```
 mStates <- c("A", "IS", "ISR", "M", "MR", "B1", "B2", "B3", "B4", "B5", "B6", "BS", "C", "CR", "CCS"
 "E", "ER", "ELCS", "EMCS", "EHCS", "ERCS", "TF", "D");

qcStates <- c("Q1", "Q2", "Q3", "Q4", "Q5", "Q6", "Q7", "Q8", "Q9", "Q10", "Q11", "Q12", "Q13", "Q14", "Q15",
        "Q16", "Q17", "Q18", "Q19", "Q20", "Q21", "Q22", "Q23", "Q24", "Q25", "Q26", "Q27", "Q28", "Q29", "Q30",
        "Q31", "Q32", "Q33", "Q34", "Q35", "Q36", "Q37", "Q38", "Q39", "Q40", "Q41", "Q42", "Q43", "Q44", "Q45",
        "Q46", "Q47", "Q48", "Q49", "Q50", "Q51", "Q52", "Q53", "Q54", "Q55", "Q56", "Q57", "Q58", "Q59", "Q60",
        "Q61", "Q62", "Q63", "Q64",
        "C1", "C2", "C3", "C4", "C5", "C6", "C7", "C8", "C9", "C10", "C11", "C12", "C13", "C14", "C15",
        "C16", "C17", "C18", "C19", "C20", "C21", "C22", "C23", "C24", "C25", "C26", "C27", "C28", "C29", "C30",
        "C31", "C32", "C33", "C34", "C35", "C36", "C37", "C38", "C39", "C40", "C41", "C42", "C43", "C44", "C45",
        "C46", "C47", "C48", "C49", "C50", "C51", "C52", "C53", "C54", "C55", "C56", "C57", "C58", "C59", "C60",
        "C61", "C62", "C63", "C64");

nTX <- 64
nStates <- 25;
cohort <- 1000
nCycles  <- 58;
#nSims <- 1;
YrCycles <- 12; ##used to convert annual utilties to cycle length utilities
mcmcdf <- function (pnStates, n){
 emcmc <- matrix(data=rep(0, (n*(length(pnStates)+1))), nrow=n, ncol=(length(pnStates)+1));  ##SR: creates a matrix of zero values
 ## where the number of rows is the cohort, and the number of columns is the number of states + 1 (not sure yet why there
 ## needs to be a column of 1 to n)
 colnames(emcmc) <- c("ID", pnStates);
 emcmc[,1] <-seq(1,n);
 (data.frame(emcmc));
}

rmdf <- function (pnStates, n){
 rmd <- matrix(data=rep(0, (n*(length(pnStates)+1))), nrow=n, ncol=(length(pnStates)+1));  ##SR: creates a matrix of zero values
 ## where the number of rows is the cohort, and the number of columns is the number of states + 1 (not sure yet why there
 ## needs to be a column of 1 to n)
 colnames(rmd) <- c("ID", pnStates);
 rmd[,1] <-seq(1,n);
 (rmd);
}
df <- function (c, r){
 pm <- matrix(data=rep(0, r*c), nrow=r, ncol=c);  ##SR: creates a matrix of zero values
 ## where the number of rows is the cohort, and the number of columns is the number of states + 1 (not sure yet why there
 ## needs to be a column of 1 to n)
 #colnames(pm) <- c(pnStates);
 (pm);
}
#################################################################
#################################################################
dft<-df(10500,nSims)
#dft<-MMcreateMatrix2(df, 5389, 10)
df1<-df(10500,nSims)
dfe<-df(10500,nSims)
rmd<-rmdf(qcStates, nSims)
mcmc <- mcmcdf(qcStates, nSims)
#trans<-tab.datTnames(mStates)
#mModel <- MMcreateMatrix(trans, nStates, mStates)

#################################################################

#antiperspirants drop out rate
dft[,70]<-rbeta(nSims,0.611,0.505)
P_R <- rbeta(nSims,5.977938,38.40171)  ##Placebo response
dft[,1]<-P_R
lor<-tab.datCU[sample(nrow(tab.datCU),size=nSims,replace=TRUE),]
if (sap1==7){
 lor<-tab.datMSU[sample(nrow(tab.datMSU),size=nSims,replace=TRUE),]
}
#write.csv(lorCU, file = "lor.csv")
logISP_ORm<-1.11
if (det==1){}
if (det==2){
 logISP_ORm<-1.11
 if (sap1==9){
 logISP_ORm<-runif(nSims,0,2.22)
 }
}
ISP_ORm<-exp(logISP_ORm)
#ISP_ORm <- 0.4 ##relative risk mean of Iontophoresis sponge vs botox. Vary this in sensitivity analysis.
dft[,2]<-ISP_ORm
#ISB_RR <- exp(ISB_lnRR) ##convert back to RR from LN(RR)
ISP_OR <- ISP_ORm
ISP_RR<-ISP_OR/(1-dft[,1]*(1-ISP_OR))
if (sap6==1){}
if (sap6==2){
 ISP_RR<-isrr
}
IS_R <- dft[,1]*ISP_RR
dft[,3]<-IS_R
dft[,3]<-ifelse(dft[,3]>1,1,dft[,3])
#IS_NR <- 1-IS_R
dft[,4]<-1-dft[,3]
IS_SE<-0.16
if (det==2){
 IS_SE <- rbeta(nSims,0.511,2.709) ##drop out rate due to side effects
}
dft[,5]<-IS_SE
#IS_NSE <- 1-IS_SE
dft[,6]<-1-dft[,5]
dft[,7]<-exp(2.064)
if (det==2){
 #MP_orCU<-exp(lor$mp)
```

```
  dft[,7]<-exp(lor$mp)
}
#MP_RR<-MP_OR/(1-P_R*(1-MP_OR))
dft[,8]<-dft[,7]/(1-dft[,1]*(1-dft[,7]))
#MP_RR <- exp(MP_lnRR) ##convert back to RR from LN(RR)
#dft[,8]<-dft[,7]
#M_R <- P_R*MP_RR
dft[,9]<-dft[,1]*dft[,8]
dft[,9]<-ifelse(dft[,9]>1,1,dft[,9])
#M_NR <- 1-M_R
dft[,10]<-1-dft[,9]
M_SE<-0.37
if (det==2){
  M_SE <- rbeta(nSims,0.962,1.652) ##drop out rate due to side effects
}
dft[,11]<-M_SE
#M_NSE <- 1-M_SE
dft[,12]<-1-dft[,11]
M_SR <- 1  ##Sustained response: change in sensitivity analysis
if (sap1==5){
  M_SR <- 0.9975 #moderate decline in effectiveness over time
}
if (sap1==6){
  M_SR <- 0.99    #considerable decline in effectiveness over time
}
dft[,13]<-M_SR
################
dft[,14]<-exp(2.218)
if (det==2){
  #BP_orCU<-exp(lor$bp)
  dft[,14]<-exp(lor$bp)
}
#BP_RR<-BP_OR/(1-P_R*(1-BP_OR))
dft[,15]<-dft[,14]/(1-dft[,1]*(1-dft[,14]))
#BP_RR <- exp(BP_lnRR) ##convert back to RR from LN(RR)
#dft[,15]<-dft[,14]
#B_R <- P_R*BP_RR
dft[,16]<-dft[,1]*dft[,15]
dft[,16]<-ifelse(dft[,16]>1,1,dft[,16])
#B_NR <- 1-B_R
dft[,17]<-1-dft[,16]
B_SE<-0
if (sap5==1){}
if (sap5==2){
  B_SE<-0.1
}
if (sap5==3){
  B_SE<-0.2
}
#B_SE <- 0 ##drop out rate due to side effects
#if (det==2){
 # B_SE<-dunif(nSims,0,0.5)
#}
dft[,18]<-B_SE
#B_NSE <- 1-B_SE
dft[,19]<-1-dft[,18]
################
dft[,20]<-exp(1.417)
if (det==2){
  #CP_orCU<-exp(lor$cp)
  dft[,20]<-exp(lor$cp)
}
if (sap4==1){}
if (sap4==2){
  dft[,20]<-exp(2.198)
if (det==2){
  #CP_orCU<-exp(lor$cp)
  dft[,20]<-exp(lor$lp)
}
}
if (sap4==3){
  dft[,20]<-exp(2.705)
  if (det==2){
    #CP_orCU<-exp(lor$cp)
    dft[,20]<-exp(lor$micp)
  }
}
if (sap4==4){
  dft[,20]<-exp(2.728)
  if (det==2){
    #CP_orCU<-exp(lor$cp)
    dft[,20]<-exp(lor$rp)
  }
}
#CP_RR<-CP_OR/(1-P_R*(1-CP_OR))
dft[,21]<-dft[,20]/(1-dft[,1]*(1-dft[,20]))
#CB_RR <- exp(CB_lnRR) ##convert back to RR from LN(RR)
#dft[,21]<-dft[,20]
#C_R <- P_R*CP_RR
dft[,22]<-dft[,1]*dft[,21]
dft[,22]<-ifelse(dft[,22]>1,1,dft[,22])
#C_NR <- 1-C_R
dft[,23]<-1-dft[,22]
#CCS <- 0.02
dft[,24]<-0
E_R <- 340/1700
ELCS <- 394/1700
EMCS <- 409/1700
EHCS <- 367/1700
ERCS <- 190/1700
if (sap1==8){
```

```
  E_R <- 37/453
  ELCS <- 92/453
  EMCS <- 174/453
  EHCS <- 150/453
  ERCS <- 0
}
if (det==2){
  draws <- rdirichlet(nSims, c(340,394,409,367,190) ) #compensatory sweating random draw: smidfelt 2011
  E_R <- draws[,1]
  ELCS <- draws[,2]
  EMCS <- draws[,3]
  EHCS <- draws[,4]
  ERCS <- draws[,5]
}
if (sap1==1){}
if (sap1==2){
  draws <- rdirichlet(nSims, c(37,92,174,150) ) #compensatory sweating random draw: wolosker 2012
  E_R <- draws[,1]
  ELCS <- draws[,2]
  EMCS <- draws[,3]
  EHCS <- draws[,4]
  ERCS <- 0
}
dft[,25]<-E_R
dft[,26]<-ELCS
dft[,27]<-EMCS
dft[,28]<-EHCS
dft[,29]<-ERCS
#derive the HDSS0/1 and HDSS3/2 ratios
dft[,30]<-ifelse(dft[,3]<=0.5,exp(1.2076-5.8374*dft[,3]),0.38) #IS_R  HDSS_01_IS
dft[,31]<-ifelse(dft[,3]<=0.5,0.38,exp(-4.6407+5.8278*dft[,3])) #IS_R  HDSS_32_IS
dft[,32]<-ifelse(dft[,9]<=0.5,exp(1.2076-5.8374*dft[,9]),0.38) #M_R  HDSS_01_M
dft[,33]<-ifelse(dft[,9]<=0.5,0.38,exp(-4.6407+5.8278*dft[,9])) #M_R  HDSS_32_M
dft[,34]<-ifelse(dft[,16]<=0.5,exp(1.2076-5.8374*dft[,16]),0.38) #B_R  HDSS_01_B
dft[,35]<-ifelse(dft[,16]<=0.5,0.38,exp(-4.6407+5.8278*dft[,16])) #B_R  HDSS_32_B
dft[,36]<-ifelse(dft[,22]<=0.5,exp(1.2076-5.8374*dft[,22]),0.38) #C_R  HDSS_01_C
dft[,37]<-ifelse(dft[,22]<=0.5,0.38,exp(-4.6407+5.8278*dft[,22])) #C_R  HDSS_32_C

#determine the HDSS states conditional on response
#Ris0<-(IS_NR*HDSS_01_IS)/(1+HDSS_01_IS)
dft[,38]<-(dft[,4]*dft[,30])/(1+dft[,30])
#Ris1<-IS_NR/(1+HDSS_01_IS)
dft[,39]<-dft[,4]/(1+dft[,30])
#Ris2<-IS_R/(1+HDSS_32_IS)
dft[,40]<-dft[,3]/(1+dft[,31])
#Ris3<-(IS_R*HDSS_32_IS)/(1+HDSS_32_IS)
dft[,41]<-(dft[,3]*dft[,31])/(1+dft[,31])
#Rm0<-(M_NR*HDSS_01_M)/(1+HDSS_01_M)
dft[,42]<-(dft[,10]*dft[,32])/(1+dft[,32])
#Rm1<-M_NR/(1+HDSS_01_M)
dft[,43]<-dft[,10]/(1+dft[,32])
#Rm2<-M_R/(1+HDSS_32_M)
dft[,44]<-dft[,9]/(1+dft[,33])
#Rm3<-(M_R*HDSS_32_M)/(1+HDSS_32_M)
dft[,45]<-(dft[,9]*dft[,33])/(1+dft[,33])
#Rb0<-(B_NR*HDSS_01_B)/(1+HDSS_01_B)
dft[,46]<-(dft[,17]*dft[,34])/(1+dft[,34])
#Rb1<-B_NR/(1+HDSS_01_B)
dft[,47]<-dft[,17]/(1+dft[,34])
#Rb2<-B_R/(1+HDSS_32_B)
dft[,48]<-dft[,16]/(1+dft[,35])
#Rb3<-(B_R*HDSS_32_B)/(1+HDSS_32_B)
