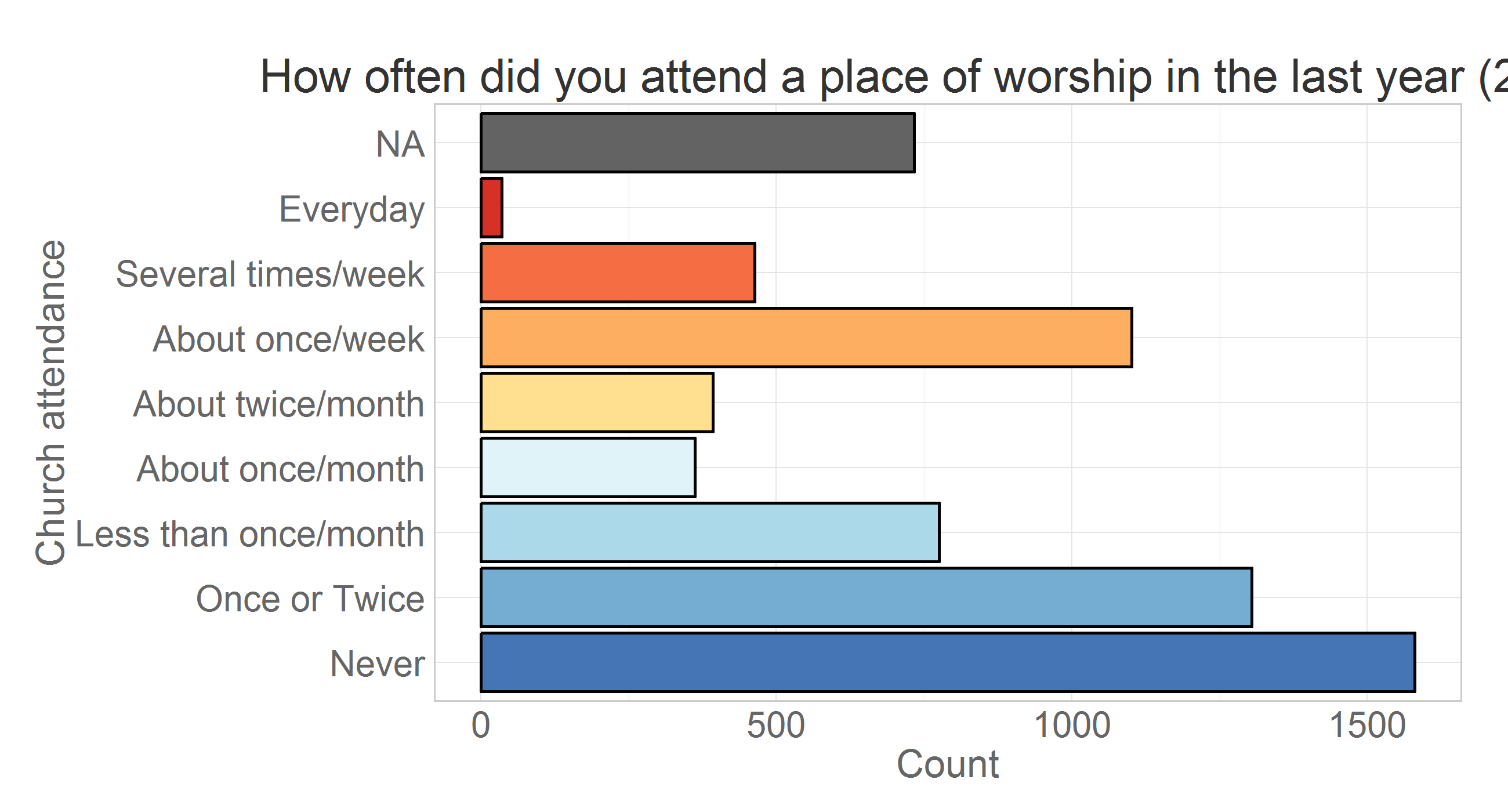
Metrics

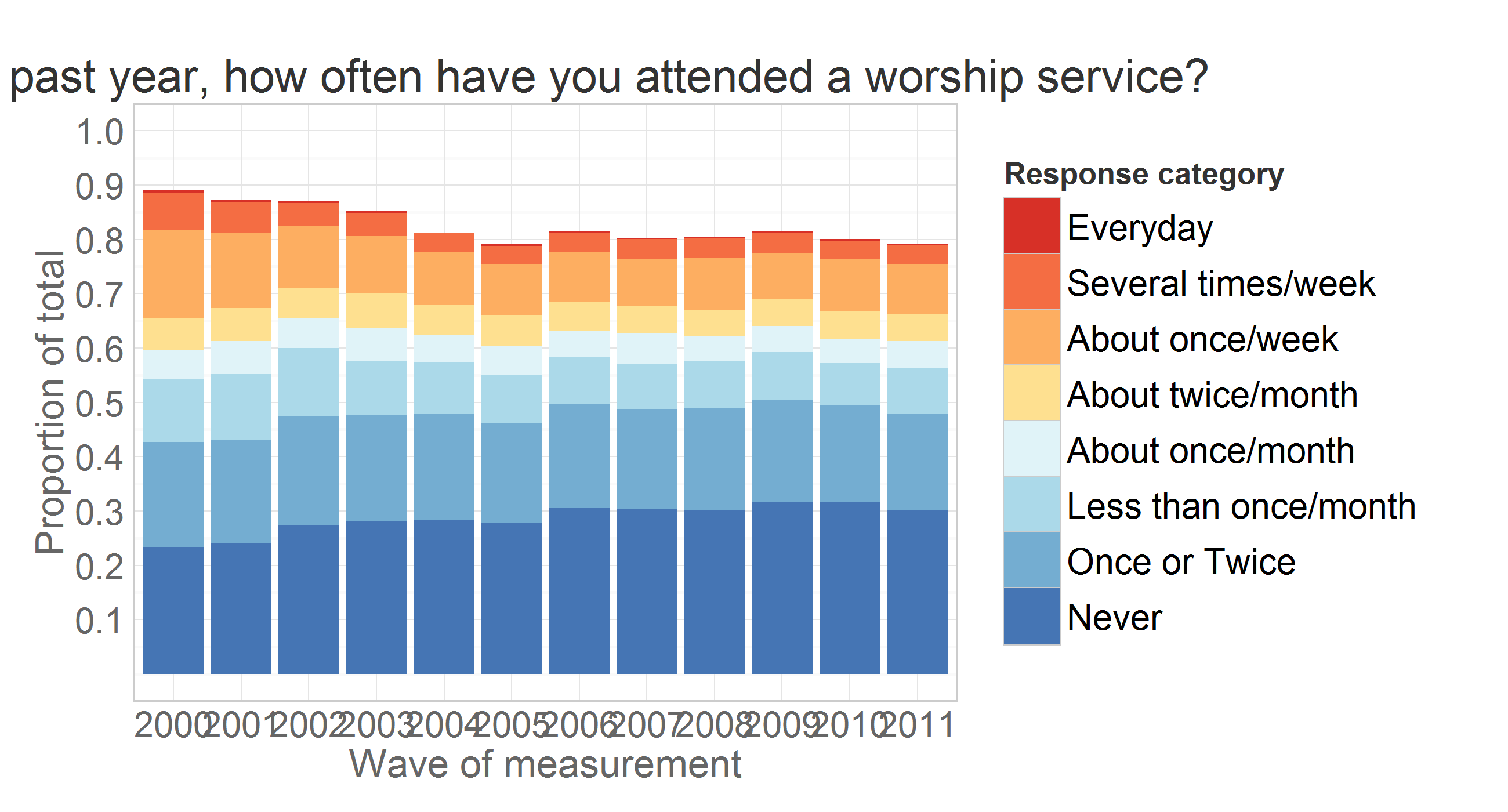
Andriy Koval

Tuesday, June 24, 2014

