R-code

# Input: A data frame df with variables:
# - In, time of arrival for each patient in whole minutes since time 0
# - Created, time of patient record creation, in whole minutes after time 0
# If the patient was not pre-reported, Created=In

library(lubridate)

# Start and end of the period.
# All arrivals should be within these time points
start = as.numeric(strptime("2010-01-01","%Y-%m-%d"))
stop = as.numeric(strptime("2018-01-01","%Y-%m-%d"))

T <- seq(start,stop, by=60)
N <- length(T)
createdN <- rep(0,N)
createdt <- rep(0,N)
createdt2 <- rep(0,N)
createdt3 <- rep(0,N)
created6plus <- rep(0,N)

Arrival_1h <- rep(0,N)
Arrival_2h <- rep(0,N)
Arrival_3h <- rep(0,N)

for (j in 1:nrow(df)){
  # For each patient, mark as arriving 1, 2 and 3 hours in advance
  ind_1h <- (df$In[j]-60):(df$In[j]-1)
  ind_2h <- (df$In[j]-2*60):(df$In[j]-1)
  ind_3h <- (df$In[j]-3*60):(df$In[j]-1)
  Arrival_1h[ind_1h] <- Arrival_1h[ind_1h]+1
  Arrival_2h[ind_2h] <- Arrival_2h[ind_2h]+1
  Arrival_3h[ind_3h] <- Arrival_3h[ind_3h]+1

  # For pre-reported patients
  if (df$In>df$Created){
    ind_c <- df$Created[j]:df$In[j]-1
    n <- length(ind_c)
    # If pre-reported for more than 6 hours,
    # leave out of time calculation, but
if (n>6*60){
    created6plus[ind_c[(6*60+1):n]] = created6[ind_c[(6*60+1):n]]+1
    ind_c  <- ind_c[0:(6*60)]
    n      <- length(ind_c)
}

# Number of patients pre-reported at any time, and sum of time (^2 and ^3) since creation for all such patients
createdN[ind_c]  <- nMeldt[ind_c]+1
createdt[ind_c]  <- Meldtt[ind_c]+(1:n)
createdt2[ind_c] <- Meldtt2[ind_c]+(1:n)^2
createdt3[ind_c] <- Meldtt3[ind_c]+(1:n)^3
}

data = data.frame(t,created,createdt,createdt2,createdt3,created6plus)

# Counting arrivals in the previous 1, 2 and 3 hours
data$prev_1h             <- rep(0,N)
data$prev_2h             <- rep(0,N)
data$prev_3h             <- rep(0,N)
data$prev_1h[(60+1):N]   <- data$Arrival_1h[1:(N-60)]
data$prev_2h[(60*2+1):N] < - data$Arrival_1h[1:(N-60*2)]
data$prev_3h[(60*3+1):N] <- data$Arrival_1h[1:(N-60*3)]

# Time corrected for daylight savings time
data$t_dst  <- data$t + 60*60*as.numeric(dst(as.POSIXct(data$t,origin='1970-01-01')))

# Period of yearly and weekly variation
Ty               = 60*60*24*365/2/pi
Tw               = 60*60*24*7/2/pi

# Fit the model using GLM
# Note that the variable Holiday should be initialized with
# three levels: no holiday, holiday, and day after holiday
reg_1h = glm(Arrival_1h ~
             sin(t_dst/Tw)  + cos(t_dst/Tw)+
             sin(2*t_dst/Tw)  + cos(2*t_dst/Tw)+
             sin(3*t_dst/Tw)  + cos(3*t_dst/Tw)+
             sin(4*t_dst/Tw)  + cos(4*t_dst/Tw)+
             sin(5*t_dst/Tw)  + cos(5*t_dst/Tw)+
             sin(6*t_dst/Tw)  + cos(6*t_dst/Tw)+
             sin(7*t_dst/Tw)  + cos(7*t_dst/Tw)+
\[\sin(8t_{\text{dst}}/Tw) + \cos(8t_{\text{dst}}/Tw) + \sin(9t_{\text{dst}}/Tw) + \cos(9t_{\text{dst}}/Tw) + \sin(10t_{\text{dst}}/Tw) + \cos(10t_{\text{dst}}/Tw) + \sin(11t_{\text{dst}}/Tw) + \cos(11t_{\text{dst}}/Tw) + \sin(12t_{\text{dst}}/Tw) + \cos(12t_{\text{dst}}/Tw) + \sin(13t_{\text{dst}}/Tw) + \cos(13t_{\text{dst}}/Tw) + \sin(14t_{\text{dst}}/Tw) + \cos(14t_{\text{dst}}/Tw) + \sin(15t_{\text{dst}}/Tw) + \cos(15t_{\text{dst}}/Tw) + \sin(16t_{\text{dst}}/Tw) + \cos(16t_{\text{dst}}/Tw) + \sin(17t_{\text{dst}}/Tw) + \cos(17t_{\text{dst}}/Tw) + \sin(18t_{\text{dst}}/Tw) + \cos(18t_{\text{dst}}/Tw) + \sin(19t_{\text{dst}}/Tw) + \cos(19t_{\text{dst}}/Tw) + \sin(20t_{\text{dst}}/Tw) + \cos(20t_{\text{dst}}/Tw) + \sin(21t_{\text{dst}}/Tw) + \cos(21t_{\text{dst}}/Tw) + \sin(22t_{\text{dst}}/Tw) + \cos(22t_{\text{dst}}/Tw) + \sin(23t_{\text{dst}}/Tw) + \cos(23t_{\text{dst}}/Tw) + \sin(24t_{\text{dst}}/Tw) + \cos(24t_{\text{dst}}/Tw) + \sin(t/Ty) + \cos(t/Ty) + \sin(2t/Ty) + \cos(2t/Ty) + \sin(3t/Ty) + \cos(3t/Ty) + \sin(4t/Ty) + \cos(4t/Ty) + \sin(5t/Ty) + \cos(5t/Ty) + \sin(6t/Ty) + \cos(6t/Ty) + \sin(7t/Ty) + \cos(7t/Ty) + \sin(8t/Ty) + \cos(8t/Ty) + t + I(t^2) + \text{Holiday} + \text{prev}_1h + \text{prev}_2h + \text{prev}_3h + \text{createdN} + \text{createdt} + \text{createdt2} + \text{createdt3} + \text{created6plus}, \text{data} = \text{data, family} = \text{poisson(link='log')}\]