

Problemset5

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11/04/2020

Abstract

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Warning: package 'broom' was built under R version 3.6.2

Warning: package 'tidyverse' was built under R version 3.6.2

Warning: package 'tidyr' was built under R version 3.6.2

Warning: package 'gridExtra' was built under R version 3.6.2

Warning: package 'pastecs' was built under R version 3.6.2

```
##  x days_to_21  all felony misdemeanor fbi_offense_miss violent murder
## 1 1      -1461 5289    1556          3064          206    686      7
## 2 2      -1460 4800    1460          2756          196    581      8
## 3 3      -1459 4464    1356          2589          214    561      8
## 4 4      -1458 4425    1382          2511          180    587     15
## 5 5      -1457 4451    1423          2535          169    596      5
## 6 6      -1456 4501    1375          2593          176    587      9
##  manslaughter rape robbery assault aggravated_assault ot_assault property
## 1           2   18    136    523          205          318    1438
## 2           1    8    113    451          183          268    1392
## 3           1    5    105    442          160          282    1329
## 4           1   10    106    455          181          274    1361
## 5           0    7    106    478          190          288    1351
## 6           0   12    110    456          171          285    1373
##  burglary larceny mv_theft stolen_prop_buy_rec_poss vandalism ill_drugs
## 1        362    576    200          109          191    618
## 2        353    561    206          90          182    564
## 3        331    527    172          109          190    529
## 4        330    564    196          105          166    498
## 5        334    546    188          94          189    523
## 6        343    559    183          90          198    510
##  cocaine_opio_sale_manuf mj_sale_manuf dang_non_narc_sale_manuf
## 1                40          51          13
## 2                47          44          16
## 3                43          48           9
## 4                40          48           8
## 5                55          37          13
```

## 6		51		44		13	
##	cocaine_opio_posses	mj_posses	dang_non_narc_posses	alcohol	drunk_at_risk		
## 1		129	275	110	874	0	
## 2		123	253	81	723	1	
## 3		115	239	75	619	1	
## 4		86	248	68	577	1	
## 5		112	231	75	634	0	
## 6		98	242	62	602	2	
##	dui	liquor_laws	drunkeness_pc	disorderly_cond	vagrancy	fbi_other	arson
## 1	120	361	246	124	23	713	7
## 2	139	250	203	114	17	676	16
## 3	94	253	139	122	11	578	7
## 4	96	226	150	86	19	605	6
## 5	98	249	162	112	13	589	3
## 6	104	222	146	107	23	624	8
##	forgery_counterfit	fraud	embezelment	weapons	prostitution	sex_offenses	
## 1		24	21	6	133	13	40
## 2		22	23	4	129	8	43
## 3		16	13	8	116	13	29
## 4		16	17	3	132	11	40
## 5		20	11	12	139	10	38
## 6		25	29	7	118	8	36
##	bookmaking	all_other_gambling	aga_family_child	curfew_loitering	runaways		
## 1	0		3	0	331	135	
## 2	0		2	0	334	95	
## 3	0		2	0	275	99	
## 4	0		4	0	285	91	
## 5	0		3	0	261	92	
## 6	1		3	0	284	105	
##	coded_on_offense	county_ordinance	outside_warrent	traffic_violations			
## 1		518	155	19		100	
## 2		480	159	17		103	
## 3		471	139	19		104	
## 4		444	149	13		94	
## 5		419	129	16		95	
## 6		445	165	20		94	
##	hit_run_reckl_driv	parole_violation	dump_or_litter	trespass			
## 1		85	13	11	106		
## 2		75	3	8	87		
## 3		88	9	4	71		
## 4		69	14	5	74		
## 5		57	6	3	89		
## 6		60	11	3	62		
##	violate_court_order	failure_to_appear	cont_delinq_minor	not_classified			
## 1		5	16	8	442		
## 2		5	21	2	384		
## 3		10	20	7	377		
## 4		6	18	2	353		
## 5		11	12	1	339		
## 6		4	25	1	360		
##	other_reported	pop1	pop2	pop3	pop_day1	pop_day2	pop_day3
## 1	104	12877264	12486051	3175170	35280.17	34208.36	8699.095
## 2	103	12877587	12486315	3175108	35281.06	34209.08	8698.926
## 3	109	12877910	12486579	3175046	35281.95	34209.81	8698.757

```

## 4      102 12878234 12486843 3174984 35282.83 34210.53 8698.587
## 5      90 12878557 12487107 3174923 35283.72 34211.25 8698.418
## 6     105 12878881 12487371 3174861 35284.61 34211.98 8698.249
##  years_to_21 yrs_to_21_month yrs_to_21_fortnight post      linear      square
## 1    -4.002740      17.0137      16.99178      0 -4.002740 16.02193
## 2    -4.000000      17.0137      16.99178      0 -4.000000 16.00000
## 3    -3.997260      17.0137      16.99178      0 -3.997260 15.97809
## 4    -3.994521      17.0137      16.99178      0 -3.994521 15.95619
## 5    -3.991781      17.0137      16.99178      0 -3.991781 15.93431
## 6    -3.989041      17.0137      17.03014      0 -3.989041 15.91245
##      cubic linear_post square_post cubic_post birthday_19 birthday_19_1
## 1 -64.13160      0      0      0      0      0
## 2 -64.00000      0      0      0      0      0
## 3 -63.86858      0      0      0      0      0
## 4 -63.73735      0      0      0      0      0
## 5 -63.60629      0      0      0      0      0
## 6 -63.47541      0      0      0      0      0
##  birthday_20 birthday_20_1 birthday_21 birthday_21_1 birthday_22
## 1      0      0      0      0      0
## 2      0      0      0      0      0
## 3      0      0      0      0      0
## 4      0      0      0      0      0
## 5      0      0      0      0      0
## 6      0      0      0      0      0
##  birthday_22_1 birthday_23 birthday_23_1 ill_drugs_r
## 1      0      0      0 175.1692
## 2      0      0      0 159.8591
## 3      0      0      0 149.9350
## 4      0      0      0 141.1451
## 5      0      0      0 148.2270
## 6      0      0      0 144.5390
##  cocaine_opio_sale_manuf_r mj_sale_manuf_r dang_non_narc_sale_manuf_r
## 1      11.33781      14.45571      3.684789
## 2      13.32160      12.47128      4.535011
## 3      12.18754      13.60469      2.550880
## 4      11.33696      13.60435      2.267392
## 5      15.58793      10.48642      3.684419
## 6      14.45390      12.47003      3.684326
##  cocaine_opio_posSES_r mj_posSES_r dang_non_narc_posSES_r      dui_r
## 1      36.56445      77.94746      31.17898 34.01344
## 2      34.86290      71.70986      22.95849 39.39791
## 3      32.59457      67.74003      21.25733 26.64252
## 4      24.37446      70.28914      19.27283 27.20870
## 5      31.74269      65.46929      21.25626 27.77485
## 6      27.77415      68.58515      17.57140 29.47461
##  liquor_laws_r drunkenness_pc_r felony_r misdemeanor_r violent_r murder_r
## 1     102.32376      69.72755 454.8596      895.6875 200.5358 2.046283
## 2      70.85955      57.53795 426.7872      805.6340 169.8379 2.338560
## 3      71.70806      39.39692 396.3776      756.8006 163.9881 2.338511
## 4      64.05381      42.51359 403.9692      733.9846 171.5846 4.384615
## 5      70.57079      45.91353 415.9450      740.9843 174.2117 1.461507
## 6      62.91696      41.37782 401.9061      757.9217 171.5773 2.630658
##  manslaughter_r rape_r robbery_r assault_r aggravated_assault_r
## 1      0.5846524 5.261872 39.75636 152.8866      59.92687

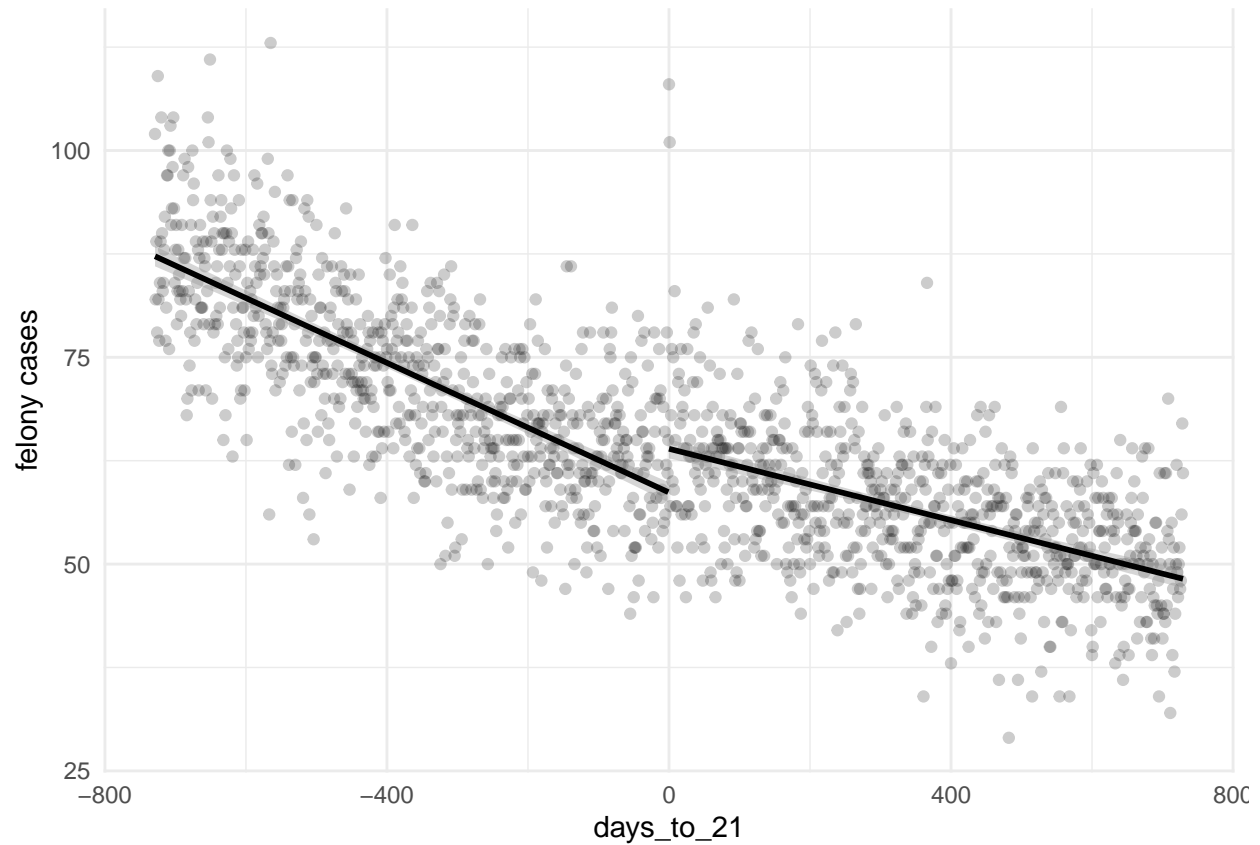
```

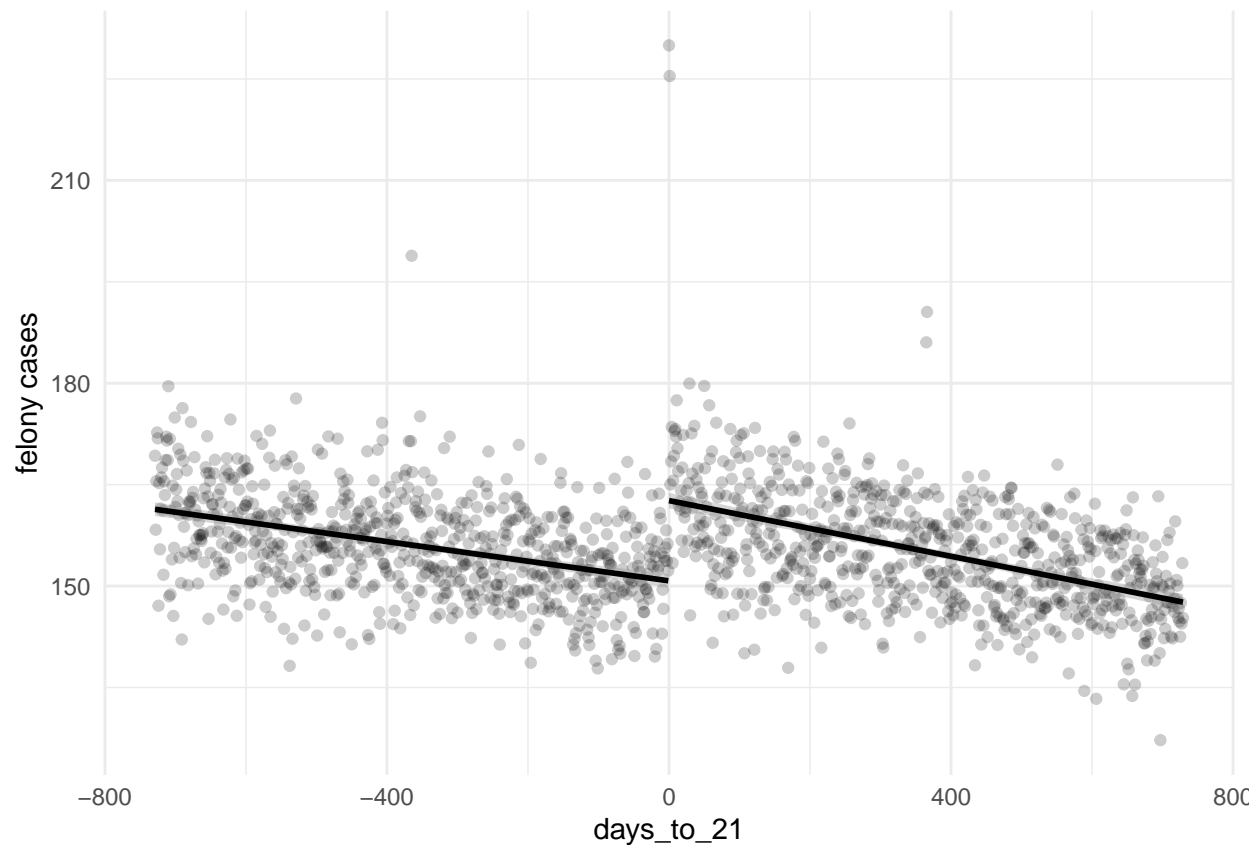
## 2	0.2923200	2.338560	33.03216	131.8363	53.49457
## 3	0.2923139	1.461569	30.69295	129.2027	46.77022
## 4	0.2923077	2.923077	30.98461	133.0000	52.90769
## 5	0.0000000	2.046110	30.98396	139.7201	55.53728
## 6	0.0000000	3.507544	32.15248	133.2867	49.98250
##	ot_assault_r	property_r	burglary_r	larceny_r	mv_theft_r
## 1	92.95974	420.3651	105.82209	168.3799	58.46524
## 2	78.34177	406.9095	103.18897	163.9915	60.21793
## 3	82.43251	388.4851	96.75588	154.0494	50.27798
## 4	80.09230	397.8307	96.46153	164.8615	57.29230
## 5	84.18283	394.8993	97.62870	159.5966	54.95268
## 6	83.30416	401.3215	100.25729	163.3931	53.49004
##	stolen_prop_buy_rec_	poss_r	vandalism_r	disorderly_cond_r	vagrancy_r
## 1		31.86356	55.83431	36.24845	6.723503
## 2		26.30880	53.20225	33.32448	4.969441
## 3		31.86221	55.53963	35.66229	3.215452
## 4		30.69231	48.52307	25.13846	5.553846
## 5		27.47634	55.24498	32.73777	3.799919
## 6		26.30658	57.87447	31.27560	6.722792
##	fbi_other_r	arson_r	forgery_counterfit_r	fraud_r	embezelment_r
## 1	208.4286	2.0462835	7.015829	6.138850	1.753957
## 2	197.6083	4.6771205	6.431041	6.723361	1.169280
## 3	168.9574	2.0461970	4.677022	3.800080	2.338511
## 4	176.8461	1.7538460	4.676923	4.969230	0.876923
## 5	172.1656	0.8769045	5.846030	3.215316	3.507618
## 6	182.3923	2.3383625	7.307383	8.476564	2.046067
##	weapons_r	prostitution_r	sex_offenses_r	bookmaking_r	
## 1	38.87939	3.800241	11.693049	0.0000000	
## 2	37.70928	2.338560	12.569761	0.0000000	
## 3	33.90841	3.800080	8.477102	0.0000000	
## 4	38.58461	3.215384	11.692307	0.0000000	
## 5	40.62991	2.923015	11.107457	0.0000000	
## 6	34.49085	2.338362	10.522631	0.2922953	
##	all_other_gambling_r	aga_family_child_r	curfew_loitering_r	runaways_r	
## 1	0.8769786		0	96.75998	39.46404
## 2	0.5846401		0	97.63489	27.77040
## 3	0.5846277		0	80.38631	28.93907
## 4	1.1692307		0	83.30769	26.60000
## 5	0.8769045		0	76.29069	26.89174
## 6	0.8768859		0	83.01187	30.69101
##	county_ordinance_r	traffic_violations_r	hit_run_reckl_driv_r		
## 1	45.31056		29.23262	24.84773	
## 2	46.47889		30.10896	21.92400	
## 3	40.63163		30.40064	25.72362	
## 4	43.55384		27.47692	20.16923	
## 5	37.70689		27.76864	16.66119	
## 6	48.22873		27.47576	17.53772	
##	dump_or_litter_r	trespass_r	violate_court_order_r	failure_to_appear_r	
## 1	3.2155883	30.98658	1.461631	4.677219	
## 2	2.3385603	25.43184	1.461600	6.138721	
## 3	1.1692554	20.75428	2.923139	5.846277	
## 4	1.4615384	21.63077	1.753846	5.261538	
## 5	0.8769045	26.01483	3.215316	3.507618	
## 6	0.8768859	18.12231	1.169181	7.307383	

##	cont_delinq_minor_r	not_classified_r	drunk_at_risk_r	outside_warrent_r
## 1	2.3386097	129.20819	0.000000	21.84135
## 2	0.5846401	112.25089	1.149567	19.54264
## 3	2.0461970	110.20232	1.149590	21.84220
## 4	0.5846153	103.18461	1.149612	14.94496
## 5	0.2923015	99.09021	0.000000	18.39415
## 6	0.2922953	105.22631	2.299313	22.99313

##	parole_violation_r	other_reported_r	coded_on_offense_r	alcohol_r
## 1	14.944083	119.5527	178.8560	249.0367
## 2	3.448702	118.4054	157.4586	207.2389
## 3	10.346306	125.3053	161.6835	177.7748
## 4	16.094567	117.2604	152.9318	165.6180
## 5	6.897806	103.4671	141.3356	180.7969
## 6	12.646224	120.7140	156.6496	174.0671

##	all_r	other_r
## 1	1561.600	516.4927
## 2	1411.163	467.3178
## 3	1321.026	440.8433
## 4	1309.141	432.9626
## 5	1310.726	412.5914
## 6	1335.773	444.2682