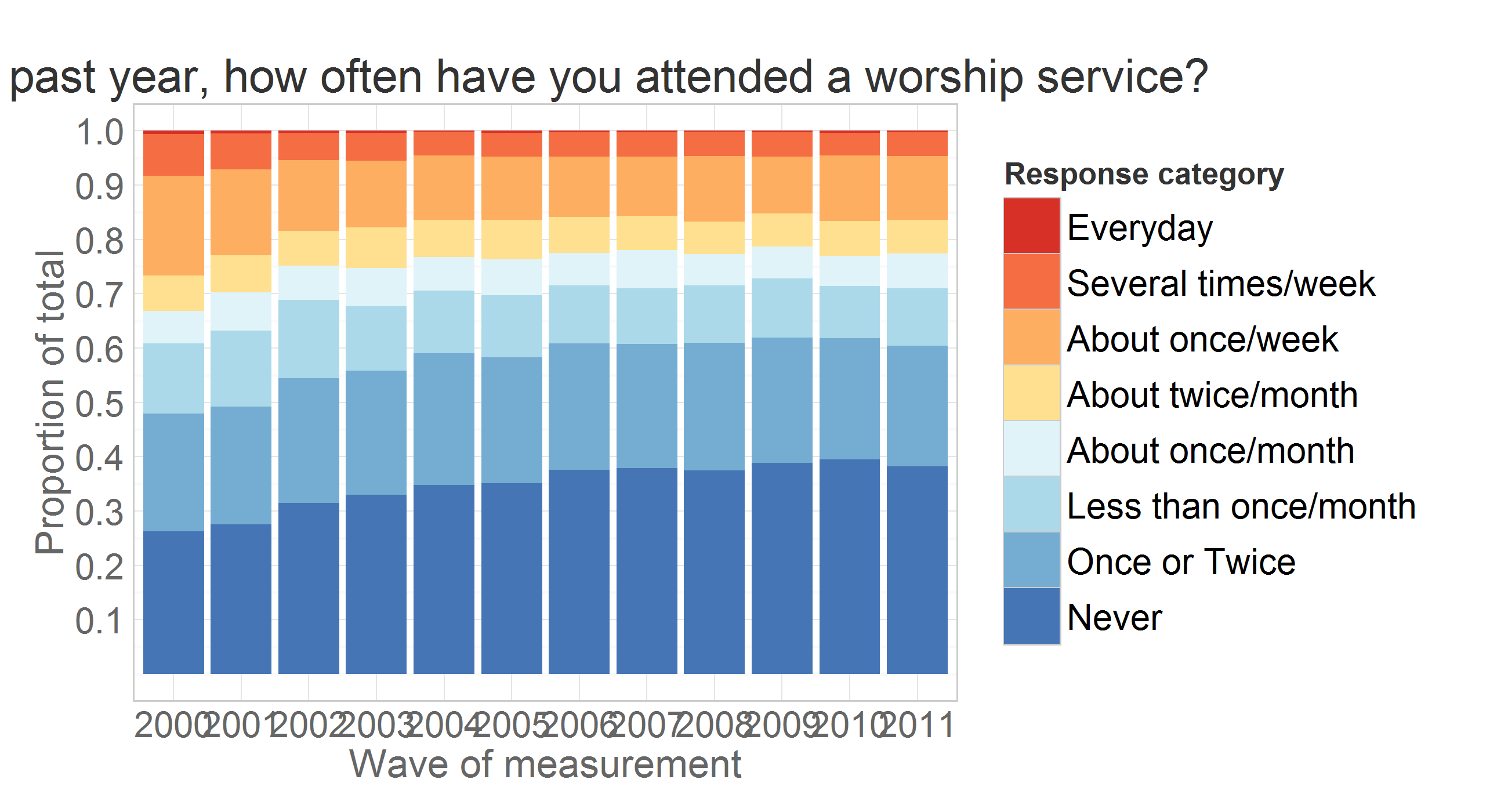
## Mapping Church Attendance in Time

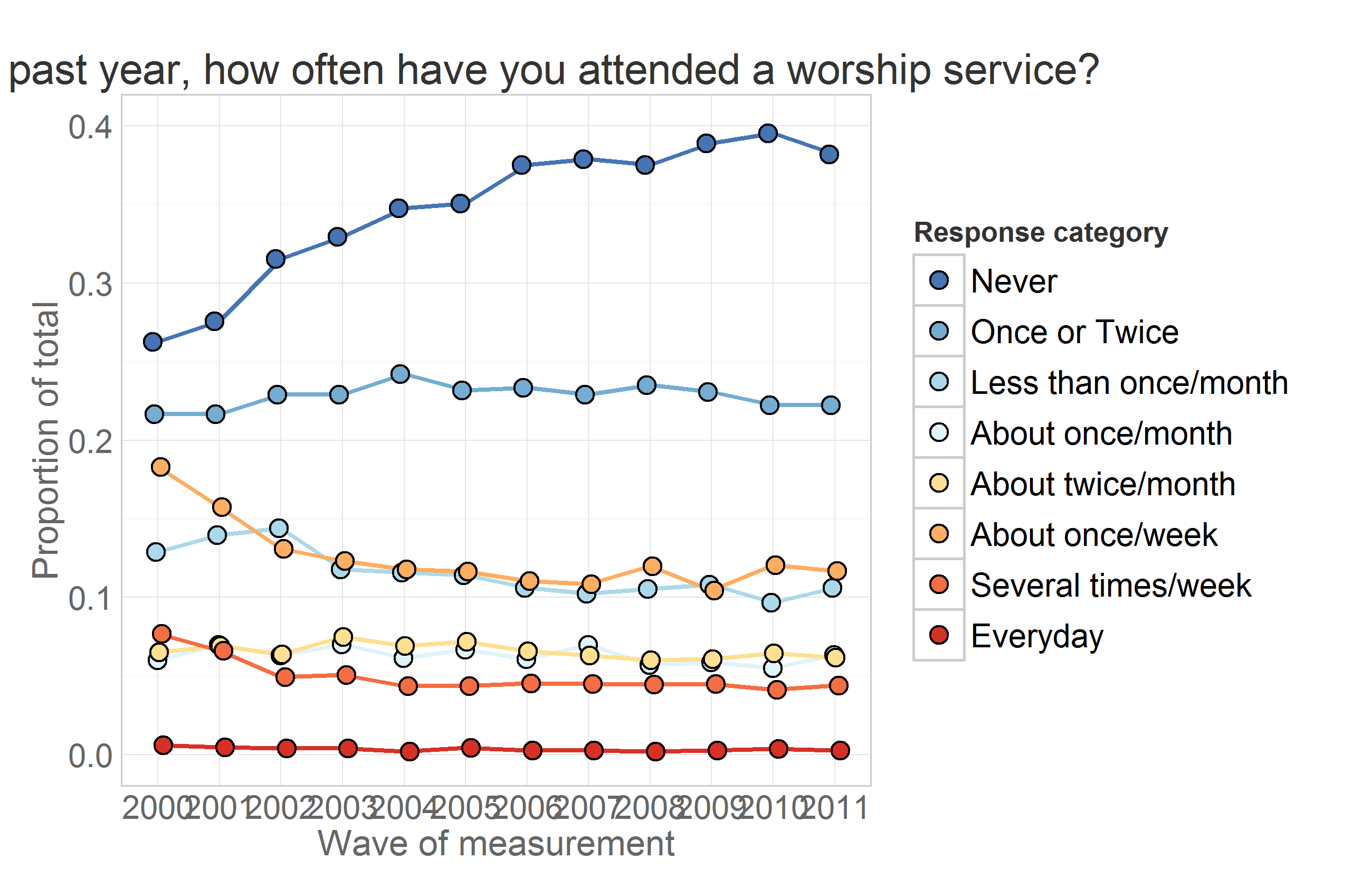
### Cross-Sectional View

The focal variable of interest is **attend**, an item measuring church attendance in the current year. The questionnaire recorded the responses on the ordinal scale.  


