josh summary

```
library(dplyr)
```

```
Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```
library(ggplot2)
library(scales)
```

```
Warning: package 'scales' was built under R version 4.3.3
```

```
library(reshape2)
library(rjags)
```

```
Warning: package 'rjags' was built under R version 4.3.1

Loading required package: coda

Warning: package 'coda' was built under R version 4.3.1
```

```
Linked to JAGS 4.3.1

Loaded modules: basemod,bugs
```

```
library(stringr)
library(tidyr)
```

```

Attaching package: 'tidyr'

The following object is masked from 'package:reshape2':

    smiths
```

```
library(tidybayes)
```

```
Warning: package 'tidybayes' was built under R version 4.3.3
```

```
library(lubridate)
```

```

Attaching package: 'lubridate'

The following objects are masked from 'package:base':

    date, intersect, setdiff, union
```

```
library(tsModel)
```

```
Warning: package 'tsModel' was built under R version 4.3.3

Time Series Modeling for Air Pollution and Health (0.6-2)
```

```
library(dlnm)
```

```
Warning: package 'dlnm' was built under R version 4.3.3

This is dlnm 2.4.7. For details: help(dlnm) and vignette('dlnmOverview').
```

```
library(INLA)
```

```
Warning: package 'INLA' was built under R version 4.3.1
```

```
Loading required package: Matrix
```

```
Warning: package 'Matrix' was built under R version 4.3.1
```

```

Attaching package: 'Matrix'
```

```
The following objects are masked from 'package:tidyr':

    expand, pack, unpack
```

```
Loading required package: sp
```

```
This is INLA_23.06.29 built 2023-06-30 04:18:35 UTC.
 - See www.r-inla.org/contact-us for how to get help.
```

```
library(RColorBrewer)

ds1 <- readRDS('./Data/CONFIDENTIAL/lagged_data.rds')
```

Create basis functions

```
nlag=14

basis_pm2_5_lin <-   crossbasis(ds1$pm2_5, lag=nlag, argvar=list(fun="lin"),
                                arglag=list(fun="poly",degree=4))

colnames(basis_pm2_5_lin) = paste0("basis_pm2_5.", colnames(basis_pm2_5_lin))


ds1a <- ds1 %>%
  mutate(weekdate=floor_date(date, 'week'),
         weekN = as.numeric(difftime(weekdate, min(weekdate), units = "weeks")),
```

```
          cal_monthN= as.numeric(as.factor(paste(year(date), month(date), '01', sep='-')))
  )
```

INLA model 1

Day of week effect

PM2.5 distributed lag basis

RW2 using time index

Negative binomial

```
mod1_lin <-   inla(Cases_Total ~ day_of_week  + basis_pm2_5_lin + f(t, model='rw2', scale.
                   control.predictor = list(link = 1, compute = TRUE),
                   control.compute=list(return.marginals.predictor=TRUE),
                   control.fixed = list(correlation.matrix = TRUE,
                                        prec.intercept = 1e-4, prec = 1e-4)
)
```

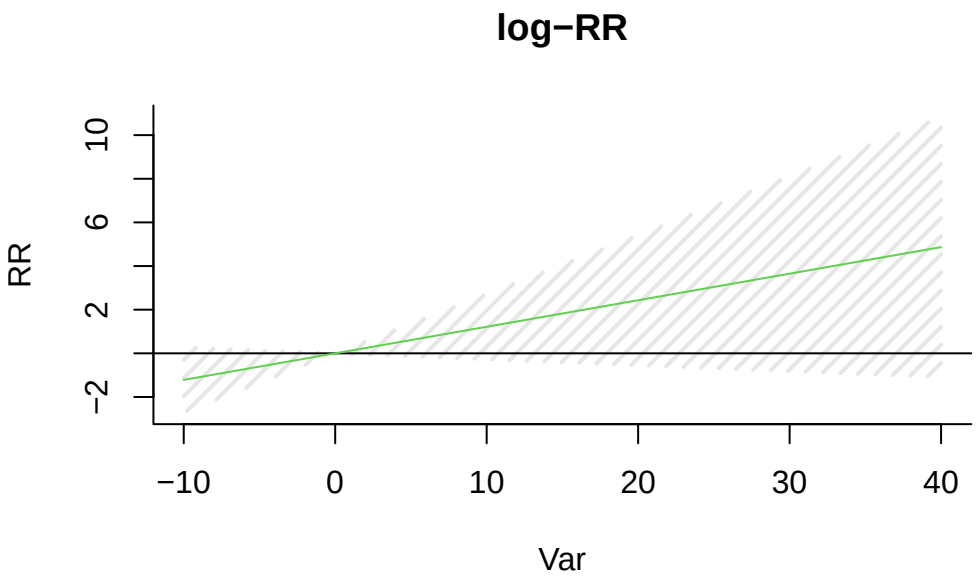
Extract coefficients

```
mod1.coef <- mod1_lin$summary.fixed[grep('basis_pm',row.names(mod1_lin$summary.fixed)),'me

mod1.vcov <-mod1_lin$misc$lincomb.derived.covariance.matrix[grep('basis_pm',row.names(mod1

pred1.pm <- crosspred(basis_pm2_5_lin, coef=mod1.coef, vcov=mod1.vcov, at=-10:40,bylag=0.2
```