dft[,49]<-(dft[,16]*dft[,35])/(1+dft[,35])
#Rc0<-(C_NR*HDSS_01_C)/(1+HDSS_01_C)
dft[,50]<-(dft[,23]*dft[,36])/(1+dft[,36])
#Rc1<-C_NR/(1+HDSS_01_C)
dft[,51]<-dft[,23]/(1+dft[,36])
#Rc2<-C_R/(1+HDSS_32_C)
dft[,52]<-dft[,22]/(1+dft[,37])
#Rc3<-(C_R*HDSS_32_C)/(1+HDSS_32_C)
dft[,53]<-(dft[,22]*dft[,37])/(1+dft[,37])
#determine partial responders with adverse events and no responders with or without adverse events. For the purpose
#of calcuating the probability of minor surgery
#Ris_partial<-Ris1*IS_NSE
dft[,61]<-dft[,39]*dft[,6]
#Ris_noresp<-Ris0+Ris1-Ris_partial+IS_R*IS_SE
dft[,62]<-dft[,38]+dft[,39]-dft[,61]+dft[,3]*dft[,5]
#Ris_ratio<-Ris_noresp/(Ris_noresp+Ris_partial)
dft[,63]<-dft[,62]/(dft[,62]+dft[,61])
#Rm_partial<-Rm1*M_NSE
dft[,64]<-dft[,43]*dft[,12]
#Rm_noresp<-Rm0+Rm1-Rm_partial+M_R*M_SE
dft[,65]<-dft[,42]+dft[,43]-dft[,64]+dft[,9]*dft[,11]
#Rm_ratio<-Rm_noresp/(Rm_noresp+Rm_partial)
dft[,66]<-dft[,65]/(dft[,65]+dft[,64])
#Rb_partial<-Rb1*B_NSE
dft[,67]<-dft[,47]*dft[,19]
#Rb_noresp<-Rb0+Rb1-Rb_partial+B_R*B_SE
dft[,68]<-dft[,46]+dft[,47]-dft[,67]+dft[,16]*dft[,18]
#Rb_ratio<-Rb_noresp/(Rb_noresp+Rb_partial)
dft[,69]<-dft[,68]/(dft[,68]+dft[,67])
##Utilities
avpop_utility1<-tab.datU
avpop_utility<-as.numeric(avpop_utility1)
#dft[,54]<-avpop_utility
HDSS2_draw <- 0.906
if (det==2){
HDSS2_draw <- rbeta(nSims,416.6093,43.27513)
}
dft[,55]<-HDSS2_draw
#HDSS2_utility <- 1-((1-HDSS2_draw)*1.594)
```

```
dft[,56]<-1-((1-dft[,55])*1.594)
HDSS3_draw <- 0.875
if (det==2){
HDSS3_draw <- rbeta(nSims,391.017,55.77788)
}
dft[,57]<-HDSS3_draw
#HDSS3_utility <- 1-((1-HDSS3_draw)*1.594)
dft[,58]<-1-((1-dft[,57])*1.594)
HDSS4_draw <- 0.805
if (det==2){
HDSS4_draw <- rbeta(nSims,276.24,66.96217)
}
dft[,59]<-HDSS4_draw
#HDSS4_utility <- 1-((1-HDSS4_draw)*1.594)
dft[,60]<-1-((1-dft[,59])*1.594)
##Costs
#cost-to-charge ratio distribution
dft[,71]<-rnorm(nSims,0.648,0.167)
cp<-tab.datC
cp["A"]<-cp["A"]*(1-dft[70])
if (sap1==10){
  #cp["ISR"]<-5.64: 10 year time horizon
  cp["ISR"]<-5.64
  cp["IS"]<-153.81
}
if (sap4==2){
  cp<-tab.datClaser
  cp[,"C"]<-69+3.72+3768
}
if (sap4==3){
  cp<-tab.datCmicro
  cp[,"C"]<-69+3.72+(1495*2)
}
if (sap4==4){
  cp<-tab.datCradio
  cp[,"C"]<-69+3.72+1169.7
}
#if (sap2==2){
 # cp[,"C"]<- 1006.94*(1/0.63) #cost of radiofrequency
#}
#if (sap2==3){
 # cp[,"C"]<- 1010.85*2 #cost of two microwave visits
#}
if (sap2==4){
  cp[,"ISR"]<- 3.37 #Cost of NHS subsidising home iontophoresis
}
if (sap2==5){
  cp[,"M1"]<- 283.39+45.21+11.42 #sensitivity analysis of glycopyrrolate medication costs
  cp[,"M2"]<- 283.39+45.21+11.42 #sensitivity analysis of glycopyrrolate medication costs
  cp[,"M3"]<- 283.39+45.21+11.42 #sensitivity analysis of glycopyrrolate medication costs
  cp[,"MR"]<- 283.39+11.42
}
if (sap2==6){
  cp[,"M1"]<-  45.21+11.42+(283.39+28.13)/2 #sensitivity analysis of half taking glycopyrrolate and half taking propantheline costs
  cp[,"M2"]<-  45.21+11.42+(283.39+28.13)/2 #sensitivity analysis of half taking glycopyrrolate and half taking propantheline costs
  cp[,"M3"]<-  45.21+11.42+(283.39+28.13)/2 #sensitivity analysis of half taking glycopyrrolate and half taking propantheline costs
  cp[,"MR"]<-  11.42+(283.39+28.13)/2
}
if (sap2==7){
  cp[,"M1"]<-  45.21+11.42+283.39*(4/35) #sensitivity analysis of emergency glycopyrrolate medication costs
  cp[,"M2"]<-  45.21+11.42+283.39*(4/35) #sensitivity analysis of emergency glycopyrrolate medication costs
  cp[,"M3"]<-  45.21+11.42+283.39*(4/35) #sensitivity analysis of emergency glycopyrrolate medication costs
  cp[,"MR"]<-  11.42+283.39*(4/35)
}
if (sap2==8){
  cp[,"C"]<- 1195.1+3.72  #sensitivity analysis of infection rate of 10%
}
rt<-as.numeric(cp)
for (i in 1:nStates){
  dft[,(100+i)]<-rt[i]
}
#Account for private-to-NHS cost ratio uncetainty
if (sap4==2){
  dft[,115]<-dft[,115]*dft[,71]
}
if (sap4==3){
  dft[,115]<-dft[,115]*dft[,71]
}
##mortality risk
mr <- tab.datMR
rtrisk<-as.numeric(mr)
 #######################
##CAll prob functions
#b<-20
for (b in 1:64){
#  dft1<-nTreat(b,dft,sap2)
  #####################################
  #derive the probabilitites of receiving either medication, iontophoresis or antiperspirants following
  #treatment failure or compensatory sweating.These are conditional on the treatment sequence
  #####################################
  dfe<-dft
  if (b == 49|b == 50|b == 51|b == 52|b == 61|b == 62|b == 63|b == 64|
       b == 41|b == 42|b == 43|b == 44|b == 53|b == 54|b == 55|b == 56|
       b == 47|b == 48|b == 59|b == 60|
       b == 46|b == 58|b == 45|b == 57){
    #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
    dfe[,86]<-(dfe[,43]/(dfe[,43]+dfe[,42]+dft[,9]*dft[,11]))*dfe[,12]
    #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
    dfe[,87]<-(1-dfe[,86])*(dfe[,39]/(dfe[,39]+dfe[,38]+dft[,3]*dft[,5]))*dfe[,6]
    #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
    dfe[,88]<-(1-dfe[,86]-dfe[,87])*(dfe[,47]/(dfe[,47]+dfe[,46]+dft[,16]*dft[,18]))*dfe[,19]
```

```
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
  #noben<-Ris_ratio*Rm_ratio*Rb_ratio
  dfe[,90]<- dfe[,63]*dfe[,66]*dfe[,69]
  #maxben<-min(Ris_ratio,Rm_ratio,Rb_ratio)
  dfe[,91]<- min(dfe[,63],dfe[,66],dfe[,69])
} else if (b == 17| b == 18|b == 19|b == 20|b == 23|b == 24|b == 22|b == 21)  {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-(dfe[,43]/(dfe[,43]+dfe[,42]+dft[,9]*dft[,11]))*dfe[,12]
  #tfION<-(1-tfMED)*((RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE)
  dfe[,87]<-0
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-(1-dfe[,86]-dfe[,87])*(dfe[,47]/(dfe[,47]+dfe[,46]+dft[,16]*dft[,18]))*dfe[,19]
  #tfANTI<-1-tfMED-tfION
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]

  #noben<-Rm_ratio*Rb_ratio
  dfe[,90]<- dfe[,66]*dfe[,69]
  #maxben<-min(Rm_ratio,Rb_ratio)
  dfe[,91]<- min(dfe[,66],dfe[,69])
  } else if (b == 25| b == 26|b == 27|b == 28|b == 29|b == 30|b == 31|b == 32)  {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-0
  #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
  dfe[,87]<-(1-dfe[,86])*(dfe[,39]/(dfe[,39]+dfe[,38]+dft[,3]*dft[,5]))*dfe[,6]
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-(1-dfe[,86]-dfe[,87])*(dfe[,47]/(dfe[,47]+dfe[,46]+dft[,16]*dft[,18]))*dfe[,19]
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
  #noben<-Ris_ratio*Rb_ratio
  dfe[,90]<- dfe[,63]*dfe[,69]
  #maxben<-min(Ris_ratio,Rb_ratio)
  dfe[,91]<- min(dfe[,63],dfe[,69])
} else if (b == 33| b == 34|b == 35|b == 36|b == 37|b == 38|b == 39|b == 40)  {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-(dfe[,43]/(dfe[,43]+dfe[,42]+dft[,9]*dft[,11]))*dfe[,12]
  #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
  dfe[,87]<-(1-dfe[,86])*((dfe[,39]/(dfe[,39]+dfe[,38]+dft[,3]*dft[,5]))*dfe[,6])
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-0
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
  #noben<-Ris_ratio*Rm_ratio
  dfe[,90]<- dfe[,63]*dfe[,66]
  #maxben<-min(Ris_ratio,Rm_ratio)
  dfe[,91]<- min(dfe[,63],dfe[,66])
  } else if (b == 13| b == 14|b == 15|b == 16)  {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-0
  #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
  dfe[,87]<-(1-dfe[,86])*((dfe[,39]/(dfe[,39]+dfe[,38]+dft[,3]*dft[,5]))*dfe[,6])
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-0
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
  #noben<-Ris_ratio
  dfe[,90]<- dfe[,63]
  #maxben<-Ris_ratio
  dfe[,91]<- dfe[,63]
} else if (b == 9| b == 10|b == 11|b == 12)  {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-(dfe[,43]/(dfe[,43]+dfe[,42]+dft[,9]*dft[,11]))*dfe[,12]
  #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
  dfe[,87]<-0
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-0
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
  #noben<-Rm_ratio
  dfe[,90]<- dfe[,66]
  #maxben<-Rm_ratio
  dfe[,91]<- dfe[,66]
  } else if (b == 5| b == 6|b == 7|b == 8)  {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-0
  #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
  dfe[,87]<-0
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-(1-dfe[,86]-dfe[,87])*(dfe[,47]/(dfe[,47]+dfe[,46]+dft[,16]*dft[,18]))*dfe[,19]