Creating frequency distributions for each of the measurement wave we have:  


Missing values are used in the calculation of total responses to show the natural attrition in the study. Assumming that attrition is not significantly associated with the outcome measure, we can remove missing values from the calculation of the total and look at prevalence of endorsements over time.

 Tracing the rate of change of prevalence in a line graph, we see more clearly which categores increase over time (e.g. "Never"), which decline (e.g. ""About once/week), and which stay relatively stable (e.g. "About twice/month")



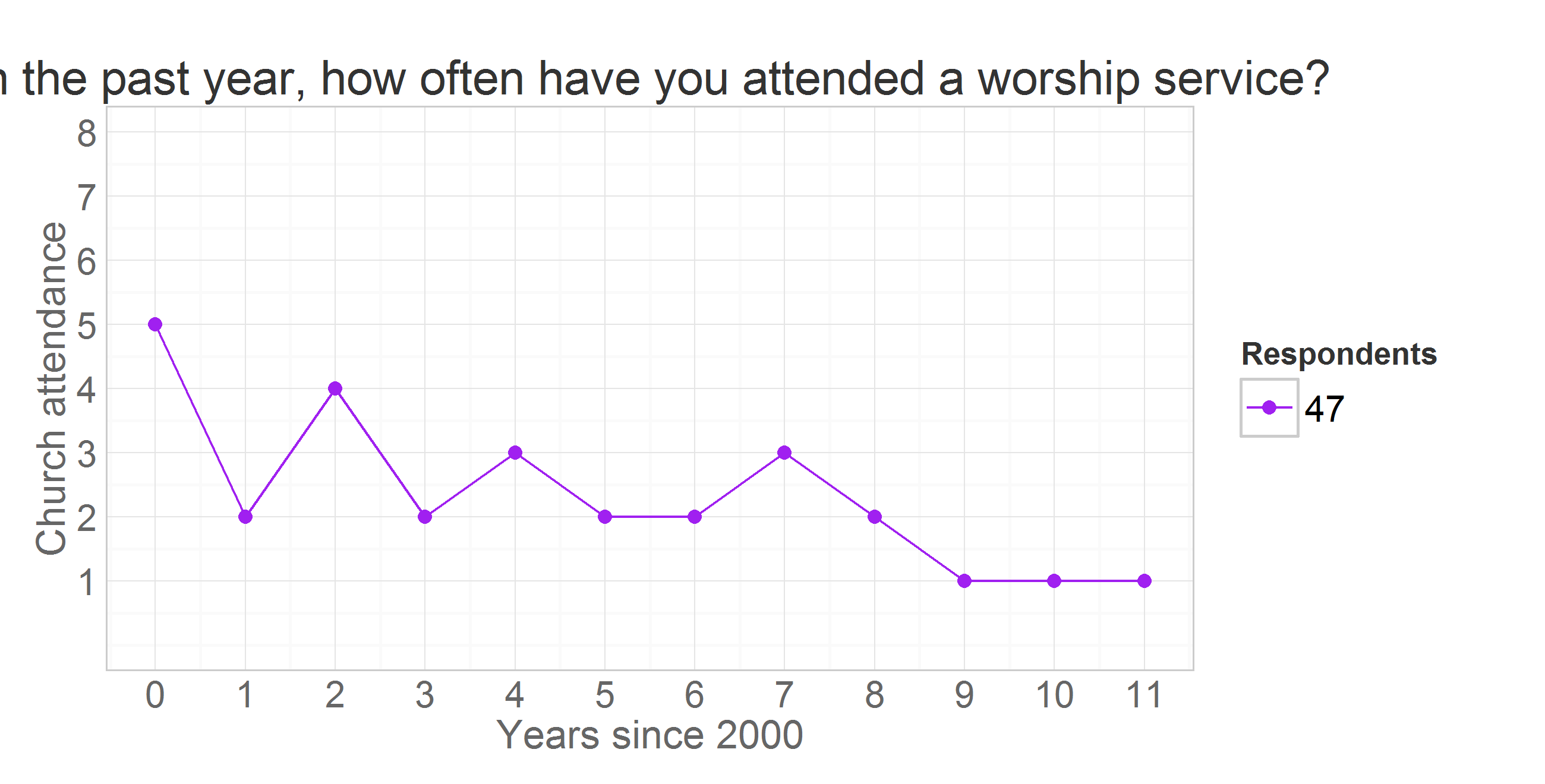
### Longitudinal View

Graphs above shows change in the cross-sectional distribution of responses over the years. Modeling the change in these response frequencies is handled well by Markov models. LCM, however, works with longitudinal data, modeling the trajectory of each individual and treating attendance as a continuous outcome.