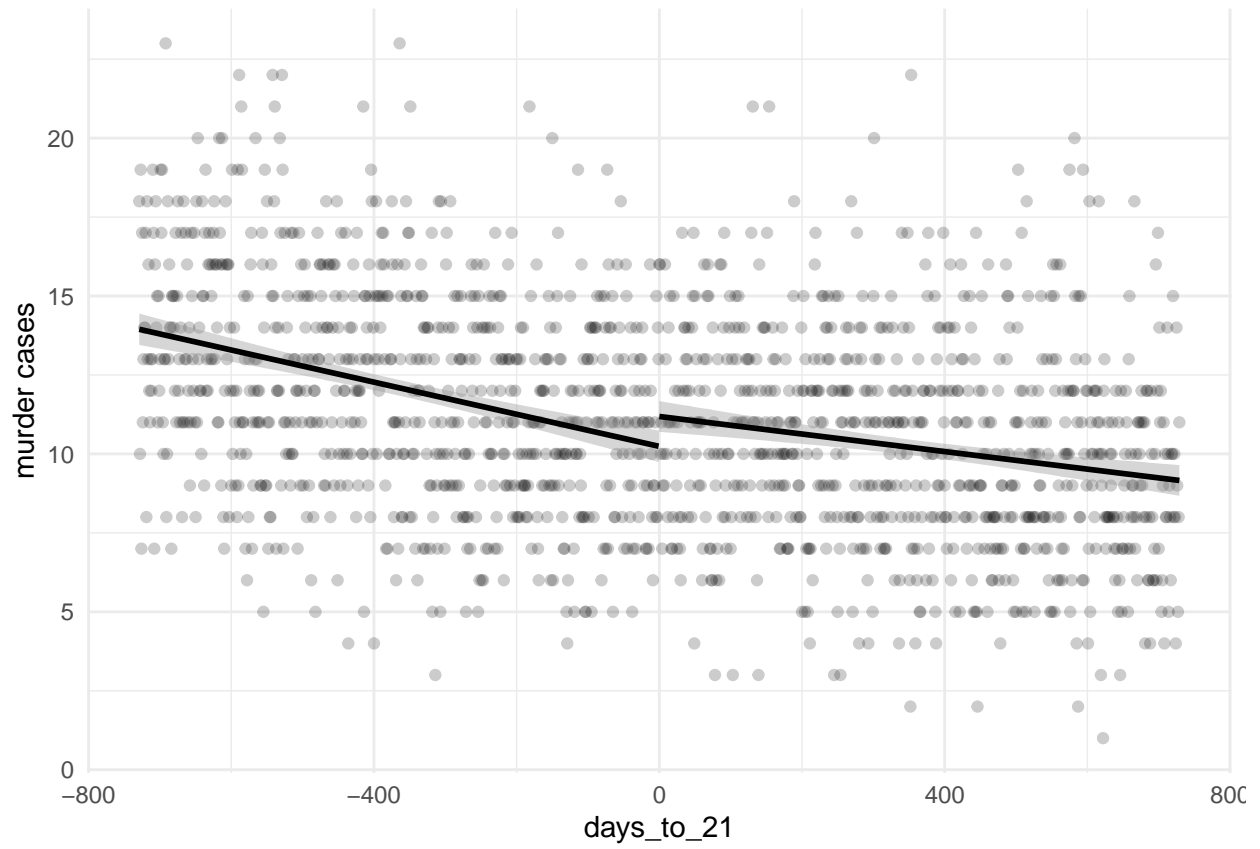


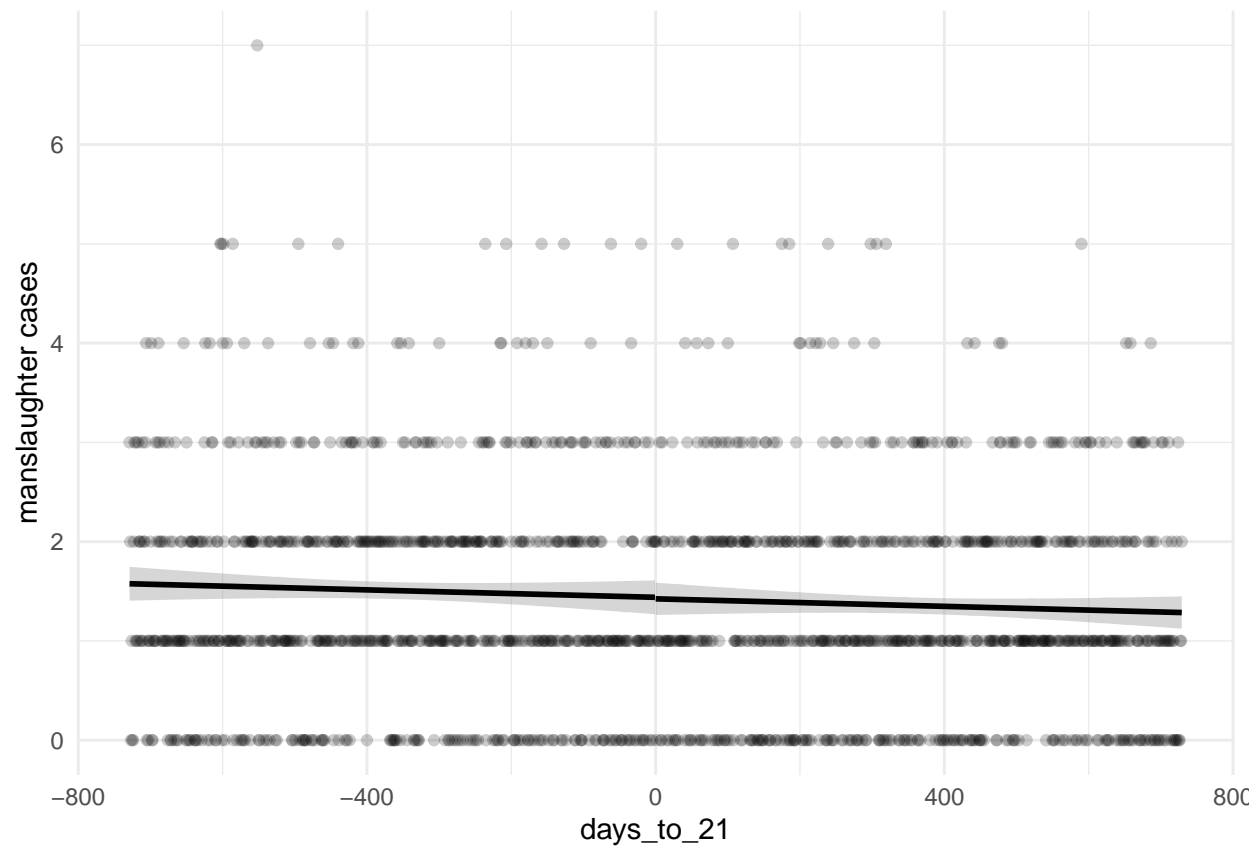


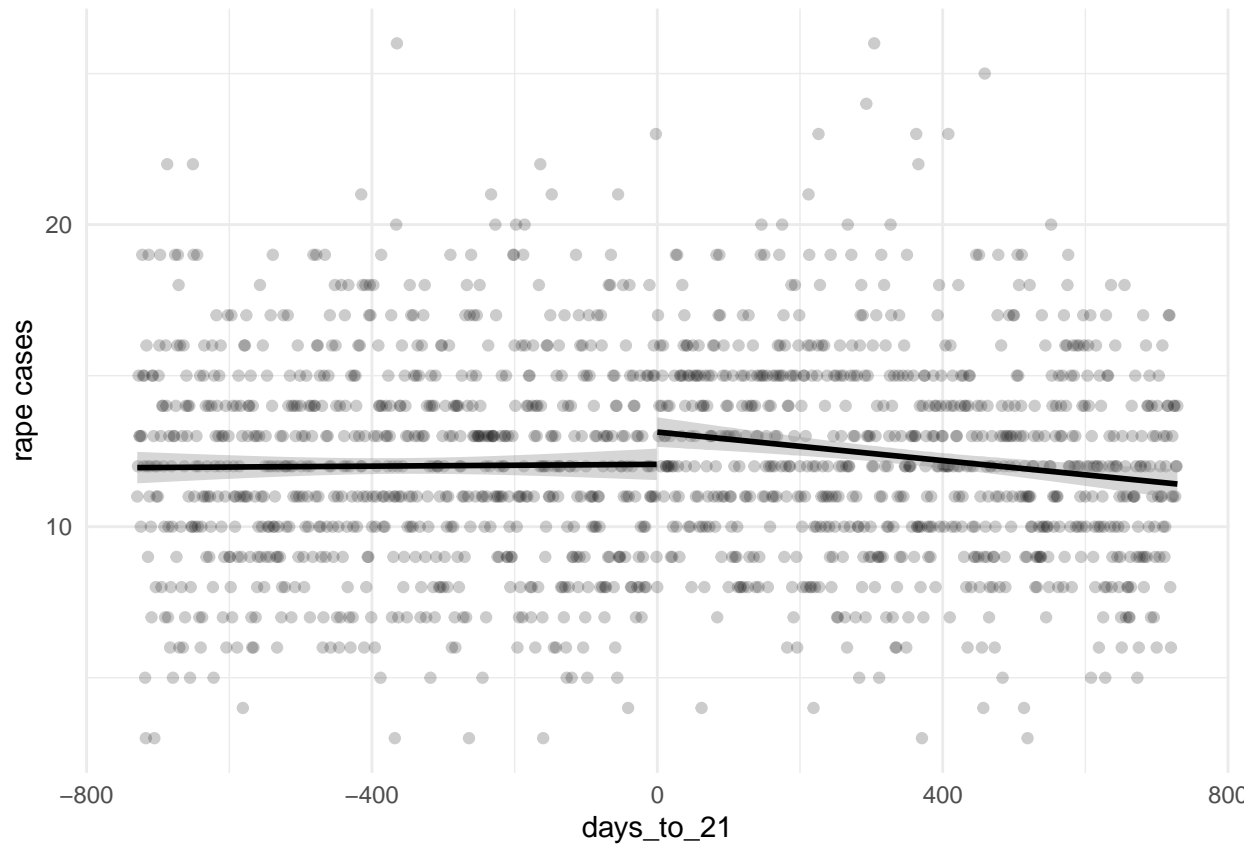
```
## # A tibble: 3 x 5
##   term          estimate std.error statistic  p.value
##   <chr>         <dbl>     <dbl>     <dbl>    <dbl>
## 1 (Intercept) 1574.         4.34      363.    0.
## 2 days_to_21  -0.0341    0.00460   -7.42 1.55e-13
## 3 under_21    -93.5       7.76    -12.1 1.09e-32
```

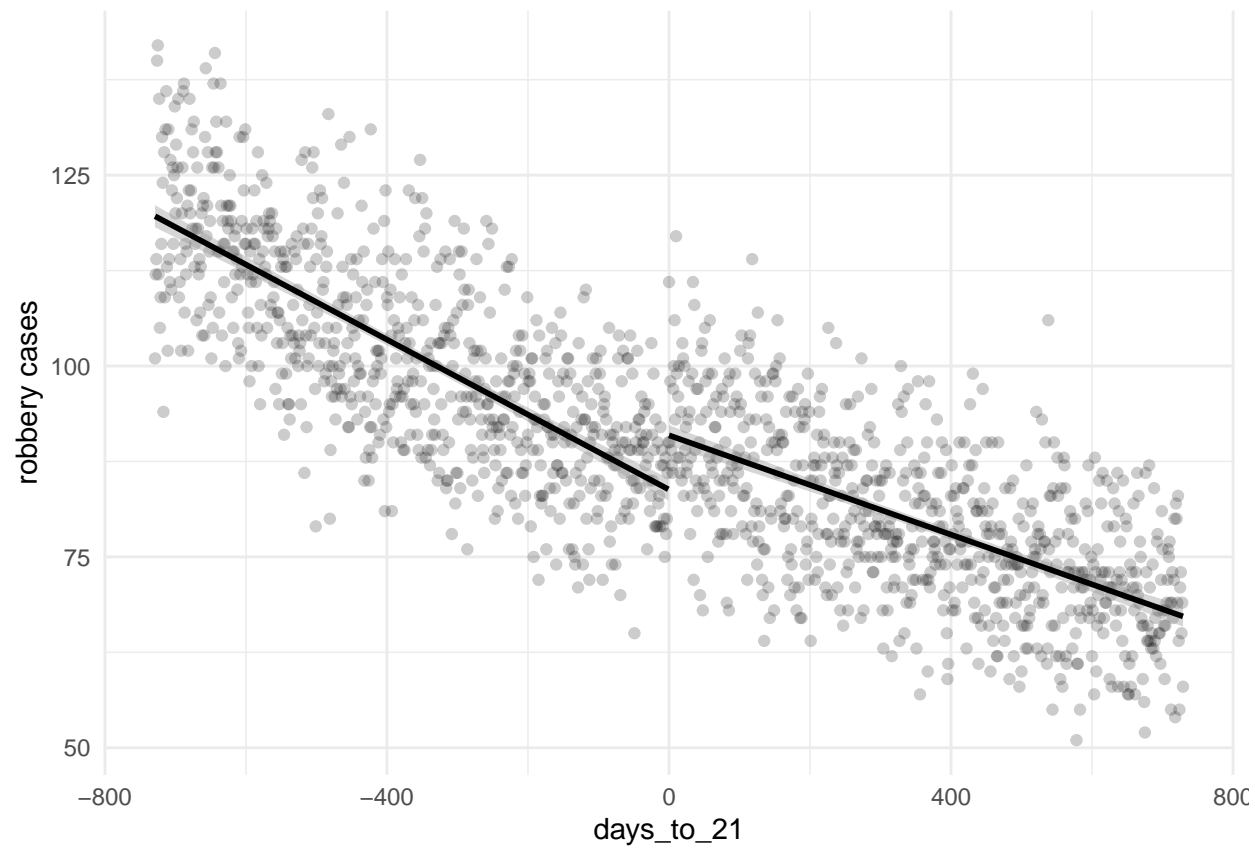
Violent cases

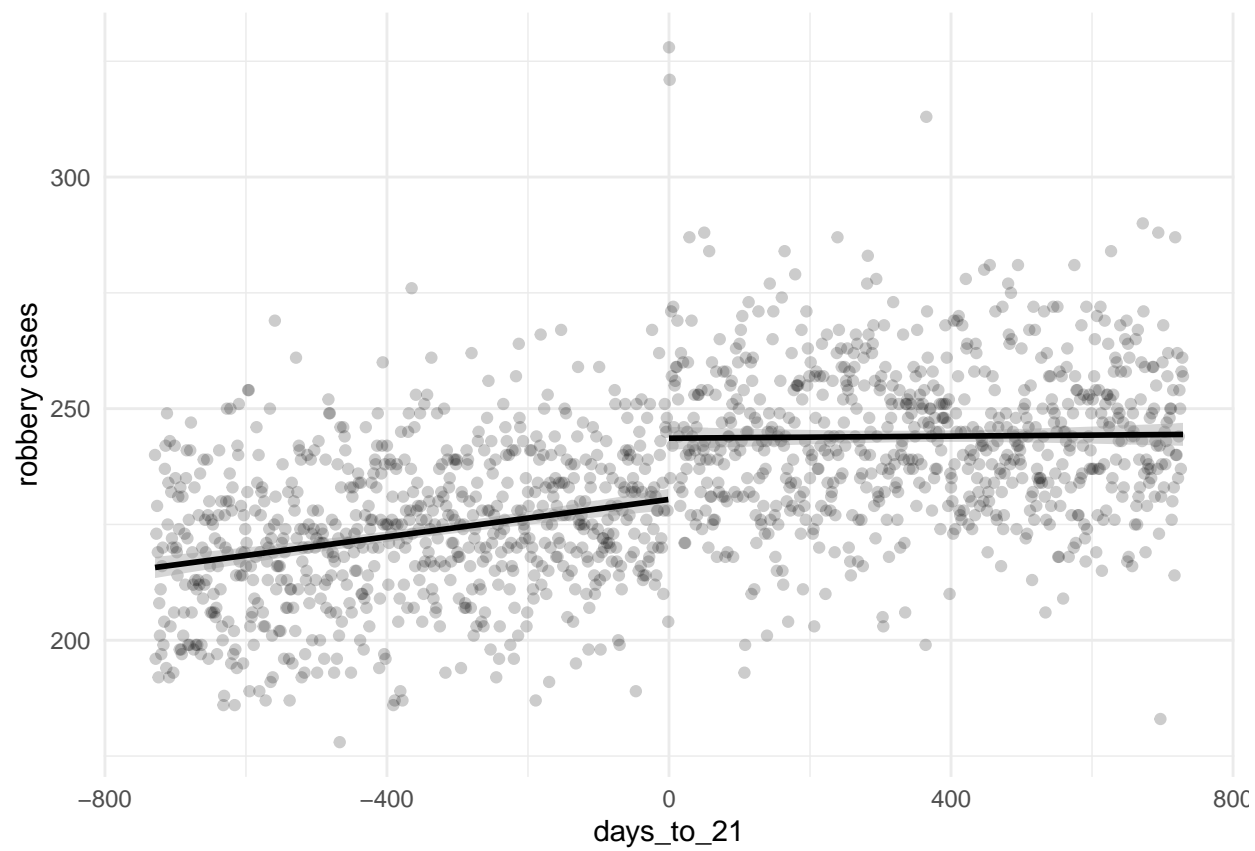
```
##   days_to_21 murder manslaughter rape robbery aggravated_assault
## 1      -729     18           3    11     101             240
## 2      -728     10           2    12     112             196
## 3      -727     19           0    15     114             223
## 4      -726      7           1    13     140             229
## 5      -725     17           0    13     142             219
## 6      -724     11           0    10     112             192
##   ot_assault under_21
## 1        215        0
## 2        218        0
## 3        204        0
## 4        210        0
## 5        206        0
## 6        186        0
```

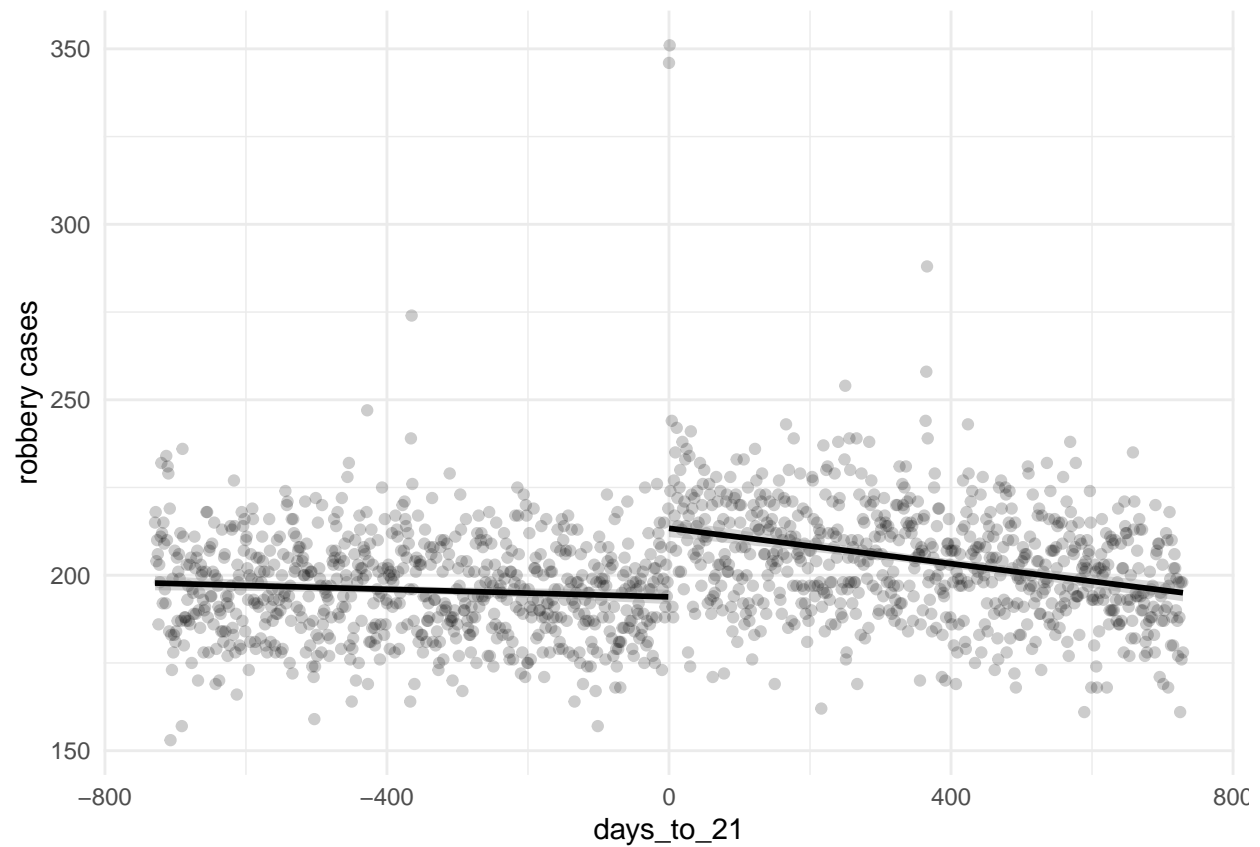






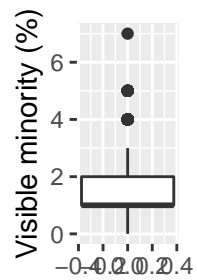
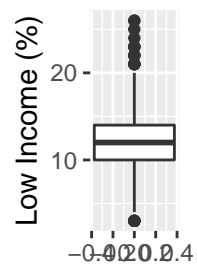
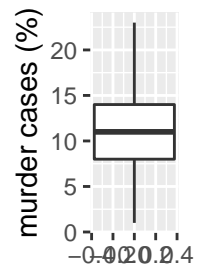