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
  #noben<-Rb_ratio
  dfe[,90]<- dfe[,69]
  #maxben<-Rb_ratio
  dfe[,91]<- dfe[,69]
} else   {
  #tfMED<-(RM1/(RM0+RM1+M_R*M_SE))*M_NSE
  dfe[,86]<-0
  #tfION<-(1-tfMED)*(RIS1/(RIS0+RIS1+IS_R*IS_SE))*IS_NSE
  dfe[,87]<-0
  #tfBOT<-(1-tfMED)*(1-tfION)*((RB1/(RB0+RB1+B_R*B_SE))*B_NSE
  dfe[,88]<-0
  #tfANTI<-1-tfMED-tfION-tfBOT
  dfe[,89]<-1-dfe[,86]-dfe[,87]-dfe[,88]
}
##cost of treatment failure/treating compensatory sweating
#cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)*(1-ANTI drop out)
dfe[,124]<-dfe[,86]*(28.13+11.42)+dfe[,87]*0+dfe[,88]*dfe[,114]/6+dfe[,89]*(3.01+11.42)*(1-dfe[,70])
#cpELCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
dfe[,120]<-dfe[,86]*(28.13+11.42)+dfe[,87]*0+dfe[,88]*dfe[,114]/6+dfe[,89]*(3.01+11.42)
#cpEMCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
```

```
  dfe[,121]<-dfe[,86]*(28.13+11.42)+dfe[,87]*0+dfe[,88]*dfe[,114]/6+dfe[,89]*(3.01+11.42)
  #cpEHCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  dfe[,122]<-dfe[,86]*(28.13+11.42)+dfe[,87]*0+dfe[,88]*dfe[,114]/6+dfe[,89]*(3.01+11.42)
  #cpERCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  dfe[,123]<-dfe[,86]*(28.13+11.42)+dfe[,87]*0+dfe[,88]*dfe[,114]/6+dfe[,89]*(3.01+11.42)

  if (b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
       b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
       b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
    #cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
    dfe[,124]<-(dfe[,86]/(dfe[,86]+dfe[,87]+dfe[,88]))*(28.13+11.42)+(dfe[,87]/(dfe[,86]+dfe[,87]+dfe[,88]))*0+
      (dfe[,88]/(dfe[,86]+dfe[,87]+dfe[,88]))*dfe[,114]/6
  }
if  (b == 2| b == 3 | b == 4){
  dfe[,124]<-dfe[,101]
  dfe[,120]<-dfe[,101]
  dfe[,121]<-dfe[,101]
  dfe[,122]<-dfe[,101]
  dfe[,123]<-dfe[,101]
}
  if (sap2==1){}
  #sensitivity analysis of NHS subsidising home iontophoresis
  if (sap2==4){
    cpISR<- 3.37 #Cost of NHS subsidising home iontophoresis
    dfe[,103]<-cpISR
    #cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
    dfe[,124]<-dfe[,86]*(28.13+11.42)+dfe[,87]*3.37+dfe[,88]*dfe[,14]/6+dfe[,89]*(3.01+11.42)
    #cpELCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
    dfe[,120]<-dfe[,86]*(28.13+11.42)+dfe[,87]*3.37+dfe[,88]*dfe[,14]/6+dfe[,89]*(3.01+11.42)
    #cpEMCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
    dfe[,121]<-dfe[,86]*(28.13+11.42)+dfe[,87]*3.37+dfe[,88]*dfe[,14]/6+dfe[,89]*(3.01+11.42)
    #cpEHCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
    dfe[,122]<-dfe[,86]*(28.13+11.42)+dfe[,87]*3.37+dfe[,88]*dfe[,14]/6+dfe[,89]*(3.01+11.42)
    #cpERCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
    dfe[,123]<-dfe[,86]*(28.13+11.42)+dfe[,87]*3.37+dfe[,88]*dfe[,14]/6+dfe[,89]*(3.01+11.42)
    if (b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
         b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
         b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
      #cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
      dfe[,124]<-(dfe[,86]/(dfe[,86]+dfe[,87]+dfe[,88]))*(28.13+11.42)+(dfe[,87]/(dfe[,86]+dfe[,87]+dfe[,88]))*3.37+
        (dfe[,88]/(dfe[,86]+dfe[,87]+dfe[,88]))*dfe[,114]/6
    }
  }
  #initial population sequence (cols: 87 to 109)
  if (b == 1){
    dfe[,301]<-1
    dfe[,302:325]<-0
  } else if (b == 13| b == 14|b == 15|b == 16|b == 25|b == 26|b == 27|b == 28|b == 33|b == 34|b == 35|b == 36|b == 41|
             b == 42|b == 43|b == 44|b == 45|b == 46|b == 47|b == 48){
    dfe[,302]<-1
    dfe[,301]<-0
    dfe[,303:325]<-0
  } else if (b == 9| b == 10|b == 11|b == 12|b == 17|b == 18|b == 19|b == 20|b == 37|b == 38|b == 39|b == 40|b == 49|
             b == 50|b == 51|b == 52|b == 53|b == 54|b == 55|b == 56){
    dfe[,304]<-1
    dfe[,301:303]<-0
    dfe[,305:325]<-0
  } else if (b == 5| b == 6|b == 7|b == 8|b == 21|b == 22|b == 23|b == 24|b == 29|b == 30|b == 31|b == 32|b == 57|
             b == 58|b == 59|b == 60|b == 61|b == 62|b == 63|b == 64){
    dfe[,308]<-1
    dfe[,301:307]<-0
    dfe[,309:325]<-0
  } else if (b == 3| b == 4){
    dfe[,315]<-0.5
    dfe[,301]<-0.5
    dfe[,302:314]<-0
    dfe[,316:325]<-0
  } else { #if (b == 2)
    dfe[,318]<-0.5
    dfe[,301]<-0.5
    dfe[,302:317]<-0
    dfe[,319:325]<-0
  }
  dfe[,4001:4025]<-dfe[,301:325]
  df1<-dfe
 # write.csv(df1, file = "df1.csv")
  ##set utilities so that they don't exceed average population
  av_pop_utility <-  avpop_utility[1]
  df1[,251]<-av_pop_utility
  base_utility <- (df1[,58] + df1[,60])/2
  HDSS1response_utility <- (df1[,56] + df1[,58])/2
  halfHDSSresponse_utility <- (base_utility + HDSS1response_utility)/2
  HDSS2response_utility <- (df1[,56]+df1[,251])/2 #correct to ensure that utility isn't higher than population average for older persons
  threeqrtsHDSSresponse_utility <- (HDSS1response_utility + HDSS2response_utility)/2
  HDSS3response_utility <- df1[,251]
  df1[,201]<- halfHDSSresponse_utility*(1-df1[70])/YrCycles
  df1[,202]<-((HDSS2response_utility*df1[,40]) + (HDSS3response_utility*df1[,41]) + (base_utility*df1[,38]) + (HDSS1response_utility*df1[,39])) /YrCycles##Assumption of complete
utility gain in first month
  df1[,204]<-((HDSS2response_utility*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43]))/YrCycles ##Assumption of complete
utility gain in first month
  df1[,205]<-((HDSS2response_utility*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43]))/YrCycles ##Assumption of complete
utility gain in first month
  df1[,206]<-((HDSS2response_utility*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43]))/YrCycles ##Assumption of complete
utility gain in first month
  df1[,208]<-((HDSS2response_utility*df1[,48]) + (HDSS3response_utility*df1[,49]) + (base_utility*df1[,46]) + (HDSS1response_utility*df1[,47]))/YrCycles ##Assumption of complete
utility gain in first month
  df1[,215]<-((HDSS2response_utility*df1[,52]) + (HDSS3response_utility*df1[,53]) + (base_utility*df1[,50]) + (HDSS1response_utility*df1[,51]))/YrCycles ##Assumption of complete
utility gain in first month
  df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.487))/YrCycles
  df1[,224]<-(((df1[,86]+df1[,87]+df1[,88])*HDSS1response_utility)+((df1[,89])*base_utility))/YrCycles
 if (b == 2| b == 4|b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
```

```
      b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
      b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
  df1[,224]<-HDSS1response_utility/YrCycles
 }
 df1[,225]<-0 ##zero utility when dead
  df1[,203]<-((HDSS2response_utility*df1[,40]/(df1[,40]+df1[,41])) + (HDSS3response_utility*df1[,41]/(df1[,40]+df1[,41])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,207]<-((HDSS2response_utility*df1[,44]/(df1[,44]+df1[,45])) + (HDSS3response_utility*df1[,45]/(df1[,44]+df1[,45])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,209]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,210]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,211]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,212]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,213]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,214]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,216]<-((HDSS2response_utility*df1[,52]/(df1[,52]+df1[,53])) + (HDSS3response_utility*df1[,53]/(df1[,53]+df1[,52])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,219]<-df1[,251]/YrCycles ##Assumption of complete utility gain from second month
  ##Need to put in the CS utility scores
  df1[,217]<-base_utility/YrCycles ##Assumption of no utility gain with CS following curettage
  df1[,220]<-threeqrtsHDSSresponse_utility/YrCycles ##Assumption of 1.5 HDSS utility gain with low/mild CS following ETS
  df1[,221]<-HDSS1response_utility/YrCycles ##Assumption of 1 HDSS utility gain with moderate CS following ETS
  df1[,222]<-base_utility/YrCycles ##Assumption of no utility gain with  high/severe CS following ETS
  df1[,223]<-0.487/YrCycles ##Assumption of negative utility gain with  intervention regret CS following ETS.
