Scenarios 11-15

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```
set.seed(219)
source("bayesian_ssr.R")
```

```
-- Attaching packages --------------------------------------- tidyverse 1.3.2 --
v ggplot2 3.5.0      v purrr   1.0.1
v tibble  3.1.8      v dplyr   1.0.10
v tidyr   1.2.1      v stringr 1.5.0
v readr   2.1.3      v forcats 0.5.2

Warning: package 'ggplot2' was built under R version 4.2.3

-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
```

Scenario 11-15

```
alpha<-runif(5000,0,1000)
beta<-alpha
df_sample_size<-tibble()

df_q_andmu_posteriors_50<-tibble()
df_alpha_beta_posteriors_50<-tibble()
df_D_posteriors_50<-tibble()
interim_allocation_50<-tibble()

df_q_andmu_posteriors_25<-tibble()
df_alpha_beta_posteriors_25<-tibble()
df_D_posteriors_25<-tibble()
```

```
interim_allocation_25<-tibble()

df_q_andmu_posteriors_125<-tibble()
df_alpha_beta_posteriors_125<-tibble()
df_D_posteriors_125<-tibble()
interim_allocation_125<-tibble()

for(i in 1:length(alpha)){
  aux<-sample_size_calculation(alpha_prior = alpha[i],beta_prior = beta[i], eta=0.95, zeta
  if(any(is.na(aux)))next
  df_sample_size<-rbind(df_sample_size,aux)
  #Scenario 1
  length1<-round(aux$treatment1/2)
  y1_aux=rnorm(length1,mean=0, sd=1)
  length2<-round(aux$treatment2/2)
  y2_aux=rnorm(length2,mean=0.1, sd=1)
  length3<-round(aux$treatment3/2)
  y3_aux=rnorm(length3,mean=0.2, sd=1)
  length4<-round(aux$treatment4/2)
  y4_aux=rnorm(length4,mean=0.6, sd=1)

  y=c(y1_aux,y2_aux,y3_aux,y4_aux)
  treatment_assignment<-c(rep(1,length1),rep(2,length2),
                          rep(3,length3),rep(4,length4))
  df_50=tibble(treatment_assignment,y)
  aux_post_50<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1,
                                      N_treat = c(length1,length2,length3,length4),
                                      y_treatment = df_50)

  df_q_andmu_posteriors_50<-rbind(df_q_andmu_posteriors_50,aux_post_50$q_andmu_posteriors)
  df_alpha_beta_posteriors_50<-rbind(df_alpha_beta_posteriors_50,aux_post_50$alpha_beta_pa
  df_D_posteriors_50<-rbind(df_D_posteriors_50,aux_post_50$D)

  treatment_differences_50<-get_treatment_difference(aux_post_50$q_andmu_posteriors,aux_po
  new_r<-allocation_calculation(treatment_differences_50)
  interim_allocation_50<-rbind(interim_allocation_50,new_r)

  #Scenario 2

  length1<-round(aux$treatment1/4)
  y1_aux=rnorm(length1,mean=0, sd=1)
```

```
length2<-round(aux$treatment2/4)
y2_aux=rnorm(length2,mean=0.1, sd=1)
length3<-round(aux$treatment3/4)
y3_aux=rnorm(length3,mean=0.2, sd=1)
length4<-round(aux$treatment4/4)
y4_aux=rnorm(length4,mean=0.6, sd=1)

y=c(y1_aux,y2_aux,y3_aux,y4_aux)
treatment_assignment<-c(rep(1,length1),rep(2,length2),
                        rep(3,length3),rep(4,length4))
df_25=tibble(treatment_assignment,y)

aux_post_25<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1,
                                    N_treat = c(length1,length2,length3,length4),
                                    y_treatment = df_25)

df_q_andmu_posteriors_25<-rbind(df_q_andmu_posteriors_25,aux_post_25$q_andmu_posteriors)
df_alpha_beta_posteriors_25<-rbind(df_alpha_beta_posteriors_25,aux_post_25$alpha_beta_pa
df_D_posteriors_25<-rbind(df_D_posteriors_25,aux_post_25$D)

treatment_differences_25<-get_treatment_difference(aux_post_25$q_andmu_posteriors,aux_po
new_r<-allocation_calculation(treatment_differences_25)
interim_allocation_25<-rbind(interim_allocation_25,new_r)