Plot

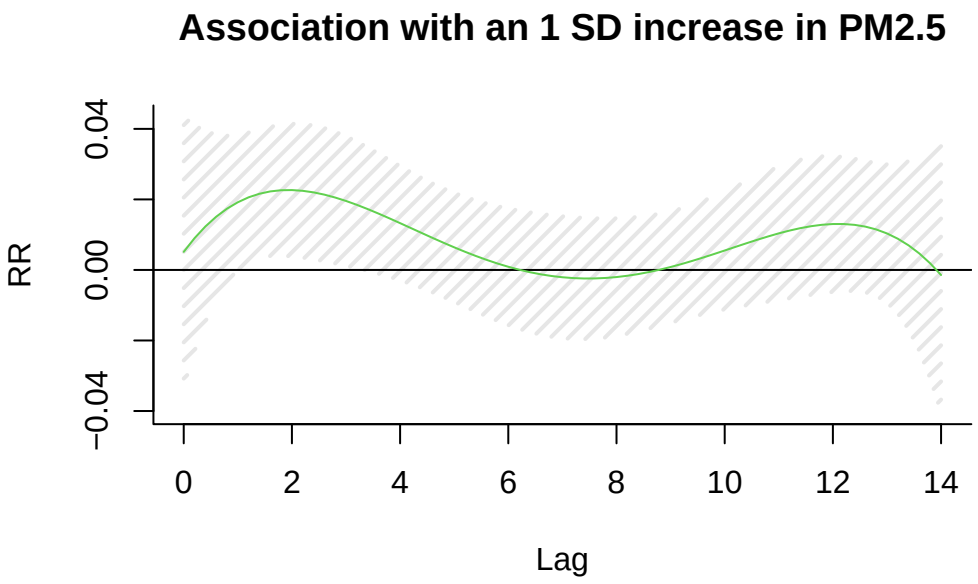
Trends

```
plot(pred1.pm, "overall", var=1,lag=1, col=3, ylab="RR", ci.arg=list(density=15,lwd=2),
     main="log-RR")
```



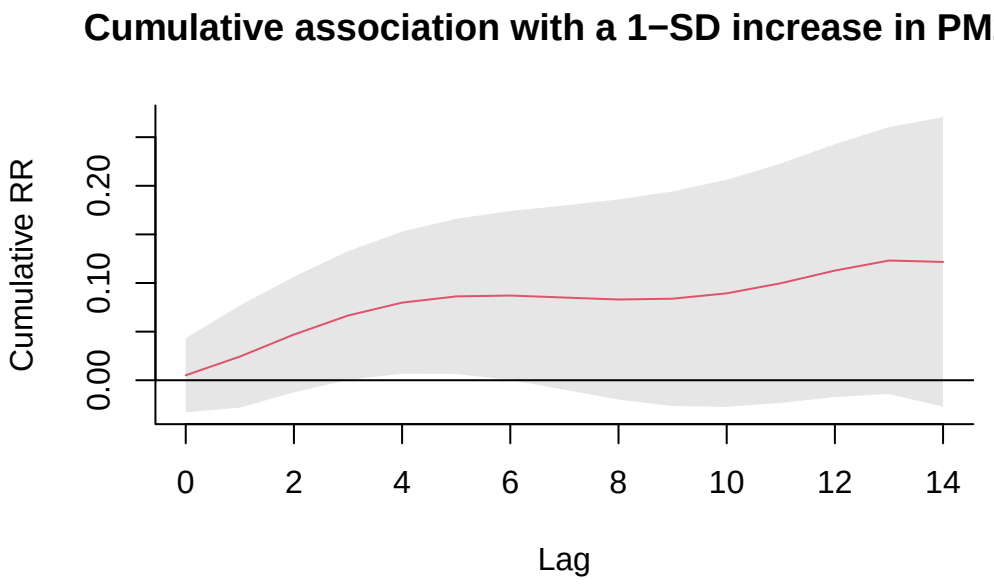
Coefficients

```
plot(pred1.pm, "slices", var=1, col=3, ylab="RR", ci.arg=list(density=15,lwd=2),
     main="Association with an 1 SD increase in PM2.5")
```



