Grease blocks sewers more frequently in cold weather

UNM R Programming Group:
Albuquerque Sewer Data Project

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1 Daily mean air temperature predicts sewage temperature

See results in ManholeWeatherRegression.Rnw

2 Weekly mean air temperature predicts total number of sewer blockages that week

The negative binomial GLM is highly significant (table **??**):

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	1.0313	0.1728	5.97	0.0000
Mean.TemperatureF	-0.0274	0.0102	-2.68	0.0074

Table 1: Weekly mean air temperature predicts the number of blocked sewers that week

[1] "Pseudo R^2 = 0.018" llh llhNull G2 McFadden r2ML -8.16e+02 -8.19e+02 7.06e+00 4.31e-03 1.49e-02 r2CU 1.54e-02
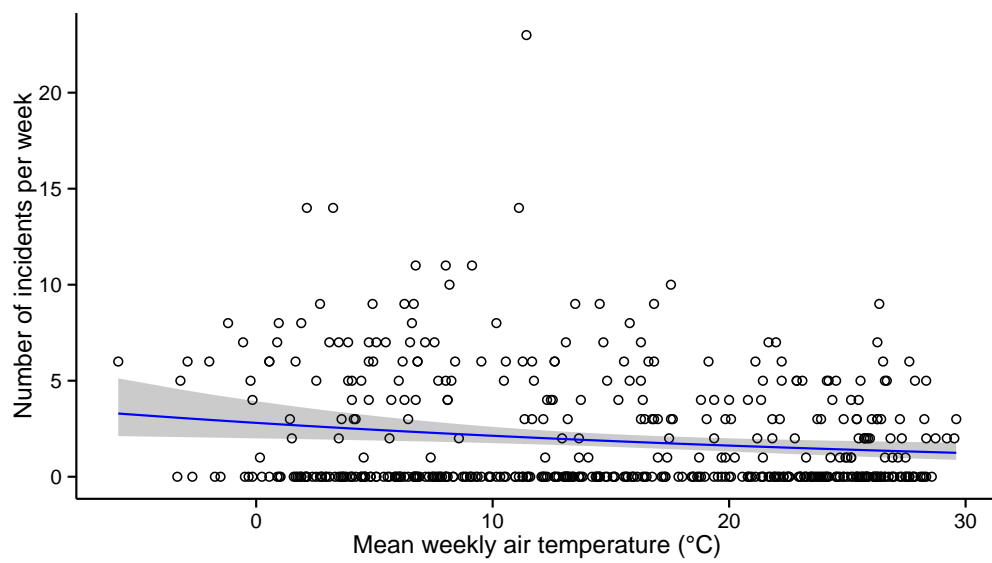
Figure 1: Air temperature and total sewer blockages

3 Temperature predicts only those blockages caused by grease

If we make a GLM of only those blockages caused by grease, and another for all other (i.e., non-grease) blockages, temperature is only a significant predictor of grease blockages.

	Estimate	Std. Error	z value	Pr($>$|z|)
(Intercept)	0.5586	0.1616	3.46	0.0005
Mean.TemperatureF	-0.0393	0.0099	-3.99	0.0001

Table 2: Negative binomial GLM predicting blockages caused by grease

[1] "Pseudo $R^2 = 0.018$"

	Estimate	Std. Error	z value	Pr($>$|z|)
(Intercept)	0.0812	0.1673	0.49	0.6276
Mean.TemperatureF	-0.0140	0.0099	-1.41	0.1573

