

```

library(plyr)
library(dplyr)

##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:plyr':
##
##   arrange, count, desc, failwith, id, mutate, rename, summarise,
##   summarize
## The following objects are masked from 'package:stats':
##
##   filter, lag
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union

library(tidyr)
library(lubridate)

##
## Attaching package: 'lubridate'
## The following object is masked from 'package:plyr':
##
##   here
## The following object is masked from 'package:base':
##
##   date

library(ggplot2)
library(grid)

library(MMWRweek)
library(cdcfluview)

get_legend_grob <- function(x) {
  data <- ggplot2:::ggplot_build(x)

  plot <- data$plot
  panel <- data$panel
  data <- data$data
  theme <- ggplot2:::plot_theme(plot)
  position <- theme$legend.position
  if (length(position) == 2) {
    position <- "manual"
  }

  legend_box <- if (position != "none") {

```

```

    ggplot2:::build_guides(plot$scales, plot$layers, plot$mapping,
      position, theme, plot$guides, plot$labels)
  } else {
    ggplot2:::zeroGrob()
  }
  if (ggplot2:::is.zero(legend_box)) {
    position <- "none"
  }
  else {
    legend_width <- gtable:::gtable_width(legend_box) + theme$legend.margin
    legend_height <- gtable:::gtable_height(legend_box) + theme$legend.margin
    just <- valid.just(theme$legend.justification)
    xjust <- just[1]
    yjust <- just[2]
    if (position == "manual") {
      xpos <- theme$legend.position[1]
      ypos <- theme$legend.position[2]
      legend_box <- editGrob(legend_box, vp = viewport(x = xpos,
        y = ypos, just = c(xjust, yjust), height = legend_height,
        width = legend_width))
    }
    else {
      legend_box <- editGrob(legend_box, vp = viewport(x = xjust,
        y = yjust, just = c(xjust, yjust)))
    }
  }
  return(legend_box)
}

```

```

regionflu <- get_flu_data("hhs",
  sub_region = 1:10,
  data_source = "who",
  years=1997:2017)
usflu <- get_flu_data("national",
  sub_region = NA,
  data_source = "who",
  years=1997:2017)
usflu_ilineet <- get_flu_data("national",
  sub_region = NA,
  data_source = "ilineet",
  years=1997:2017)

usflu_ilineet <- usflu_ilineet %>%
  mutate(

```

```

    year = YEAR,
    week = WEEK,
    time = as.POSIXct(MMWRweek2Date(year, week)),
    wILI = as.numeric(`% WEIGHTED ILI`)
  )

## Warning in evalq(as.numeric(c("1.10148", "1.20007", "1.37876", "1.1992",
: NAs introduced by coercion

usflu_merged <- rbind.fill(
  usflu[[1]] %>%
    transmute(
      region_type = `REGION TYPE`,
      region = REGION,
      year = YEAR,
      week = WEEK,
      total_specimens = as.numeric(`TOTAL SPECIMENS`),
      total_A = as.numeric(`A (2009 H1N1)` +
        as.numeric(`A (H1)` +
        as.numeric(`A (H3)` +
        as.numeric(`A (Subtyping not Performed)` +
        as.numeric(`A (Unable to Subtype)` +
        as.numeric(H3N2v),
      total_A_typed = as.numeric(`A (2009 H1N1)` +
        as.numeric(`A (H1)` +
        as.numeric(`A (H3)` +
        as.numeric(H3N2v),
      total_A_2009H1N1 = as.numeric(`A (2009 H1N1)`),
      total_A_H1 = as.numeric(`A (H1)`),
      total_A_H3 = as.numeric(`A (H3)`),
      total_A_H3N2v = as.numeric(H3N2v),
      total_B = as.numeric(B),
      percent_positive = as.numeric(`PERCENT POSITIVE`),
      percent_A = total_A / total_specimens * 100,
      percent_A_2009H1N1 = as.numeric(`A (2009 H1N1)` / total_specimens * 100,
      percent_A_H1 = as.numeric(`A (H1)` / total_specimens * 100,
      percent_A_H3 = as.numeric(`A (H3)` / total_specimens * 100,
      percent_A_H3N2v = as.numeric(H3N2v) / total_specimens * 100,
      percent_B = total_B / total_specimens * 100,
      percent_A_2009H1N1_rel_typed_A = as.numeric(`A (2009 H1N1)` / total_A_typed * 100,
      percent_A_H1_rel_typed_A = as.numeric(`A (H1)` / total_A_typed * 100,
      percent_A_H3_rel_typed_A = as.numeric(`A (H3)` / total_A_typed * 100,
      percent_A_H3N2v_rel_typed_A = as.numeric(H3N2v) / total_A_typed * 100
    )#,
  # usflu[[2]] %>%
  #   transmute(

```

```

#     region_type = `REGION TYPE`,
#     region = REGION,
#     year = YEAR,
#     week = WEEK,
#     total_specimens = as.numeric(`TOTAL SPECIMENS`),
#     total_A = as.numeric(`A (2009 H1N1)` +
#       as.numeric(`A (H3)` +
#       as.numeric(`A (Subtyping not Performed)` +
#       as.numeric(H3N2v),
#     total_A_typed = as.numeric(`A (2009 H1N1)` +
#       as.numeric(`A (H3)` +
#       as.numeric(H3N2v),
#     total_A_2009H1N1 = as.numeric(`A (2009 H1N1)`),
#     total_A_H1 = 0L,
#     total_A_H3 = as.numeric(`A (H3)`),
#     total_A_H3N2v = as.numeric(H3N2v),
#     total_B = as.numeric(B) +
#       as.numeric(BVic) +
#       as.numeric(BYam),
#     percent_positive = (total_A + total_B) / total_specimens * 100,
#     percent_A = total_A / total_specimens * 100,
#     percent_B = total_B / total_specimens * 100,
#     percent_A_2009H1N1_rel_typed_A = as.numeric(`A (2009 H1N1)` / total_A_typed * 100,
#     percent_A_H3_rel_typed_A = as.numeric(`A (H3)` / total_A_typed * 100,
#     percent_A_H3N2v_rel_typed_A = as.numeric(H3N2v) / total_A_typed * 100
#   )#,
#   usflu[[3]] %>%
#     transmute(
#       region_type = `REGION TYPE`,
#       region = REGION,
#       year = YEAR,
#       week = WEEK,
#       total_specimens = `TOTAL SPECIMENS`,
#       total_A = `TOTAL A`,
#       total_B = `TOTAL B`,
#       percent_positive = as.numeric(`PERCENT POSITIVE`),
#       percent_A = `PERCENT A`,
#       percent_B = `PERCENT B`
#     )
#   ) %>%
#   mutate(
#     time = as.POSIXct(MMRWeek2Date(year, week))
#   )
## Warning in evalq(as.numeric(c("1291", "1513", "1552", "1669", "1897",
## "2106", : NAs introduced by coercion

```

[illegible]

```
## Warning in evalq(as.numeric(c("0", "0", "3", "0", "9", "0", "3",
"5", "14", : NAs introduced by coercion
## Warning in evalq(as.numeric(c("0", "0", "0", "0", "0", "0", "0",
"0", "0", : NAs introduced by coercion
```

```
grid.newpage()
pushViewport(viewport(layout = grid.layout(nrow = 2, ncol = 2, widths = unit(c(1, 0.2), "nul

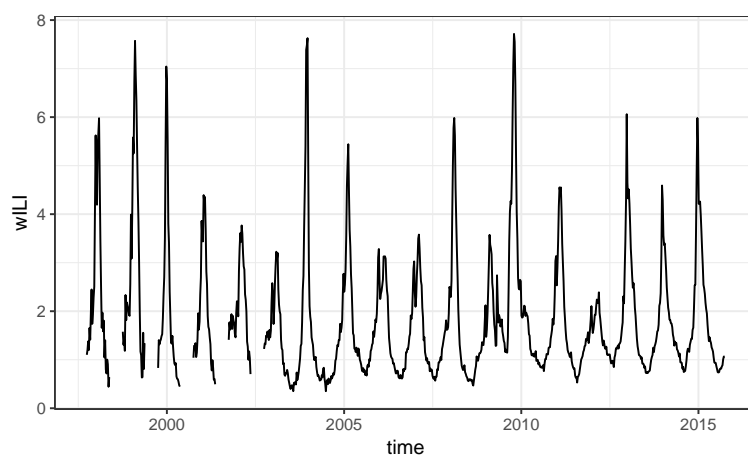
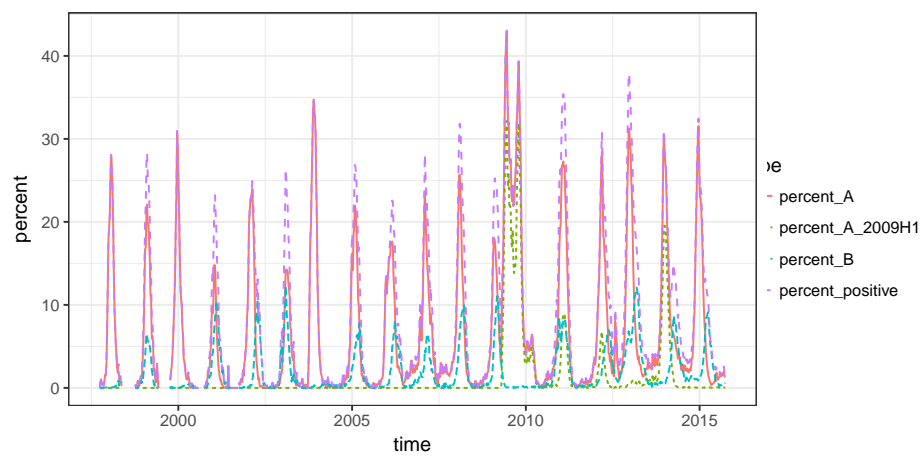
p_typed <- ggplot(usflu_merged %>%
  gather_("type", "percent", c("percent_A", "percent_A_2009H1N1", "percent_B", "percent_p
  geom_line(aes(x = time, y = percent, colour = type, linetype = type)) +
  theme_bw()

type_legend <- get_legend_grob(p_typed)
p_typed <- p_typed +
  theme(legend.position = "none")

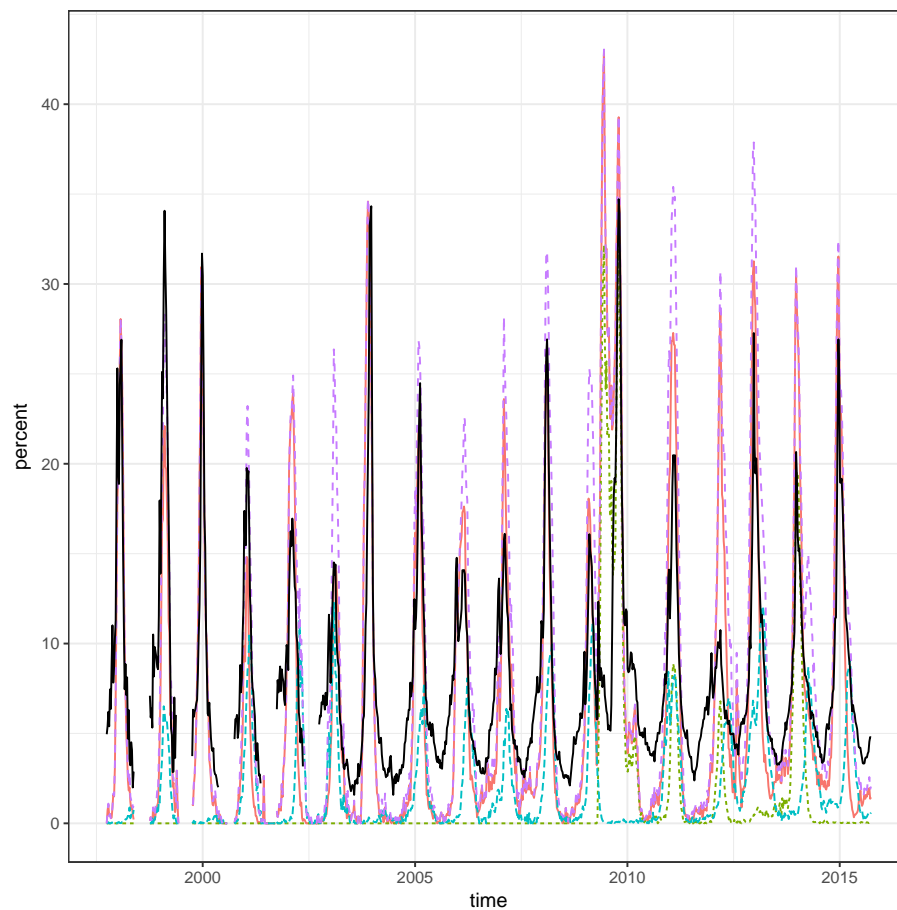
p_ilinet <- ggplot(usflu_ilinet %>%
  filter(paste(year, week, sep = "_") %in% paste(usflu_merged$year, usflu_merged$week, sep
) +
  geom_line(aes(x = time, y = wILI)) +
  theme_bw()

pushViewport(viewport(layout.pos.row = 1, layout.pos.col = 2))
grid.draw(type_legend)
upViewport()

print(p_typed, vp = viewport(layout.pos.row = 1, layout.pos.col = 1))
print(p_ilinet, vp = viewport(layout.pos.row = 2, layout.pos.col = 1))
```



```
p_typed <- p_typed +
  geom_line(aes(x = time, y = 4.5 * wILI),
    data = usflu_ilinet %>%
      filter(paste(year, week, sep = "_") %in% paste(usflu_merged$year, usflu_merged$week,
        )
      )
  )
print(p_typed)
```



```
ggplot(usflu_early_typed %>%
  gather_("type", "percent",
    c("percent_A",
      "percent_A_2009H1N1_rel_typed_A",
      "percent_A_H1_rel_typed_A",
      "percent_A_H3_rel_typed_A",
      "percent_A_H3N2v_rel_typed_A",
      "percent_positive"))) +
  geom_line(aes(x = time, y = percent, colour = type, linetype = type)) +
  theme_bw()

## Error in eval(lhs, parent, parent): object 'usflu_early_typed' not
found
```



```

regionflu <- get_flu_data("hhs", sub_region=1:10, data_source="ilinet", years=1997:2016)
usflu <- get_flu_data("national", sub_region=NA, data_source="ilinet", years=1997:2016)

## make AGE cols in usflu integer data type
cols <- matches('^AGE', vars=colnames(usflu))
usflu[,cols] <- sapply(usflu[,cols], as.integer)

## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion

cols <- matches('^AGE', vars=colnames(regionflu))
regionflu[,cols] <- sapply(regionflu[,cols], as.integer)

data <- bind_rows(regionflu, usflu)
data <- transmute(data,
  region_type = `REGION TYPE`,
  region = REGION,
  year = YEAR,
  week = WEEK,
  time = as.POSIXct(MMWRweek2Date(YEAR, WEEK)),
  weighted_ili = as.numeric(`% WEIGHTED ILI`),
  unweighted_ili = as.numeric(`%UNWEIGHTED ILI`),
  age_0_4 = as.integer(`AGE 0-4`),
  age_5_24 = as.integer(`AGE 5-24`),
  age_25_49 = as.integer(`AGE 25-49`),
  age_25_64 = as.integer(`AGE 25-64`),
  age_50_64 = as.integer(`AGE 50-64`),
  age_65 = as.integer(`AGE 65`),
  total_ili = as.integer(ILITOTAL),
  total_patients = as.integer(`TOTAL PATIENTS`)
)

## Warning in evalq(as.numeric(c("0.498535", "0.374963", "1.35428",
## "0.400338", : NAs introduced by coercion
## Warning in evalq(as.numeric(c("0.623848", "0.384615", "1.34172",
## "0.45001", : NAs introduced by coercion
## Warning in evalq(as.integer(c("44", "3", "32", "46", "89", "5",
## "27", "5", : NAs introduced by coercion
## Warning in evalq(as.integer(c("7053", "780", "2385", "10222", "9875",
## "669", : NAs introduced by coercion

data$season <- ifelse(
  data$week <= 30,

