investigation-US-election-2016

```r
library(conflicted)
    conflicts_prefer(dplyr::filter, dplyr::lag)
library(tidyverse)
library(R6)
library(formatR)
library(lubridate)
```

```r
allstates = polls$state |>
    unique() |>
    sort()
polls = polls |>
    mutate(
        interval = startdate %--% enddate,
        middate = ymd(startdate + (enddate - startdate)/2),
        .keep = "unused",
        .after = "state"
    ) |>
    mutate(
        grade = grade |>
            factor(
                levels = c(
                    "A+",
                    "A",
                    "A-",
                    "B+",
                    "B",
                    "B-",
                    "C+",
                    "C",
                    "C-",
                    "D+",
                    "D",
                    "D-",
                    NA
                )
            ),
        .keep = "unused",
        .before = "samplesize"
    )
```

```r
finalresults = tibble(
    state = allstates,
    clinton = c(34.36, 36.55, 45.13, 33.65, 61.73, 48.16, 54.57, 53.09, 90.86, 47.82, 45.64, 62.22, 27.4
    trump = c(62.08, 51.28, 48.67, 60.57, 31.62, 43.25, 40.93, 41.71, 4.09, 49.02, 50.77, 30.04, 59.26,
    johnson = c(2.09, 5.88, 4.13, 2.65, 3.37, 5.18, 2.96, 3.33, 1.58, 2.20, 3.05, 3.72, 4.10, 3.79, 4.9
    mcmullin = c(NA, NA, 0.68, 1.17, 0.28, 1.04, 0.13, 0.16, NA, NA, 0.32, NA, 6.73, 0.21, NA, 0.79, 0.5
)
```

```
# helps filter for candidate name in results
candidatenames = c("clinton", "trump", "johnson", "mcmullin")

candidate = R6Class(
    classname = "candidate",
    public = list(
        name = "character",
        opponents = "character",
        colour = "character",
        polls = "tbl_df",
        finalresults = "tbl_df",

        initialize = function(name, colour){
            self$name = name
            self$colour = colour
            self$opponents = candidatenames[candidatenames != self$name] # the list of other candidates
            self$polls = polls |>
                select(!contains(self$opponents)) |> # filter polls to only this candidate
                rename(
                    rawpolls = starts_with("rawpoll"),
                    adjpolls = starts_with("adjpoll")
                ) # rename columns for use in candidateplot functions
            self$finalresults = finalresults |>
                select(!contains(self$opponents))
        } # end of initialize
    ) # end of list
)
```

```
clinton = candidate$new(name = "clinton", colour = "blue")
trump = candidate$new(name = "trump", colour = "red")
johnson = candidate$new(name = "johnson", colour = "orange")
mcmullin = candidate$new(name = "mcmullin", colour = "purple")

candidates = list(clinton, trump, johnson, mcmullin)
rm(candidatenames) # only needed for candidate construction
```

```
densepollsbegin = function(thestate, thedate) { # for graphing purposes
    # calculate the earliest date after thedate (inclusive) where there are three
    # consecutive polls in short succession (within two months)
    statepolls = polls |>
        filter(state == thestate, middate >= thedate) |>
        arrange(middate)
    earliestdate = statepolls$middate |>
        min()
    earlydate = earliestdate
    while (nrow(statepolls) > 2) {
        statepolls = statepolls[-1,]
        threemos = interval(
            start = earlydate,
            end = earlydate %m+% months(2, abbreviate = FALSE)
        )
        if (
            threemos |>
            int_overlaps(
                statepolls$interval[which.min(sapply(statepolls$interval, int_start))]
            )
        ) {
            temppolls = statepolls[-1,]
            if (
                threemos |>
                int_overlaps(
                    temppolls$interval[which.min(sapply(temppolls$interval, int_start))]
                )
            ) {
                return(earlydate)
                break
            }
        }
        earlydate = statepolls$middate |>
            min()
    }
    return(earliestdate) # failed to find three such polls; just graph all polls
}

earliestdate = ymd("2016-05-01")
finaldate = ymd("2016-11-08")
```

```
candidateplotraw = function(thestate, thecandidate, thefirstdate) {
    statepolls = thecandidate$polls |>
        filter(state == thestate)
    if ( # in this state, not all polls for this candidate are NA
        any(!is.na(statepolls$rawpolls))
    ) {
        datevsraw = aes(
            x = statepolls$middate,
            y = statepolls$rawpolls
        )
        return(
            last_plot() + geom_point(
                mapping = datevsraw,
                colour = thecandidate$colour,
                na.rm = TRUE
            ) + geom_smooth(
                mapping = datevsraw,
                colour = thecandidate$colour,
                fill = thecandidate$colour,
                alpha = 0.4,
                na.rm = TRUE
            ) + geom_segment(
                mapping = aes(
                x = thefirstdate,
                y = filter(thecandidate$finalresults, state == thestate)[1,2] |>
                    as.numeric(),
                xend = finaldate,
                yend = filter(thecandidate$finalresults, state == thestate)[1,2] |>
                    as.numeric()
                ),
                colour = thecandidate$colour,
                linewidth = 1.0
            )
        ) # end of return
    } # end of if
    else return(last_plot()) # catch the case where the candidate was not polled in the given state
}

candidateplotadj = function(thestate, thecandidate, thefirstdate) {
    statepolls = thecandidate$polls |>
        filter(state == thestate)
    if ( # in this state, not all polls for this candidate are NA
        any(!is.na(statepolls$adjpolls))
    ) {
        datevsadj = aes(
            x = statepolls$middate,
            y = statepolls$adjpolls
        )
        return(
            last_plot() + geom_point(
                mapping = datevsadj,
                colour = thecandidate$colour,
                na.rm = TRUE
            ) + geom_smooth(
                mapping = datevsadj,
                colour = thecandidate$colour,
                fill = thecandidate$colour,
                alpha = 0.4,
                na.rm = TRUE
            ) + geom_segment(
                mapping = aes(
                x = thefirstdate,
                y = filter(thecandidate$finalresults, state == thestate)[1,2] |>
                    as.numeric(),
                xend = finaldate,
                yend = filter(thecandidate$finalresults, state == thestate)[1,2] |>
                    as.numeric()
                ),
                colour = thecandidate$colour,
                linewidth = 1.0
            )
        ) # end of return
    } # end of if
    else return(last_plot()) # catch the case where the candidate was not polled in the given state
}
```

```
stateplotraw = function(thestate) {
    plot = ggplot()
    firstdatetoplot = thestate |>
```

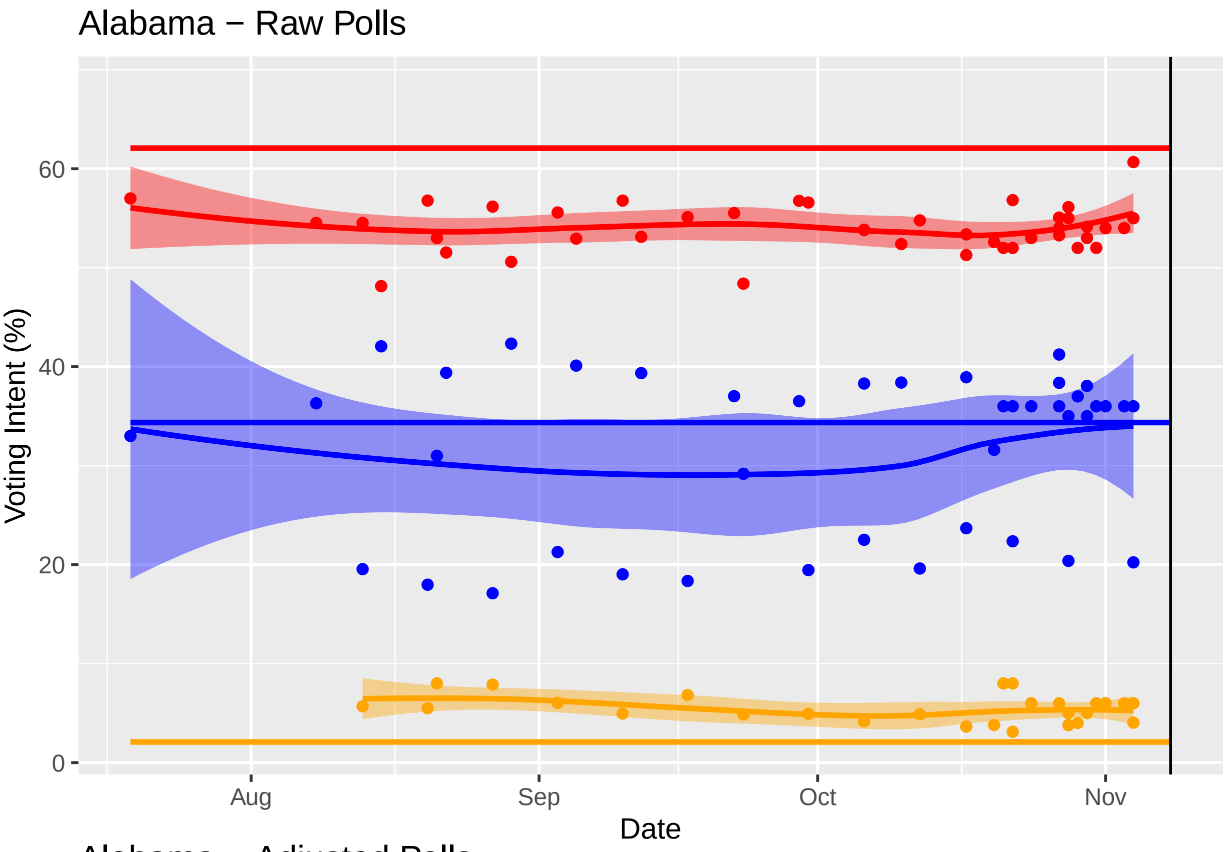
```
        densepollsbegin(earliestdate)
    for (cand in candidates) plot = candidateplotraw(thestate, cand, firstdatetoplot)
    stateraw = thestate |>
        paste("Raw Polls", sep = " - ")
    firstdatetoplot = thestate |>
        densepollsbegin(earliestdate)

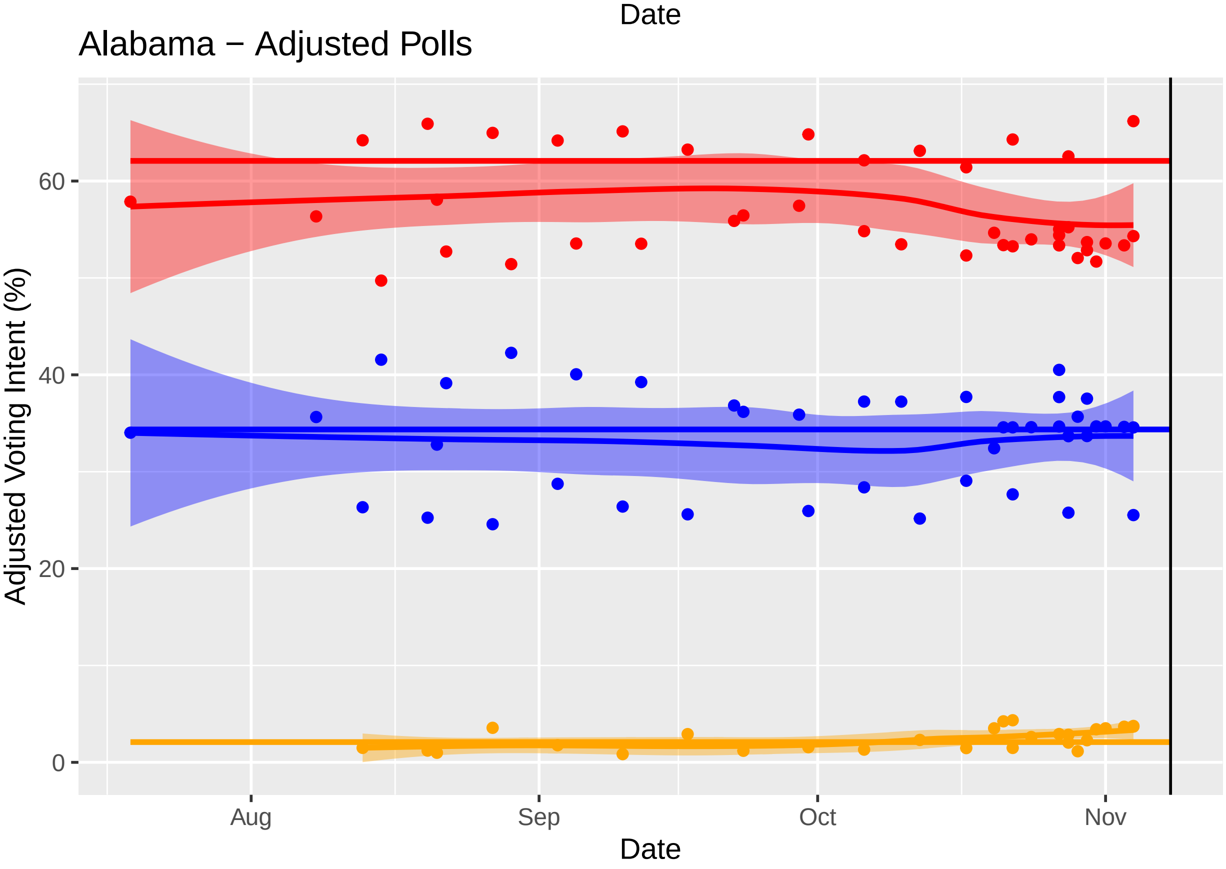
    return(
        plot + geom_vline(xintercept = finaldate) + labs(
            title = stateraw,
            x = "Date",
            y = "Voting Intent (%)"
        ) + xlim(firstdatetoplot, finaldate)
    )
}

stateplotadj = function(thestate) {
    plot = ggplot()
    firstdatetoplot = thestate |>
        densepollsbegin(earliestdate)
    for (cand in candidates) plot = candidateplotadj(thestate, cand, firstdatetoplot)
    stateadj = thestate |>
        paste("Adjusted Polls", sep = " - ")

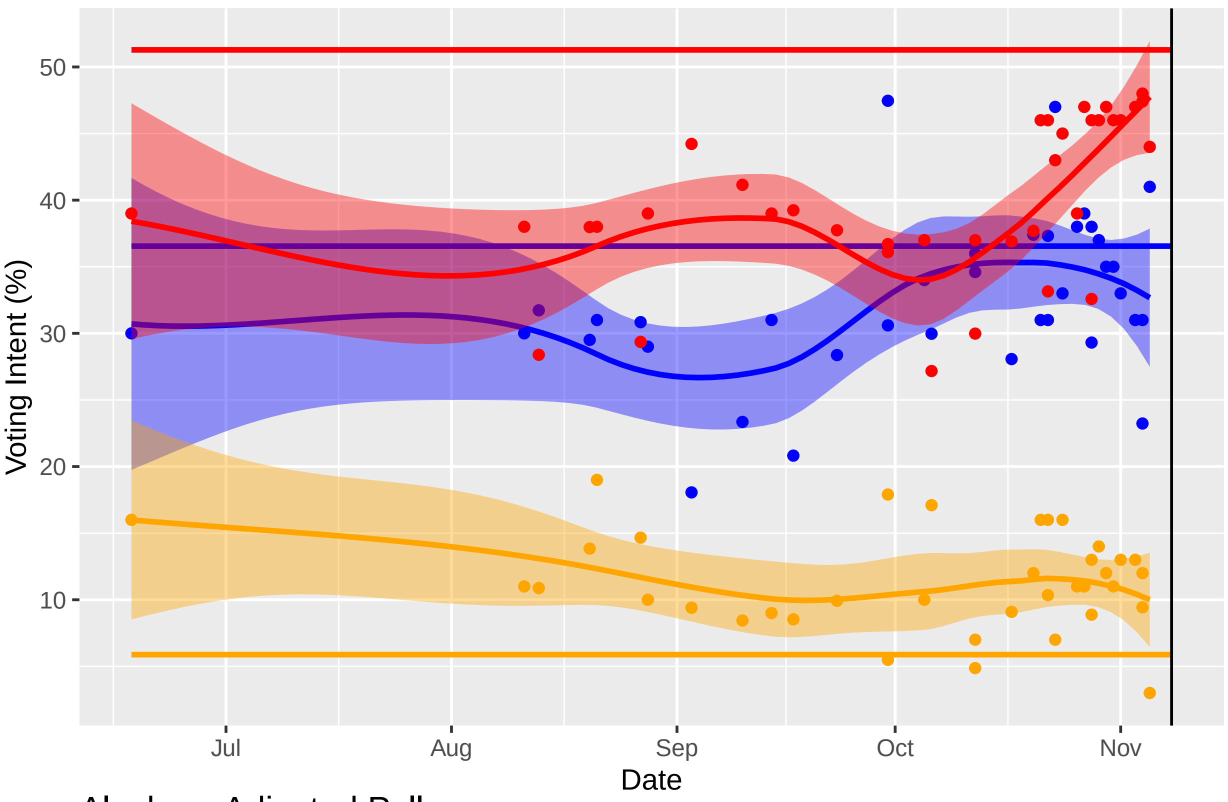
    return(
        plot + geom_vline(xintercept = finaldate) + labs(
            title = stateadj,
            x = "Date",
            y = "Adjusted Voting Intent (%)"
        ) + xlim(firstdatetoplot, finaldate)
    )
}
```

```
for (thestate in allstates) {
    stateplotraw(thestate) |>
        print()
    stateplotadj(thestate) |>
        print()
}
```

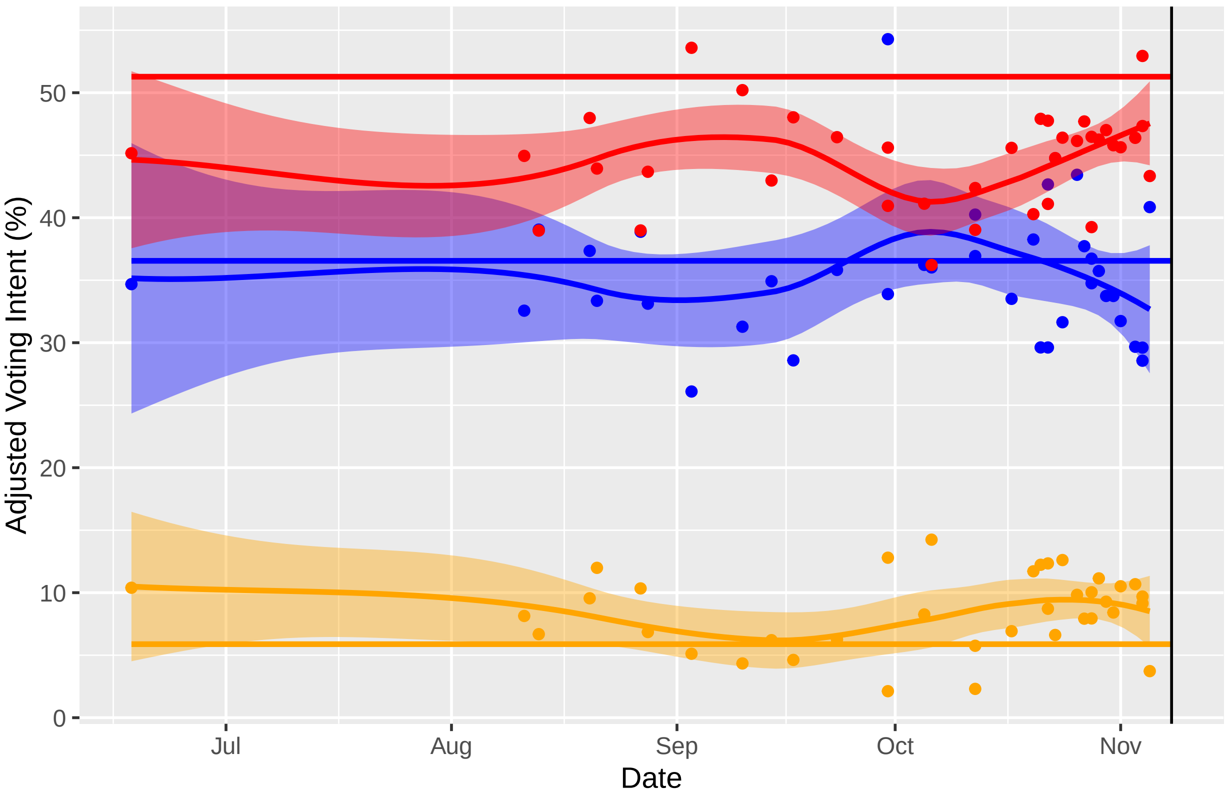

Alabama − Raw Polls
Voting Intent (%)
0
20
40
60
Aug
Sep
Oct
Nov
Date

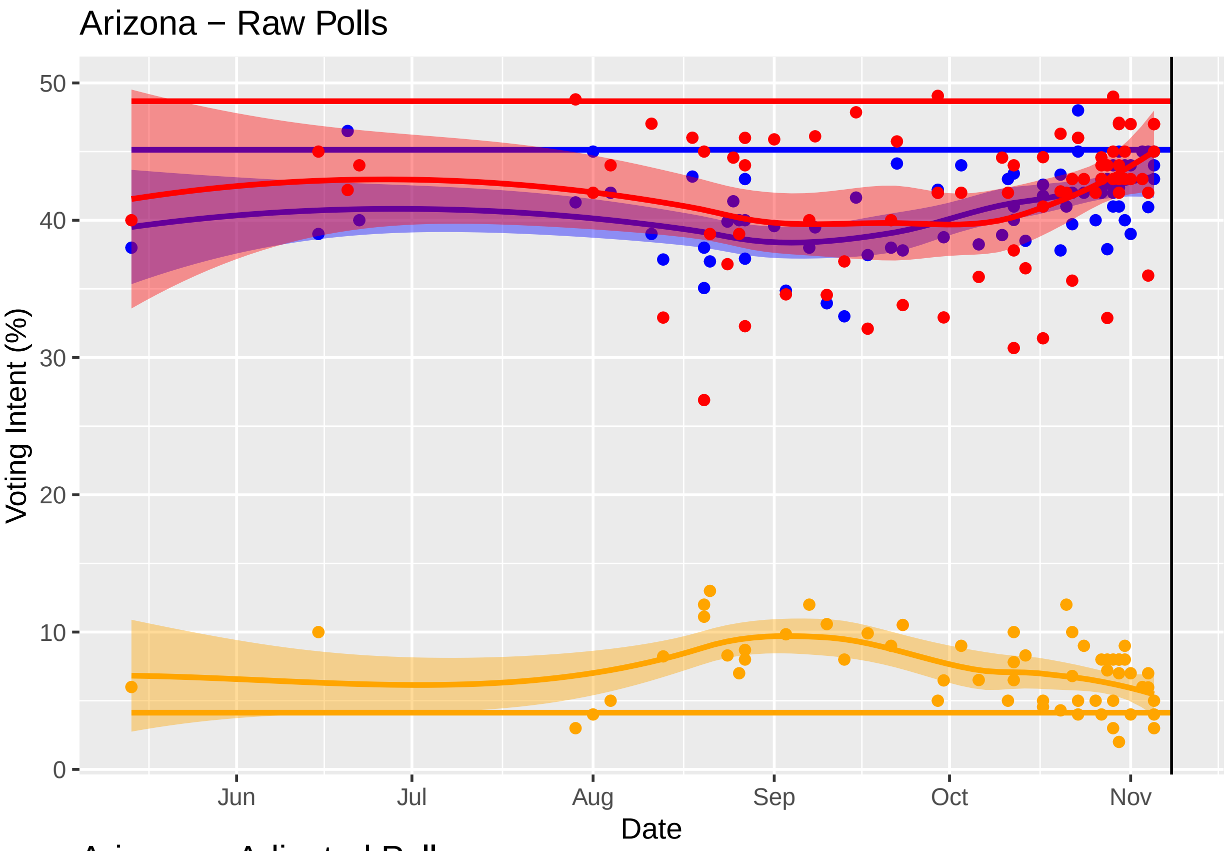

Alabama − Adjusted Polls
Adjusted Voting Intent (%)
0
20
40
60
Aug
Sep
Oct
Nov
Date

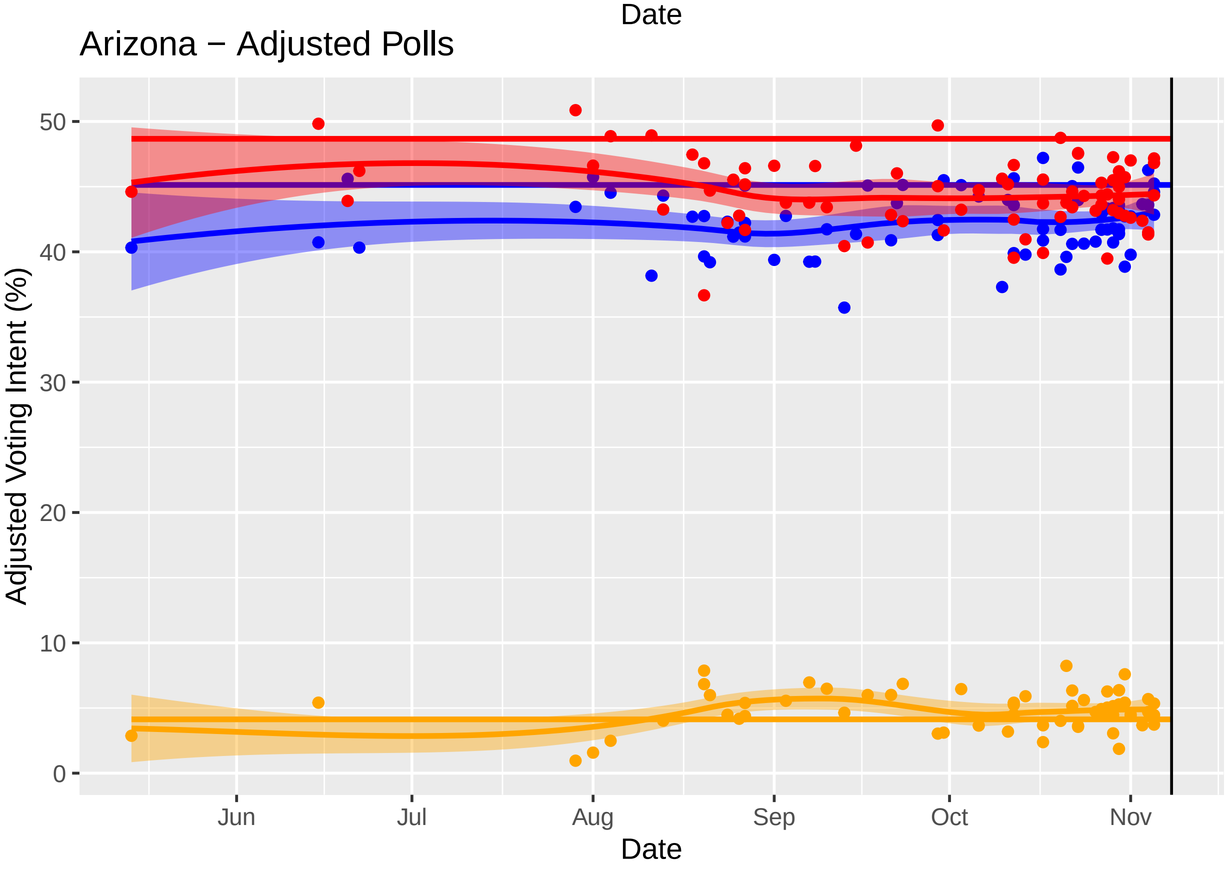
Alaska − Raw Polls



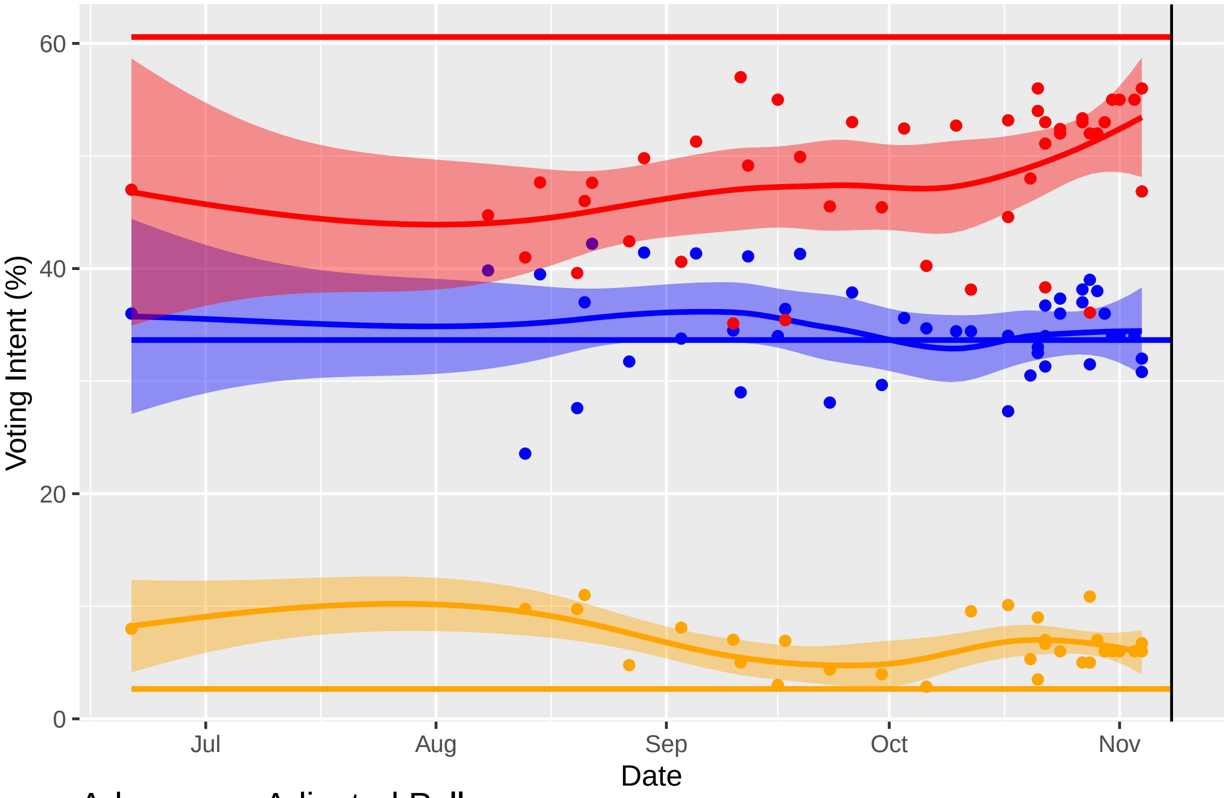
Alaska − Adjusted Polls



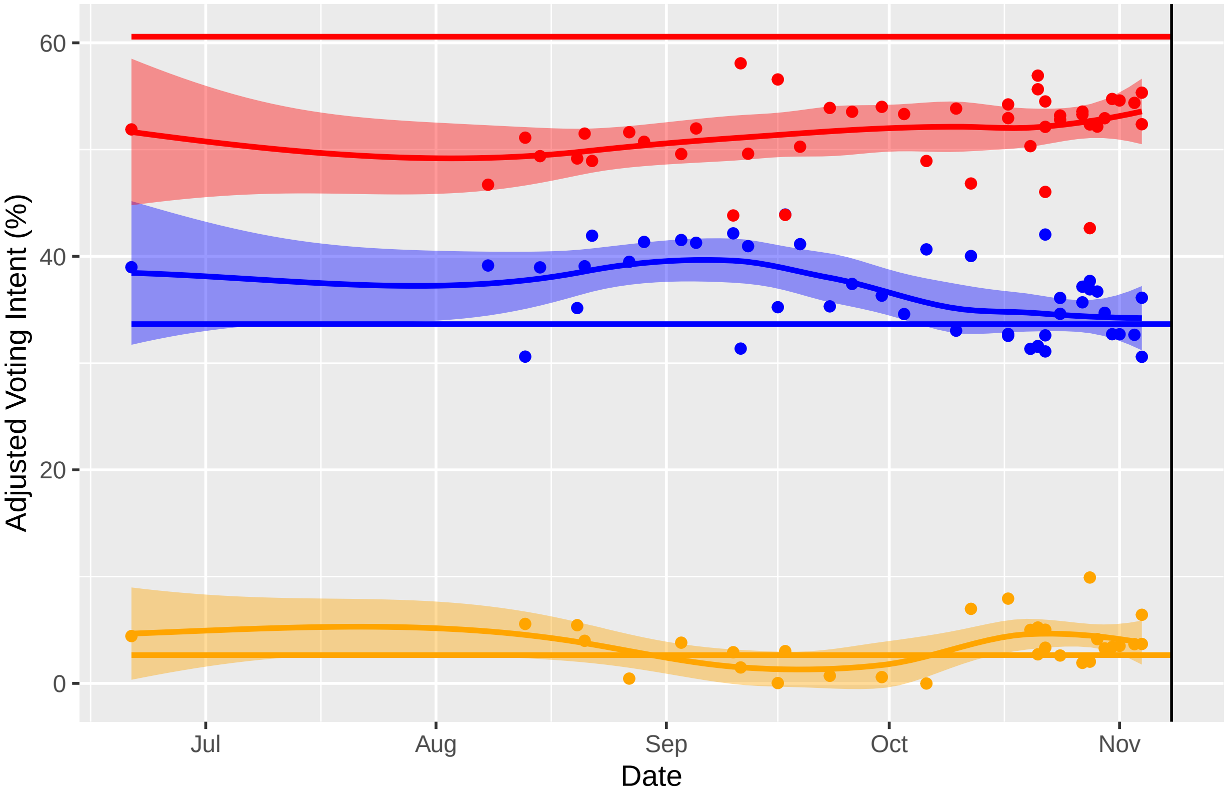

Arizona − Raw Polls
Voting Intent (%)
50
40
30
20
10
0
Jun
Jul
Aug
Sep
Oct
Nov
Date

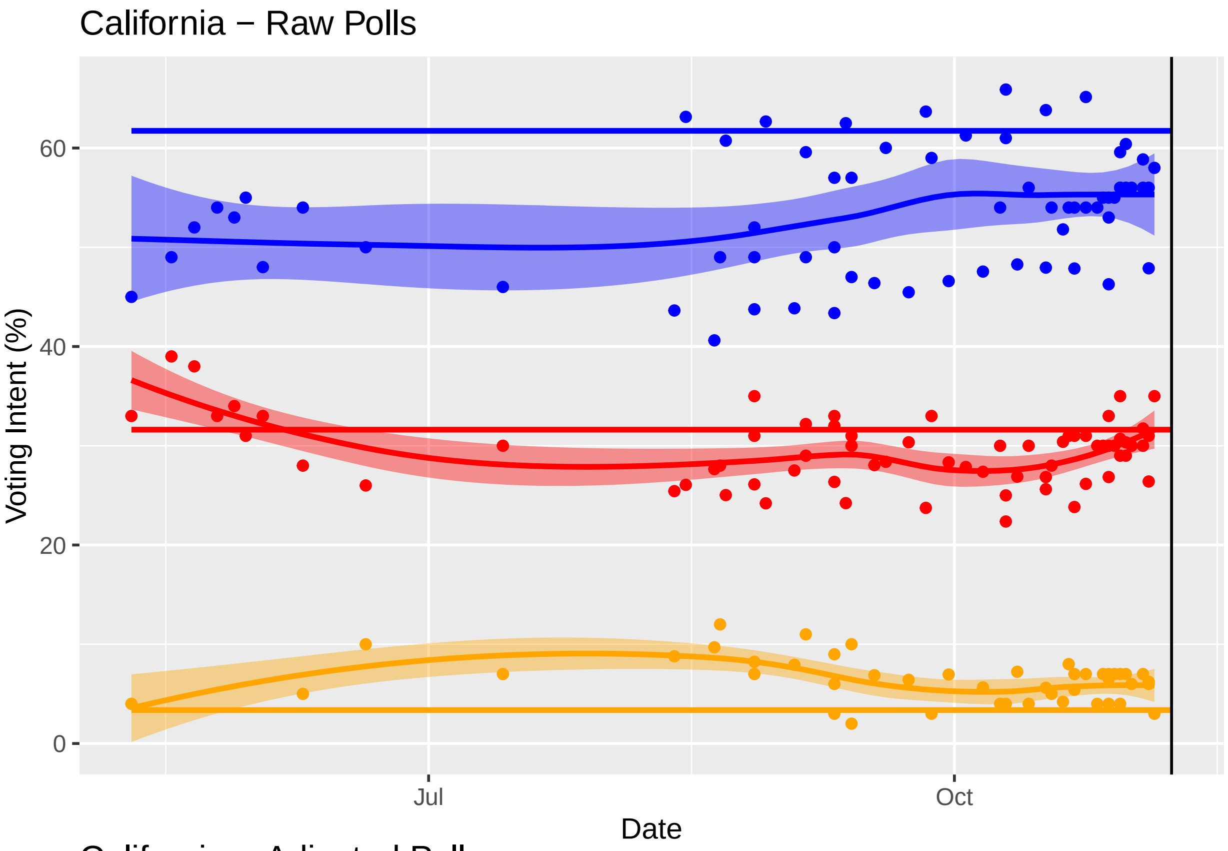

Arizona − Adjusted Polls
Adjusted Voting Intent (%)
50
40
30
20
10
0
Jun
Jul
Aug
Sep
Oct
Nov
Date