#Scenario 3

length1<-round(aux$treatment1/8)
y1_aux=rnorm(length1,mean=0, sd=1)
length2<-round(aux$treatment2/8)
y2_aux=rnorm(length2,mean=0.1, sd=1)
length3<-round(aux$treatment3/8)
y3_aux=rnorm(length3,mean=0.2, sd=1)
length4<-round(aux$treatment4/8)
y4_aux=rnorm(length4,mean=0.6, sd=1)

y=c(y1_aux,y2_aux,y3_aux,y4_aux)
treatment_assignment<-c(rep(1,length1),rep(2,length2),
                        rep(3,length3),rep(4,length4))
df_125=tibble(treatment_assignment,y)
```

```
  aux_post_125<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1
                                       N_treat = c(length1,length2,length3,length4),
                                       y_treatment = df_125)

  df_q_andmu_posteriors_125<-rbind(df_q_andmu_posteriors_125,aux_post_125$q_andmu_posterio
  df_alpha_beta_posteriors_125<-rbind(df_alpha_beta_posteriors_125,aux_post_125$alpha_beta
  df_D_posteriors_125<-rbind(df_D_posteriors_125,aux_post_125$D)

  treatment_differences_125<-get_treatment_difference(aux_post_125$q_andmu_posteriors,aux_
  new_r<-allocation_calculation(treatment_differences_125)
  interim_allocation_125<-rbind(interim_allocation_125,new_r)

}
colMeans(df_sample_size)
```

```
treatment1 treatment2 treatment3 treatment4
  211.9939   211.9939   211.9939   211.9939
```

```
#no RAR
interim_ss50<-tibble()
for(i in 1:nrow(df_alpha_beta_posteriors_50)){
  interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_50$alpha_post
                                       xi=0.95,r=c(1/4,1/4,1/4,1/4),q_prior =as.numeric( d
                                       delta_star=0.3)
  interim_ss50<-rbind(interim_ss50,interim_aux)
}

colMeans(interim_ss50)
```

```
treatment1 treatment2 treatment3 treatment4
  91.90249   91.90249   91.90249   91.90249
```

```
interim_ss_rar50<-tibble()
for(i in 1:nrow(df_alpha_beta_posteriors_50)){
  interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_50$alpha_post
                                       xi=0.95,r=as.numeric(interim_allocation_50[i,]),q_p
                                       delta_star=0.3)
  interim_ss_rar50<-rbind(interim_ss_rar50,interim_aux)
}
```

```
  colMeans(interim_ss_rar50,na.rm = T)
```

```
treatment1 treatment2 treatment3 treatment4
  91.76203   109.21539   145.80623   183.10488
```

```
  #no RAR
  interim_ss25<-tibble()
  for(i in 1:nrow(df_alpha_beta_posteriors_25)){
    interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_25$alpha_post
                                         xi=0.95,r=c(1/4,1/4,1/4,1/4),q_prior =as.numeric( d
                                         delta_star=0.3)
    interim_ss25<-rbind(interim_ss25,interim_aux)
  }

  colMeans(interim_ss25)
```

```
treatment1 treatment2 treatment3 treatment4
  146.1241   146.1241   146.1241   146.1241
```

```
  interim_ss_rar25<-tibble()
  for(i in 1:nrow(df_alpha_beta_posteriors_25)){
    interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_25$alpha_post
                                         xi=0.95,r=as.numeric(interim_allocation_25[i,]),q_p
                                         delta_star=0.3)
    interim_ss_rar25<-rbind(interim_ss_rar25,interim_aux)
  }

  colMeans(interim_ss_rar25,na.rm = T)
```

```
treatment1 treatment2 treatment3 treatment4
  186.4562   175.4539   238.0275   357.6600
```

```
  #no RAR
  interim_ss125<-tibble()
  for(i in 1:nrow(df_alpha_beta_posteriors_125)){
    interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_125$alpha_pos
                                         xi=0.95,r=c(1/4,1/4,1/4,1/4),q_prior =as.numeric( d
                                         delta_star=0.3)
```

```
  interim_ss125<-rbind(interim_ss125,interim_aux)
}

colMeans(interim_ss125)
```

```
treatment1 treatment2 treatment3 treatment4
  173.9453   173.9453   173.9453   173.9453
```

```
interim_ss_rar125<-tibble()
for(i in 1:nrow(df_alpha_beta_posteriors_125)){
  interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_125$alpha_pos
                                       xi=0.95,r=as.numeric(interim_allocation_125[i,]),q_
                                       delta_star=0.3)
  interim_ss_rar125<-rbind(interim_ss_rar125,interim_aux)
}

colMeans(interim_ss_rar125,na.rm = T)
```

```
treatment1 treatment2 treatment3 treatment4
  286.5052   215.0756   298.0285   497.7019
```