```

```

paste0(data$year - 1, "/", data$year),
paste0(data$year, "/", data$year + 1)
)

## Season week column: week number within season
## weeks after week 30 get season_week = week - 30
## weeks before week 30 get season_week = week + (number of weeks in previous year) - 30
## This computation relies on the start_date function in package MMWRweek,
## which is not exported from that package's namespace!!!
data$season_week <- ifelse(
  data$week <= 30,
  data$week + MMWRweek(MMWRweek::start_date(data$year) - 1)$MMWRweek - 30,
  data$week - 30
)

```

```

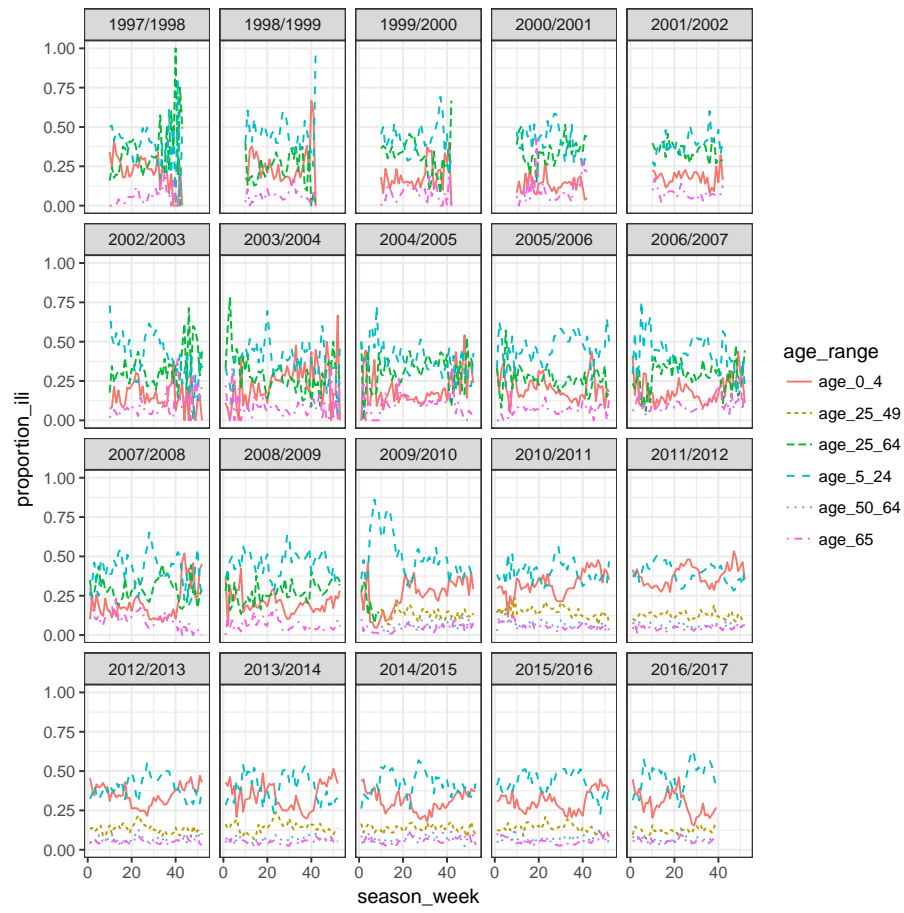
data_age_gathered <- data %>%
  gather_("age_range",
    "count",
    c("age_0_4", "age_5_24", "age_25_49", "age_25_64", "age_50_64", "age_65")) %>%
  mutate(
    proportion_ili = count / total_ili,
    proportion_patients = count / total_patients)

for(region_val in unique(data_age_gathered$region)) {
  p <- ggplot(data_age_gathered %>% filter(region == region_val)) +
    geom_line(aes(x = season_week, y = proportion_ili, colour = age_range, linetype = age_range)) +
    facet_wrap(~ season) +
    theme_bw()
  print(p)

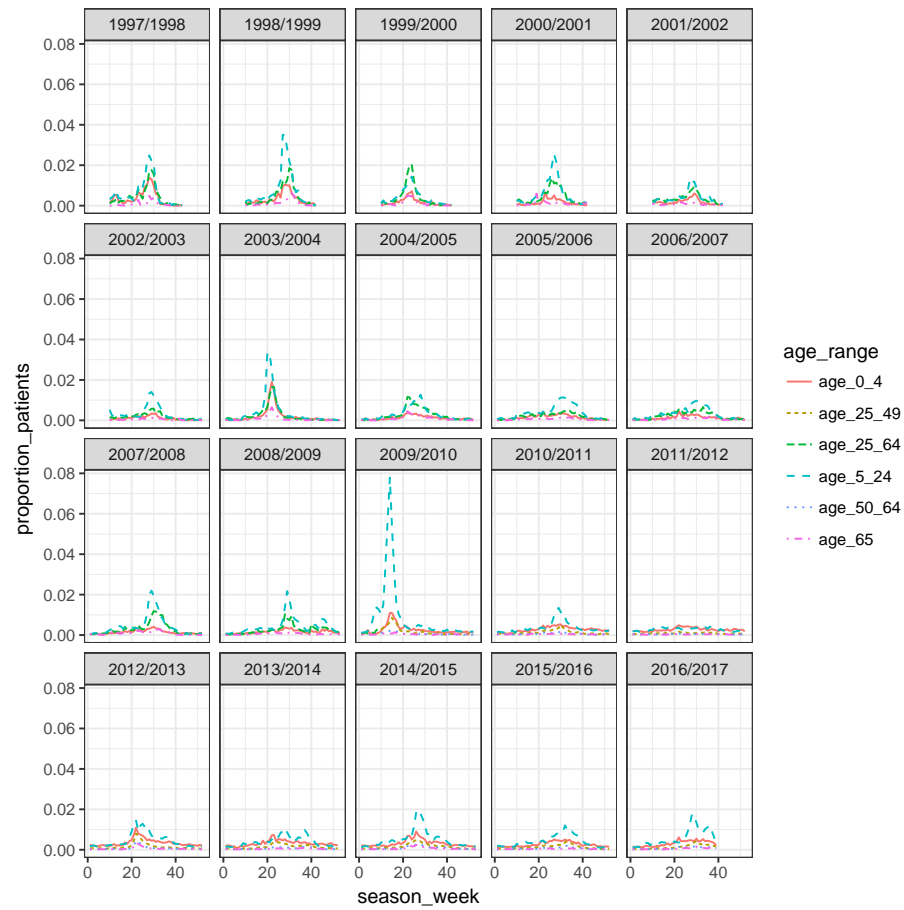
  p <- ggplot(data_age_gathered %>% filter(region == region_val)) +
    geom_line(aes(x = season_week, y = proportion_patients, colour = age_range, linetype = age_range)) +
    facet_wrap(~ season) +
    theme_bw()
  print(p)
}

## Warning: Removed 1649 rows containing missing values (geom_path).

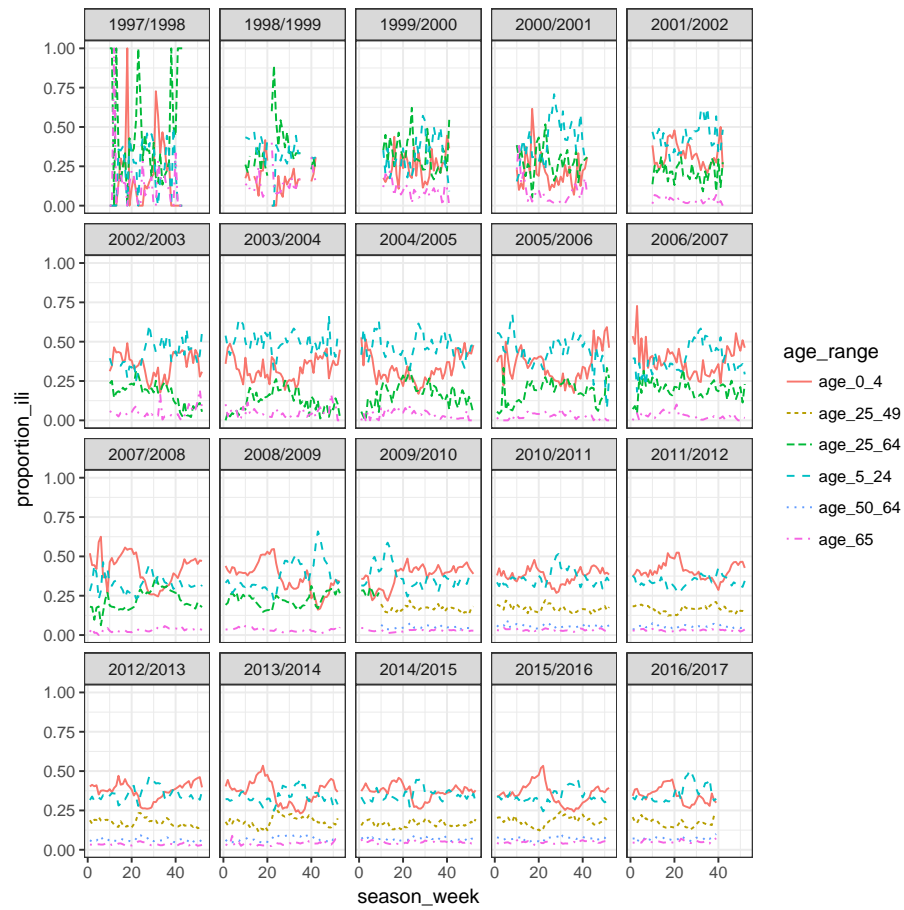
```



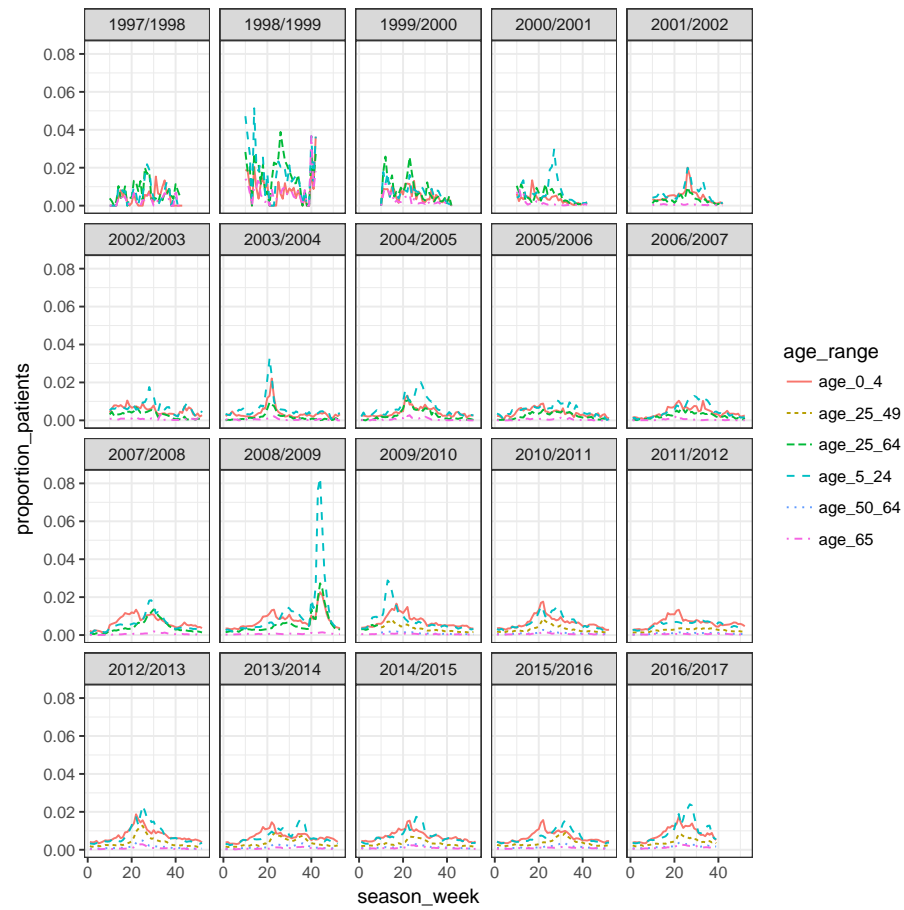
## Warning: Removed 1649 rows containing missing values (geom\_path).