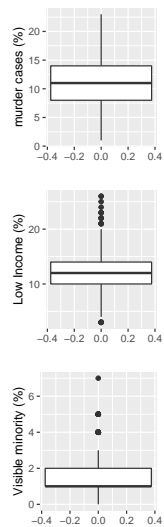
```
## # A tibble: 3 x 5
##   term      estimate std.error statistic  p.value
##   <chr>      <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept)  1.44      0.0671     21.4 9.20e-89
## 2 days_to_21 -0.000189  0.000143    -1.32 1.86e- 1
## 3 under_21    -0.0151    0.120     -0.126 9.00e- 1
```

```
## # A tibble: 3 x 5
##   term      estimate std.error statistic p.value
##   <chr>      <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept) 11.6      0.204     56.8 0
## 2 days_to_21 -0.00111  0.000433   -2.56 0.0107
## 3 under_21    1.07     0.365     2.93 0.00340
```



```
## TableGrob (3 x 1) "arrange": 3 grobs
##   z      cells   name      grob
## 1 1 (1-1,1-1) arrange gtable[layout]
## 2 2 (2-2,1-1) arrange gtable[layout]
## 3 3 (3-3,1-1) arrange gtable[layout]
```

days_to_21	murder	manslaughter	rape	robbery	aggravated_assault	ot_assault	under_21	stats
1459.00	1459.00	1459.00	1459.00	1459.00	1459.00	1459.00	1459.00	nbr.val
1.00	0.00	327.00	0.00	0.00	0.00	0.00	729.00	nbr.null
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	nbr.na
-729.00	1.00	0.00	3.00	51.00	178.00	153.00	0.00	min
729.00	23.00	7.00	26.00	142.00	328.00	351.00	1.00	max
1458.00	22.00	7.00	23.00	91.00	150.00	198.00	1.00	range
0.00	16243.00	2088.00	17714.00	131889.00	340741.00	291800.00	730.00	sum
0.00	11.00	1.00	12.00	89.00	233.00	199.00	1.00	median
0.00	11.13	1.43	12.14	90.40	233.54	200.00	0.50	mean
11.03	0.09	0.03	0.09	0.45	0.51	0.44	0.01	SE.mean
21.64	0.19	0.06	0.18	0.89	1.01	0.85	0.03	CI.mean.0.95
177511.67	13.10	1.32	12.21	297.07	384.81	276.26	0.25	var
421.32	3.62	1.15	3.49	17.24	19.62	16.62	0.50	std.dev
Inf	0.33	0.80	0.29	0.19	0.08	0.08	1.00	coef.var



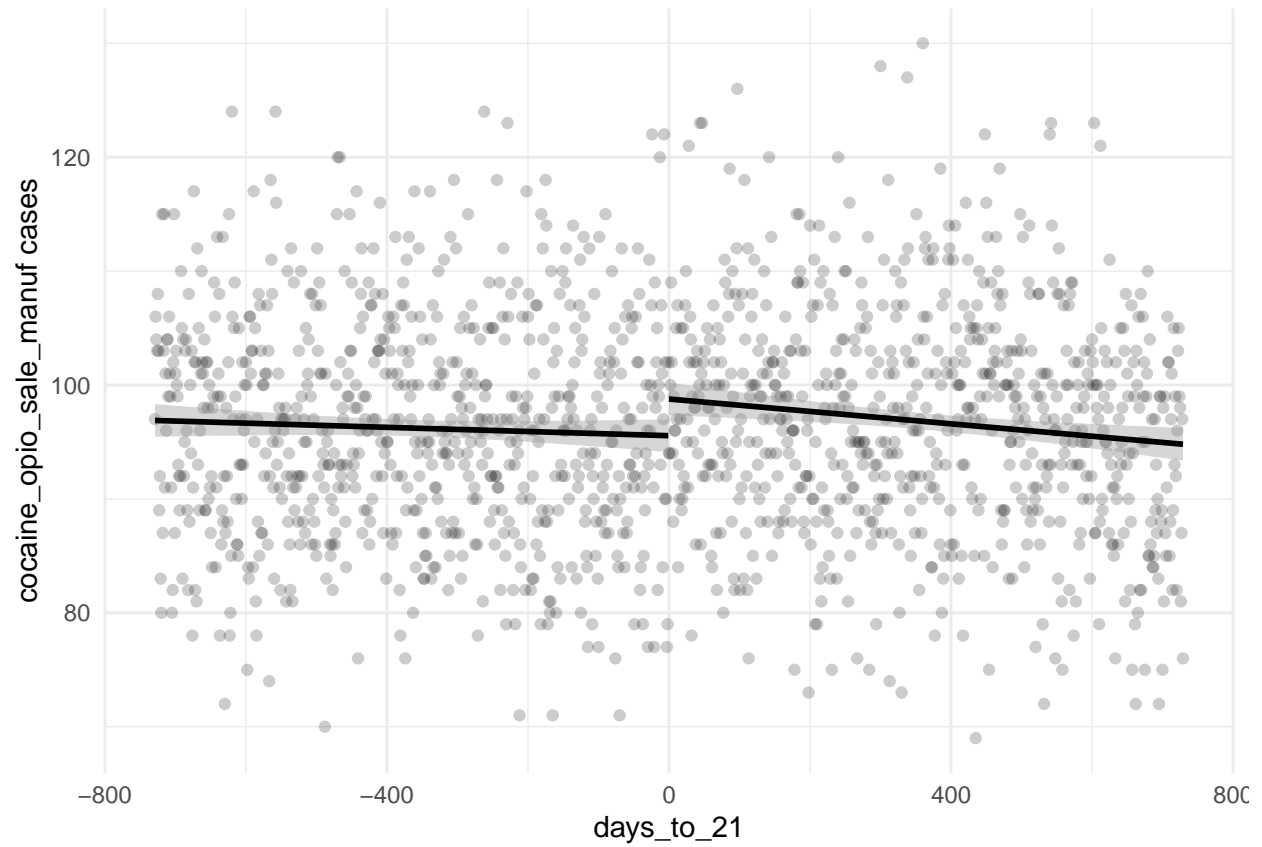
days_to_21	murder	manslaughter	rape	robbery	aggravated_assault	ot_assault	under_21	stats
1459.00	1459.00	1459.00	1459.00	1459.00	1459.00	1459.00	1459.00	nbr.val
1.00	0.00	327.00	0.00	0.00	0.00	0.00	729.00	nbr.null
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	nbr.na
-729.00	1.00	0.00	3.00	51.00	178.00	153.00	0.00	min
729.00	23.00	7.00	26.00	142.00	328.00	351.00	1.00	max
1458.00	22.00	7.00	23.00	91.00	150.00	198.00	1.00	range
0.00	16243.00	2088.00	17714.00	131889.00	340741.00	291800.00	730.00	sum
0.00	11.00	1.00	12.00	89.00	233.00	199.00	1.00	median
0.00	11.13	1.43	12.14	90.40	233.54	200.00	0.50	mean
11.03	0.09	0.03	0.09	0.45	0.51	0.44	0.01	SE.mean
21.64	0.19	0.06	0.18	0.89	1.01	0.85	0.03	CI.mean.0.95
177511.67	13.10	1.32	12.21	297.07	384.81	276.26	0.25	var
421.32	3.62	1.15	3.49	17.24	19.62	16.62	0.50	std.dev
Inf	0.33	0.80	0.29	0.19	0.08	0.08	1.00	coef.var

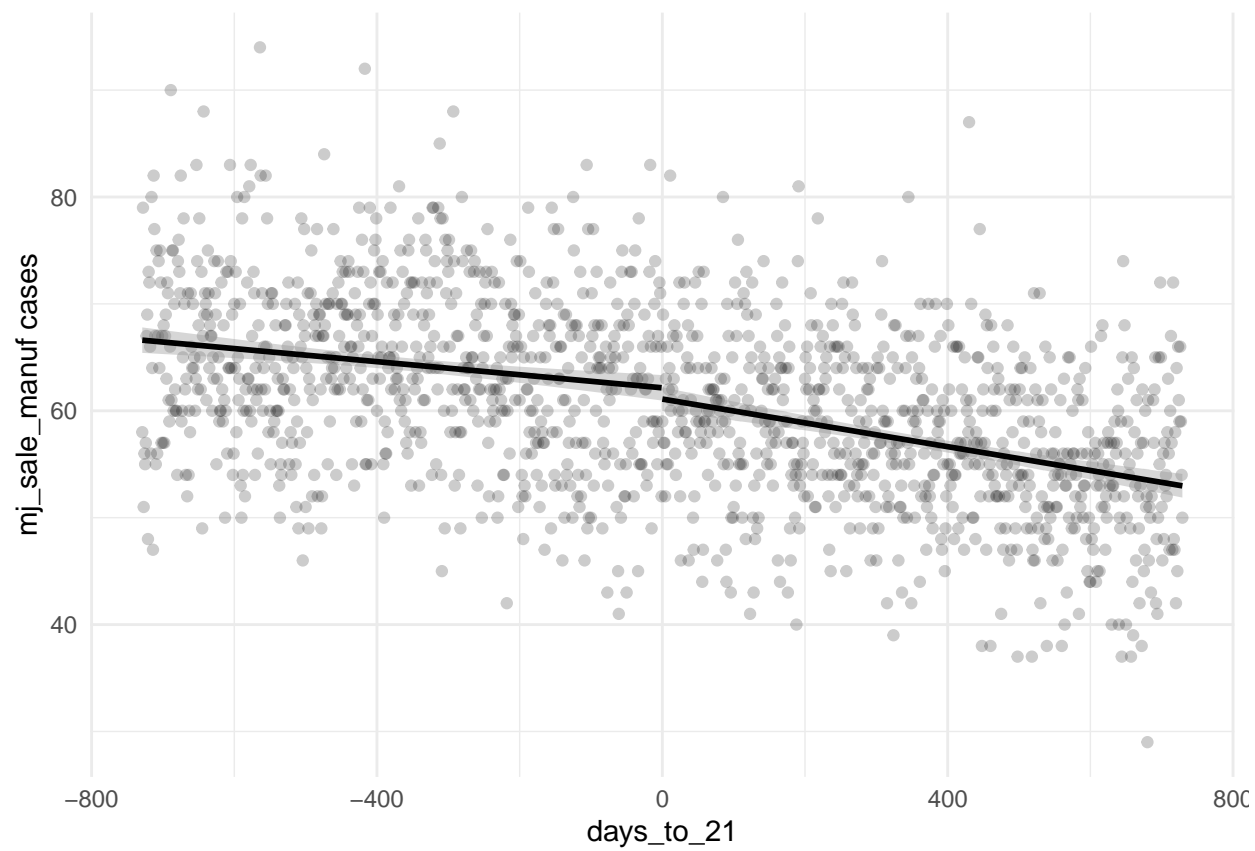
Figure 1: Descriptive statistics of the data

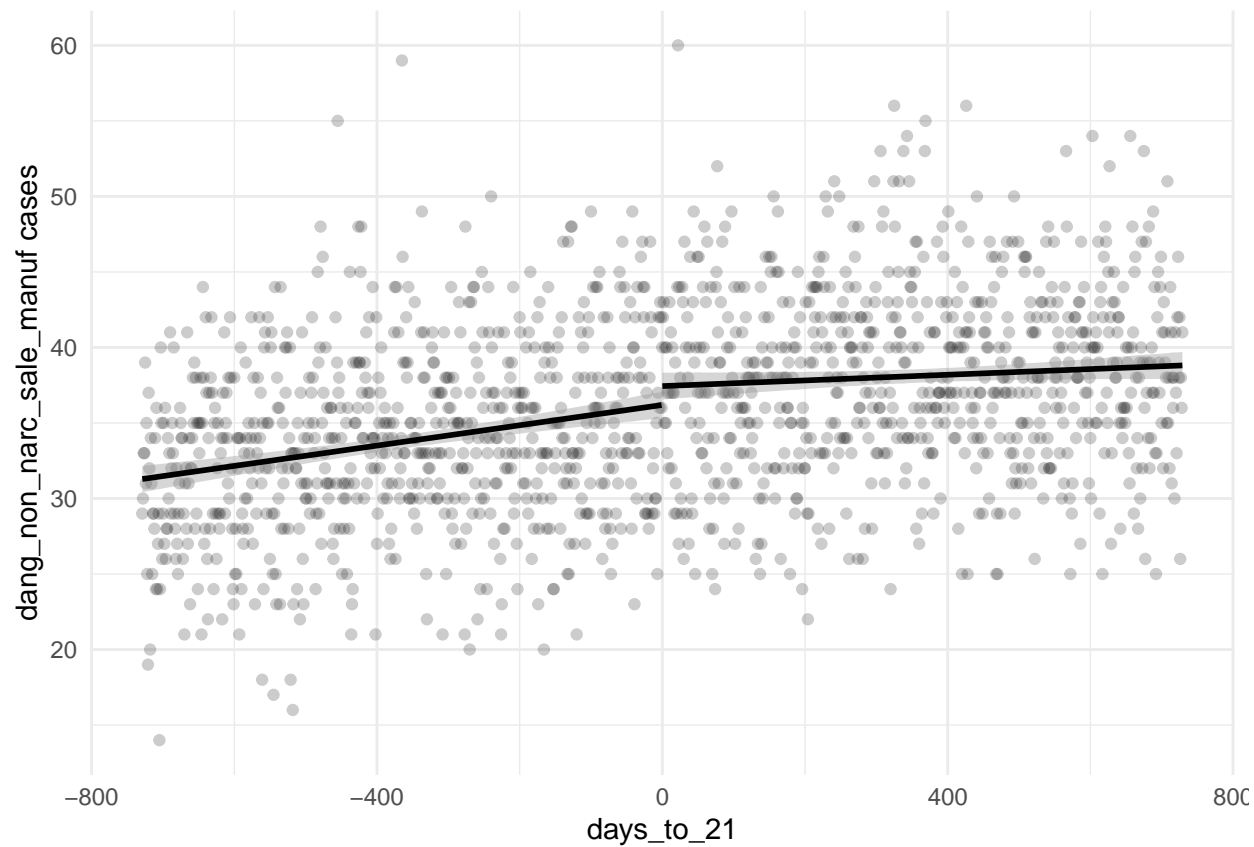
Drugs cases

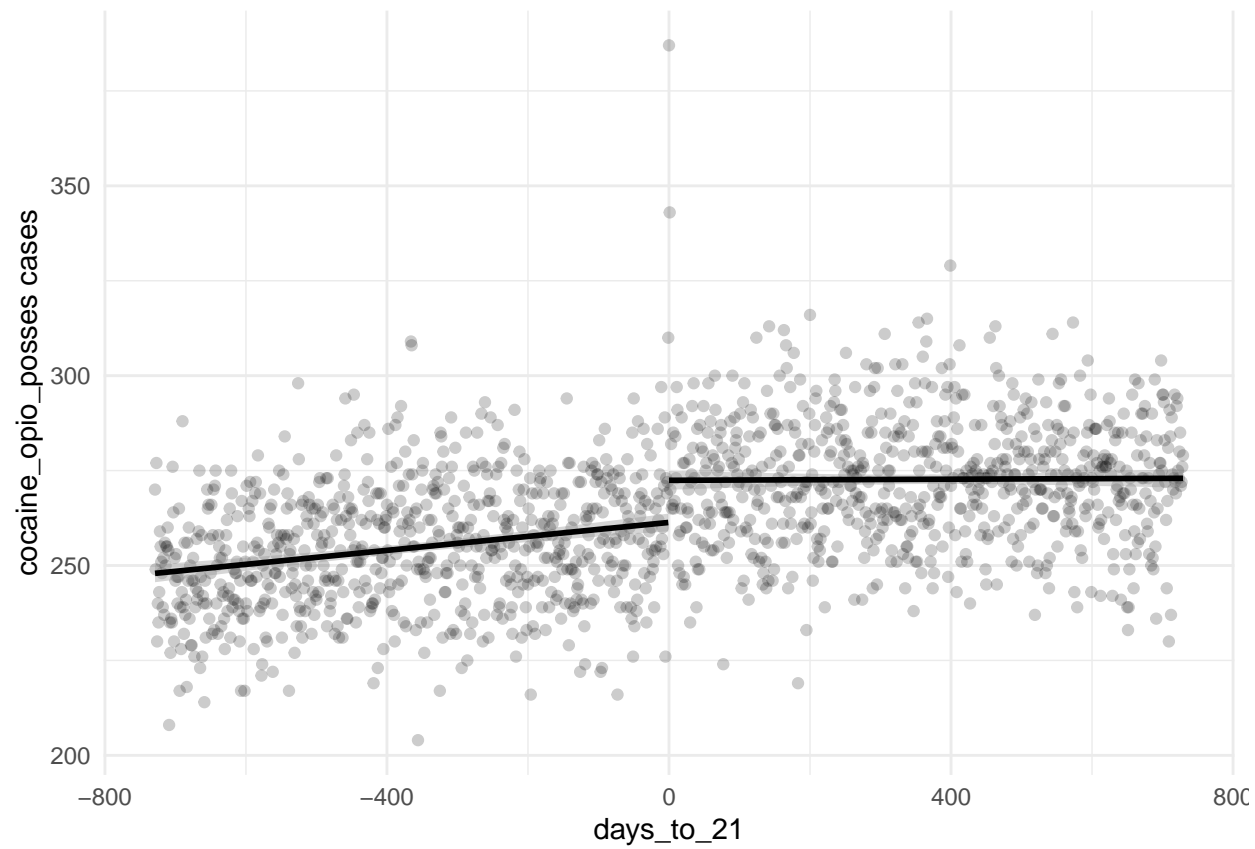
```
##   days_to_21 cocaine_opio_sale_manuf mj_sale_manuf
## 1      -729                97             58
## 2      -728                106            79
## 3      -727                104            51
## 4      -726                103            56
## 5      -725                108            55
## 6      -724                103            57
##   dang_non_narc_sale_manuf cocaine_opio_posses mj_posses
## 1                29                270        264
## 2                30                249        252
## 3                33                277        265
```