To demonstrate mapping of individual trajectories to time, let's select a dataset that would include personal identifyer (**id**), cohort indicator (**byear**), wave of measurement (**year**) and the focal variable of interest - worship attendance (**attend**).

ds<- dsL %>% dplyr::filter(year %in% c(2000:2011), id==47) %>%  
 dplyr:: select(id, byear, year, attend, attendF)  
print(ds)

id byear year attend attendF  
1 47 1982 2000 5 About twice/month  
2 47 1982 2001 2 Once or Twice  
3 47 1982 2002 4 About once/month  
4 47 1982 2003 2 Once or Twice  
5 47 1982 2004 3 Less than once/month  
6 47 1982 2005 2 Once or Twice  
7 47 1982 2006 2 Once or Twice  
8 47 1982 2007 3 Less than once/month  
9 47 1982 2008 2 Once or Twice  
10 47 1982 2009 1 Never  
11 47 1982 2010 1 Never  
12 47 1982 2011 1 Never

The view above lists attendance data for subjust with id = 47. Mapping his attendance to time we have  


where vertical dimension maps the outcome value and the horizontal maps the time. There will be a trajecory for each of the

length(unique(dsL$id))

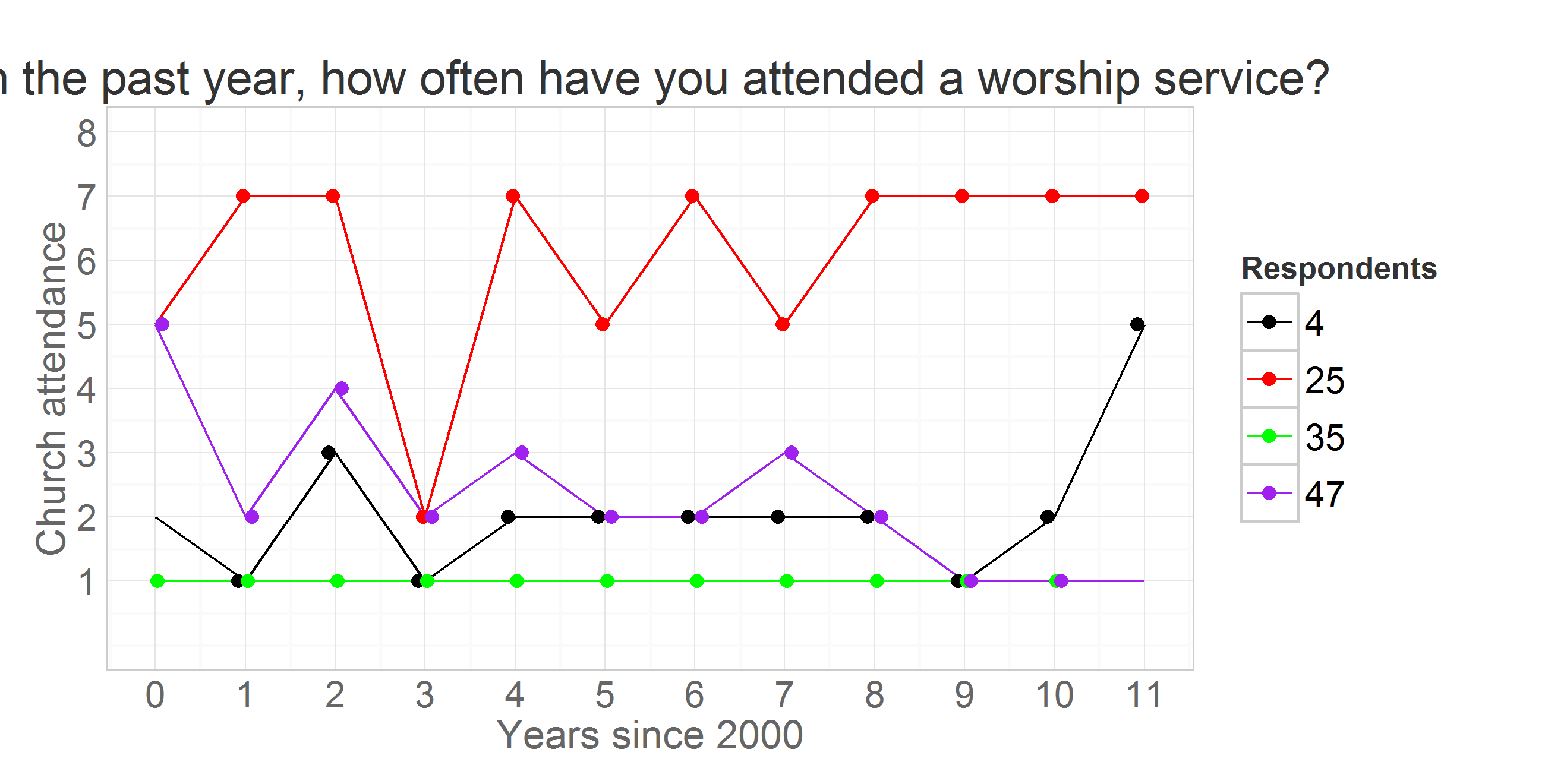
[1] 8983

subjects in total. Unless specified otherwise, only individuals from the cross-sample will be used in the model to increase external validity.

ds<- dsL %>% dplyr::filter(sample==1)

Each of such trajectories imply a story, a life scenario. Why one person grows in his religious involvement, while other declines, or never develops an interest in the first place? To demostrate how interpretations of trajectories can vary among individuals consider the following scenario.