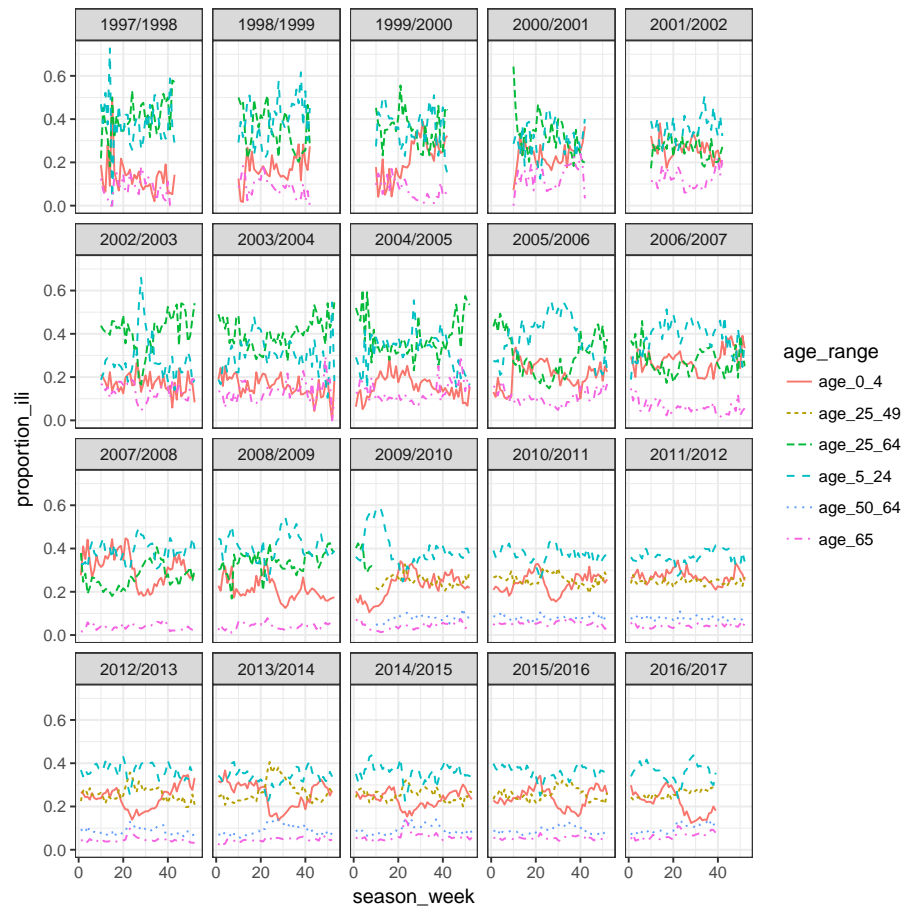
## Warning: Removed 1649 rows containing missing values (geom\_path).



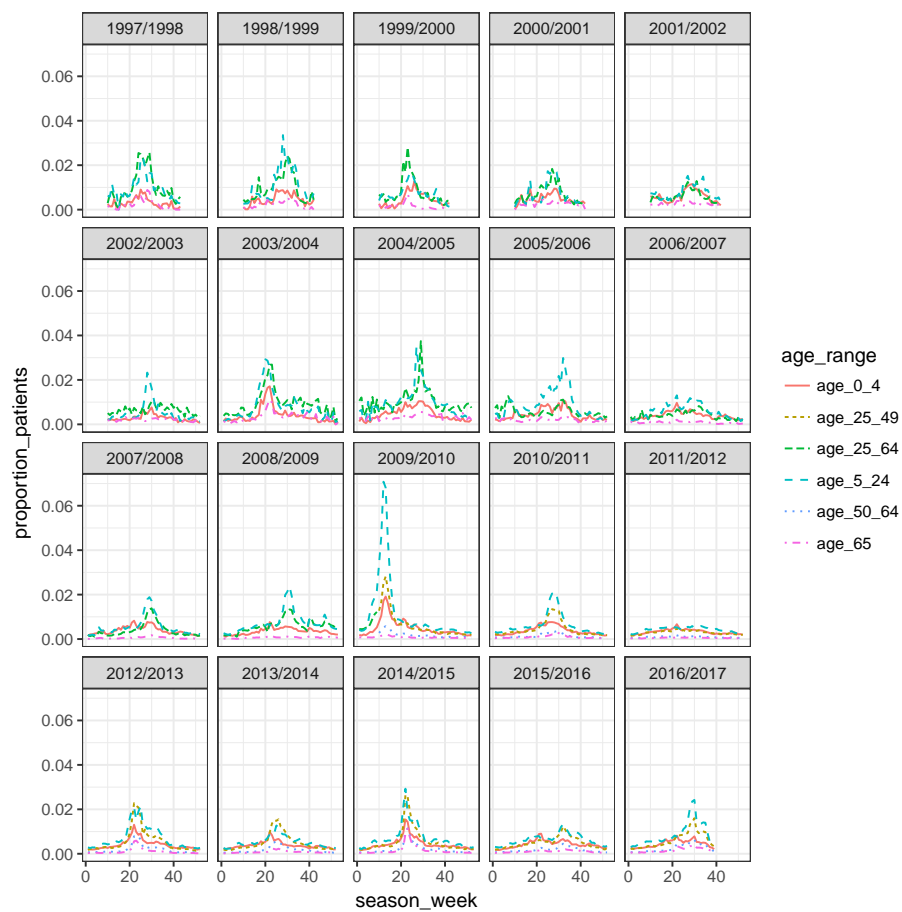
## Warning: Removed 1649 rows containing missing values (geom\_path).