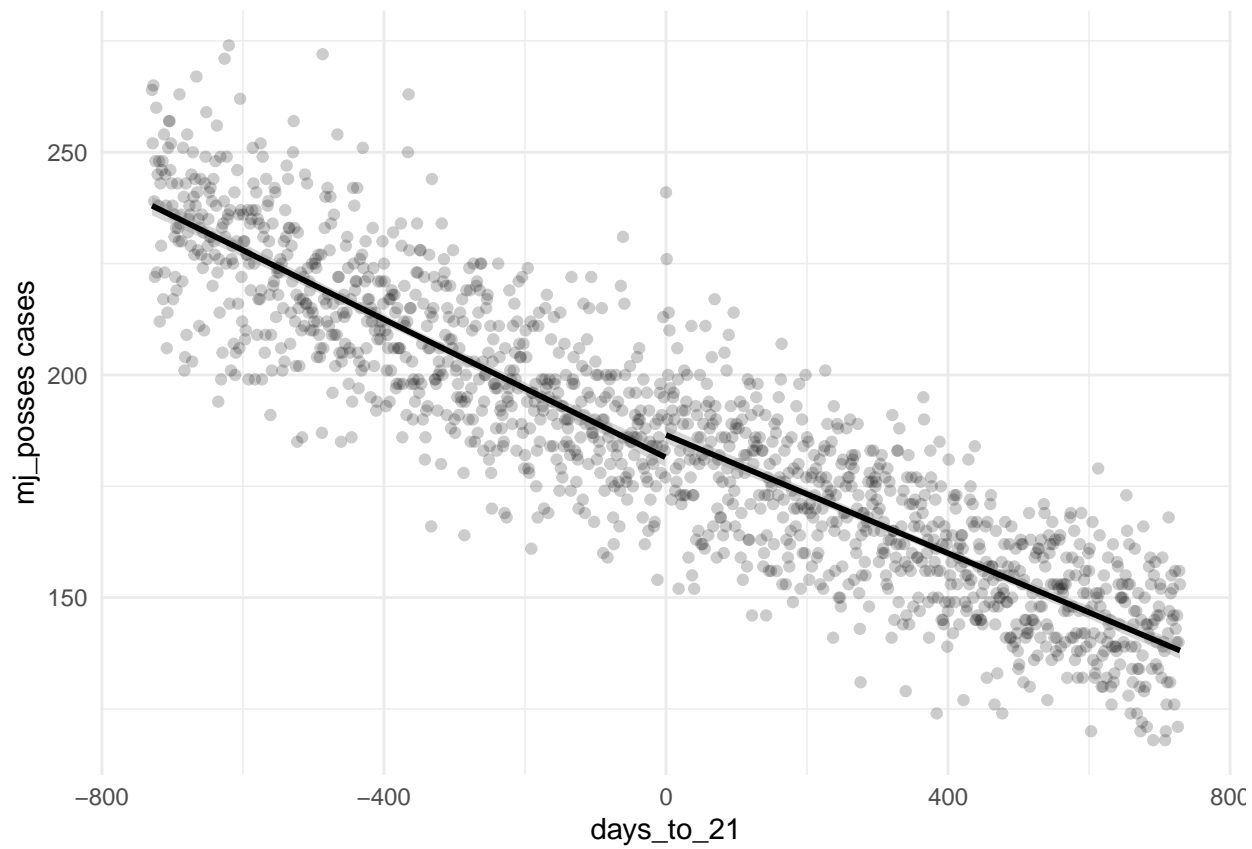
## 4	33	230	239
## 5	39	240	222
## 6	31	235	248
##	dang_non_narc_posses	under_21	
## 1	170	0	
## 2	157	0	
## 3	139	0	
## 4	151	0	
## 5	158	0	
## 6	165	0	

