Supplemental Appendix B1: WinBUGS Code

```
#Model 1 specification

model
{
r[1:8] ~ dmulti(p[1:8], n)
## p[1] = p(111); p[8] = p(000); pr = true prevalence
#Model specification
model
{
r[1:8] ~ dmulti(p[1:8], n)
## p[1] = p(111); p[8] = p(000); pr = true prevalence
p[1] <- pr*(se[1]*se[2]*se[3]) + (1-pr)*((1-sp[1])*(1-sp[2])*(1-sp[3]))
p[2] <- pr*(se[1]*se[2]*(1-se[3])) + (1-pr)*((1-sp[1])*(1-sp[2])*sp[3])
p[3] <- pr*(se[1]*(1-se[2])*se[3]) + (1-pr)*((1-sp[1])*sp[2]*(1-sp[3]))
p[4] <- pr*(se[1]*(1-se[2])*(1-se[3])) + (1-pr)*((1-sp[1])*sp[2]*sp[3])
p[5] <- pr*((1-se[1])*se[2]*se[3]) + (1-pr)*(sp[1]*(1-sp[2])*(1-sp[3]))
p[6] <- pr*((1-se[1])*se[2]*(1-se[3])) + (1-pr)*(sp[1]*(1-sp[2])*sp[3])
p[7] <- pr*((1-se[1])*(1-se[2])*se[3]) + (1-pr)*(sp[1]*sp[2]*(1-sp[3]))
p[8] <- pr*((1-se[1])*(1-se[2])*(1-se[3])) + (1-pr)*(sp[1]*sp[2]*sp[3])

#Prior specification
   pr ~ dunif(0,1)
se[1] ~ dunif(0.88,1)
se[2] ~ dunif(0.4,1)
se[3] ~ dunif(0.9,1)
sp[1] ~ dunif(0.93,1)
sp[2] ~ dunif(0.99,1)
sp[3] ~ dunif(0.95,1)


r2[1:8] ~ dmulti(p[1:8], n)
```

```
for ( i in 1:8)
{
d[i] <-(pow(r[i]-p[i]*n,2)/(p[i]*n))
d2[i] <- (pow(r2[i]-p[i]*n,2)/(p[i]*n))
}
bayesp <- step(sum(d[]) - sum(d2[]))
}

#data specification
list(r=c(18,2,31,7,1,0,11,3663), n=3733)
```

Supplemental Appendix B2: WinBUGS Code

```
#Model 9 specification

model
{
r[1:8] ~ dmulti(p[1:8], n)
## p[1] = p(111); p[8] = p(000); pr = true prevalence
## a_ijk = covariance between sensitivities; b_ijk = covariance between specificities
## i = RBT, j = SAT-EDTA, k = iELISA
p[1] <- pr*(se[1]*se[2]*se[3]) + (1-pr)*((1-sp[1])*(1-sp[2])*(1-sp[3])+(1-sp[1])*b23+(1-sp[2])*b13+(1-sp[3])*b12)
p[2] <- pr*(se[1]*se[2]*(1-se[3])) + (1-pr)*((1-sp[1])*(1-sp[2])*sp[3]-(1-sp[1])*b23-(1-sp[2])*b13+sp[3]*b12)
p[3] <- pr*(se[1]*(1-se[2])*se[3]) + (1-pr)*((1-sp[1])*sp[2]*(1-sp[3])-(1-sp[1])*b23+sp[2]*b13-(1-sp[3])*b12)
p[4] <- pr*(se[1]*(1-se[2])*(1-se[3])) + (1-pr)*((1-sp[1])*sp[2]*sp[3]+(1-sp[1])*b23-sp[2]*b13-sp[3]*b12)
p[5] <- pr*((1-se[1])*se[2]*se[3]) + (1-pr)*(sp[1]*(1-sp[2])*(1-sp[3])+sp[1]*b23-(1-sp[2])*b13-(1-sp[3])*b12)