## Warning: Removed 1649 rows containing missing values (geom\_path).

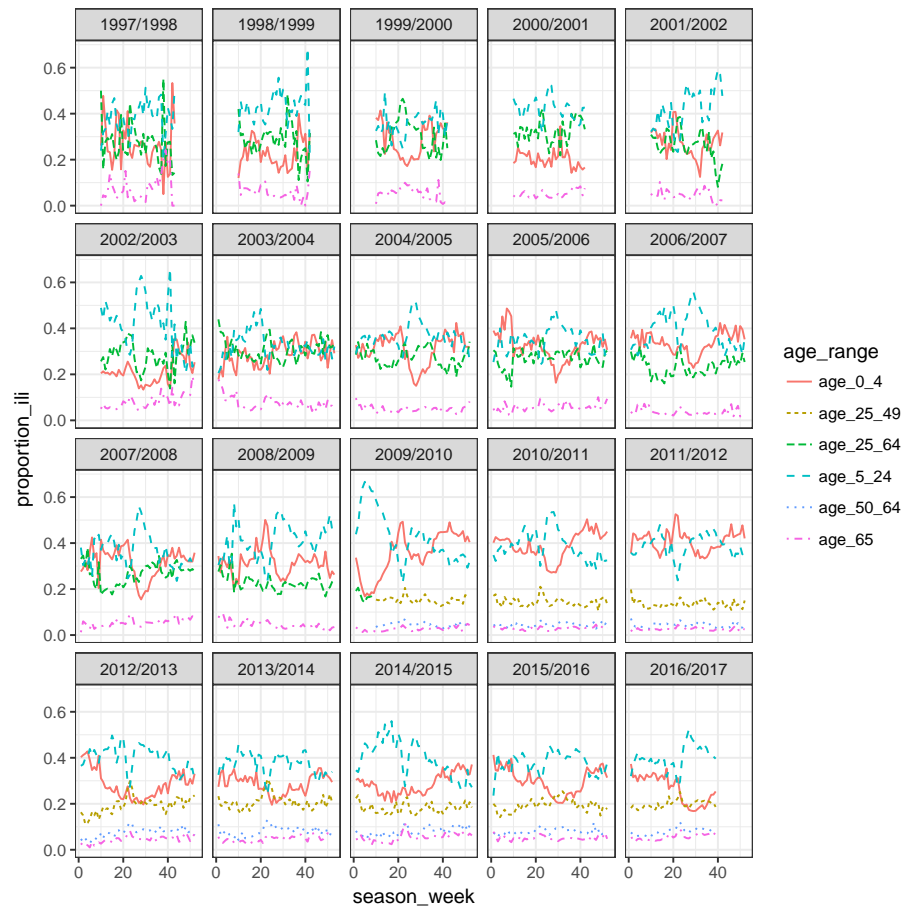


## Warning: Removed 1649 rows containing missing values (geom\_path).

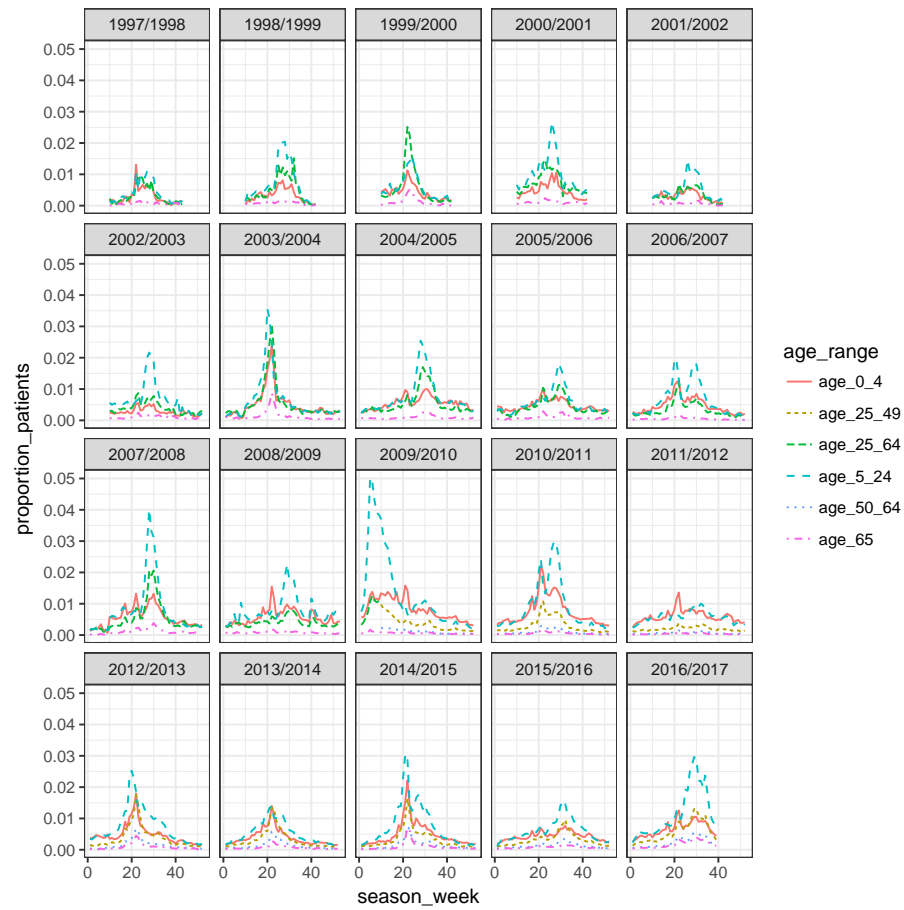


## Warning: Removed 1649 rows containing missing values (geom\_path).

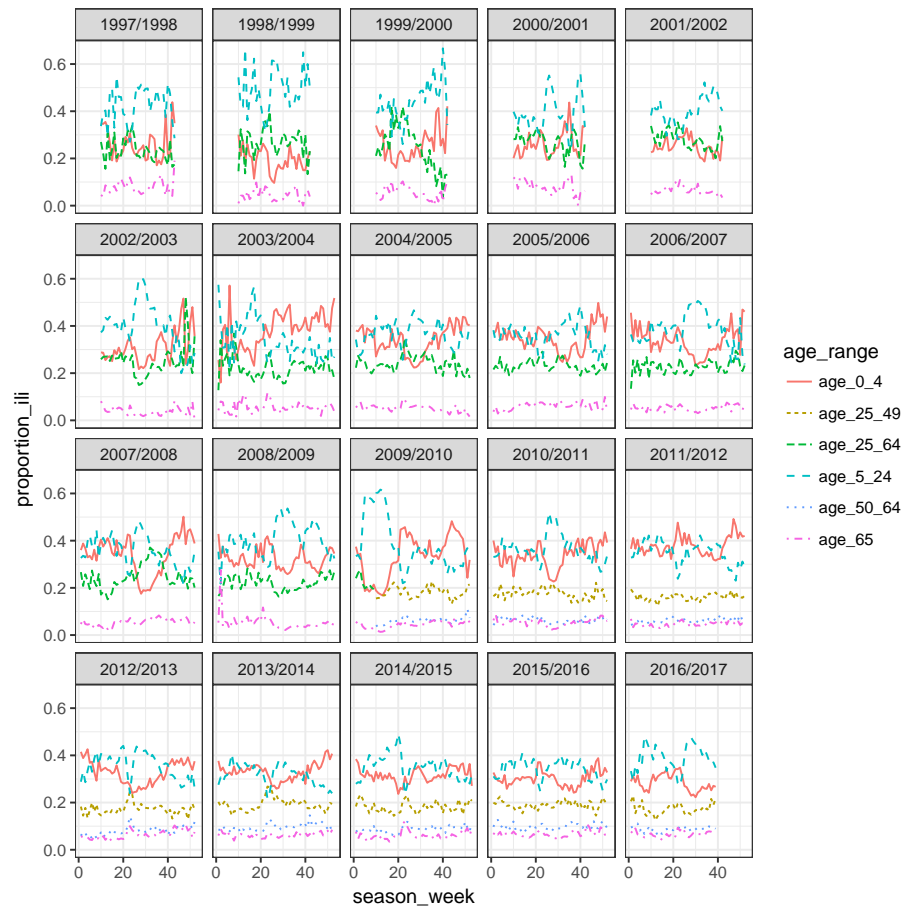




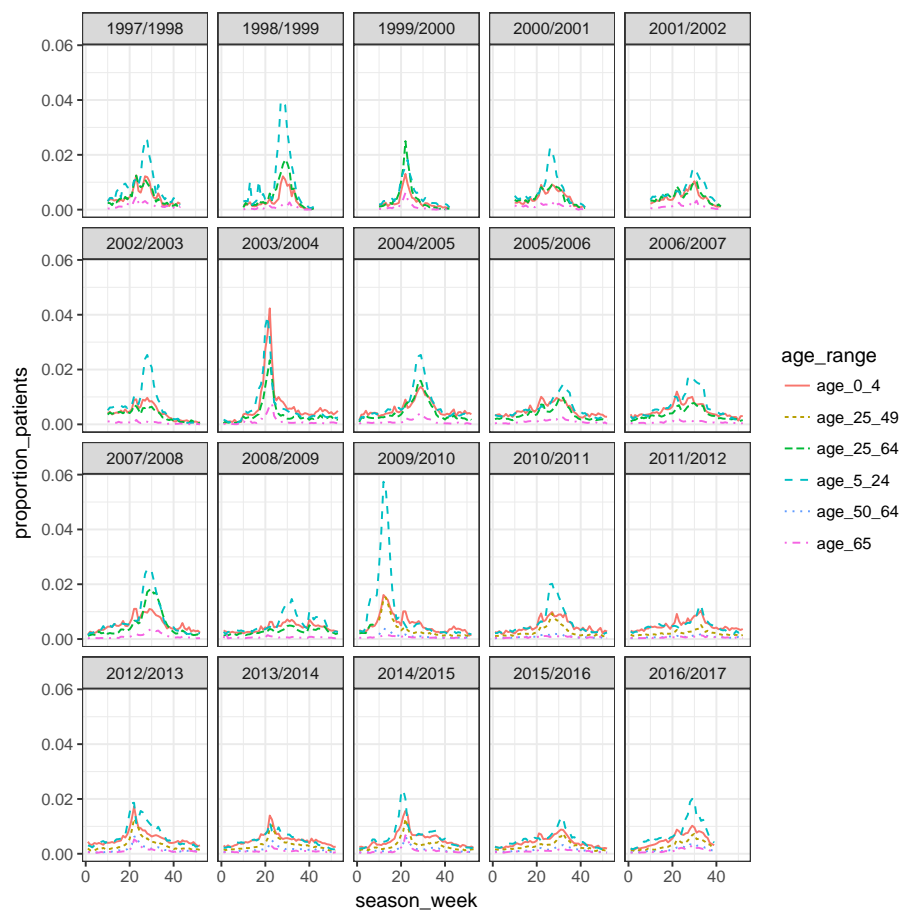
## Warning: Removed 1649 rows containing missing values (geom\_path).



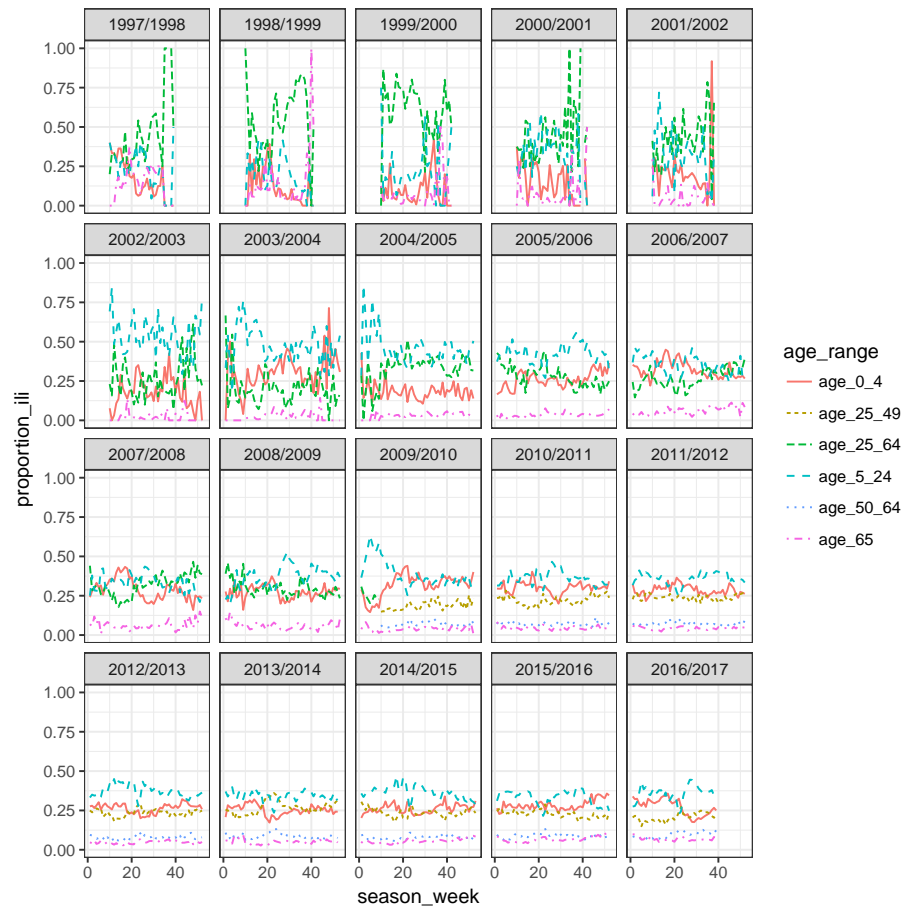
## Warning: Removed 1649 rows containing missing values (geom\_path).



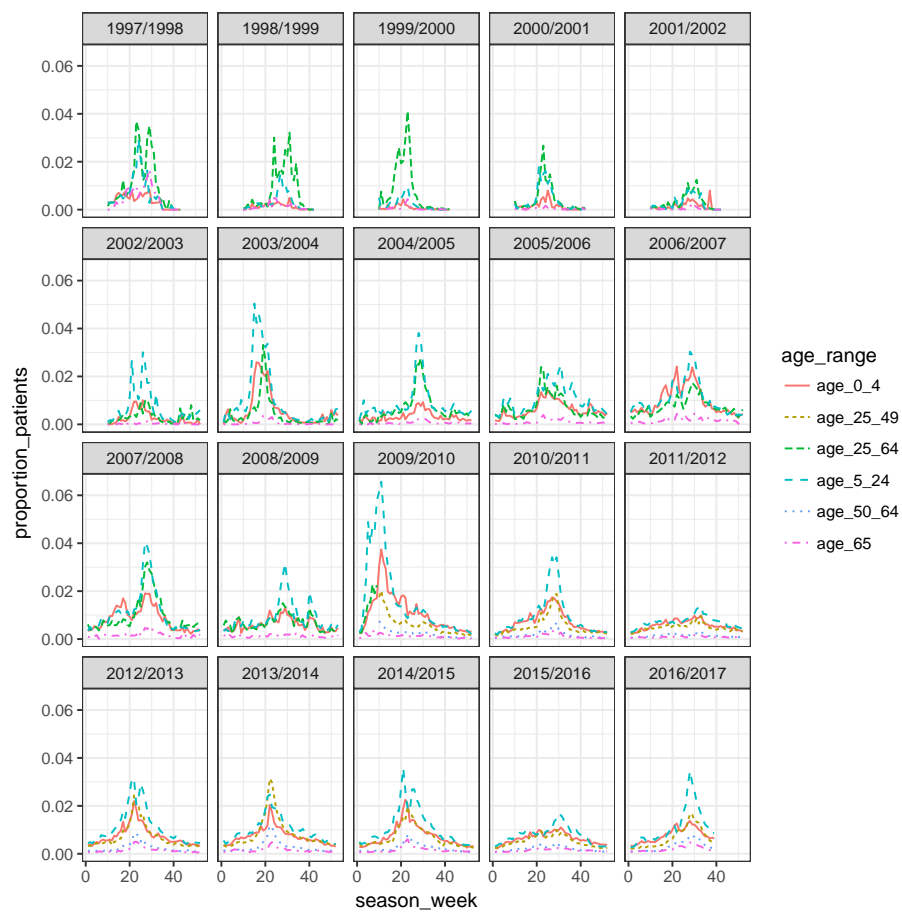
## Warning: Removed 1649 rows containing missing values (geom\_path).



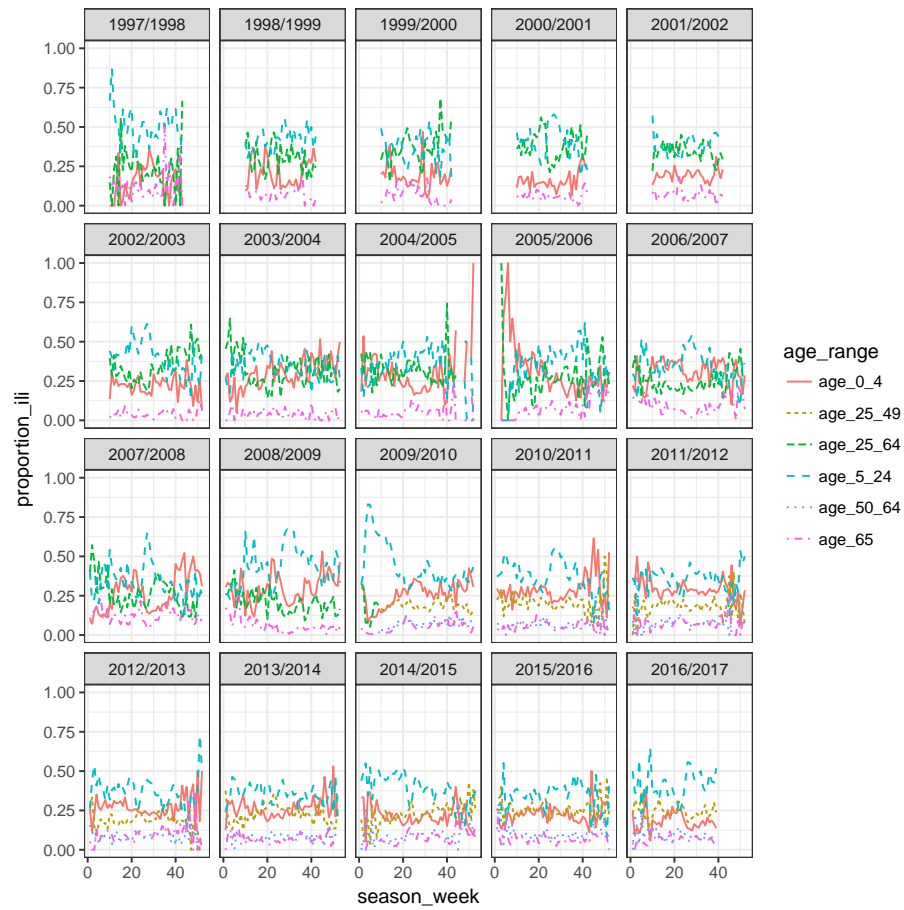
## Warning: Removed 1649 rows containing missing values (geom\_path).



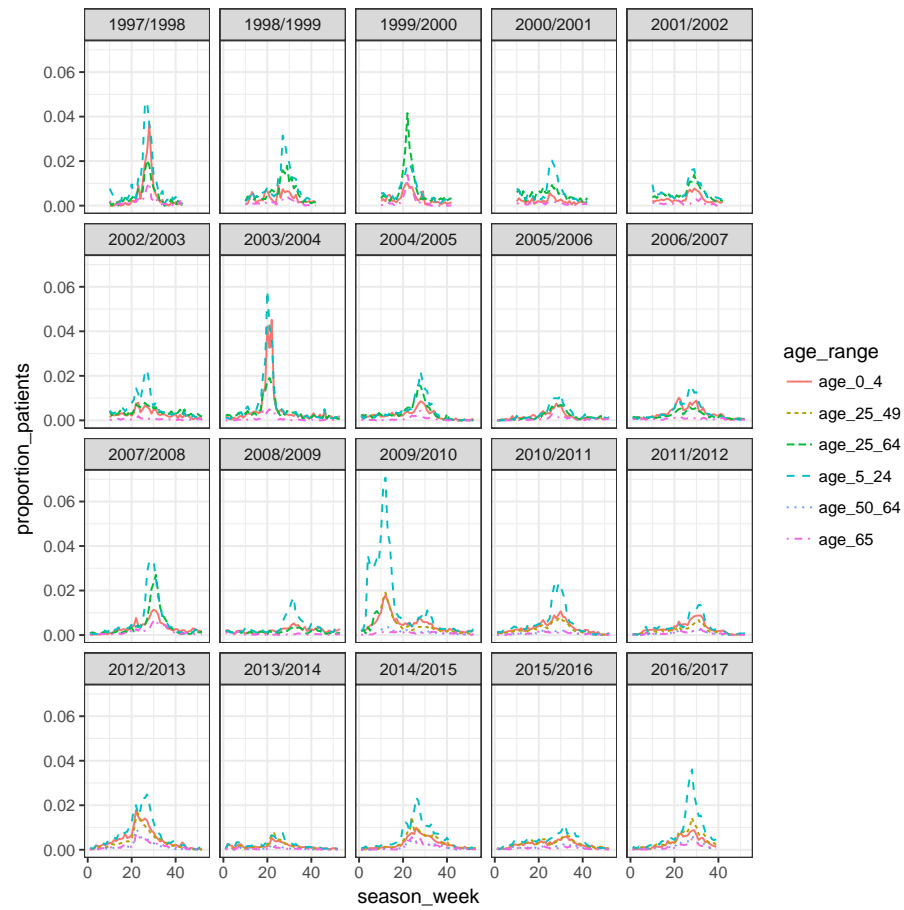
## Warning: Removed 1649 rows containing missing values (geom\_path).