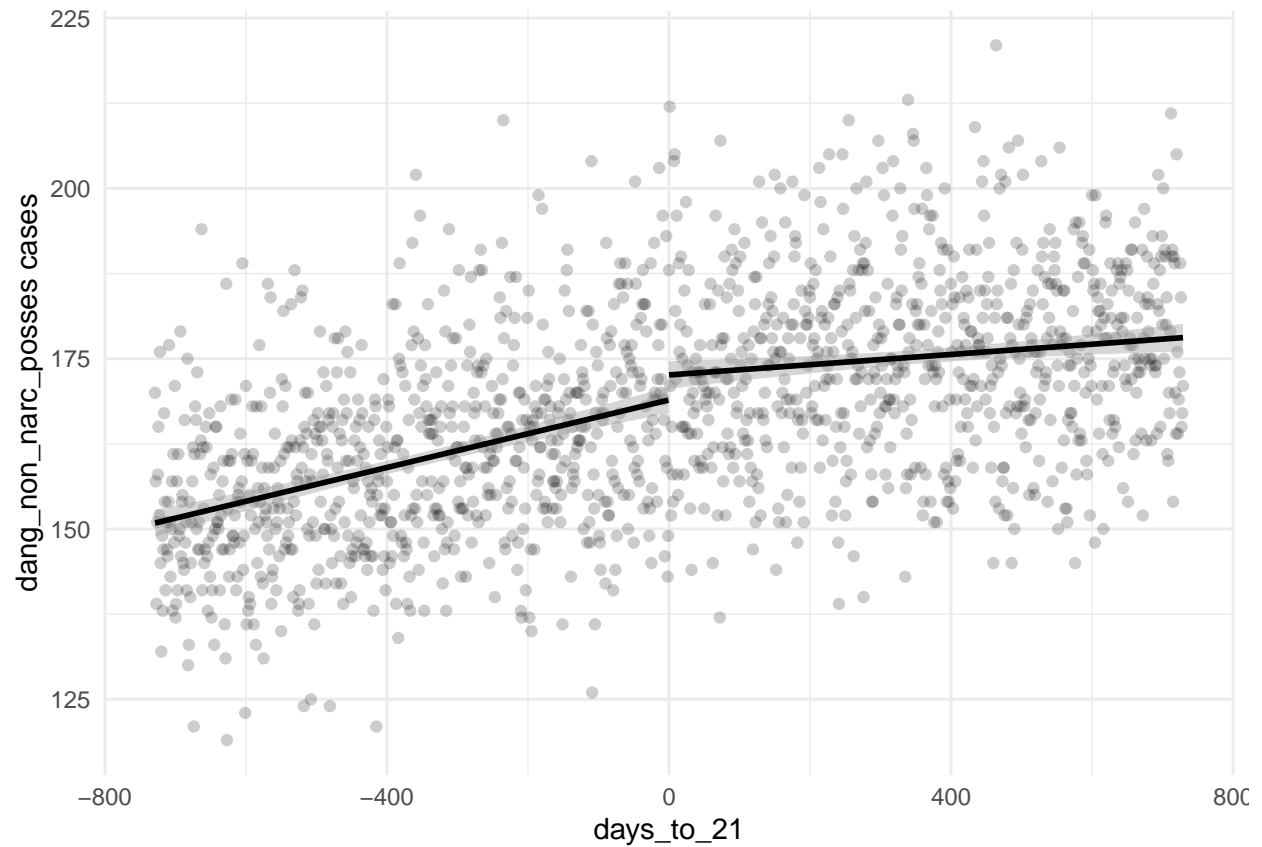






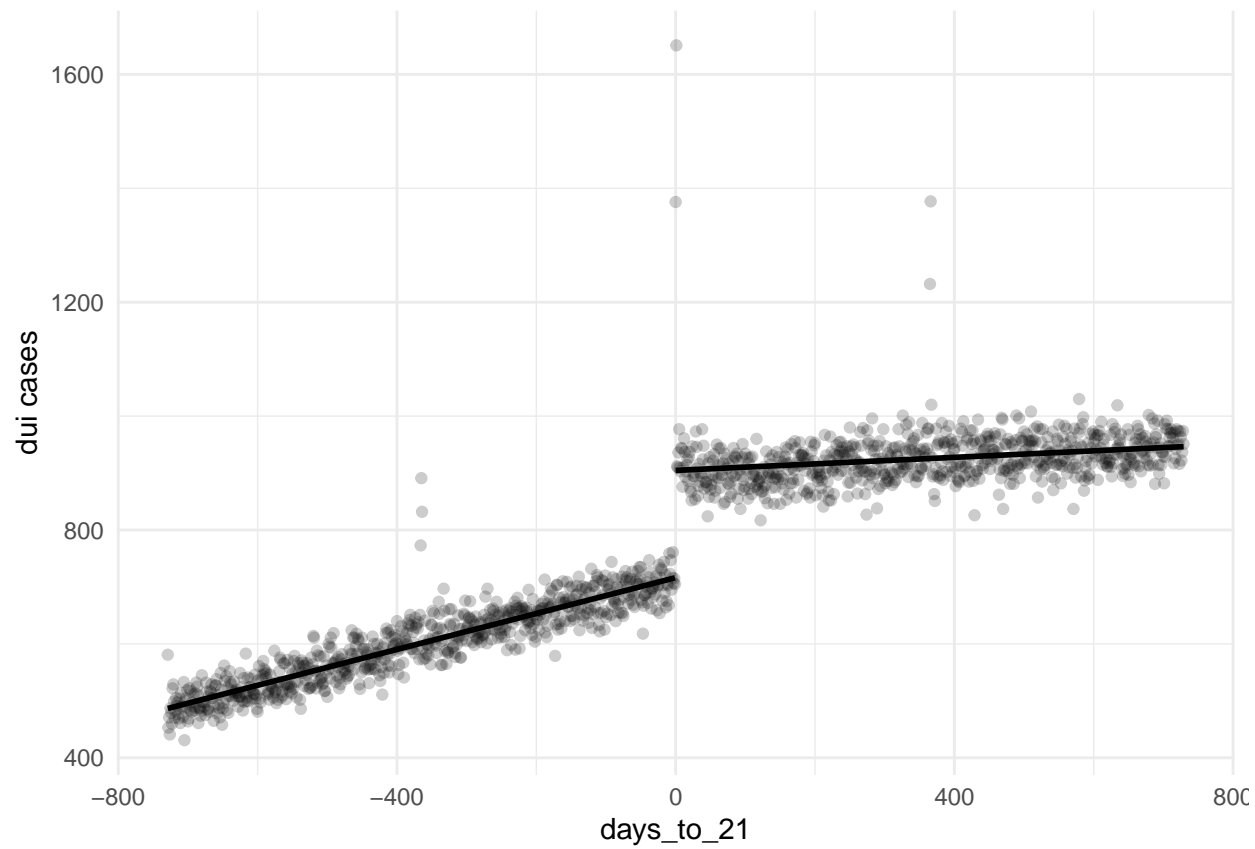


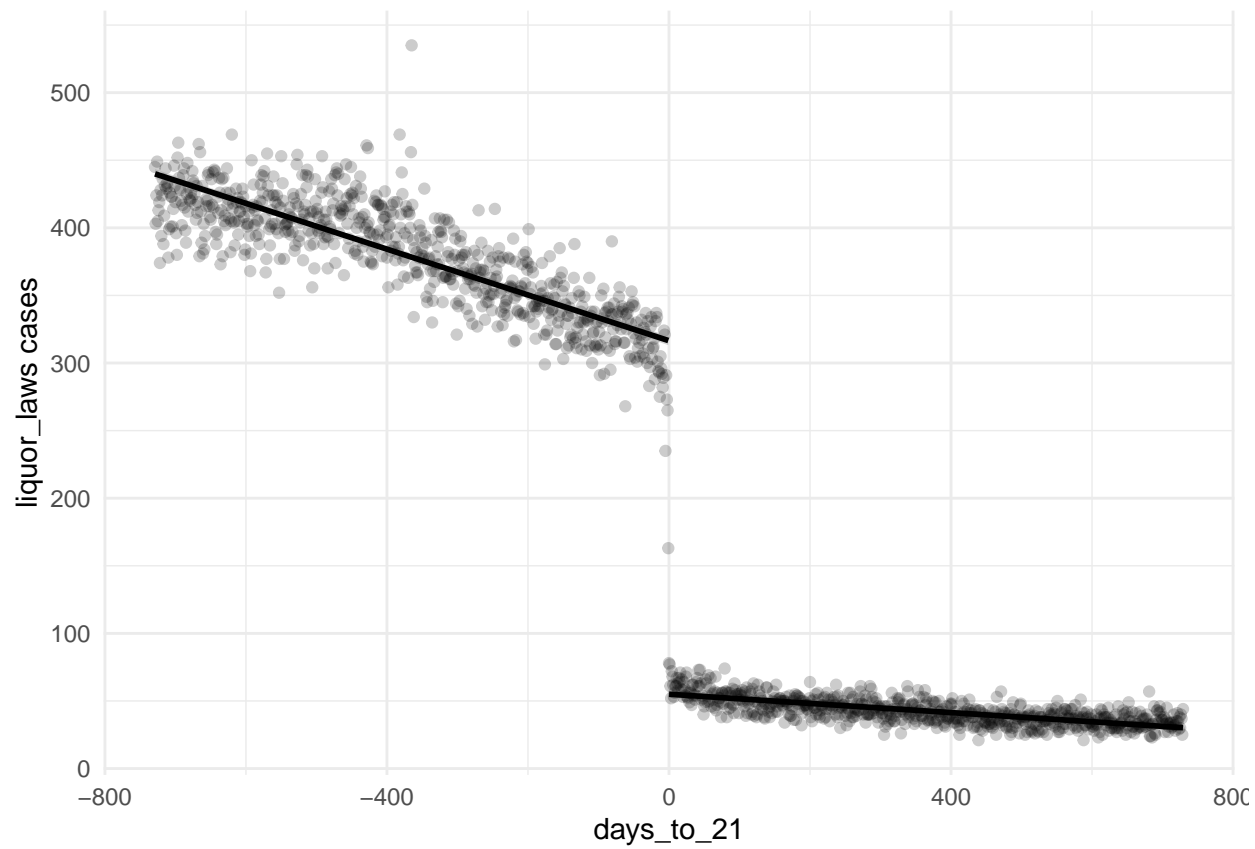


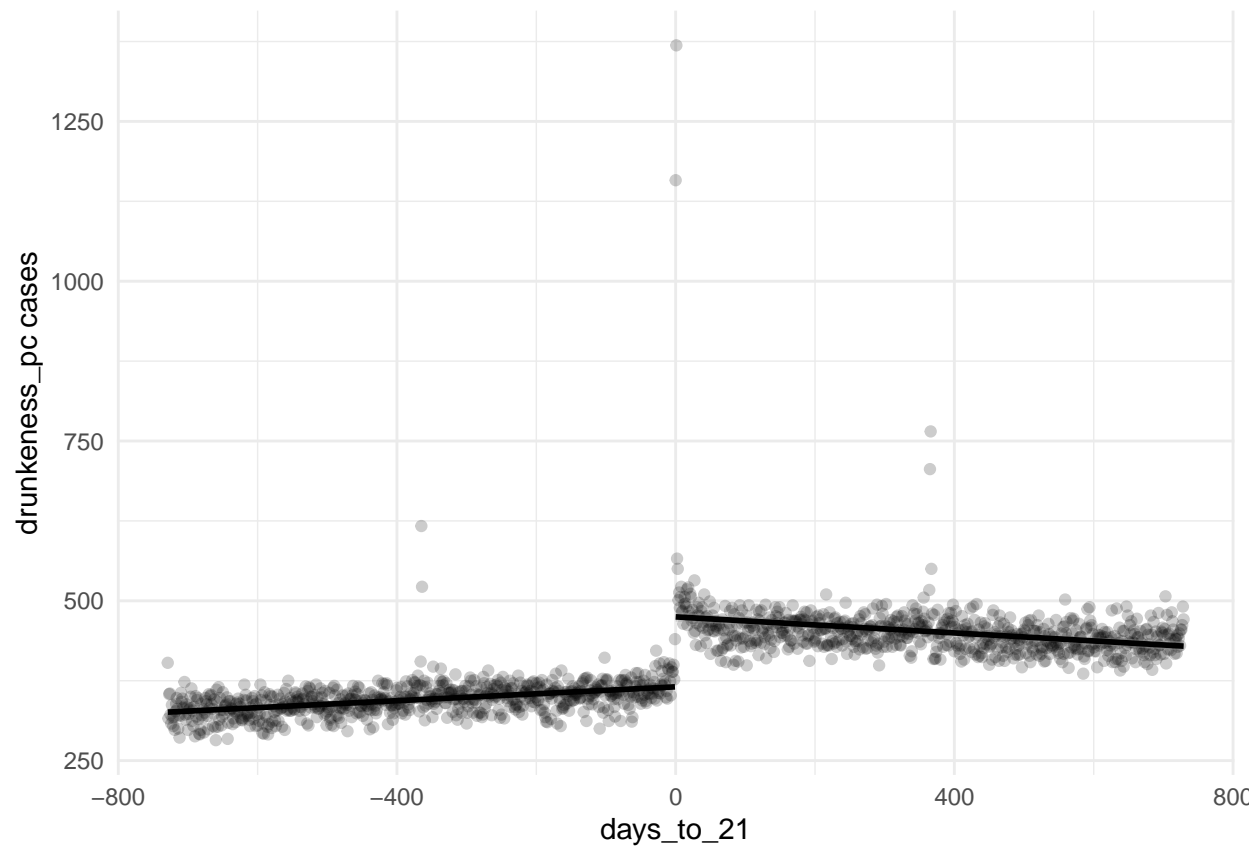


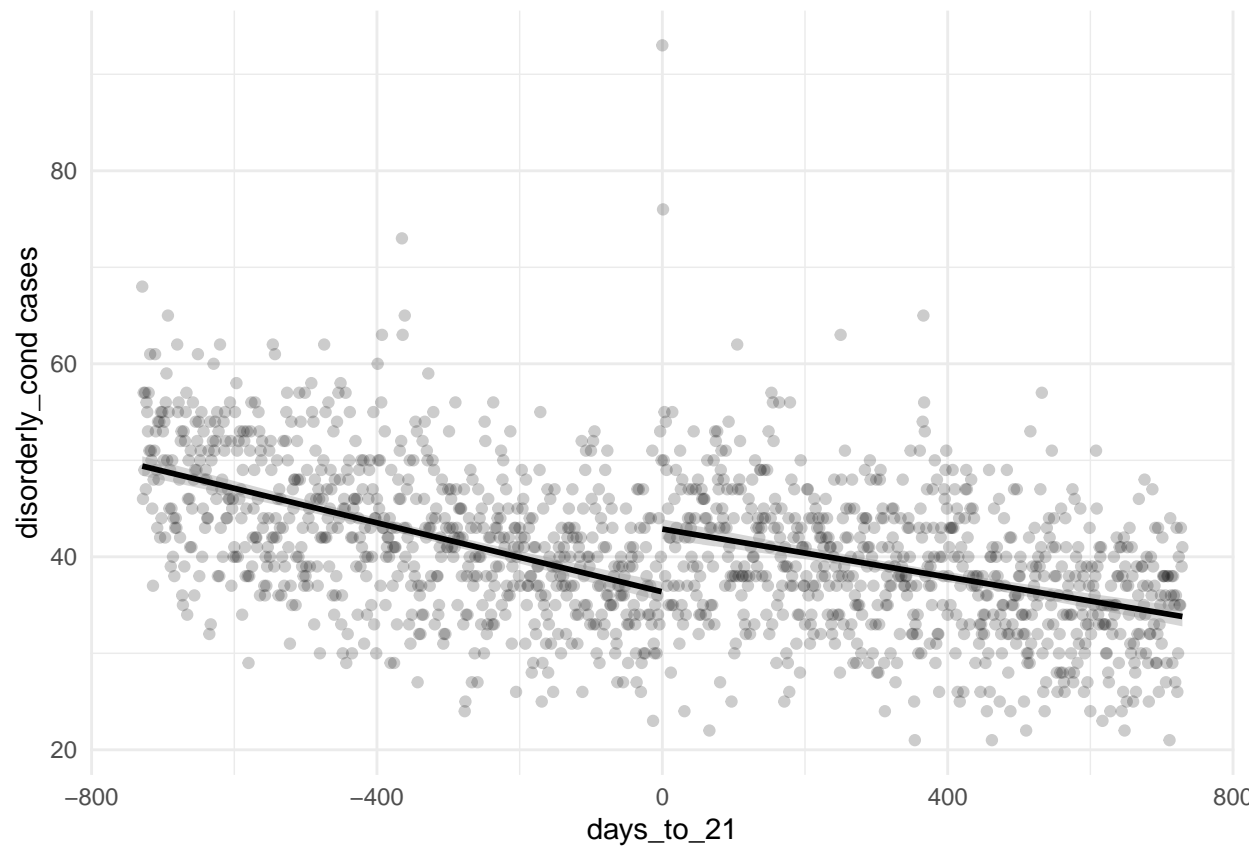
Alcohol Cases

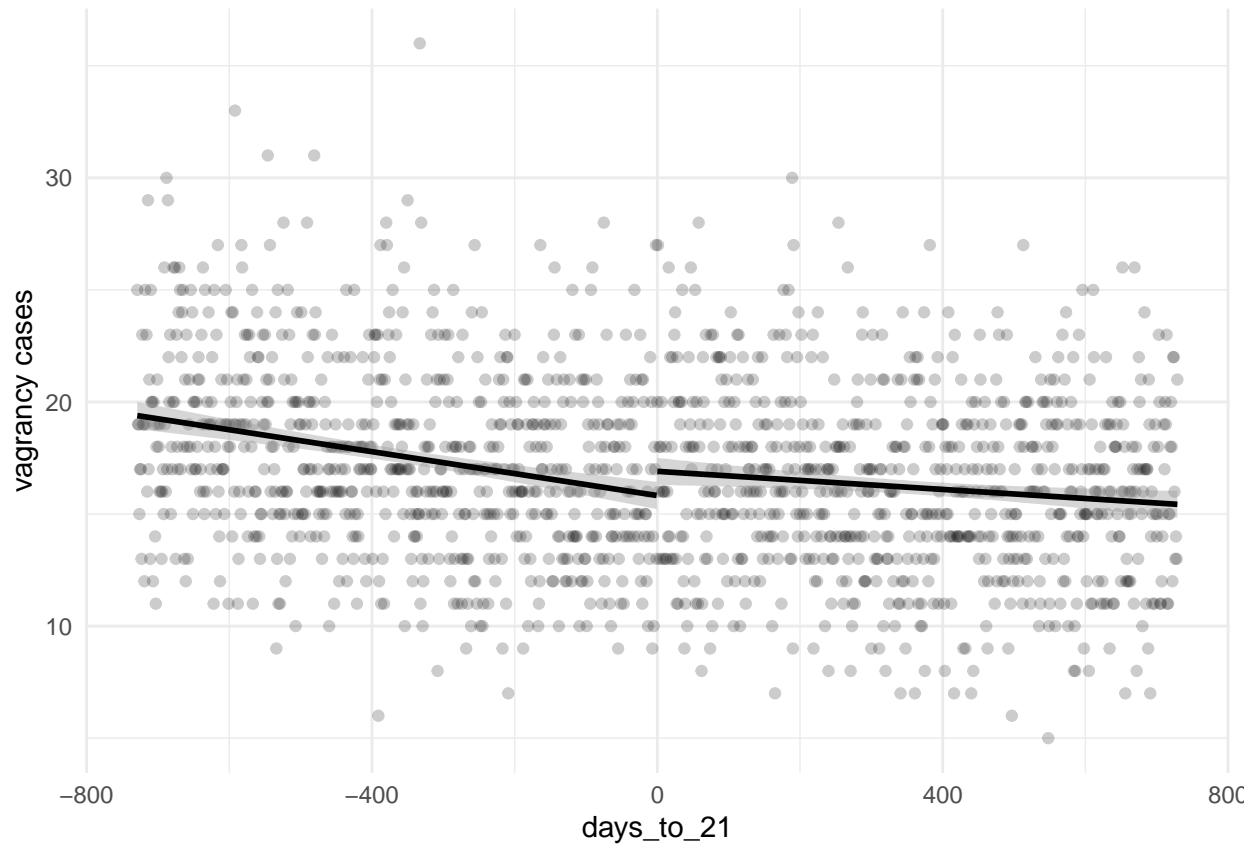
```
##   days_to_21 dui liquor_laws drunkenness_pc disorderly_cond vagrancy
## 1      -729  581          445           403           68        25
## 2      -728  453          403           316           46        19
## 3      -727  471          424           354           57        19
## 4      -726  441          449           355           49        15
## 5      -725  487          405           322           57        17
## 6      -724  479          413           308           47        17
##   under_21
## 1         0
## 2         0
## 3         0
## 4         0
## 5         0
## 6         0
```







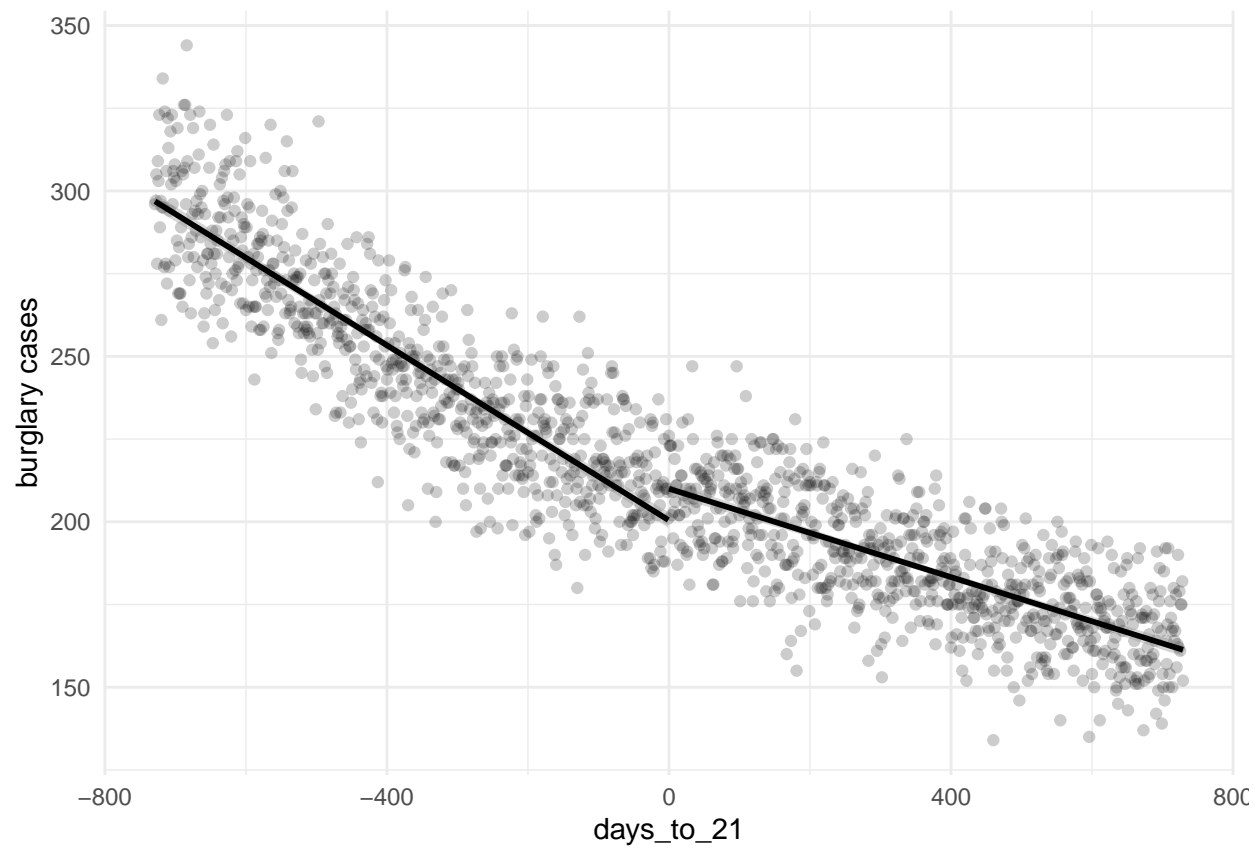


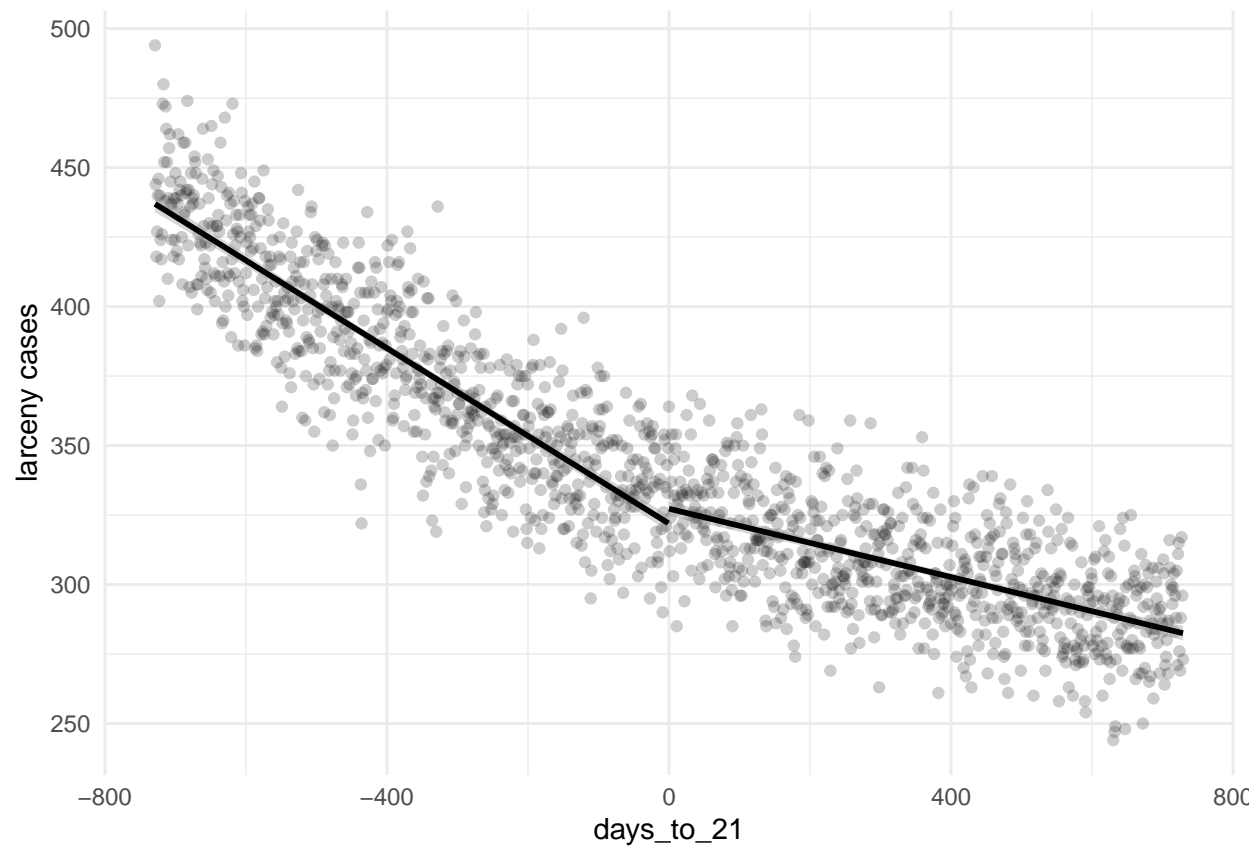


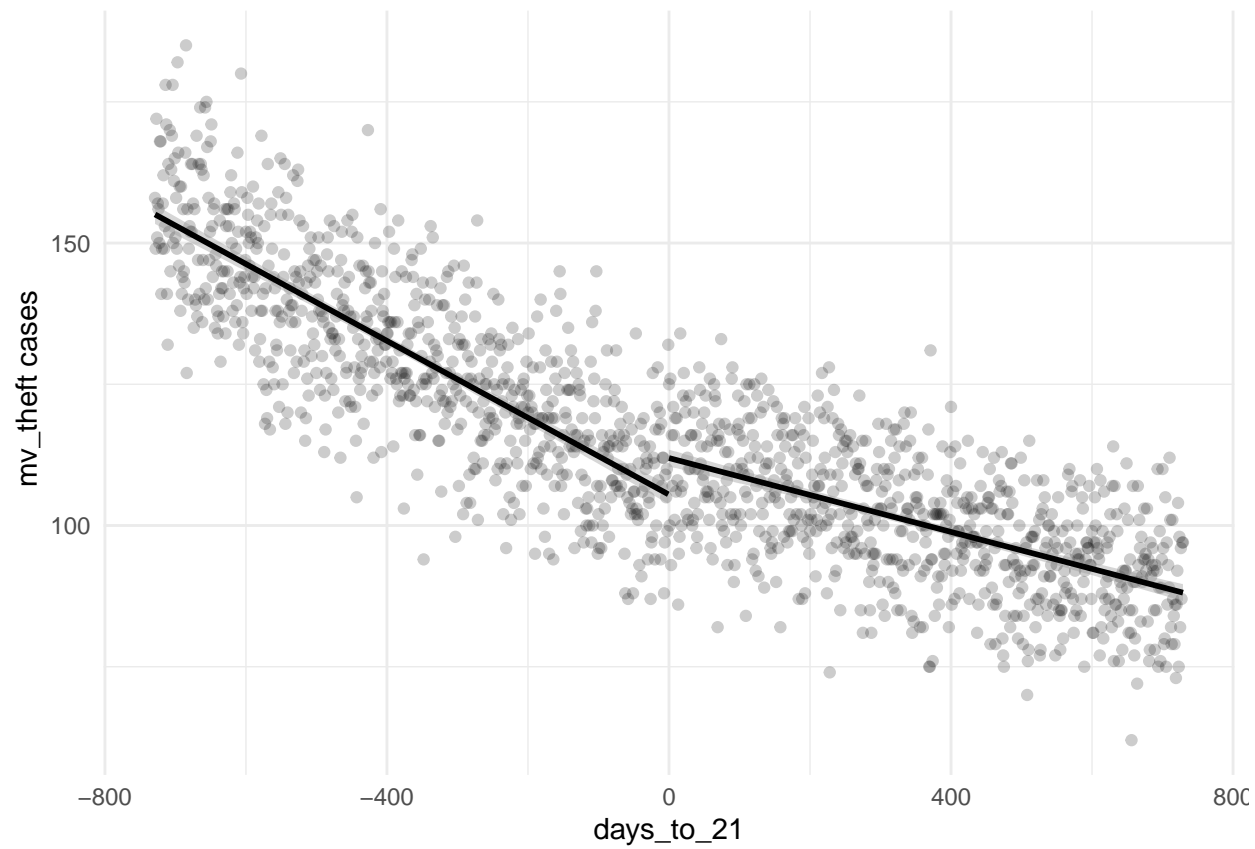
```
## # A tibble: 3 x 5
##   term      estimate std.error statistic  p.value
##   <chr>      <dbl>      <dbl>      <dbl>    <dbl>
## 1 (Intercept) 16.4        0.243      67.3    0.
## 2 days_to_21 -0.00345    0.000516   -6.69 3.13e-11
## 3 under_21    1.08        0.435       2.48 1.34e- 2
```

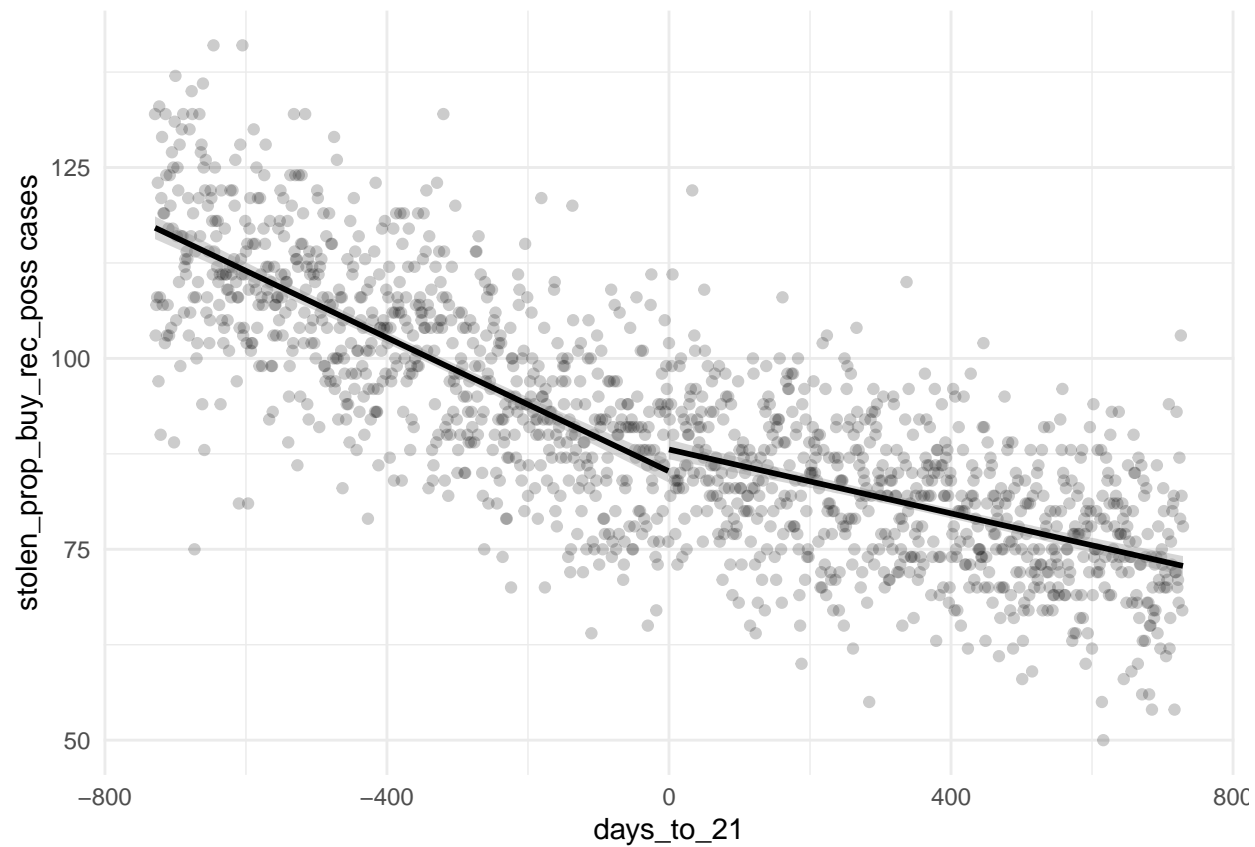
Property cases

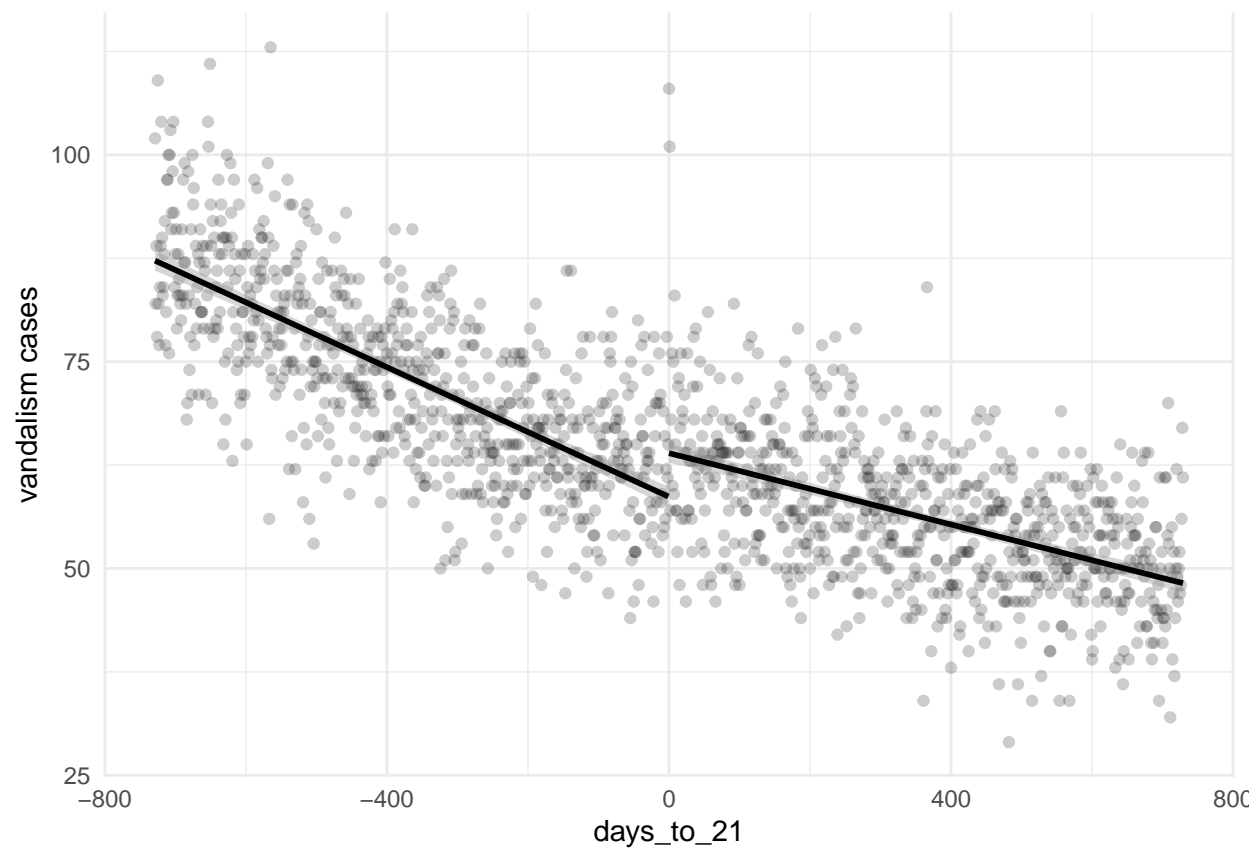
```
##   days_to_21 burglary larceny mv_theft stolen_prop_buy_rec_poss vandalism
## 1      -729      296     494     158                        132      102
## 2      -728      297     444     149                        103       82
## 3      -727      305     418     172                        107       89
## 4      -726      278     427     151                        108       78
## 5      -725      309     440     157                        123      109
## 6      -724      303     446     156                         97       82
##   under_21
## 1         0
## 2         0
## 3         0
## 4         0
## 5         0
## 6         0
```