Attendance trajectories of subjects with **id**s 4, 25, 35, and 47 are plotted in the next graph



The respondent **id**=35 reported attending no worship services in any of the years, while respodent **id**=25 seemed to frequent it, indicating weekly attendance in 8 out of the 12 years. Individual **id**=47 started as a fairly regular attendee of religious services in 2000 (5= "about twice a month"), then gradually declined his involvement to nill in 2009 and on. Respondent **id**=4, on the other hand started off with a rather passive involvement, reporting attended church only "Once or twice" in 2000, maintained a low level of participation throughout the years, only to surge his attendance in 2011. Latent curve models will describe intraindividual trajectories of change, while summarizinig the interindividual similarities and trends.

Previous research in religiousity indicated that age might be one of the primary factors explaining interindividual differences in church attendance. To examine the role of age, we change the metric of time from waves of measurement, as in the previous graph, to biological age. There are, however, a number of ways information about age was recorded.

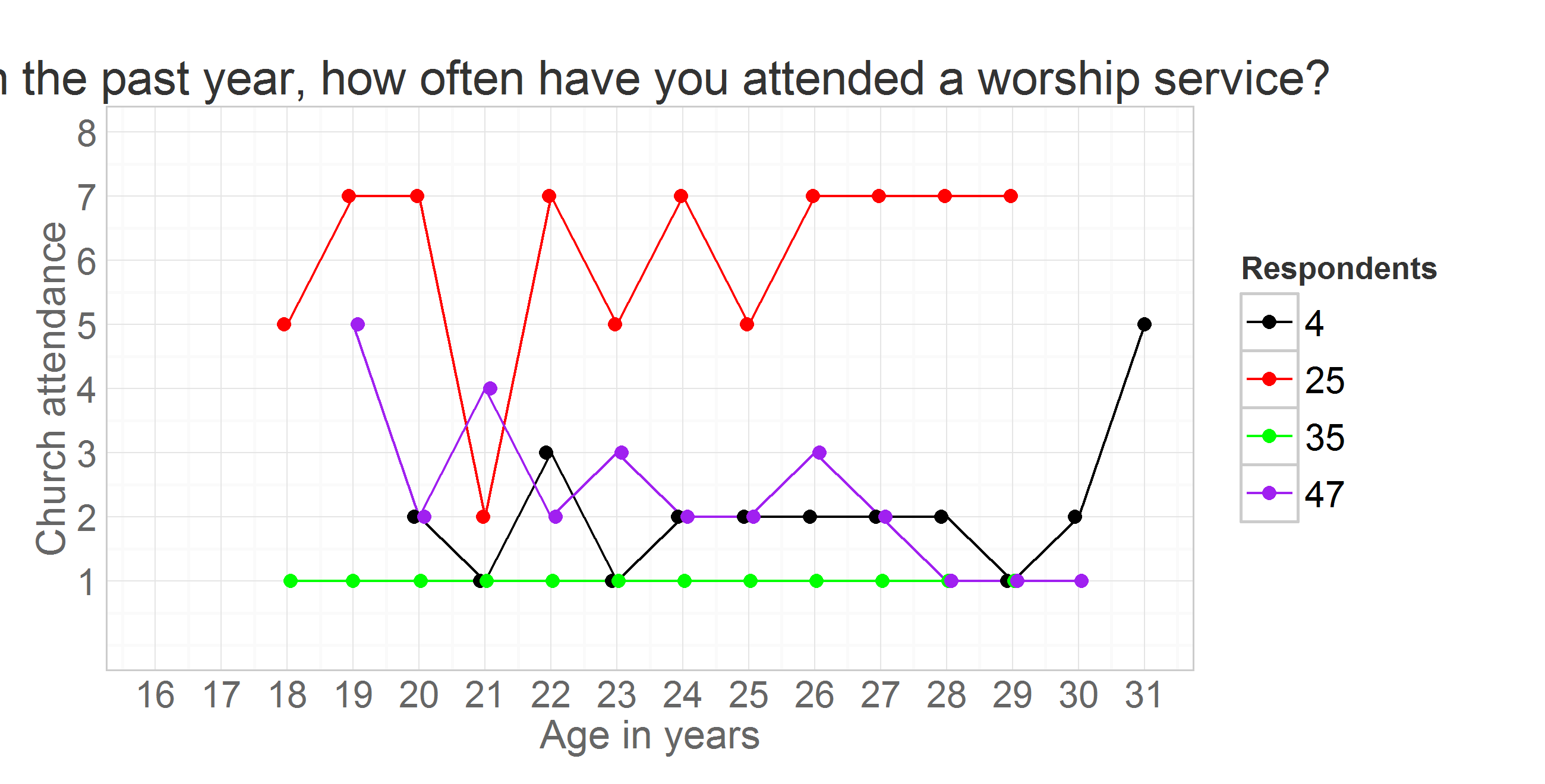
ds<- dsL %>% dplyr::filter(id %in% c(4,25,35,47),year %in% c(2000:2011)) %>%   
 dplyr::select(idF,attend, year, byear, ageyear, agemon, ageyear) %>%   
 mutate(time=year-2000, age=(year-byear+1), ageCurrent = agemon/12)  
print(ds[ds$idF==25,])