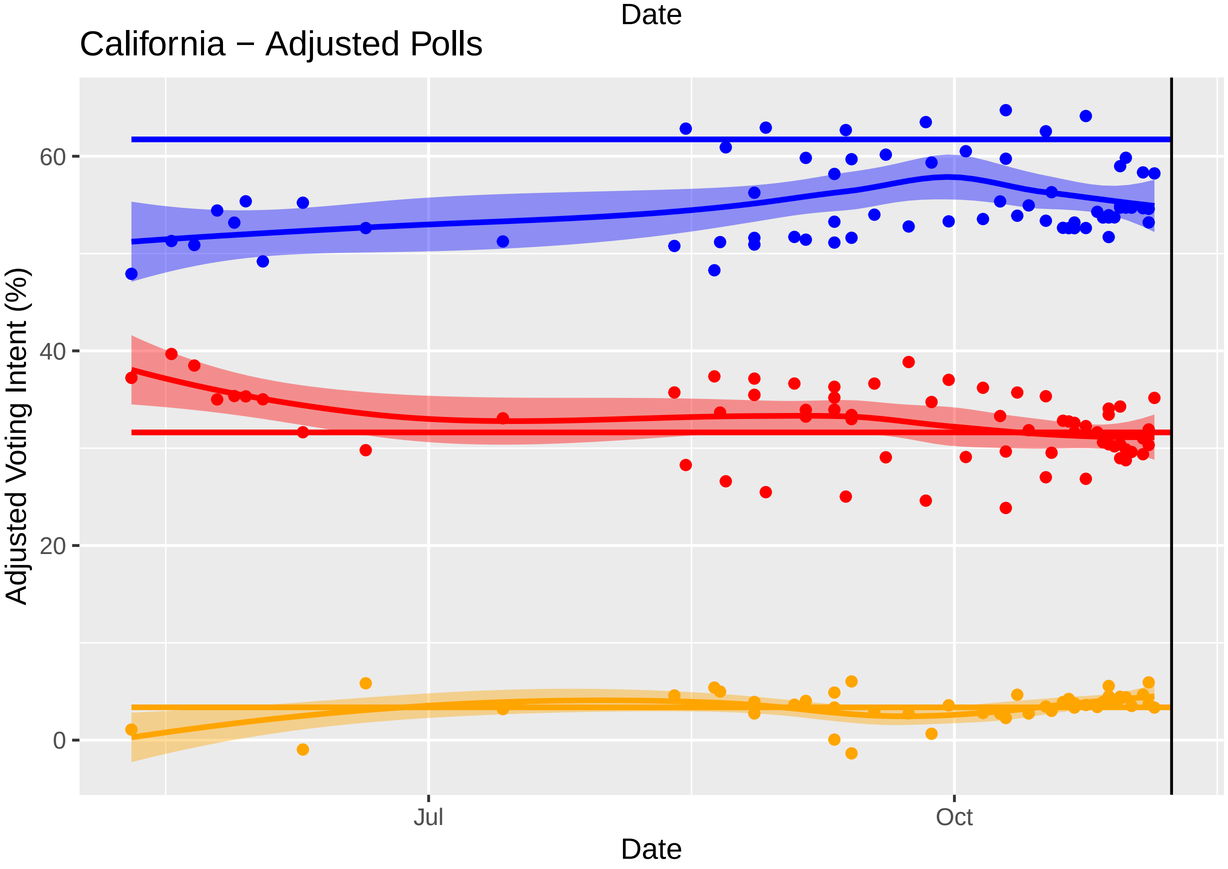
Arkansas − Raw Polls



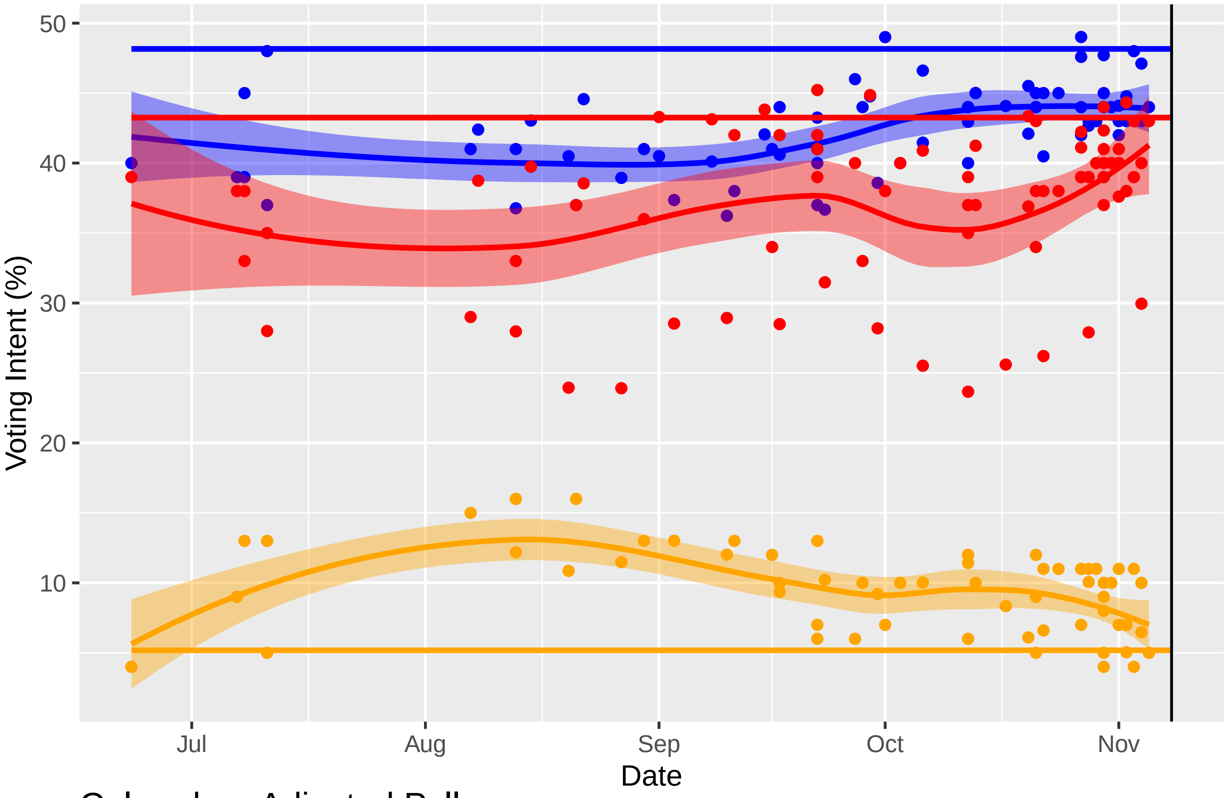
Arkansas − Adjusted Polls



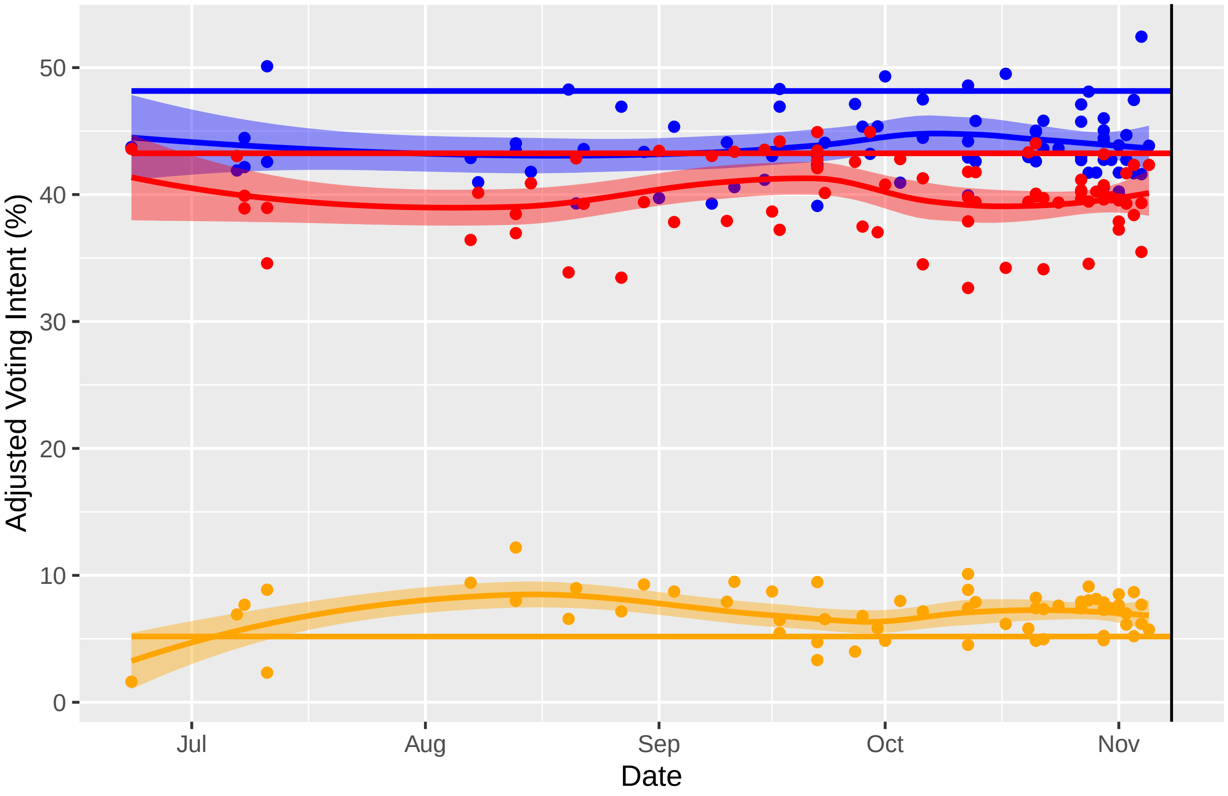

California − Raw Polls
Voting Intent (%)
60
40
20
0
Jul
Oct
Date

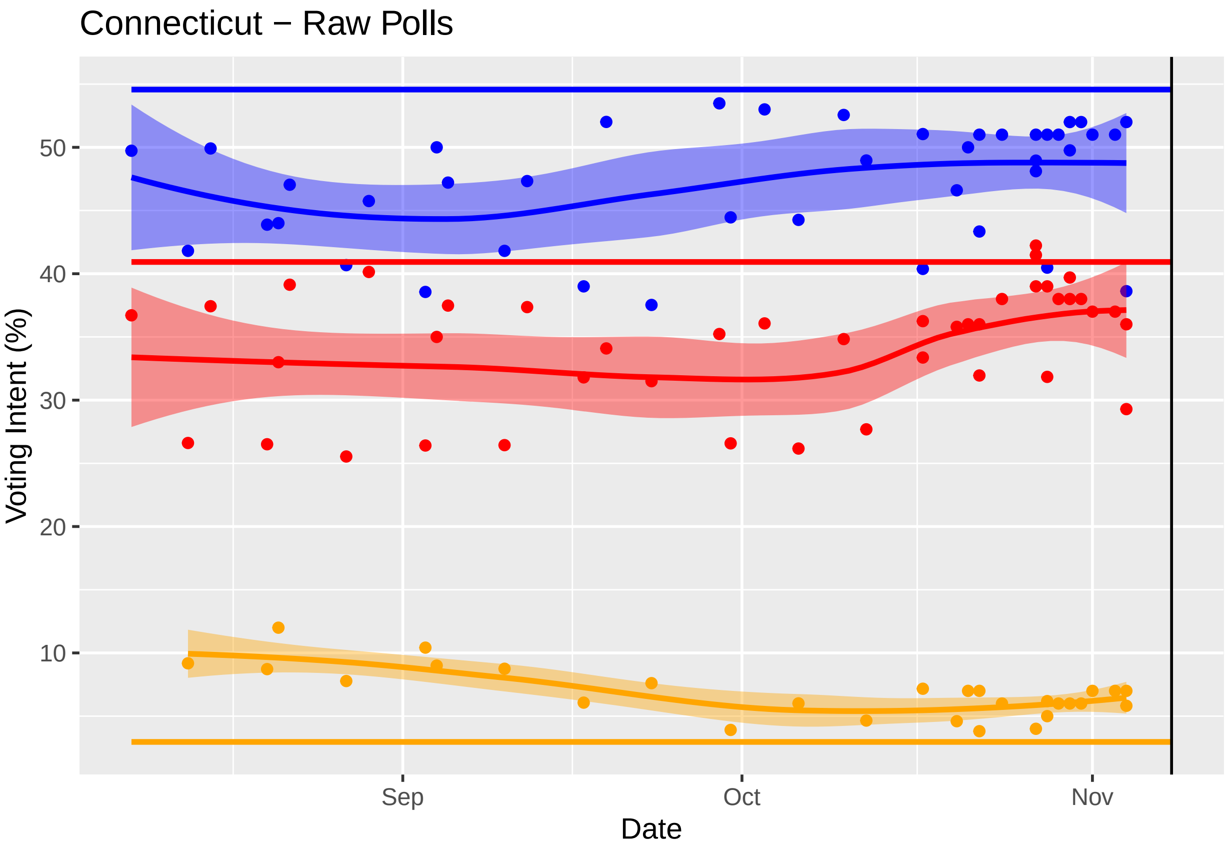

California − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Jul
Oct
Date

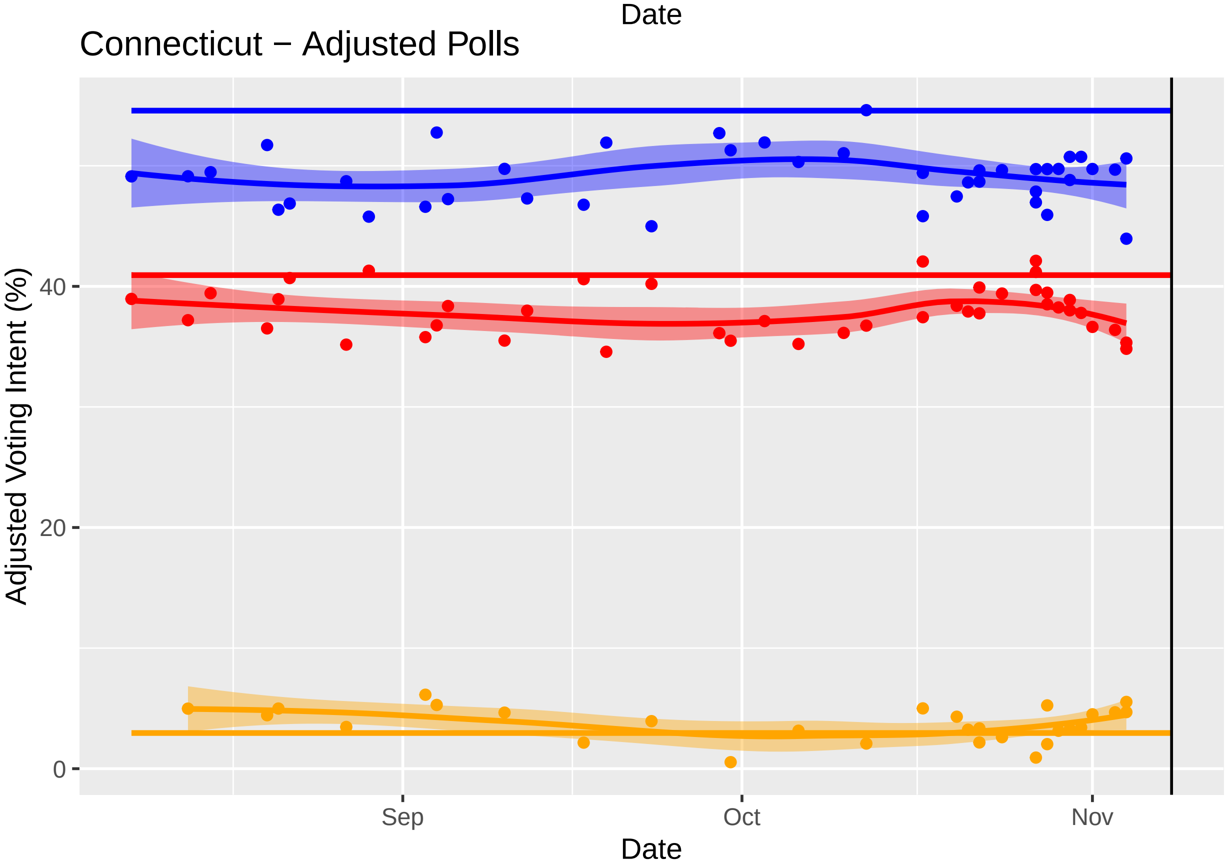
Colorado − Raw Polls

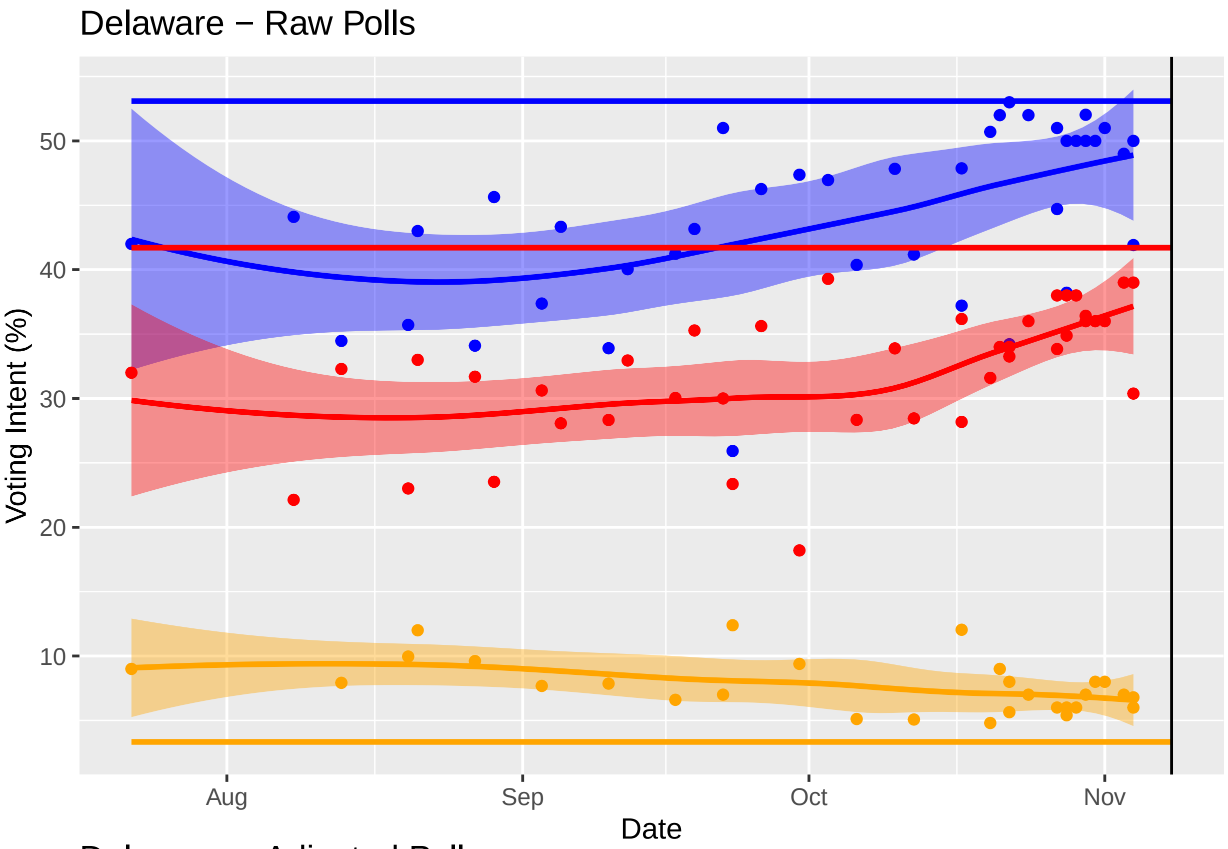


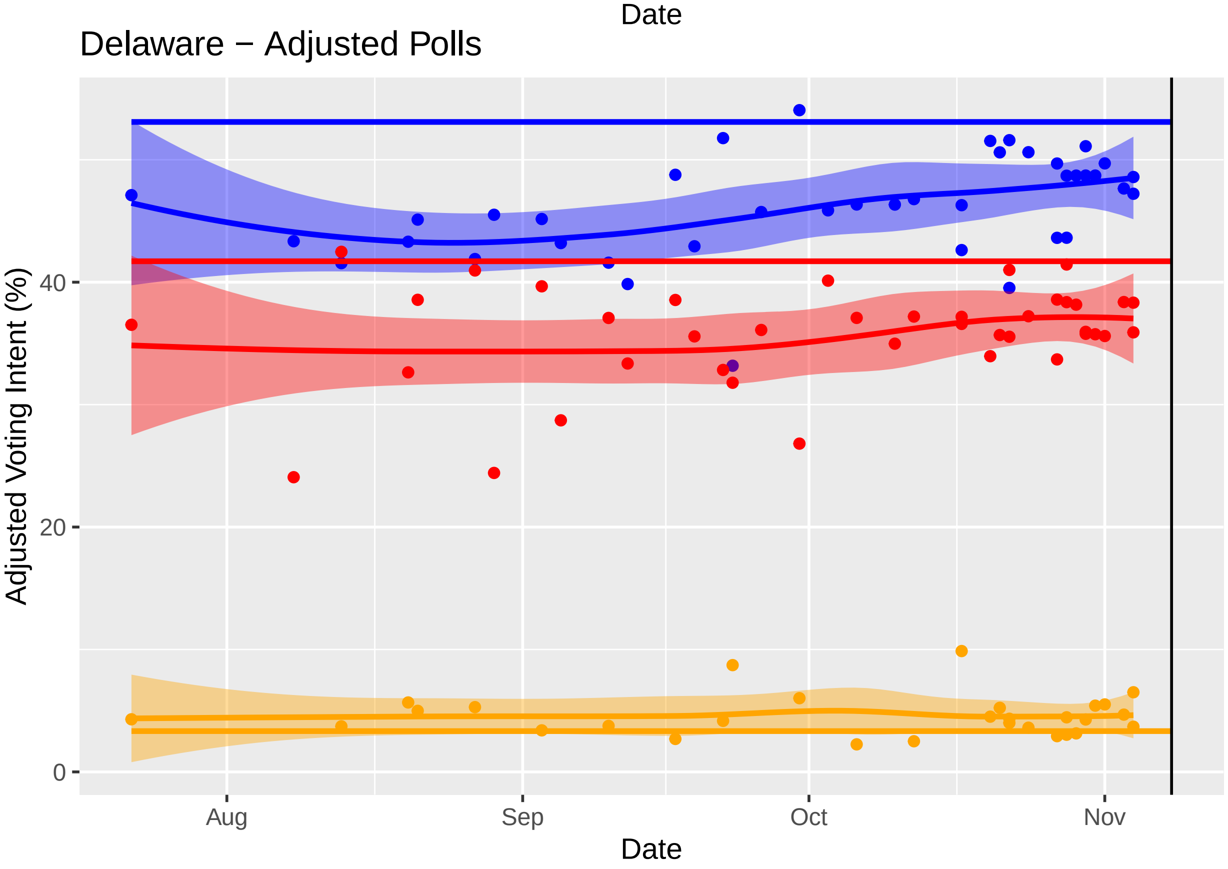
Colorado − Adjusted Polls



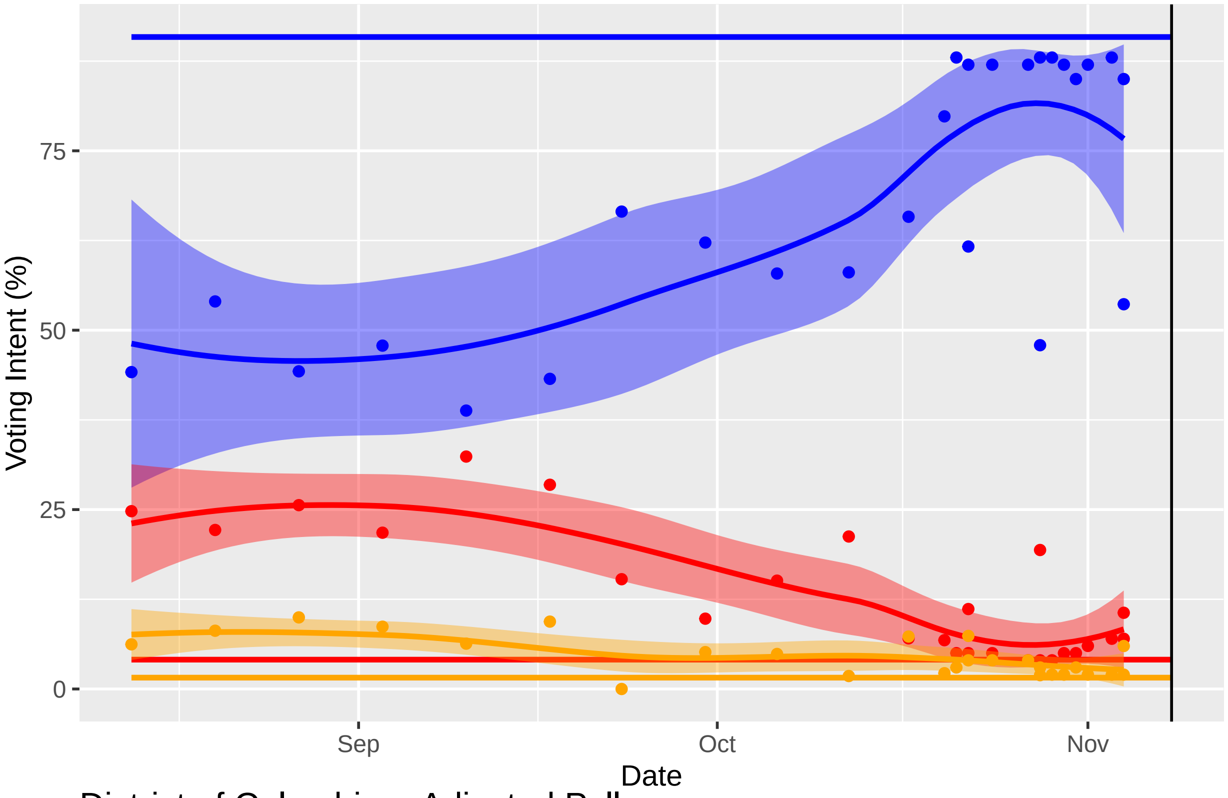

Connecticut − Raw Polls
Voting Intent (%)
50
40
30
20
10
Sep
Oct
Nov
Date


Connecticut − Adjusted Polls
Adjusted Voting Intent (%)
40
20
0
Sep
Oct
Nov
Date

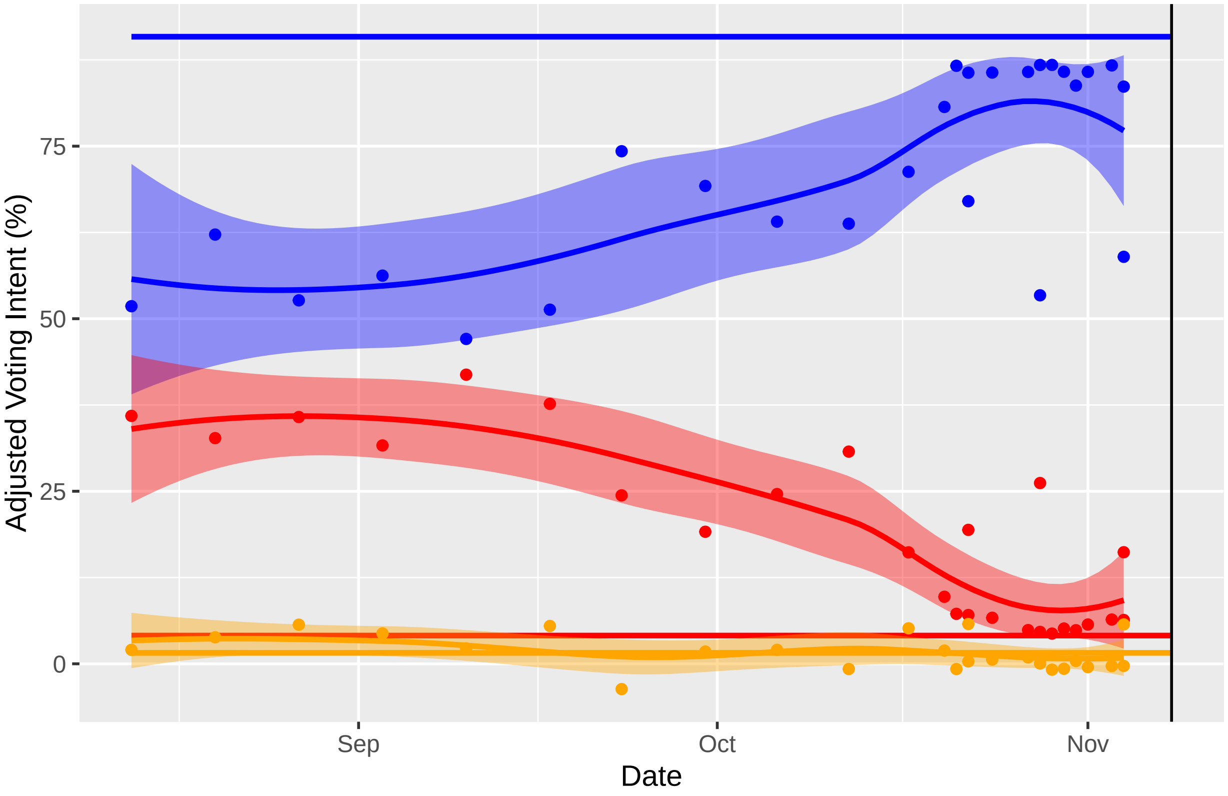

Delaware − Raw Polls
Voting Intent (%)
50
40
30
20
10
Aug
Sep
Oct
Nov
Date

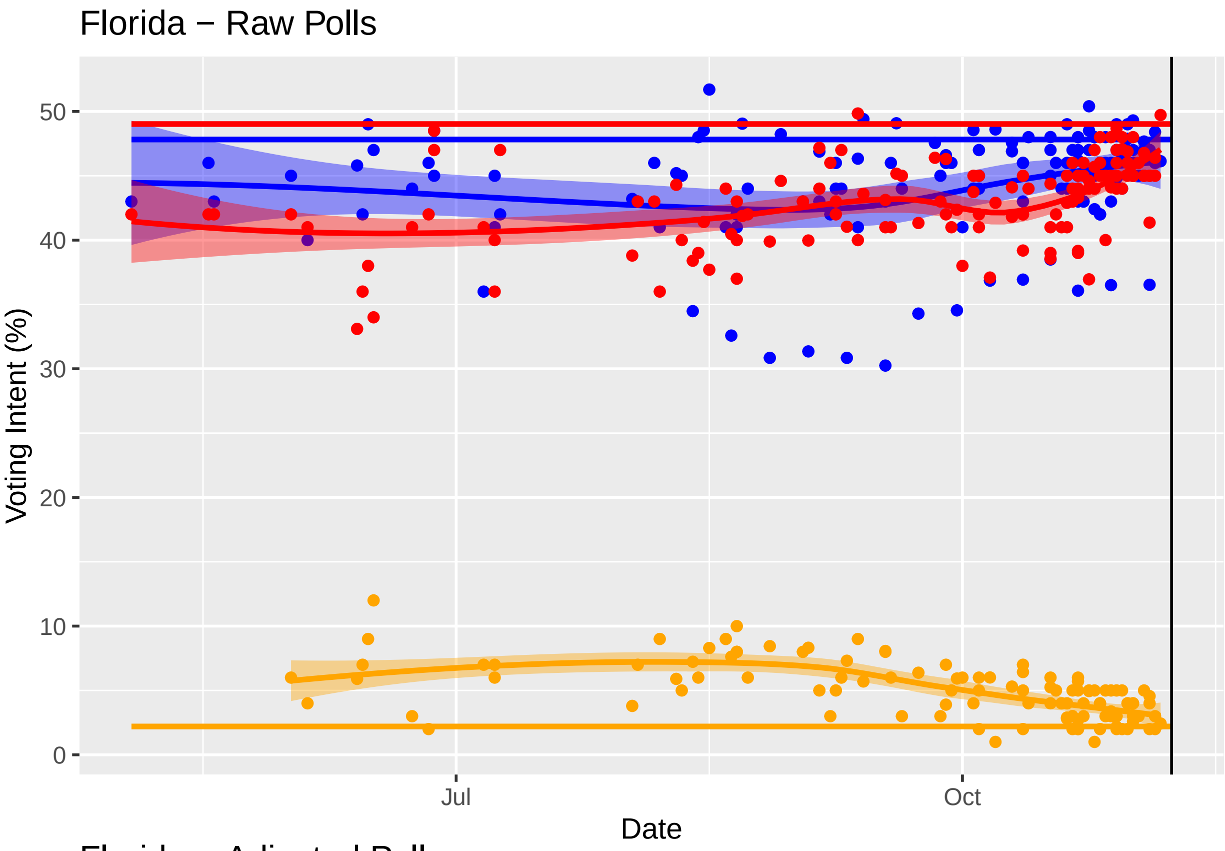

Delaware − Adjusted Polls
Adjusted Voting Intent (%)
40
20
0
Aug
Sep
Oct
Nov
Date

District of Columbia − Raw Polls



District of Columbia − Adjusted Polls




Florida − Raw Polls
Voting Intent (%)
50
40
30
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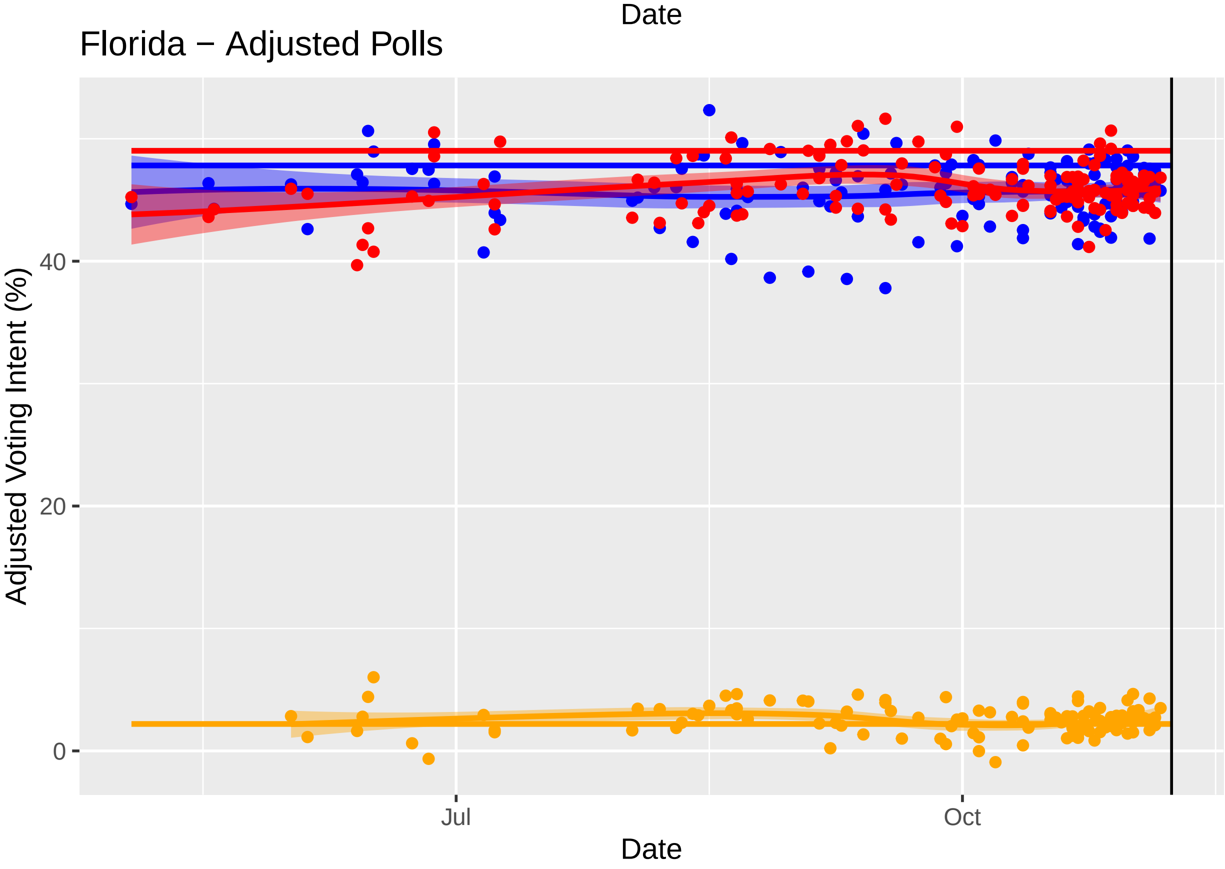
0
Jul
Oct
Date


Florida − Adjusted Polls
Adjusted Voting Intent (%)
40
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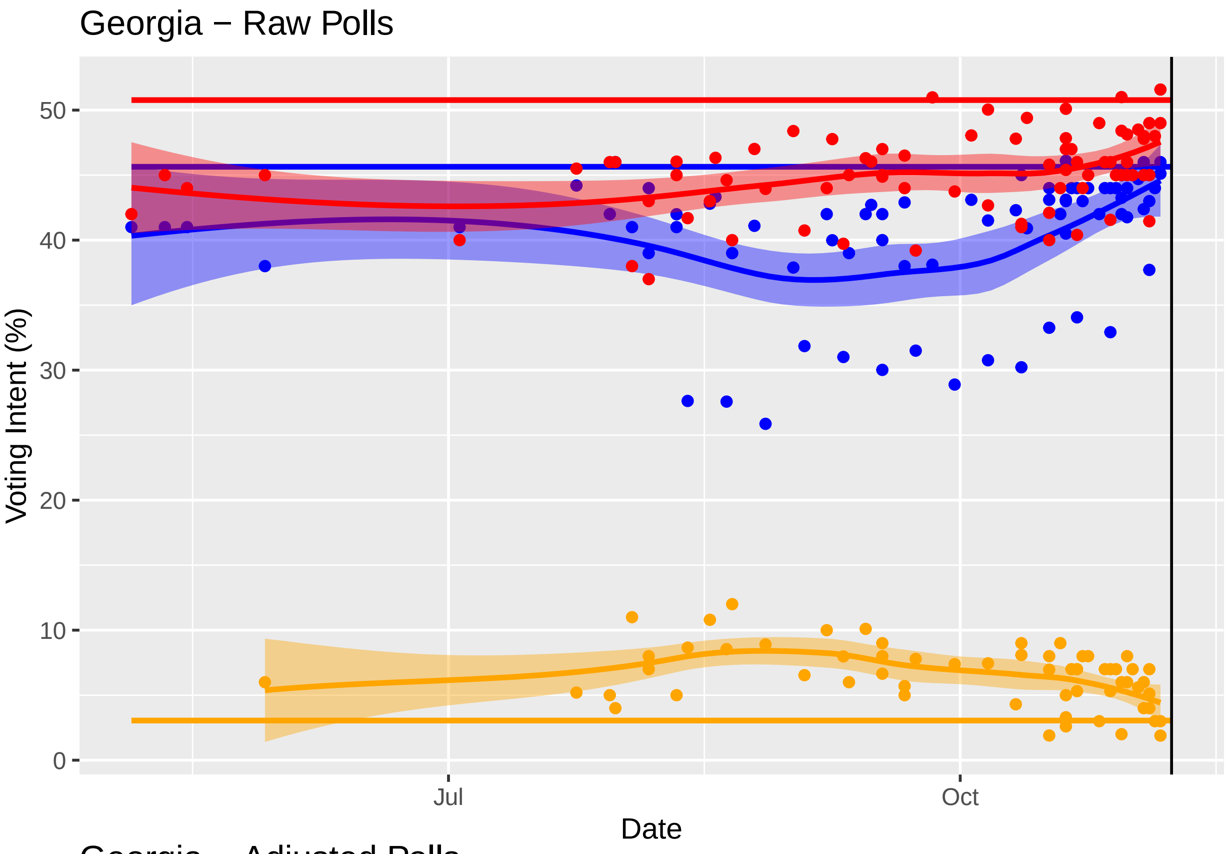
0
Jul
Oct
Date


Georgia − Raw Polls
Voting Intent (%)
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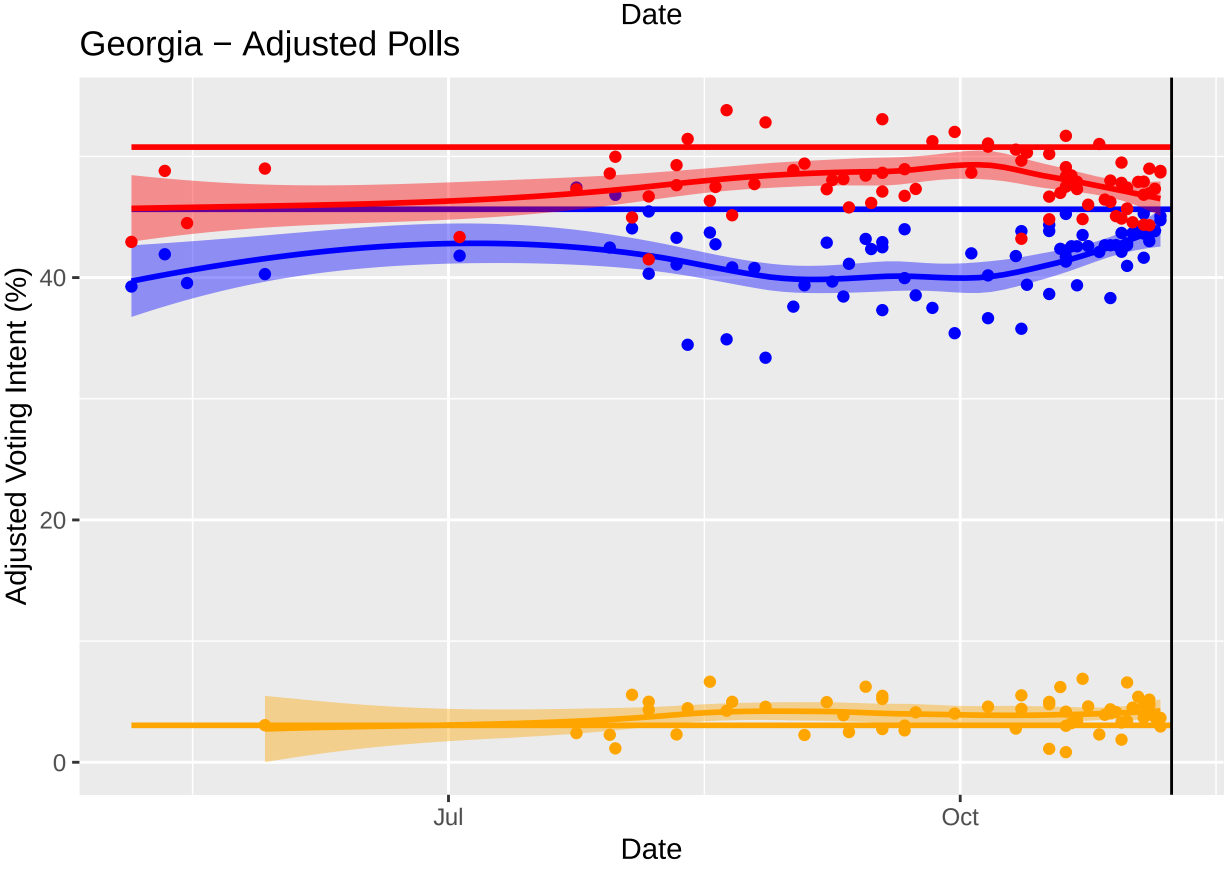
Date


Georgia − Adjusted Polls
Adjusted Voting Intent (%)
40
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0
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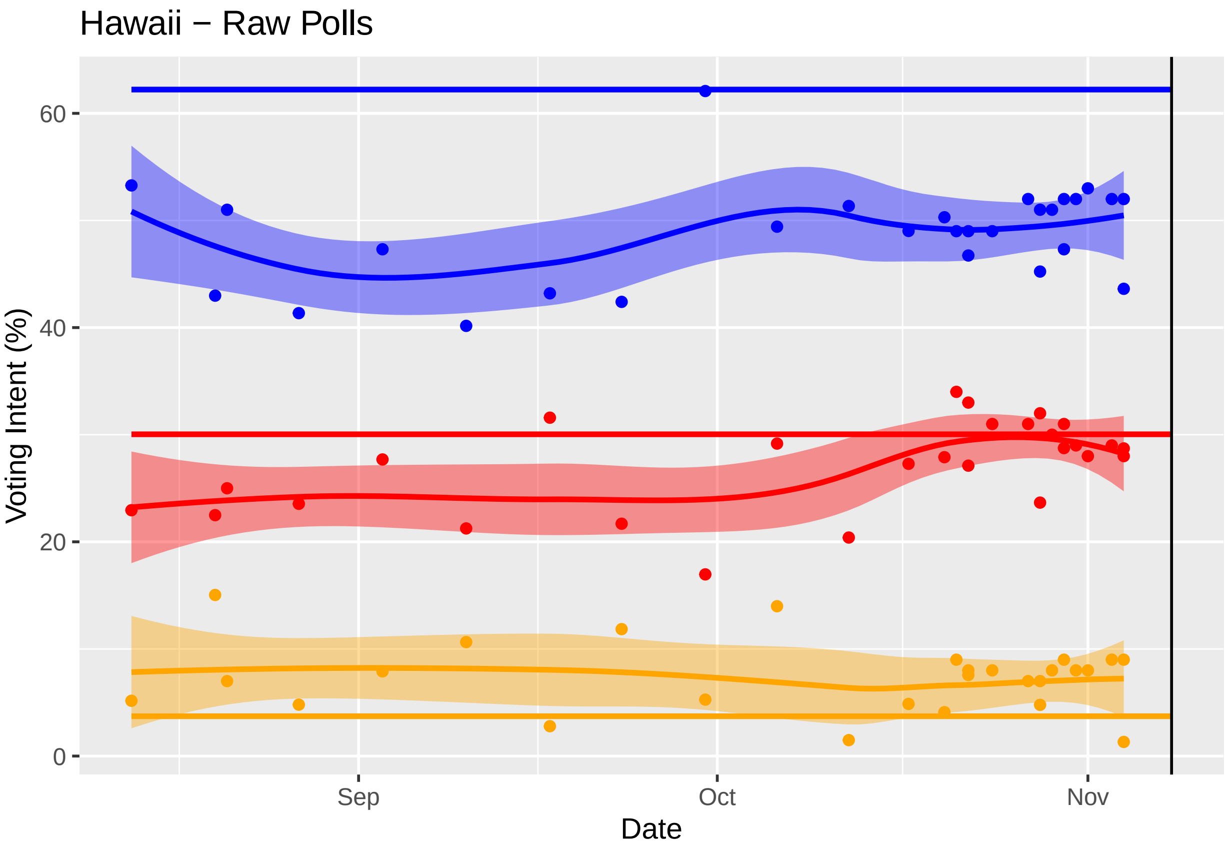
Oct
Date


Hawaii − Raw Polls
Voting Intent (%)
60
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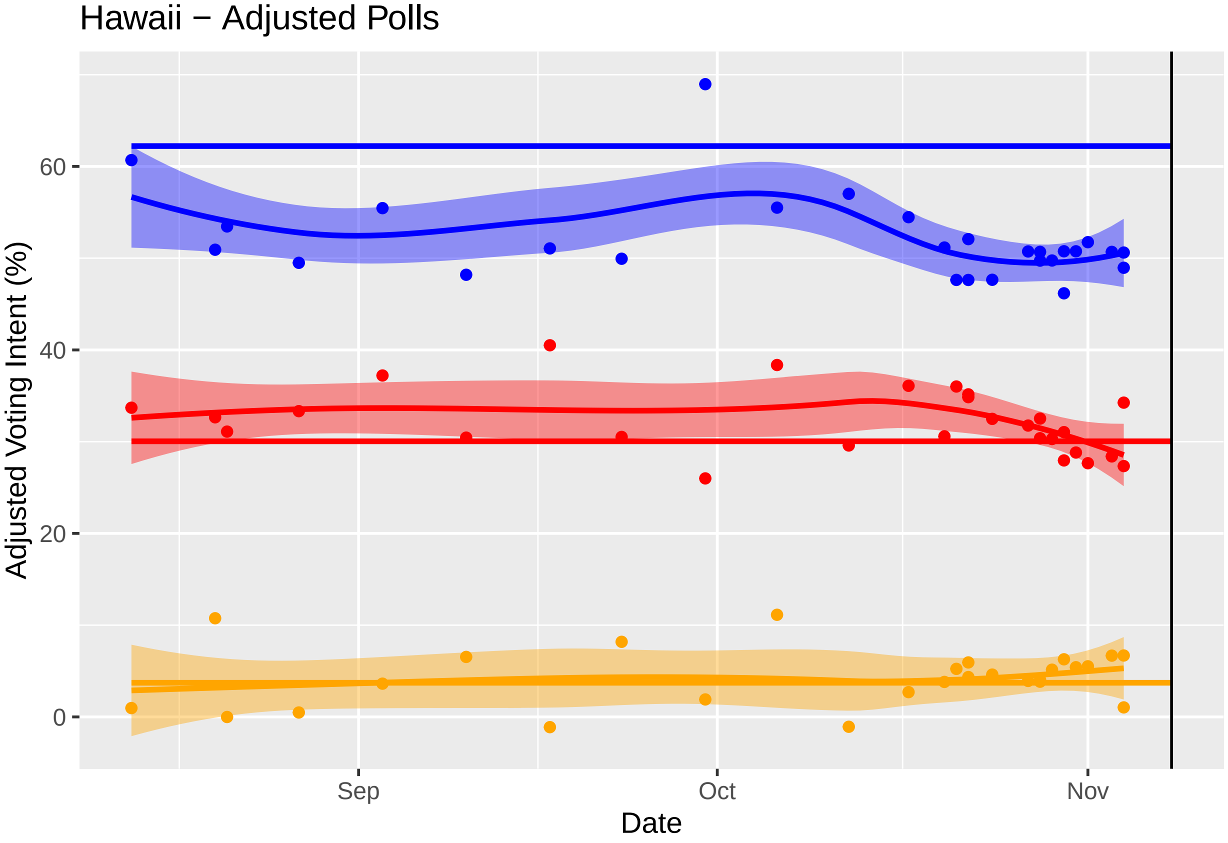
Date


Hawaii − Adjusted Polls
Adjusted Voting Intent (%)
60
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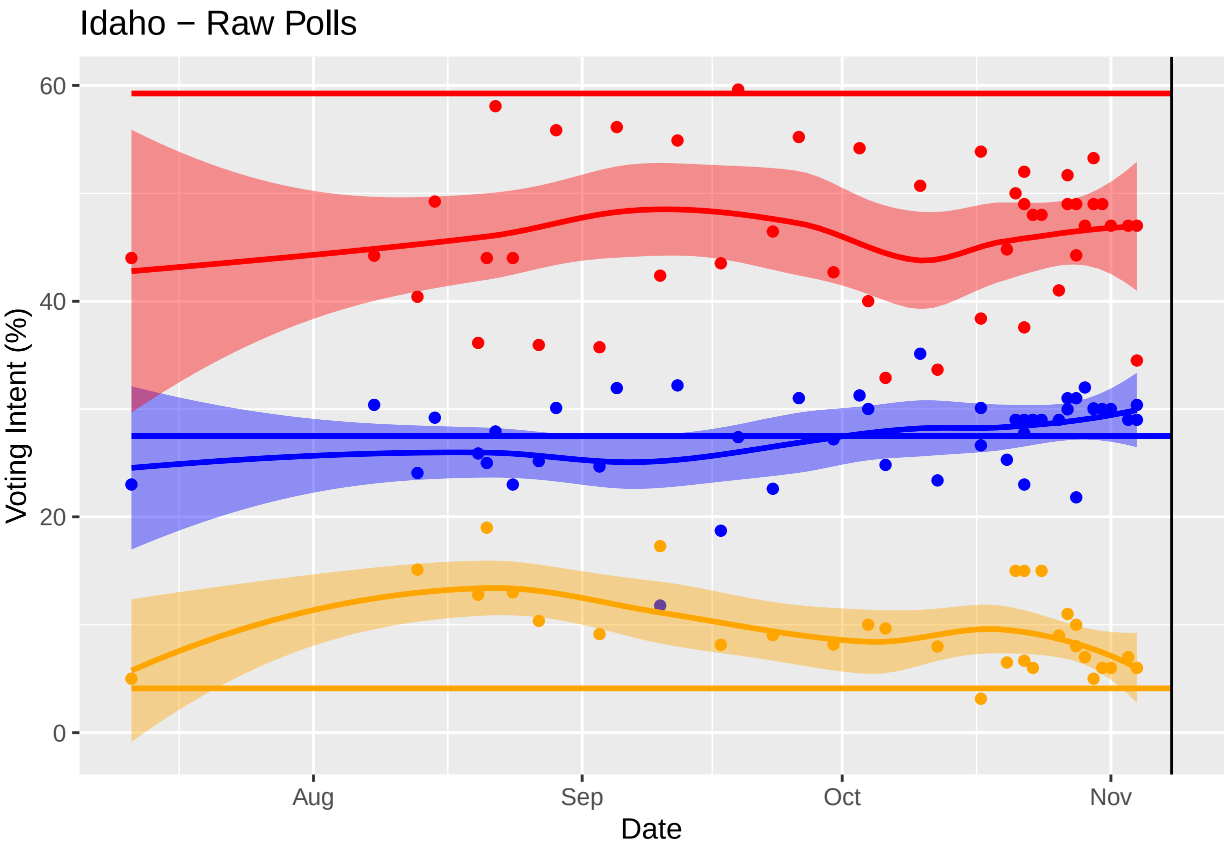
Date


Idaho − Raw Polls
Voting Intent (%)
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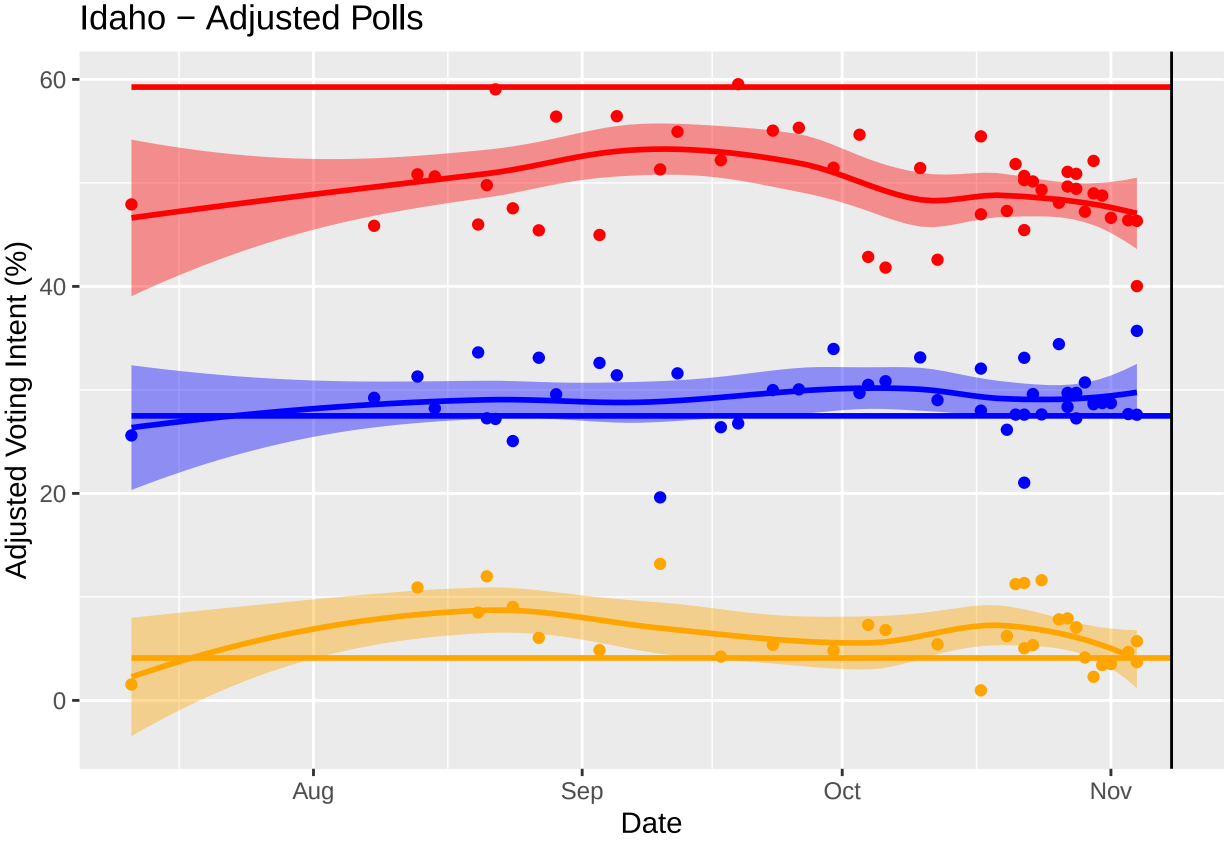
Date