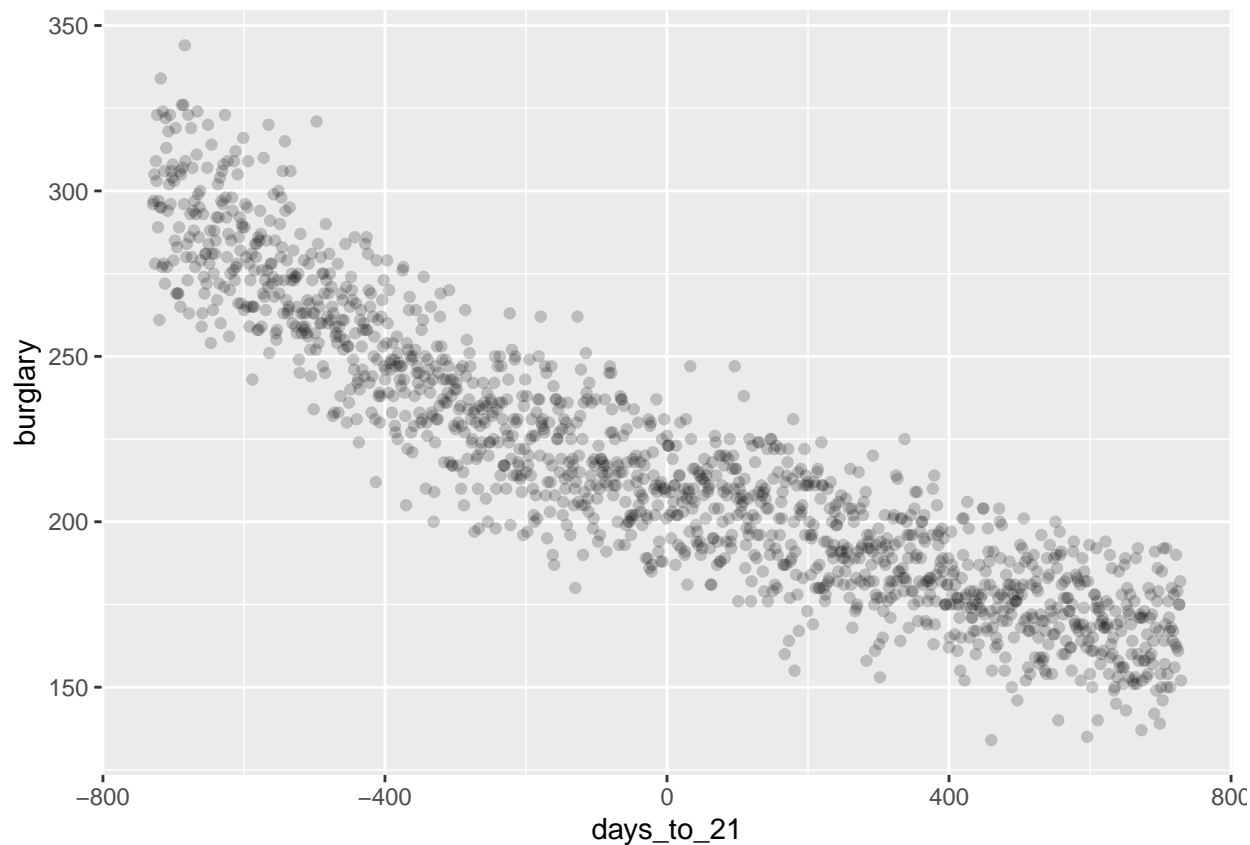










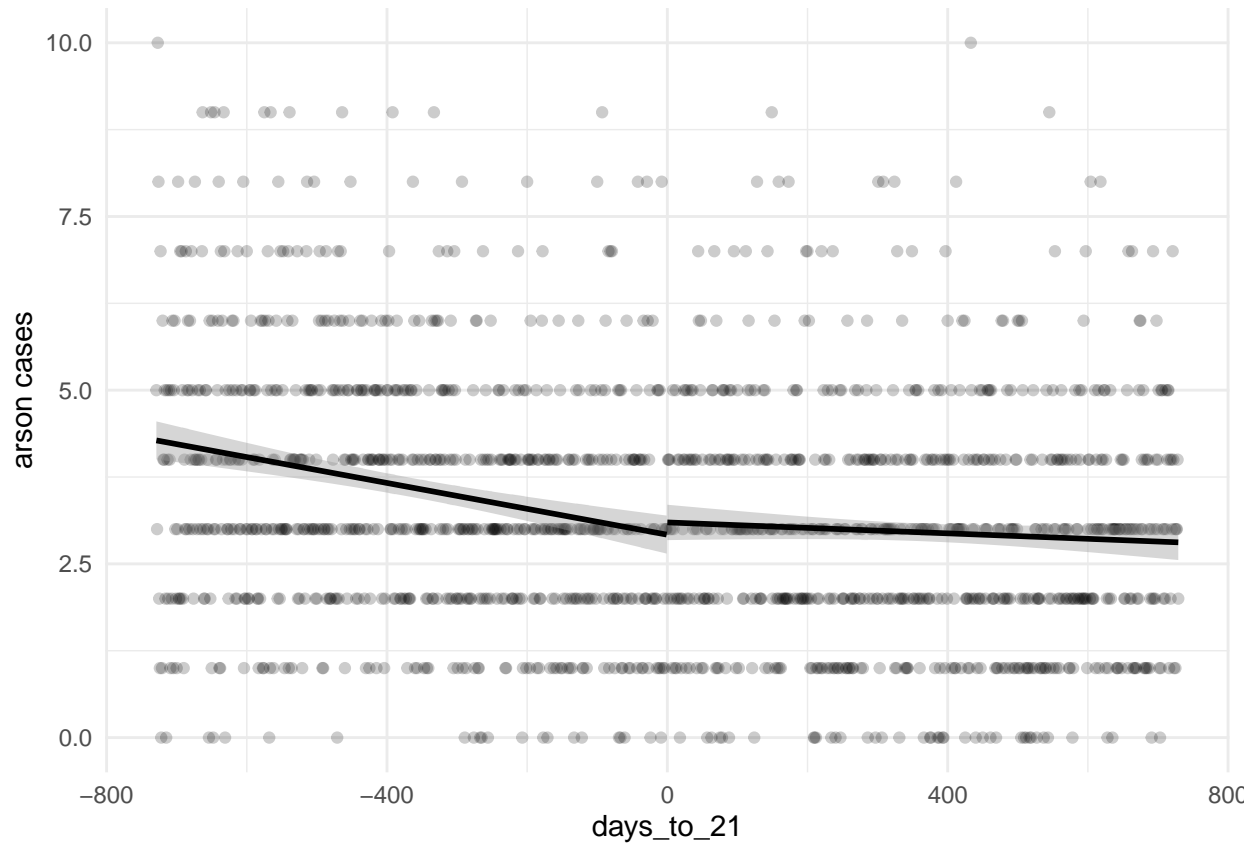


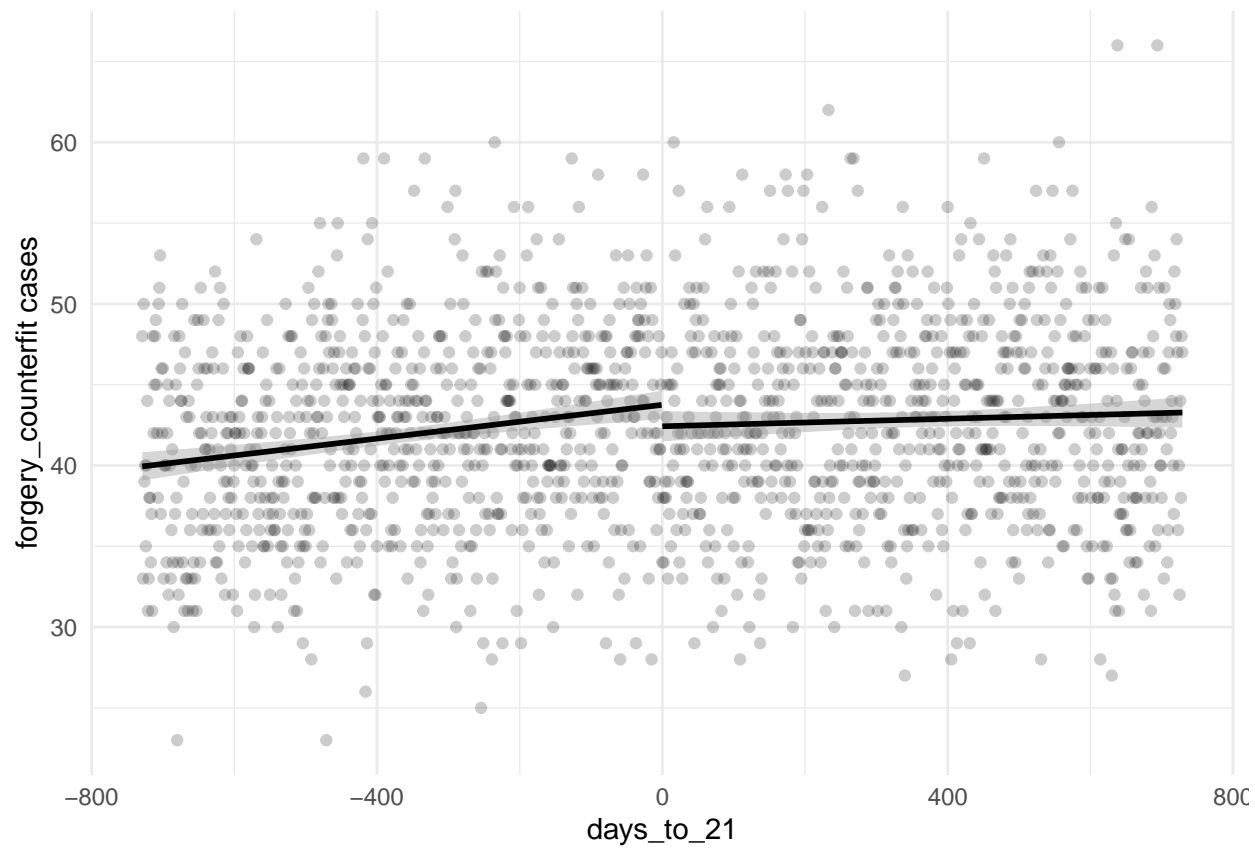
```
## # A tibble: 3 x 5
##   term          estimate std.error statistic    p.value
##   <chr>         <dbl>     <dbl>    <dbl>    <dbl>
## 1 (Intercept)  212.         0.968     219.    0.
## 2 days_to_21   -0.0995      0.00206   -48.4  1.70e-305
## 3 under_21      9.50        1.73       5.49  4.72e- 8
```

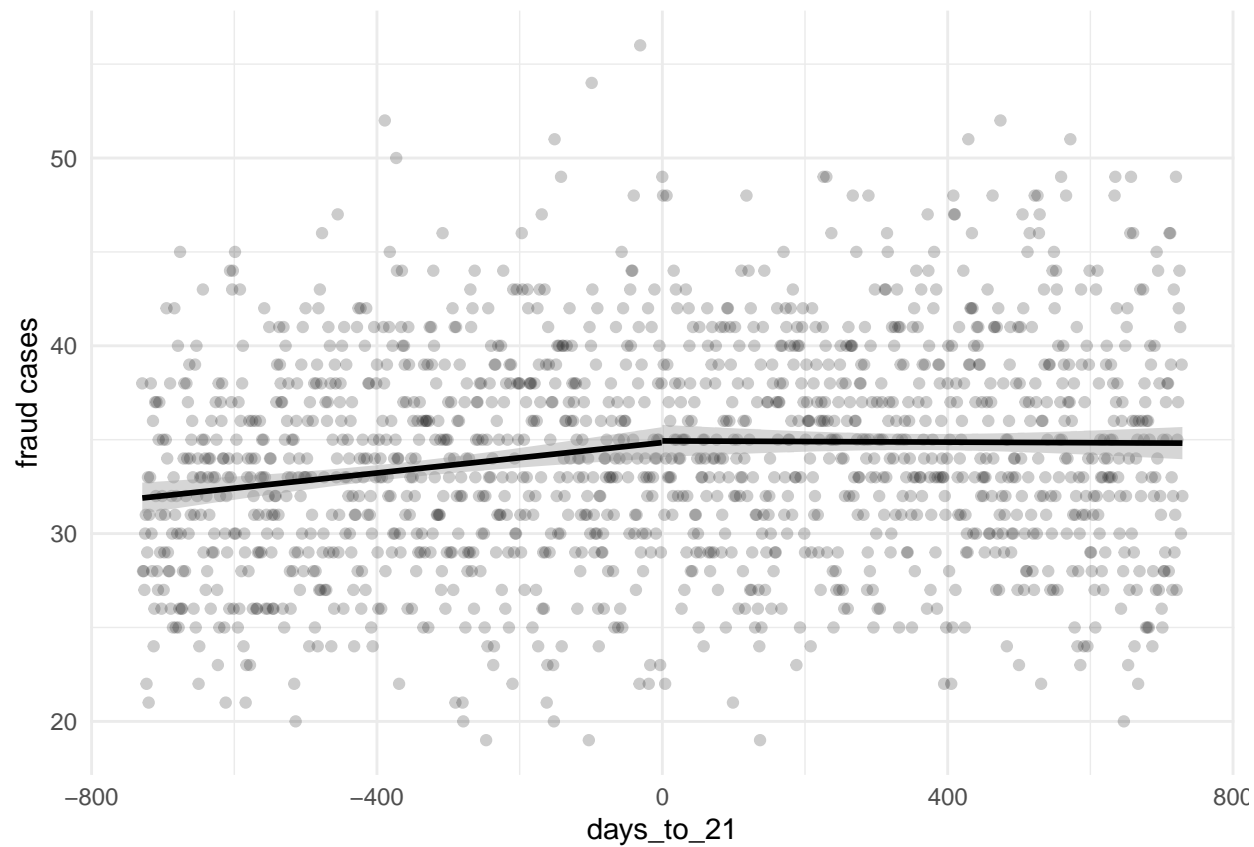
FBI other cases

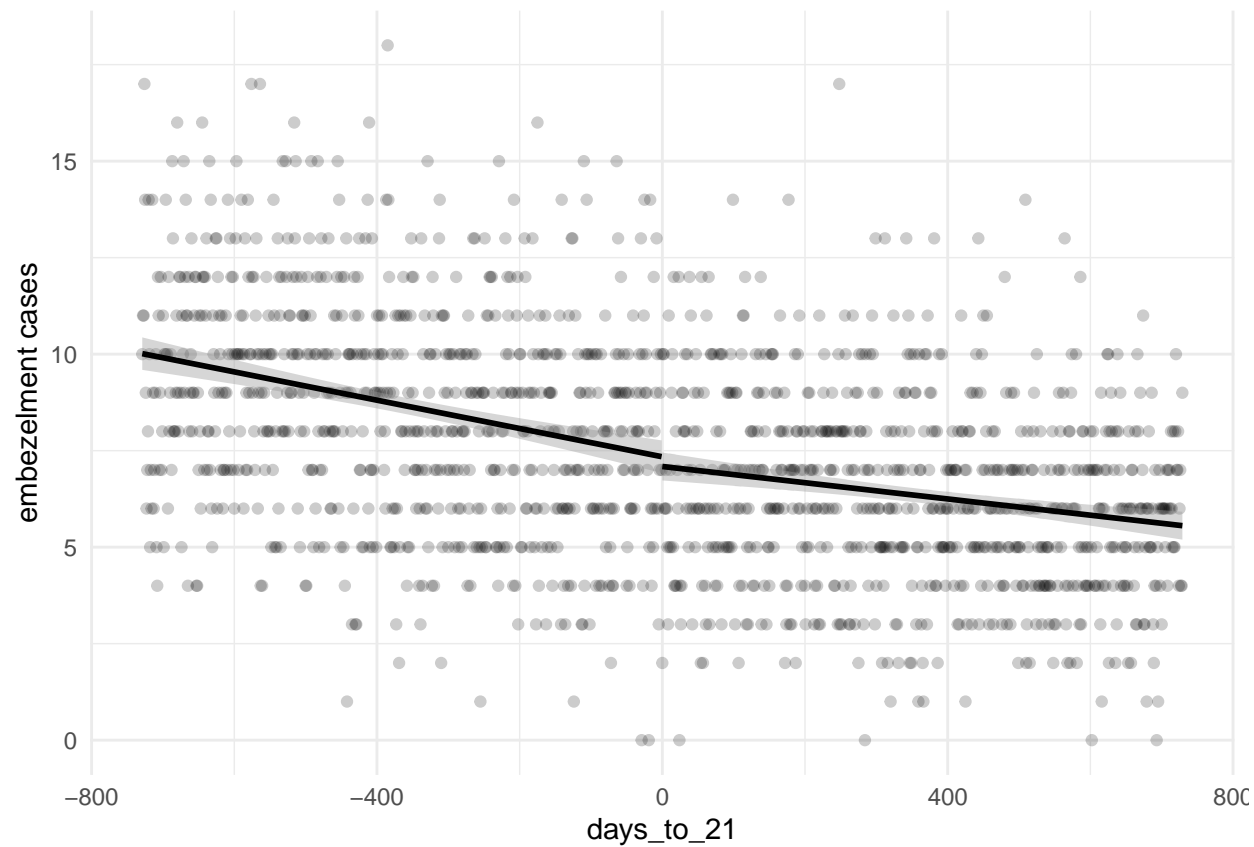
```
##   days_to_21 arson  forgery_counterfit  fraud  embezelment  weapons
## 1      -729     5              48    38           10    129
## 2      -728     3              33    28           11    145
## 3      -727    10              50    28           11    157
## 4      -726     8              39    27           17    133
## 5      -725     2              40    30           14    132
## 6      -724     1              35    31            9    151
##   prostitution sex_offenses  bookmaking  all_other_gambling  aga_family_child
## 1           46           38           0           3           1
## 2           57           38           0           4           1
## 3           33           44           0           0           1
## 4           42           33           1           2           0
## 5           45           43           0           6           0
## 6           42           40           0           4           1
##   curfew_loitering  runaways  under_21
```