  #16th percentile of beta sample distribution of HDSS 4 in Base-case
  if (sap3==1){}
  if (sap3==2){
    df1[,223]<-0.571/YrCycles #25th percentile of beta sample distribution of HDSS 4 in Base-case
    df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.571))/YrCycles
  }
  if (sap3==3){
    df1[,223]<-0.21/YrCycles #2.5th percentile of beta sample distribution of HDSS 4 in Base-case
    df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.21))/YrCycles
  }
  #sensitivity analysis for emergency medication use
  if (sap3==4){
    df1[,204]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)/YrCycles
    df1[,205]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)/YrCycles
    df1[,206]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)/YrCycles
    df1[,207]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45])*(4/35)/YrCycles
  }
  ##Define new initial population- first row of trace matrix
  df1[,6001:6025]<-df1[,4001:4025]*df1[,201:225] #QALYs
  df1[,8001:8025]<-df1[,4001:4025]*df1[,101:125] #Costs
  #Sum the QALYs across the states for each cycle
  df1[,10001]<-rowSums(df1[,6001:6025])
  #Sum the costs across the states for each iteration
  df1[,10101]<-rowSums(df1[,8001:8025])
 #write.csv(df1, file = "df1.csv")
 #i<-3
for (i in 2:12){
  ##set utilities so that they don't exceed average population
  av_pop_utility <-  avpop_utility[i]
  df1[,251]<-av_pop_utility
  base_utility <- (df1[,58] + df1[,60])/2
  HDSS1response_utility <- (df1[,56] + df1[,58])/2
  if (sap3==8){
    HDSS1response_utility <- df1[,58]
  }
  halfHDSSresponse_utility <- (base_utility + HDSS1response_utility)/2
  HDSS2response_utility <- (df1[,56]+df1[,251])/2 #correct to ensure that utility isn't higher than population average for older persons
  threeqrtsHDSSresponse_utility <- (HDSS1response_utility + HDSS2response_utility)/2
  HDSS3response_utility <- df1[,251]
  df1[,201]<- base_utility*(1-df1[70])/YrCycles
  df1[,202]<-((HDSS2response_utility*df1[,40]) + (HDSS3response_utility*df1[,41]) + (base_utility*df1[,38]) + (HDSS1response_utility*df1[,39])) /YrCycles##Assumption of complete utility gain in first month
  df1[,204]<-((HDSS2response_utility*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43]))/YrCycles ##Assumption of complete utility gain in first month
  df1[,205]<-((HDSS2response_utility*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43]))/YrCycles ##Assumption of complete utility gain in first month
  df1[,206]<-((HDSS2response_utility*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43]))/YrCycles ##Assumption of complete utility gain in first month
  df1[,208]<-((HDSS2response_utility*df1[,48]) + (HDSS3response_utility*df1[,49]) + (base_utility*df1[,46]) + (HDSS1response_utility*df1[,47]))/YrCycles ##Assumption of complete utility gain in first month
  df1[,215]<-((HDSS2response_utility*df1[,52]) + (HDSS3response_utility*df1[,53]) + (base_utility*df1[,50]) + (HDSS1response_utility*df1[,51]))/YrCycles ##Assumption of complete utility gain in first month
  df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.487))/YrCycles
  df1[,224]<-(((df1[,86]+df1[,87]+df1[,88])*HDSS1response_utility)+((df1[,89])*base_utility))/YrCycles
  df1[,225]<-0 ##zero utility when dead
  df1[,203]<-((HDSS2response_utility*df1[,40]/(df1[,40]+df1[,41])) + (HDSS3response_utility*df1[,41]/(df1[,40]+df1[,41])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,207]<-((HDSS2response_utility*df1[,44]/(df1[,44]+df1[,45])) + (HDSS3response_utility*df1[,45]/(df1[,44]+df1[,45])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,209]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,210]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,211]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,212]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,213]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,214]<-((HDSS2response_utility*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48])))/YrCycles ##Assumption of complete utility gain from second month
```

```
  df1[,216]<-((HDSS2response_utility*df1[,52]/(df1[,52]+df1[,53])) + (HDSS3response_utility*df1[,53]/(df1[,53]+df1[,52])))/YrCycles ##Assumption of complete utility gain from second month
  df1[,219]<-df1[,251]/YrCycles ##Assumption of complete utility gain from second month
  ##Need to put in the CS utility scores
  df1[,217]<-base_utility/YrCycles ##Assumption of no utility gain with CS following curettage
  df1[,220]<-threeqrtsHDSSresponse_utility/YrCycles ##Assumption of 1.5 HDSS utility gain with low/mild CS following ETS
  df1[,221]<-HDSS1response_utility/YrCycles ##Assumption of 1 HDSS utility gain with moderate CS following ETS
  df1[,222]<-base_utility/YrCycles ##Assumption of no utility gain with  high/severe CS following ETS
  df1[,223]<-0.487/YrCycles ##Assumption of negative utility gain with  intervention regret CS following ETS.
  #16th percentile of beta sample distribution of HDSS 4 in Base-case
  if (sap3==1){}
  if (sap3==2){
    df1[,223]<-0.571/YrCycles #25th percentile of beta sample distribution of HDSS 4 in Base-case
    df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.571))/YrCycles
  }
  if (sap3==3){
    df1[,223]<-0.21/YrCycles #2.5th percentile of beta sample distribution of HDSS 4 in Base-case
    df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.21))/YrCycles
  }
  #sensitivity analysis for emergency medication use
  if (sap3==4){
    df1[,204]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)/YrCycles
    df1[,205]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)/YrCycles
    df1[,206]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)/YrCycles
    df1[,207]<-(HDSS2response_utility*df1[,44] + HDSS3response_utility*df1[,45])*(4/35)/YrCycles
  }
  MORT <- rtrisk[i]
  df1[,401]<-MORT
  df1[,(1000+24*25+1):(1000+24*25+24)]<-df1[,401]
  #ALIVE <- 1-MORT
  df1[,402] <- 1-df1[,401]
  ##Transition probabilities grouped by original state, excluding transition to the next treatment and mortality
  #mModel["A","A"] <- ALIVE
  df1[,1001]<-df1[,402]
  #IS_CONTINUE <-  IS_R*ALIVE*IS_NSE
  df1[,403] <-  df1[,3]*df1[,402]*df1[,6]
  #IS_DROP <- 1-MORT-IS_CONTINUE ## drop out rate due to non-response and side effects
  df1[,404] <- 1-df1[,401]-df1[,403] ## drop out rate due to non-response and side effects
  #mModel["IS","ISR"] <- IS_CONTINUE
  df1[,(1000+2*25+2)]<-df1[,403]
  #mModel["IS","IS"] <- 0
  df1[,(1000+1*25+2)]<-0
  #mModel["ISR","ISR"] <- ALIVE
  df1[,(1000+2*25+3)]<-df1[,402]
  #ISC_DROP <- (1-IS_R)*noben*ALIVE
  df1[,426] <- (1-df1[,3])*df1[,90]*df1[,402] ##Probability of progression following
if (sap3==7){
  #ISC_DROP <- (1-IS_R)*maxben*ALIVE
  df1[,426] <- (1-df1[,3])*df1[,91]*df1[,402] ##Probability of progression following
}
  #ISTF_DROP <- 1-MORT-IS_CONTINUE-ISC_DROP  #Progress to TF instead of minor surgery if medication partially successful
  df1[,425] <-  1-df1[,401]-df1[,403]-df1[,426]
  #M_CONTINUE <-  M_R*ALIVE*M_NSE
  df1[,405] <-  df1[,9]*df1[,402]*df1[,12]
  #M_DROP <- 1-MORT-M_CONTINUE ## drop out rate due to non-response and side effects
  df1[,406] <- 1-df1[,401]-df1[,405] ## drop out rate due to non-response and side effects
#MC_DROP <- (1-M_R)*noben*ALIVE
df1[,424] <- (1-df1[,9])*df1[,90]*df1[,402] ##Probability of progression following
if (sap3==7){
  #MC_DROP <- (1-M_R)*maxben*ALIVE
  df1[,424] <- (1-df1[,9])*df1[,91]*df1[,402] ##Probability of progression following
}
#MTF_DROP <- 1-MORT-M_CONTINUE-MC_DROP  #Progress to TF instead of minor surgery if medication partially successful
df1[,423] <-  1-df1[,401]-df1[,405]-df1[,424]
  #mModel["M3","MR"] <- M_CONTINUE
  df1[,(1000+6*25+6)]<-df1[,405]
  if (sap3==5){
    #mModel["M3","MR"] <- 0
    df1[,(1000+6*25+6)]<-0
  }
  #mModel["M1","M2"] <- ALIVE
  df1[,(1000+4*25+4)]<-df1[,402]
  if (sap3==5){
    df1[,(1000+4*25+4)]<-0
  }
  #mModel["M2","M3"] <- ALIVE
  df1[,(1000+5*25+5)]<-df1[,402]
  if (sap3==5){
    df1[,(1000+5*25+5)]<-0
  }
  #mModel["M1","M1"] <- 0
  df1[,(1000+3*25+4)]<-0
  #mModel["M2","M2"] <- 0
  df1[,(1000+4*25+5)]<-0
  #mModel["M3","M3"] <- 0
  df1[,(1000+5*25+6)]<-0
  #MR_CONTINUE <- M_SR*ALIVE
  df1[,407] <- df1[,13]*df1[,402]
  #mModel["MR","MR"] <- MR_CONTINUE ##Can vary this in SA to allow for decling effectiveness over time
  df1[,(1000+6*25+7)]<-df1[,407]
  #MR_DROP <- 1- MORT - MR_CONTINUE
  df1[,432] <- 1 - df1[,401] - df1[,407]
  #M_SR_DROP <- 1-MORT-MR_CONTINUE
  df1[,429] <- 1-df1[,401]-df1[,407]
#MC_SR_DROP <- noben*ALIVE
df1[,430] <- df1[,90]*(1-df1[,13])*df1[,402] ##Probability of progression following
if (sap3==7){
  #MC_SR_DROP <- maxben*ALIVE
  df1[,430] <- df1[,91]*(1-df1[,13])*df1[,402] ##Probability of progression following
}