idF attend year byear ageyear agemon time age ageCurrent  
13 25 5 2000 1983 17 214 0 18 17.83  
14 25 7 2001 1983 18 226 1 19 18.83  
15 25 7 2002 1983 19 236 2 20 19.67  
16 25 2 2003 1983 21 254 3 21 21.17  
17 25 7 2004 1983 21 261 4 22 21.75  
18 25 5 2005 1983 22 272 5 23 22.67  
19 25 7 2006 1983 23 284 6 24 23.67  
20 25 5 2007 1983 24 295 7 25 24.58  
21 25 7 2008 1983 25 307 8 26 25.58  
22 25 7 2009 1983 26 319 9 27 26.58  
23 25 7 2010 1983 27 332 10 28 27.67  
24 25 7 2011 1983 28 342 11 29 28.50

ds

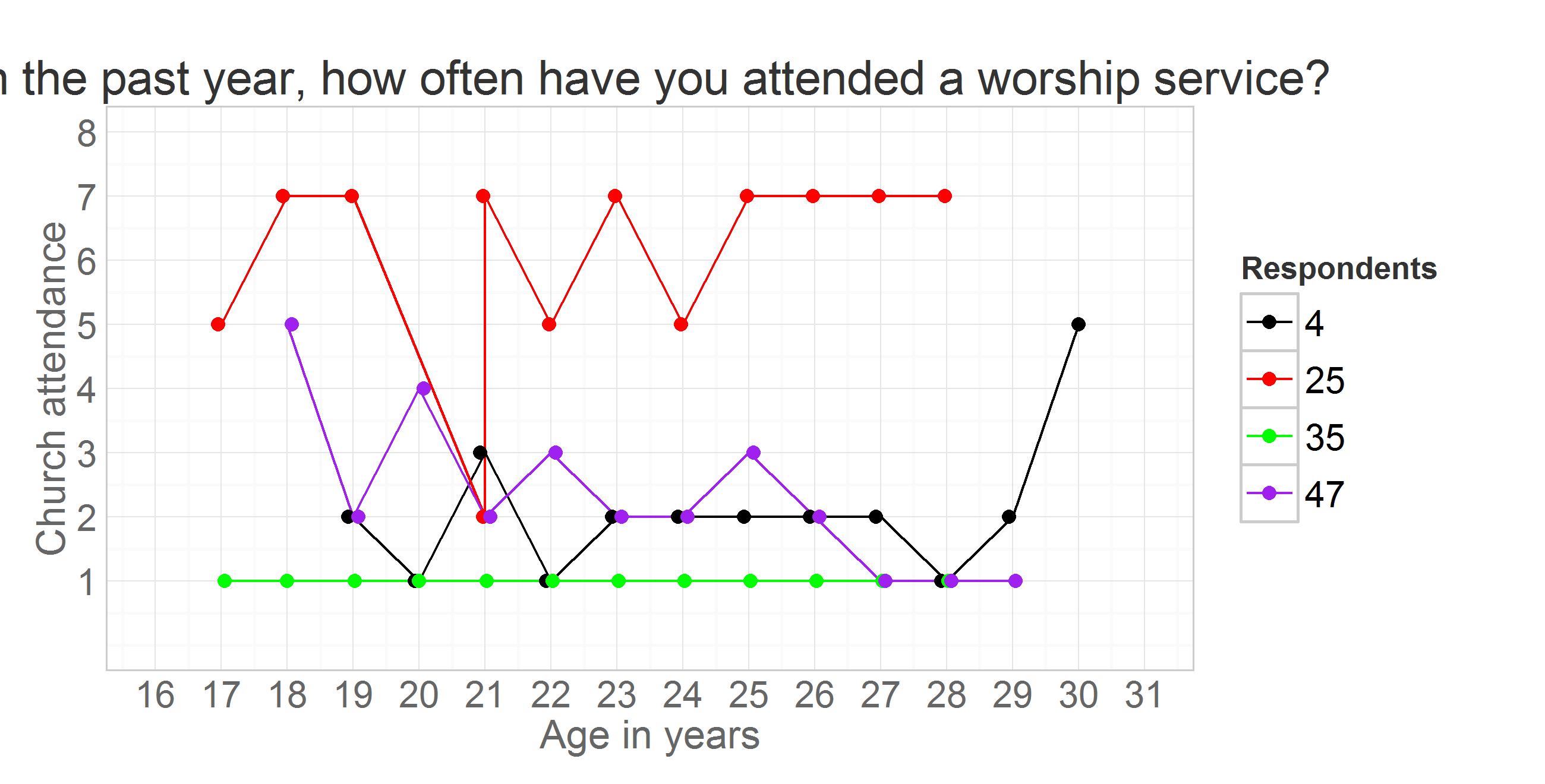
idF attend year byear ageyear agemon time age ageCurrent  
1 4 2 2000 1981 19 238 0 20 19.83  
2 4 1 2001 1981 20 251 1 21 20.92  
3 4 3 2002 1981 21 262 2 22 21.83  
4 4 1 2003 1981 22 276 3 23 23.00  
5 4 2 2004 1981 23 287 4 24 23.92  
6 4 2 2005 1981 24 297 5 25 24.75  
7 4 2 2006 1981 25 309 6 26 25.75  
8 4 2 2007 1981 26 320 7 27 26.67  
9 4 2 2008 1981 27 336 8 28 28.00  
10 4 1 2009 1981 28 344 9 29 28.67  
11 4 2 2010 1981 29 357 10 30 29.75  
12 4 5 2011 1981 30 368 11 31 30.67  
13 25 5 2000 1983 17 214 0 18 17.83  
14 25 7 2001 1983 18 226 1 19 18.83  
15 25 7 2002 1983 19 236 2 20 19.67  
16 25 2 2003 1983 21 254 3 21 21.17  
17 25 7 2004 1983 21 261 4 22 21.75  
18 25 5 2005 1983 22 272 5 23 22.67  
19 25 7 2006 1983 23 284 6 24 23.67  
20 25 5 2007 1983 24 295 7 25 24.58  
21 25 7 2008 1983 25 307 8 26 25.58  
22 25 7 2009 1983 26 319 9 27 26.58  
23 25 7 2010 1983 27 332 10 28 27.67  
24 25 7 2011 1983 28 342 11 29 28.50  
25 35 1 2000 1983 17 216 0 18 18.00  
26 35 1 2001 1983 18 227 1 19 18.92  
27 35 1 2002 1983 19 239 2 20 19.92  
28 35 1 2003 1983 20 250 3 21 20.83  
29 35 1 2004 1983 21 264 4 22 22.00  
30 35 1 2005 1983 22 274 5 23 22.83  
31 35 1 2006 1983 23 286 6 24 23.83  
32 35 1 2007 1983 24 297 7 25 24.75  
33 35 1 2008 1983 25 310 8 26 25.83  
34 35 1 2009 1983 26 320 9 27 26.67  
35 35 1 2010 1983 27 334 10 28 27.83  
36 35 1 2011 1983 28 345 11 29 28.75  
37 47 5 2000 1982 18 220 0 19 18.33  
38 47 2 2001 1982 19 233 1 20 19.42  
39 47 4 2002 1982 20 243 2 21 20.25  
40 47 2 2003 1982 21 257 3 22 21.42  
41 47 3 2004 1982 22 266 4 23 22.17  
42 47 2 2005 1982 23 280 5 24 23.33  
43 47 2 2006 1982 24 292 6 25 24.33  
44 47 3 2007 1982 25 302 7 26 25.17  
45 47 2 2008 1982 26 315 8 27 26.25  
46 47 1 2009 1982 27 326 9 28 27.17  
47 47 1 2010 1982 28 339 10 29 28.25  
48 47 1 2011 1982 29 351 11 30 29.25