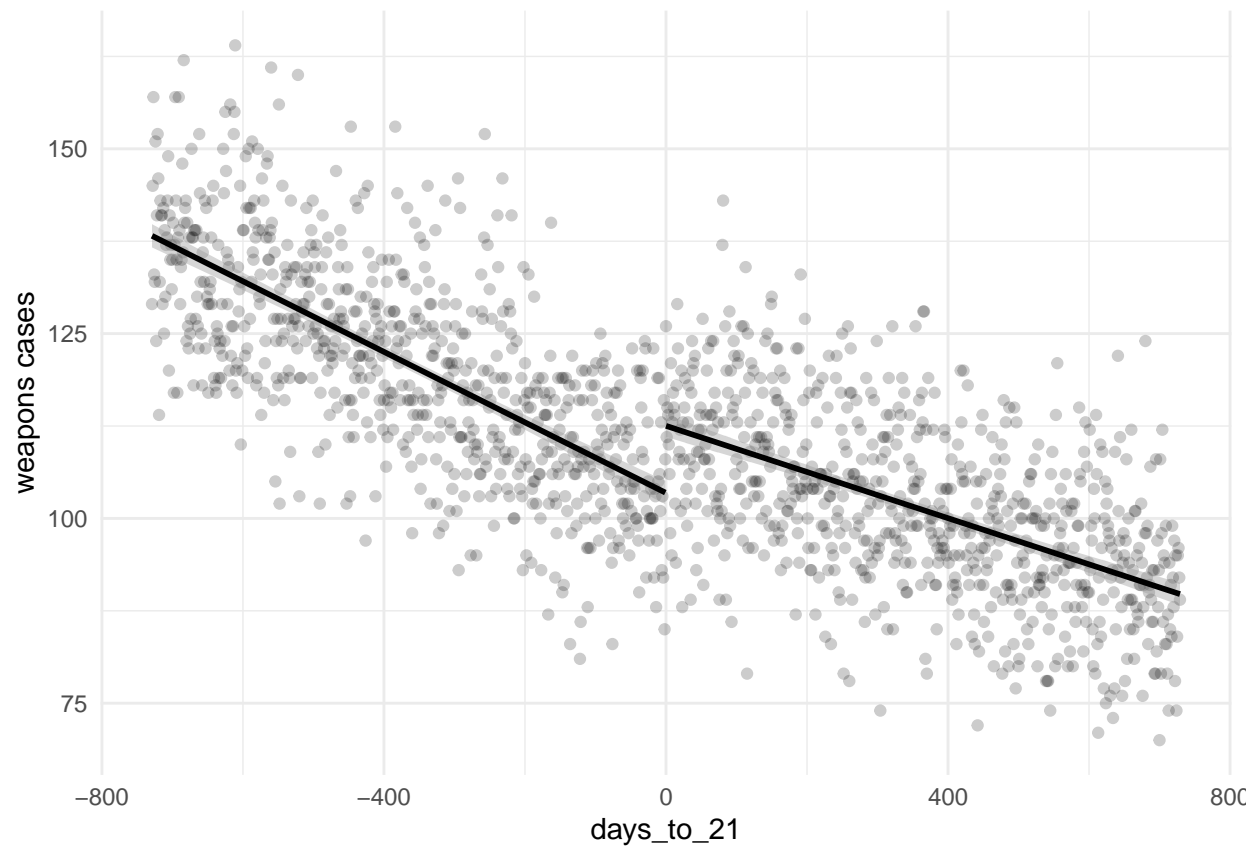
## 1	0	0	0
## 2	0	0	0
## 3	0	0	0
## 4	0	0	0
## 5	0	0	0
## 6	0	0	0