Idaho − Adjusted Polls
Adjusted Voting Intent (%)
60
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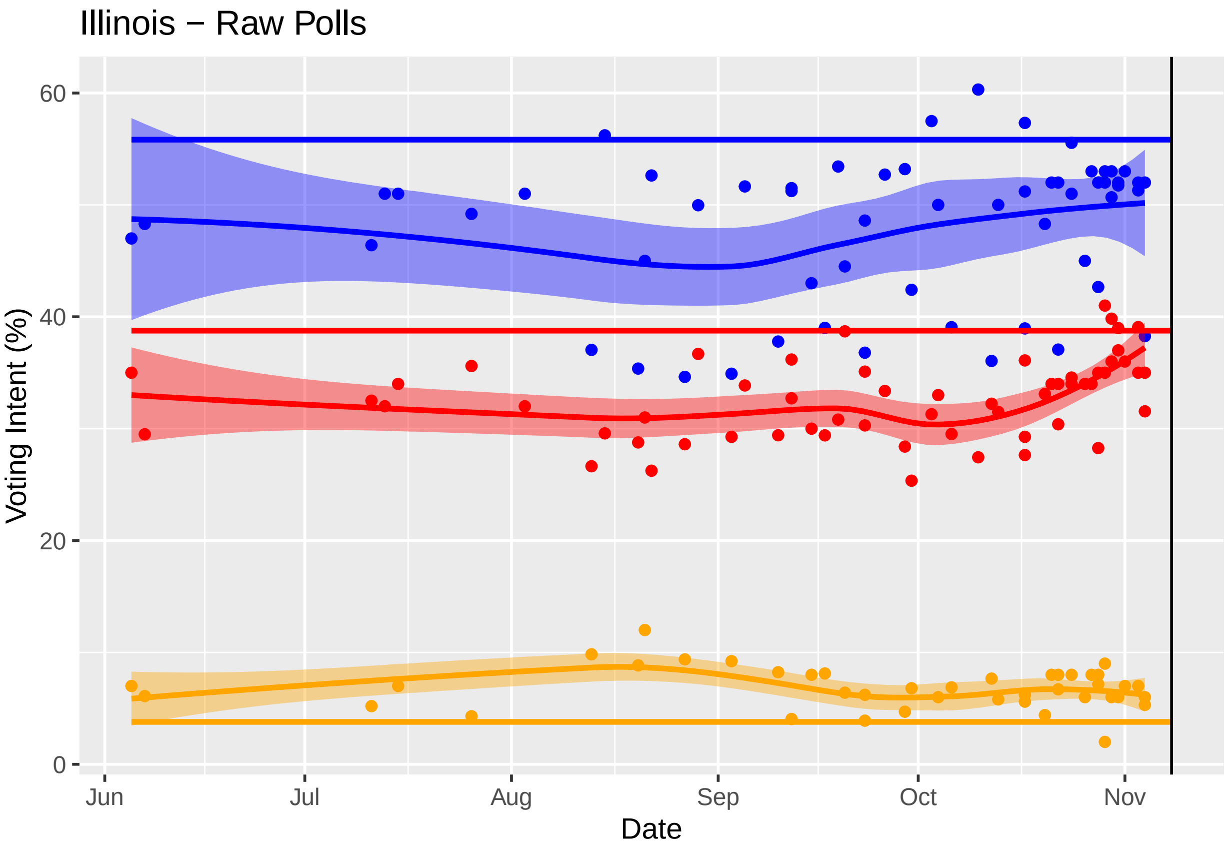
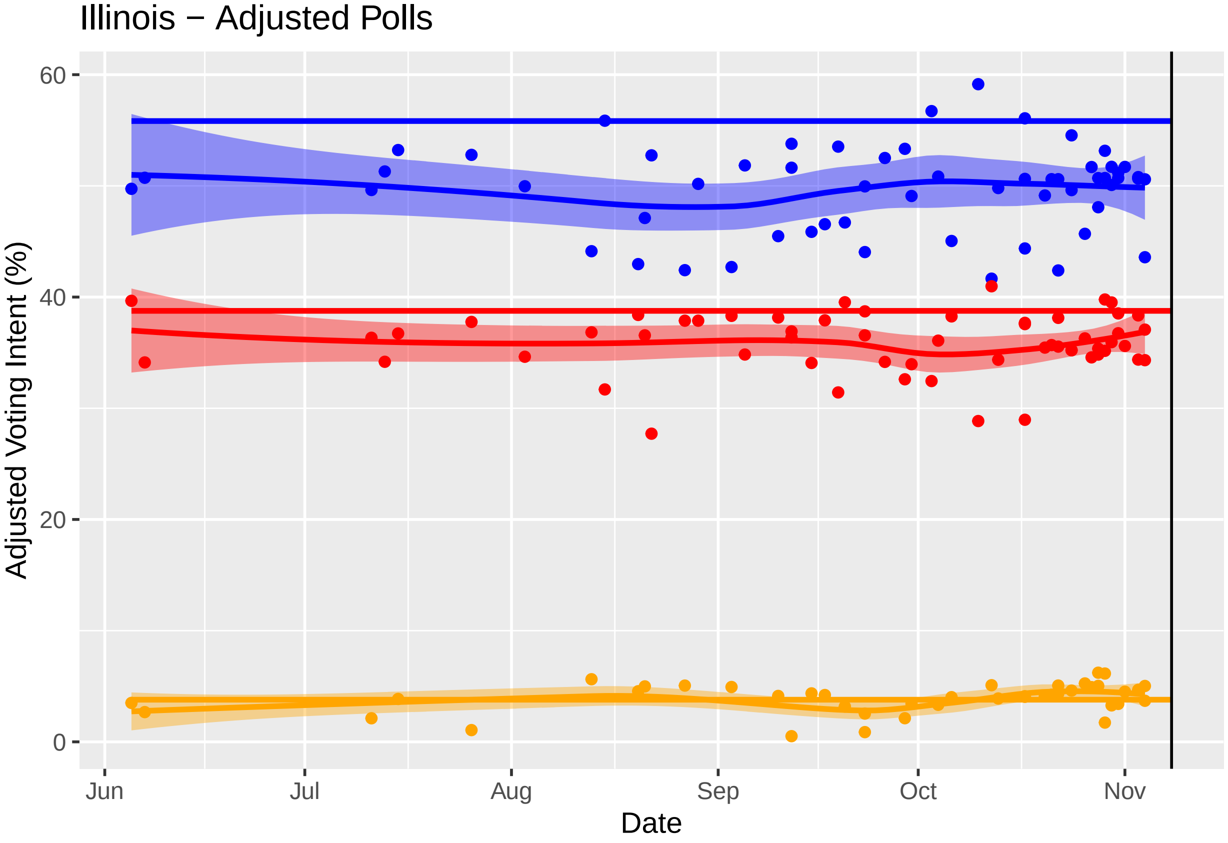
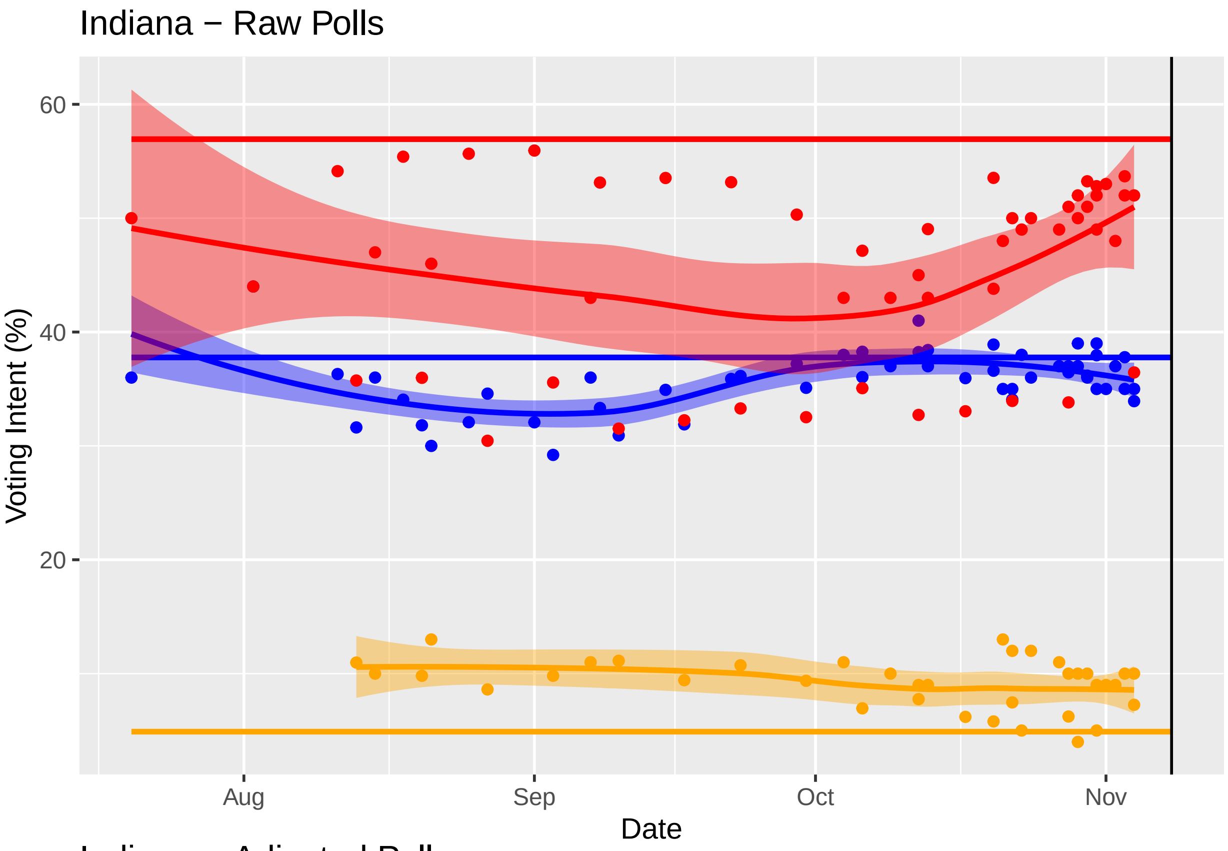
Date


Illinois − Raw Polls


Illinois − Adjusted Polls


Indiana − Raw Polls
Voting Intent (%)
60
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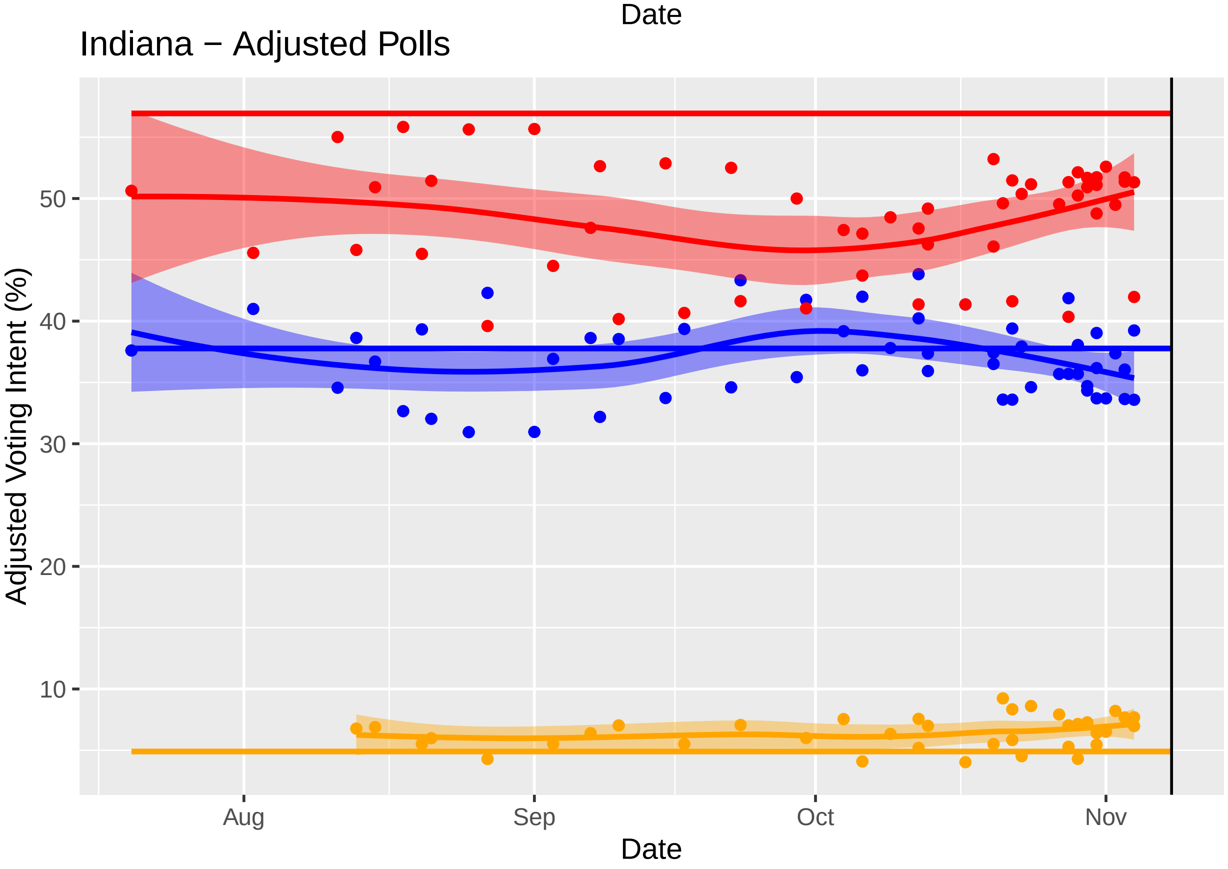
Nov
Date


Indiana − Adjusted Polls
Adjusted Voting Intent (%)
50
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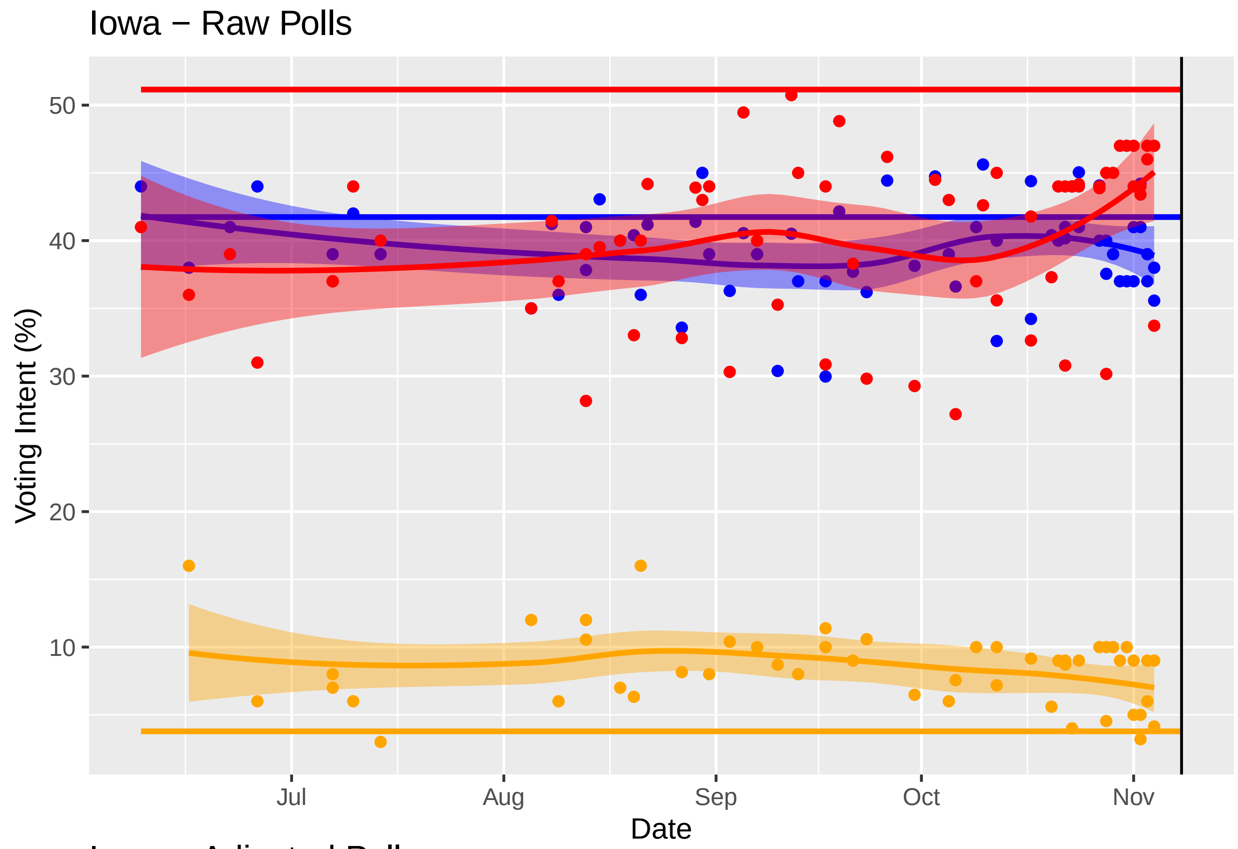
Date


Iowa − Raw Polls
Voting Intent (%)
50
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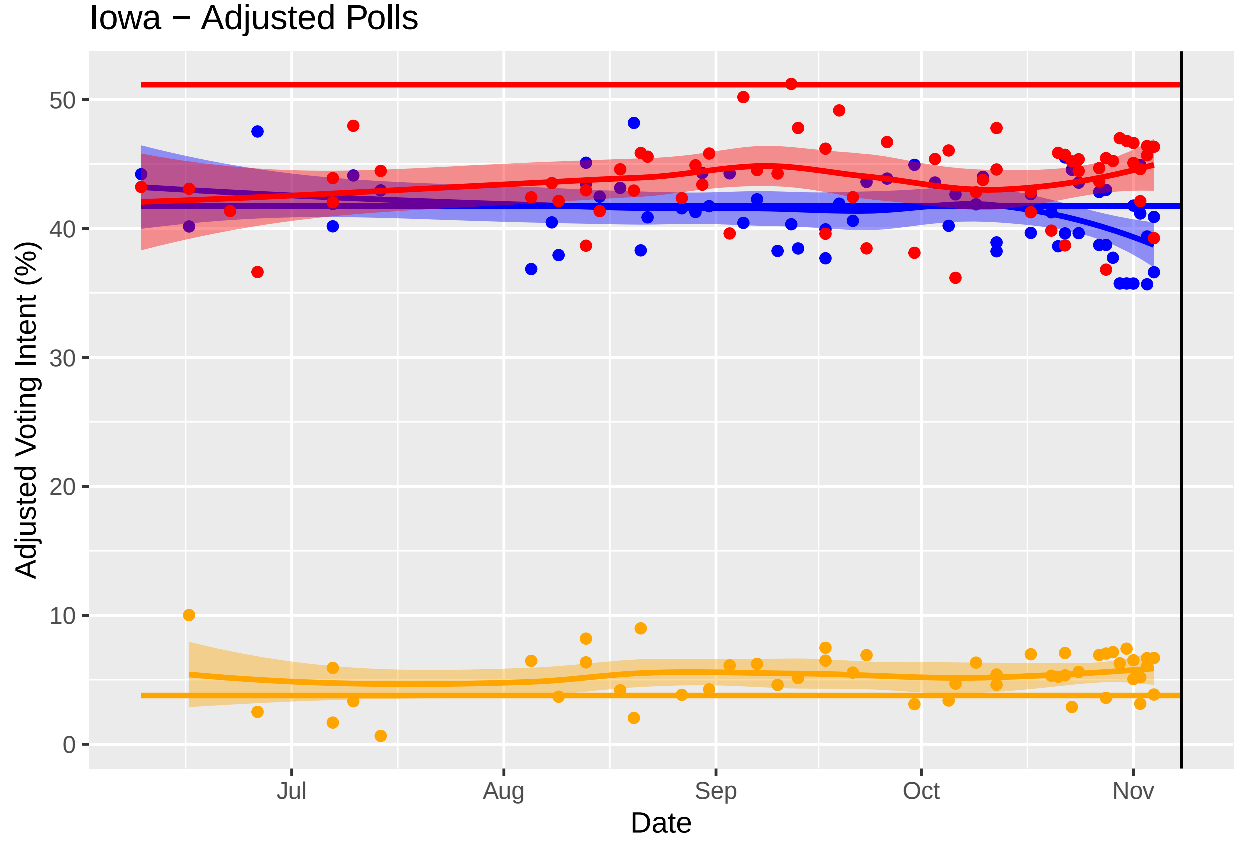
Date


Iowa − Adjusted Polls
Adjusted Voting Intent (%)
50
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Jul
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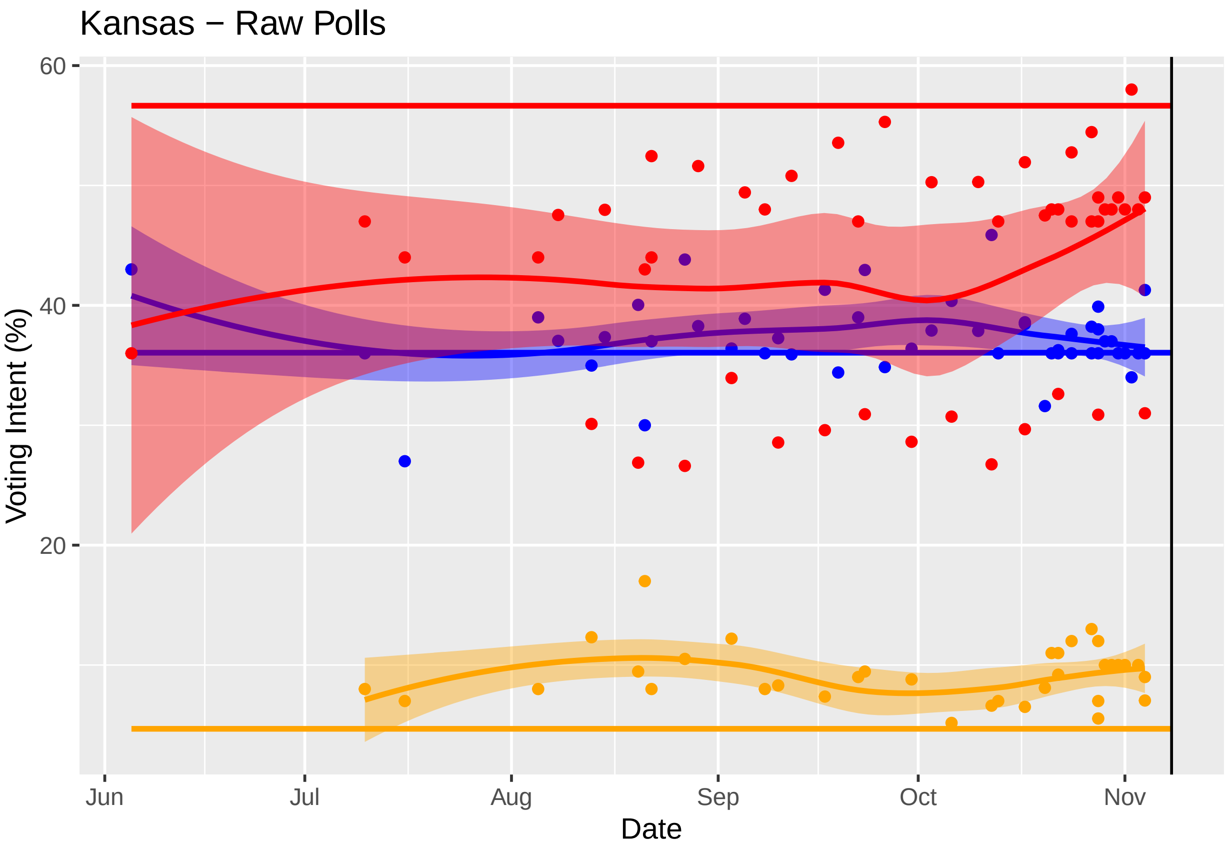
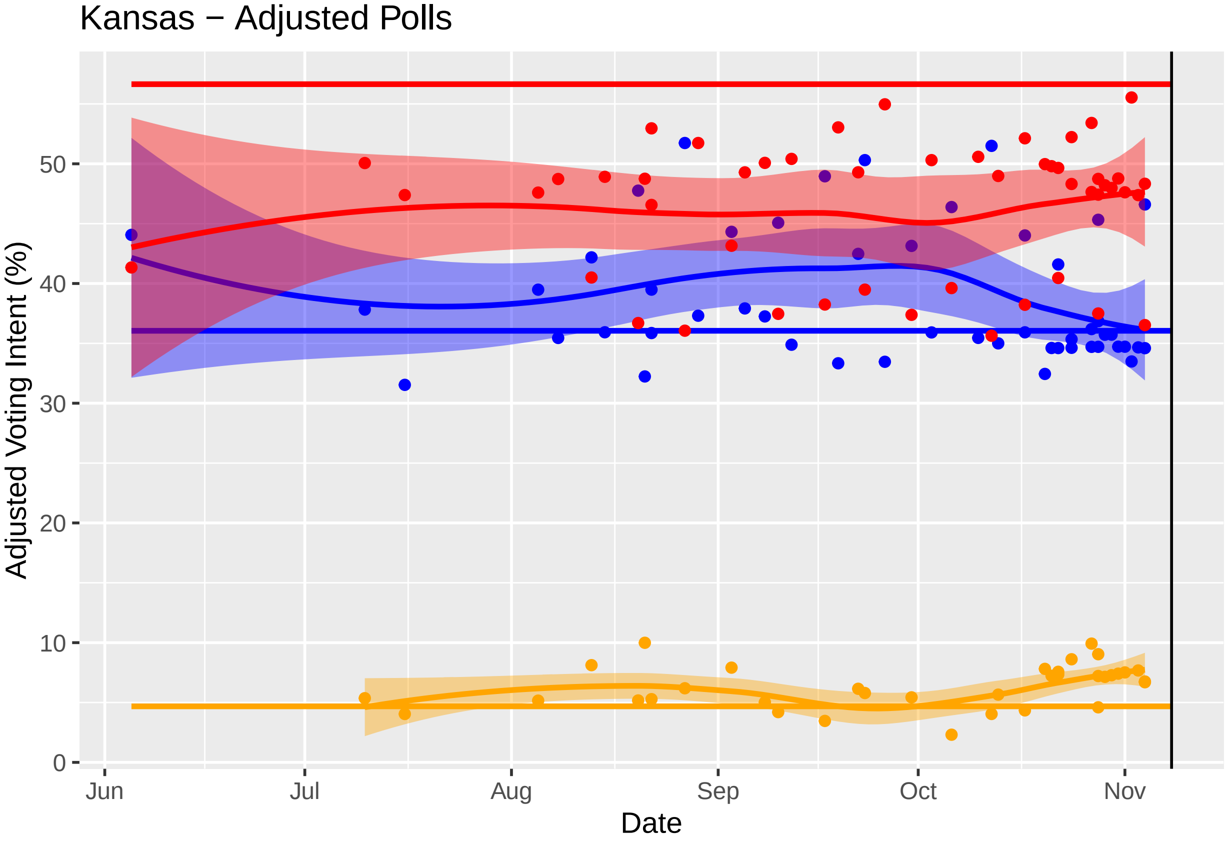
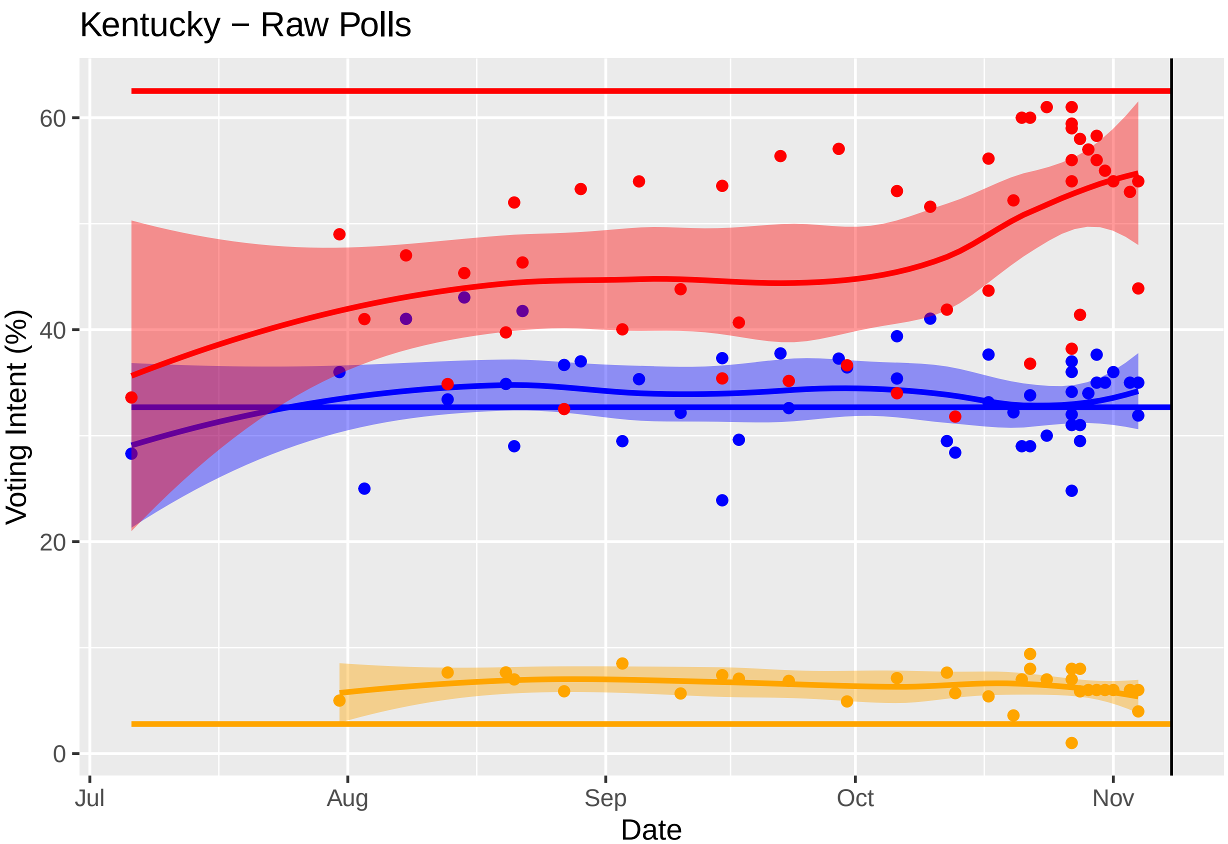
Nov
Date

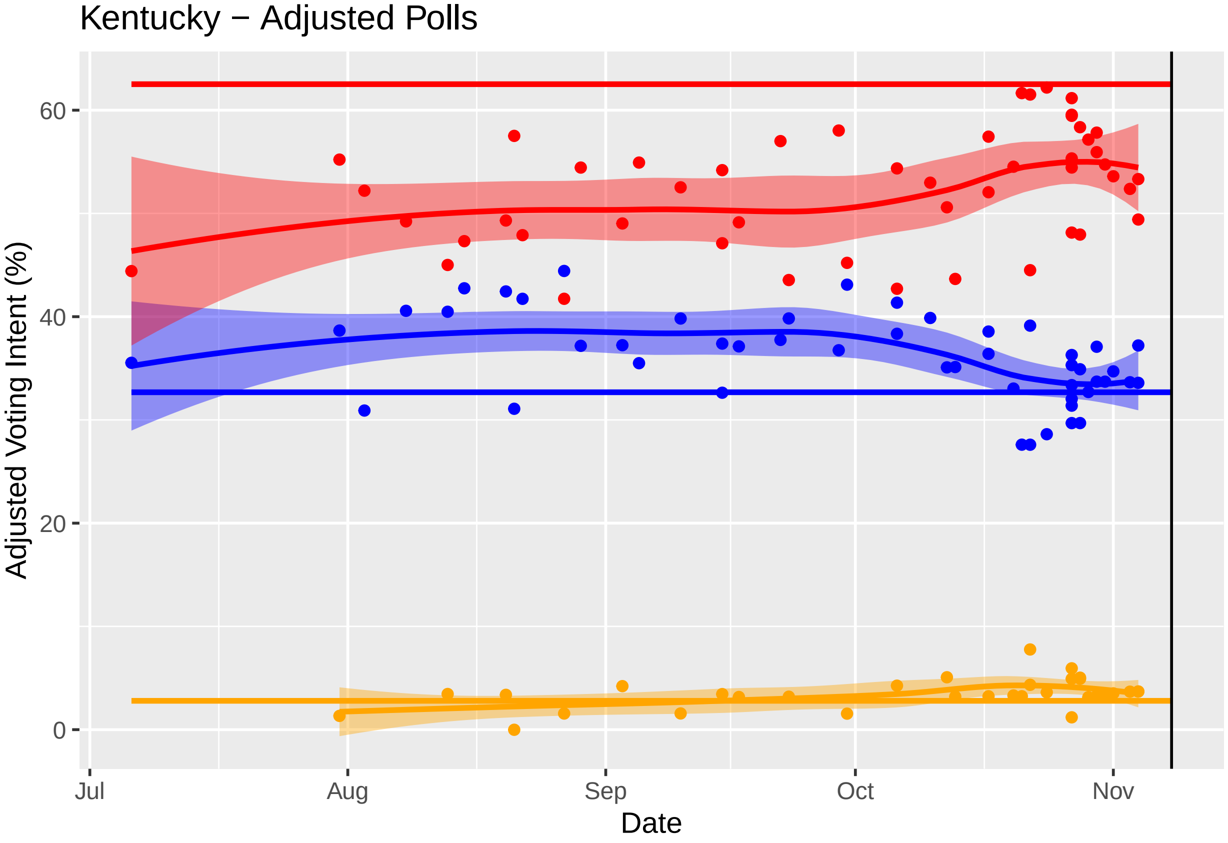


Kansas − Raw Polls

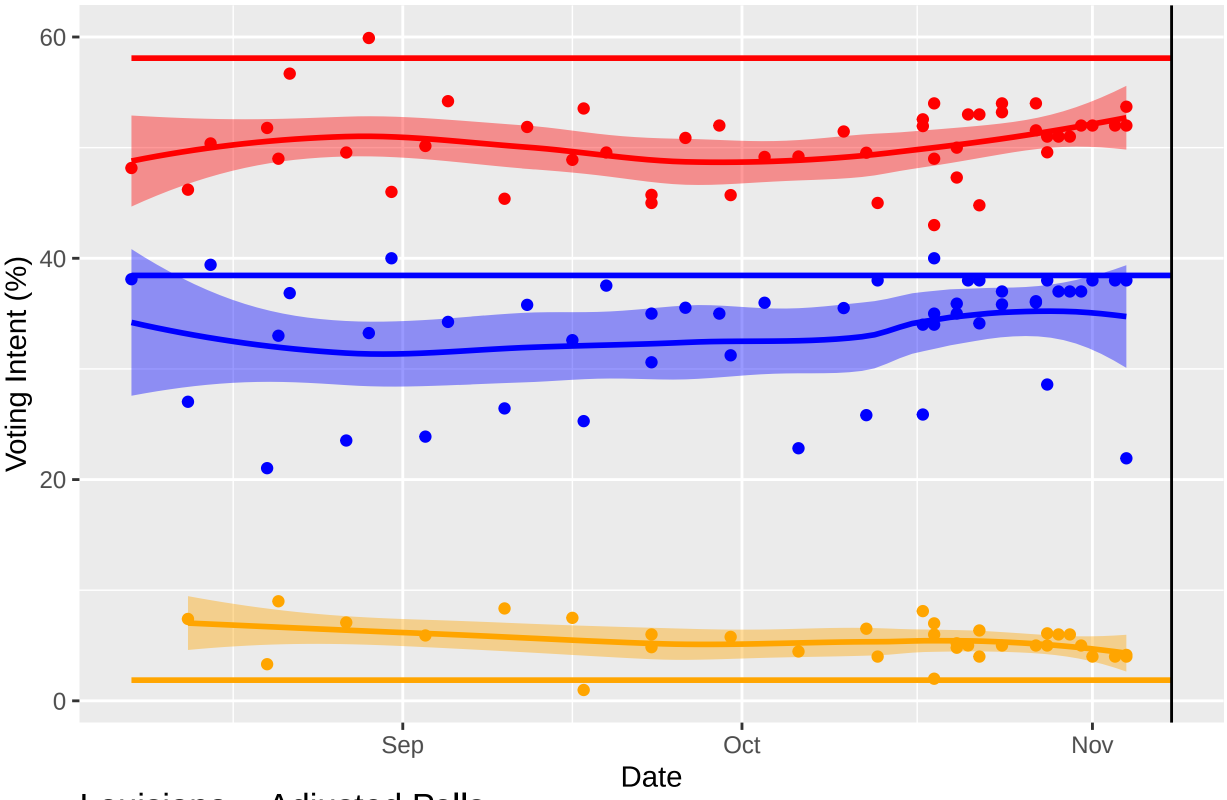


Kansas − Adjusted Polls

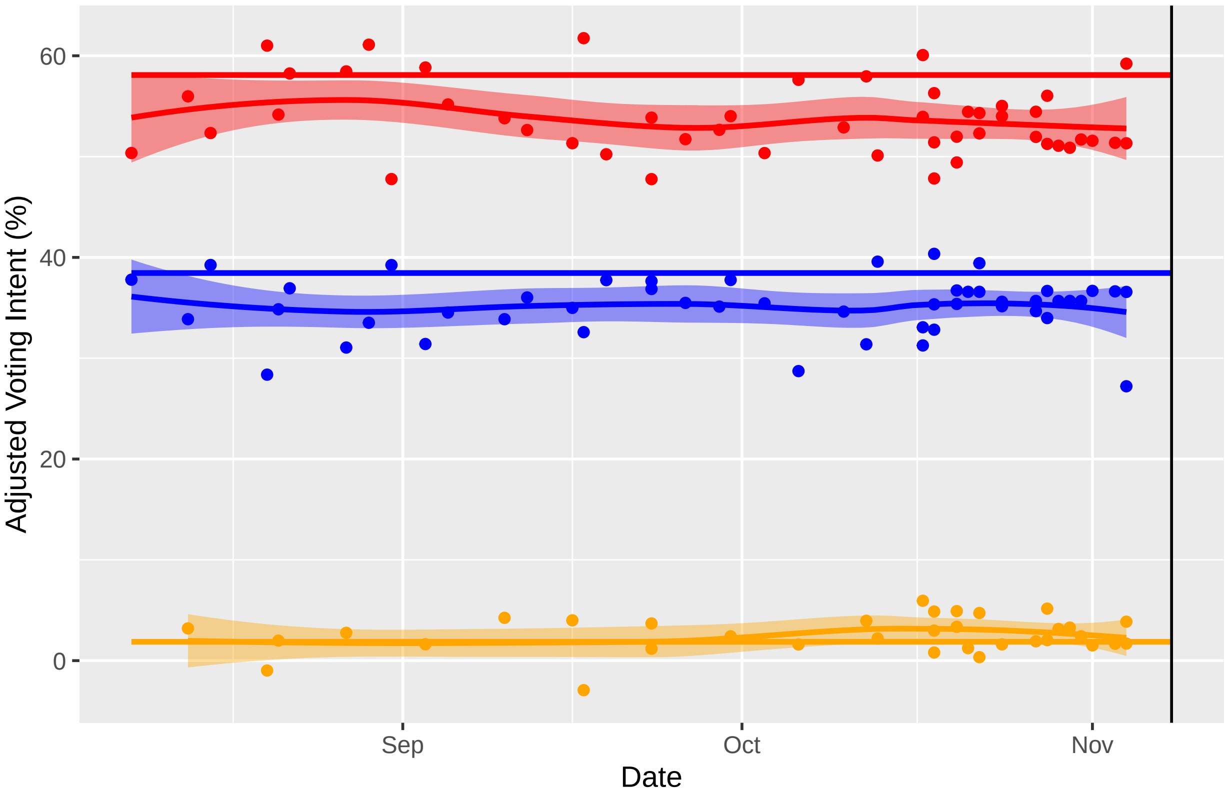

Kentucky − Raw Polls
Voting Intent (%)
60
40
20
0
Jul
Aug
Sep
Oct
Nov
Date

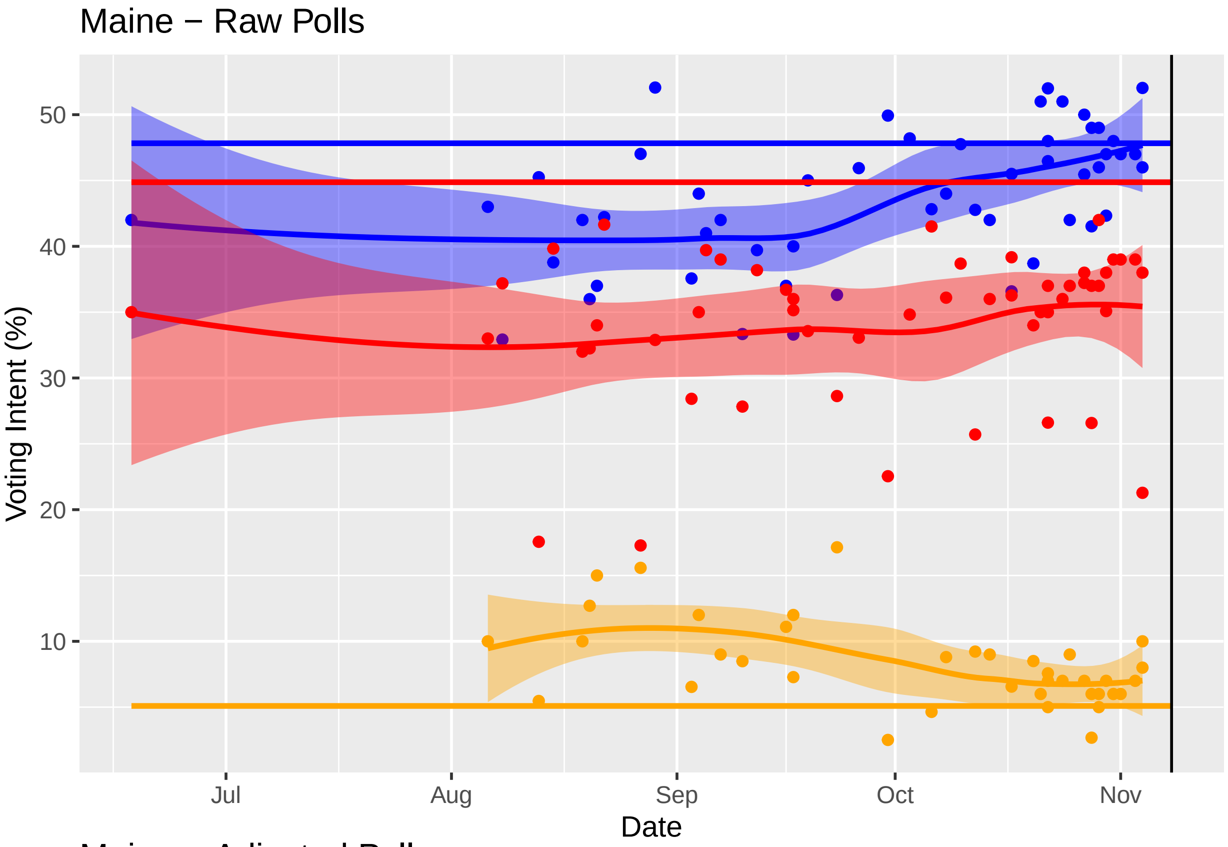

Kentucky − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Jul
Aug
Sep
Oct
Nov
Date