p[6] <- pr*((1-se[1])*se[2]*(1-se[3])) + (1-pr)*(sp[1]*(1-sp[2])*sp[3]-sp[1]*b23+(1-sp[2])*b13-sp[3]*b12)
p[7] <- pr*((1-se[1])*(1-se[2])*se[3]) + (1-pr)*(sp[1]*sp[2]*(1-sp[3])-sp[1]*b23-sp[2]*b13+(1-sp[3])*b12)
p[8] <- pr*((1-se[1])*(1-se[2])*(1-se[3])) + (1-pr)*(sp[1]*sp[2]*sp[3]+sp[1]*b23+sp[2]*b13+sp[3]*b12)
#Prior specification
pr ~ dunif(0,0.2)
se[1] ~ dunif(0.88,1)
se[2] ~ dunif(0.4,1)
se[3] ~ dunif(0.9,1)
sp[1] ~ dunif(0.93,1)
sp[2] ~ dunif(0.99,1)
sp[3] ~dunif(0.95,1)
#Lower and upper limits for covariance parameters based on proposed priors
ll1 <- max(-(1-se[1])*(1-se[2]), -se[1]*se[2])
ul1 <- min(se[1]*(1-se[2]),(1-se[1])*se[2])
a12 ~ dunif(ll1,ul1)
ll2 <- max(-(1-se[1])*(1-se[3]), -se[1]*se[3])
ul2 <- min(se[1]*(1-se[3]),(1-se[1])*se[3])
a13 ~ dunif(ll2,ul2)
```

```
ll3 <- max(-(1-se[2])*(1-se[3]), -se[2]*se[3])
ul3 <- min(se[2]*(1-se[3]),(1-se[2])*se[3])
a23 ~ dunif(ll3,ul3)
ll4 <- max(-(1-sp[1])*(1-sp[2]), -sp[1]*sp[2])
ul4 <- min(sp[1]*(1-sp[2]),(1-sp[1])*sp[2])
b12 ~ dunif(ll4,ul4)
ll5 <- max(-(1-sp[1])*(1-sp[3]), -sp[1]*sp[3])
ul5 <- min(sp[1]*(1-sp[3]),(1-sp[1])*sp[3])
b13 ~ dunif(ll5,ul5)
ll6 <- max(-(1-sp[2])*(1-sp[3]), -sp[2]*sp[3])
ul6 <- min(sp[2]*(1-sp[3]),(1-sp[2])*sp[3])
b23 ~ dunif(ll6,ul6)
ll71 <- -(se[1]*se[2]*se[3]+se[1]*a23+se[2]*a13+se[3]*a12)
ll72 <- -((1-se[1])*(1-se[2])*se[3]-(1-se[1])*a23-(1-se[2])*a13+se[3]*a12)
ll73 <- -((1-se[1])*se[2]*(1-se[3])-(1-se[1])*a23+se[2]*a13-(1-se[3])*a12)
ll74 <- -(se[1]*(1-se[2])*(1-se[3])+se[1]*a23-(1-se[2])*a13-(1-se[3])*a12)
ll7 <- max(max(ll71, ll72), max(ll73, ll74))
ul71 <- (1-se[1])*se[2]*se[3]+(1-se[1])*a23-se[2]*a13-se[3]*a12
ul72 <- se[1]*(1-se[2])*se[3]-se[1]*a23+(1-se[2])*a13-se[3]*a12
ul73 <- se[1]*se[2]*(1-se[3])-se[1]*a23-se[2]*a13+(1-se[3])*a12
ul74 <- (1-se[1])*(1-se[2])*(1-se[3])+(1-se[1])*a23+(1-se[2])*a13+(1-se[3])*a12
ul7 <- min(min(ul71, ul72), min(ul73, ul74))
l1l <- min(ll7,ul7)
u1l <- max(ll7,ul7)
ll81 <- -(sp[1]*sp[2]*sp[3]+sp[1]*b23+sp[2]*b13+sp[3]*b12)
ll82 <- -((1-sp[1])*(1-sp[2])*sp[3]-(1-sp[1])*b23-(1-sp[2])*b13+sp[3]*b12)
ll83 <- -((1-sp[1])*sp[2]*(1-sp[3])-(1-sp[1])*b23+sp[2]*b13-(1-sp[3])*b12)