## Warning: Removed 1649 rows containing missing values (geom\_path).

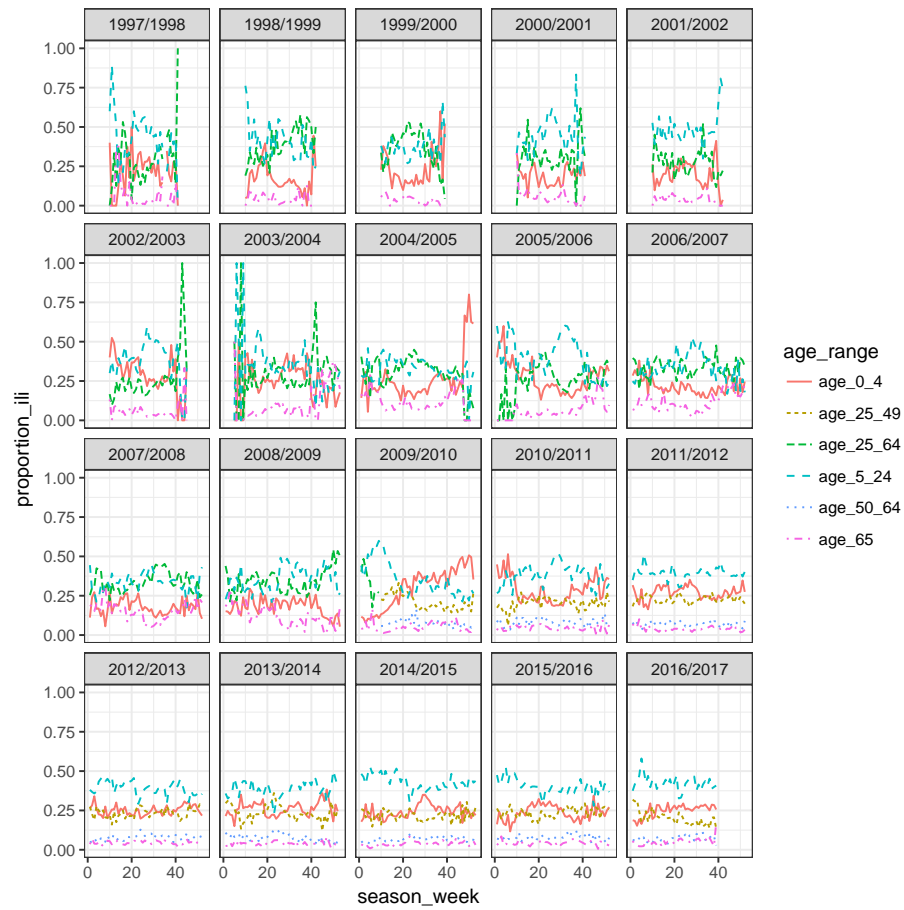


## Warning: Removed 1649 rows containing missing values (geom\_path).

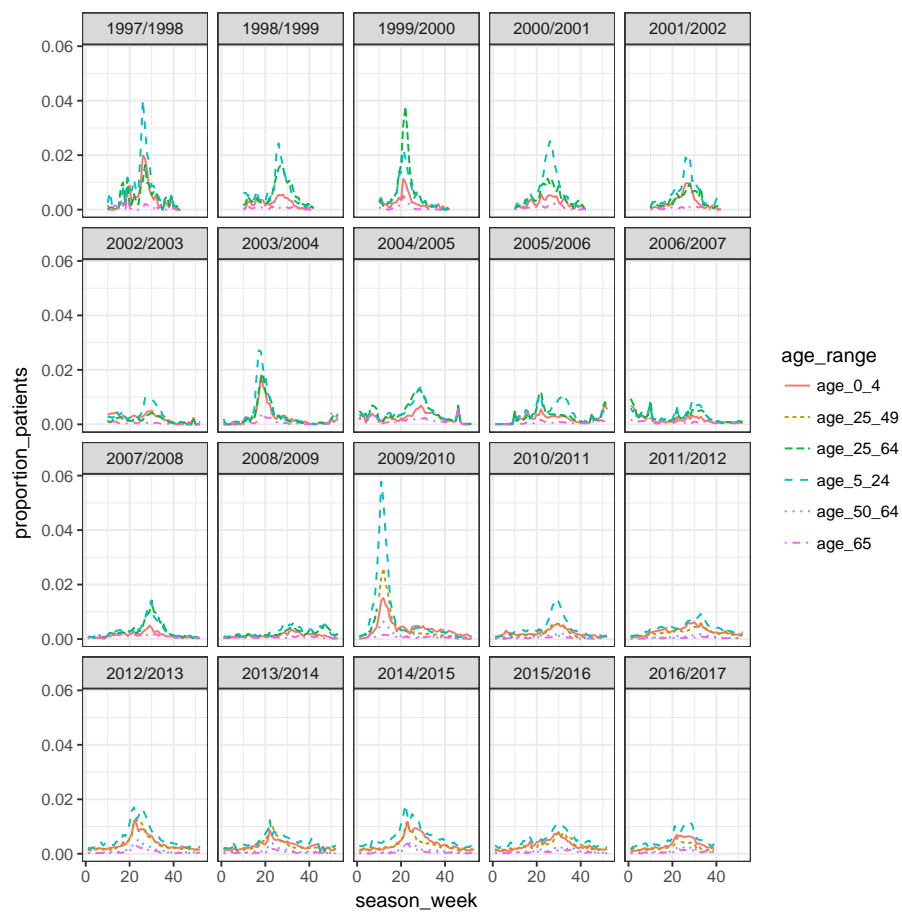


## Warning: Removed 1649 rows containing missing values (geom\_path).

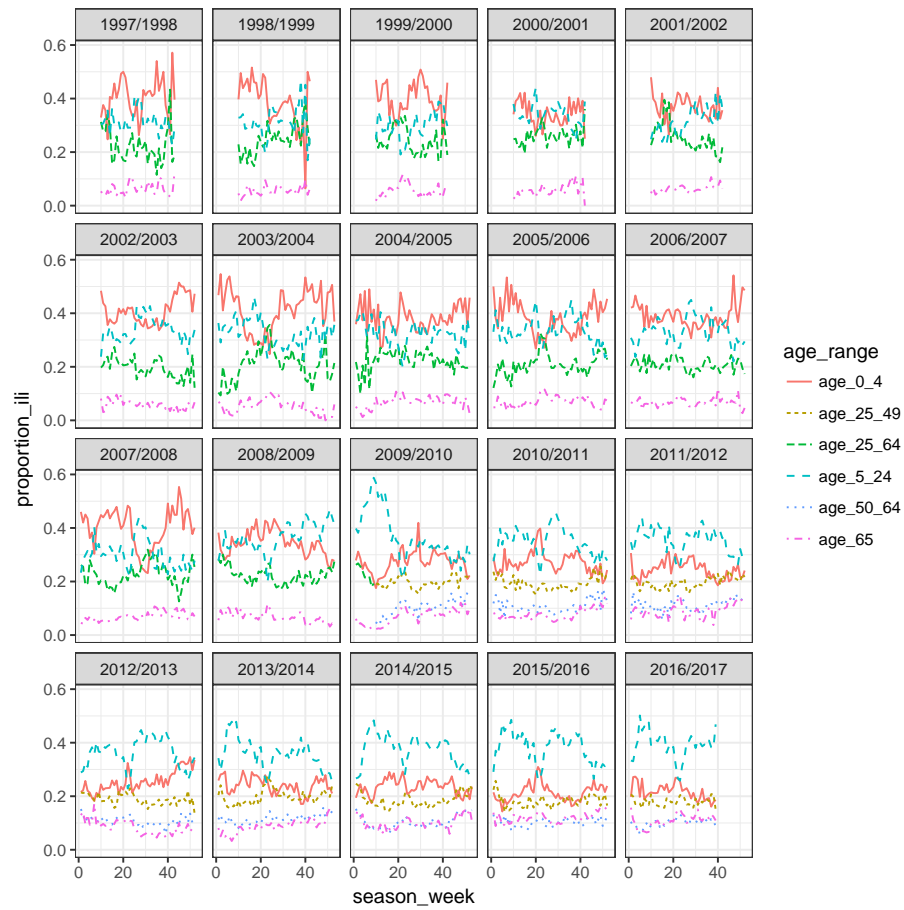




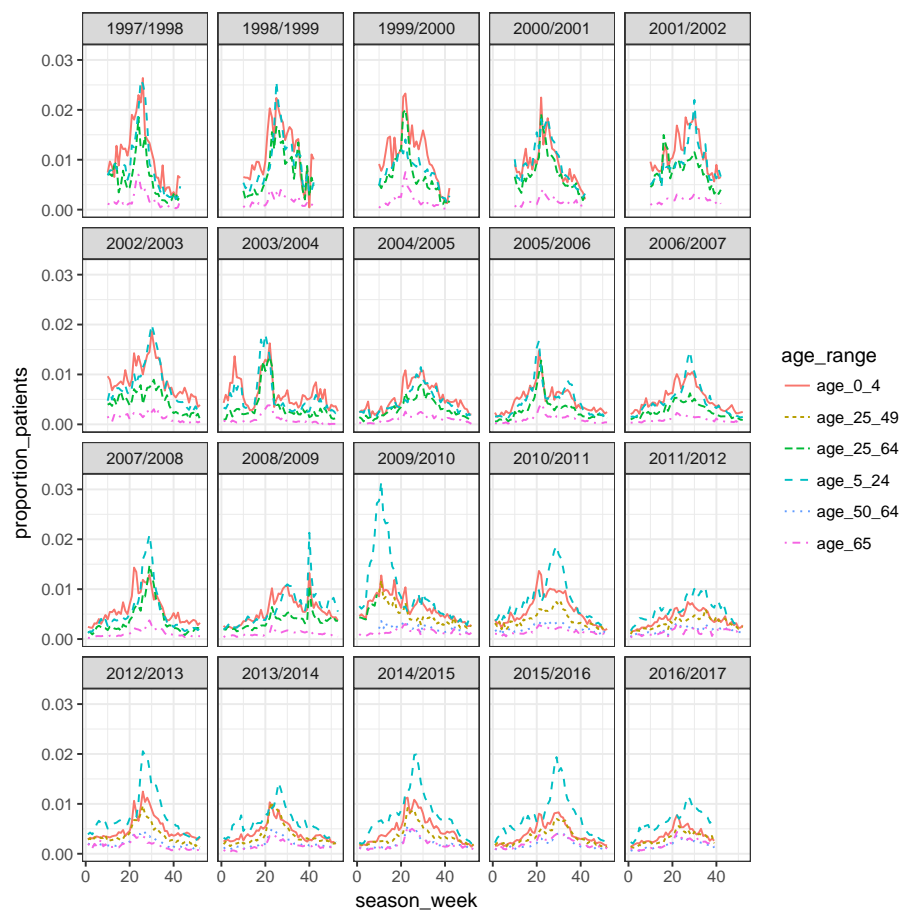
## Warning: Removed 1649 rows containing missing values (geom\_path).



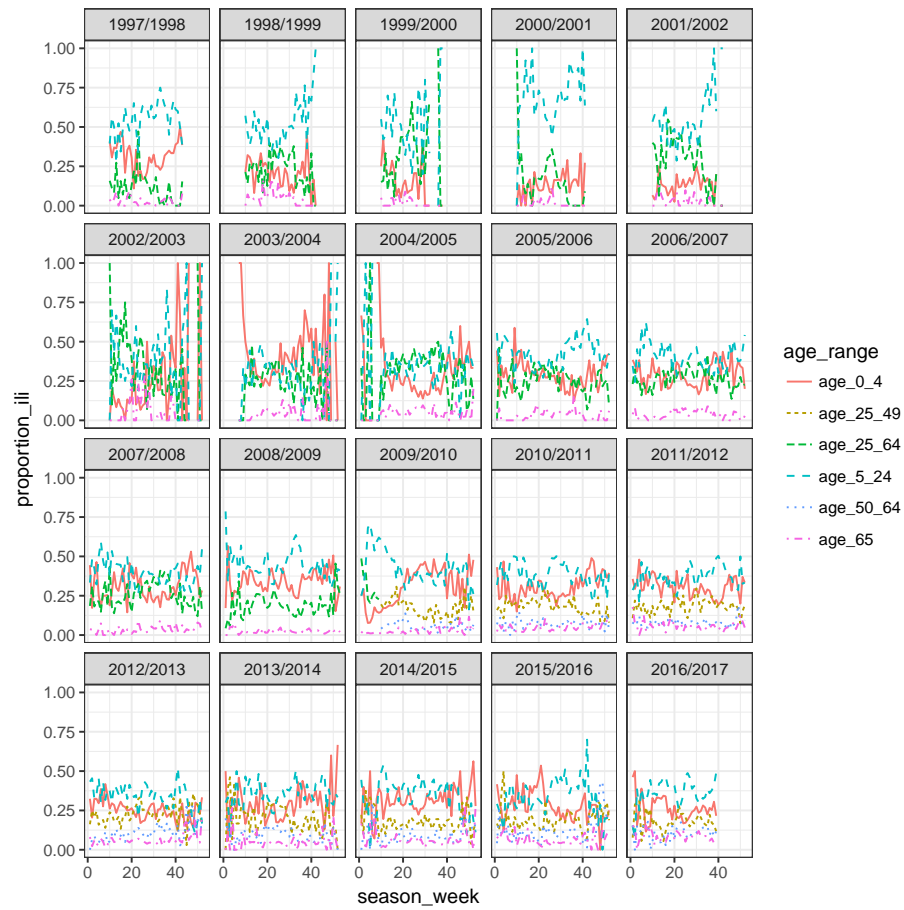
## Warning: Removed 1649 rows containing missing values (geom\_path).