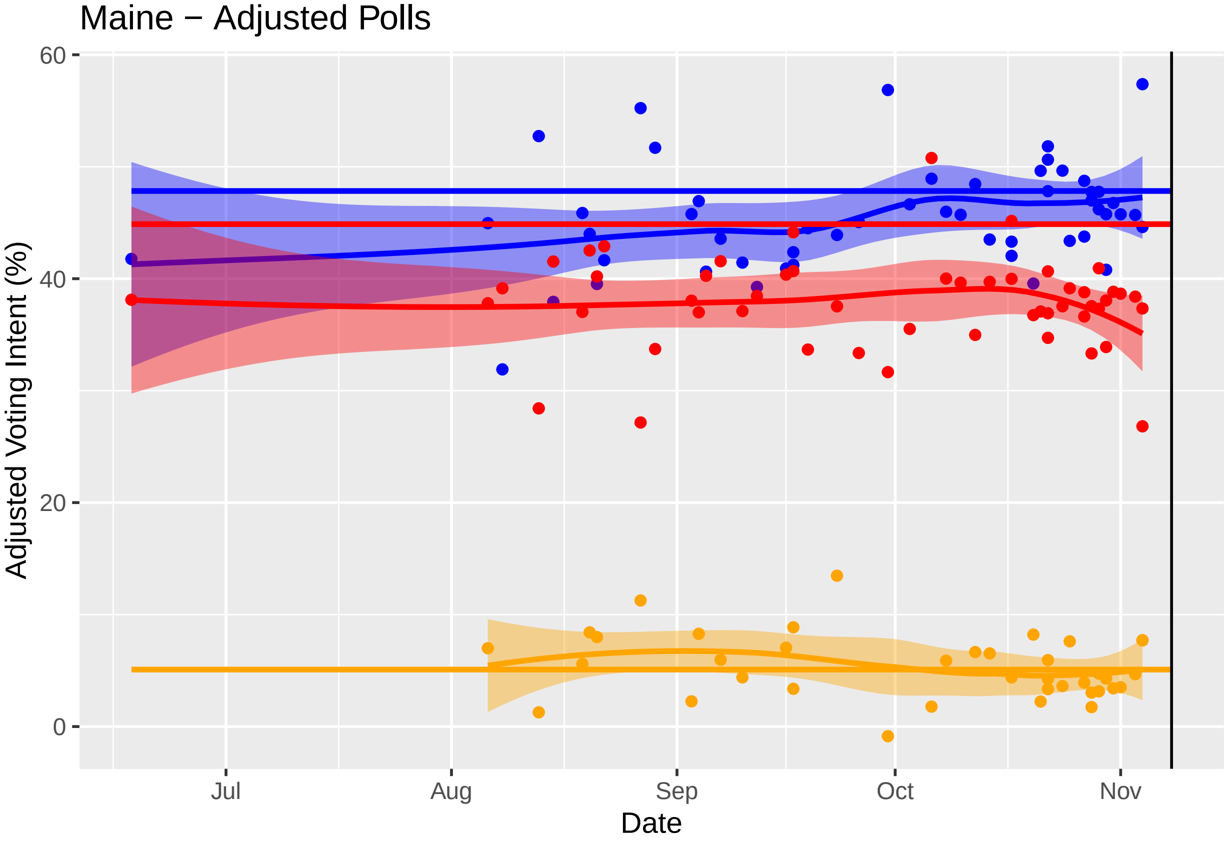
Louisiana − Raw Polls



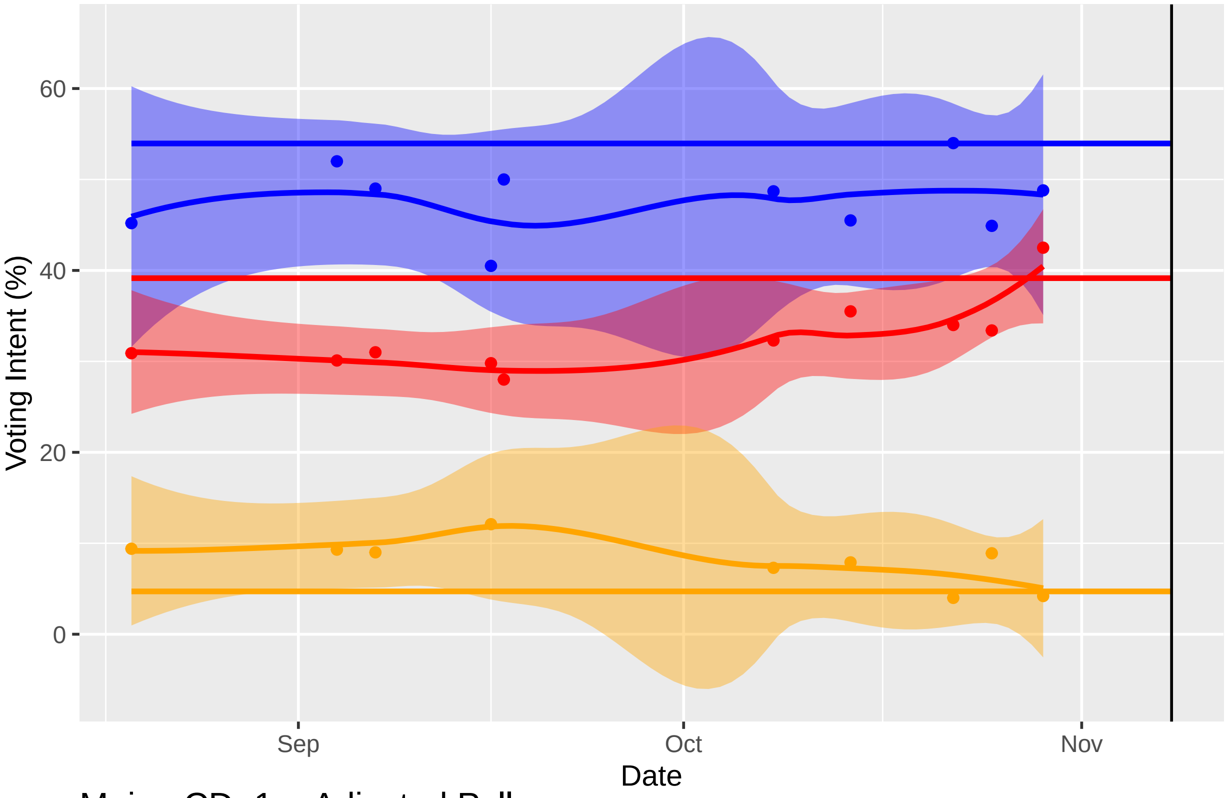
Louisiana − Adjusted Polls



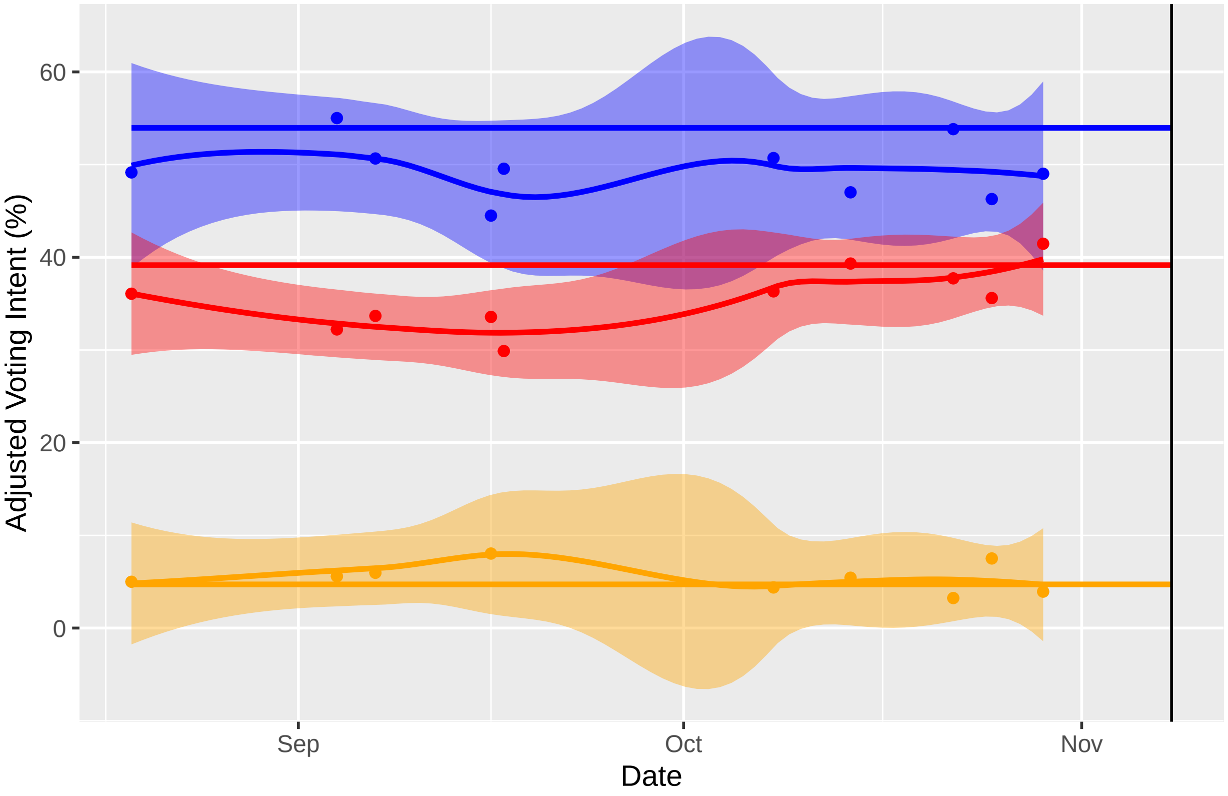

Maine − Raw Polls

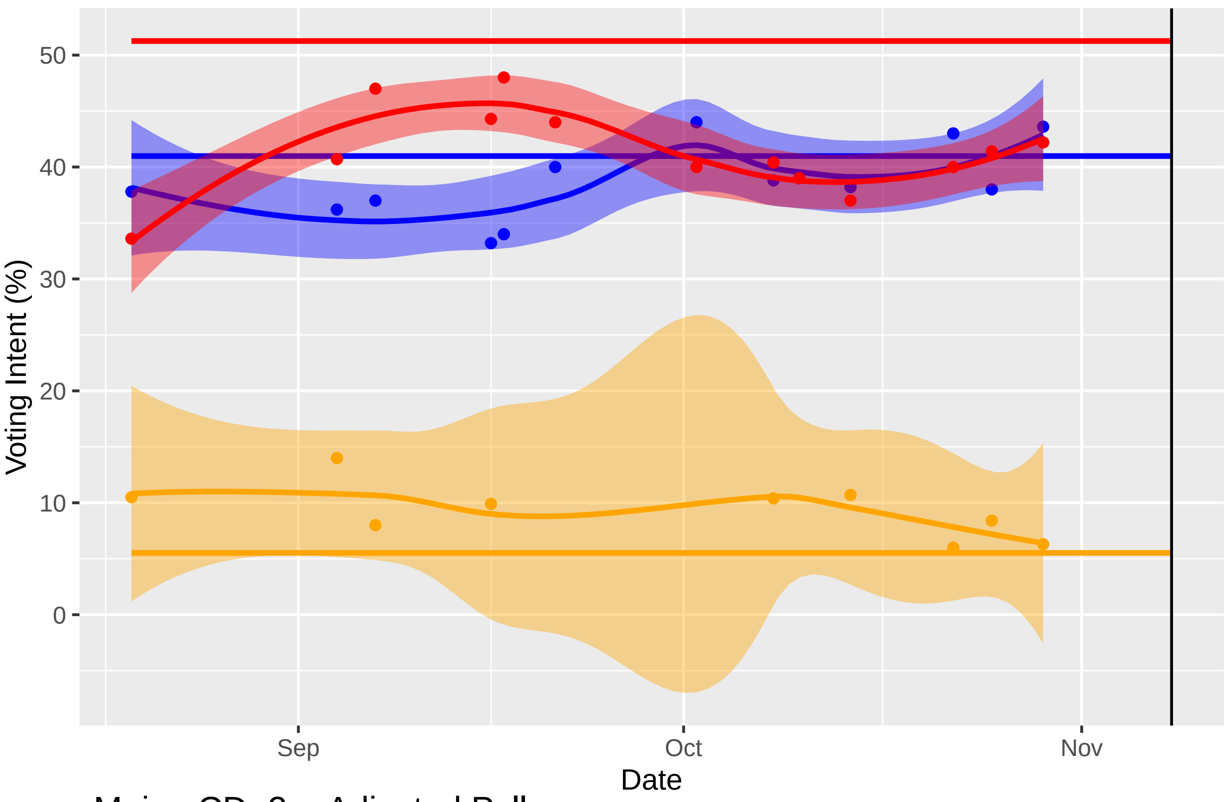

Maine − Adjusted Polls

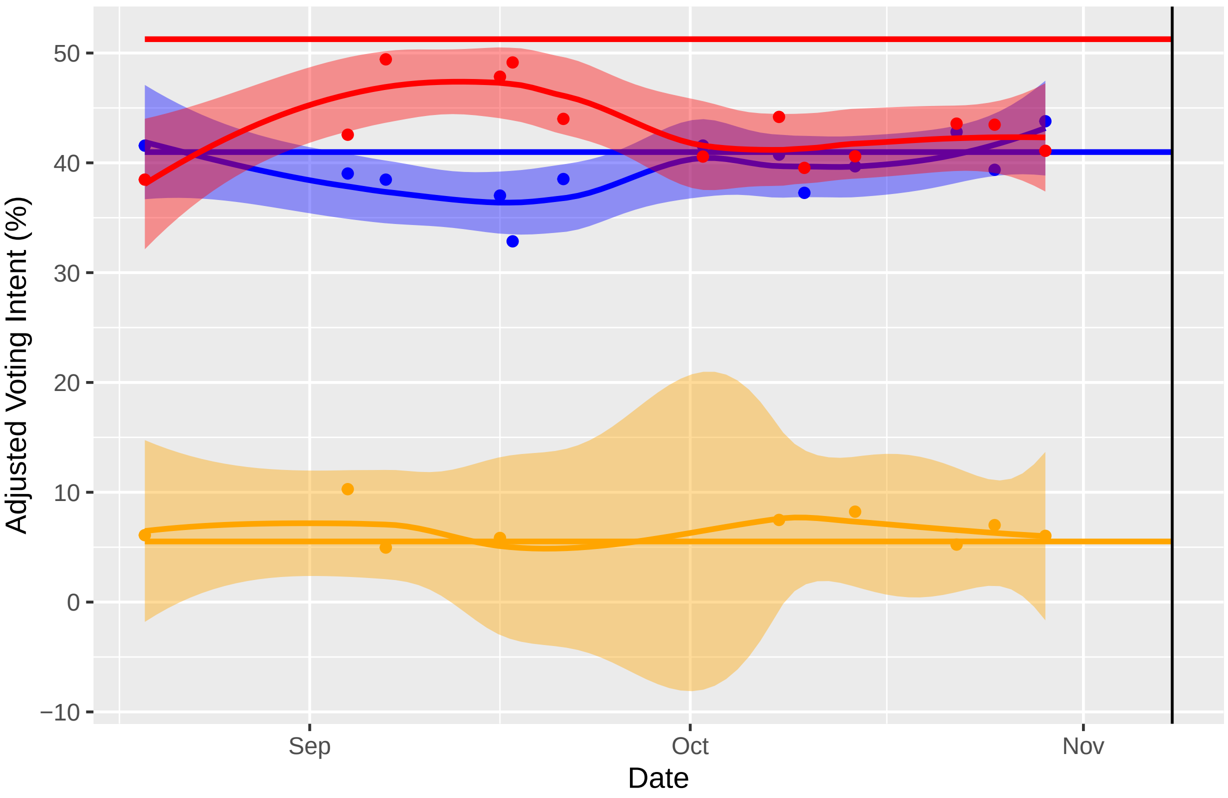
Maine CD−1 − Raw Polls

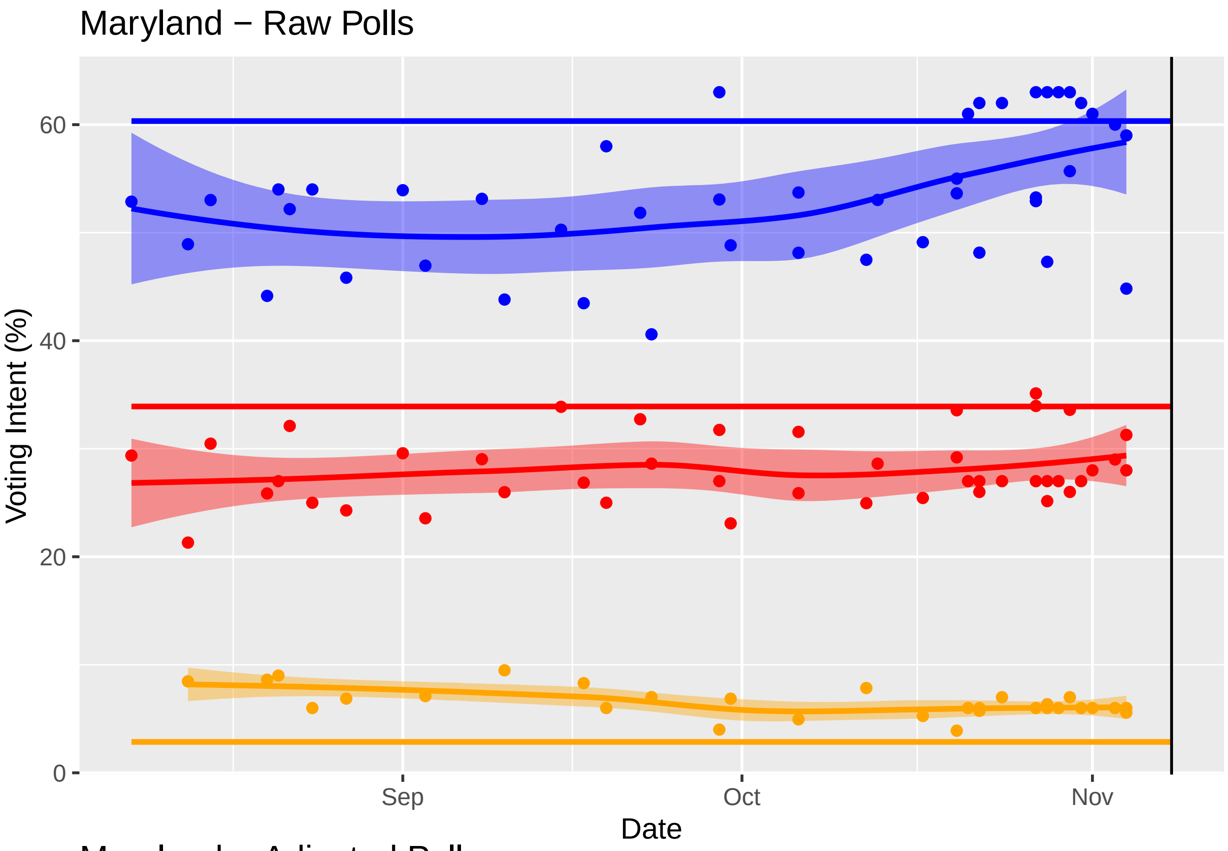


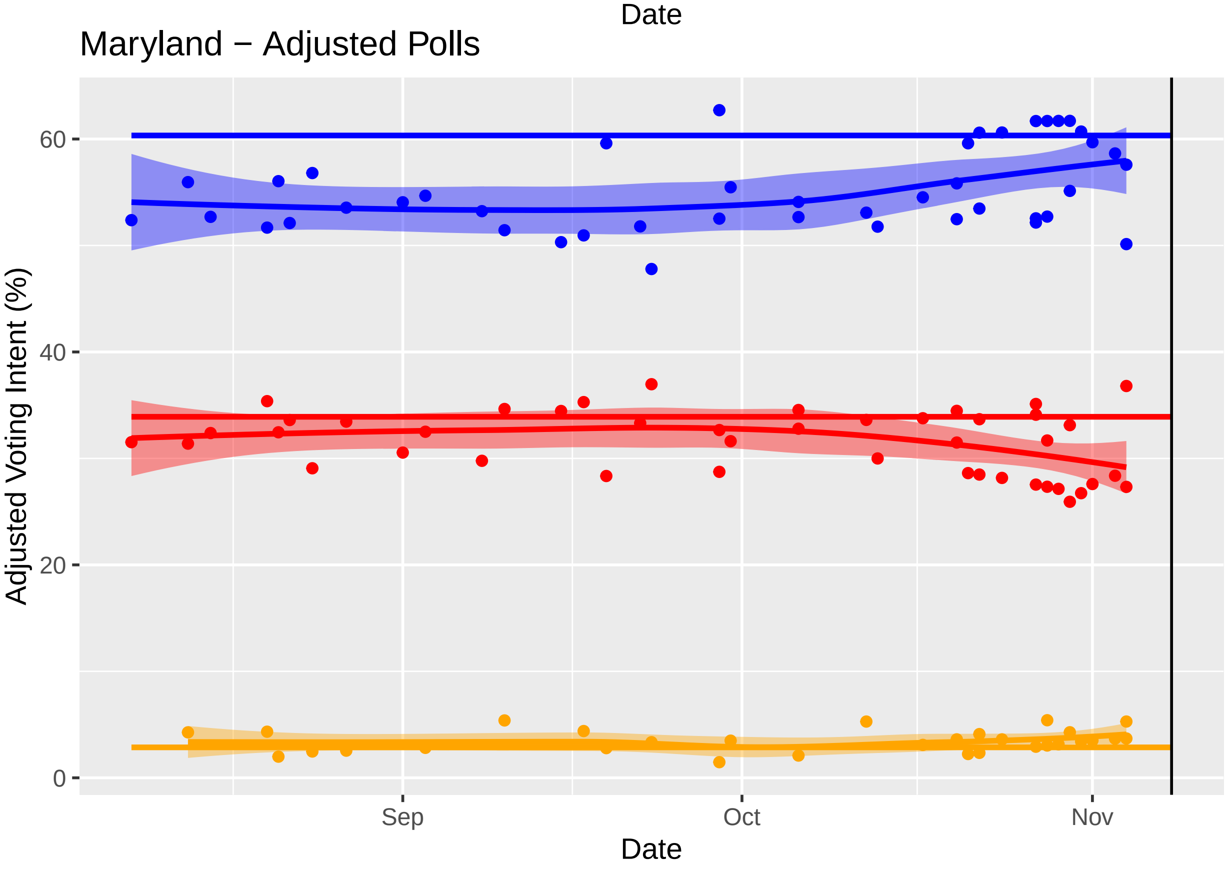
Maine CD−1 − Adjusted Polls

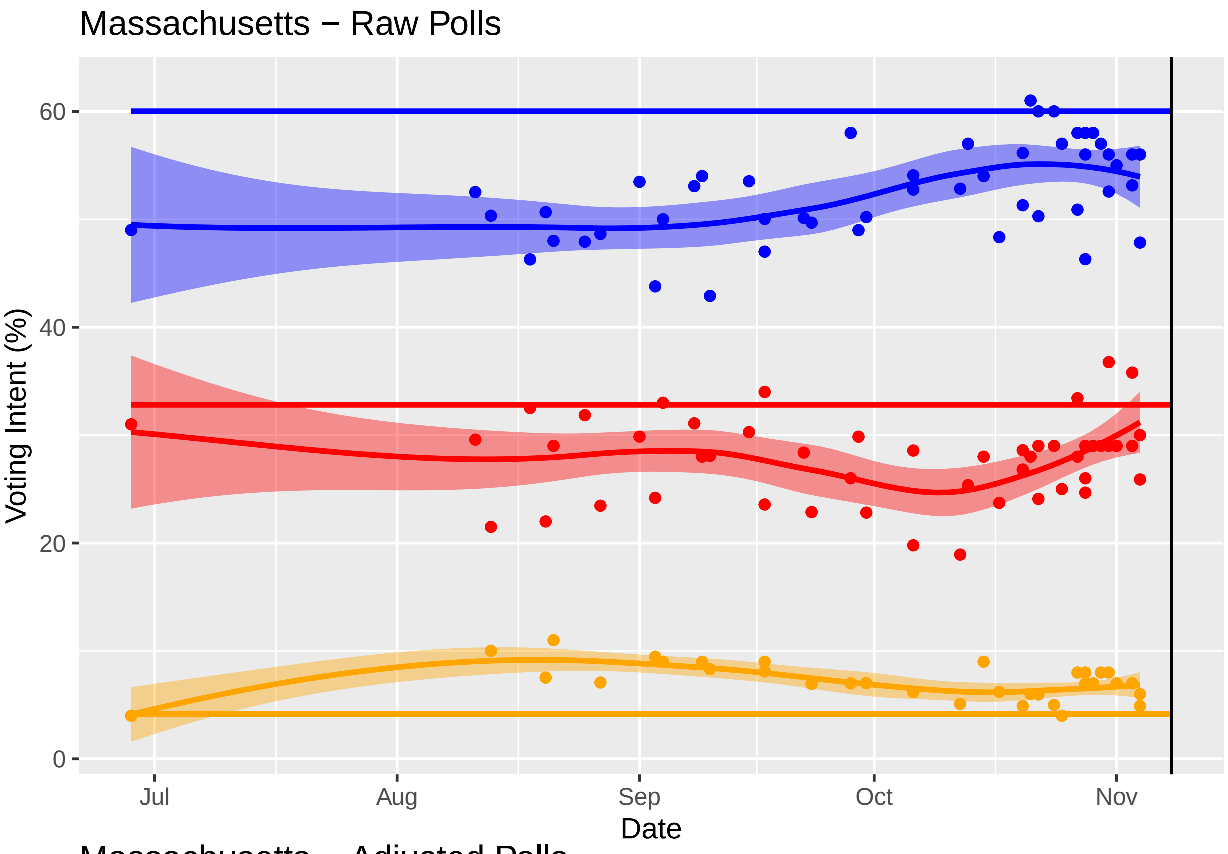


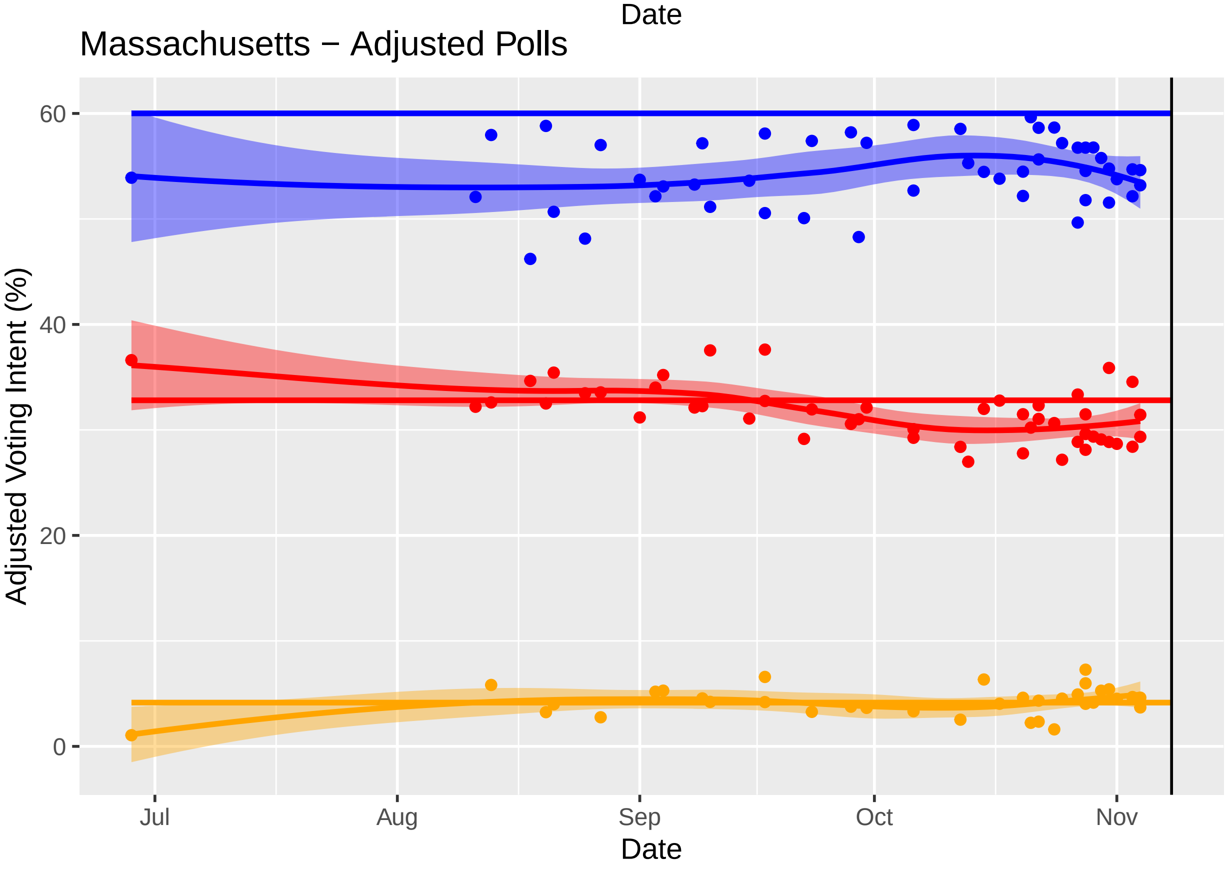

Maine CD−2 − Raw Polls


Maine CD−2 − Adjusted Polls

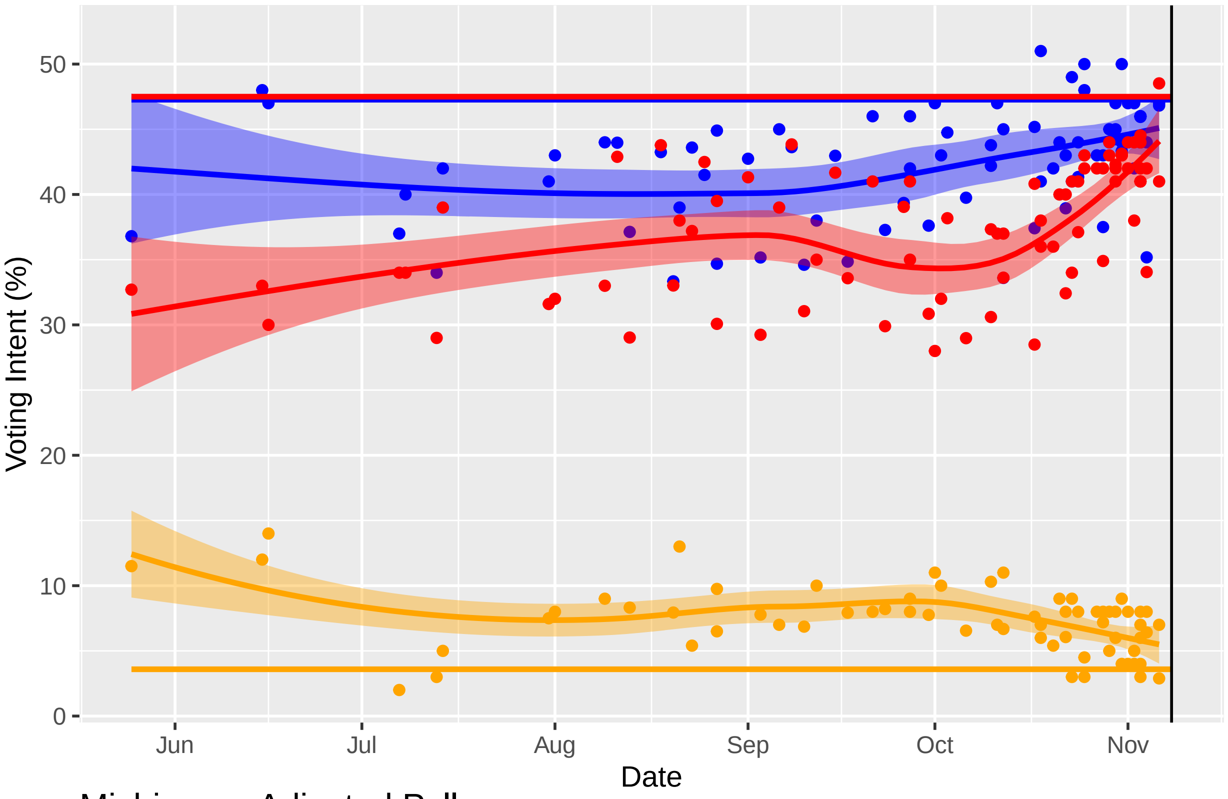

Maryland − Raw Polls
Voting Intent (%)
60
40
20
0
Sep
Oct
Nov
Date


Maryland − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Sep
Oct
Nov
Date

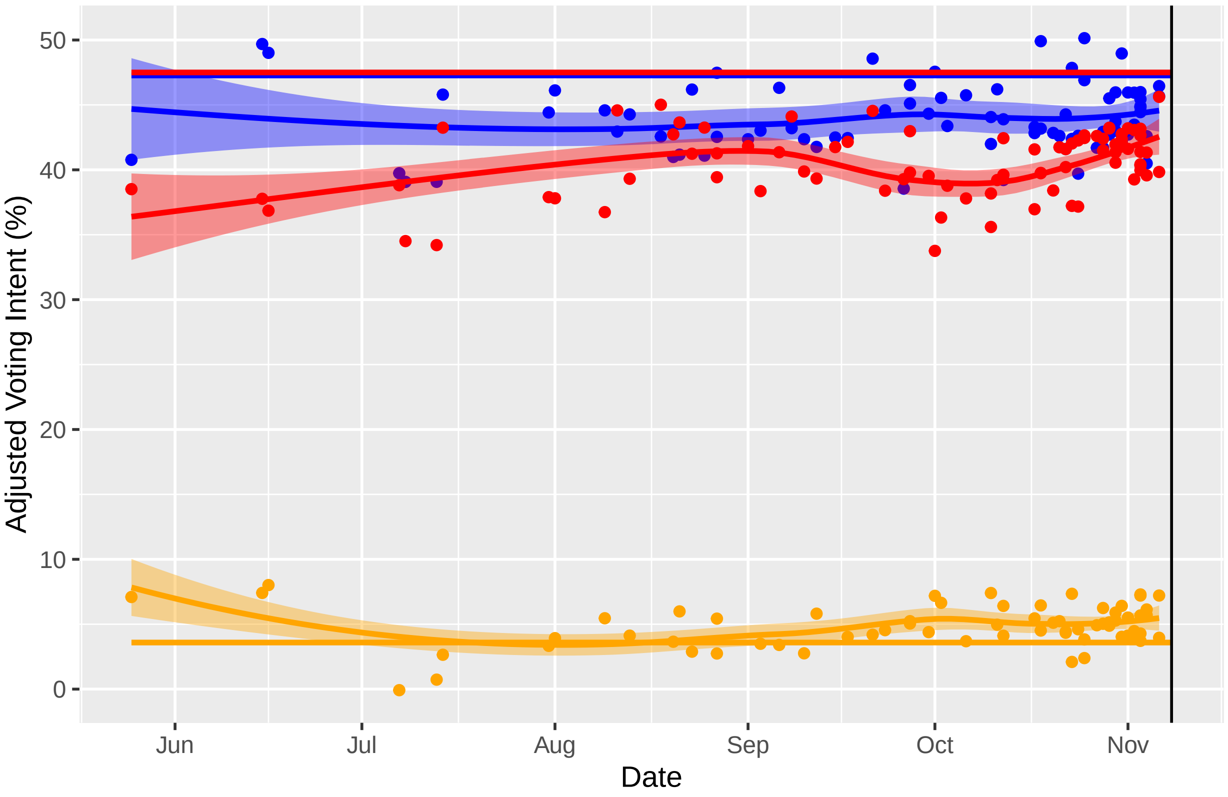

Massachusetts − Raw Polls
Voting Intent (%)
60
40
20
0
Jul
Aug
Sep
Oct
Nov
Date

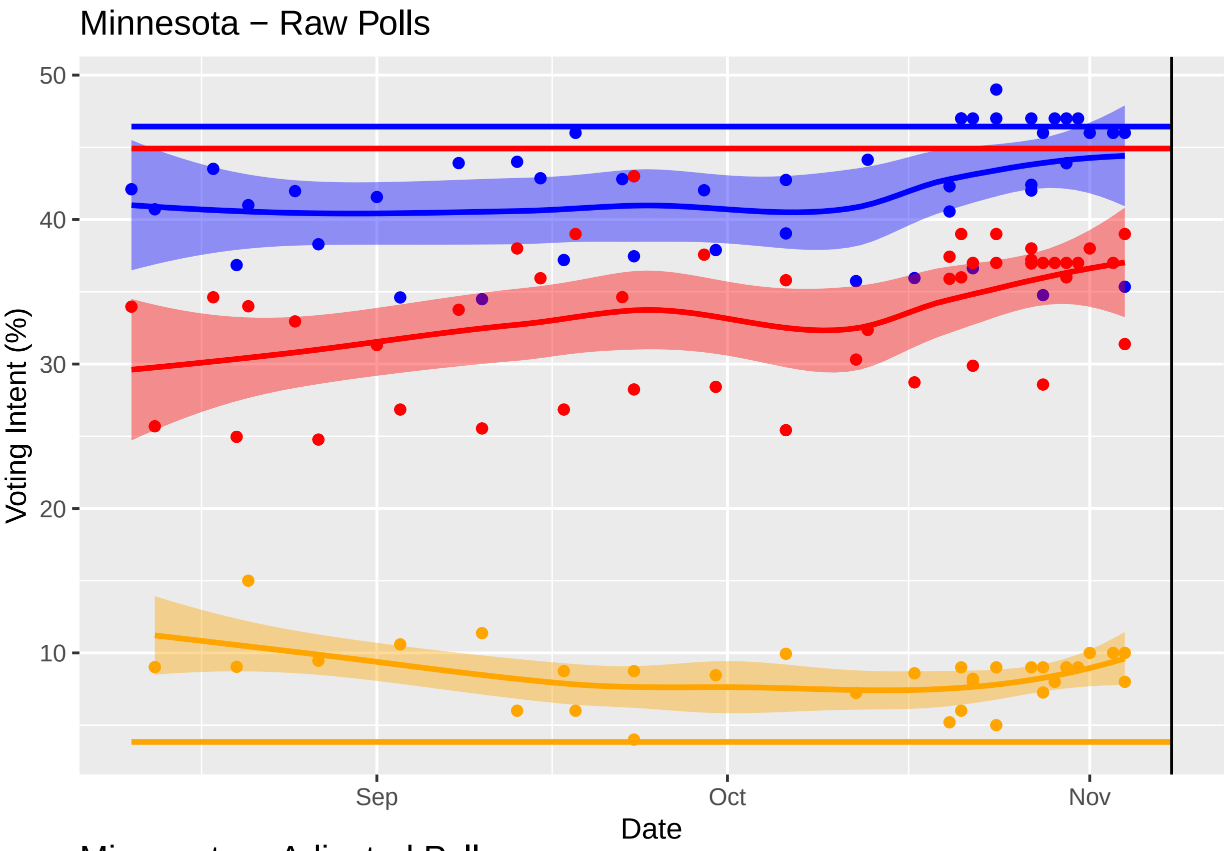

Massachusetts − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Jul
Aug
Sep
Oct
Nov
Date

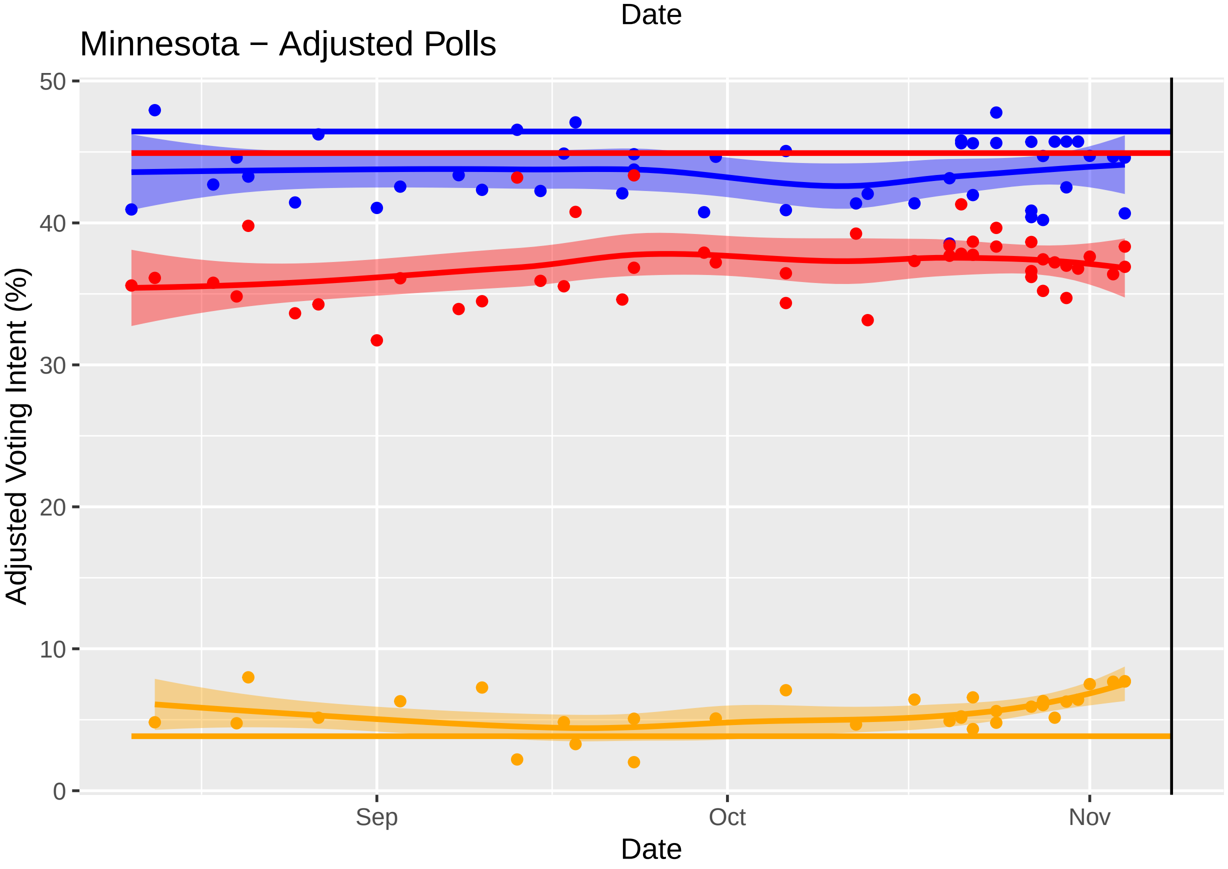
Michigan − Raw Polls

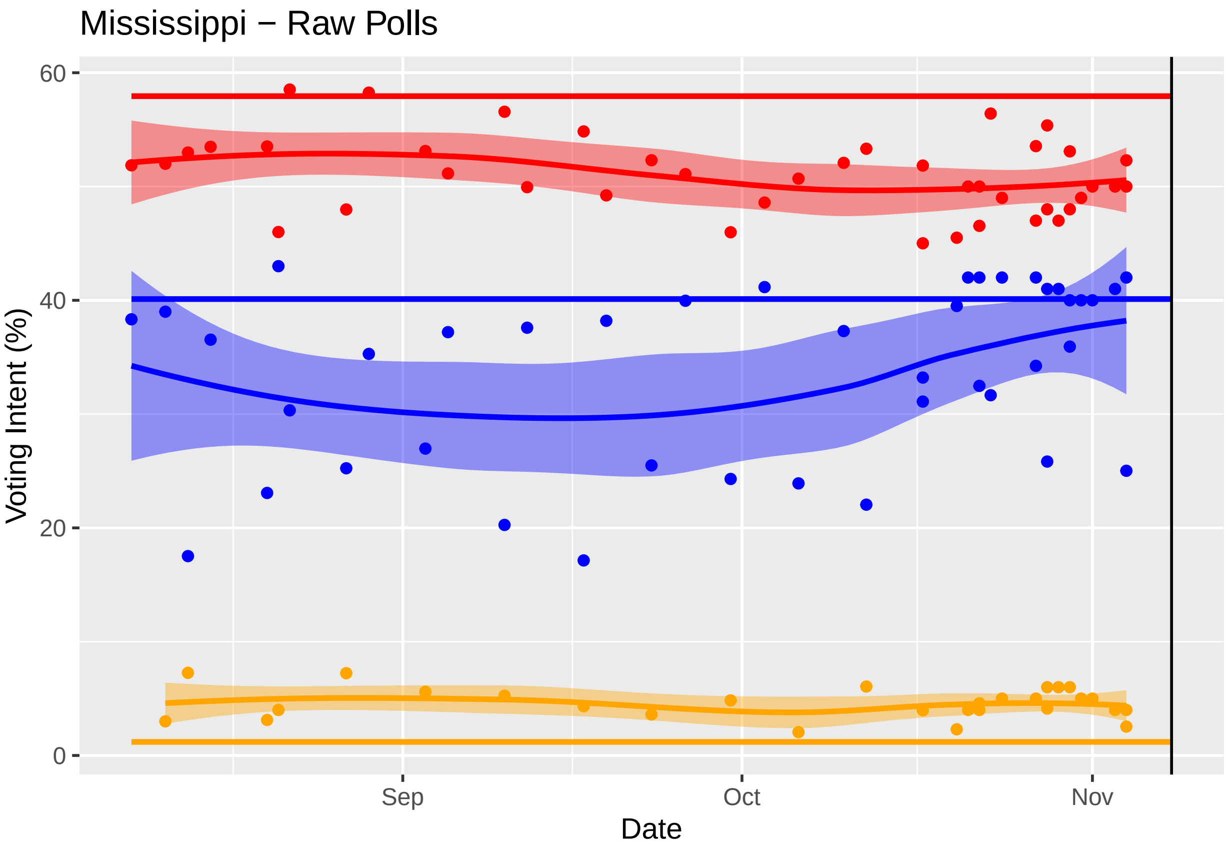


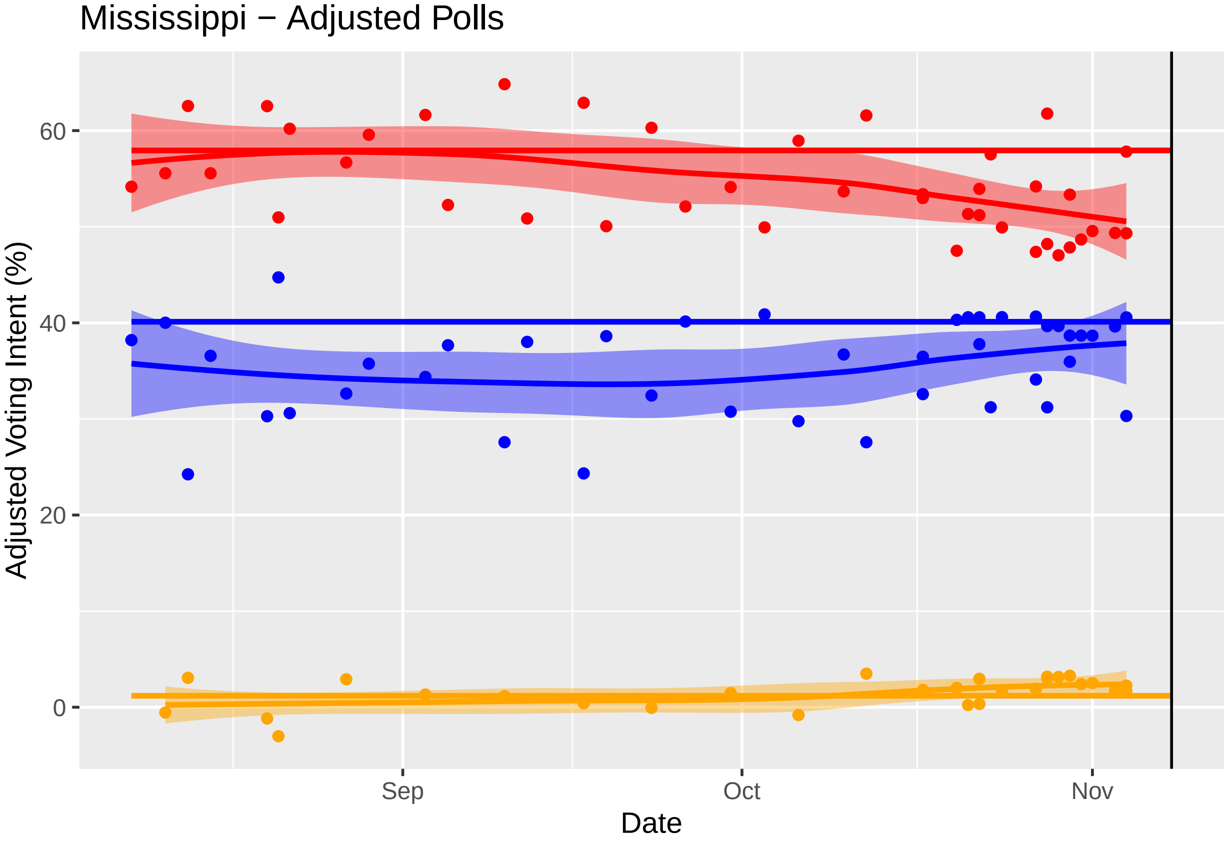
Michigan − Adjusted Polls

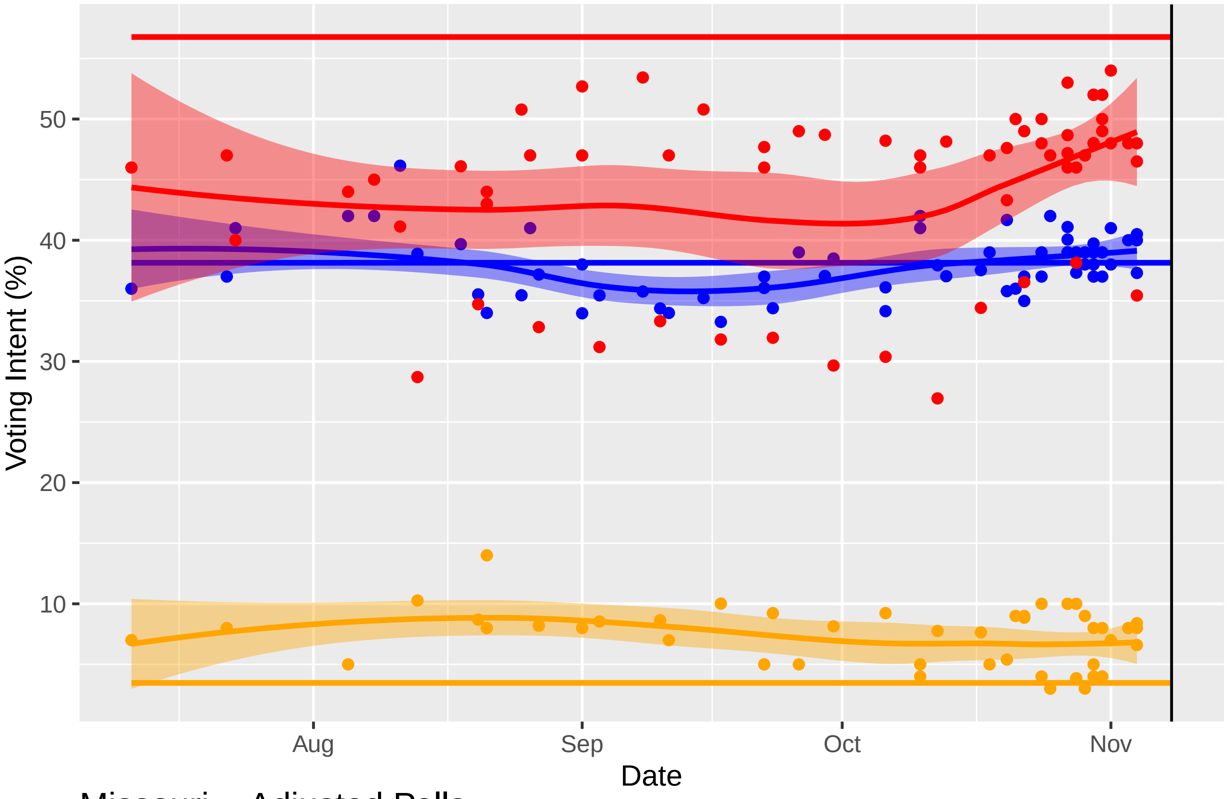



Minnesota − Raw Polls
Voting Intent (%)
50
40
30
20
10
Sep
Oct
Nov
Date

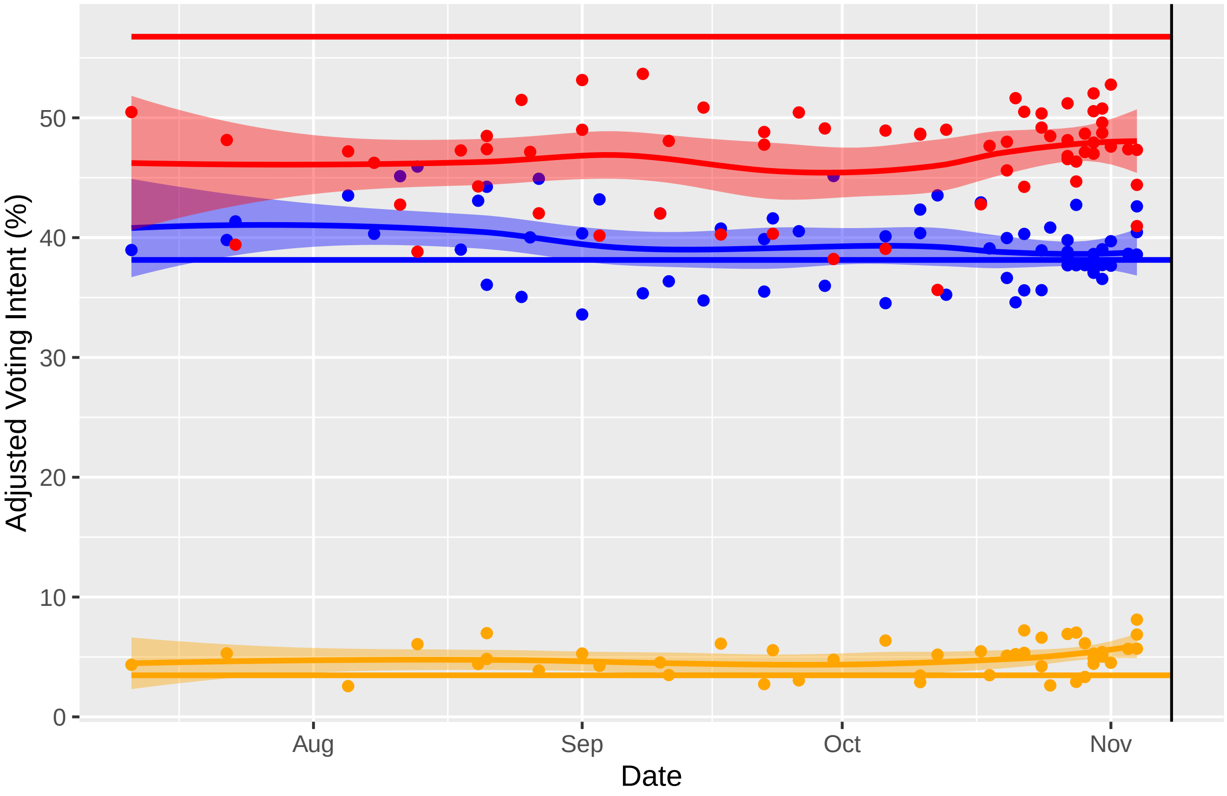

Minnesota − Adjusted Polls
Adjusted Voting Intent (%)
50
40
30
20
10
0
Sep
Oct
Nov
Date