#MTF_SR_DROP <- 1-MORT-MR_CONTINUE-MC_SR_DROP  #Progress to TF instead of minor surgery if medication partially successful
```

```
df1[,431] <-  1-df1[,401]-df1[,407]-df1[,430]
  #B_CONTINUE <-  B_R*ALIVE*B_NSE
  df1[,409] <-  df1[,16]*df1[,402]*df1[,19]
  #B_DROP <- 1-MORT-B_CONTINUE ## drop out rate due to non-response and side effects. Assumption that botox
  df1[,410] <- 1-df1[,401]-df1[,409] ## drop out rate due to non-response and side effects. Assumption that botox
#BC_DROP <- (1-B_R)*noben*ALIVE
df1[,428] <- (1-df1[,16])*df1[,90]*df1[,402] ##Probability of progression following
if (sap3==7){
  #BC_DROP <- (1-B_R)*maxben*ALIVE
  df1[,428] <- (1-df1[,16])*df1[,91]*df1[,402] ##Probability of progression following
}
#BTF_DROP <- 1-MORT-B_CONTINUE-BC_DROP  #Progress to TF instead of minor surgery if medication partially successful
df1[,427] <-  1-df1[,401]-df1[,409]-df1[,428]
  ##drop outdue to side effects and lack of effectiveness occurs at the end of the first month and immediately
  ##move on to next treatment after 1st month
  #mModel["B1","B2"] <- B_CONTINUE
  df1[,(1000+8*25+8)]<-df1[,409]
  #mModel["B1","B1"] <- 0
  df1[,(1000+7*25+8)]<-0
  #mModel["B2","B3"] <- ALIVE
  df1[,(1000+9*25+9)]<-df1[,402]
  #mModel["B3","B4"] <- ALIVE
  df1[,(1000+10*25+10)]<-df1[,402]
  #mModel["B4","B5"] <- ALIVE
  df1[,(1000+11*25+11)]<-df1[,402]
  #mModel["B5","B6"] <- ALIVE
  df1[,(1000+12*25+12)]<-df1[,402]
  #mModel["B6","BS"] <- ALIVE
  df1[,(1000+13*25+13)]<-df1[,402]
  #mModel["BS","B2"] <- ALIVE
  df1[,(1000+8*25+14)]<-df1[,402]
  #CCS_TRANS <- CCS*ALIVE
  df1[,411] <- df1[,24]*df1[,402]
  #mModel["C","CCS"]<-CCS_TRANS
  df1[,(1000+16*25+15)]<-df1[,411]
  #mModel["C","C"] <- 0
  df1[,(1000+14*25+15)]<-0
  #no_CCS <- 1-CCS
  df1[,412]<-1-df1[,24]
  #C_SUCCESS <- C_R*ALIVE*no_CCS
  df1[,413] <- df1[,22]*df1[,402]*df1[,412]
  #mModel["C","CR"]<-C_SUCCESS
  df1[,(1000+15*25+15)]<-df1[,413]
  #C_DROP <- 1-MORT-CCS_TRANS-C_SUCCESS
  df1[,414] <- 1-df1[,401]-df1[,411]-df1[,413]
#CC_DROP <- Rc0*ALIVE
df1[,434] <- df1[,50]*df1[,402]
#CC_tf <- 1-MORT-CCS_TRANS-C_SUCCESS-CC_DROP
df1[,435] <- 1-df1[,401]-df1[,411]-df1[,413]-df1[,434]
  #mModel["CR","CR"] <- ALIVE
  df1[,(1000+15*25+16)]<-df1[,402]
  #mModel["CCS","CCS"] <- ALIVE
  df1[,(1000+16*25+17)]<-df1[,402]
  #ELCS_TRANS <- ELCS*ALIVE
  df1[,415] <- df1[,26]*df1[,402]
  #mModel["E","ELCS"]<-ELCS_TRANS
  df1[,(1000+19*25+18)]<-df1[,415]
  #EMCS_TRANS <- EMCS*ALIVE
  df1[,416] <- df1[,27]*df1[,402]
  #mModel["E","EMCS"]<-EMCS_TRANS
  df1[,(1000+20*25+18)]<-df1[,416]
  #EHCS_TRANS <- EHCS*ALIVE
  df1[,417] <- df1[,28]*df1[,402]
  #mModel["E","EHCS"]<-EHCS_TRANS
  df1[,(1000+21*25+18)]<-df1[,417]
  #ERCS_TRANS <- ERCS*ALIVE
  df1[,418] <- df1[,29]*df1[,402]
  #mModel["E","ERCS"]<-ERCS_TRANS
  df1[,(1000+22*25+18)]<-df1[,418]
  #no_ECS <- 1-ELCS-EMCS-EHCS-ERCS
  df1[,419] <- 1-df1[,26]-df1[,27]-df1[,28]-df1[,29]
  #E_SUCCESS <- E_R*ALIVE*no_ECS
  df1[,420] <- 1-df1[,415]-df1[,416]-df1[,417]-df1[,418]
  #mModel["E","ER"]<-E_SUCCESS
  df1[,(1000+18*25+18)]<-df1[,420]
  #mModel["E","E"] <- 0
  df1[,(1000+17*25+18)]<-0
  #E_NR <- 1-MORT-ELCS_TRANS-EMCS_TRANS-EHCS_TRANS-ERCS_TRANS-E_SUCCESS
  df1[,421] <- 1-df1[,401]-df1[,415]-df1[,416]-df1[,417]-df1[,418]-df1[,420]
  #mModel["ER","ER"] <- ALIVE
  df1[,(1000+18*25+19)]<-df1[,402]
  #mModel["ELCS","ELCS"] <- ALIVE
  df1[,(1000+19*25+20)]<-df1[,402]
  #mModel["EMCS","EMCS"] <- ALIVE
  df1[,(1000+20*25+21)]<-df1[,402]
  #mModel["EHCS","EHCS"] <- ALIVE
  df1[,(1000+21*25+22)]<-df1[,402]
  #mModel["ERCS","ERCS"] <- ALIVE
  df1[,(1000+22*25+23)]<-df1[,402]
  #mModel["TF","TF"] <- ALIVE
  df1[,(1000+23*25+24)]<-df1[,402]
  #mModel["D","D"] <- 1
  df1[,(1000+24*25+25)]<-1
  ##################################
  #Set transition matrix for each sequence
  ##################################
  if (b == 33| b == 34|b == 35|b == 36|b == 41|b == 42|b == 43|b == 44|b == 57|b == 58|b == 59|b == 60){
    #mModel["IS","M1"]<-IS_DROP
    df1[,(1000+3*25+2)]<-df1[,404]
  }
  if (b == 25| b == 26|b == 27|b == 28|b == 45|b == 46|b == 47|b == 48|b == 49|b == 50|b == 51|b == 52){
```

```
  #mModel["IS","B1"]<-IS_DROP
  df1[,(1000+7*25+2)]<-df1[,404]
}
if (b == 15| b == 16|b == 31|b == 32|b == 39|b == 40|b == 55|b == 56|b == 63|b == 64){
  #mModel["IS","C"]<-ISC_DROP
  df1[,(1000+14*25+2)]<-df1[,426]
  #mModel["IS","TF"]<-ISTF_DROP
  df1[,(1000+23*25+2)]<-df1[,425]
}
if (sap3==6){
if (b == 15| b == 16|b == 31|b == 32|b == 39|b == 40|b == 55|b == 56|b == 63|b == 64){
  #mModel["IS","C"]<-IS_DROP
  df1[,(1000+14*25+2)]<-df1[,404]
}
}
if (b == 14| b == 30|b == 38|b == 54|b == 62){
  #mModel["IS","E"]<-ISC_DROP
  df1[,(1000+17*25+2)]<-df1[,426]
  #mModel["IS","TF"]<-ISTF_DROP
  df1[,(1000+23*25+2)]<-df1[,425]
  }
if (sap3==6){
if (b == 14| b == 30|b == 38|b == 54|b == 62){
  #mModel["IS","E"]<-IS_DROP
  df1[,(1000+17*25+2)]<-df1[,404]
}
}
if (b == 13| b == 29|b == 37|b == 53|b == 61){
  #mModel["IS","TF"]<-IS_DROP
  df1[,(1000+23*25+2)]<-df1[,404]
}
#############################################
if (b == 37| b == 38|b == 39|b == 40|b == 49|b == 50|b == 51|b == 52|b == 61|b == 62|b == 63|b == 64){
  #mModel["M3","IS"]<-M_DROP
  df1[,(1000+1*25+6)]<-df1[,406]
  #mModel["MR","IS"]<-M_RSR
  df1[,(1000+1*25+7)]<-df1[,432]
}
if (b == 17| b == 18|b == 19|b == 20|b == 41|b == 42|b == 43|b == 44|b == 53|b == 54|b == 55|b == 56){

  #mModel["M3","B1"]<-M_DROP
  df1[,(1000+7*25+6)]<-df1[,406]
  #mModel["MR","B1"]<-MR-CONTINUE
  df1[,(1000+7*25+7)]<-df1[,432]
}
if (b == 11| b == 12|b == 23|b == 24|b == 35|b == 36|b == 47|b == 48|b == 59|b == 60){
  #mModel["M3","C"]<-MC_DROP
  df1[,(1000+14*25+6)]<-df1[,424]
  #mModel["M3","TF"]<-MTF_DROP
  df1[,(1000+23*25+6)]<-df1[,423]
  #mModel["MR","C"]<-MC_SR_DROP
  df1[,(1000+14*25+7)]<-df1[,431]
  #mModel["MR","TF"]<-MTF_SR_DROP
  df1[,(1000+23*25+7)]<-df1[,430]
  }
if (sap3==6){
if (b == 11| b == 12|b == 23|b == 24|b == 35|b == 36|b == 47|b == 48|b == 59|b == 60){
  #mModel["M3","C"]<-M_DROP
  df1[,(1000+14*25+6)]<-df1[,406]
  #mModel["MR","C"]<-M_SR_DROP
  df1[,(1000+14*25+7)]<-df1[,429]
}
}
if (b == 10| b == 22|b == 34|b == 46|b == 58){
  #mModel["M3","E"]<-MC_DROP
  df1[,(1000+17*25+6)]<-df1[,424]
  #mModel["M3","TF"]<-MTF_DROP
  df1[,(1000+23*25+6)]<-df1[,423]
  #mModel["MR","E"]<-MC_SR_DROP
  df1[,(1000+17*25+7)]<-df1[,431]
  #mModel["MR","TF"]<-MTF_SR_DROP
  df1[,(1000+23*25+7)]<-df1[,430]
    }
if (sap3==6){
if (b == 10| b == 22|b == 34|b == 46|b == 58){
  #mModel["M3","E"]<-M_DROP
  df1[,(1000+17*25+6)]<-df1[,406]
  #mModel["MR","E"]<-M_SR_DROP
  df1[,(1000+17*25+7)]<-df1[,429]
  }
}
if (b == 9| b == 21|b == 33|b == 45|b == 57){
  #mModel["M3","TF"]<-M_DROP
  df1[,(1000+23*25+6)]<-df1[,406]
  #mModel["MR","TF"]<-M_SR_DROP
  df1[,(1000+23*25+7)]<-df1[,429]
  }
#############################################
if (b == 29| b == 30|b == 31|b == 32|b == 53|b == 54|b == 55|b == 56|b == 57|b == 58|b == 59|b == 60){
  #mModel["B1","IS"]<-B_DROP
  df1[,(1000+1*25+8)]<-df1[,410]
}
if (b == 21| b == 22|b == 23|b == 24|b == 45|b == 46|b == 47|b == 48|b == 61|b == 62|b == 63|b == 64){
  #mModel["B1","M1"]<-B_DROP
  df1[,(1000+3*25+8)]<-df1[,410]
  }
if (b == 7| b == 8|b == 19|b == 20|b == 27|b == 28|b == 43|b == 44|b == 51|b == 52){
  #mModel["B1","C"]<-BC_DROP
  df1[,(1000+14*25+8)]<-df1[,428]
  #mModel["B1","TF"]<-BTF_DROP
  df1[,(1000+23*25+8)]<-df1[,427]
```

```
    }
  if (sap3==6){
  if (b == 7| b == 8|b == 19|b == 20|b == 27|b == 28|b == 43|b == 44|b == 51|b == 52){
    #mModel["B1","C"]<-B_DROP
    df1[,(1000+14*25+8)]<-df1[,410]
    }
  }
  if (b == 6| b == 18|b == 26|b == 42|b == 50){
    #mModel["B1","E"]<-BC_DROP
    df1[,(1000+17*25+8)]<-df1[,428]
    #mModel["B1","TF"]<-BTF_DROP
    df1[,(1000+23*25+8)]<-df1[,427]
    }
  if (sap3==6){
  if (b == 6| b == 18|b == 26|b == 42|b == 50){
    #mModel["B1","E"]<-B_DROP
    df1[,(1000+17*25+8)]<-df1[,410]
    }
  }
  if (b == 5| b == 17|b == 25|b == 41|b == 49){
    #mModel["B1","TF"]<-B_DROP
    df1[,(1000+23*25+8)]<-df1[,410]
  }
  ###############################################
if (b == 4| b == 8|b == 12|b == 16|b == 20|b == 24|b == 28|b == 32|b == 36|b == 40|b == 44|b == 48|b == 52|
     b == 56|b == 60|b == 64){
  #mModel["C","E"]<-CC_DROP
  df1[,(1000+17*25+15)]<-df1[,434]
  #mModel["C","TF"]<-CC_tf
  df1[,(1000+23*25+15)]<-df1[,435]
}
if (sap3==6){
  if (b == 4| b == 8|b == 12|b == 16|b == 20|b == 24|b == 28|b == 32|b == 36|b == 40|b == 44|b == 48|b == 52|
       b == 56|b == 60|b == 64){
    #mModel["C","E"]<-C_DROP
    df1[,(1000+17*25+15)]<-df1[,414]
  }
}
  if (b == 3| b == 7|b == 11|b == 15|b == 19|b == 23|b == 27|b == 31|b == 35|b == 39|b == 43|b == 47|b == 51|
       b == 55|b == 59|b == 63){
    #mModel["C","TF"]<-C_DROP
    df1[,(1000+23*25+15)]<-df1[,414]
  }