Note that for person **id** = 25 the age was recorded as 21 years for both 2003 and 2004. However, when you examine age in months (**agemon**) you can see this is rounding issue that disappears once a more precise scale is used. To avoid this potentially confusing peculiarity, age in years will be either calculated as (**age** = **year** - **byear** + 1)

Plotting age, caclulated as age = year - byear + 1 

ds<- dsL %>% dplyr::filter(id %in% c(4,25,35,47),year %in% c(2000:2011)) %>%   
 dplyr::select(idF,year,attend,agemon,ageyear) %>%   
 mutate(time=year-2000, age=ageyear)  
head(ds,12)

idF year attend agemon ageyear time age  
1 4 2000 2 238 19 0 19  
2 4 2001 1 251 20 1 20  
3 4 2002 3 262 21 2 21  
4 4 2003 1 276 22 3 22  
5 4 2004 2 287 23 4 23  
6 4 2005 2 297 24 5 24  
7 4 2006 2 309 25 6 25  
8 4 2007 2 320 26 7 26  
9 4 2008 2 336 27 8 27  
10 4 2009 1 344 28 9 28  
11 4 2010 2 357 29 10 29  
12 4 2011 5 368 30 11 30

Plotting age, caclulated as age = ageyear 

Plotting age, caclulated as age = agemon/12

ds<- dsL %>% dplyr::filter(id %in% c(4,25,35,47),year %in% c(2000:2011)) %>%   
 dplyr::select(idF,year,attend,agemon,ageyear,byear) %>%   
 mutate(time=year-2000, age=agemon/12)  
head(ds,12)

idF year attend agemon ageyear byear time age  
1 4 2000 2 238 19 1981 0 19.83  
2 4 2001 1 251 20 1981 1 20.92  
3 4 2002 3 262 21 1981 2 21.83  
4 4 2003 1 276 22 1981 3 23.00  
5 4 2004 2 287 23 1981 4 23.92  
6 4 2005 2 297 24 1981 5 24.75  
7 4 2006 2 309 25 1981 6 25.75  
8 4 2007 2 320 26 1981 7 26.67  
9 4 2008 2 336 27 1981 8 28.00  
10 4 2009 1 344 28 1981 9 28.67  
11 4 2010 2 357 29 1981 10 29.75  
12 4 2011 5 368 30 1981 11 30.67