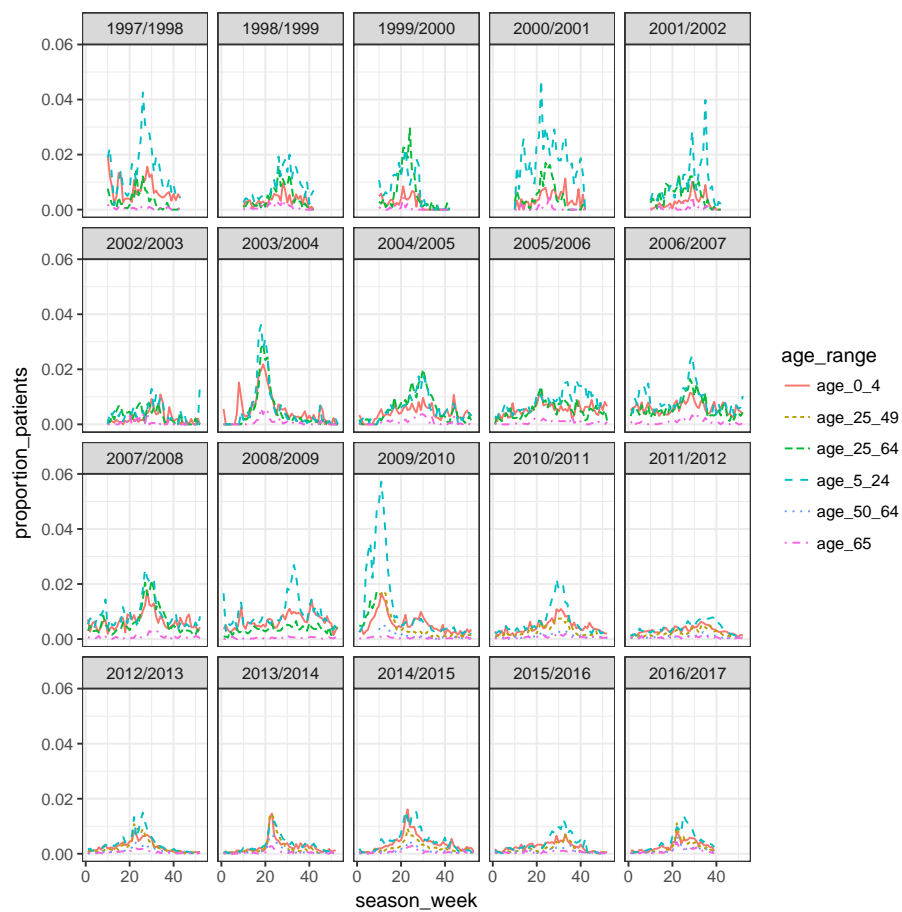
## Warning: Removed 1649 rows containing missing values (geom\_path).



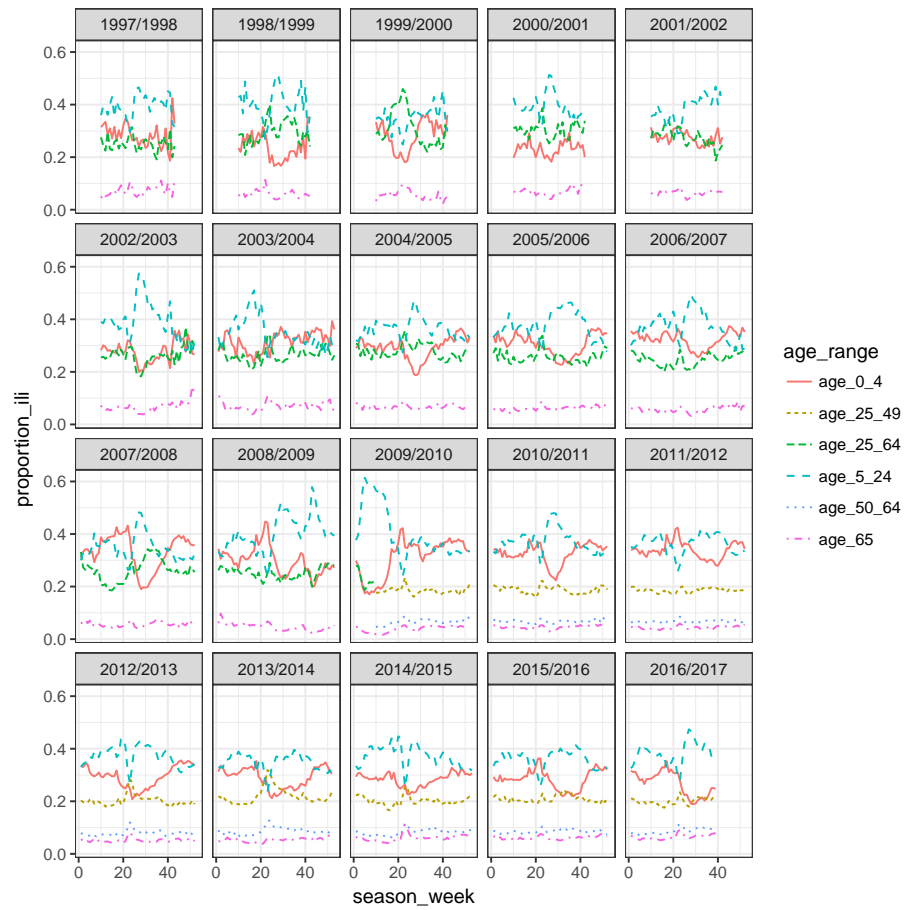
## Warning: Removed 1649 rows containing missing values (geom\_path).



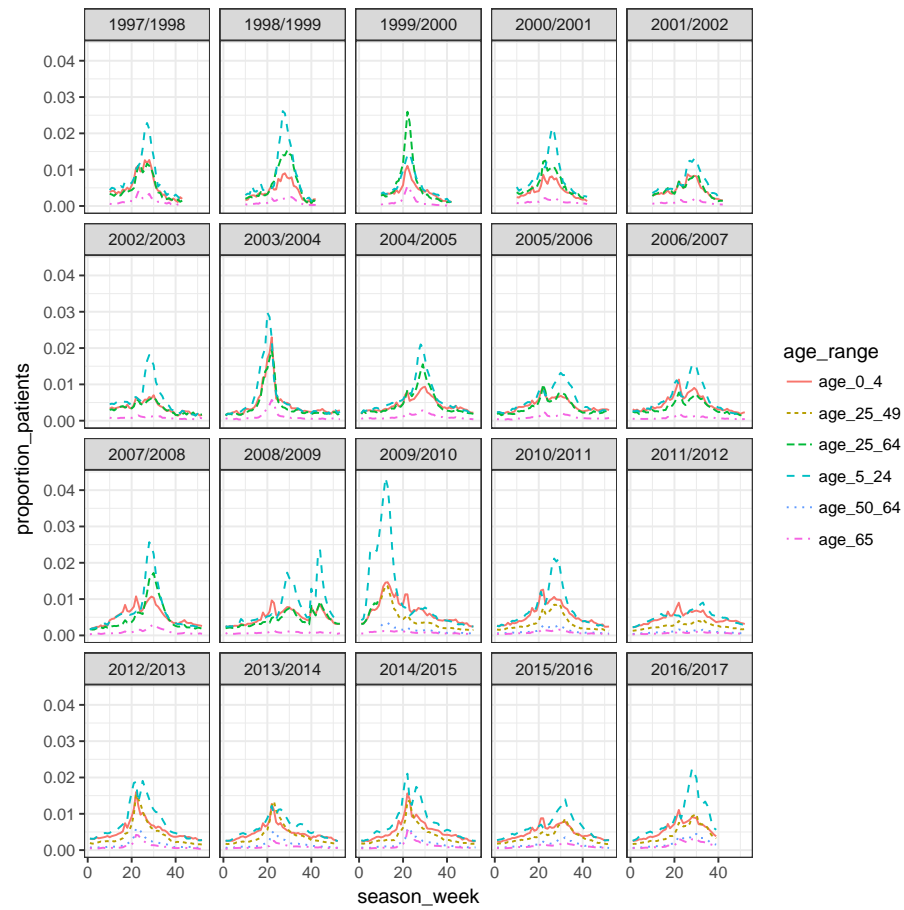
## Warning: Removed 1649 rows containing missing values (geom\_path).



## Warning: Removed 1649 rows containing missing values (geom\_path).



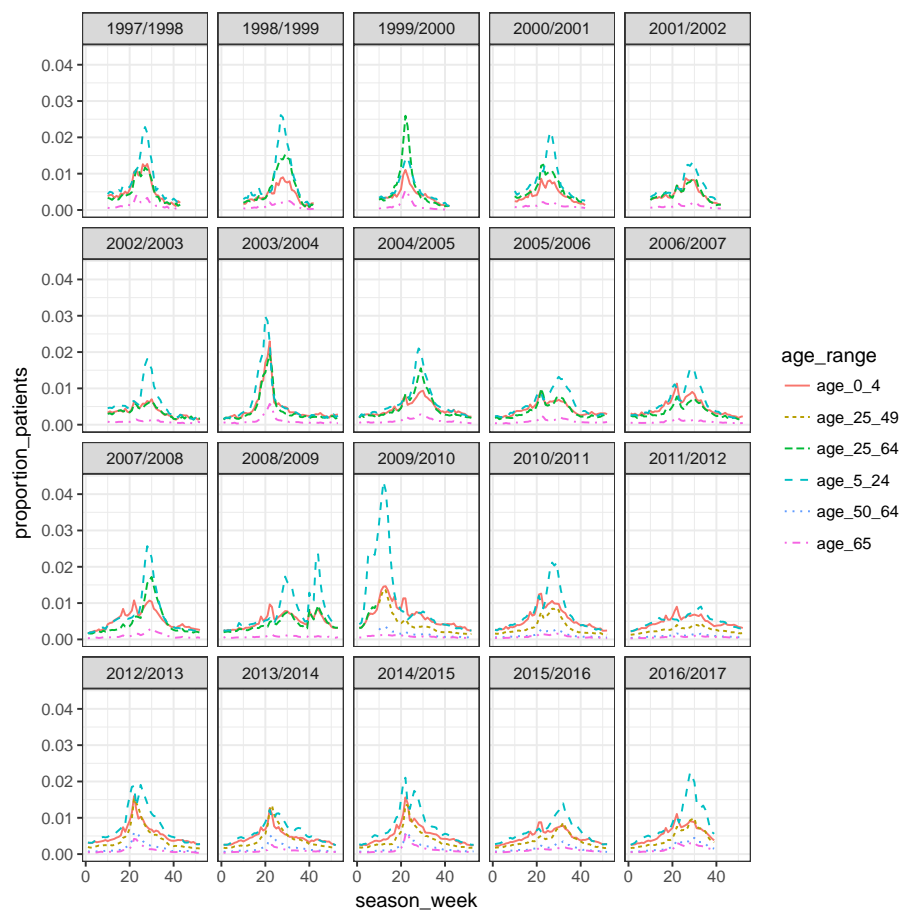
## Warning: Removed 1649 rows containing missing values (geom\_path).



```
print(p)

## Warning: Removed 1649 rows containing missing values (geom_path).
```





```

peak_times_by_age_season <- data_age_gathered %>%
  group_by(age_range, season, region) %>%
  summarize(peak_week = season_week[which.max(proportion_patients)[1]])

peak_times_by_age_season_wide <- peak_times_by_age_season %>%
  ungroup() %>%
  spread(age_range, peak_week)

peak_times_by_age_season_wide %>%
  as.data.frame()

```

##	season	region	age_0_4	age_25_49	age_25_64	age_5_24	age_50_64
## 1	1997/1998	Region 1	28	NA	29	28	NA
## 2	1997/1998	Region 10	10	NA	23	26	NA
## 3	1997/1998	Region 2	31	NA	26	27	NA
## 4	1997/1998	Region 3	25	NA	29	26	NA