```
interim_ss_rar25<-tibble()
df_sample_size<-tibble()
interim_ss_rar50<-tibble()
df_q_andmu_posteriors_50<-tibble()
df_alpha_beta_posteriors_50<-tibble()
df_D_posteriors_50<-tibble()
interim_allocation_50<-tibble()

df_q_andmu_posteriors_25<-tibble()
df_alpha_beta_posteriors_25<-tibble()
df_D_posteriors_25<-tibble()
interim_allocation_25<-tibble()



for(i in 1:length(alpha)){
  aux<-sample_size_calculation(alpha_prior = alpha[i],beta_prior = beta[i], eta=0.95, zeta
  if(any(is.na(aux)))next
```

```
df_sample_size<-rbind(df_sample_size,aux)
#Scenario 4
length1<-round(aux$treatment1/4)
y1_aux=rnorm(length1,mean=0, sd=1)
length2<-round(aux$treatment2/4)
y2_aux=rnorm(length2,mean=0.1, sd=1)
length3<-round(aux$treatment3/4)
y3_aux=rnorm(length3,mean=0.2, sd=1)
length4<-round(aux$treatment2/4)
y4_aux=rnorm(round(aux$treatment4/4),mean=0.6, sd=1)
y=c(y1_aux,y2_aux,y3_aux,y4_aux)

treatment_assignment<-c(rep(1,length1),rep(2,length2),
                        rep(3,length3),rep(4,length4))
df_25=tibble(treatment_assignment,y)

aux_post_25<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1,
                                    N_treat = c(length1,length2,length3,length4),
                                    y_treatment = df_25)

df_q_andmu_posteriors_25<-aux_post_25$q_andmu_posteriors
df_alpha_beta_posteriors_25<-aux_post_25$alpha_beta_params
df_D_posteriors_25<-aux_post_25$D

treatment_differences_25<-get_treatment_difference(aux_post_25$q_andmu_posteriors,aux_po
new_r<-allocation_calculation(treatment_differences_25)
interim_allocation_25<-rbind(interim_allocation_25,new_r)

interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_25$alpha_post
                                     xi=0.95,r=as.numeric(new_r),q_prior =as.numeric( df
                                     delta_star=0.3)
if(any(is.na(interim_aux)))next
interim_ss_rar25<-rbind(interim_ss_rar25,interim_aux)


#Scenario 4
length1<-max(0,round(interim_aux$treatment1/2-aux$treatment1/4))
y1_aux=rnorm(length1,mean=0, sd=1)
length2<-max(0,round(interim_aux$treatment2/2-aux$treatment2/4))
y2_aux=rnorm(length2,mean=0.1, sd=1)
length3<-max(0,round(interim_aux$treatment3/2-aux$treatment3/4))
```

```
    y3_aux=rnorm(length3,mean=0.2, sd=1)
    length4<-max(0,round(interim_aux$treatment4/2-aux$treatment4/4))
    y4_aux=rnorm(length4,mean=0.6, sd=1)

    y=c(y1_aux,y2_aux,y3_aux,y4_aux)
    treatment_assignment<-c(rep(1,length1),rep(2,length2),rep(3,length3),rep(4,length4))
    df_50=tibble(treatment_assignment,y)
    df<-rbind(df_25,df_50)
    aux_post_50<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1,
                                        N_treat = c(max(round(aux$treatment1/4),round(interim_a
                                                    max(round(aux$treatment2/4),round(interim_a
                                                    max(round(aux$treatment3/4),round(interim_a
                                                    max(round(aux$treatment4/4),round(interim_a
                                        y_treatment = df)

    df_q_andmu_posteriors_50<-aux_post_50$q_andmu_posteriors
    df_alpha_beta_posteriors_50<-aux_post_50$alpha_beta_params
    df_D_posteriors_50<-aux_post_50$D
    treatment_differences_50<-get_treatment_difference(aux_post_50$q_andmu_posteriors,aux_po
    new_r<-allocation_calculation(treatment_differences_50)
    interim_allocation_50<-rbind(interim_allocation_50,new_r)
    interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_50$alpha_post
                                         xi=0.95,r=as.numeric(new_r),q_prior =as.numeric( df
                                         delta_star=0.3)
      if(any(is.na(interim_aux)))next
     interim_ss_rar50<-rbind(interim_ss_rar50,interim_aux)


  }
  colMeans(interim_ss_rar50)
```

```
treatment1 treatment2 treatment3 treatment4
  142.8600   147.4940   221.8957   285.8957
```

```
  interim_ss_rar25<-tibble()
  df_sample_size<-tibble()
  interim_ss_rar75<-tibble()
  df_q_andmu_posteriors_75<-tibble()
  df_alpha_beta_posteriors_75<-tibble()
  df_D_posteriors_75<-tibble()
  interim_allocation_75<-tibble()
```