Cumulative effect

```
plot(pred1.pm, "slices", var=1, col=2, cumul=TRUE, ylab="Cumulative RR",
     main="Cumulative association with a 1-SD increase in PM2.5")
```



INLA model 2

Same as INLA model 1, except we have a RW2 for month index (instead of day inde)

Day of week effect

PM2.5 distributed lag basis

RW2 using time index

Negative binomial

```
mod2_lin <-   inla(Cases_Total ~ day_of_week  + basis_pm2_5_lin + f(cal_monthN, model='rw2
                   control.predictor = list(link = 1, compute = TRUE),
                   control.compute=list(return.marginals.predictor=TRUE),
                   control.fixed = list(correlation.matrix = TRUE,
                                        prec.intercept = 1e-4, prec = 1e-4)
)
```

Extract coefficients

```
mod2.coef <- mod2_lin$summary.fixed[grep('basis_pm',row.names(mod1_lin$summary.fixed)),'me
```

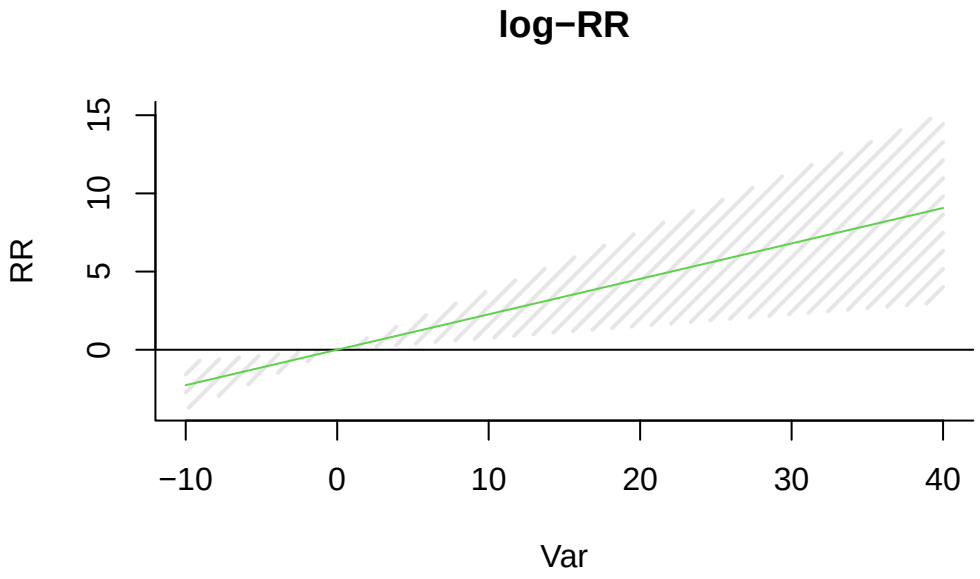
```
mod2.vcov <-mod2_lin$misc$lincomb.derived.covariance.matrix[grep('basis_pm',row.names(mod2
```

```
pred2.pm <- crosspred(basis_pm2_5_lin, coef=mod2.coef, vcov=mod2.vcov, at=-10:40,bylag=0.2
```