Mississippi − Raw Polls

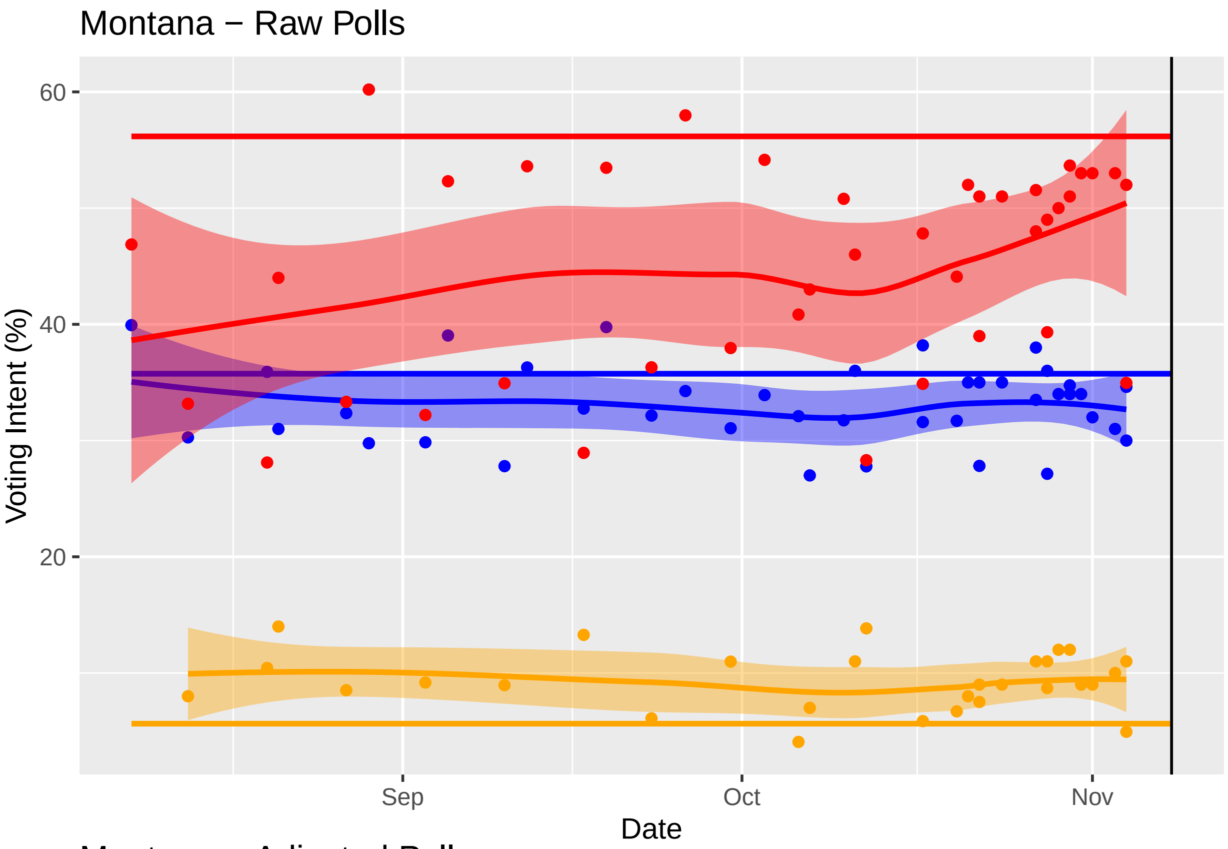

Mississippi − Adjusted Polls

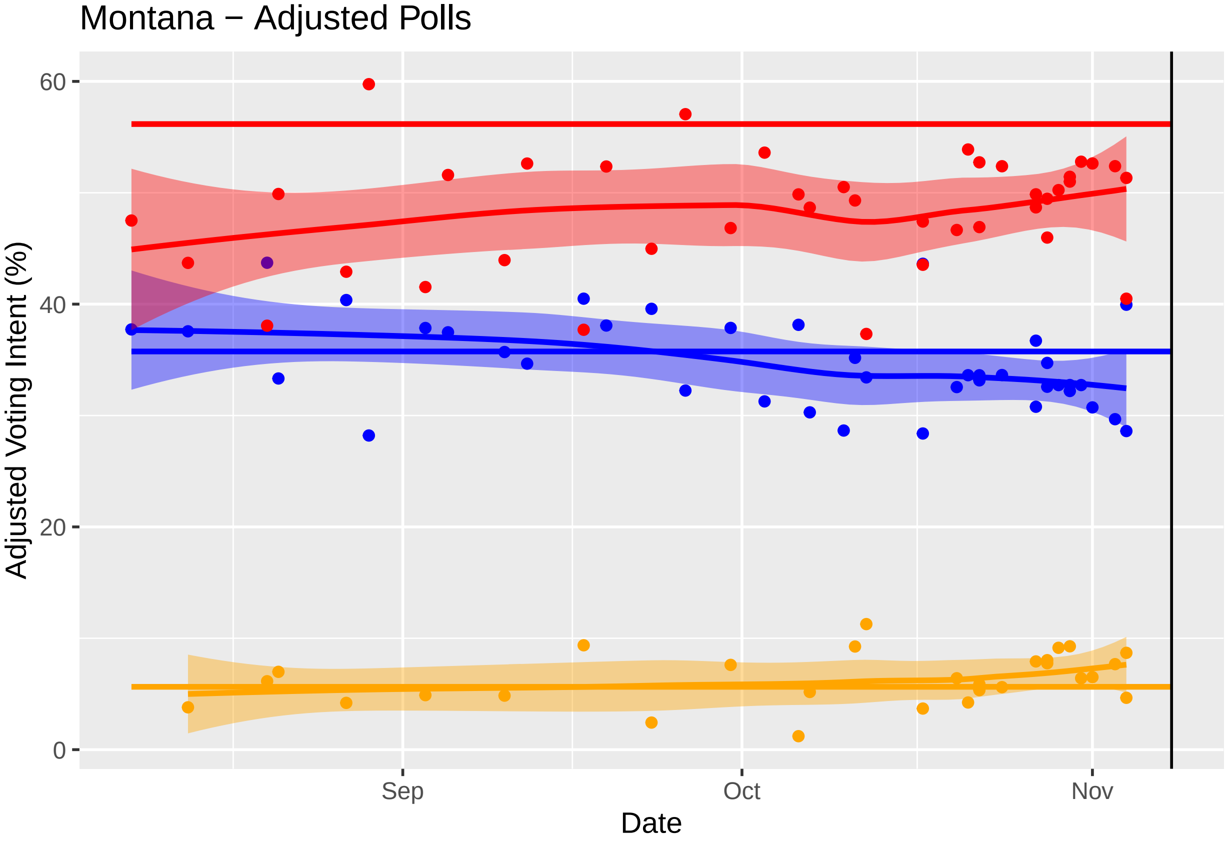


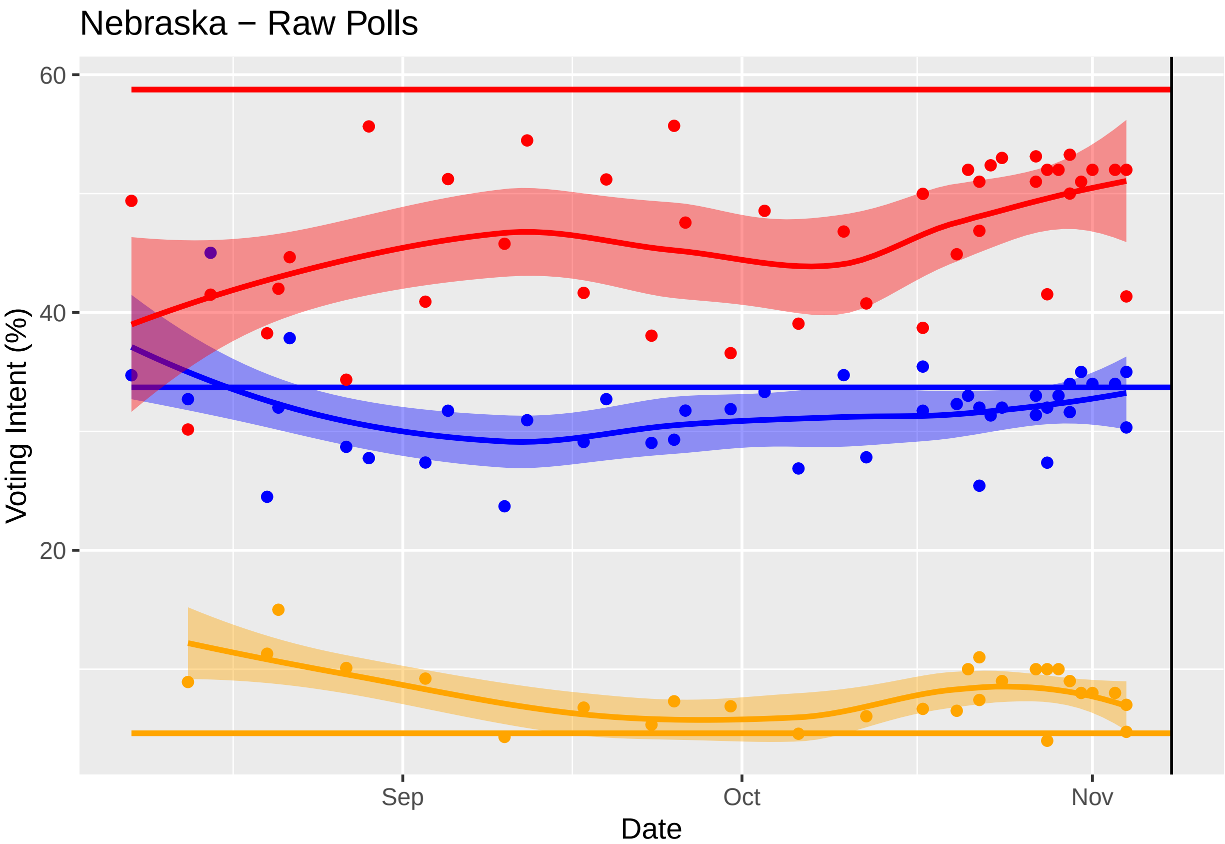
Missouri − Raw Polls

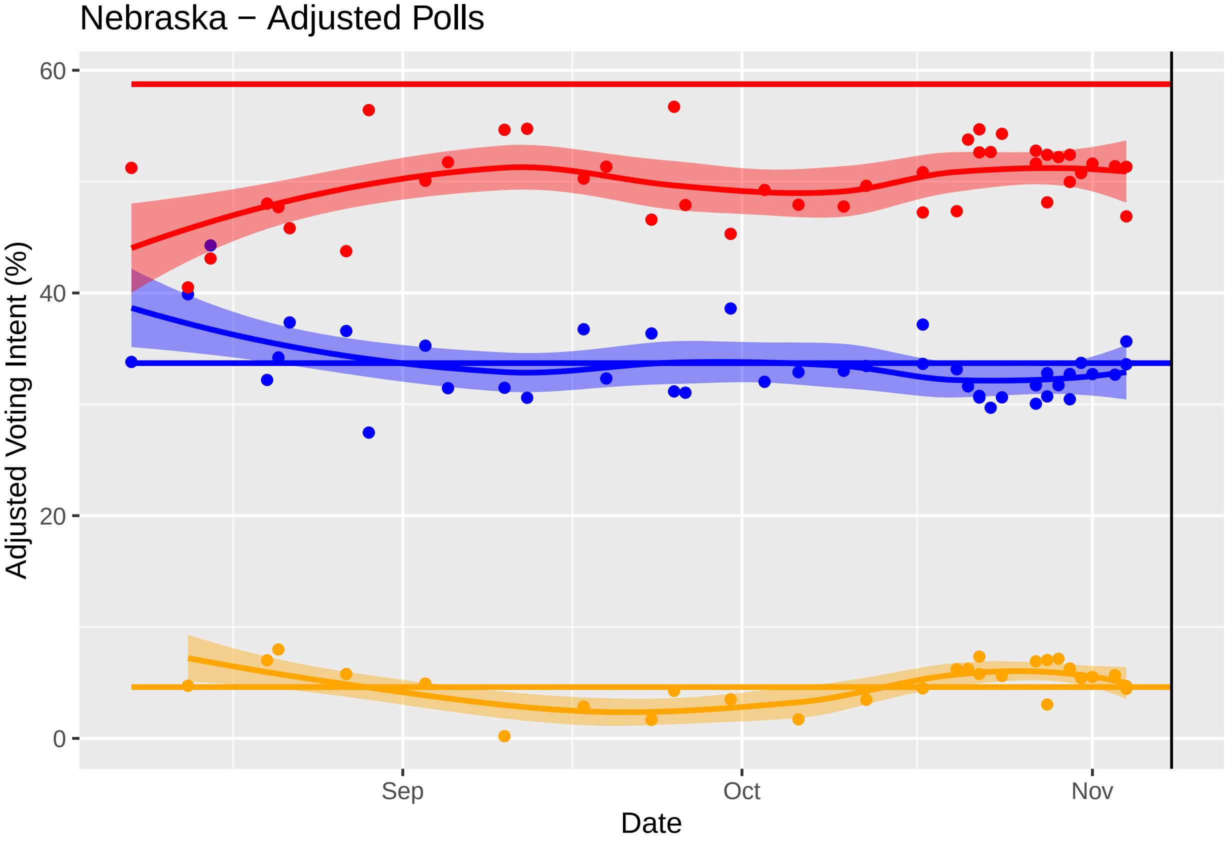


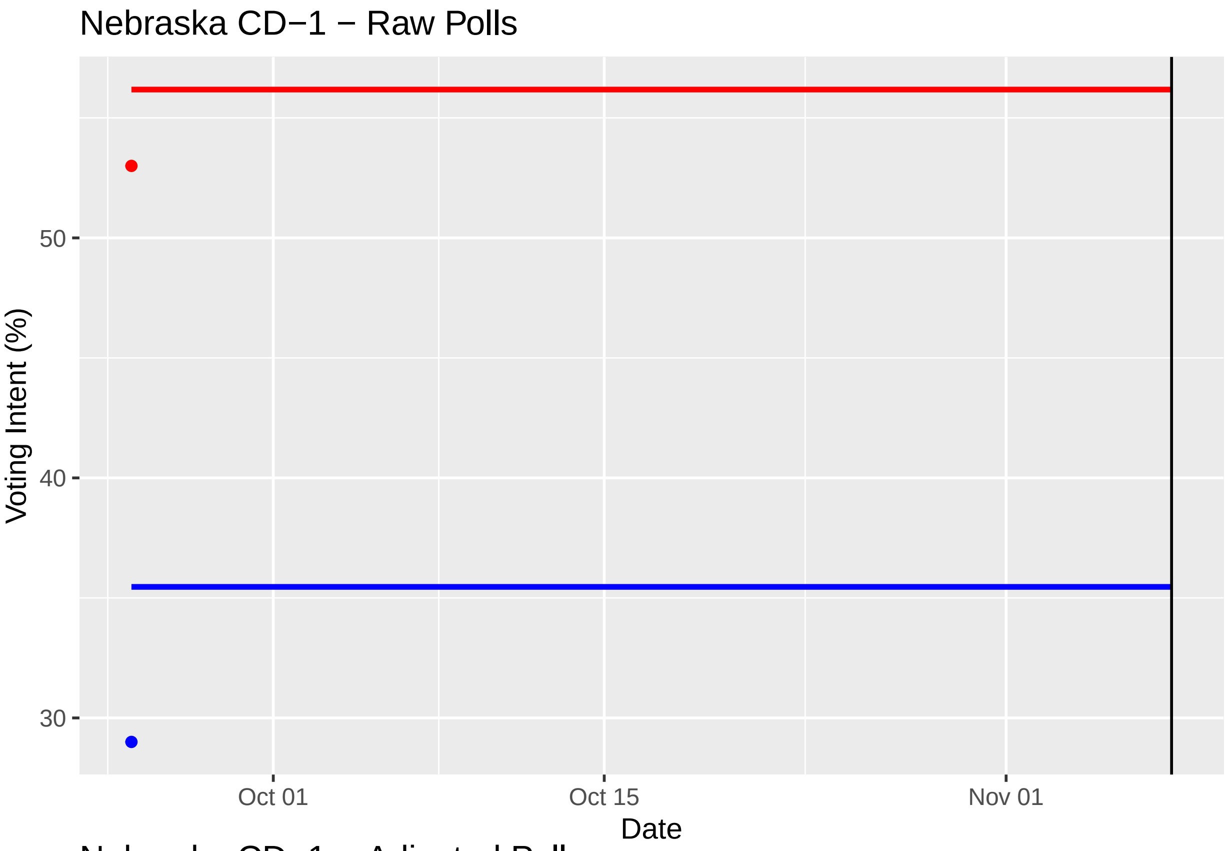
Missouri − Adjusted Polls

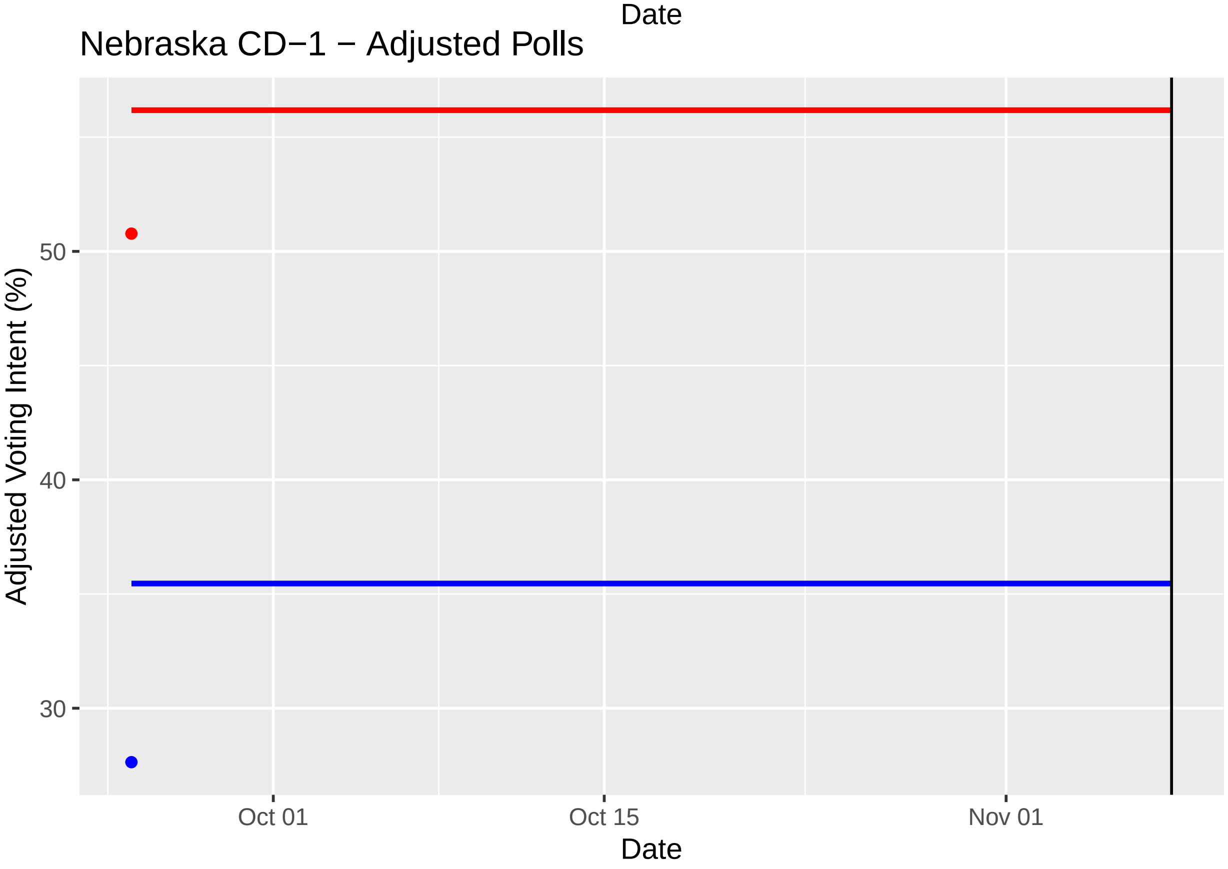

Montana − Raw Polls
Voting Intent (%)
60
40
20
Sep
Oct
Nov
Date


Montana − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Sep
Oct
Nov
Date


Nebraska − Raw Polls
Voting Intent (%)
60
40
20
Sep
Oct
Nov
Date


Nebraska − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Sep
Oct
Nov
Date





```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : span too small.  fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : at 17069

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : radius 0.0196

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : all data on boundary of neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : pseudoinverse used at 17069

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : neighborhood radius 0.14

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : reciprocal condition number 1

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : at 17097

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : radius 0.0196

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : all data on boundary of neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : There are other near singularities as well. 0.0196

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : zero-width neighborhood. make span bigger

## Warning: Computation failed in ‘stat_smooth()‘
## Caused by error in ‘predLoess()‘:
## ! NA/NaN/Inf in foreign function call (arg 5)

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : span too small.  fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : at 17069

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : radius 0.0196
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : all data on boundary of neighborhood. make span bigger
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : pseudoinverse used at 17069
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : neighborhood radius 0.14
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : reciprocal condition number 1
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : at 17097
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : radius 0.0196
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : all data on boundary of neighborhood. make span bigger
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```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
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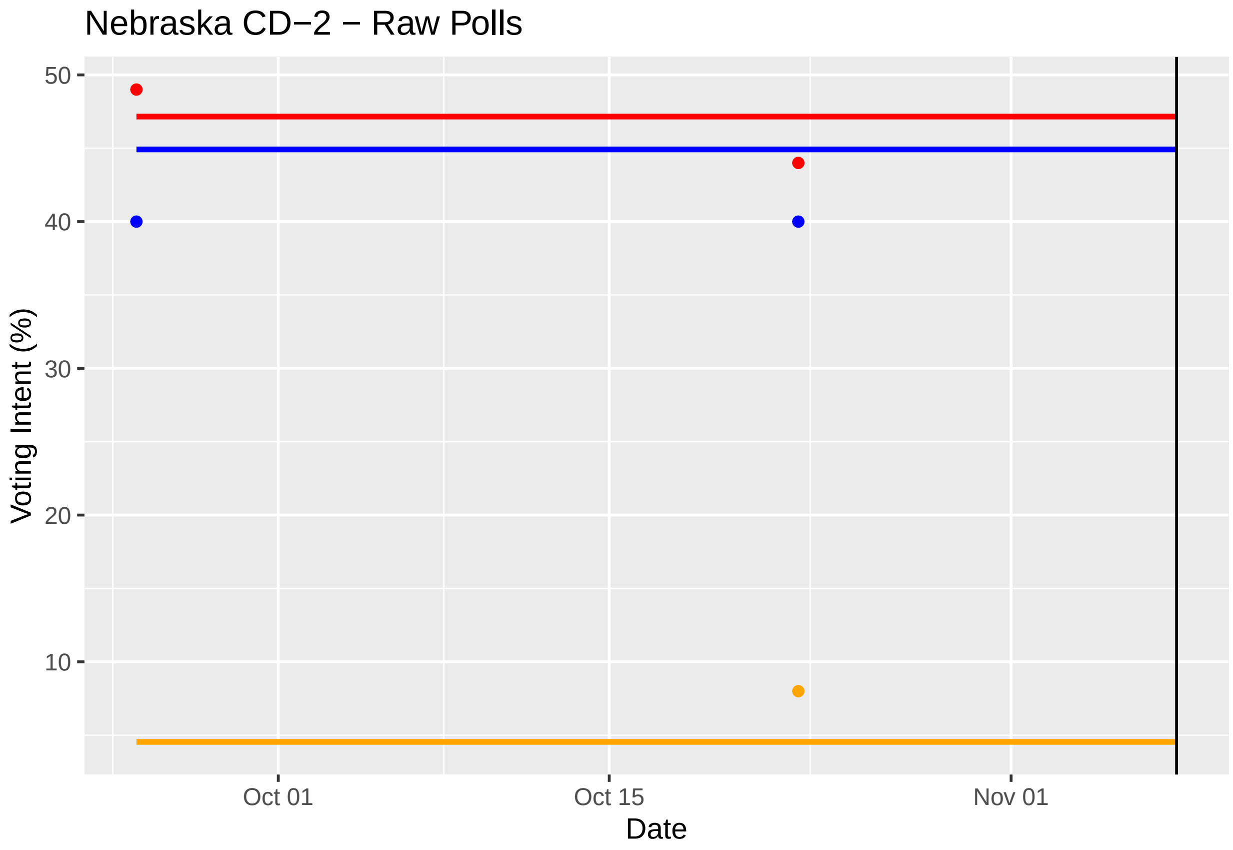
```

```
## Warning: Computation failed in ‘stat_smooth()‘
## Caused by error in ‘predLoess()‘:
## ! NA/NaN/Inf in foreign function call (arg 5)
```



```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
## : span too small.  fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
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## : all data on boundary of neighborhood. make span bigger

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## : pseudoinverse used at 17069

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
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## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = parametric,
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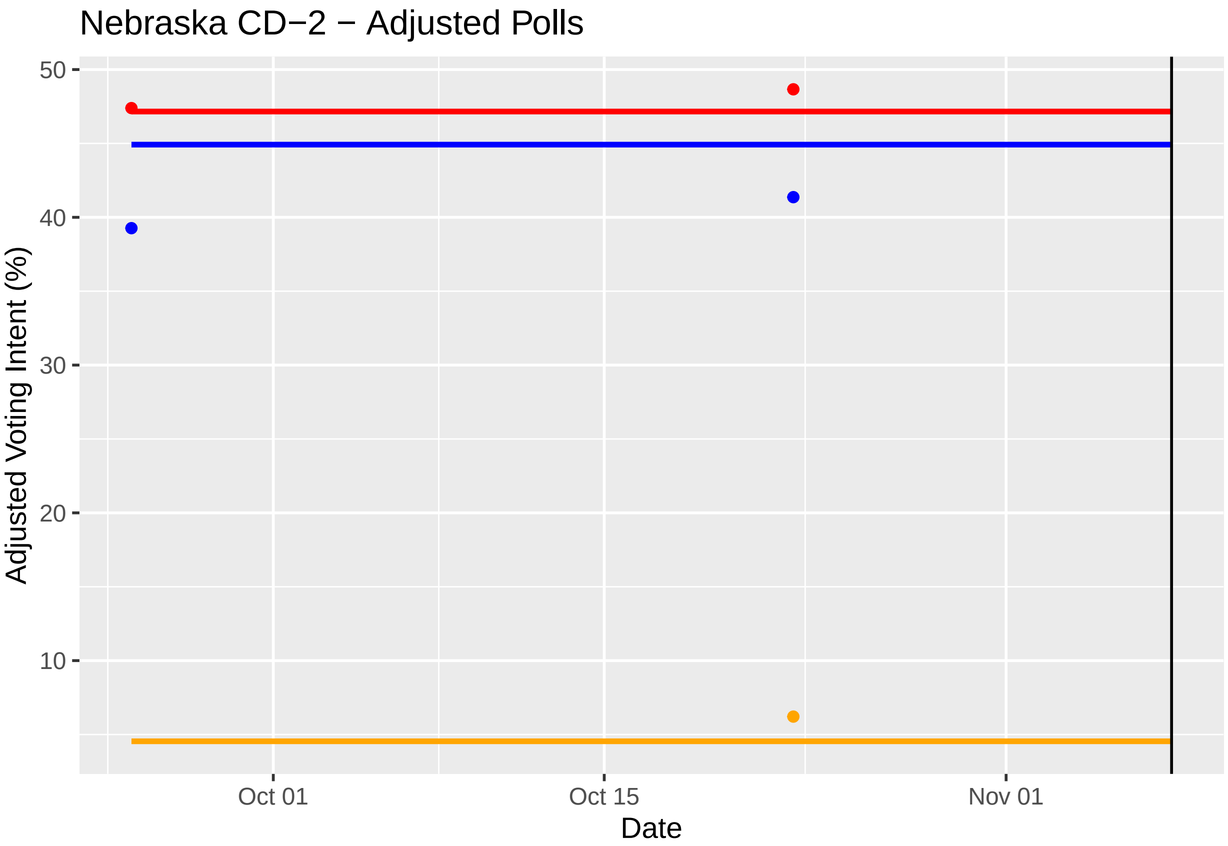
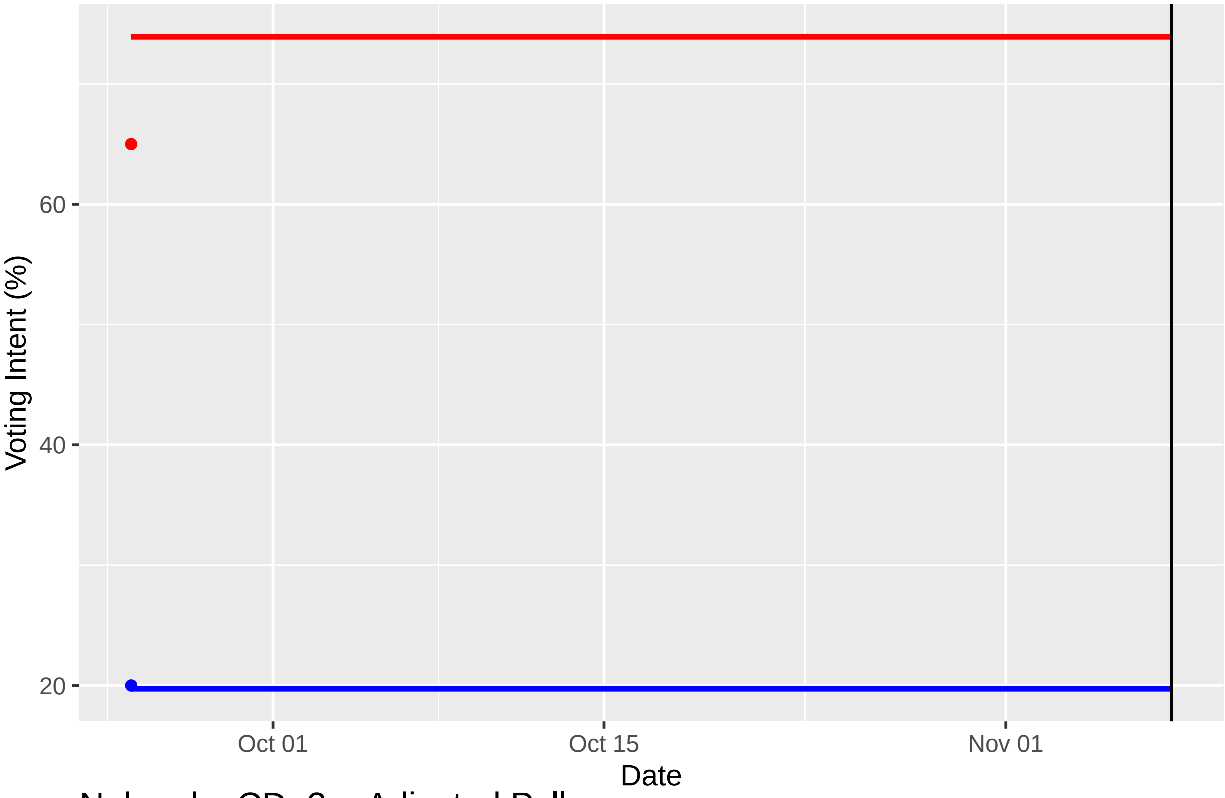
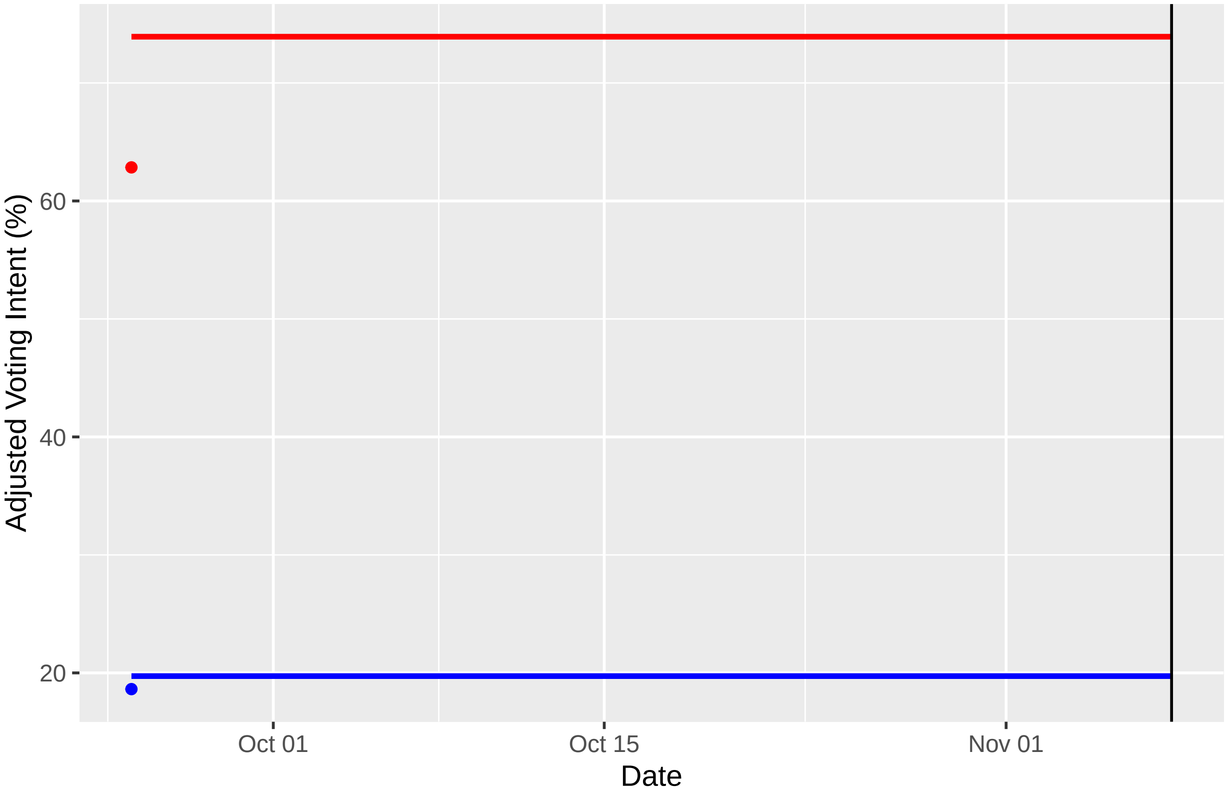
## ! NA/NaN/Inf in foreign function call (arg 5)
```