ll84 <- -(sp[1]*(1-sp[2])*(1-sp[3])+sp[1]*b23-(1-sp[2])*b13-(1-sp[3])*b12)
ll8 <- max(max(ll81, ll82), max(ll83, ll84))
ul81 <- (1-sp[1])*sp[2]*sp[3]+(1-sp[1])*b23-sp[2]*b13-sp[3]*b12
ul82 <- sp[1]*(1-sp[2])*sp[3]-sp[1]*b23+(1-sp[2])*b13-sp[3]*b12
ul83 <- sp[1]*sp[2]*(1-sp[3])-sp[1]*b23-sp[2]*b13+(1-sp[3])*b12
```

```
ul84 <- (1-sp[1])*(1-sp[2])*(1-sp[3])+(1-sp[1])*b23+(1-sp[2])*b13+(1-sp[3])*b12
ul8 <- min(min(ul81, ul82), min(ul83, ul84))
l2l <- min(ll8,ul8)
u2l <- max(ll8,ul8)


r2[1:8] ~ dmulti(p[1:8],n)
for ( i in 1:8)
{
####d[i] <- r[i]*log(max(r[i],1)/(p[i]*n))
d[i] <-(pow(r[i]-p[i]*n,2)/(p[i]*n))
####d2[i] <- r2[i]*log(max(r2[i],1)/(p[i]*n))
d2[i] <- (pow(r2[i]-p[i]*n,2)/(p[i]*n))
}
bayesp <- step(sum(d[]) - sum(d2[]))
}

#data specification
list(r=c(18,2,31,7,1,0,11,3663), n=3733)
# Specification of initial values for the three chains used

 list(pr=0.05, se=c( 0.9 , 0.912 , 0.956 ), sp=c( 0.966 , 0.999 , 0.97 ), a12= 0.0352 ,a13= 0.0176 ,a23= 0.018128 ,b12= 0.000466 ,b13= 0.01398
,b23= 0.00047 ,r2=c(18,2,31,7,1,0,11,3663))

 list(pr=0.15, se=c( 0.93 , 0.638 , 0.9728 ), sp=c( 0.935 , 0.99995 , 0.985 ), a12= 0.00965999999999999 ,a13= 0.011696 ,a23= 0.0037536 ,b12=
0.0000217499999999976 ,b13= 0.00652500000000001 ,b23= 0.0000242499999999973 , r2=c(18,2,31,7,1,0,11,3663))

 list(pr=0.1, se=c( 0.98 , 0.858 , 0.9216 ), sp=c( 0.988 , 0.993 , 0.995 ), a12= 0.00716000000000001 ,a13= 0.00843200000000001 ,a23=
0.0280672 ,b12= 0.003416 ,b13= 0.00244 ,b23= 0.002465 , r2=c(18,2,31,7,1,0,11,3663))
```

Supplemental Appendix B3: WinBUGS Code

```
#Model 10 specification

model
{
r[1:8] ~ dmulti(p[1:8], n)
## p[1] = p(111); p[8] = p(000); pr = true prevalence
## a_ijk = covariance between sensitivities; b_ijk = covariance between specificities
## i = RBT, j = SAT-EDTA, k = iELISA
p[1] <- pr*(se[1]*se[2]*se[3]+se[1]*a23+se[2]*a13+se[3]*a12+a123) + (1-pr)*((1-sp[1])*(1-sp[2])*(1-sp[3])+(1-sp[1])*b23+(1-sp[2])*b13+(1-sp[3])*b12-b123)
p[2] <- pr*(se[1]*se[2]*(1-se[3])-se[1]*a23-se[2]*a13+(1-se[3])*a12-a123) + (1-pr)*((1-sp[1])*(1-sp[2])*sp[3]-(1-sp[1])*b23-(1-sp[2])*b13+sp[3]*b12+b123)