  ###############################################
  if (b == 2| b == 4|b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
       b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
       b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
    #mModel["E","TF"]<-0
    df1[,(1000+23*25+18)]<-0
  }
###########
##initial population cols: 87 to 109
for (j in 1:25){
  ##define holding intermediate states: 1001:763 transition matrix; 789:1413 for intermediate states
  df1[,(3001+(j-1)*25):(3025+(j-1)*25)]<-df1[,301:325]*df1[,(1001+(j-1)*25):(1001+24+(j-1)*25)]#A
}
for (j in 1:25){

  ##cols 89 to 113 becomes the holding vector for the initial population
  df1[,(301+(j-1))]<-rowSums(df1[ ,(3001+(j-1)*25):(3025+(j-1)*25)])
}
##derive the population distirbutions from the second cycle onwards
df1[,(4001+(i-1)*25):(4025+(i-1)*25)]<-df1[,301:325]
##derive the QALYs from the second cycle onwards
df1[,(6001+(i-1)*25):(6025+(i-1)*25)]<-df1[,(4001+(i-1)*25):(4025+(i-1)*25)]*df1[,201:225]/(1+0.002871)^(i-0.5);
##derive the Costs from the second cycle onwards
df1[,(8001+(i-1)*25):(8025+(i-1)*25)]<-df1[,(4001+(i-1)*25):(4025+(i-1)*25)]*df1[,101:125]/(1+0.002871)^(i-0.5);
#Sum the QALYs across the states for each cycle
df1[,(10001+(i-1))]<-rowSums(df1[,(6001+(i-1)*25):(6025+(i-1)*25)])
#Sum the costs across the states for each iteration
df1[,(10101+(i-1))]<-rowSums(df1[,(8001+(i-1)*25):(8025+(i-1)*25)])
} #END OF i in 2:12 loop
#write.csv(df1, file = "df1.csv")
#adjust the costs to be annual costs
df1[,101:113]<-df1[,101:113]*12
df1[,115:125]<-df1[,115:125]*12
df1[,109:114]<-df1[,114]*2
#cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)*(1-ANTI drop out)
df1[,124]<-df1[,86]*(28.13+11.42)*12+df1[,87]*0*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12*(1-df1[,70])
#cpELCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
df1[,120]<-df1[,86]*(28.13+11.42)*12+df1[,87]*0*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
#cpEMCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
df1[,121]<-df1[,86]*(28.13+11.42)*12+df1[,87]*0*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
#cpEHCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
df1[,122]<-df1[,86]*(28.13+11.42)*12+df1[,87]*0*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
#cpERCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
df1[,123]<-df1[,86]*(28.13+11.42)*12+df1[,87]*0*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
if (b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
     b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
     b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
  #cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  df1[,124]<-(df1[,86]/(df1[,86]+df1[,87]+df1[,88]))*(28.13+11.42)*12+(df1[,87]/(df1[,86]+df1[,87]+df1[,88]))*0*12+
    (df1[,88]/(df1[,86]+df1[,87]+df1[,88]))*df1[,114]*2
}
if  (b == 2| b == 4){
  dfe[,124]<-0
}
#sensitivity analysis of NHS subsidising home iontophoresis
if (sap2==4){
  cpISR<- 3.37 #Cost of NHS subsidising home iontophoresis
  dfe[,103]<-cpISR
```

```
  #cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)*(1-ANTI drop out)
  df1[,124]<-df1[,86]*(28.13+11.42)*12+df1[,87]*3.37*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12*(1-df1[,70])
  #cpELCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  df1[,120]<-df1[,86]*(28.13+11.42)*12+df1[,87]*3.37*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
  #cpEMCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  df1[,121]<-df1[,86]*(28.13+11.42)*12+df1[,87]*3.37*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
  #cpEHCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  df1[,122]<-df1[,86]*(28.13+11.42)*12+df1[,87]*3.37*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
  #cpERCS<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
  df1[,123]<-df1[,86]*(28.13+11.42)*12+df1[,87]*3.37*12+df1[,88]*df1[,114]*2+df1[,89]*(3.01+11.42)*12
  if (b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
       b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
       b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
   #cpTF<-tfMED*(28.13+11.42)+tfION*3.37+tfBOT*BScost+tfANTI*(3.01+11.42)
   df1[,124]<-(df1[,86]/(df1[,86]+df1[,87]+df1[,88]))*(28.13+11.42)*12+(df1[,87]/(df1[,86]+df1[,87]+df1[,88]))*3.37*12+
     (df1[,88]/(df1[,86]+df1[,87]+df1[,88]))*df1[,114]*2
  }
}
if (sap1==5){
  M_SR <- 0.970409082 #moderate decline in effectiveness over time
}
if (sap1==6){
  M_SR <- 0.886384872  #considerable decline in effectiveness over time
}
df1[,13]<-M_SR
for (i in 13:58){
   ##set utilities so that they don't exceed average population
  av_pop_utility <-  avpop_utility[i]
  df1[,251]<-av_pop_utility
  base_utility <- (df1[,58] + df1[,60])/2
  HDSS1response_utility <- (df1[,56] + df1[,58])/2
  if (sap3==8){
    HDSS1response_utility <- df1[,58]
  }
  halfHDSSresponse_utility <- (base_utility + HDSS1response_utility)/2
  HDSS2response_utility <- (df1[,56]+df1[,251])/2 #correct to ensure that utility isn't higher than population average for older persons
  df1[,252]<-HDSS2response_utility
  df1[,252]<-ifelse(df1[,252]>df1[,251],df1[,251],df1[,252])
  threeqrtsHDSSresponse_utility <- (HDSS1response_utility + df1[,252])/2
  HDSS3response_utility <- df1[,251]
  df1[,201]<- halfHDSSresponse_utility*(1-df1[70])
  df1[,202]<-((df1[,252]*df1[,40]) + (HDSS3response_utility*df1[,41]) + (base_utility*df1[,38]) + (HDSS1response_utility*df1[,39]))##Assumption of complete utility gain in first month
  df1[,204]<-((df1[,252]*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43])) ##Assumption of complete utility gain in first
month
  df1[,205]<-((df1[,252]*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43])) ##Assumption of complete utility gain in first
month
  df1[,206]<-((df1[,252]*df1[,44]) + (HDSS3response_utility*df1[,45]) + (base_utility*df1[,42]) + (HDSS1response_utility*df1[,43])) ##Assumption of complete utility gain in first
month
  df1[,208]<-((df1[,252]*df1[,48]) + (HDSS3response_utility*df1[,49]) + (base_utility*df1[,46]) + (HDSS1response_utility*df1[,47])) ##Assumption of complete utility gain in first
month
  df1[,215]<-((df1[,252]*df1[,52]) + (HDSS3response_utility*df1[,53]) + (base_utility*df1[,50]) + (HDSS1response_utility*df1[,51])) ##Assumption of complete utility gain in first
month
  df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.487))
  df1[,224]<-(((df1[,86]+df1[,87]+df1[,88])*HDSS1response_utility)+((df1[,89])*base_utility))
  if (b == 2| b == 4|b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
       b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
       b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
   df1[,224]<-HDSS1response_utility
  }
  df1[,225]<-0 ##zero utility when dead
  df1[,203]<-((df1[,252]*df1[,40]/(df1[,40]+df1[,41])) + (HDSS3response_utility*df1[,41]/(df1[,40]+df1[,41]))) ##Assumption of complete utility gain from second month
  df1[,207]<-((df1[,252]*df1[,44]/(df1[,44]+df1[,45])) + (HDSS3response_utility*df1[,45]/(df1[,44]+df1[,45]))) ##Assumption of complete utility gain from second month
  df1[,209]<-((df1[,252]*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48]))) ##Assumption of complete utility gain from second month
  df1[,210]<-((df1[,252]*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48]))) ##Assumption of complete utility gain from second month
  df1[,211]<-((df1[,252]*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48]))) ##Assumption of complete utility gain from second month
  df1[,212]<-((df1[,252]*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48]))) ##Assumption of complete utility gain from second month
  df1[,213]<-((df1[,252]*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48]))) ##Assumption of complete utility gain from second month
  df1[,214]<-((df1[,252]*df1[,48]/(df1[,48]+df1[,49])) + (HDSS3response_utility*df1[,49]/(df1[,49]+df1[,48]))) ##Assumption of complete utility gain from second month
  df1[,216]<-((df1[,252]*df1[,52]/(df1[,52]+df1[,53])) + (HDSS3response_utility*df1[,53]/(df1[,53]+df1[,52]))) ##Assumption of complete utility gain from second month
  df1[,219]<-df1[,251] ##Assumption of complete utility gain from second month
  ##Need to put in the CS utility scores
  df1[,217]<-base_utility ##Assumption of no utility gain with CS following curettage
  df1[,220]<-threeqrtsHDSSresponse_utility ##Assumption of 1.5 HDSS utility gain with low/mild CS following ETS
  df1[,221]<-HDSS1response_utility ##Assumption of 1 HDSS utility gain with moderate CS following ETS
  df1[,222]<-base_utility ##Assumption of no utility gain with  high/severe CS following ETS
  df1[,223]<-0.487 ##Assumption of negative utility gain with  intervention regret CS following ETS.