Table 3: Negative binomial GLM predicting blockages not caused by grease
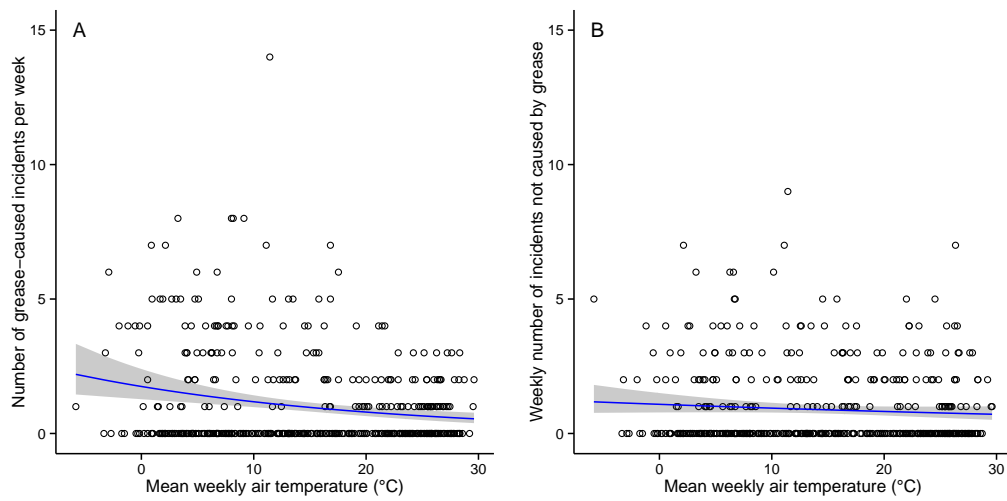
[1] "Pseudo $R^2 = 0.0053$"

Figure 2: Temperature predicts blockages caused by grease (A) but not other blockages (B)

4   Thanksgiving and Christmas

Can this pattern be explained by increased consumption of meat during Thanksgiving and Christmas?

Christmas is always in week 52; during the study period, Thanksgiving was in week 48 in 2009, and week 47 in 2010-13.

```
## Warning:  cannot compute exact p-value with ties

##
##  Wilcoxon rank sum test with continuity
##  correction
##
## data:  holiday.blocks and not.on.holiday
## W = 119, p-value = 0.8727
## alternative hypothesis: true location shift is not equal to 0
```
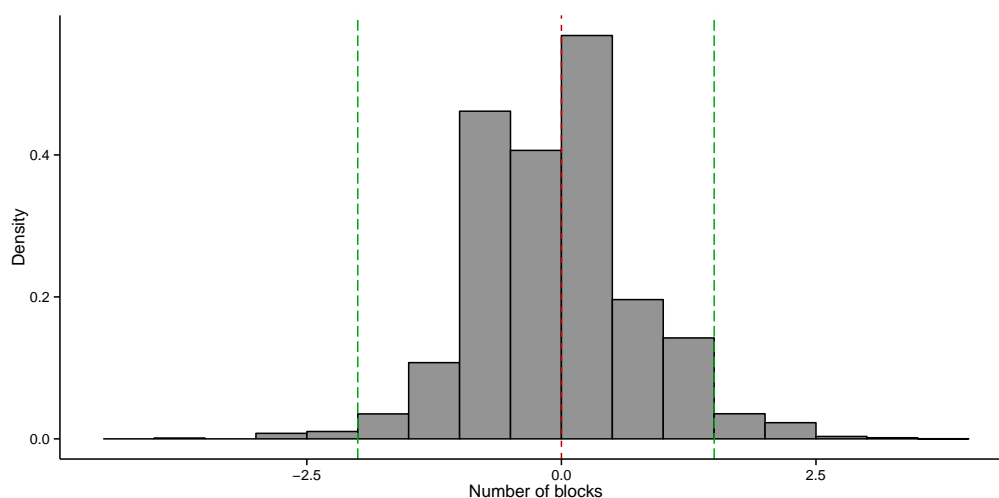

Figure 3: Temperature predicts blockages caused by grease (A) but not other blockages (B)

Without accounting for temperature, the weeks of Thanksgiving and Christmas did appear to have an exceptionally high number of blockages (lower CI = 0).

However, when including only November and December in the analysis, there appears to be no difference between holiday weeks and other weeks.

5 Days with grease blockages are colder than those with other blockages

The median temperature during days with grease blockages was $10\,^{\circ}$C whereas other blockages had an average of $13.9\,^{\circ}$C.

This difference was significantly different (Wilcoxon rank sum test: $W = 1.101 \times 10^5$, $p = 3.834 \times 10^{-5}$).

6 No difference in the diameter of pipes blocked by grease versus other blockages

Both samples had a median of 8 (units?) and did not significantly differ (Wilcoxon rank sum test: $W = 1.104 \times 10^5$, $p = 0.376$).