62
##   20190926  635   73
##   20190927  603   62
##   20190928  636   55
##   20190929  619   94
##   20190930  696   54
##   20191001  796   60
##   20191002  677   46
##   20191003  661   59
##   20191004  650   56
##   20191005  633   81
##   20191006  596   74
##   20191007  685   56
##   20191008  648   57
##   20191009  661   64
##   20191010  593   50
##   20191011  653   63
##   20191012  658   64
##   20191013  599   97
##   20191014  623   61
##   20191015  685   48
##   20191016  675   60
##   20191017  620   50
##   20191018  637   64
##   20191019  623   89
##   20191020  626   93
##   20191021  639   73
##   20191022  599   55
##   20191023  644   53
##   20191024  655   55
##   20191025  676   71
##   20191026  487   70
##   20191027  621   80
##   20191028  589   69
##   20191029  561   63
##   20191030  504   67
##   20191031  524   59
##   20191101  748   62
##   20191102  590   71
##   20191103  626   91
##   20191104  595   69
##   20191105  573   57
##   20191106  595   61
```

```
##   20191107  598   64
##   20191108  606   69
##   20191109  627   79
##   20191110  568   80
##   20191111  447   45
##   20191112  492   49
##   20191113  509   66
##   20191114  534   40
##   20191115  681   67
##   20191116  583   78
##   20191117  616   84
##   20191118  614   63
##   20191119  619   56
##   20191120  654   70
##   20191121  592   65
##   20191122  658   62
##   20191123  617   78
##   20191124  615   82
##   20191125  629   57
##   20191126  601   72
##   20191127  579   54
##   20191128  425   78
##   20191129  559   84
##   20191130  595   67
##   20191201  630   69
##   20191202  648   57
##   20191203  631   55
##   20191204  672   63
##   20191205  633   63
##   20191206  659   71
##   20191207  617   75
##   20191208  577   92
##   20191209  638   60
##   20191210  619   49
##   20191211  545   52
##   20191212  602   50
##   20191213  664   63
##   20191214  606   73
##   20191215  566   87
##   20191216  566   56
##   20191217  600   65
##   20191218  568   72
##   20191219  605   76
##   20191220  666   49
##   20191221  668   71
##   20191222  606   69
##   20191223  619   63
##   20191224  538   70
##   20191225  401  109
##   20191226  531   68
##   20191227  616   59
##   20191228  567   69
##   20191229  593   96
##   20191230  547   67
```

```
##   20191231  474   62
##   20200101  692  137
##   20200102  581   50
##   20200103  616   69
##   20200104  539   93
##   20200105  540   79
##   20200106  624   67
##   20200107  561   56
##   20200108  577   66
##   20200109  574   48
##   20200110  558   57
##   20200111  498   60
##   20200112  497   77
##   20200113  594   53
##   20200114  614   44
##   20200115  573   67
##   20200116  602   65
##   20200117  533   46
##   20200118  496   65
##   20200119  428   73
##   20200120  552   61
##   20200121  534   48
##   20200122  560   65
##   20200123  526   58
##   20200124  601   52
##   20200125  584   72
##   20200126  528   77
##   20200127  613   75
##   20200128  616   62
##   20200129  575   40
##   20200130  555   55
##   20200131  627   65
##   20200201  687   80
##   20200202  534  119
##   20200203  666   62
##   20200204  579   56
##   20200205  573   51
##   20200206  491   54
##   20200207  625   60
##   20200208  554   65
##   20200209  478   79
##   20200210  564   55
##   20200211  556   69
##   20200212  584   40
##   20200213  493   51
##   20200214  520   63
##   20200215  508   83
##   20200216  536   79
##   20200217  525   71
##   20200218  577   79
##   20200219  523   52
##   20200220  546   44
##   20200221  597   50
##   20200222  602   77
```

```
##   20200223  576   77
##   20200224  539   53
##   20200225  453   56
##   20200226  540   52
##   20200227  506   55
##   20200228  602   46
##   20200229  522   58
##   20200301  603   80
##   20200302  536   54
##   20200303  565   63
##   20200304  559   60
##   20200305  522   57
##   20200306  612   86
##   20200307  508   72
##   20200308  570   63
##   20200309  491   70
##   20200310  514   44
##   20200311  528   57
##   20200312  557   64
##   20200313  601   63
##   20200314  522   93
##   20200315  484   87
##   20200316  466   51
##   20200317  517   52
##   20200318  461   59
##   20200319  406   67
##   20200320  414   67
##   20200321  369   69
##   20200322  296   79
##   20200323  342   48
##   20200324  352   67
##   20200325  382   53
##   20200326  370   51
##   20200327  355   60
##   20200328  381   86
##   20200329  413   83
##   20200330  390   53
##   20200331  321   59
##   20200401  418   56
##   20200402  314   55
##   20200403  436   68
##   20200404  378   57
##   20200405  335   66
##   20200406  386   61
##   20200407  398   52
##   20200408  381   55
##   20200409  362   58
##   20200410  373   39
##   20200411  379   63
##   20200412  325   54
##   20200413  351   40
##   20200414  325   34
##   20200415  342   48
##   20200416  353   47
```