  #16th percentile of beta sample distribution of HDSS 4 in Base-case
  if (sap3==1){}
  if (sap3==2){
   df1[,223]<-0.571 #25th percentile of beta sample distribution of HDSS 4 in Base-case
   df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.571))
  }
  if (sap3==3){
   df1[,223]<-0.21 #2.5th percentile of beta sample distribution of HDSS 4 in Base-case
   df1[,218]<-((df1[,25]*df1[,251])+(df1[,26]*threeqrtsHDSSresponse_utility)+(df1[,27]*HDSS1response_utility)+(df1[,28]*base_utility)+(df1[,29]*0.21))
  }
  #sensitivity analysis for emergency medication use
  if (sap3==4){
   df1[,204]<-(df1[,252]*df1[,44] + HDSS3response_utility*df1[,45] + base_utility*df1[,42] + HDSS1response_utility*df1[,43])*(4/35)
   df1[,207]<-(df1[,252]*df1[,44] + HDSS3response_utility*df1[,45])*(4/35)
  }
 # df1[,114:138]<-df1[,201:225]
#  df1[,639:(1000+24*25+25)]<-rtrisk[i]
  MORT <- rtrisk[i]
  df1[,401]<-MORT
df1[,(1000+24*25+1):(1000+24*25+24)]<-df1[,401]
#ALIVE <- 1-MORT
df1[,402] <- 1-df1[,401]
##Transition probabilities grouped by original state, excluding transition to the next treatment and mortality
#mModel["A","A"] <- ALIVE
df1[,1001]<-df1[,402]
```

```
#IS_CONTINUE <-  IS_R*ALIVE*IS_NSE
df1[,403] <-  df1[,3]*df1[,402]*df1[,6]
#IS_DROP <- 1-MORT-IS_CONTINUE ## drop out rate due to non-response and side effects
df1[,404] <- 1-df1[,401]-df1[,403] ## drop out rate due to non-response and side effects
#mModel["IS","ISR"] <- IS_CONTINUE
df1[,(1000+2*25+2)]<-df1[,403]
#mModel["IS","IS"] <- 0
df1[,(1000+1*25+2)]<-0
#mModel["ISR","ISR"] <- ALIVE
df1[,(1000+2*25+3)]<-df1[,402]
#ISC_DROP <- (1-IS_R)*noben*ALIVE
df1[,426] <- (1-df1[,3])*df1[,90]*df1[,402] ##Probability of progression following
if (sap3==7){
  #ISC_DROP <- (1-IS_R)*maxben*ALIVE
  df1[,426] <- (1-df1[,3])*df1[,91]*df1[,402] ##Probability of progression following
}
#ISTF_DROP <- 1-MORT-IS_CONTINUE-ISC_DROP  #Progress to TF instead of minor surgery if medication partially successful
df1[,425] <-  1-df1[,401]-df1[,403]-df1[,426]
#M_CONTINUE <-  M_R*ALIVE*M_NSE
df1[,405] <-  df1[,9]*df1[,402]*df1[,12]
#M_DROP <- 1-MORT-M_CONTINUE ## drop out rate due to non-response and side effects
df1[,406] <- 1-df1[,401]-df1[,405] ## drop out rate due to non-response and side effects
#MC_DROP <- (1-M_R)*noben*ALIVE
df1[,424] <- (1-df1[,9])*df1[,90]*df1[,402] ##Probability of progression following
if (sap3==7){
  #MC_DROP <- (1-M_R)*maxben*ALIVE
  df1[,424] <- (1-df1[,9])*df1[,91]*df1[,402] ##Probability of progression following
}
#MTF_DROP <- 1-MORT-M_CONTINUE-MC_DROP  #Progress to TF instead of minor surgery if medication partially successful
df1[,423] <-  1-df1[,401]-df1[,405]-df1[,424]
#mModel["M3","MR"] <- M_CONTINUE
df1[,(1000+6*25+6)]<-df1[,405]
if (sap3==5){
  #mModel["M3","MR"] <- 0
  df1[,(1000+6*25+6)]<-0
}
#mModel["M1","M2"] <- ALIVE
df1[,(1000+4*25+4)]<-df1[,402]
if (sap3==5){
  df1[,(1000+4*25+4)]<-0
}
#mModel["M2","M3"] <- ALIVE
df1[,(1000+5*25+5)]<-df1[,402]
if (sap3==5){
  df1[,(1000+5*25+5)]<-0
}
#mModel["M1","M1"] <- 0
df1[,(1000+3*25+4)]<-0
#mModel["M2","M2"] <- 0
df1[,(1000+4*25+5)]<-0
#mModel["M3","M3"] <- 0
df1[,(1000+5*25+6)]<-0
#MR_CONTINUE <- M_SR*ALIVE
df1[,407] <- df1[,13]*df1[,402]
#mModel["MR","MR"] <- MR_CONTINUE ##Can vary this in SA to allow for decling effectiveness over time
df1[,(1000+6*25+7)]<-df1[,407]
#MR_DROP <- 1- MORT - MR_CONTINUE
df1[,432] <- 1 - df1[,401] - df1[,407]
#M_SR_DROP <- 1-MORT-MR_CONTINUE
df1[,429] <- 1-df1[,401]-df1[,407]
#MC_SR_DROP <- noben*ALIVE
df1[,430] <- df1[,90]*(1-df1[,13])*df1[,402] ##Probability of progression following
if (sap3==7){
  #MC_SR_DROP <- maxben*ALIVE
  df1[,430] <- df1[,91]*(1-df1[,13])*df1[,402] ##Probability of progression following
}
#MTF_SR_DROP <- 1-MORT-MR_CONTINUE-MC_SR_DROP  #Progress to TF instead of minor surgery if medication partially successful
df1[,431] <-  1-df1[,401]-df1[,407]-df1[,430]
#B_CONTINUE <-  B_R*ALIVE*B_NSE
df1[,409] <-  df1[,16]*df1[,402]*df1[,19]
#B_DROP <- 1-MORT-B_CONTINUE ## drop out rate due to non-response and side effects. Assumption that botox
df1[,410] <- 1-df1[,401]-df1[,409] ## drop out rate due to non-response and side effects. Assumption that botox
#BC_DROP <- (1-B_R)*noben*ALIVE
df1[,428] <- (1-df1[,16])*df1[,90]*df1[,402] ##Probability of progression following
if (sap3==7){
  #BC_DROP <- (1-B_R)*maxben*ALIVE
  df1[,428] <- (1-df1[,16])*df1[,91]*df1[,402] ##Probability of progression following
}
#BTF_DROP <- 1-MORT-B_CONTINUE-BC_DROP  #Progress to TF instead of minor surgery if medication partially successful
df1[,427] <-  1-df1[,401]-df1[,409]-df1[,428]
##drop outdue to side effects and lack of effectiveness occurs at the end of the first month and immediately
##move on to next treatment after 1st month
#mModel["B1","B2"] <- B_CONTINUE
df1[,(1000+8*25+8)]<-df1[,409]
#mModel["B1","B1"] <- 0
df1[,(1000+7*25+8)]<-0
#mModel["B2","B3"] <- ALIVE
df1[,(1000+9*25+9)]<-df1[,402]
#mModel["B3","B4"] <- ALIVE
df1[,(1000+10*25+10)]<-df1[,402]
#mModel["B4","B5"] <- ALIVE
df1[,(1000+11*25+11)]<-df1[,402]
#mModel["B5","B6"] <- ALIVE
df1[,(1000+12*25+12)]<-df1[,402]
#mModel["B6","BS"] <- ALIVE
df1[,(1000+13*25+13)]<-df1[,402]
#mModel["BS","B2"] <- ALIVE
df1[,(1000+8*25+14)]<-df1[,402]


#CCS_TRANS <- CCS*ALIVE
```

```
df1[,411] <- df1[,24]*df1[,402]
#mModel["C","CCS"]<-CCS_TRANS
df1[,(1000+16*25+15)]<-df1[,411]
#mModel["C","C"] <- 0
df1[,(1000+14*25+15)]<-0
#no_CCS <- 1-CCS
df1[,412]<-1-df1[,24]
#C_SUCCESS <- C_R*ALIVE*no_CCS
df1[,413] <- df1[,22]*df1[,402]*df1[,412]
#mModel["C","CR"]<-C_SUCCESS
df1[,(1000+15*25+15)]<-df1[,413]
#C_DROP <- 1-MORT-CCS_TRANS-C_SUCCESS
df1[,414] <- 1-df1[,401]-df1[,411]-df1[,413]
#CC_DROP <- Rc0*ALIVE
df1[,434] <- df1[,50]*df1[,402]
#CC_tf <- 1-MORT-CCS_TRANS-C_SUCCESS-CC_DROP
df1[,435] <- 1-df1[,401]-df1[,411]-df1[,413]-df1[,434]
#mModel["CR","CR"] <- ALIVE
df1[,(1000+15*25+16)]<-df1[,402]
#mModel["CCS","CCS"] <- ALIVE
df1[,(1000+16*25+17)]<-df1[,402]
#ELCS_TRANS <- ELCS*ALIVE
df1[,415] <- df1[,26]*df1[,402]
#mModel["E","ELCS"]<-ELCS_TRANS
df1[,(1000+19*25+18)]<-df1[,415]
#EMCS_TRANS <- EMCS*ALIVE
df1[,416] <- df1[,27]*df1[,402]
#mModel["E","EMCS"]<-EMCS_TRANS
df1[,(1000+20*25+18)]<-df1[,416]
#EHCS_TRANS <- EHCS*ALIVE
df1[,417] <- df1[,28]*df1[,402]
#mModel["E","EHCS"]<-EHCS_TRANS
df1[,(1000+21*25+18)]<-df1[,417]
#ERCS_TRANS <- ERCS*ALIVE
df1[,418] <- df1[,29]*df1[,402]
#mModel["E","ERCS"]<-ERCS_TRANS
df1[,(1000+22*25+18)]<-df1[,418]
#no_ECS <- 1-ELCS-EMCS-EHCS-ERCS
df1[,419] <- 1-df1[,26]-df1[,27]-df1[,28]-df1[,29]
#E_SUCCESS <- E_R*ALIVE*no_ECS
df1[,420] <- 1-df1[,415]-df1[,416]-df1[,417]-df1[,418]
#mModel["E","ER"]<-E_SUCCESS
df1[,(1000+18*25+18)]<-df1[,420]
#mModel["E","E"] <- 0
df1[,(1000+17*25+18)]<-0
#E_NR <- 1-MORT-ELCS_TRANS-EMCS_TRANS-EHCS_TRANS-ERCS_TRANS-E_SUCCESS
df1[,421] <- 1-df1[,401]-df1[,415]-df1[,416]-df1[,417]-df1[,418]-df1[,420]
#mModel["ER","ER"] <- ALIVE
df1[,(1000+18*25+19)]<-df1[,402]
#mModel["ELCS","ELCS"] <- ALIVE
df1[,(1000+19*25+20)]<-df1[,402]