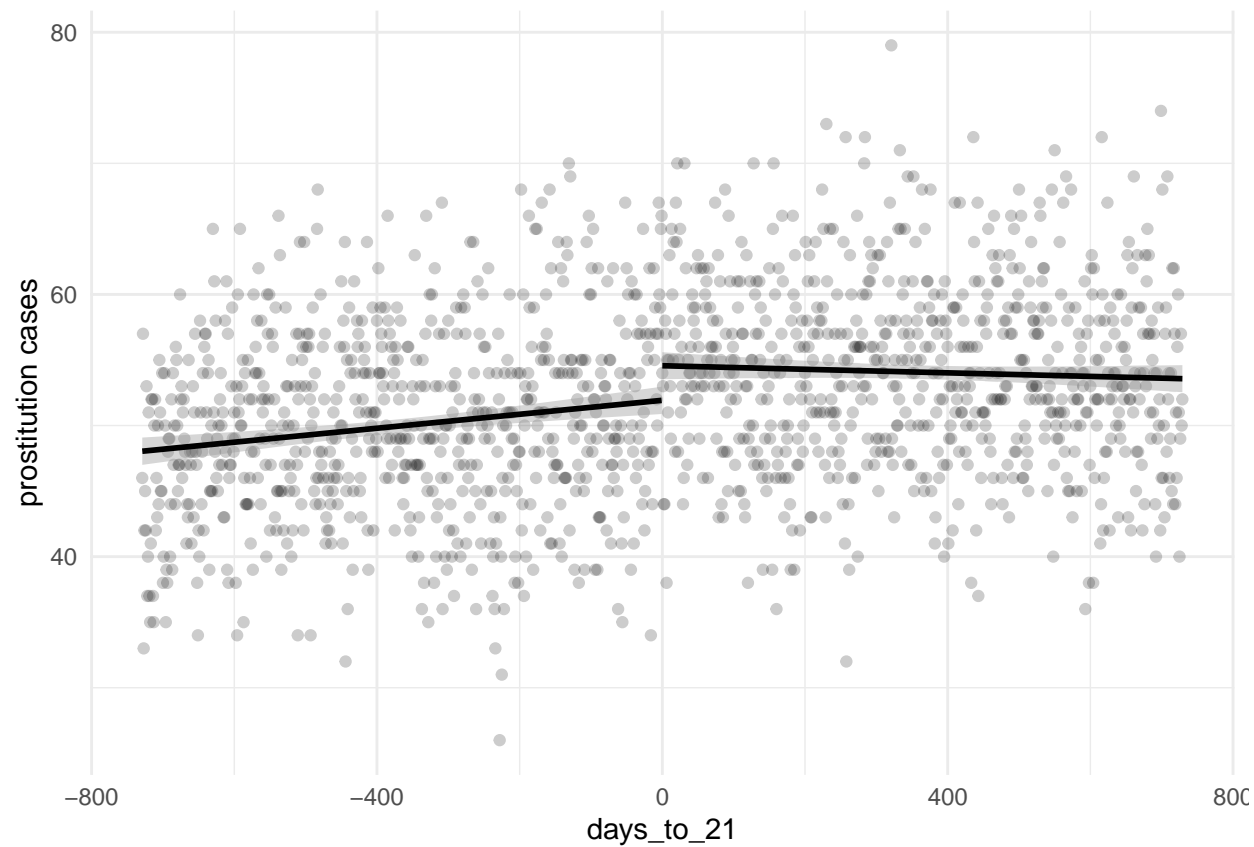


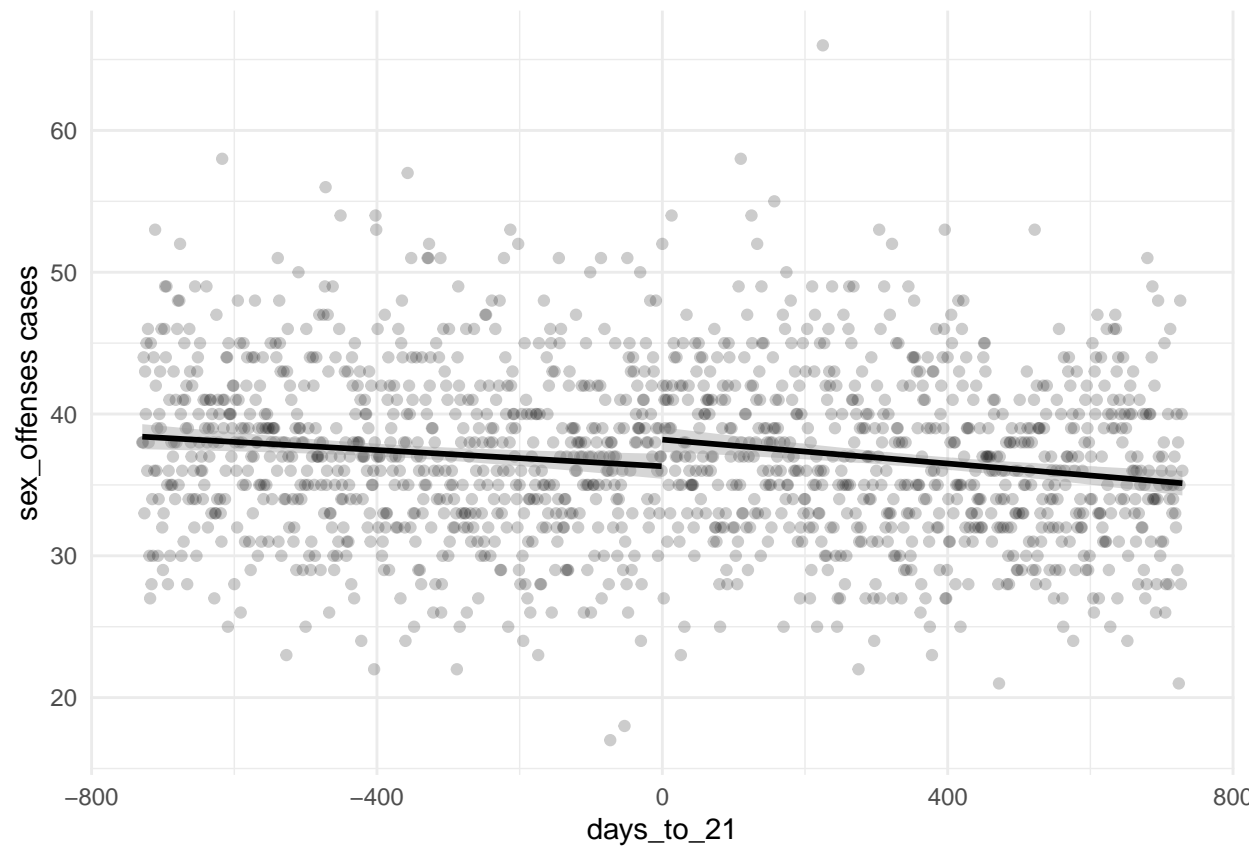


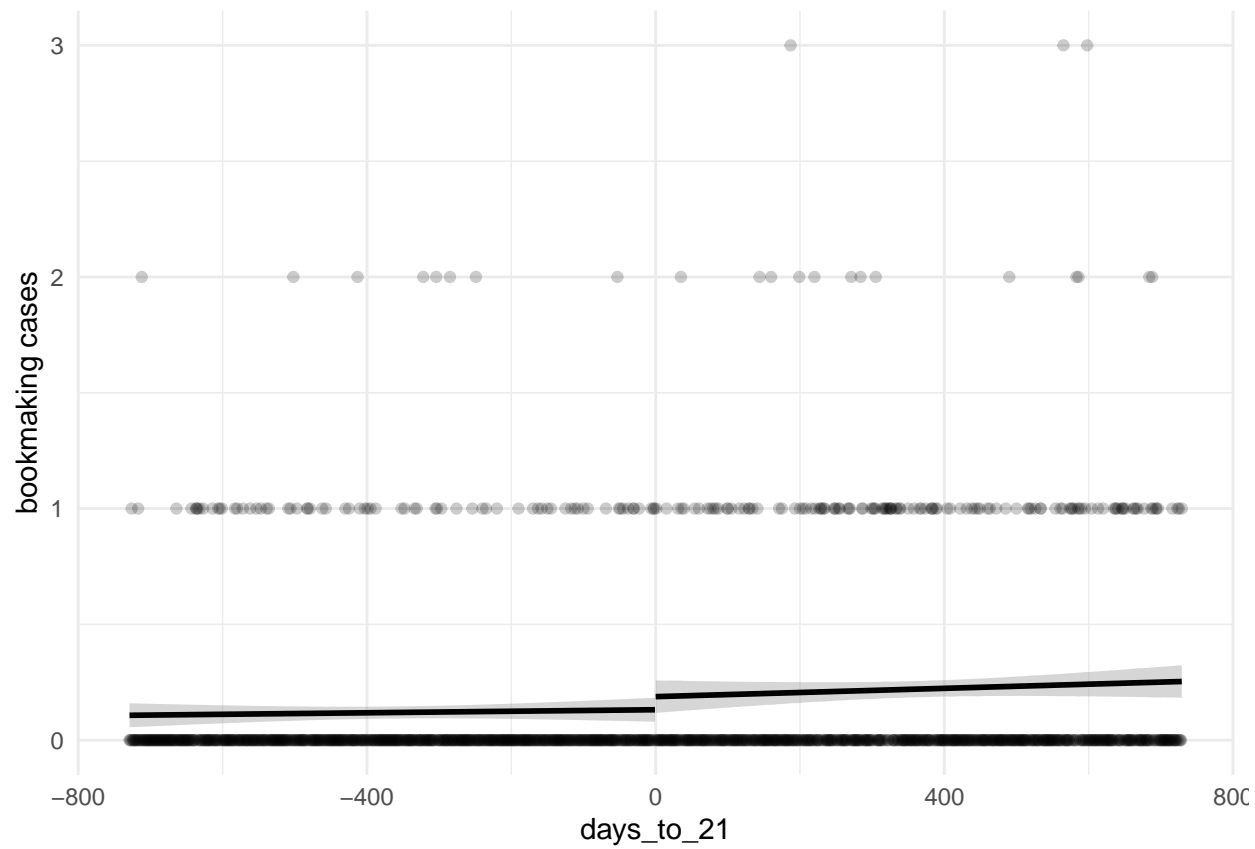


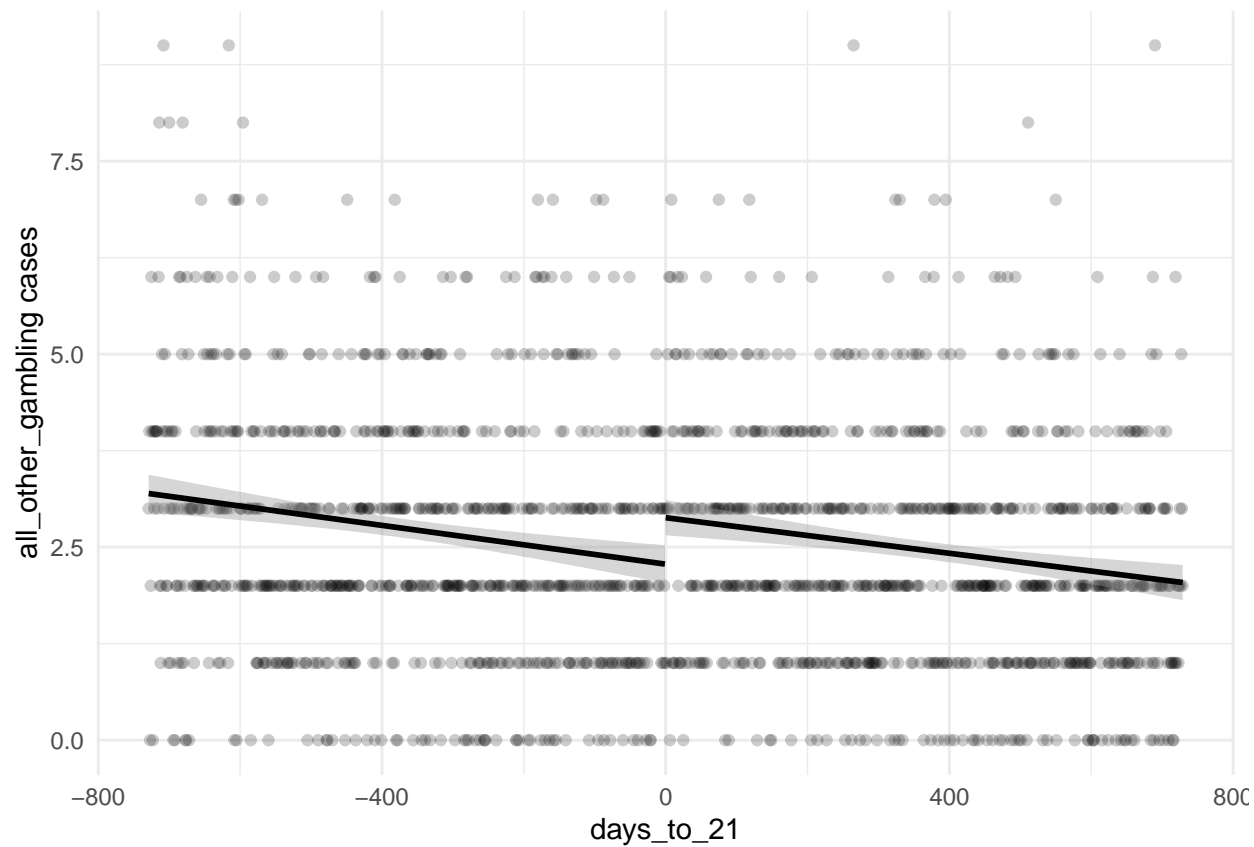


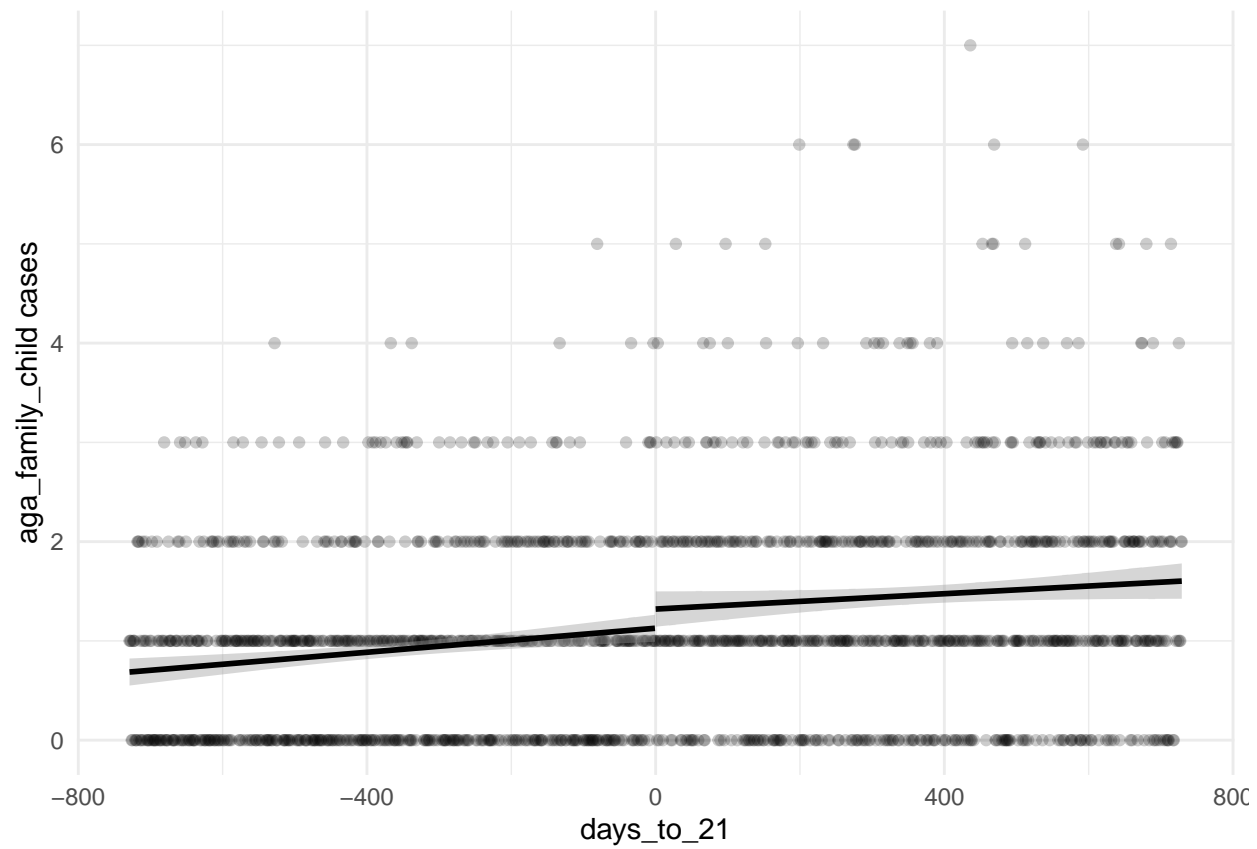


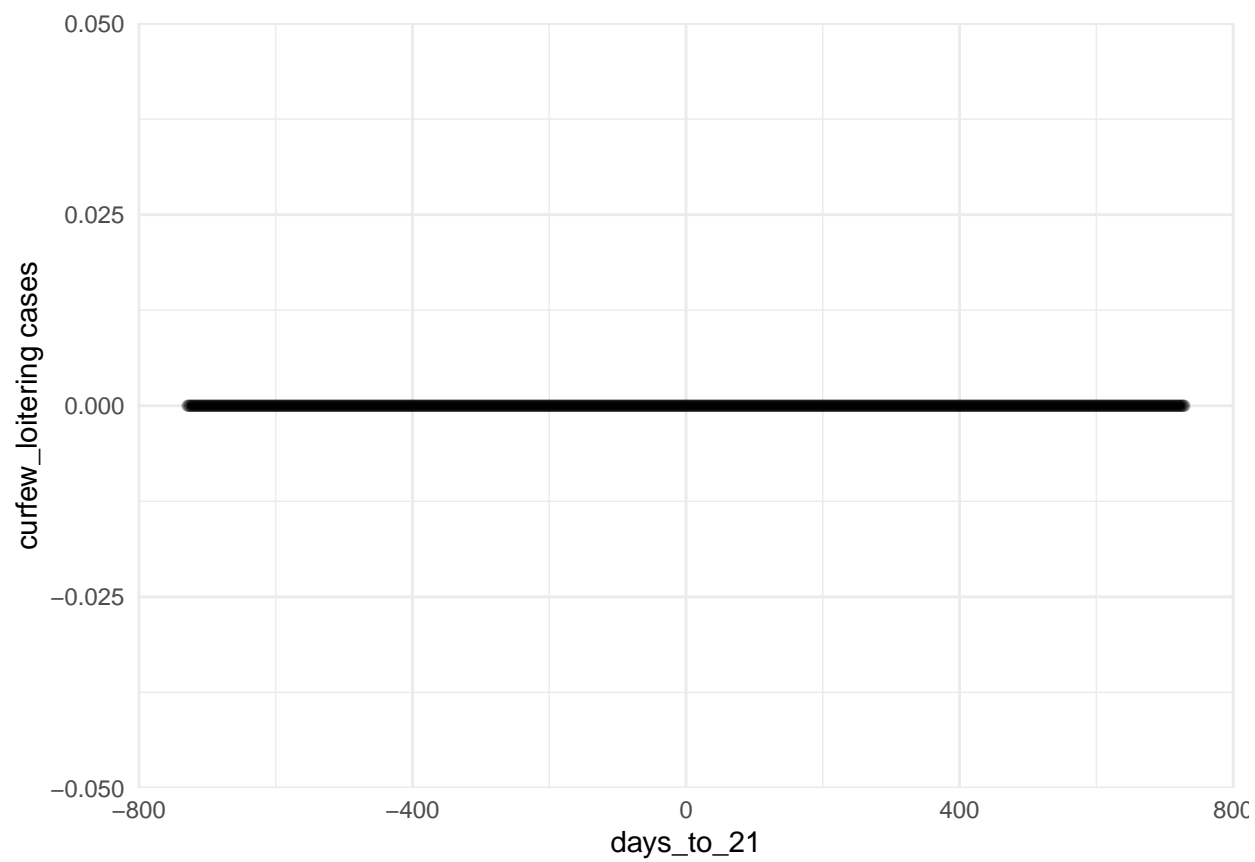


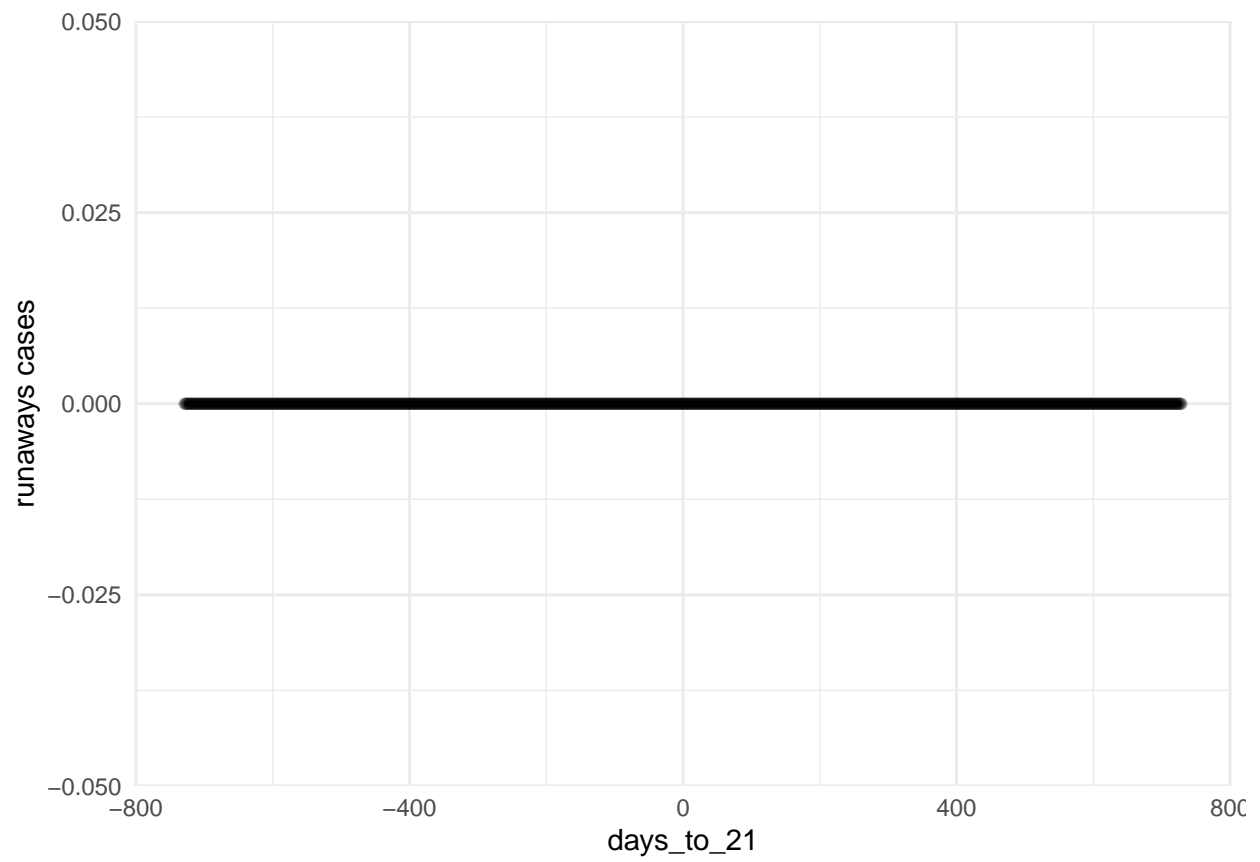












Appendix A

```
knitr::opts_chunk$set(echo = FALSE, include = TRUE)
# import libraries
library(broom)
library(tidyverse)
library(gridExtra)
library(pastecs)

setwd("~/Experimental Design for Data Science/ProblemSet5")

drinking <- read.csv("P01 Age Profile of Arrest Rates 1979-2006.csv")
drinking <- janitor::clean_names(drinking)

head(drinking)
drinking_19_to_23 <- filter(drinking, days_to_21 > -730 & days_to_21 <
  730)

drinking_19_to_23 %>% ggplot(aes(x = days_to_21, y = vandalism)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drinking_19_to_23 %>%
  filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drinking_19_to_23 %>% filter(days_to_21 >=
  0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "felony cases")
drinking_19_to_23 <- filter(drinking, days_to_21 > -730 & days_to_21 <
  730)

drinking_19_to_23 %>% ggplot(aes(x = days_to_21, y = violent_r)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drinking_19_to_23 %>%
  filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drinking_19_to_23 %>% filter(days_to_21 >=
  0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "felony cases")
drinking <- drinking %>% mutate(under_21 = if_else(days_to_21 <
  0, 0, 1))

lm(felony ~ days_to_21 + under_21, data = drinking) %>% tidy()
violent_cases <- select(drinking_19_to_23, days_to_21, murder,
  manslaughter, rape, robbery, aggravated_assault, ot_assault)

violent_cases <- violent_cases %>% mutate(under_21 = if_else(days_to_21 <
  0, 0, 1))

head(violent_cases)

# Plot murder cases
violent_cases %>% ggplot(aes(x = days_to_21, y = murder)) + geom_point(alpha = 0.2) +
  geom_smooth(data = violent_cases %>% filter(days_to_21 <
  0), method = "lm", color = "black") + geom_smooth(data = violent_cases %>%
  filter(days_to_21 >= 0), method = "lm", color = "black") +
  theme_minimal() + labs(x = "days_to_21", y = "murder cases")
```

```

# Plot manslaughter cases
violent_cases %>% ggplot(aes(x = days_to_21, y = manslaughter)) +
  geom_point(alpha = 0.2) + geom_smooth(data = violent_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = violent_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "manslaughter cases")

# Plot rape cases
violent_cases %>% ggplot(aes(x = days_to_21, y = rape)) + geom_point(alpha = 0.2) +
  geom_smooth(data = violent_cases %>% filter(days_to_21 <
    0), method = "lm", color = "black") + geom_smooth(data = violent_cases %>%
    filter(days_to_21 >= 0), method = "lm", color = "black") +
  theme_minimal() + labs(x = "days_to_21", y = "rape cases")

# Plot robbery cases
violent_cases %>% ggplot(aes(x = days_to_21, y = robbery)) +
  geom_point(alpha = 0.2) + geom_smooth(data = violent_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = violent_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "robbery cases")

# Plot aggravated assault cases
violent_cases %>% ggplot(aes(x = days_to_21, y = aggravated_assault)) +
  geom_point(alpha = 0.2) + geom_smooth(data = violent_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = violent_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "robbery cases")

# Plot ot_assault cases
violent_cases %>% ggplot(aes(x = days_to_21, y = ot_assault)) +
  geom_point(alpha = 0.2) + geom_smooth(data = violent_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = violent_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "robbery cases")

lm(manslaughter ~ days_to_21 + under_21, data = violent_cases) %>%
  tidy()

lm(rape ~ days_to_21 + under_21, data = violent_cases) %>% tidy()

# Compute descriptive statistics - boxplots
p1 <- ggplot(violent_cases) + aes(y = murder) + geom_boxplot() +
  labs(x = "", y = "murder cases (%)")
p2 <- ggplot(violent_cases) + aes(y = rape) + geom_boxplot() +
  labs(x = "", y = "Low Income (%)")
p3 <- ggplot(violent_cases) + aes(y = manslaughter) + geom_boxplot() +
  labs(x = "", y = "Visible minority (%)")
grid1 <- grid.arrange(p1, p2, p3, ncol = 1, nrow = 3)

```

```

grid1

# Compute descriptive statistics - table
tt1 <- ttheme_default()
stats_table <- stat.desc(violent_cases)
stats_table <- round(stats_table, 2)
stats_table <- mutate(stats_table, stats = row.names(stats_table))
# stats_table <- select(stats_table, stats,
# no_certificate_diploma_or_degree_2,
# x18_to_64_years_percent, total_visible_minority_population)
# colnames(stats_table) <- c('stats', 'No certificate', 'Low
# Income', 'Visible minority')
grid2 <- grid.arrange(tableGrob(stats_table, theme = tt1, rows = NULL),
  ncol = 1, nrow = 1)

# Join the boxplots and the table
grid.arrange(arrangeGrob(grid1, ncol = 2, nrow = 1), arrangeGrob(grid2,
  ncol = 1, nrow = 1), heights = c(30, 1), widths = c(1, 3),
  bottom = "Figure 1: Descriptive statistics of the data")
drugs_cases <- select(drinking_19_to_23, days_to_21, cocaine_opio_sale_manuf,
  mj_sale_manuf, dang_non_narc_sale_manuf, cocaine_opio_posses,
  mj_posses, dang_non_narc_posses)

drugs_cases <- drugs_cases %>% mutate(under_21 = if_else(days_to_21 <
  0, 0, 1))

head(drugs_cases)

# Plot cocaine_opio_sale_manuf cases
drugs_cases %>% ggplot(aes(x = days_to_21, y = cocaine_opio_sale_manuf)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drugs_cases %>%
  filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drugs_cases %>% filter(days_to_21 >= 0),
  method = "lm", color = "black") + theme_minimal() + labs(x = "days_to_21",
  y = "cocaine_opio_sale_manuf cases")

# Plot mj_sale_manuf cases
drugs_cases %>% ggplot(aes(x = days_to_21, y = mj_sale_manuf)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drugs_cases %>%
  filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drugs_cases %>% filter(days_to_21 >= 0),
  method = "lm", color = "black") + theme_minimal() + labs(x = "days_to_21",
  y = "mj_sale_manuf cases")

# Plot dang_non_narc_sale_manuf cases
drugs_cases %>% ggplot(aes(x = days_to_21, y = dang_non_narc_sale_manuf)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drugs_cases %>%
  filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drugs_cases %>% filter(days_to_21 >= 0),
  method = "lm", color = "black") + theme_minimal() + labs(x = "days_to_21",
  y = "dang_non_narc_sale_manuf cases")

```

```

# Plot cocaine_opio_poses cases
drugs_cases %>% ggplot(aes(x = days_to_21, y = cocaine_opio_poses)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drugs_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drugs_cases %>% filter(days_to_21 >= 0),
    method = "lm", color = "black") + theme_minimal() + labs(x = "days_to_21",
    y = "cocaine_opio_poses cases")

# Plot mj_poses cases
drugs_cases %>% ggplot(aes(x = days_to_21, y = mj_poses)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drugs_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drugs_cases %>% filter(days_to_21 >= 0),
    method = "lm", color = "black") + theme_minimal() + labs(x = "days_to_21",
    y = "mj_poses cases")

# Plot dang_non_narc_poses cases
drugs_cases %>% ggplot(aes(x = days_to_21, y = dang_non_narc_poses)) +
  geom_point(alpha = 0.2) + geom_smooth(data = drugs_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = drugs_cases %>% filter(days_to_21 >= 0),
    method = "lm", color = "black") + theme_minimal() + labs(x = "days_to_21",
    y = "dang_non_narc_poses cases")

alcohol_cases <- select(drinking_19_to_23, days_to_21, dui, liquor_laws,
  drunkenness_pc, disorderly_cond, vagrancy)

alcohol_cases <- alcohol_cases %>% mutate(under_21 = if_else(days_to_21 <
  0, 0, 1))

head(alcohol_cases)

# Plot dui cases
alcohol_cases %>% ggplot(aes(x = days_to_21, y = dui)) + geom_point(alpha = 0.2) +
  geom_smooth(data = alcohol_cases %>% filter(days_to_21 <
    0), method = "lm", color = "black") + geom_smooth(data = alcohol_cases %>%
  filter(days_to_21 >= 0), method = "lm", color = "black") +
  theme_minimal() + labs(x = "days_to_21", y = "dui cases")

# Plot liquor_laws cases
alcohol_cases %>% ggplot(aes(x = days_to_21, y = liquor_laws)) +
  geom_point(alpha = 0.2) + geom_smooth(data = alcohol_cases %>%
  filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = alcohol_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "liquor_laws cases")

# Plot drunkenness_pc cases
alcohol_cases %>% ggplot(aes(x = days_to_21, y = drunkenness_pc)) +
  geom_point(alpha = 0.2) + geom_smooth(data = alcohol_cases %>%

```

```

    filter(days_to_21 < 0), method = "lm", color = "black") +
    geom_smooth(data = alcohol_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
    labs(x = "days_to_21", y = "drunkenness_pc cases")

# Plot disorderly_cond cases
alcohol_cases %>% ggplot(aes(x = days_to_21, y = disorderly_cond)) +
    geom_point(alpha = 0.2) + geom_smooth(data = alcohol_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
    geom_smooth(data = alcohol_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
    labs(x = "days_to_21", y = "disorderly_cond cases")

# Plot vagrancy cases
alcohol_cases %>% ggplot(aes(x = days_to_21, y = vagrancy)) +
    geom_point(alpha = 0.2) + geom_smooth(data = alcohol_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
    geom_smooth(data = alcohol_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
    labs(x = "days_to_21", y = "vagrancy cases")

lm(vagrancy ~ days_to_21 + under_21, data = alcohol_cases) %>%
    tidy()
property_cases <- select(drinking_19_to_23, days_to_21, burglary,
    larceny, mv_theft, stolen_prop_buy_rec_poss, vandalism)

property_cases <- property_cases %>% mutate(under_21 = if_else(days_to_21 <
    0, 0, 1))

head(property_cases)

# Plot burglary cases
property_cases %>% ggplot(aes(x = days_to_21, y = burglary)) +
    geom_point(alpha = 0.2) + geom_smooth(data = property_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
    geom_smooth(data = property_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
    labs(x = "days_to_21", y = "burglary cases")

# Plot larceny cases
property_cases %>% ggplot(aes(x = days_to_21, y = larceny)) +
    geom_point(alpha = 0.2) + geom_smooth(data = property_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
    geom_smooth(data = property_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
    labs(x = "days_to_21", y = "larceny cases")

# Plot mv_theft cases
property_cases %>% ggplot(aes(x = days_to_21, y = mv_theft)) +
    geom_point(alpha = 0.2) + geom_smooth(data = property_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
    geom_smooth(data = property_cases %>% filter(days_to_21 >=

```



```

    0), method = "lm", color = "black") + theme_minimal() +
    labs(x = "days_to_21", y = "mv_theft cases")

# Plot stolen_prop_buy_rec_poss cases
property_cases %>% ggplot(aes(x = days_to_21, y = stolen_prop_buy_rec_poss)) +
  geom_point(alpha = 0.2) + geom_smooth(data = property_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = property_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "stolen_prop_buy_rec_poss cases")

# Plot vandalism cases
property_cases %>% ggplot(aes(x = days_to_21, y = vandalism)) +
  geom_point(alpha = 0.2) + geom_smooth(data = property_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = property_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "vandalism cases")

property_cases %>% ggplot(aes(x = days_to_21, y = burglary)) +
  geom_point(alpha = 0.2)

lm(burglary ~ days_to_21 + under_21, data = property_cases) %>%
  tidy()

fbi_other_cases <- select(drinking_19_to_23, days_to_21, arson,
  forgery_counterfit, fraud, embezelment, weapons, prostitution,
  sex_offenses, bookmaking, all_other_gambling, aga_family_child,
  curfew_loitering, runaways)

fbi_other_cases <- fbi_other_cases %>% mutate(under_21 = if_else(days_to_21 <
  0, 0, 1))

head(fbi_other_cases)

# Plot arson cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = arson)) +
  geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "arson cases")

# Plot forgery_counterfit cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = forgery_counterfit)) +
  geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "forgery_counterfit cases")

# Plot fraud cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = fraud)) +
  geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%

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filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "fraud cases")

# Plot embezelment cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = embezelment)) +
geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "embezelment cases")

# Plot weapons cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = weapons)) +
geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "weapons cases")

# Plot prostitution cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = prostitution)) +
geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "prostitution cases")

# Plot sex_offenses cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = sex_offenses)) +
geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "sex_offenses cases")

# Plot bookmaking cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = bookmaking)) +
geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "bookmaking cases")

# Plot all_other_gambling cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = all_other_gambling)) +
geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
filter(days_to_21 < 0), method = "lm", color = "black") +
geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
0), method = "lm", color = "black") + theme_minimal() +
labs(x = "days_to_21", y = "all_other_gambling cases")

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# Plot aga_family_child cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = aga_family_child)) +
  geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "aga_family_child cases")

# Plot curfew_loitering cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = curfew_loitering)) +
  geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "curfew_loitering cases")

# Plot runaways cases
fbi_other_cases %>% ggplot(aes(x = days_to_21, y = runaways)) +
  geom_point(alpha = 0.2) + geom_smooth(data = fbi_other_cases %>%
    filter(days_to_21 < 0), method = "lm", color = "black") +
  geom_smooth(data = fbi_other_cases %>% filter(days_to_21 >=
    0), method = "lm", color = "black") + theme_minimal() +
  labs(x = "days_to_21", y = "runaways cases")

```

References