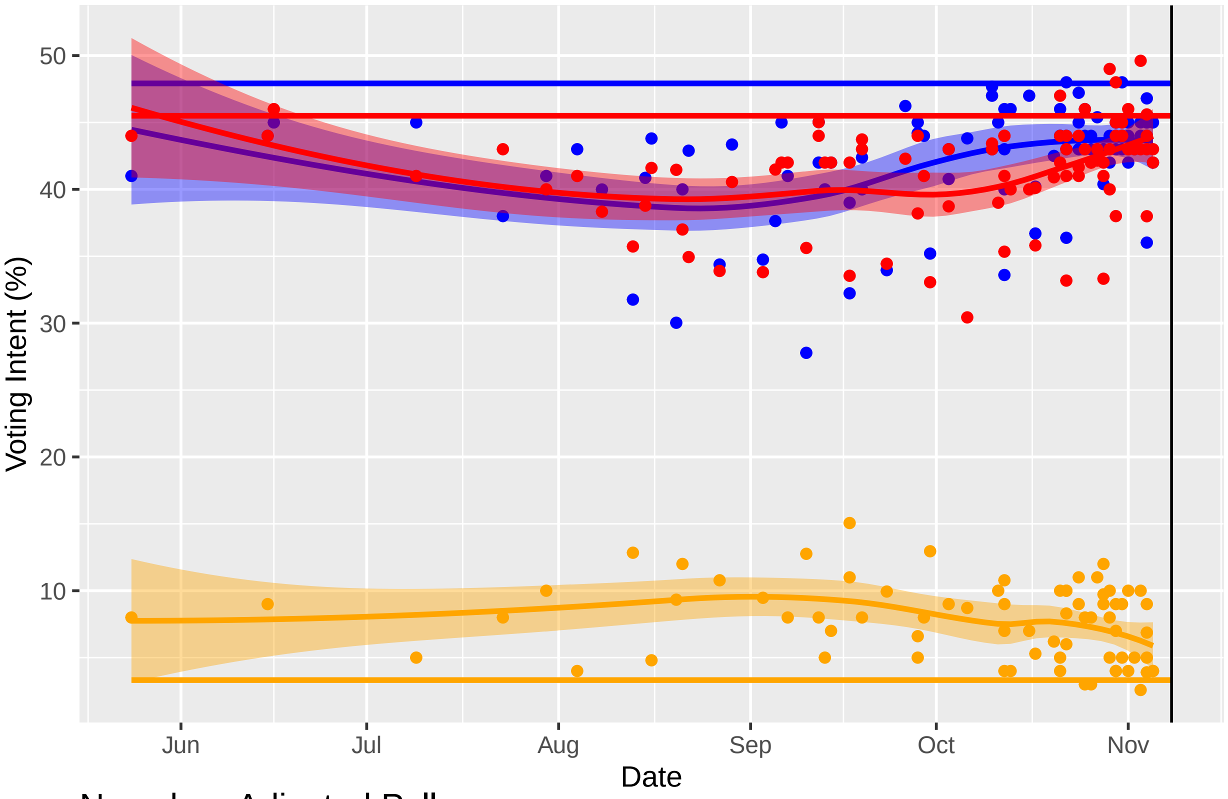
Nebraska CD−3 − Raw Polls



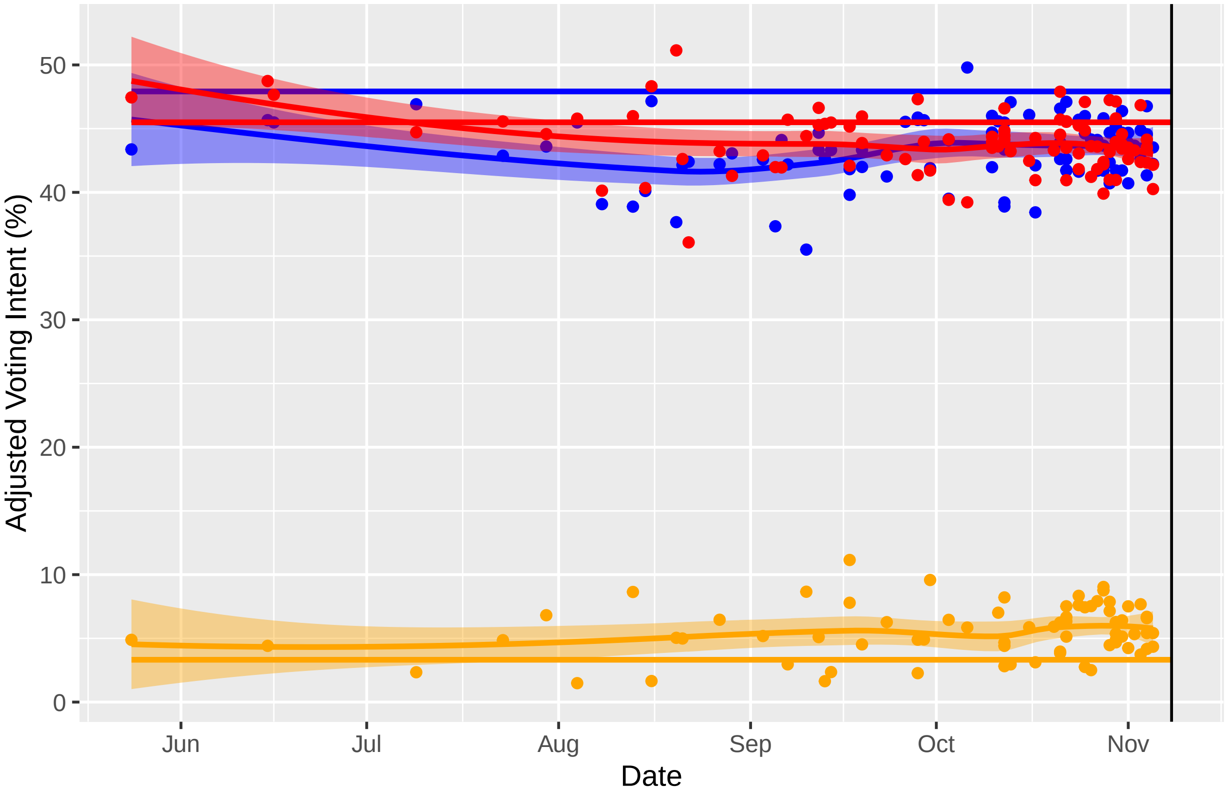
Nebraska CD−3 − Adjusted Polls

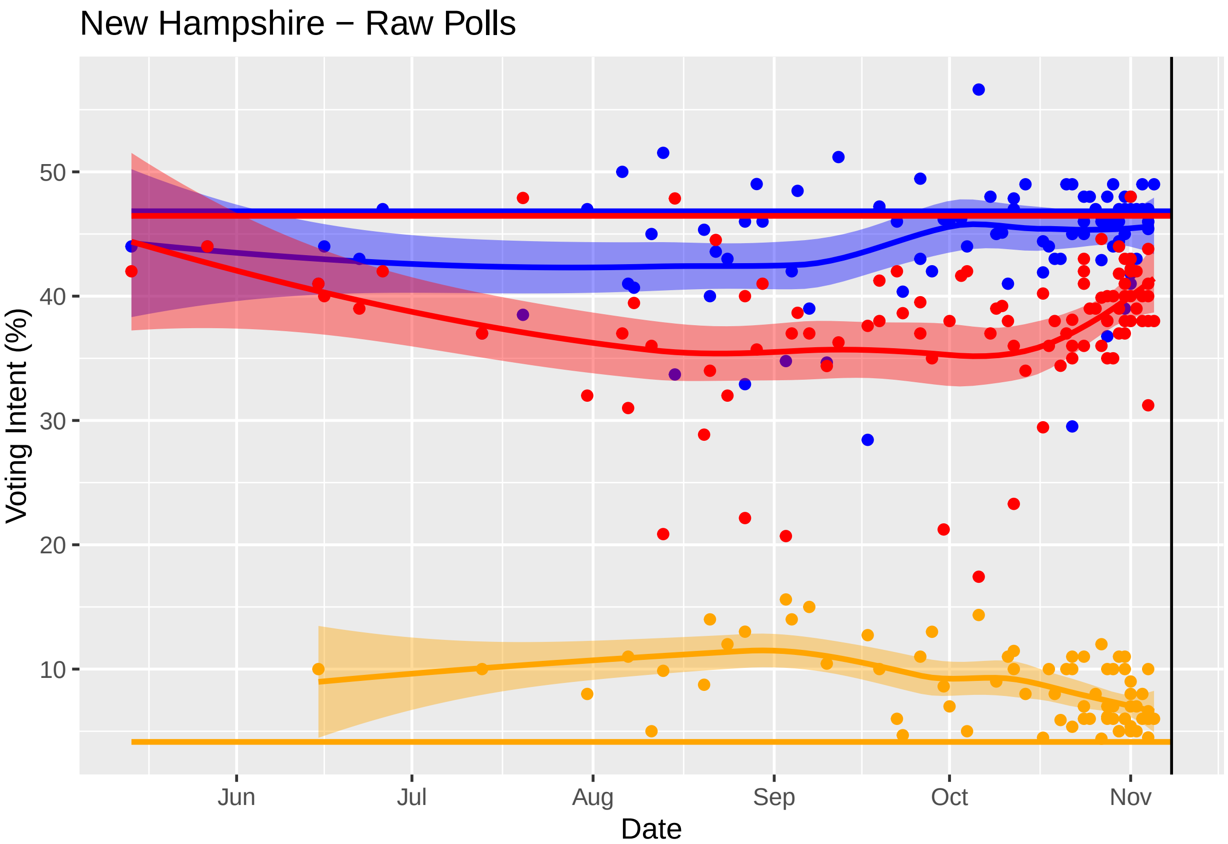


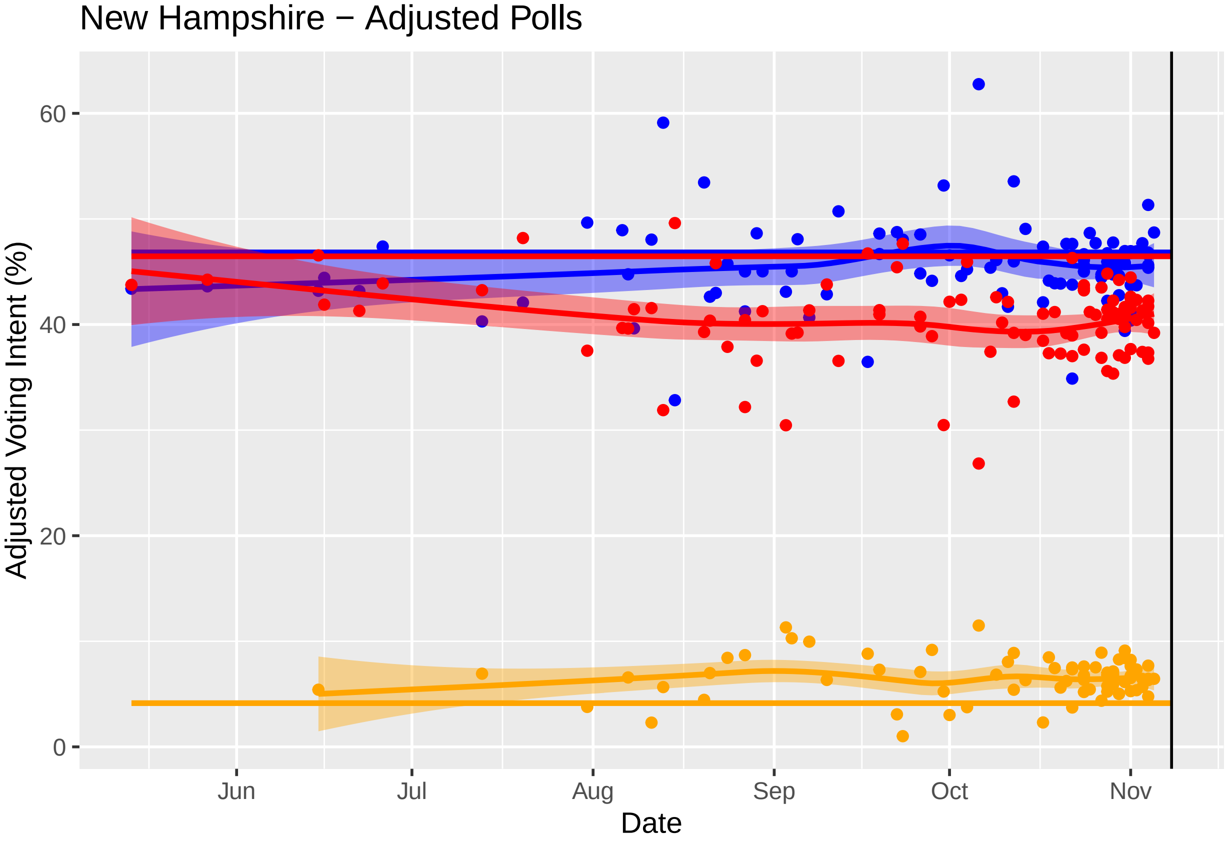
Nevada − Raw Polls

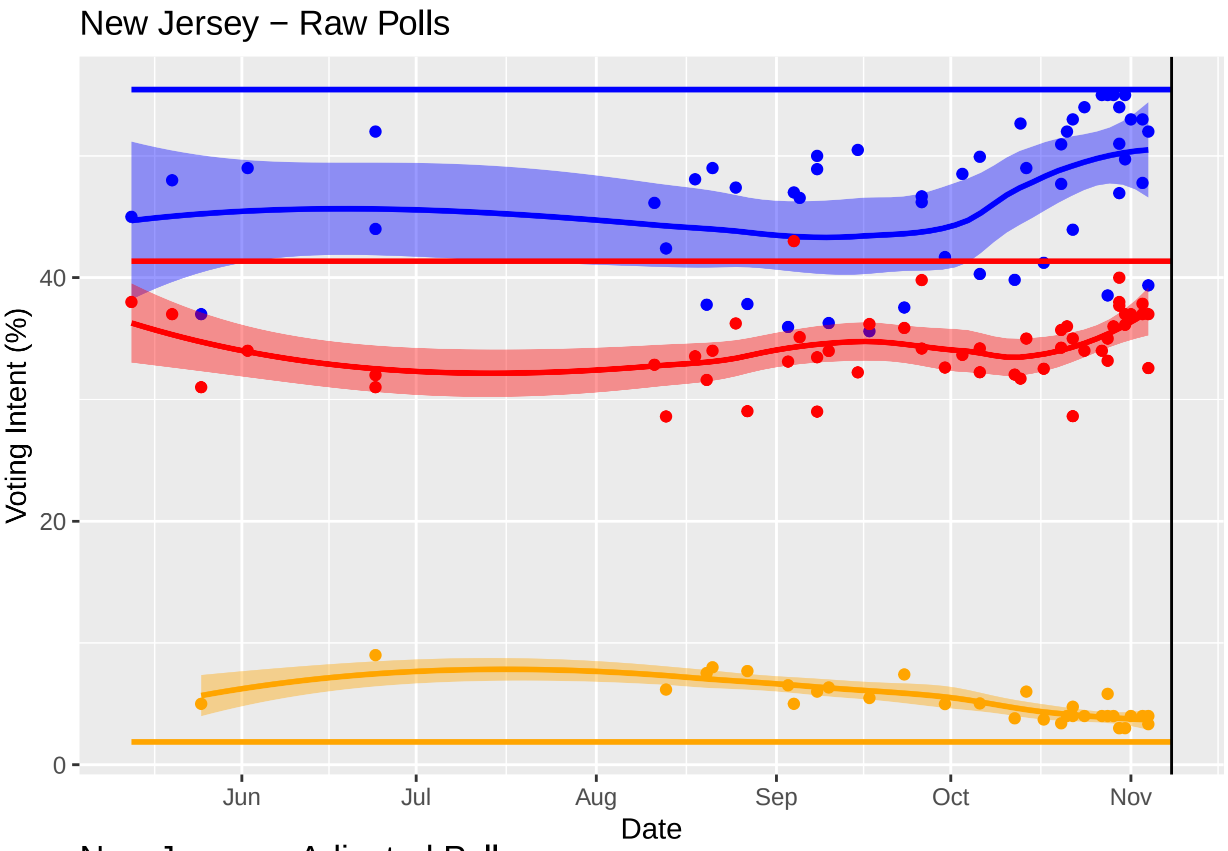


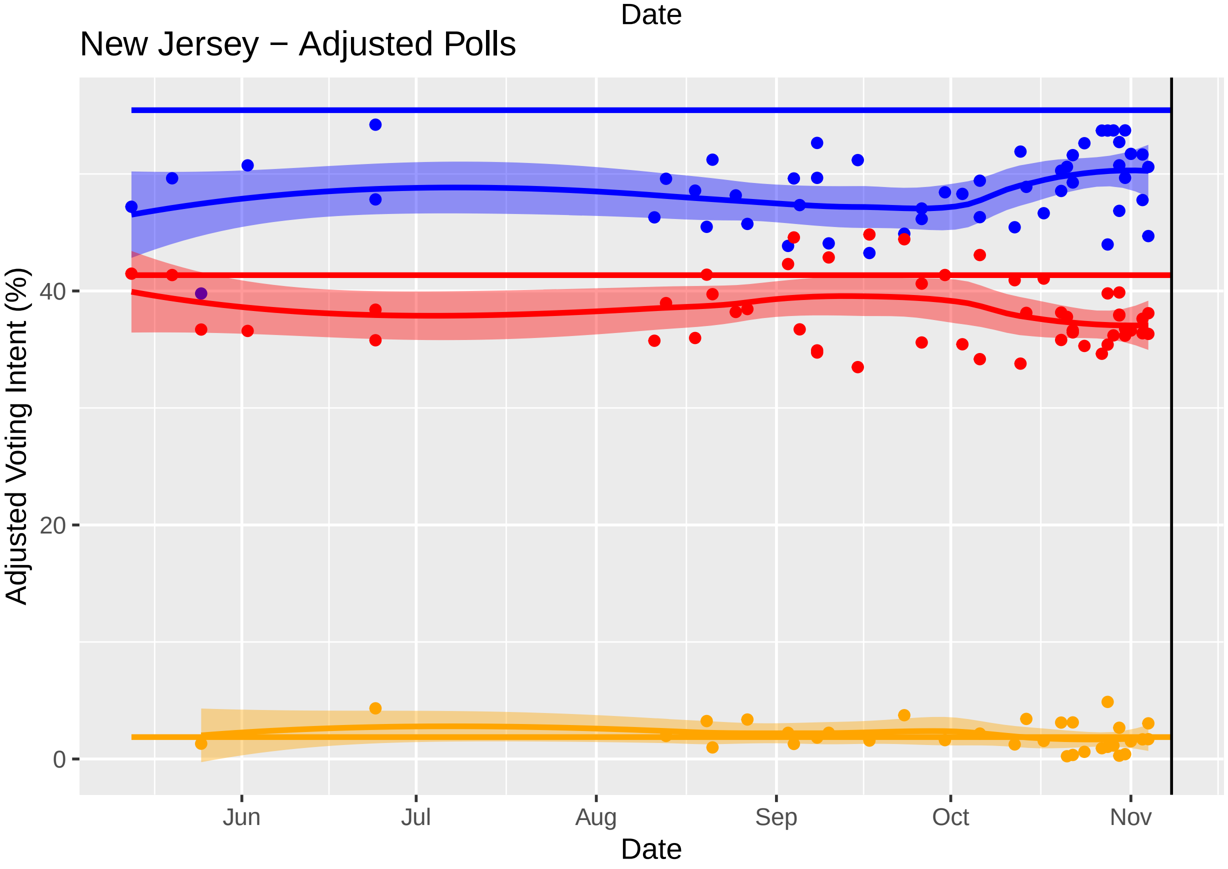
Nevada − Adjusted Polls

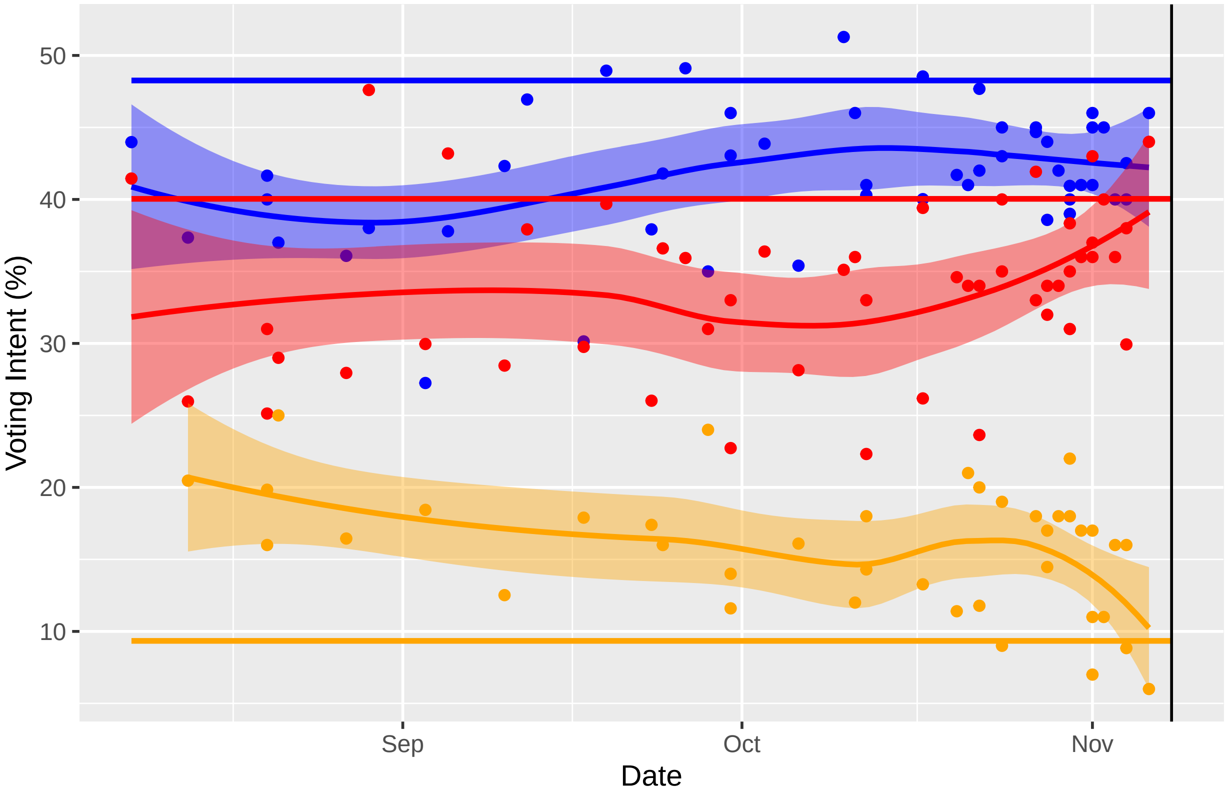


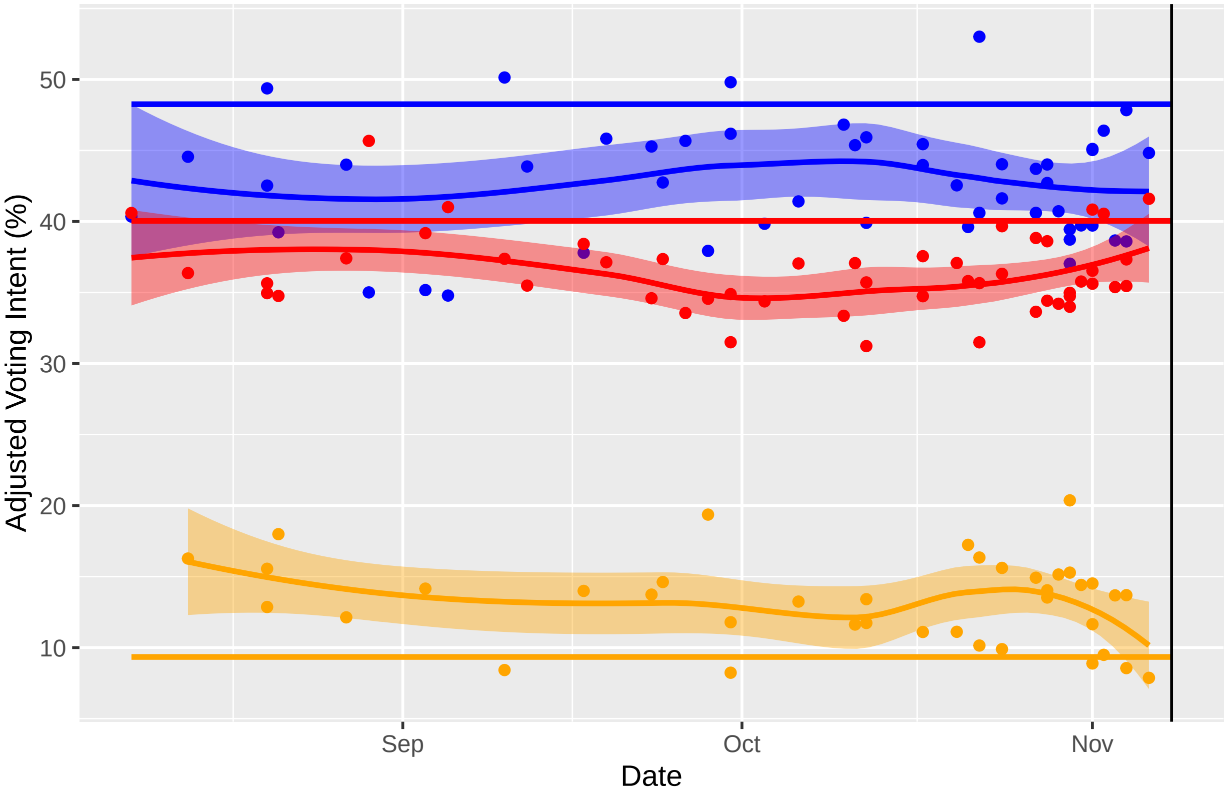

New Hampshire − Raw Polls
Voting Intent (%)
50
40
30
20
10
Jun
Jul
Aug
Sep
Oct
Nov
Date


New Hampshire − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Jun
Jul
Aug
Sep
Oct
Nov
Date

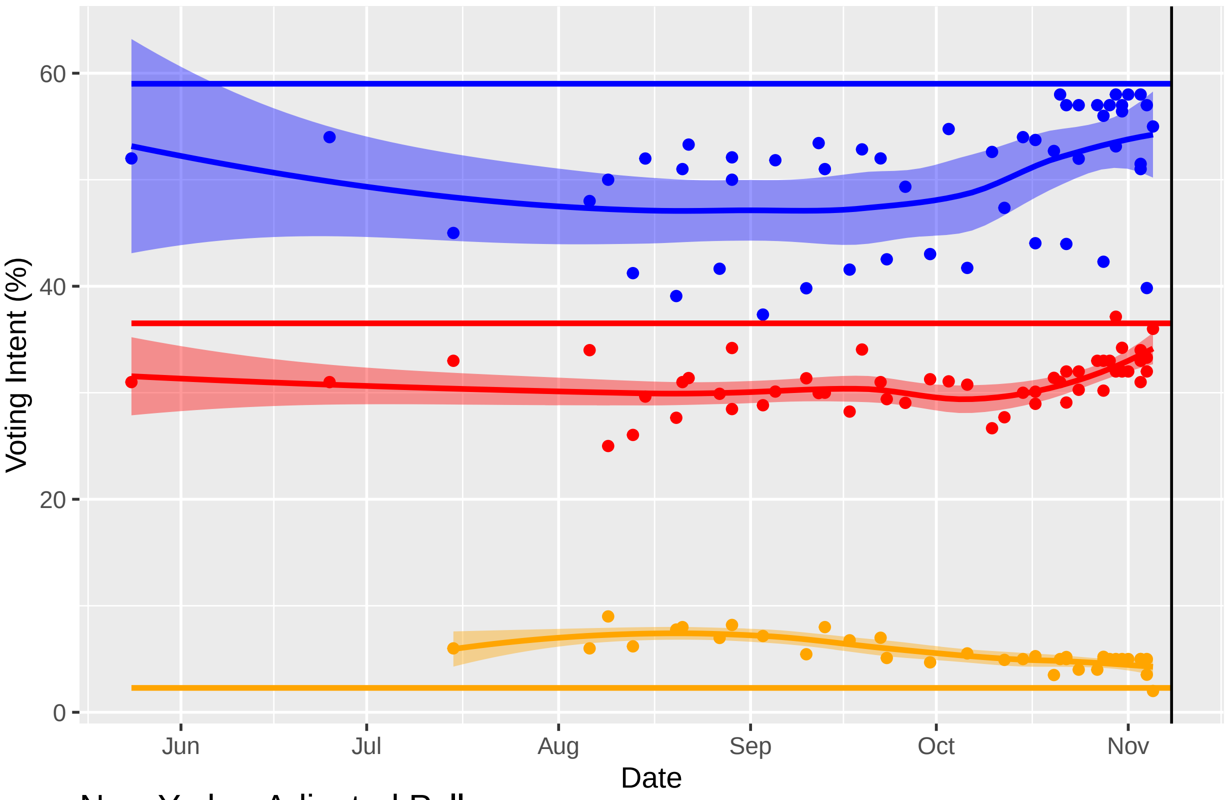

New Jersey − Raw Polls
Voting Intent (%)
0
20
40
Jun
Jul
Aug
Sep
Oct
Nov
Date


New Jersey − Adjusted Polls
Adjusted Voting Intent (%)
0
20
40
Jun
Jul
Aug
Sep
Oct
Nov
Date

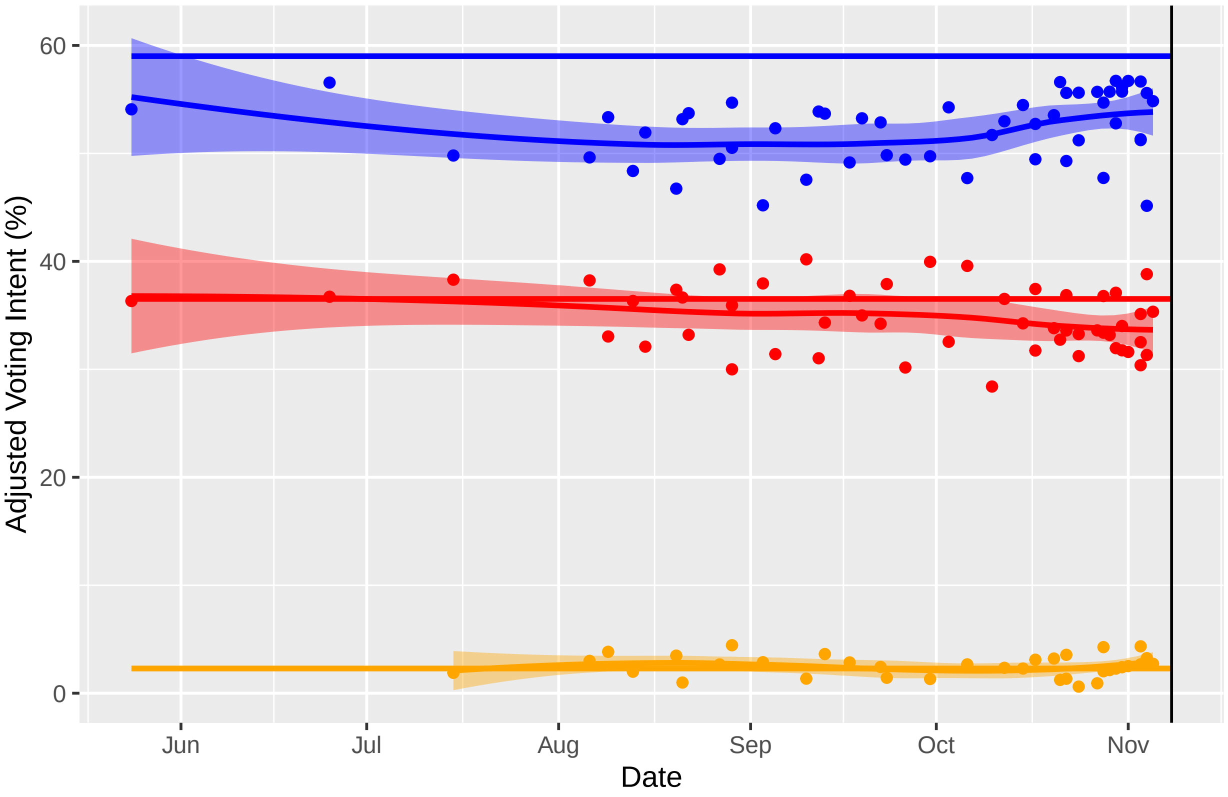

New Mexico − Raw Polls


New Mexico − Adjusted Polls

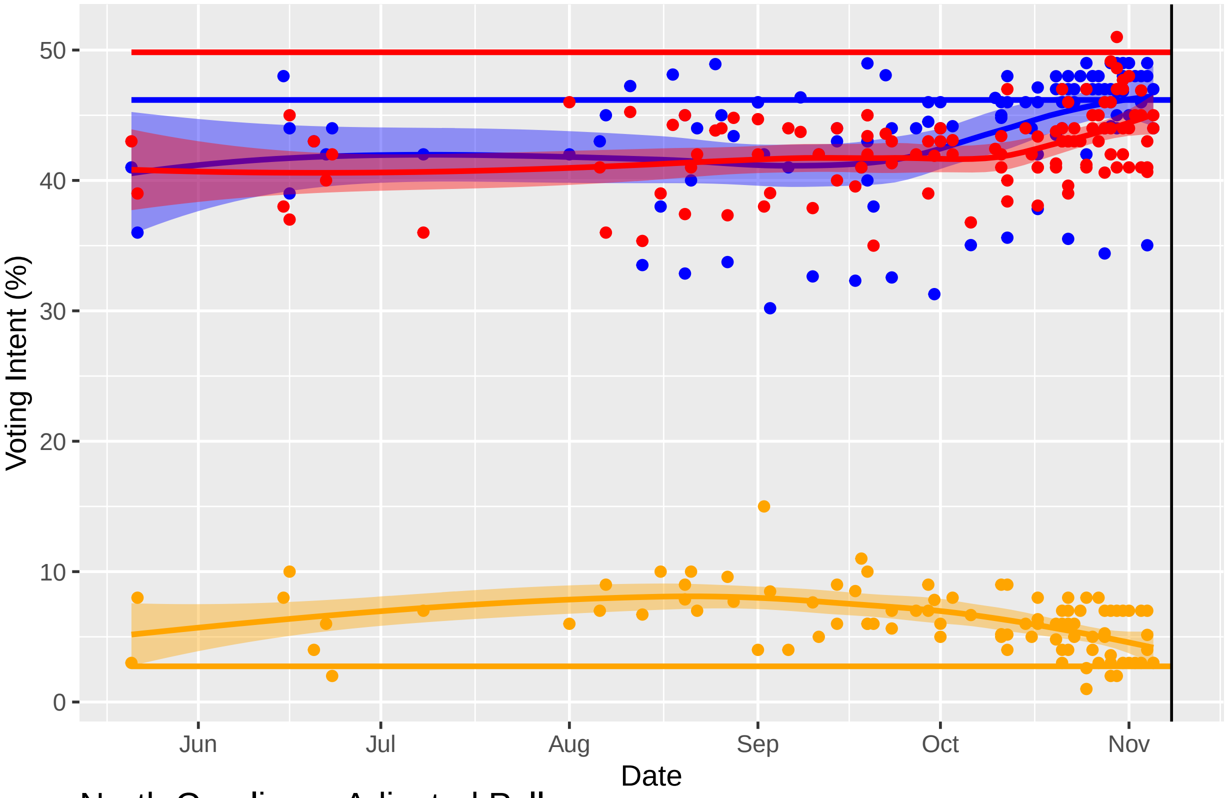
New York − Raw Polls



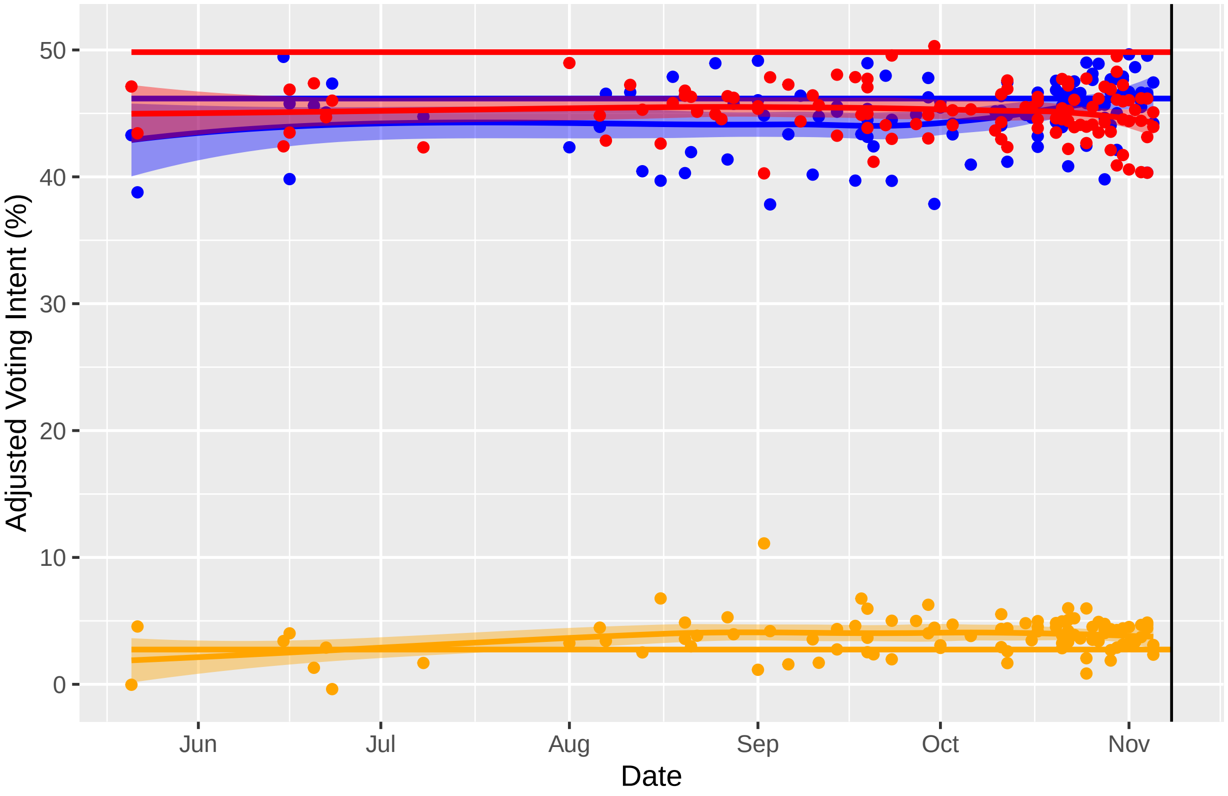
New York − Adjusted Polls

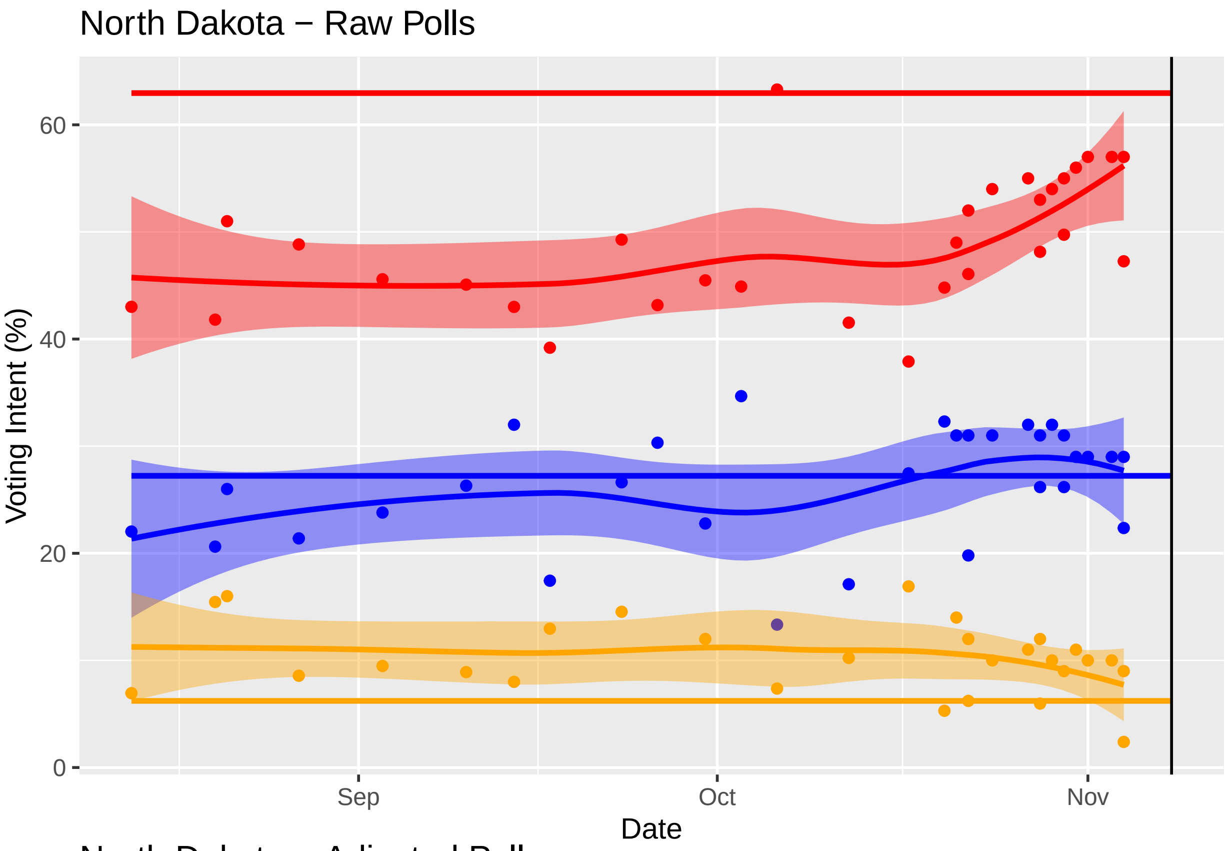


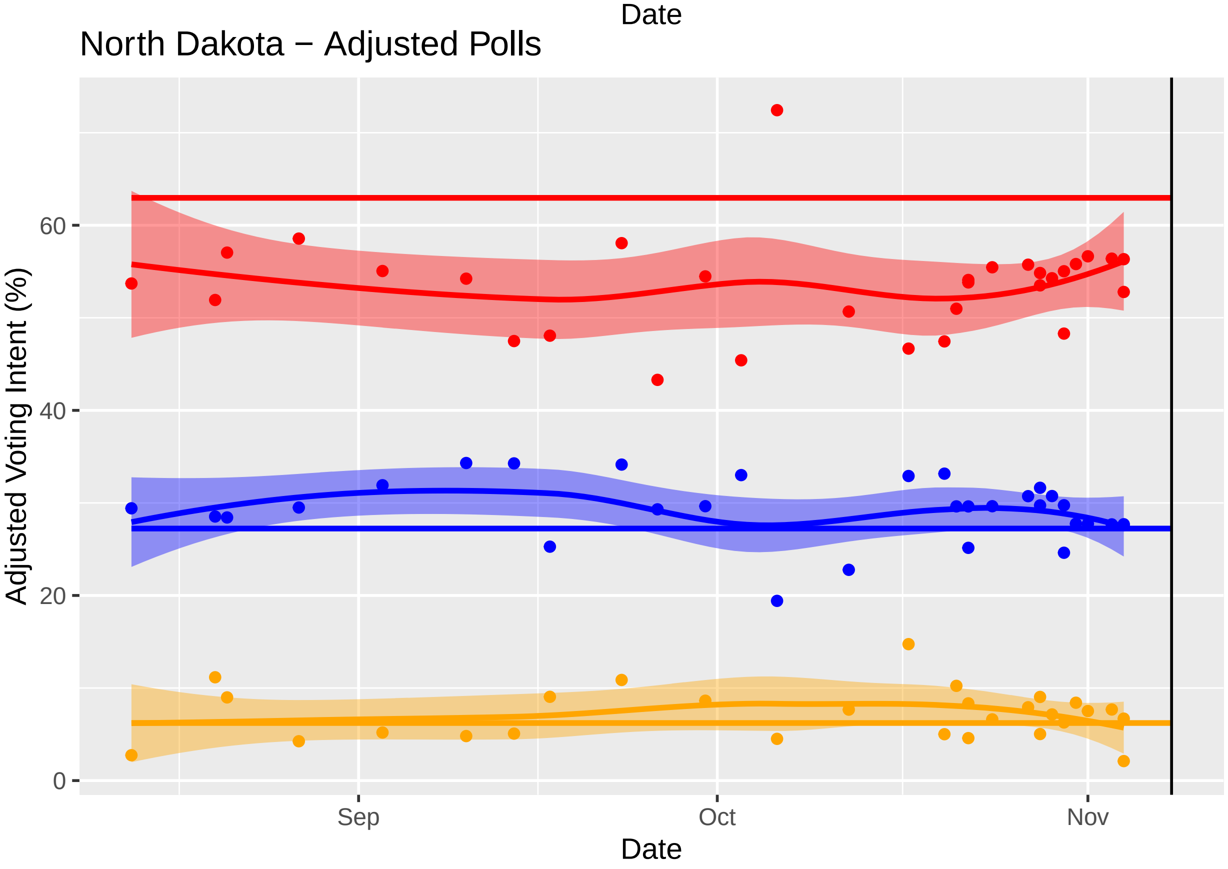
North Carolina − Raw Polls

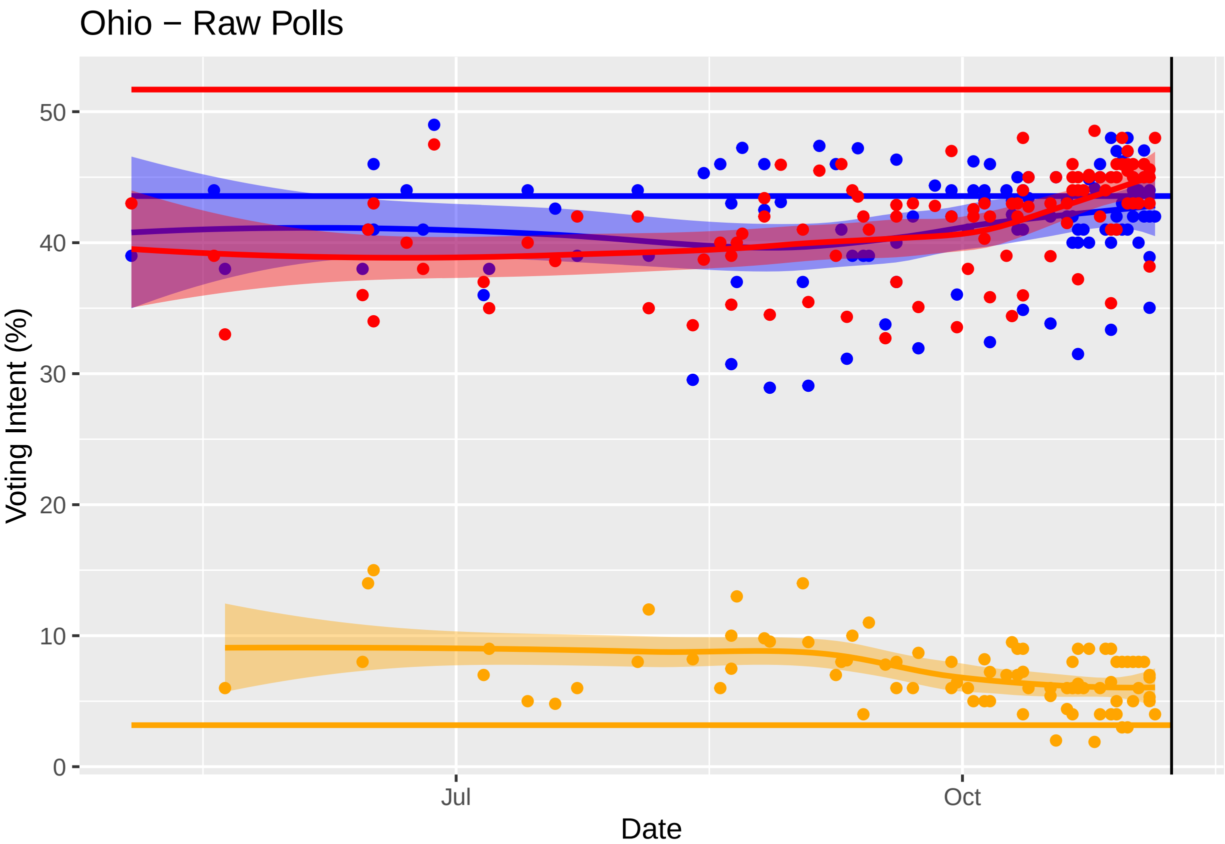


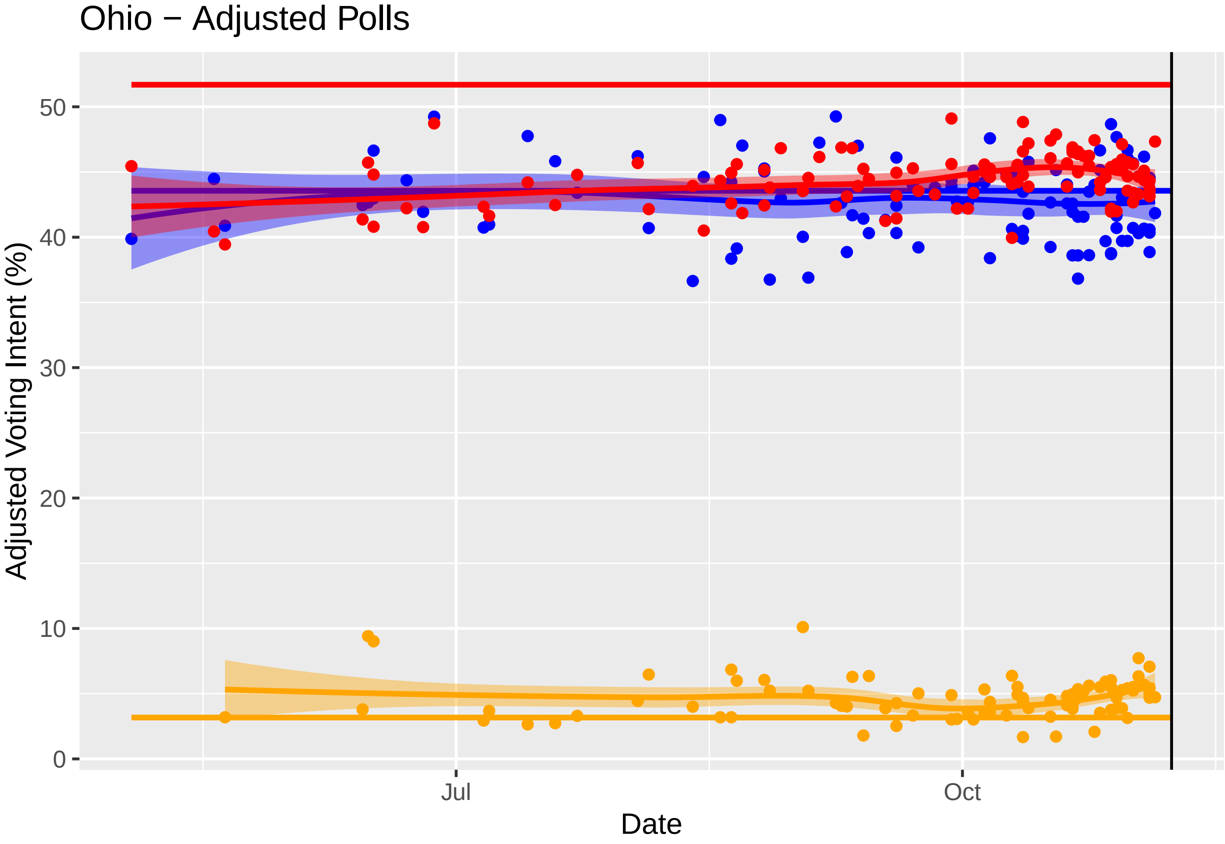
North Carolina − Adjusted Polls



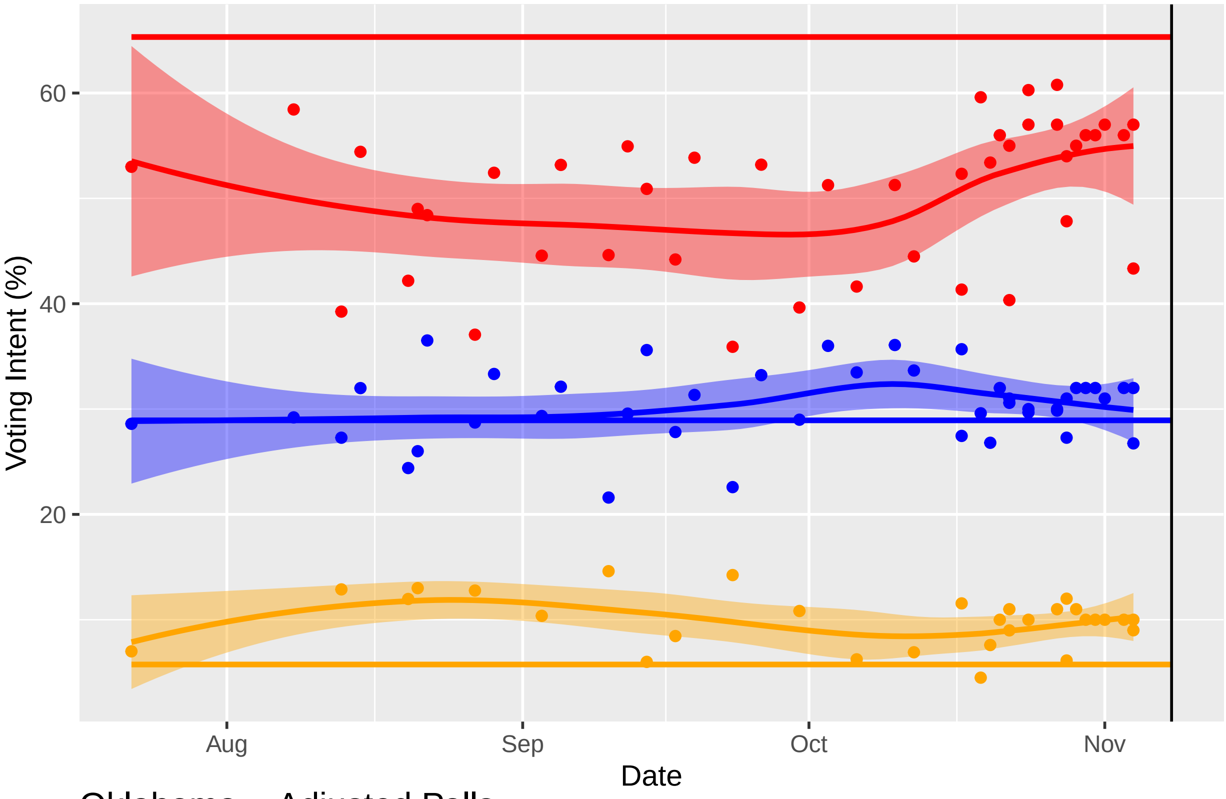

North Dakota − Raw Polls
Voting Intent (%)
0
20
40
60
Sep
Oct
Nov
Date


North Dakota − Adjusted Polls
Adjusted Voting Intent (%)
0
20
40
60
Sep
Oct
Nov
Date