Plot

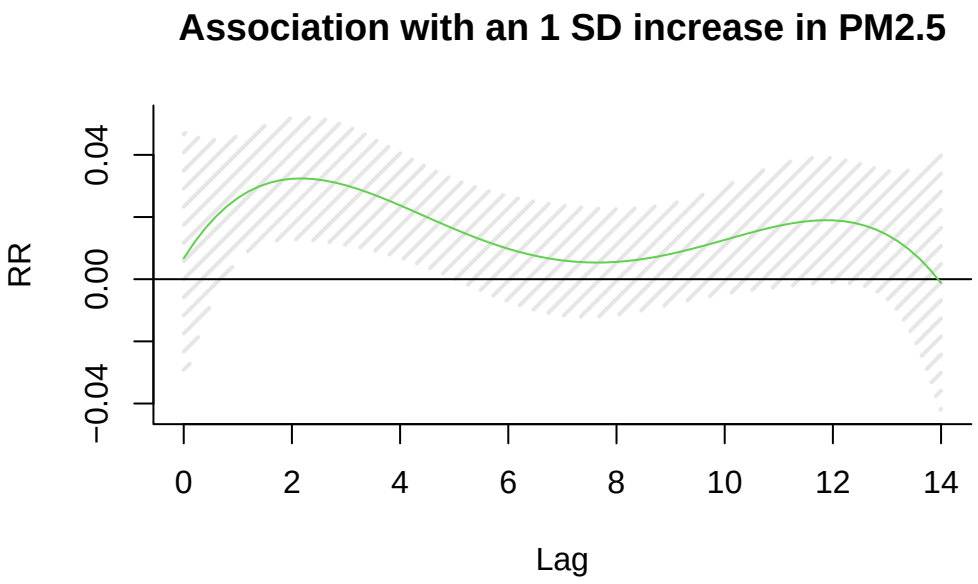
Trends

```
plot(pred2.pm, "overall", var=1,lag=1, col=3, ylab="RR", ci.arg=list(density=15,lwd=2),
     main="log-RR")
```



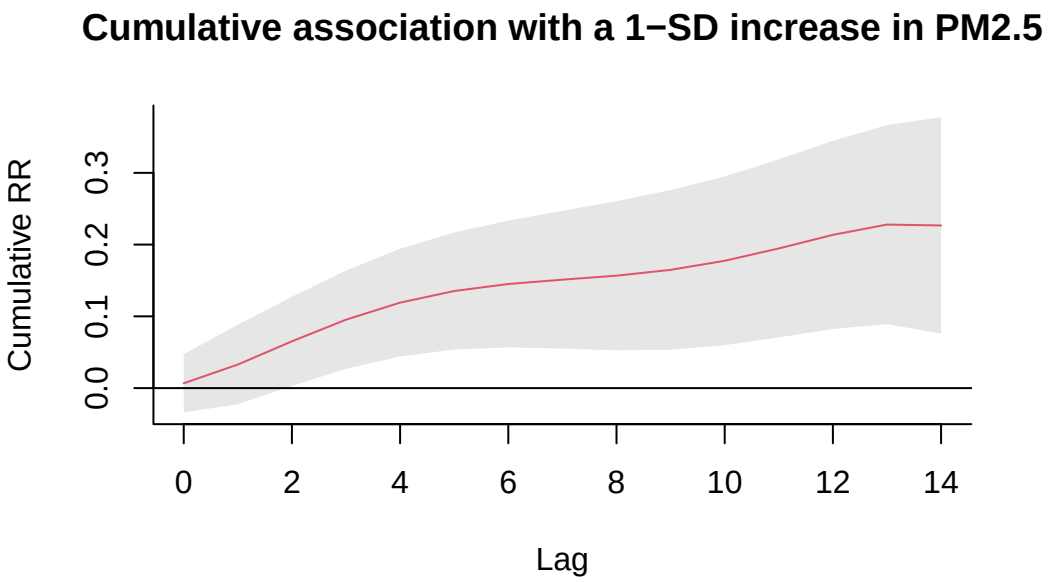
Coefficients

```
plot(pred2.pm, "slices", var=1, col=3, ylab="RR", ci.arg=list(density=15,lwd=2),
     main="Association with an 1 SD increase in PM2.5")
```



Cumulative effect

```
plot(pred2.pm, "slices", var=1, col=2, cumul=TRUE, ylab="Cumulative RR",
     main="Cumulative association with a 1-SD increase in PM2.5")
```


Cumulative association with a 1−SD increase in PM2.5
Cumulative RR
0.0
0.1
0.2
0.3
0
2
4
6
8
10
12
14
Lag