```r
df_q_andmu_posteriors_25<-tibble()
df_alpha_beta_posteriors_25<-tibble()
df_D_posteriors_25<-tibble()
interim_allocation_25<-tibble()



for(i in 1:length(alpha)){
  aux<-sample_size_calculation(alpha_prior = alpha[i],beta_prior = beta[i], eta=0.95, zeta
  if(any(is.na(aux)))next
  df_sample_size<-rbind(df_sample_size,aux)
  #Scenario 4
  length1<-round(aux$treatment1/4)
  y1_aux=rnorm(length1,mean=0, sd=1)
  length2<-round(aux$treatment2/4)
  y2_aux=rnorm(length2,mean=0.1, sd=1)
  length3<-round(aux$treatment3/4)
  y3_aux=rnorm(length3,mean=0.2, sd=1)
  length4<-round(aux$treatment2/4)
  y4_aux=rnorm(round(aux$treatment4/4),mean=0.6, sd=1)
  y=c(y1_aux,y2_aux,y3_aux,y4_aux)

  treatment_assignment<-c(rep(1,length1),rep(2,length2),
                          rep(3,length3),rep(4,length4))
  df_25=tibble(treatment_assignment,y)

  aux_post_25<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1,
                                      N_treat = c(length1,length2,length3,length4),
                                      y_treatment = df_25)

  df_q_andmu_posteriors_25<-aux_post_25$q_andmu_posteriors
  df_alpha_beta_posteriors_25<-aux_post_25$alpha_beta_params
  df_D_posteriors_25<-aux_post_25$D

  treatment_differences_25<-get_treatment_difference(aux_post_25$q_andmu_posteriors,aux_po
  new_r<-allocation_calculation(treatment_differences_25)
  interim_allocation_25<-rbind(interim_allocation_25,new_r)

  interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_25$alpha_post
                                       xi=0.95,r=as.numeric(new_r),q_prior =as.numeric( df
                                       delta_star=0.3)
```

```
  if(any(is.na(interim_aux)))next
  interim_ss_rar25<-rbind(interim_ss_rar25,interim_aux)


  #Scenario 5
  length1<-max(0,round(interim_aux$treatment1*0.75-aux$treatment1/4))
  y1_aux=rnorm(length1,mean=0, sd=1)
  length2<-max(0,round(interim_aux$treatment2*0.75-aux$treatment2/4))
  y2_aux=rnorm(length2,mean=0.1, sd=1)
  length3<-max(0,round(interim_aux$treatment3*0.75-aux$treatment3/4))
  y3_aux=rnorm(length3,mean=0.2, sd=1)
  length4<-max(0,round(interim_aux$treatment4*0.75-aux$treatment4/4))
  y4_aux=rnorm(length4,mean=0.6, sd=1)

  y=c(y1_aux,y2_aux,y3_aux,y4_aux)
  treatment_assignment<-c(rep(1,length1),rep(2,length2),rep(3,length3),rep(4,length4))
  df_75=tibble(treatment_assignment,y)
  df<-rbind(df_25,df_75)
  aux_post_75<-posterior_calculations(alpha_prior=alpha[i],beta_prior=beta[i],q_prior=c(1,
                                      N_treat = c(max(round(aux$treatment1/4),round(interim_a
                                                  max(round(aux$treatment2/4),round(interim_a
                                                  max(round(aux$treatment3/4),round(interim_a
                                                  max(round(aux$treatment4/4),round(interim_a
                                      y_treatment = df)

  df_q_andmu_posteriors_75<-aux_post_75$q_andmu_posteriors
  df_alpha_beta_posteriors_75<-aux_post_75$alpha_beta_params
  df_D_posteriors_75<-aux_post_75$D
  treatment_differences_75<-get_treatment_difference(aux_post_75$q_andmu_posteriors,aux_po
  new_r<-allocation_calculation(treatment_differences_75)
  interim_allocation_75<-rbind(interim_allocation_75,new_r)
  interim_aux<-sample_size_calculation(alpha_prior =df_alpha_beta_posteriors_75$alpha_post
                                       xi=0.95,r=as.numeric(new_r),q_prior =as.numeric( df
                                       delta_star=0.3)
  if(any(is.na(interim_aux)))next

   interim_ss_rar75<-rbind(interim_ss_rar75,interim_aux)


}
colMeans(interim_ss_rar75)
```

```
treatment1 treatment2 treatment3 treatment4
  95.25449  103.26966  157.11738  190.75171
```