```
##   20200417  368   51
##   20200418  397   55
##   20200419  291   48
##   20200420  433   53
##   20200421  357   56
##   20200422  369   53
##   20200423  397   38
##   20200424  385   49
##   20200425  343   52
##   20200426  344   75
##   20200427  345   44
##   20200428  395   61
##   20200429  361   52
##   20200430  368   52
##   20200501  454   56
##   20200502  428   58
##   20200503  415   68
##   20200504  373   60
##   20200505  376   47
##   20200506  396   55
##   20200507  378   38
##   20200508  393   49
##   20200509  399   57
##   20200510  384   81
##   20200511  399   45
##   20200512  387   57
##   20200513  442   66
##   20200514  397   57
##   20200515  475   65
##   20200516  484   86
##   20200517  373   62
##   20200518  427   66
##   20200519  418   43
##   20200520  466   56
##   20200521  426   57
##   20200522  456   59
##   20200523  477   64
##   20200524  478   80
##   20200525  524  102
##   20200526  485   80
##   20200527  496   61
##   20200528  458   83
##   20200529  502   67
##   20200530  801   77
##   20200531 1783   49
##   20200601  756   54
##   20200602  592   75
##   20200603  530   75
##   20200604  462   61
##   20200605  458   74
##   20200606  433   77
##   20200607  464   78
##   20200608  450   57
##   20200609  428   58
```

```
##   20200610  416   70
##   20200611  475   62
##   20200612  507   77
##   20200613  410   87
##   20200614  447   81
##   20200615  479   69
##   20200616  475   64
##   20200617  503   76
##   20200618  495   80
##   20200619  505   72
##   20200620  552   83
##   20200621  474  103
##   20200622  555   91
##   20200623  494   64
##   20200624  485   76
##   20200625  531   59
##   20200626  464   68
##   20200627  480   81
##   20200628  522   83
##   20200629  466   66
##   20200630  472   63
##   20200701  497   85
##   20200702  540   68
##   20200703  576   70
##   20200704  591  102
##   20200705  562  102
##   20200706  518   72
##   20200707  444   51
##   20200708  439   62
```

Chi-Square Test

```
##
##     lockdown   post    pre
##   0    31109  17599 157397
##   1     4311   2667  17919
```

```
##
##  Pearson's Chi-squared test
##
## data:  table(domvio_mut$isdomviolence, domvio_mut$chisquare_indicators)
## X-squared = 247.63, df = 2, p-value < 2.2e-16
```

Since the data (Table 1) satisfies the independent sampling assumption and is large enough (i.e. each cell $>$ 10), we will be performing a chi-square test at the $\alpha = 0.05$ significance level. We test the two hypotheses below:

H0 : The frequency of domestic violence cases in Chicago is unrelated to the phases of the pandemic. H1 : The frequency of domestic violence cases in Chicago is related to the phases of the pandemic.

Under the null hypothesis, our test statistic has a chi-square distribution with 2 degrees of freedom. We performed the test and obtained a chi-square value of 247.63, which corresponds to a p-value of < 0.001. Thus, at an $\alpha = 0.05$ significance level, we reject the null hypothesis; there is sufficient evidence to suggest that the frequency of domestic violence cases in Chicago is related to the phases of the pandemic.

Step Down 2 Proportion Z-Tests Since the overall Chi-square test was significant, we stepped down to identify where the differences are. We conducted three 2 proportion z-tests. To account for multiple comparisons, we will perform the Bonferroni correction and thus assess our results relative to the adjusted $\alpha = 0.05/3$ level.

```
##
##  2-sample test for equality of proportions with continuity correction
##
## data:  c(4311, 2667) out of c(35420, 20266)
## X-squared = 11.411, df = 1, p-value = 0.0007303
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##  -0.01569439 -0.00408326
## sample estimates:
##    prop 1    prop 2
## 0.1217109 0.1315997
```

```
##
##  2-sample test for equality of proportions with continuity correction
##
## data:  c(2667, 17919) out of c(2667 + 17599, 17919 + 157397)
## X-squared = 166.3, df = 1, p-value < 2.2e-16
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##  0.024497 0.034283
## sample estimates:
##    prop 1    prop 2
## 0.1315997 0.1022097
```

```
##
##  2-sample test for equality of proportions with continuity correction
##
## data:  c(4311, 17919) out of c(35420, 17919 + 157397)
## X-squared = 118.55, df = 1, p-value < 2.2e-16
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##  0.01579582 0.02320653
## sample estimates:
##    prop 1    prop 2
## 0.1217109 0.1022097
```

```
## [1] 0.01666667
```

We found that all three pairwise difference in proportions are significant at the adjusted siginficance level.

Regression Analysis

DISCUSSION

-summary of what you have learned about your research question along -statistical arguments supporting your conclusions -critique your own methods and provide suggestions for improving your analysis (Issues pertaining to the reliability and validity of your data and appropriateness of the statistical analysis) -what you would do differently -what you would do next if you were going to continue work on the project