## 5	1997/1998	Region 4	22	NA	24	27	NA
## 6	1997/1998	Region 5	23	NA	23	27	NA
## 7	1997/1998	Region 6	29	NA	23	24	NA
## 8	1997/1998	Region 7	28	NA	27	27	NA
## 9	1997/1998	Region 8	26	NA	27	26	NA
## 10	1997/1998	Region 9	26	NA	24	25	NA
## 11	1997/1998	X	28	NA	27	27	NA
## 12	1998/1999	Region 1	28	NA	30	27	NA
## 13	1998/1999	Region 10	28	NA	26	31	NA
## 14	1998/1999	Region 2	42	NA	26	14	NA
## 15	1998/1999	Region 3	25	NA	30	28	NA
## 16	1998/1999	Region 4	27	NA	32	28	NA
## 17	1998/1999	Region 5	28	NA	29	27	NA
## 18	1998/1999	Region 6	31	NA	31	27	NA
## 19	1998/1999	Region 7	25	NA	29	27	NA
## 20	1998/1999	Region 8	28	NA	27	26	NA
## 21	1998/1999	Region 9	25	NA	25	25	NA
## 22	1998/1999	X	28	NA	29	27	NA
## 23	1999/2000	Region 1	24	NA	23	24	NA
## 24	1999/2000	Region 10	21	NA	24	22	NA
## 25	1999/2000	Region 2	25	NA	12	11	NA
## 26	1999/2000	Region 3	26	NA	23	24	NA
## 27	1999/2000	Region 4	22	NA	22	24	NA
## 28	1999/2000	Region 5	22	NA	22	23	NA
## 29	1999/2000	Region 6	21	NA	23	23	NA
## 30	1999/2000	Region 7	22	NA	22	22	NA
## 31	1999/2000	Region 8	21	NA	22	21	NA
## 32	1999/2000	Region 9	22	NA	22	22	NA
## 33	1999/2000	X	22	NA	22	23	NA
## 34	2000/2001	Region 1	23	NA	26	27	NA
## 35	2000/2001	Region 10	33	NA	24	22	NA
## 36	2000/2001	Region 2	17	NA	23	27	NA
## 37	2000/2001	Region 3	28	NA	27	28	NA
## 38	2000/2001	Region 4	28	NA	23	26	NA
## 39	2000/2001	Region 5	27	NA	27	26	NA
## 40	2000/2001	Region 6	25	NA	23	21	NA
## 41	2000/2001	Region 7	25	NA	26	26	NA
## 42	2000/2001	Region 8	22	NA	25	26	NA
## 43	2000/2001	Region 9	22	NA	22	25	NA
## 44	2000/2001	X	22	NA	23	26	NA
## 45	2001/2002	Region 1	29	NA	29	27	NA
## 46	2001/2002	Region 10	29	NA	23	35	NA
## 47	2001/2002	Region 2	26	NA	26	26	NA
## 48	2001/2002	Region 3	29	NA	31	27	NA
## 49	2001/2002	Region 4	26	NA	22	26	NA

## 50	2001/2002	Region 5	30	NA	31	30	NA
## 51	2001/2002	Region 6	37	NA	31	27	NA
## 52	2001/2002	Region 7	29	NA	29	29	NA
## 53	2001/2002	Region 8	27	NA	28	26	NA
## 54	2001/2002	Region 9	30	NA	16	30	NA
## 55	2001/2002	X	26	NA	29	29	NA
## 56	2002/2003	Region 1	31	NA	30	29	NA
## 57	2002/2003	Region 10	34	NA	25	52	NA
## 58	2002/2003	Region 2	18	NA	22	28	NA
## 59	2002/2003	Region 3	30	NA	31	28	NA
## 60	2002/2003	Region 4	23	NA	23	28	NA
## 61	2002/2003	Region 5	28	NA	22	28	NA
## 62	2002/2003	Region 6	26	NA	28	26	NA
## 63	2002/2003	Region 7	23	NA	26	27	NA
## 64	2002/2003	Region 8	30	NA	30	29	NA
## 65	2002/2003	Region 9	30	NA	31	30	NA
## 66	2002/2003	X	30	NA	30	28	NA
## 67	2003/2004	Region 1	22	NA	23	20	NA
## 68	2003/2004	Region 10	19	NA	19	18	NA
## 69	2003/2004	Region 2	22	NA	21	21	NA
## 70	2003/2004	Region 3	22	NA	23	20	NA
## 71	2003/2004	Region 4	22	NA	22	20	NA
## 72	2003/2004	Region 5	22	NA	22	21	NA
## 73	2003/2004	Region 6	16	NA	19	15	NA
## 74	2003/2004	Region 7	22	NA	21	20	NA
## 75	2003/2004	Region 8	18	NA	19	17	NA
## 76	2003/2004	Region 9	22	NA	22	20	NA
## 77	2003/2004	X	22	NA	22	20	NA
## 78	2004/2005	Region 1	22	NA	22	28	NA
## 79	2004/2005	Region 10	44	NA	30	30	NA
## 80	2004/2005	Region 2	22	NA	23	28	NA
## 81	2004/2005	Region 3	29	NA	29	27	NA
## 82	2004/2005	Region 4	31	NA	29	28	NA
## 83	2004/2005	Region 5	29	NA	29	29	NA
## 84	2004/2005	Region 6	30	NA	29	28	NA
## 85	2004/2005	Region 7	28	NA	27	28	NA
## 86	2004/2005	Region 8	29	NA	28	29	NA
## 87	2004/2005	Region 9	22	NA	29	29	NA
## 88	2004/2005	X	30	NA	29	28	NA
## 89	2005/2006	Region 1	22	NA	33	31	NA
## 90	2005/2006	Region 10	22	NA	22	38	NA
## 91	2005/2006	Region 2	22	NA	22	28	NA
## 92	2005/2006	Region 3	32	NA	7	32	NA
## 93	2005/2006	Region 4	22	NA	30	29	NA
## 94	2005/2006	Region 5	22	NA	32	32	NA

## 95	2005/2006	Region 6	25	NA	22	31	NA
## 96	2005/2006	Region 7	28	NA	30	30	NA
## 97	2005/2006	Region 8	51	NA	22	32	NA
## 98	2005/2006	Region 9	21	NA	22	21	NA
## 99	2005/2006	X	22	NA	22	30	NA
## 100	2006/2007	Region 1	22	NA	33	30	NA
## 101	2006/2007	Region 10	28	NA	28	29	NA
## 102	2006/2007	Region 2	22	NA	23	29	NA
## 103	2006/2007	Region 3	22	NA	32	22	NA
## 104	2006/2007	Region 4	22	NA	22	20	NA
## 105	2006/2007	Region 5	22	NA	30	29	NA
## 106	2006/2007	Region 6	22	NA	29	28	NA
## 107	2006/2007	Region 7	22	NA	27	27	NA
## 108	2006/2007	Region 8	1	NA	1	29	NA
## 109	2006/2007	Region 9	29	NA	28	28	NA
## 110	2006/2007	X	22	NA	22	29	NA
## 111	2007/2008	Region 1	30	NA	30	29	NA
## 112	2007/2008	Region 10	28	NA	30	27	NA
## 113	2007/2008	Region 2	22	NA	30	29	NA
## 114	2007/2008	Region 3	22	NA	30	29	NA
## 115	2007/2008	Region 4	22	NA	30	28	NA
## 116	2007/2008	Region 5	23	NA	30	28	NA
## 117	2007/2008	Region 6	27	NA	28	27	NA
## 118	2007/2008	Region 7	30	NA	31	28	NA
## 119	2007/2008	Region 8	29	NA	30	30	NA
## 120	2007/2008	Region 9	22	NA	29	29	NA
## 121	2007/2008	X	22	NA	30	28	NA
## 122	2008/2009	Region 1	28	NA	28	29	NA
## 123	2008/2009	Region 10	41	NA	34	33	NA
## 124	2008/2009	Region 2	44	NA	44	44	NA
## 125	2008/2009	Region 3	22	NA	31	31	NA
## 126	2008/2009	Region 4	22	NA	31	29	NA
## 127	2008/2009	Region 5	30	NA	40	32	NA
## 128	2008/2009	Region 6	29	NA	28	29	NA
## 129	2008/2009	Region 7	32	NA	34	32	NA
## 130	2008/2009	Region 8	32	NA	47	33	NA
## 131	2008/2009	Region 9	40	NA	40	40	NA
## 132	2008/2009	X	22	NA	44	44	NA
## 133	2009/2010	Region 1	14	15	8	14	16
## 134	2009/2010	Region 10	11	12	9	11	11
## 135	2009/2010	Region 2	17	15	9	13	15
## 136	2009/2010	Region 3	13	13	9	12	13
## 137	2009/2010	Region 4	21	10	6	5	11
## 138	2009/2010	Region 5	12	13	9	12	12
## 139	2009/2010	Region 6	11	11	7	11	10

## 140	2009/2010	Region 7	12	12	8	12	13
## 141	2009/2010	Region 8	12	12	9	11	12
## 142	2009/2010	Region 9	11	11	9	11	11
## 143	2009/2010	X	13	12	9	12	13
## 144	2010/2011	Region 1	30	30	NA	29	30
## 145	2010/2011	Region 10	31	29	NA	29	31
## 146	2010/2011	Region 2	22	22	NA	21	22
## 147	2010/2011	Region 3	27	27	NA	27	27
## 148	2010/2011	Region 4	21	22	NA	27	22
## 149	2010/2011	Region 5	27	27	NA	27	27
## 150	2010/2011	Region 6	27	29	NA	27	29
## 151	2010/2011	Region 7	30	30	NA	29	22
## 152	2010/2011	Region 8	29	28	NA	29	31
## 153	2010/2011	Region 9	21	29	NA	29	25
## 154	2010/2011	X	22	29	NA	27	29
## 155	2011/2012	Region 1	22	38	NA	37	22
## 156	2011/2012	Region 10	33	34	NA	34	34
## 157	2011/2012	Region 2	22	23	NA	33	23
## 158	2011/2012	Region 3	22	22	NA	33	23
## 159	2011/2012	Region 4	22	22	NA	32	22
## 160	2011/2012	Region 5	33	33	NA	33	33
## 161	2011/2012	Region 6	33	33	NA	33	33
## 162	2011/2012	Region 7	31	31	NA	31	31
## 163	2011/2012	Region 8	30	33	NA	33	33
## 164	2011/2012	Region 9	27	35	NA	35	22
## 165	2011/2012	X	22	33	NA	33	22
## 166	2012/2013	Region 1	22	22	NA	22	22
## 167	2012/2013	Region 10	22	22	NA	26	22
## 168	2012/2013	Region 2	22	25	NA	25	24
## 169	2012/2013	Region 3	22	22	NA	25	24
## 170	2012/2013	Region 4	22	22	NA	20	22
## 171	2012/2013	Region 5	22	22	NA	22	23
## 172	2012/2013	Region 6	22	22	NA	21	23
## 173	2012/2013	Region 7	22	23	NA	27	22
## 174	2012/2013	Region 8	22	22	NA	22	24
## 175	2012/2013	Region 9	26	26	NA	26	26
## 176	2012/2013	X	22	22	NA	25	22
## 177	2013/2014	Region 1	23	23	NA	28	36
## 178	2013/2014	Region 10	23	23	NA	24	22
## 179	2013/2014	Region 2	22	23	NA	35	36
## 180	2013/2014	Region 3	22	26	NA	25	25
## 181	2013/2014	Region 4	22	22	NA	22	22
## 182	2013/2014	Region 5	22	23	NA	22	23
## 183	2013/2014	Region 6	22	22	NA	22	22
## 184	2013/2014	Region 7	22	23	NA	27	22

##	185	2013/2014	Region 8	22	22	NA	22	22
##	186	2013/2014	Region 9	22	23	NA	26	24
##	187	2013/2014	X	22	23	NA	22	23
##	188	2014/2015	Region 1	26	26	NA	27	26
##	189	2014/2015	Region 10	23	23	NA	22	24
##	190	2014/2015	Region 2	23	23	NA	26	24
##	191	2014/2015	Region 3	22	22	NA	22	23
##	192	2014/2015	Region 4	22	22	NA	21	22
##	193	2014/2015	Region 5	22	22	NA	21	22
##	194	2014/2015	Region 6	22	23	NA	21	23
##	195	2014/2015	Region 7	26	24	NA	26	24
##	196	2014/2015	Region 8	23	23	NA	22	23
##	197	2014/2015	Region 9	23	23	NA	27	23
##	198	2014/2015	X	22	22	NA	22	23
##	199	2015/2016	Region 1	27	33	NA	32	32
##	200	2015/2016	Region 10	33	33	NA	32	35
##	201	2015/2016	Region 2	22	32	NA	32	32
##	202	2015/2016	Region 3	22	32	NA	32	32
##	203	2015/2016	Region 4	32	32	NA	32	32
##	204	2015/2016	Region 5	31	32	NA	31	32
##	205	2015/2016	Region 6	31	29	NA	31	29
##	206	2015/2016	Region 7	32	33	NA	32	32
##	207	2015/2016	Region 8	30	32	NA	30	33
##	208	2015/2016	Region 9	30	29	NA	29	33
##	209	2015/2016	X	22	32	NA	32	32
##	210	2016/2017	Region 1	22	30	NA	28	30
##	211	2016/2017	Region 10	22	22	NA	25	22
##	212	2016/2017	Region 2	22	22	NA	27	22
##	213	2016/2017	Region 3	22	30	NA	30	30
##	214	2016/2017	Region 4	22	29	NA	29	30
##	215	2016/2017	Region 5	29	30	NA	29	30
##	216	2016/2017	Region 6	28	28	NA	28	28
##	217	2016/2017	Region 7	29	28	NA	28	28
##	218	2016/2017	Region 8	22	22	NA	28	25
##	219	2016/2017	Region 9	22	23	NA	27	22
##	220	2016/2017	X	22	30	NA	28	30
##		age_65						
##	1		28					
##	2		10					
##	3		40					
##	4		28					
##	5		21					
##	6		23					
##	7		29					
##	8		28					

## 9	19
## 10	24
## 11	23
## 12	31
## 13	28
## 14	40
## 15	30
## 16	26
## 17	31
## 18	24
## 19	29
## 20	12
## 21	22
## 22	31
## 23	22
## 24	21
## 25	12
## 26	23
## 27	23
## 28	22
## 29	23
## 30	22
## 31	21
## 32	22
## 33	22
## 34	19
## 35	26
## 36	11
## 37	17
## 38	23
## 39	28
## 40	24
## 41	26
## 42	28
## 43	23
## 44	23
## 45	23
## 46	29
## 47	27
## 48	22
## 49	31
## 50	31
## 51	29
## 52	32
## 53	27