#mModel["EMCS","EMCS"] <- ALIVE
df1[,(1000+20*25+21)]<-df1[,402]
#mModel["EHCS","EHCS"] <- ALIVE
df1[,(1000+21*25+22)]<-df1[,402]
#mModel["ERCS","ERCS"] <- ALIVE
df1[,(1000+22*25+23)]<-df1[,402]
#mModel["TF","TF"] <- ALIVE
df1[,(1000+23*25+24)]<-df1[,402]
#mModel["D","D"] <- 1
df1[,(1000+24*25+25)]<-1
##################################
#Set transition matrix for each sequence
##################################
if (b == 33| b == 34|b == 35|b == 36|b == 41|b == 42|b == 43|b == 44|b == 57|b == 58|b == 59|b == 60){
  #mModel["IS","M1"]<-IS_DROP
  df1[,(1000+3*25+2)]<-df1[,404]
}
if (b == 25| b == 26|b == 27|b == 28|b == 45|b == 46|b == 47|b == 48|b == 49|b == 50|b == 51|b == 52){
  #mModel["IS","B1"]<-IS_DROP
  df1[,(1000+7*25+2)]<-df1[,404]
}
if (b == 15| b == 16|b == 31|b == 32|b == 39|b == 40|b == 55|b == 56|b == 63|b == 64){
  #mModel["IS","C"]<-ISC_DROP
  df1[,(1000+14*25+2)]<-df1[,426]
  #mModel["IS","TF"]<-ISTF_DROP
  df1[,(1000+23*25+2)]<-df1[,425]
}
if (sap3==6){
  if (b == 15| b == 16|b == 31|b == 32|b == 39|b == 40|b == 55|b == 56|b == 63|b == 64){
    #mModel["IS","C"]<-IS_DROP
    df1[,(1000+14*25+2)]<-df1[,404]
  }
}
if (b == 14| b == 30|b == 38|b == 54|b == 62){
  #mModel["IS","E"]<-ISC_DROP
  df1[,(1000+17*25+2)]<-df1[,426]
  #mModel["IS","TF"]<-ISTF_DROP
  df1[,(1000+23*25+2)]<-df1[,425]
}
if (sap3==6){
  if (b == 14| b == 30|b == 38|b == 54|b == 62){
    #mModel["IS","E"]<-IS_DROP
    df1[,(1000+17*25+2)]<-df1[,404]
  }
}
if (b == 13| b == 29|b == 37|b == 53|b == 61){
  #mModel["IS","TF"]<-IS_DROP
  df1[,(1000+23*25+2)]<-df1[,404]
}
##########################################
```

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if (b == 37| b == 38|b == 39|b == 40|b == 49|b == 50|b == 51|b == 52|b == 61|b == 62|b == 63|b == 64){
  #mModel["M3","IS"]<-M_DROP
  df1[,(1000+1*25+6)]<-df1[,406]
  #mModel["MR","IS"]<-M_RSR
  df1[,(1000+1*25+7)]<-df1[,432]
}
if (b == 17| b == 18|b == 19|b == 20|b == 41|b == 42|b == 43|b == 44|b == 53|b == 54|b == 55|b == 56){
  #mModel["M3","B1"]<-M_DROP
  df1[,(1000+7*25+6)]<-df1[,406]
  #mModel["MR","B1"]<-MR-CONTINUE
  df1[,(1000+7*25+7)]<-df1[,432]
}
if (b == 11| b == 12|b == 23|b == 24|b == 35|b == 36|b == 47|b == 48|b == 59|b == 60){
  #mModel["M3","C"]<-MC_DROP
  df1[,(1000+14*25+6)]<-df1[,424]
  #mModel["M3","TF"]<-MTF_DROP
  df1[,(1000+23*25+6)]<-df1[,423]
  #mModel["MR","C"]<-MC_SR_DROP
  df1[,(1000+14*25+7)]<-df1[,431]
  #mModel["MR","TF"]<-MTF_SR_DROP
  df1[,(1000+23*25+7)]<-df1[,430]
}
if (sap3==6){
  if (b == 11| b == 12|b == 23|b == 24|b == 35|b == 36|b == 47|b == 48|b == 59|b == 60){
    #mModel["M3","C"]<-M_DROP
    df1[,(1000+14*25+6)]<-df1[,406]
    #mModel["MR","C"]<-M_SR_DROP
    df1[,(1000+14*25+7)]<-df1[,429]
  }
}
if (b == 10| b == 22|b == 34|b == 46|b == 58){
  #mModel["M3","E"]<-MC_DROP
  df1[,(1000+17*25+6)]<-df1[,424]
  #mModel["M3","TF"]<-MTF_DROP
  df1[,(1000+23*25+6)]<-df1[,423]
  #mModel["MR","E"]<-MC_SR_DROP
  df1[,(1000+17*25+7)]<-df1[,431]
  #mModel["MR","TF"]<-MTF_SR_DROP
  df1[,(1000+23*25+7)]<-df1[,430]
}
if (sap3==6){
  if (b == 10| b == 22|b == 34|b == 46|b == 58){
    #mModel["M3","E"]<-M_DROP
    df1[,(1000+17*25+6)]<-df1[,406]
    #mModel["MR","E"]<-M_SR_DROP
    df1[,(1000+17*25+7)]<-df1[,429]

  }
}
if (b == 9| b == 21|b == 33|b == 45|b == 57){
  #mModel["M3","TF"]<-M_DROP
  df1[,(1000+23*25+6)]<-df1[,406]
  #mModel["MR","TF"]<-M_SR_DROP
  df1[,(1000+23*25+7)]<-df1[,429]
}
############################################
if (b == 29| b == 30|b == 31|b == 32|b == 53|b == 54|b == 55|b == 56|b == 57|b == 58|b == 59|b == 60){
  #mModel["B1","IS"]<-B_DROP
  df1[,(1000+1*25+8)]<-df1[,410]
}
if (b == 21| b == 22|b == 23|b == 24|b == 45|b == 46|b == 47|b == 48|b == 61|b == 62|b == 63|b == 64){
  #mModel["B1","M1"]<-B_DROP
  df1[,(1000+3*25+8)]<-df1[,410]
}
if (b == 7| b == 8|b == 19|b == 20|b == 27|b == 28|b == 43|b == 44|b == 51|b == 52){
  #mModel["B1","C"]<-BC_DROP
  df1[,(1000+14*25+8)]<-df1[,428]
  #mModel["B1","TF"]<-BTF_DROP
  df1[,(1000+23*25+8)]<-df1[,427]
}
if (sap3==6){
  if (b == 7| b == 8|b == 19|b == 20|b == 27|b == 28|b == 43|b == 44|b == 51|b == 52){
    #mModel["B1","C"]<-B_DROP
    df1[,(1000+14*25+8)]<-df1[,410]
  }
}
if (b == 6| b == 18|b == 26|b == 42|b == 50){
  #mModel["B1","E"]<-BC_DROP
  df1[,(1000+17*25+8)]<-df1[,428]
  #mModel["B1","TF"]<-BTF_DROP
  df1[,(1000+23*25+8)]<-df1[,427]
}
if (sap3==6){
  if (b == 6| b == 18|b == 26|b == 42|b == 50){
    #mModel["B1","E"]<-B_DROP
    df1[,(1000+17*25+8)]<-df1[,410]
  }
}
if (b == 5| b == 17|b == 25|b == 41|b == 49){
  #mModel["B1","TF"]<-B_DROP
  df1[,(1000+23*25+8)]<-df1[,410]
}
############################################
if (b == 4| b == 8|b == 12|b == 16|b == 20|b == 24|b == 28|b == 32|b == 36|b == 40|b == 44|b == 48|b == 52|
      b == 56|b == 60|b == 64){
  #mModel["C","E"]<-CC_DROP
  df1[,(1000+17*25+15)]<-df1[,434]
  #mModel["C","TF"]<-CC_tf
  df1[,(1000+23*25+15)]<-df1[,435]
}
if (sap3==6){
```

```
  if (b == 4| b == 8|b == 12|b == 16|b == 20|b == 24|b == 28|b == 32|b == 36|b == 40|b == 44|b == 48|b == 52|
       b == 56|b == 60|b == 64){
   #mModel["C","E"]<-C_DROP
   df1[,(1000+17*25+15)]<-df1[,414]
  }
}
if (b == 3| b == 7|b == 11|b == 15|b == 19|b == 23|b == 27|b == 31|b == 35|b == 39|b == 43|b == 47|b == 51|
     b == 55|b == 59|b == 63){
  #mModel["C","TF"]<-C_DROP
  df1[,(1000+23*25+15)]<-df1[,414]
}
############################################
if (b == 2| b == 4|b == 6|b == 8|b == 10|b == 12|b == 14|b == 16|b == 18|b == 20|b == 22|b == 24|b == 26|
     b == 28|b == 30|b == 32|b == 34|b == 36|b == 38|b == 40|b == 42|b == 44|b == 46|b == 48|b == 50|
     b == 52|b == 54|b == 56|b == 58|b == 60|b == 62|b == 64){
  #mModel["E","TF"]<-0
  df1[,(1000+23*25+18)]<-0
}
######################################
for (j in 1:25){
  ##define holding intermediate states
  df1[,(3001+(j-1)*25):(3025+(j-1)*25)]<-df1[,301:325]*df1[,(1001+(j-1)*25):(1001+24+(j-1)*25)]#A
}
for (j in 1:25){
  ##holding vector for the initial population
  df1[,(301+(j-1))]<-rowSums(df1[ ,(3001+(j-1)*25):(3025+(j-1)*25)])
}
##derive the population distirbutions from the second cycle onwards
df1[,(4001+(i-1)*25):(4025+(i-1)*25)]<-df1[,301:325]
  df1[,(6001+(i-1)*25):(6025+(i-1)*25)]<-df1[,(4001+(i-1)*25):(4025+(i-1)*25)]*(df1[,201:225]/(1+0.035)^(i-11-0.5));
##derive the Costs from the second cycle onwards
  df1[,(8001+(i-1)*25):(8025+(i-1)*25)]<-df1[,(4001+(i-1)*25):(4025+(i-1)*25)]*df1[,101:125]/(1+0.035)^(i-11-0.5);
#Sum the QALYs across the states for each cycle
df1[,(10001+(i-1))]<-rowSums(df1[,(6001+(i-1)*25):(6025+(i-1)*25)])
#Sum the costs across the states for each iteration
df1[,(10101+(i-1))]<-rowSums(df1[,(8001+(i-1)*25):(8025+(i-1)*25)])
} #END i in 13:58 loop
#Sum the QALYs across the cycles
df1[,10201]<-rowSums(df1[,10001:10058])
#Sum the Costs across the cycles
df1[,10202]<-rowSums(df1[,10101:10158])
rmd[,(1+b)]<-df1[,10201]
rmd[,(65+b)]<-df1[,10202]
}#end intervention loop
mcmc<-rmd
 (mcmc);
}
```