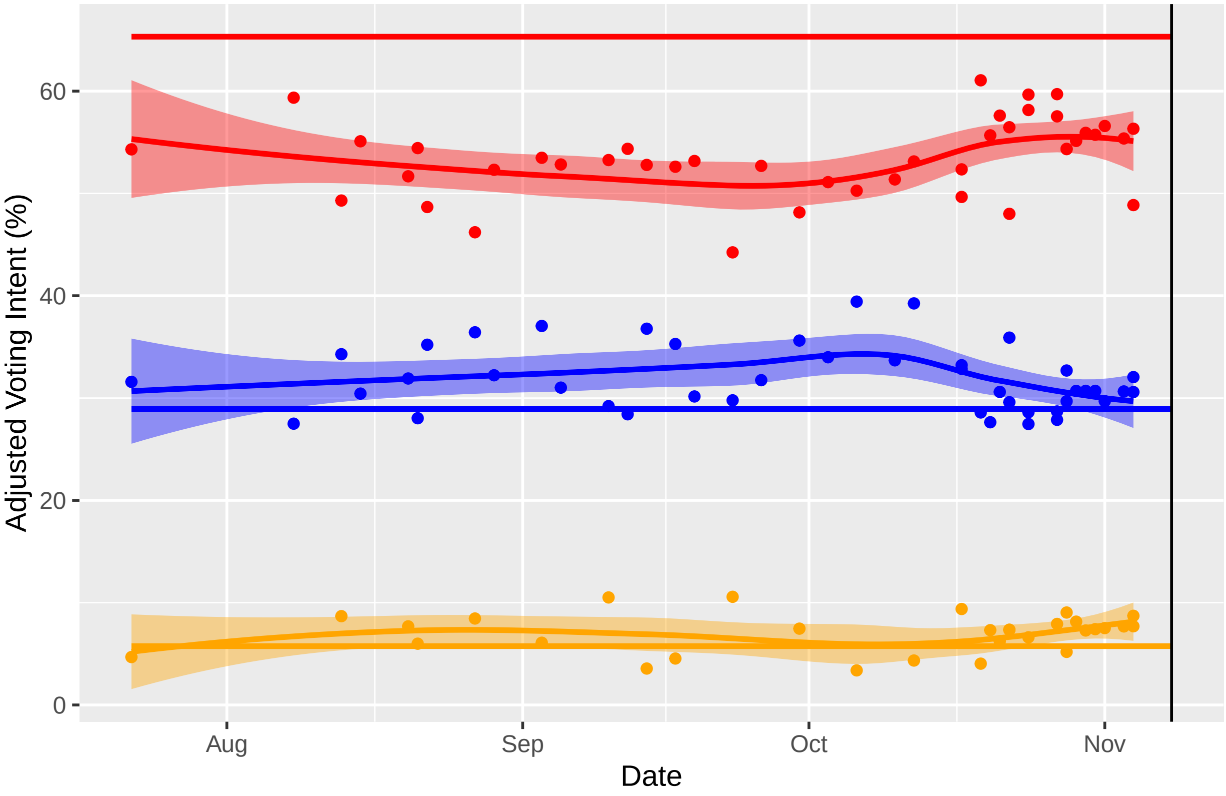

Ohio − Raw Polls

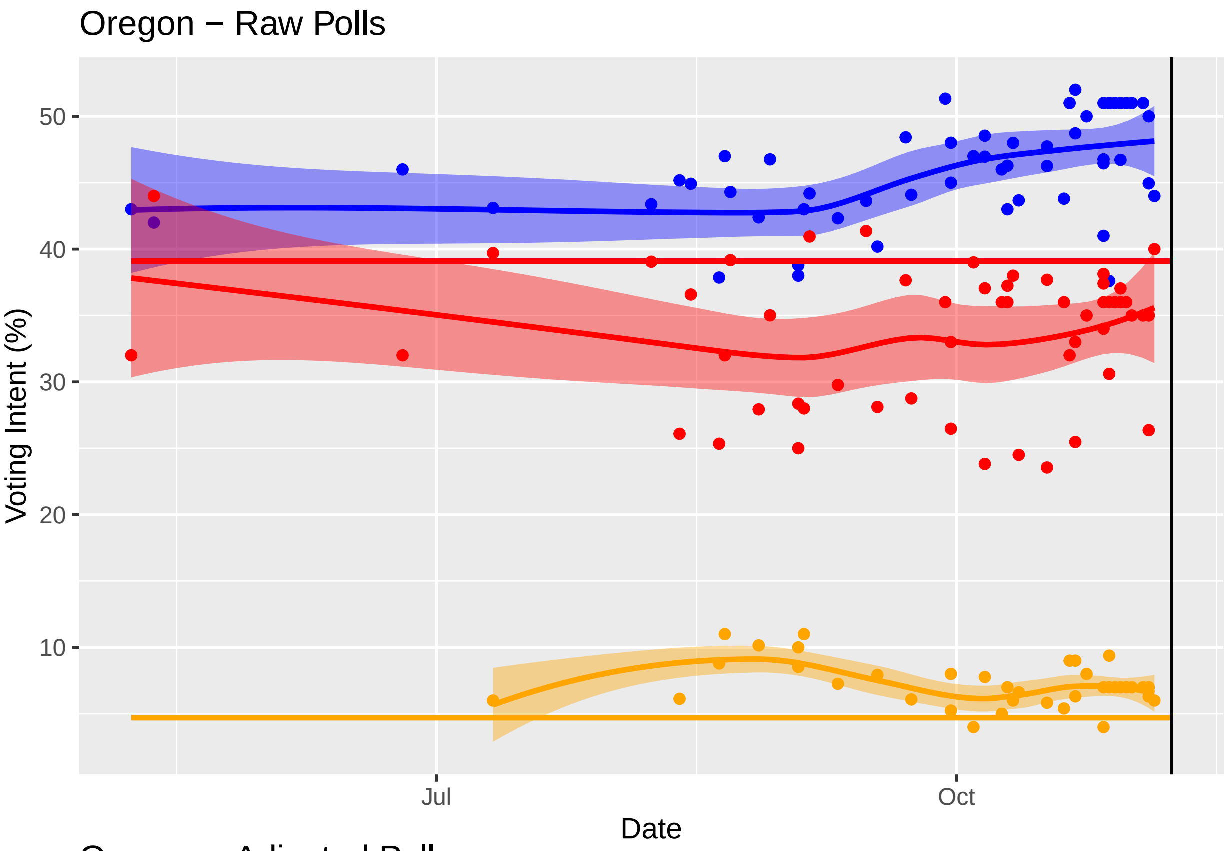

Ohio − Adjusted Polls

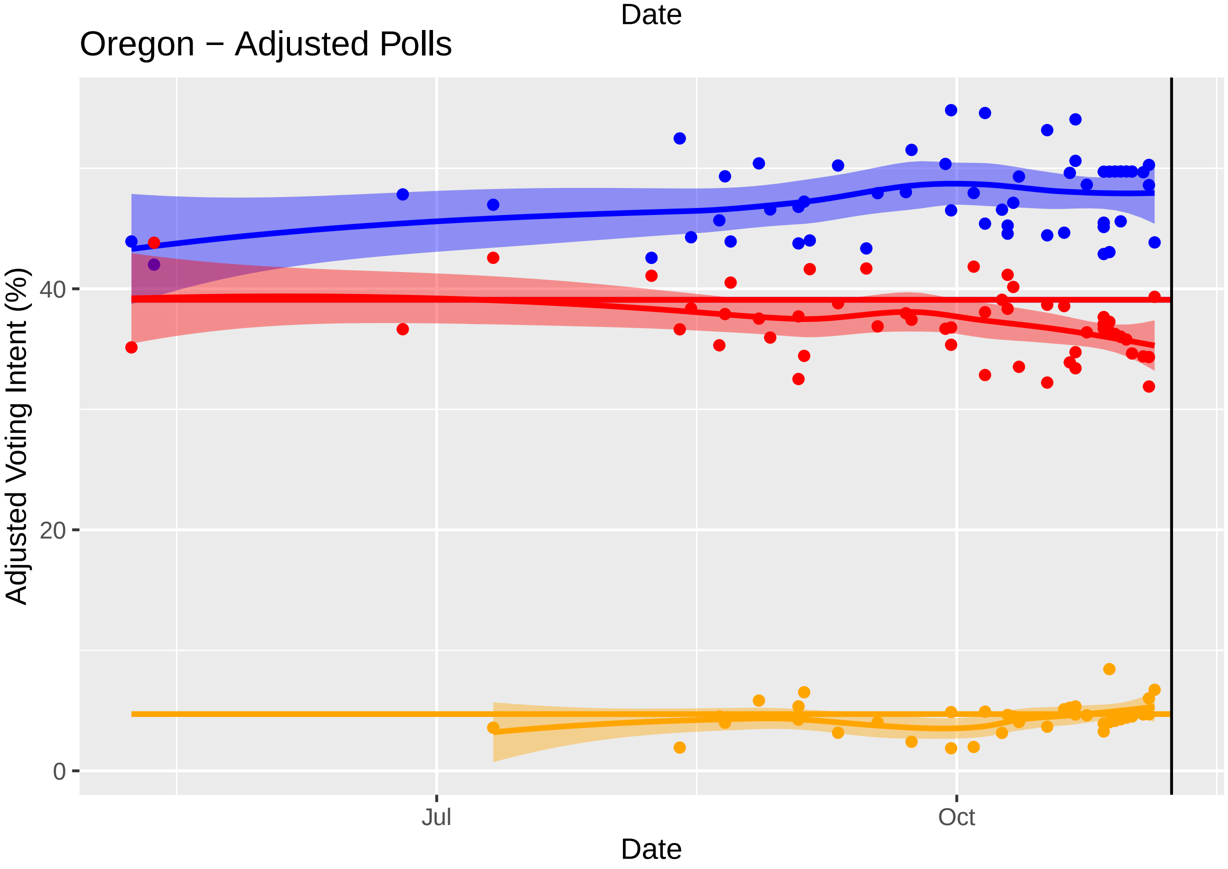
Oklahoma − Raw Polls



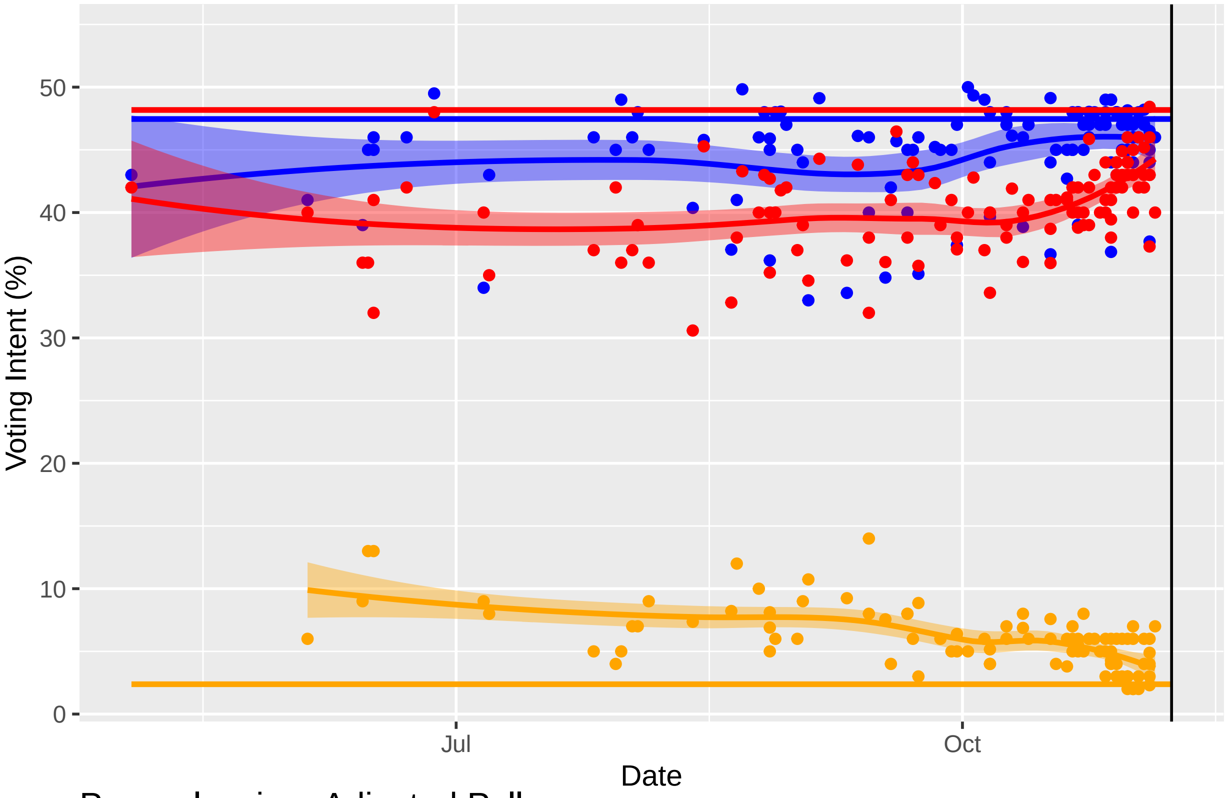
Oklahoma − Adjusted Polls



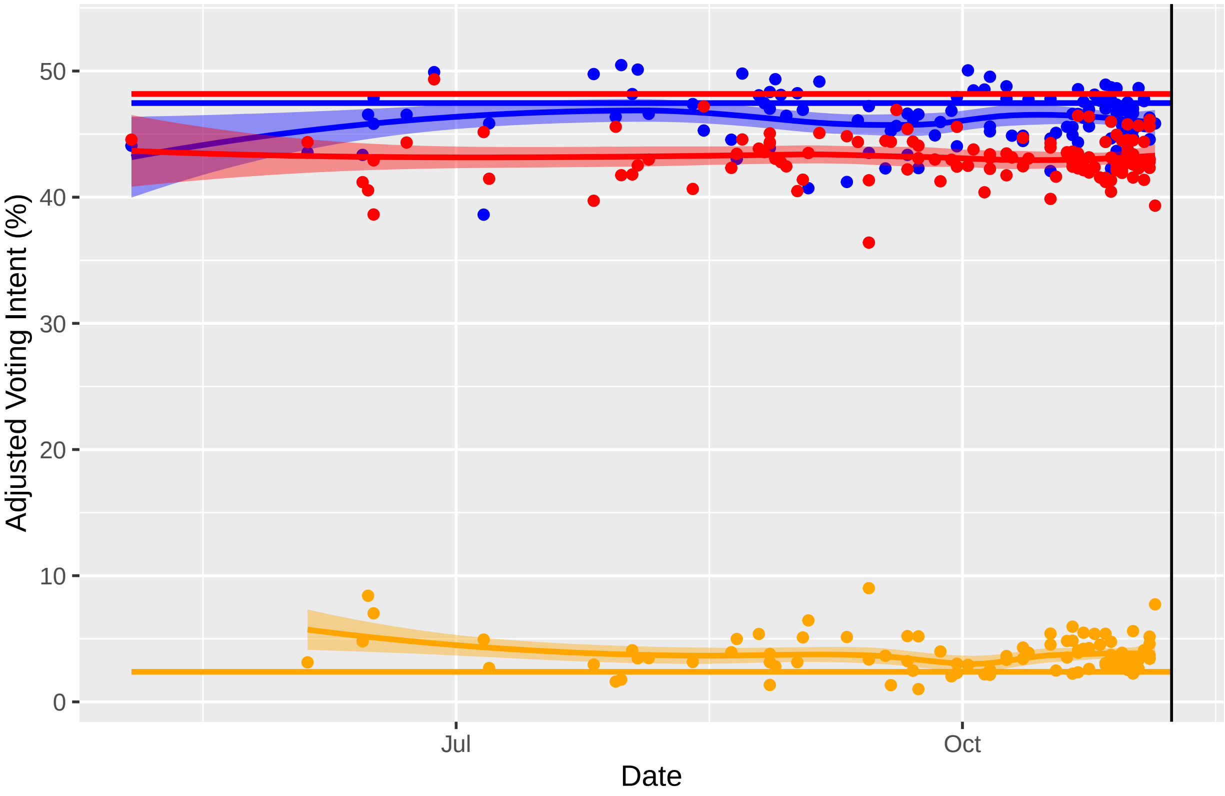

Oregon − Raw Polls
Voting Intent (%)
50
40
30
20
10
Jul
Oct
Date


Oregon − Adjusted Polls
Adjusted Voting Intent (%)
40
20
0
Jul
Oct
Date

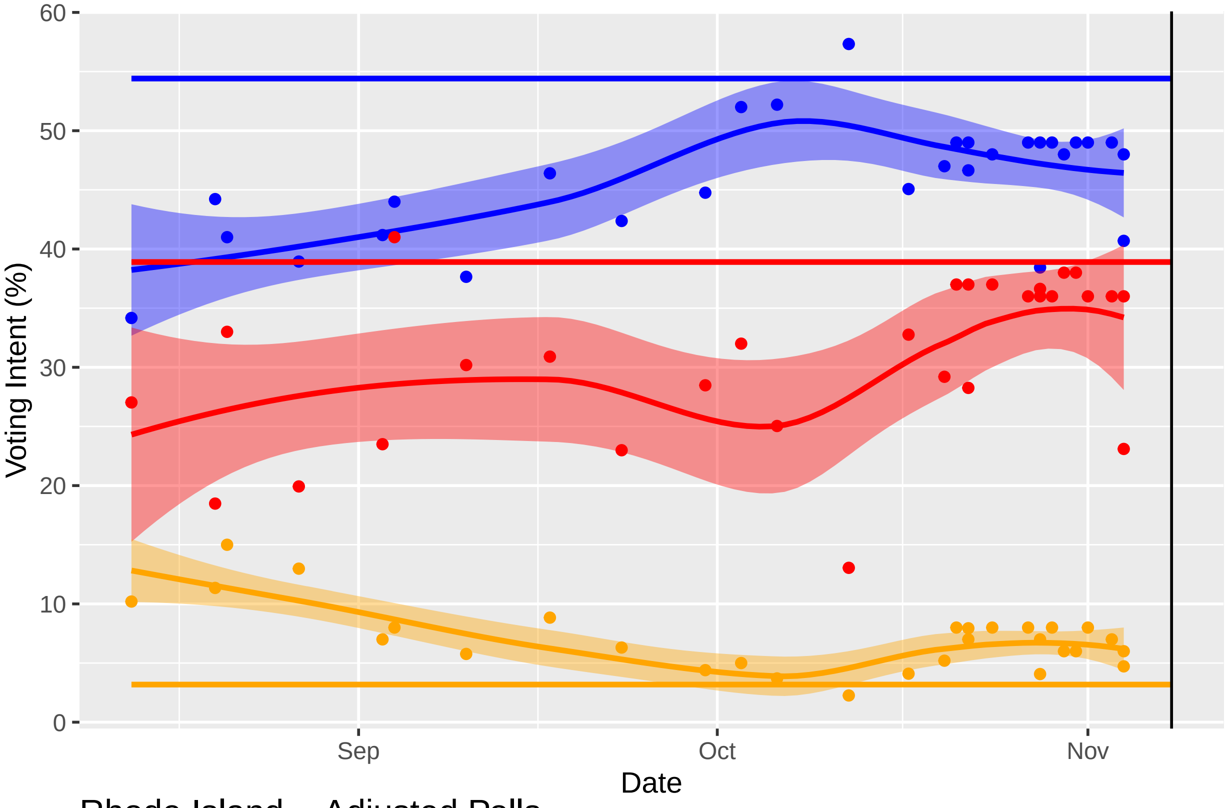
Pennsylvania − Raw Polls



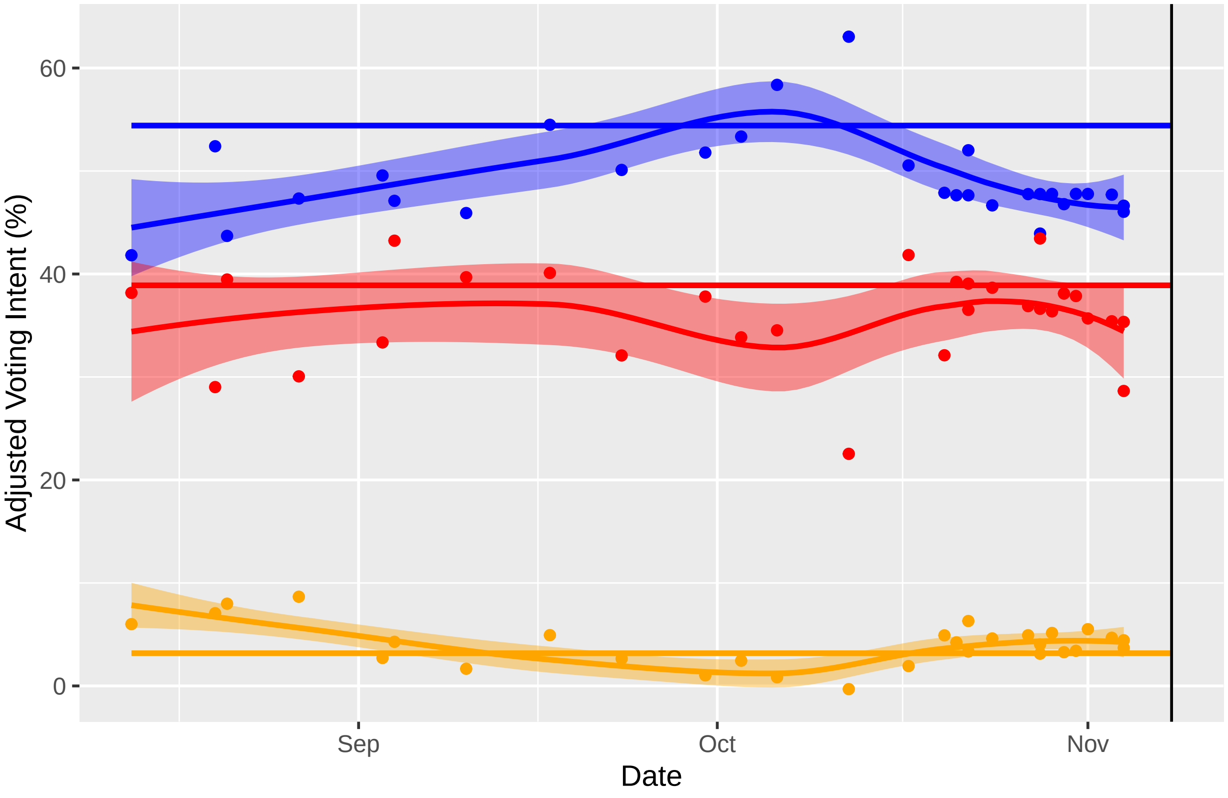
Pennsylvania − Adjusted Polls



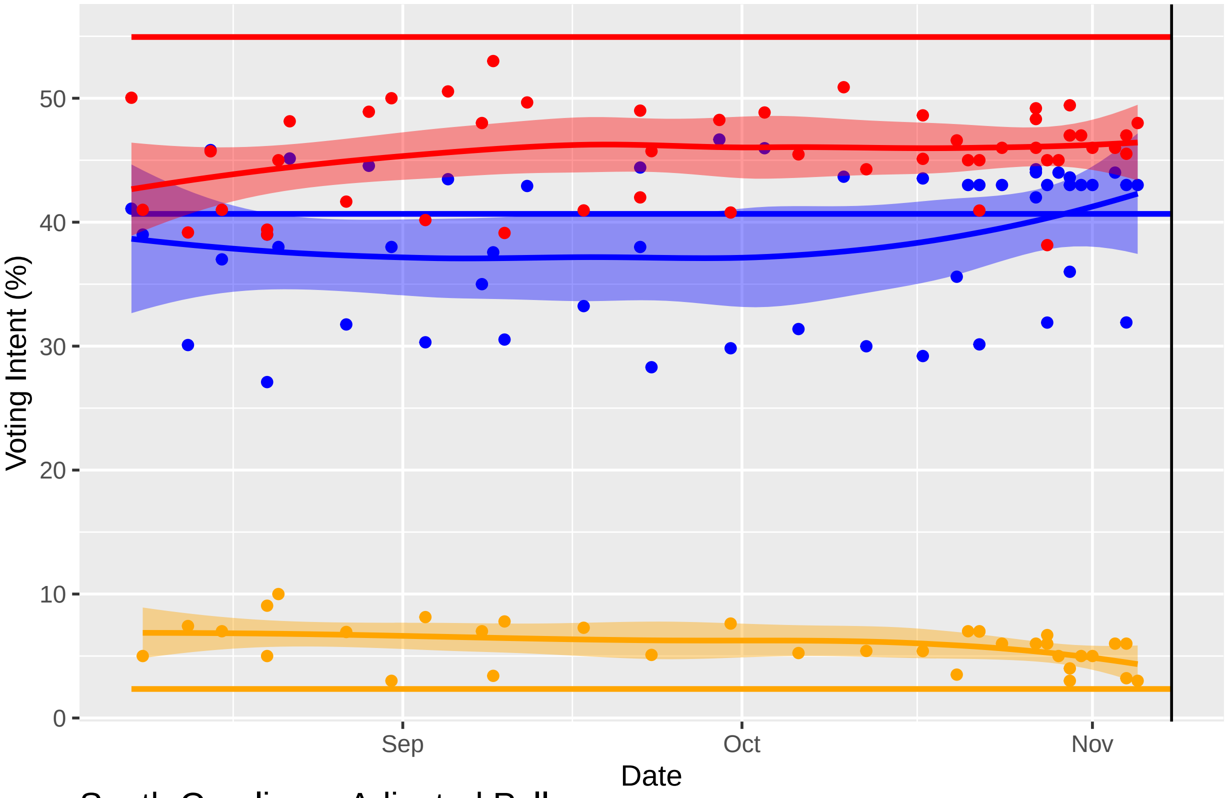
Rhode Island − Raw Polls



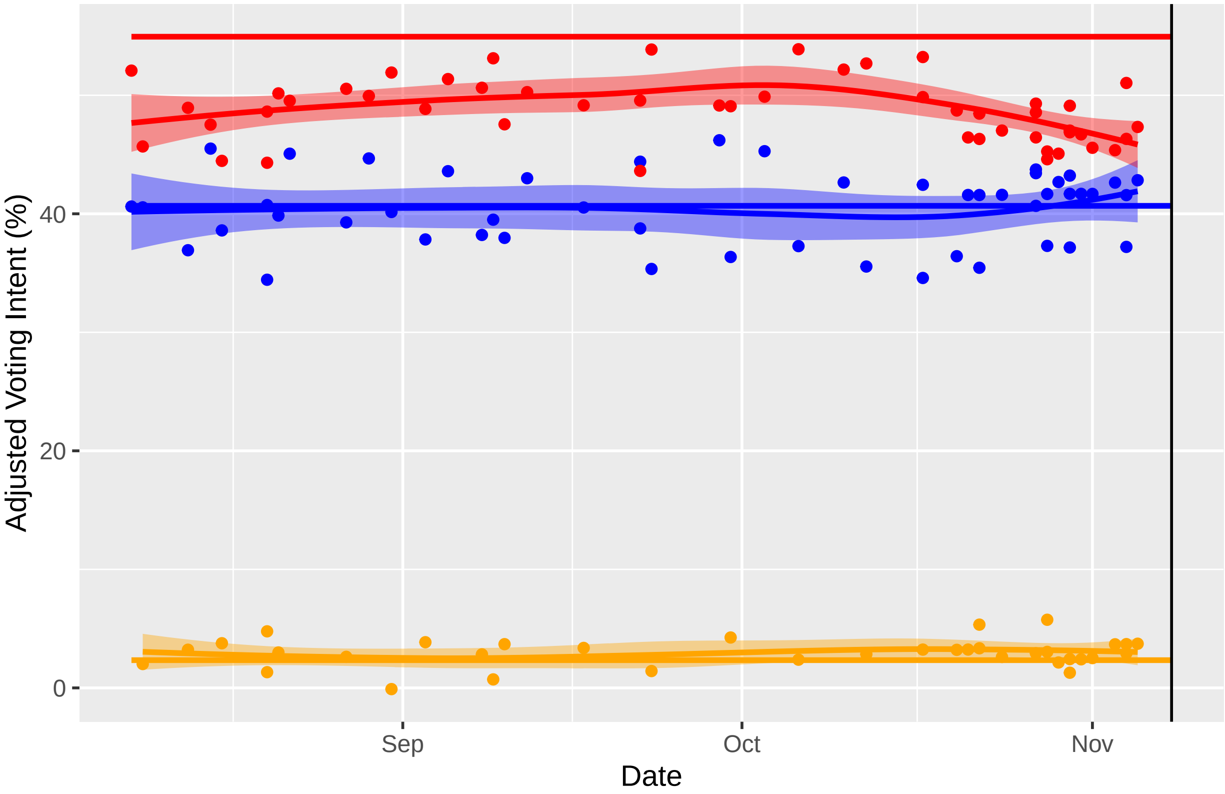
Rhode Island − Adjusted Polls

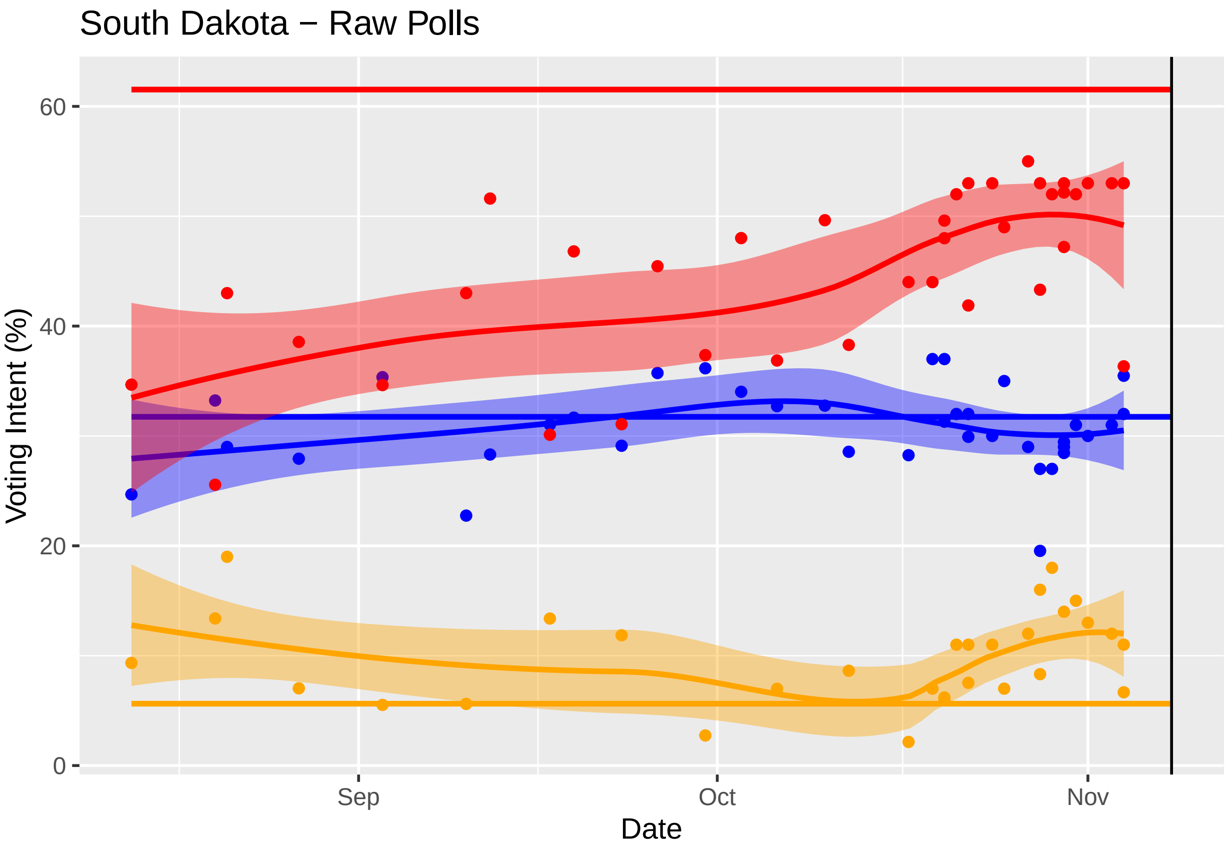


South Carolina − Raw Polls

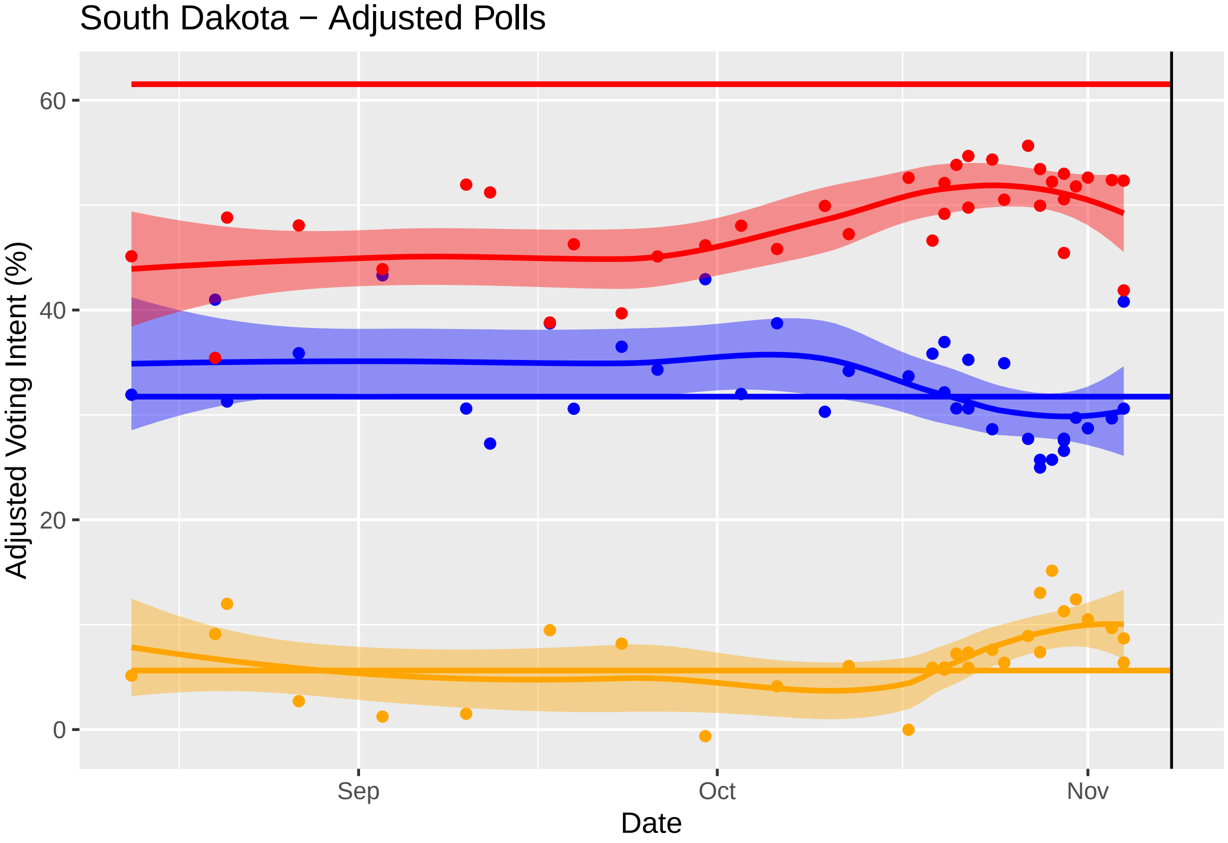


South Carolina − Adjusted Polls

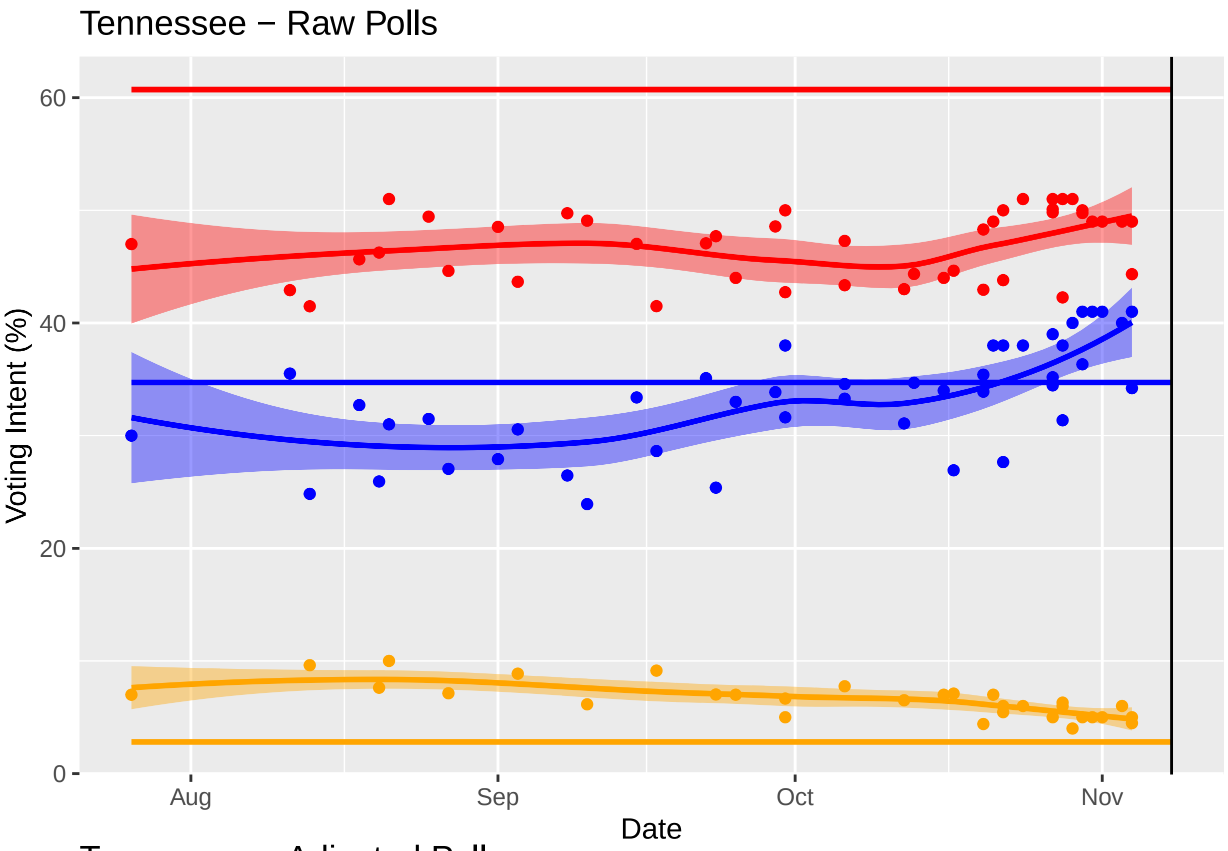


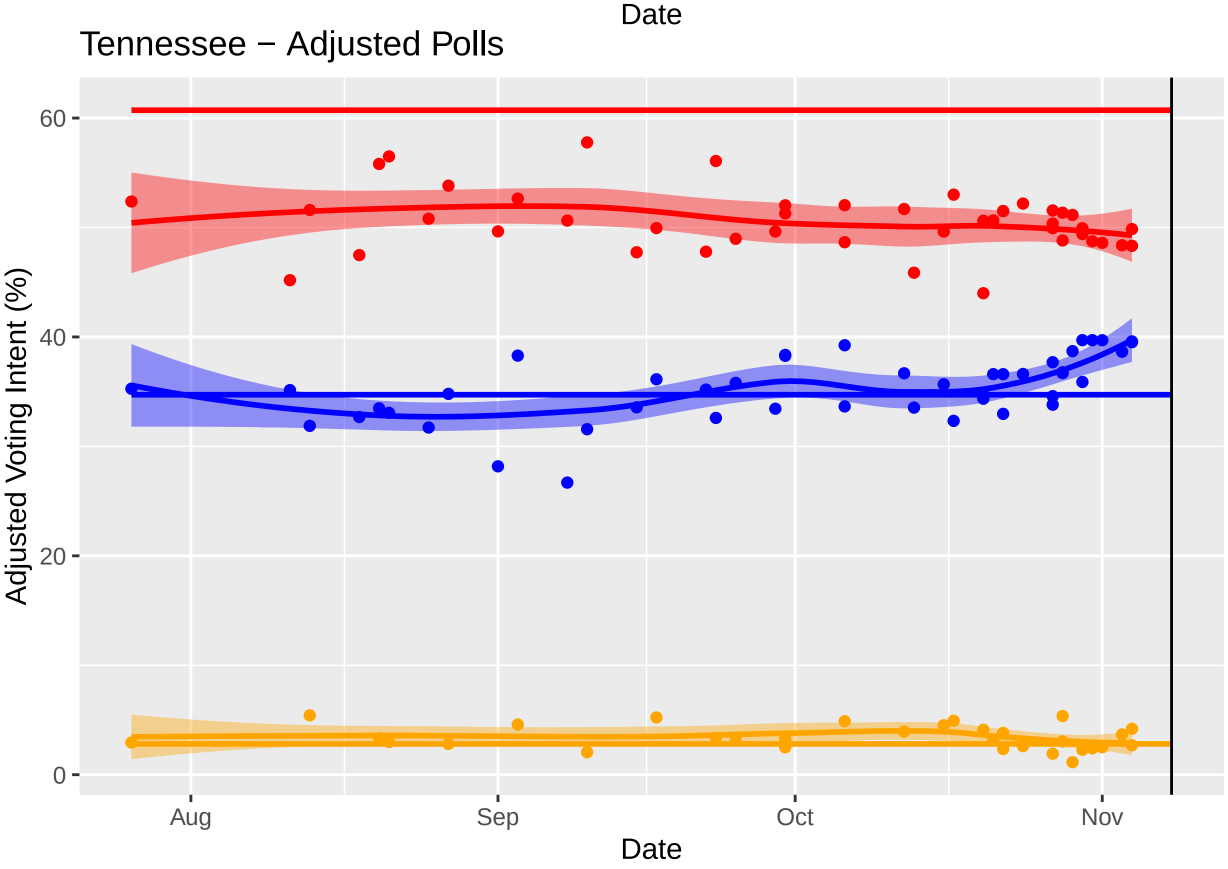


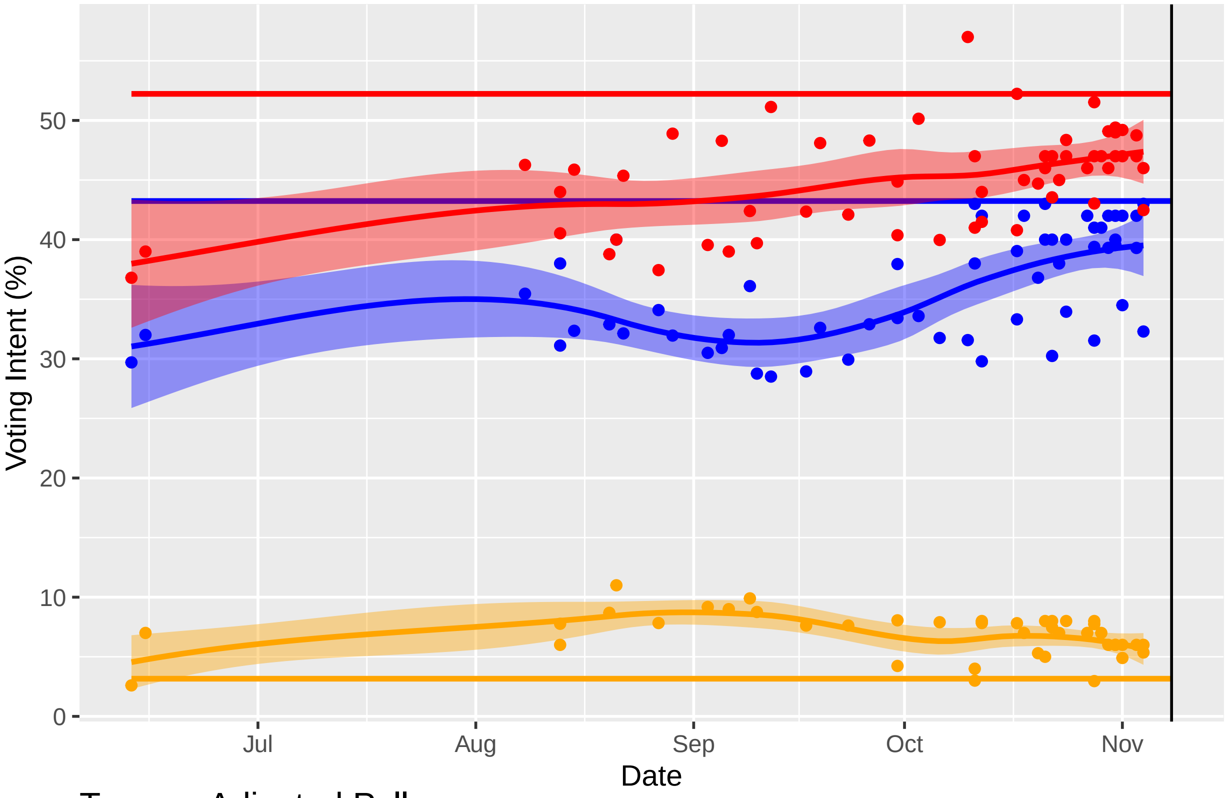
South Dakota − Raw Polls



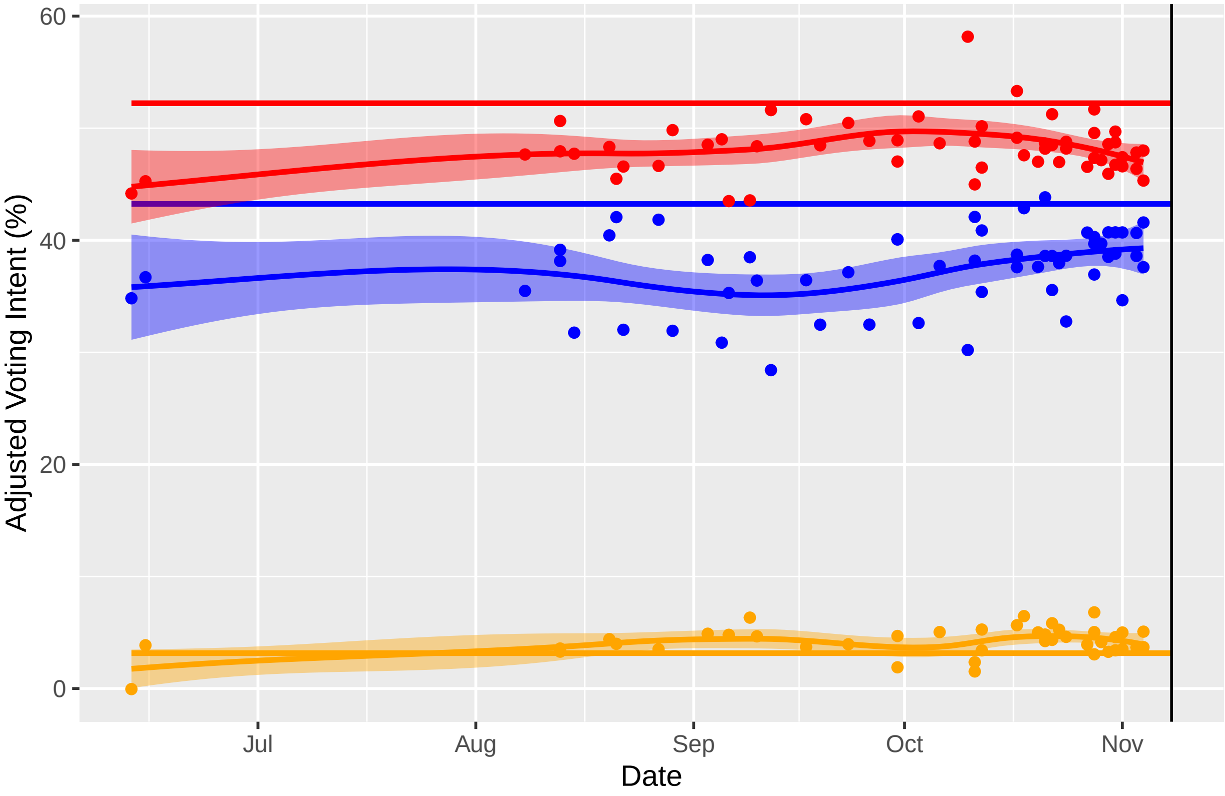
South Dakota − Adjusted Polls


Tennessee − Raw Polls
Voting Intent (%)
60
40
20
0
Aug
Sep
Oct
Nov
Date

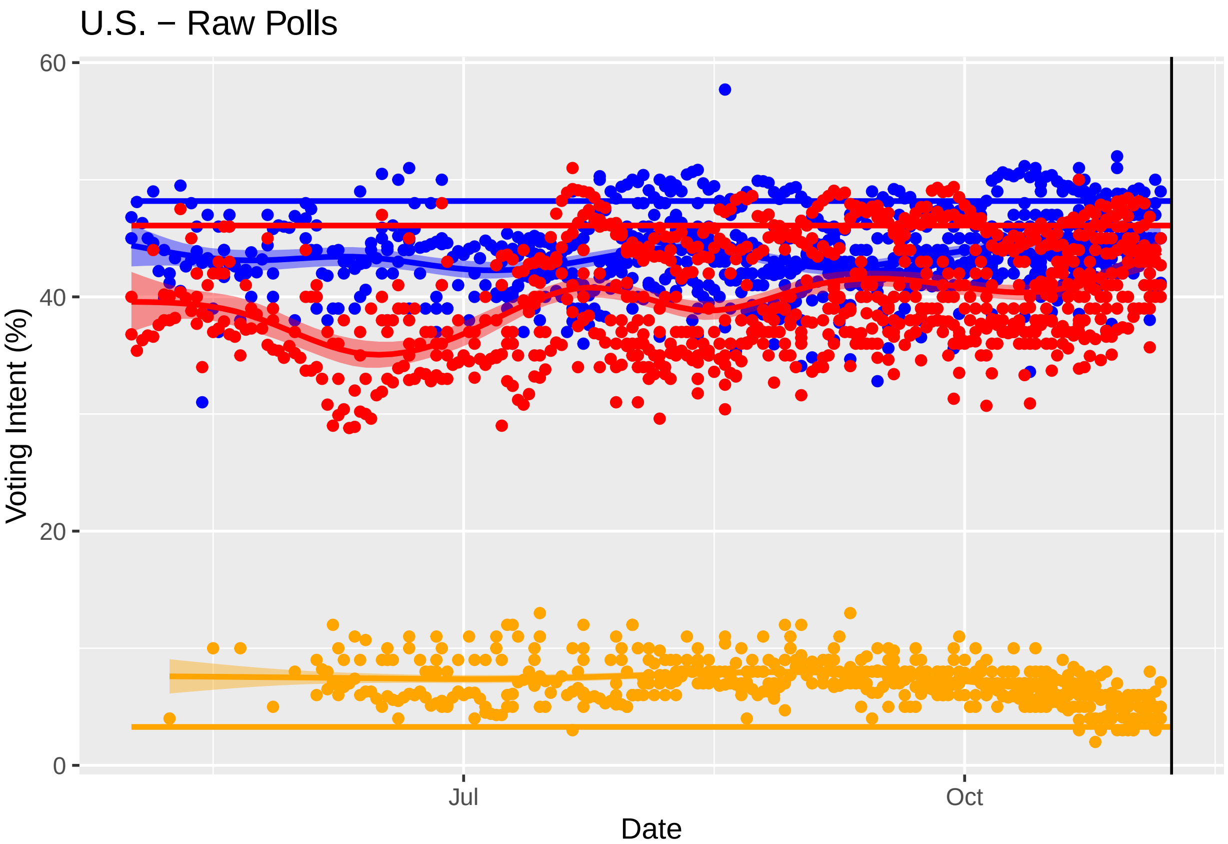

Tennessee − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Aug
Sep
Oct
Nov
Date