## 54	30
## 55	31
## 56	30
## 57	28
## 58	33
## 59	18
## 60	23
## 61	23
## 62	44
## 63	23
## 64	10
## 65	31
## 66	23
## 67	22
## 68	18
## 69	23
## 70	22
## 71	22
## 72	23
## 73	19
## 74	21
## 75	19
## 76	22
## 77	22
## 78	22
## 79	30
## 80	21
## 81	38
## 82	32
## 83	29
## 84	27
## 85	28
## 86	46
## 87	22
## 88	29
## 89	34
## 90	36
## 91	30
## 92	6
## 93	22
## 94	30
## 95	23
## 96	26
## 97	47
## 98	22



## 99	22
## 100	36
## 101	29
## 102	21
## 103	22
## 104	22
## 105	23
## 106	30
## 107	22
## 108	9
## 109	22
## 110	22
## 111	32
## 112	33
## 113	30
## 114	30
## 115	30
## 116	30
## 117	29
## 118	31
## 119	30
## 120	29
## 121	30
## 122	23
## 123	30
## 124	45
## 125	23
## 126	29
## 127	2
## 128	3
## 129	7
## 130	35
## 131	23
## 132	23
## 133	16
## 134	12
## 135	18
## 136	14
## 137	5
## 138	22
## 139	7
## 140	22
## 141	6
## 142	22
## 143	22

## 144	31
## 145	30
## 146	22
## 147	29
## 148	22
## 149	22
## 150	27
## 151	22
## 152	31
## 153	21
## 154	22
## 155	22
## 156	37
## 157	23
## 158	22
## 159	22
## 160	33
## 161	30
## 162	32
## 163	33
## 164	23
## 165	22
## 166	22
## 167	22
## 168	24
## 169	23
## 170	22
## 171	22
## 172	23
## 173	22
## 174	23
## 175	22
## 176	22
## 177	37
## 178	22
## 179	36
## 180	26
## 181	22
## 182	23
## 183	23
## 184	23
## 185	23
## 186	25
## 187	23
## 188	26

```

## 189      26
## 190      23
## 191      23
## 192      22
## 193      22
## 194      23
## 195      24
## 196      23
## 197      23
## 198      23
## 199      33
## 200      36
## 201      32
## 202      22
## 203      32
## 204      32
## 205      22
## 206      22
## 207      29
## 208      33
## 209      32
## 210      30
## 211      22
## 212      23
## 213      30
## 214      29
## 215      30
## 216      28
## 217      28
## 218      23
## 219      22
## 220      30

  filter(is.na(age_25_49))

## Error in filter_(.data, .dots = lazyeval::lazy_dots(...)): object
## 'age_25_49' not found

seasons_25_64_grouped <- paste0(1997:2009, "/", 1998:2010)
seasons_25_64_ungrouped <- paste0(2009:2016, "/", 2010:2017)

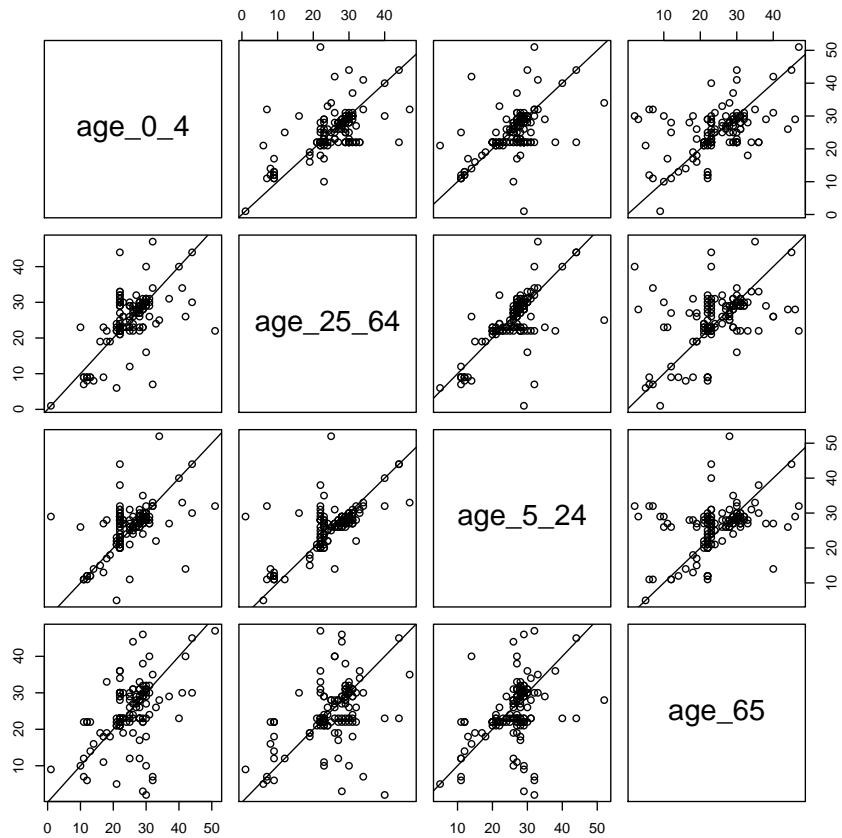
my_line <- function(x,y,...){
  points(x,y,...)
  abline(a = 0,b = 1,...)
}

```

```

pairs(
  peak_times_by_age_season_wide %>%
    filter(season %in% seasons_25_64_grouped) %>%
    select_(.dots = c("age_0_4", "age_25_64", "age_5_24", "age_65")),
  lower.panel = my_line,
  upper.panel = my_line
)

```



```

par(mfrow = c(4, 4))
var_names <- c("age_0_4", "age_25_64", "age_5_24", "age_65")

for(i in 1:3) {
  for(j in (i + 1):4) {
    peak_time_diffs <-
      (peak_times_by_age_season_wide %>%
        filter(season %in% seasons_25_64_grouped) %>%

```

```

      select_(.dots = var_names[i]))[[1]] -
      (peak_times_by_age_season_wide %>%
        filter(season %in% seasons_25_64_grouped) %>%
        select_(.dots = var_names[j]))[[1]]
    cat(paste0("peak ", var_names[i], " - peak ", var_names[j], "\n"))
    cat(paste0("diff < 0: ", sum(peak_time_diffs < 0), "\n"))
    cat(paste0("diff == 0: ", sum(peak_time_diffs == 0), "\n"))
    cat(paste0("diff > 0: ", sum(peak_time_diffs > 0), "\n\n"))
  }
}

## peak age_0_4 - peak age_25_64
## diff < 0: 61
## diff == 0: 35
## diff > 0: 47
##
## peak age_0_4 - peak age_5_24
## diff < 0: 57
## diff == 0: 33
## diff > 0: 53
##
## peak age_0_4 - peak age_65
## diff < 0: 63
## diff == 0: 32
## diff > 0: 48
##
## peak age_25_64 - peak age_5_24
## diff < 0: 53
## diff == 0: 24
## diff > 0: 66
##
## peak age_25_64 - peak age_65
## diff < 0: 51
## diff == 0: 41
## diff > 0: 51
##
## peak age_5_24 - peak age_65
## diff < 0: 66
## diff == 0: 17
## diff > 0: 60

var_names <- c("age_0_4", "age_5_24", "age_25_49", "age_50_64", "age_65")

for(i in 1:4) {
  for(j in (i + 1):5) {

```

```

peak_time_diffs <-
  (peak_times_by_age_season_wide %>%
    filter(season %in% seasons_25_64_ungrouped) %>%
    select_(.dots = var_names[i]))[[1]] -
  (peak_times_by_age_season_wide %>%
    filter(season %in% seasons_25_64_ungrouped) %>%
    select_(.dots = var_names[j]))[[1]]
cat(paste0(var_names[i], " vs. ", var_names[j], ":\n"))
cat(paste0(var_names[i], " peaked before ", var_names[j], ": ", sum(peak_time_diffs < 0)))
cat(paste0(var_names[i], " peaked same week as ", var_names[j], ": ", sum(peak_time_diffs == 0)))
cat(paste0(var_names[i], " peaked after ", var_names[j], ": ", sum(peak_time_diffs > 0)))
}
cat("\n")
}

## age_0_4 vs. age_5_24:
## age_0_4 peaked before age_5_24: 37
## age_0_4 peaked same week as age_5_24: 32
## age_0_4 peaked after age_5_24: 19
##
## age_0_4 vs. age_25_49:
## age_0_4 peaked before age_25_49: 35
## age_0_4 peaked same week as age_25_49: 44
## age_0_4 peaked after age_25_49: 9
##
## age_0_4 vs. age_50_64:
## age_0_4 peaked before age_50_64: 41
## age_0_4 peaked same week as age_50_64: 38
## age_0_4 peaked after age_50_64: 9
##
## age_0_4 vs. age_65:
## age_0_4 peaked before age_65: 46
## age_0_4 peaked same week as age_65: 27
## age_0_4 peaked after age_65: 15
##
##
## age_5_24 vs. age_25_49:
## age_5_24 peaked before age_25_49: 31
## age_5_24 peaked same week as age_25_49: 34
## age_5_24 peaked after age_25_49: 23
##
## age_5_24 vs. age_50_64:
## age_5_24 peaked before age_50_64: 36
## age_5_24 peaked same week as age_50_64: 25
## age_5_24 peaked after age_50_64: 27
##

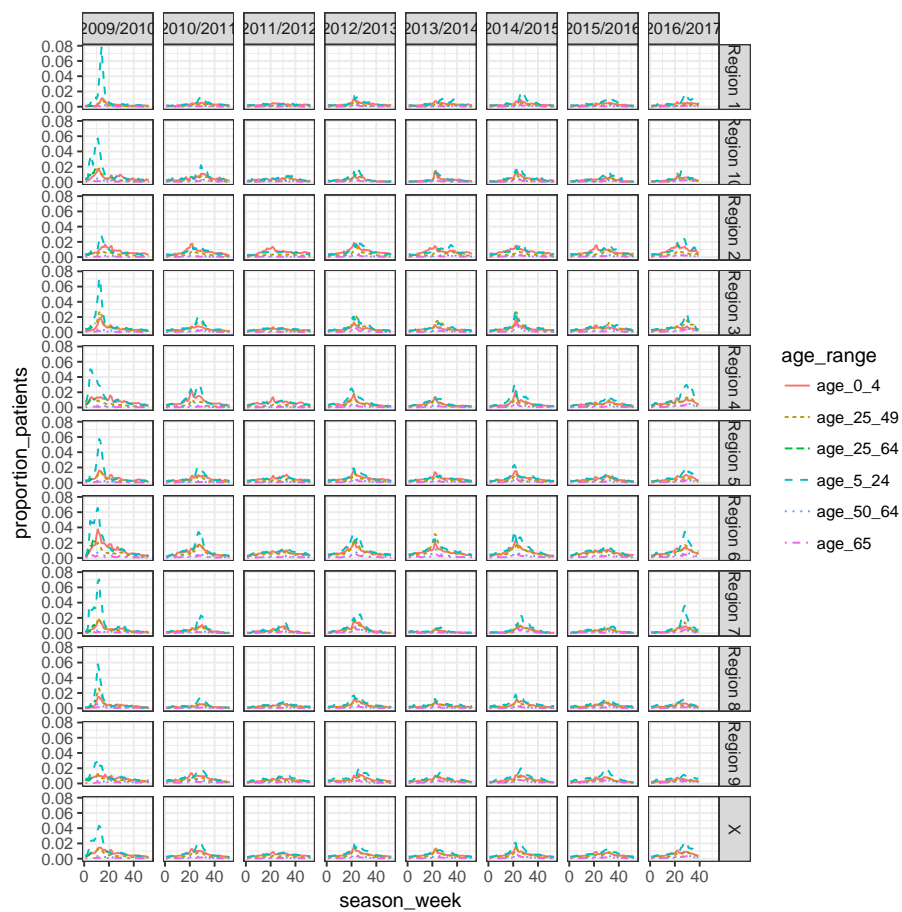
```

```
## age_5_24 vs. age_65:
## age_5_24 peaked before age_65: 39
## age_5_24 peaked same week as age_65: 14
## age_5_24 peaked after age_65: 35
##
##
## age_25_49 vs. age_50_64:
## age_25_49 peaked before age_50_64: 23
## age_25_49 peaked same week as age_50_64: 49
## age_25_49 peaked after age_50_64: 16
##
## age_25_49 vs. age_65:
## age_25_49 peaked before age_65: 28
## age_25_49 peaked same week as age_65: 39
## age_25_49 peaked after age_65: 21
##
##
## age_50_64 vs. age_65:
## age_50_64 peaked before age_65: 22
## age_50_64 peaked same week as age_65: 45
## age_50_64 peaked after age_65: 21
```

```
p <- ggplot(data_age_gathered %>% filter(season %in% seasons_25_64_ungrouped)) +
  geom_line(aes(x = season_week, y = proportion_patients, colour = age_range, linetype = age_range)) +
  facet_grid(region ~ season) +
  theme_bw()
pdf("/media/evan/data/Reich/flu-exploration/age-groups/age-groups-timeline-by-season-region.pdf")

## Error in pdf("/media/evan/data/Reich/flu-exploration/age-groups/age-groups-timeline-by-season-region.pdf") :
## cannot open file '/media/evan/data/Reich/flu-exploration/age-groups/age-groups-timeline-by-season-region.pdf'
print(p)

## Warning: Removed 413 rows containing missing values (geom_path).
```



```
dev.off()

## null device
##          1
```