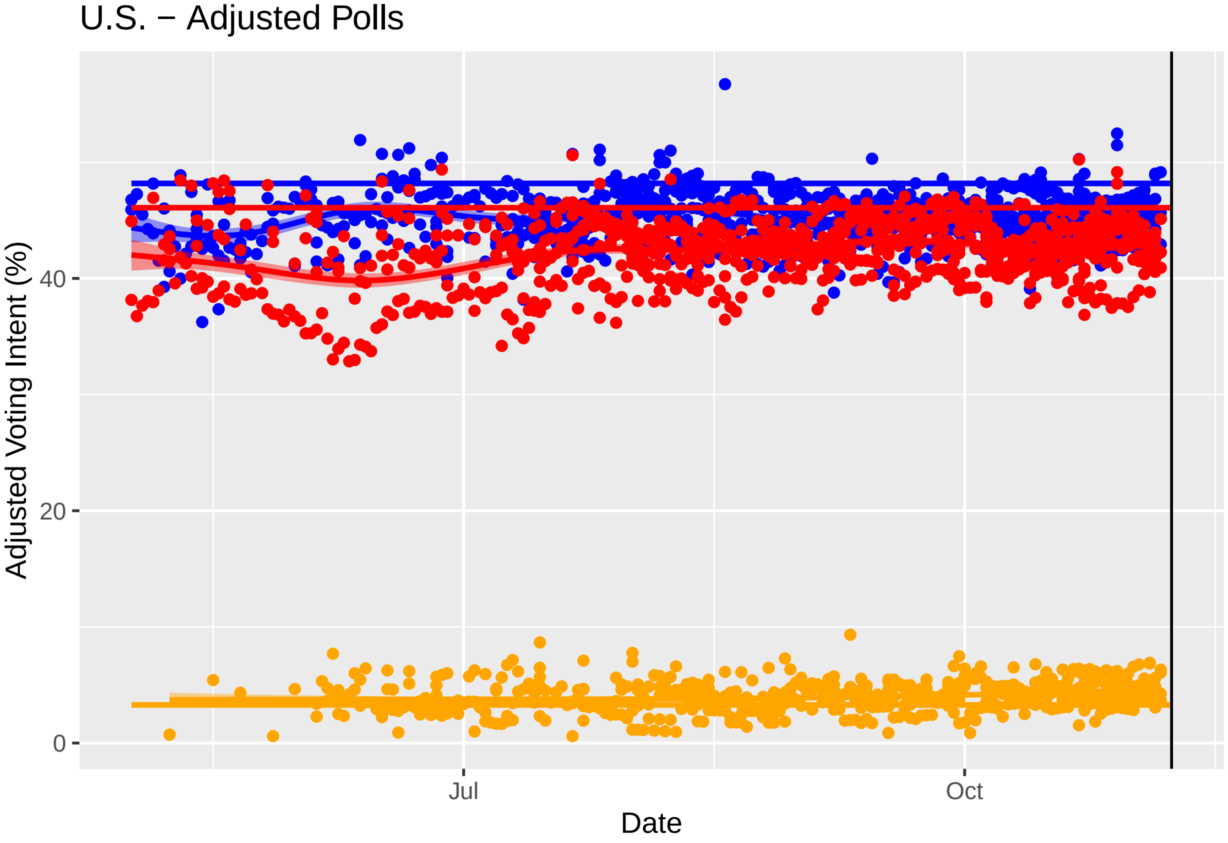
Texas − Raw Polls



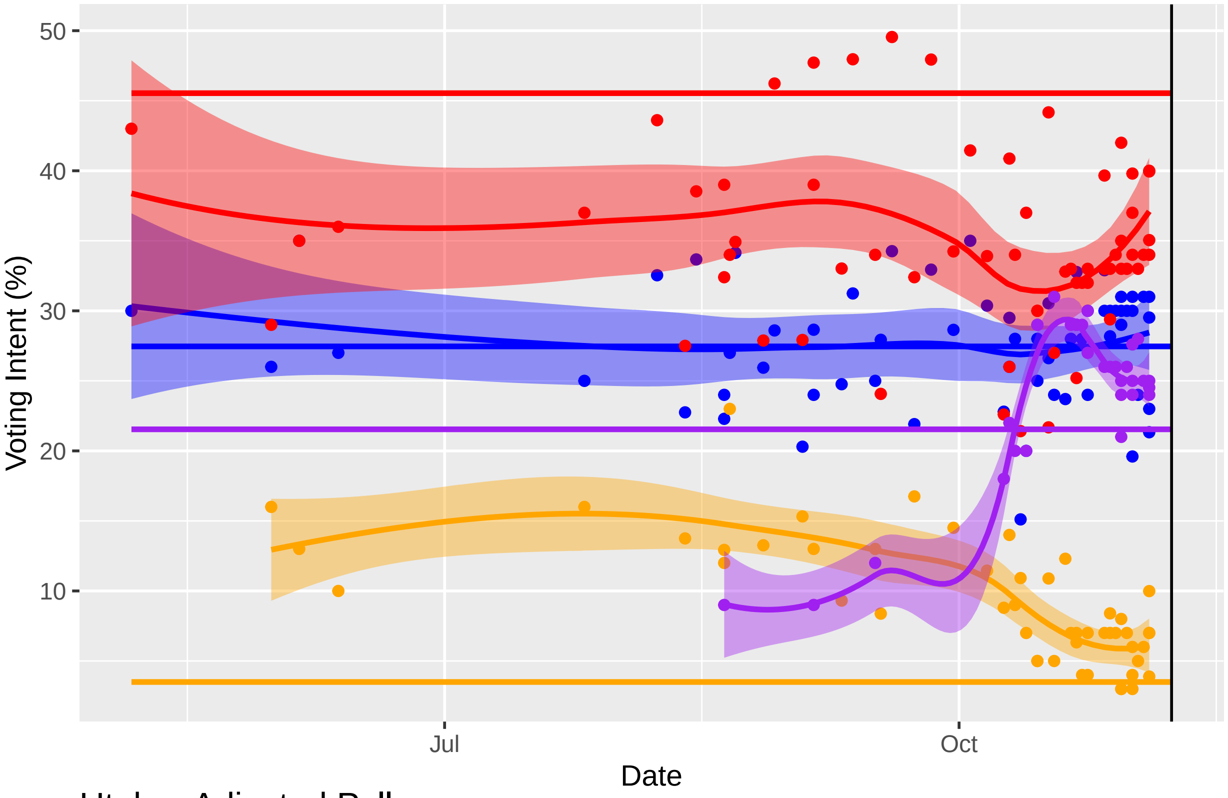
Texas − Adjusted Polls



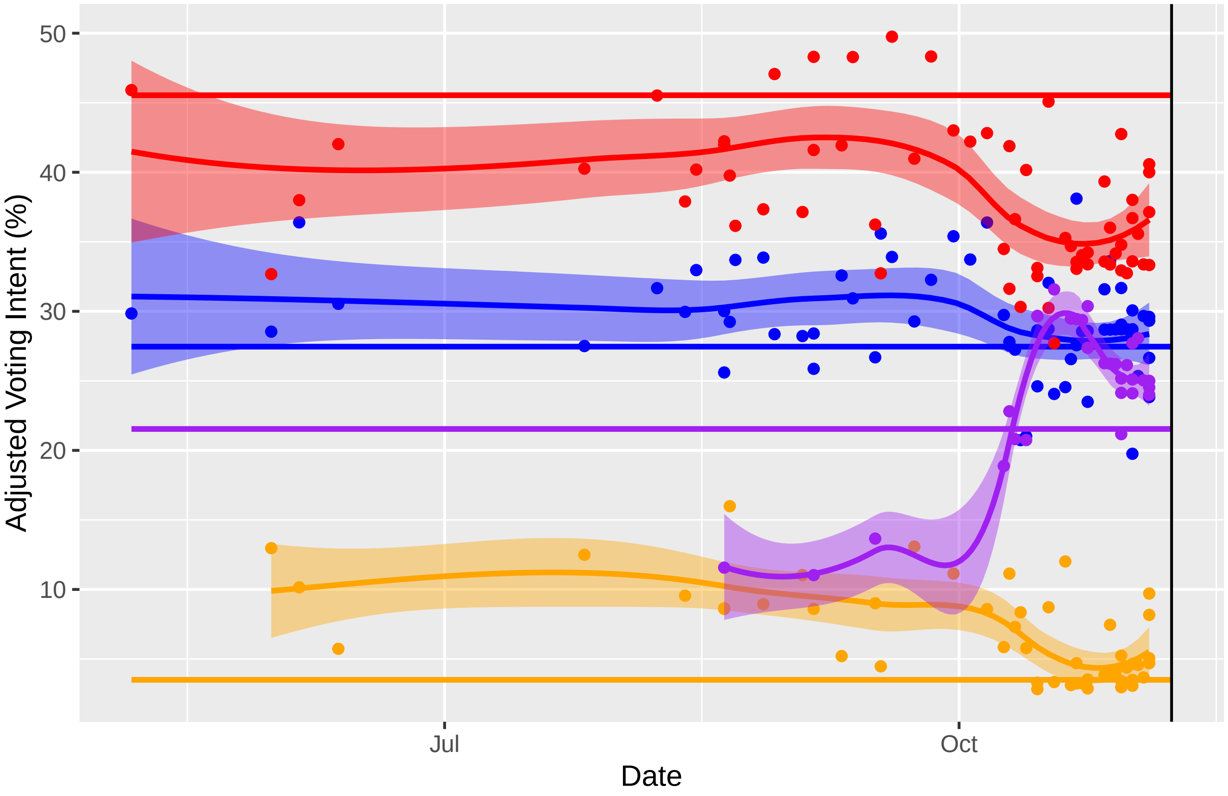
U.S. − Raw Polls



U.S. − Adjusted Polls

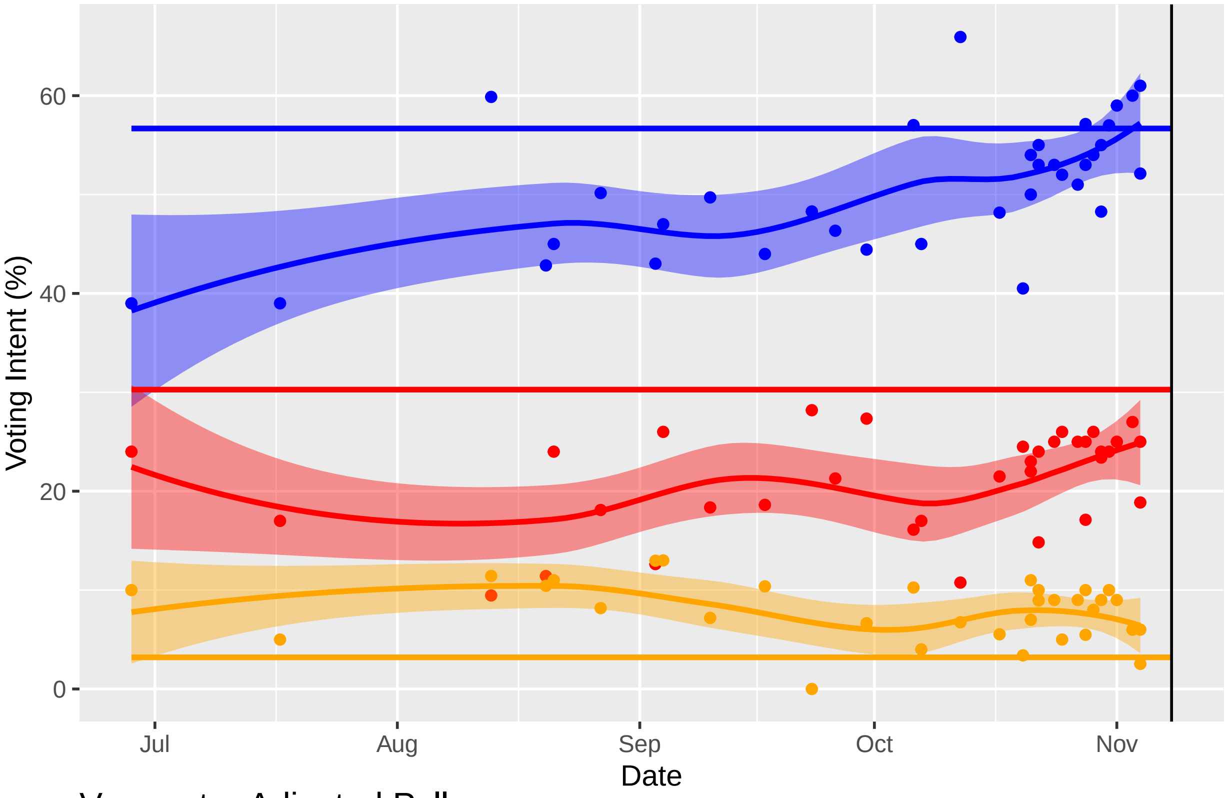


Utah − Raw Polls

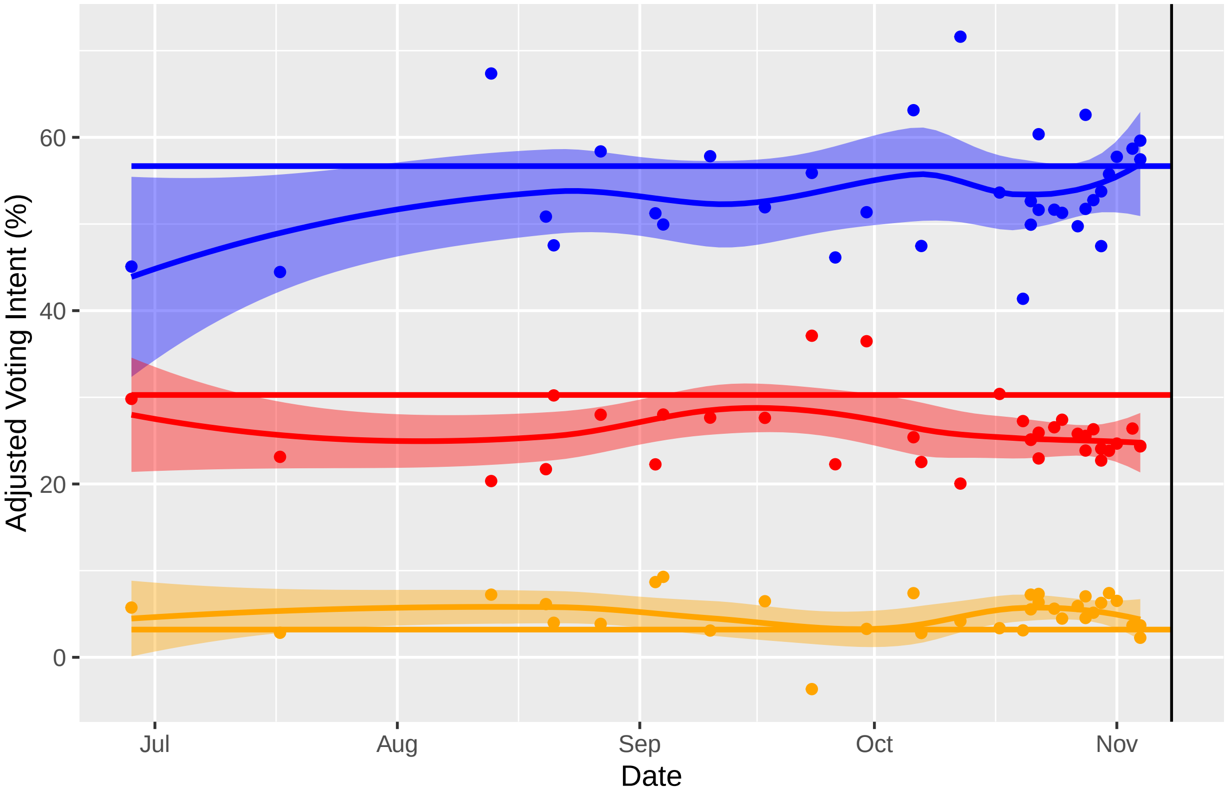


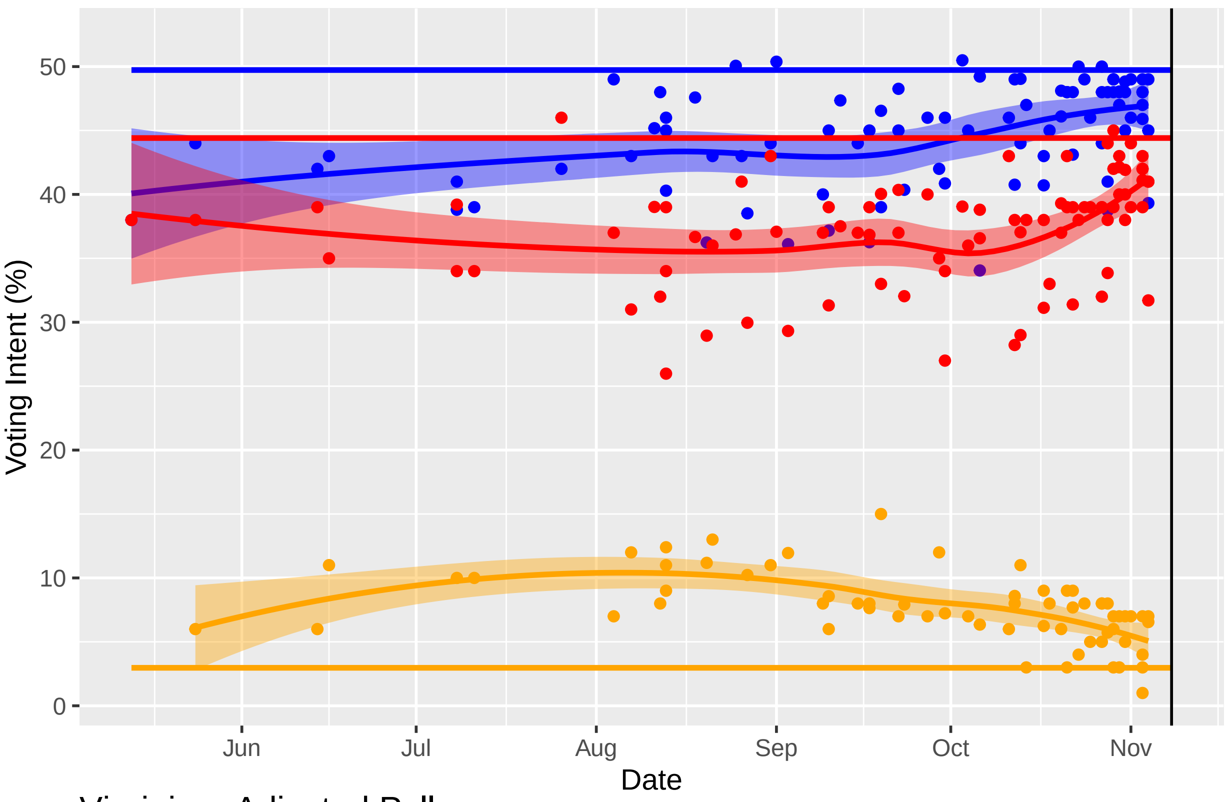
Utah − Adjusted Polls

Vermont − Raw Polls

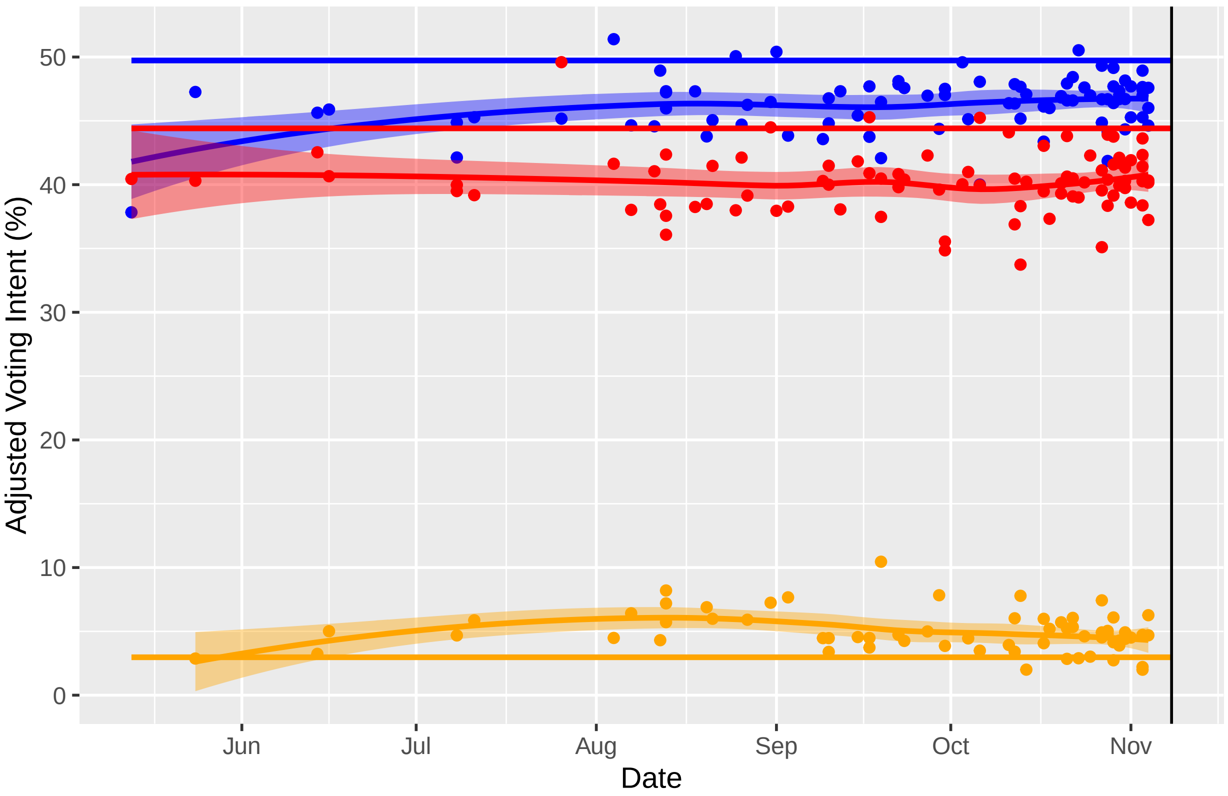


Vermont − Adjusted Polls

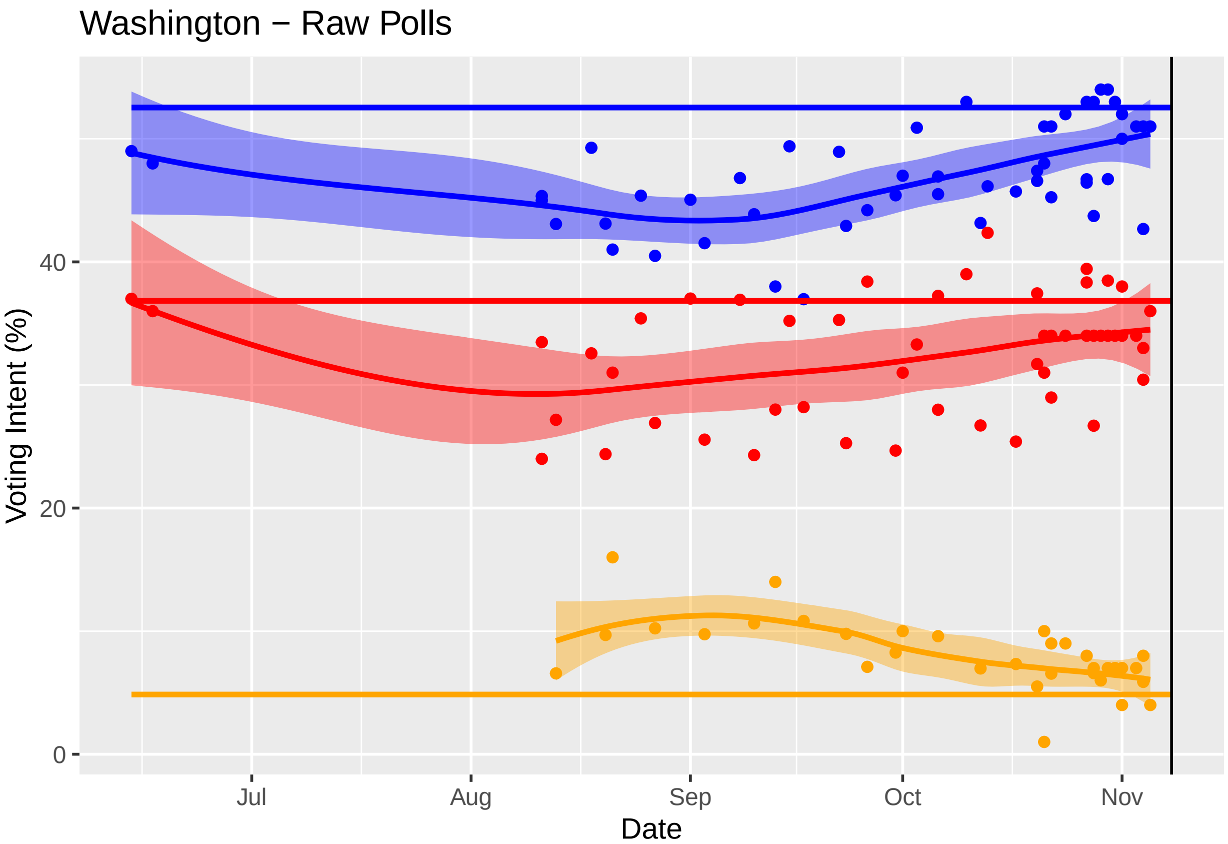


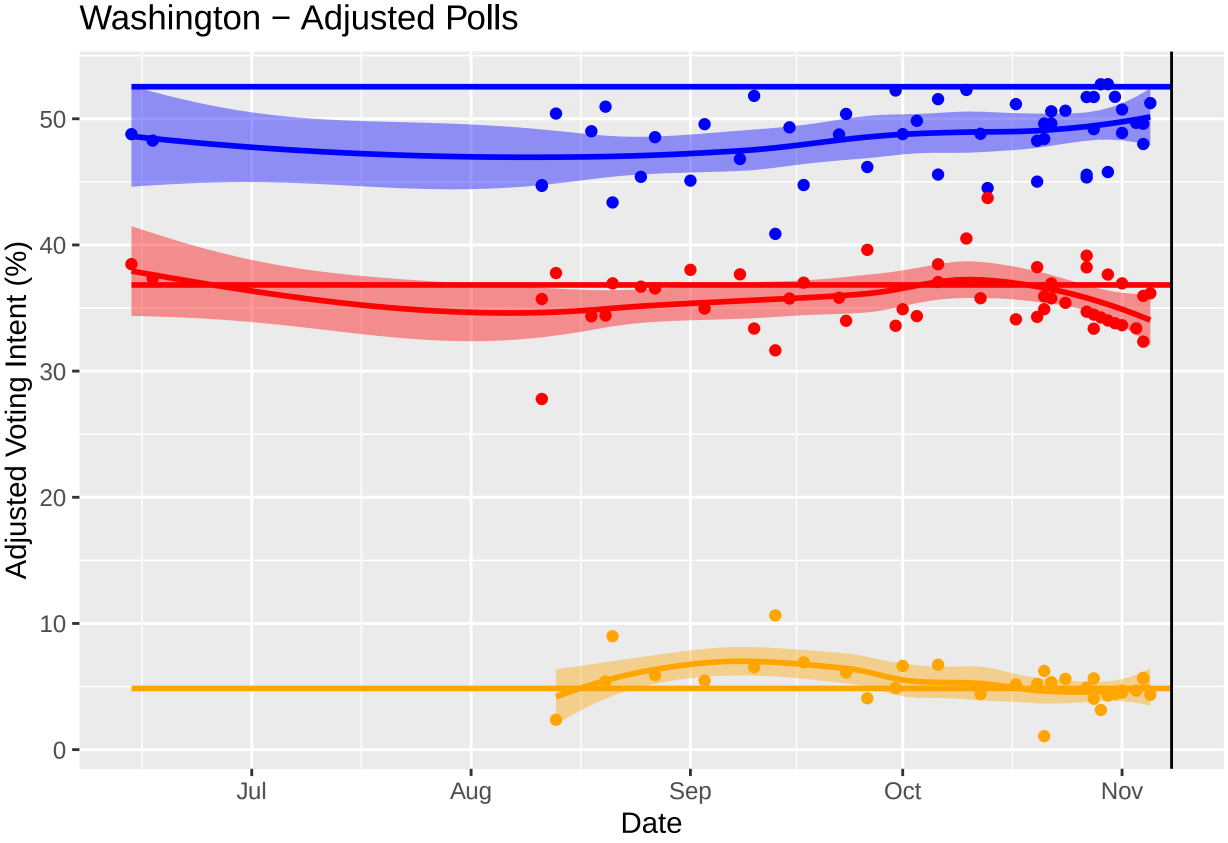


Virginia − Raw Polls

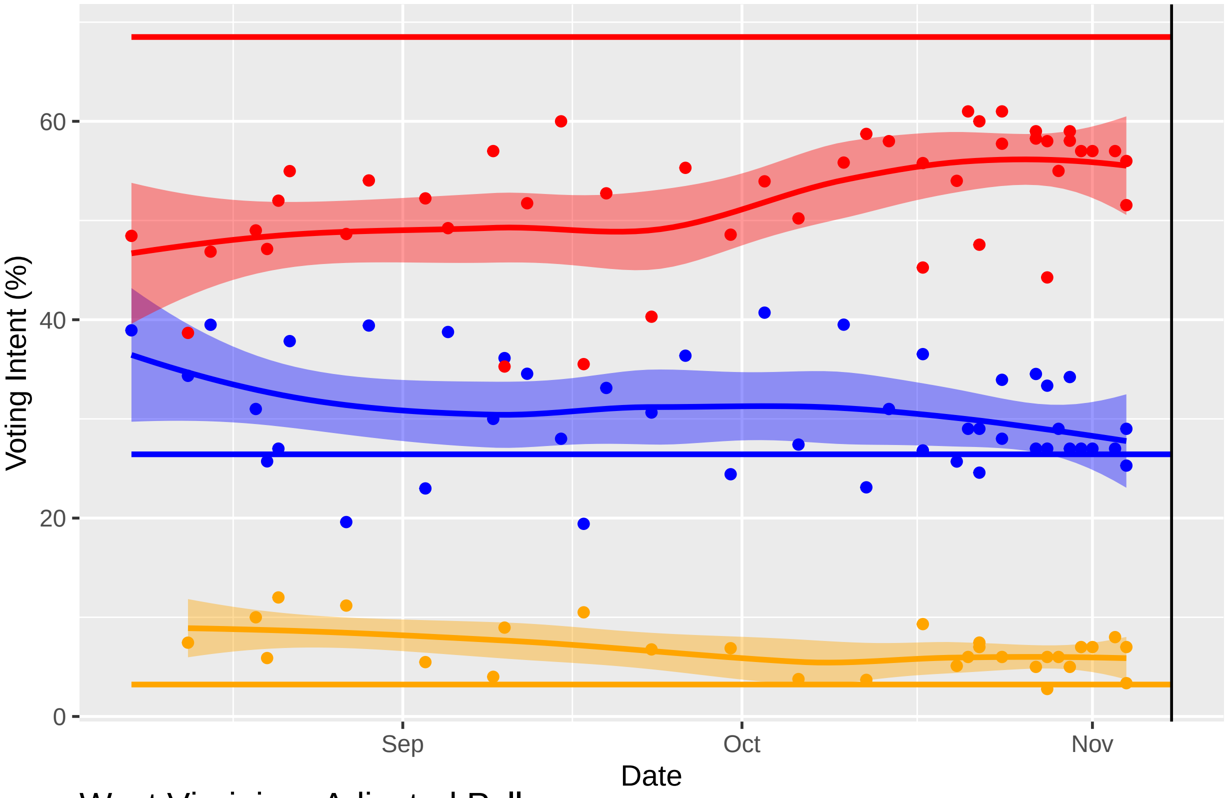


Virginia − Adjusted Polls

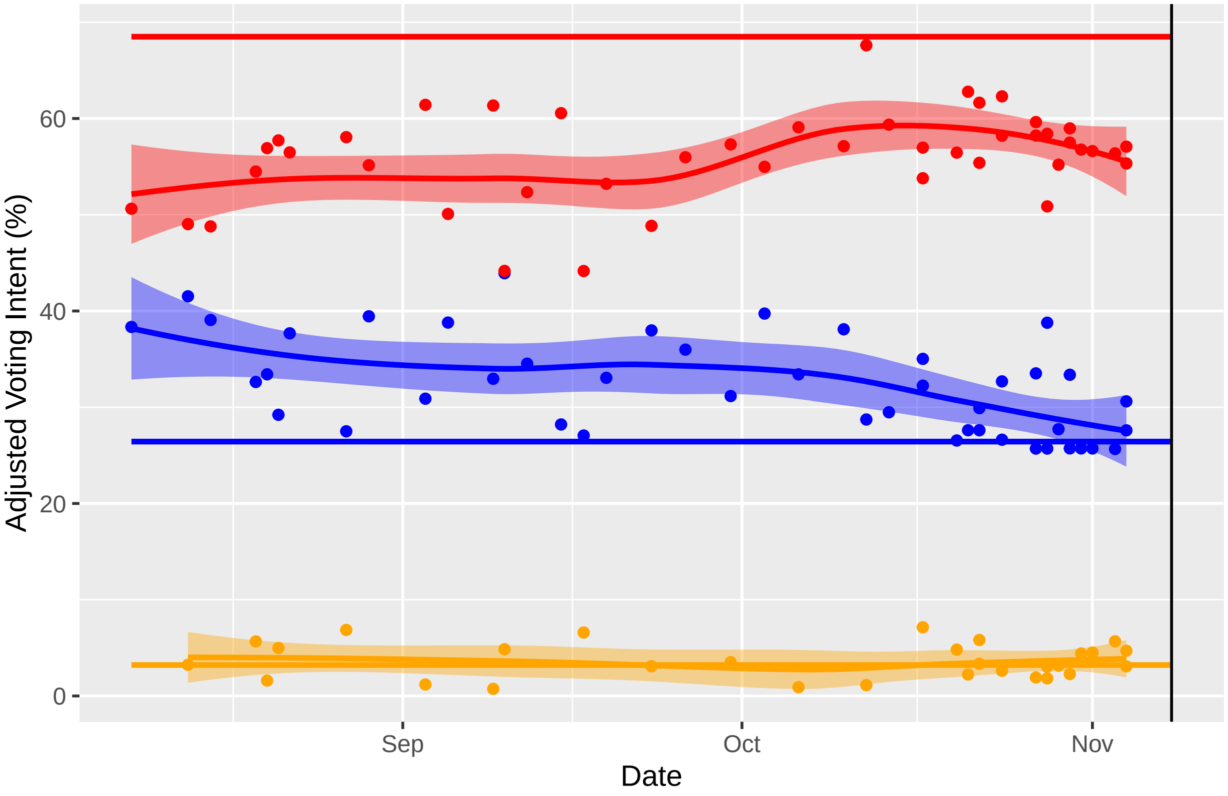

Washington − Raw Polls
Voting Intent (%)
0
20
40
Jul
Aug
Sep
Oct
Nov
Date

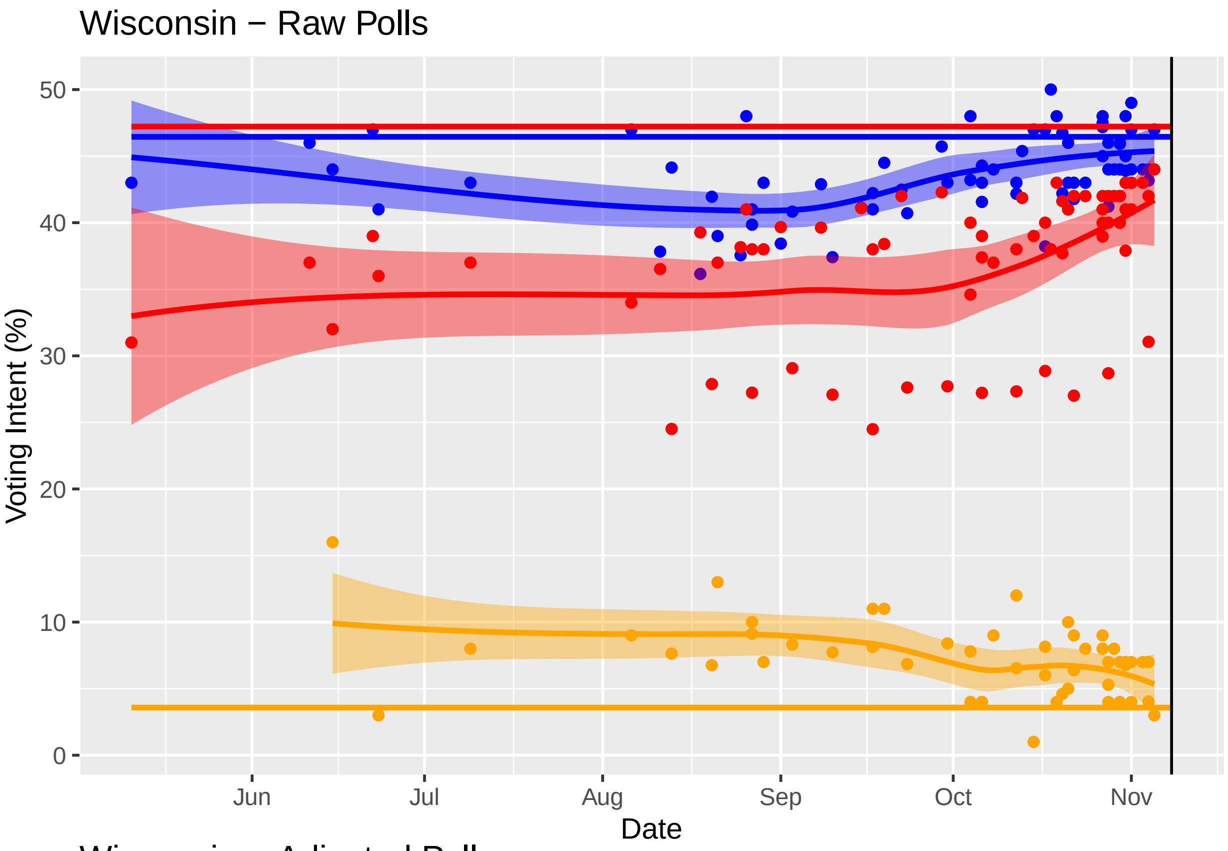

Washington − Adjusted Polls
Adjusted Voting Intent (%)
0
10
20
30
40
50
Jul
Aug
Sep
Oct
Nov
Date

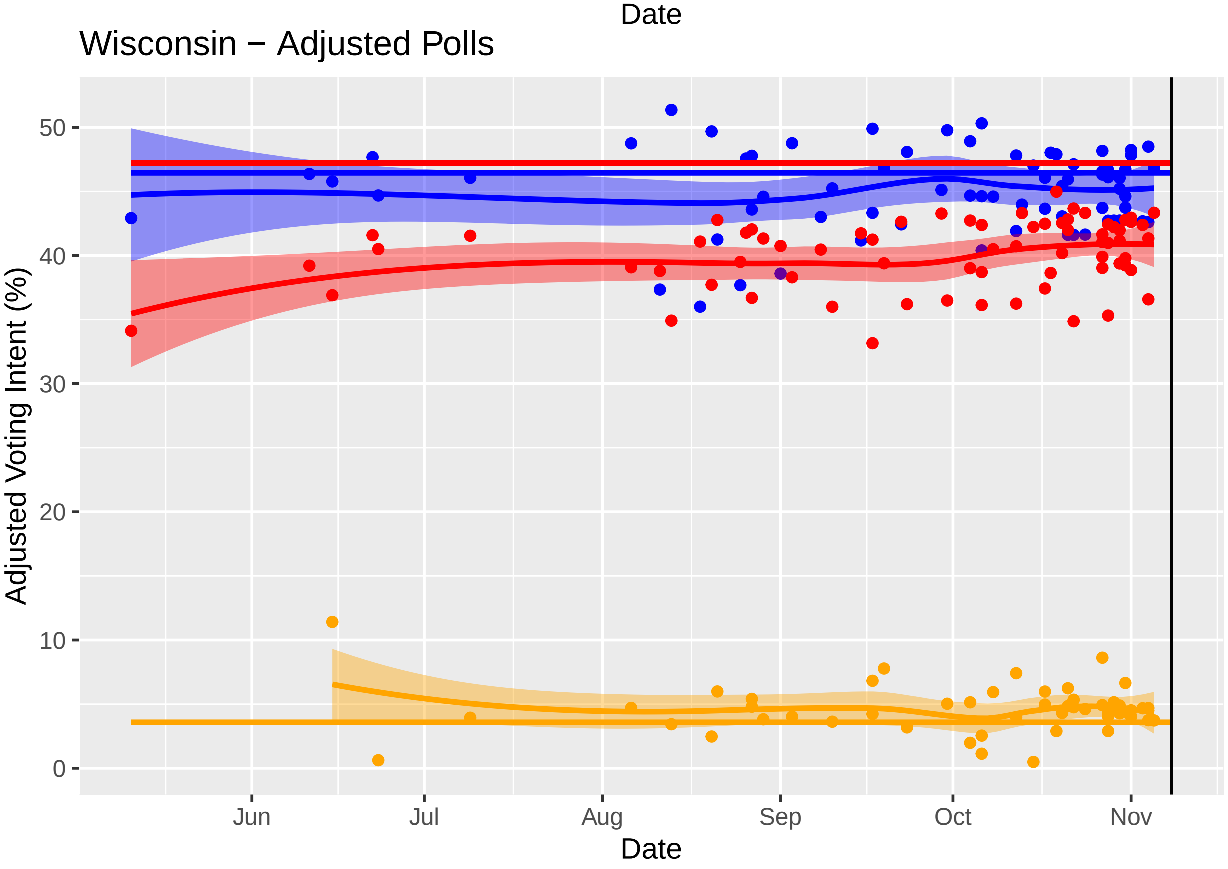
West Virginia − Raw Polls

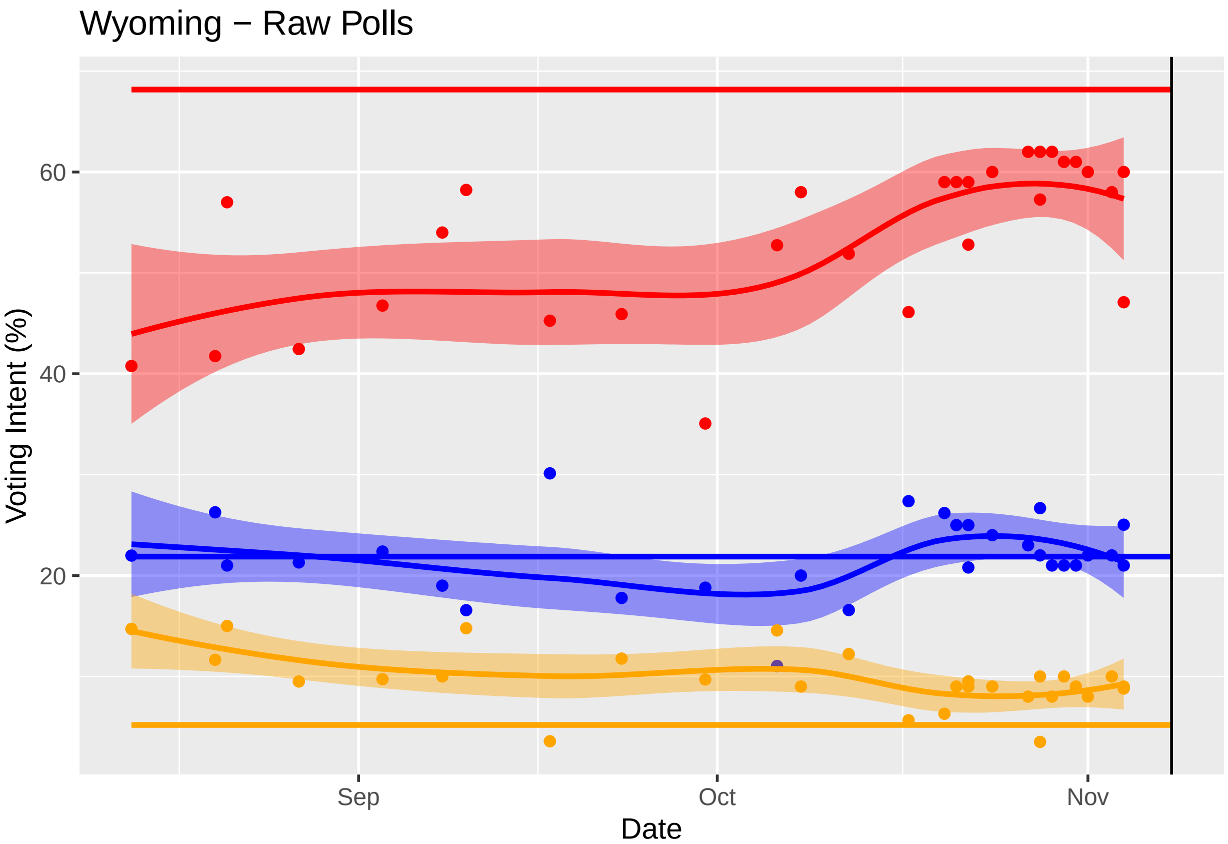


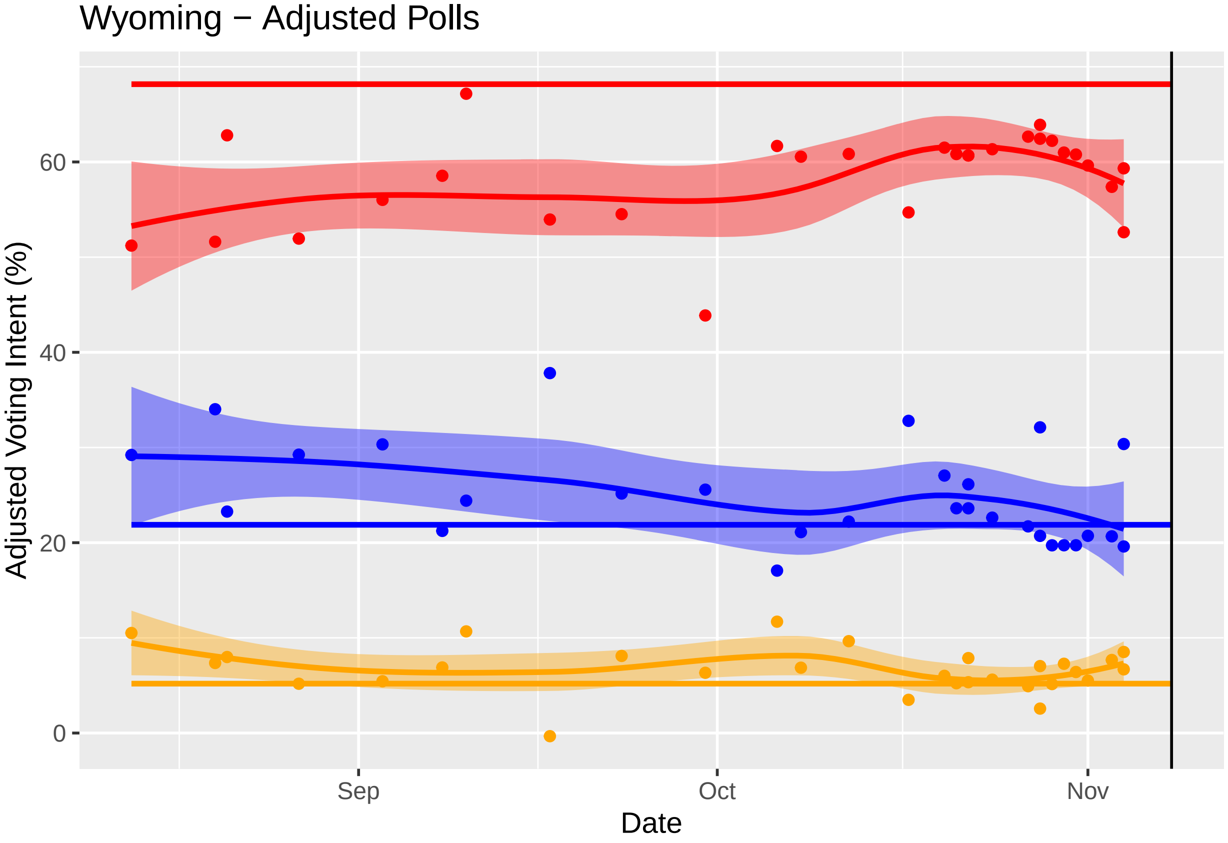
West Virginia − Adjusted Polls




Wisconsin − Raw Polls
Voting Intent (%)
0
10
20
30
40
50
Jun
Jul
Aug
Sep
Oct
Nov
Date


Wisconsin − Adjusted Polls
Adjusted Voting Intent (%)
0
10
20
30
40
50
Jun
Jul
Aug
Sep
Oct
Nov
Date


Wyoming − Raw Polls
Voting Intent (%)
60
40
20
Sep
Oct
Nov
Date


Wyoming − Adjusted Polls
Adjusted Voting Intent (%)
60
40
20
0
Sep
Oct
Nov
Date