p[3] <- pr*(se[1]*(1-se[2])*se[3]-se[1]*a23+(1-se[2])*a13-se[3]*a12-a123) + (1-pr)*((1-sp[1])*sp[2]*(1-sp[3])-(1-sp[1])*b23+sp[2]*b13-(1-sp[3])*b12+b123)
p[4] <- pr*(se[1]*(1-se[2])*(1-se[3])+se[1]*a23-(1-se[2])*a13-(1-se[3])*a12+a123) + (1-pr)*((1-sp[1])*sp[2]*sp[3]+(1-sp[1])*b23-sp[2]*b13-sp[3]*b12-b123)
p[5] <- pr*((1-se[1])*se[2]*se[3]+(1-se[1])*a23-se[2]*a13-se[3]*a12-a123) + (1-pr)*(sp[1]*(1-sp[2])*(1-sp[3])+sp[1]*b23-(1-sp[2])*b13-(1-sp[3])*b12+b123)
p[6] <- pr*((1-se[1])*se[2]*(1-se[3])-(1-se[1])*a23+se[2]*a13-(1-se[3])*a12+a123) + (1-pr)*(sp[1]*(1-sp[2])*sp[3]-sp[1]*b23+(1-sp[2])*b13-sp[3]*b12-b123)
p[7] <- pr*((1-se[1])*(1-se[2])*se[3]-(1-se[1])*a23-(1-se[2])*a13+se[3]*a12+a123) + (1-pr)*(sp[1]*sp[2]*(1-sp[3])-sp[1]*b23-sp[2]*b13+(1-sp[3])*b12-b123)
p[8] <- pr*((1-se[1])*(1-se[2])*(1-se[3])+(1-se[1])*a23+(1-se[2])*a13+(1-se[3])*a12-a123) + (1-pr)*(sp[1]*sp[2]*sp[3]+sp[1]*b23+sp[2]*b13+sp[3]*b12+b123)

#Prior specification
pr    ~ dunif(0   , 1)
se[1] ~ dunif(0.88, 1)
se[2] ~ dunif(0.40, 1)
se[3] ~ dunif(0.90, 1)
sp[1] ~ dunif(0.93, 1)
```

```
sp[2] ~ dunif(0.99, 1)
sp[3] ~ dunif(0.95, 1)

#Lower and upper limits for covariance parameters based on proposed priors
ll1 <- max(-(1-se[1])*(1-se[2]), -se[1]*se[2])
ul1 <- min(se[1]*(1-se[2]),(1-se[1])*se[2])
a12 ~ dunif(ll1,ul1)
ll2 <- max(-(1-se[1])*(1-se[3]), -se[1]*se[3])
ul2 <- min(se[1]*(1-se[3]),(1-se[1])*se[3])
a13 ~ dunif(ll2,ul2)
ll3 <- max(-(1-se[2])*(1-se[3]), -se[2]*se[3])
ul3 <- min(se[2]*(1-se[3]),(1-se[2])*se[3])
a23 ~ dunif(ll3,ul3)
ll4 <- max(-(1-sp[1])*(1-sp[2]), -sp[1]*sp[2])
ul4 <- min(sp[1]*(1-sp[2]),(1-sp[1])*sp[2])
b12 ~ dunif(ll4,ul4)
ll5 <- max(-(1-sp[1])*(1-sp[3]), -sp[1]*sp[3])
ul5 <- min(sp[1]*(1-sp[3]),(1-sp[1])*sp[3])
b13 ~ dunif(ll5,ul5)
ll6 <- max(-(1-sp[2])*(1-sp[3]), -sp[2]*sp[3])
ul6 <- min(sp[2]*(1-sp[3]),(1-sp[2])*sp[3])
b23 ~ dunif(ll6,ul6)
ll71 <- -(se[1]*se[2]*se[3]+se[1]*a23+se[2]*a13+se[3]*a12)
ll72 <- -((1-se[1])*(1-se[2])*se[3]-(1-se[1])*a23-(1-se[2])*a13+se[3]*a12)
ll73 <- -((1-se[1])*se[2]*(1-se[3])-(1-se[1])*a23+se[2]*a13-(1-se[3])*a12)
ll74 <- -(se[1]*(1-se[2])*(1-se[3])+se[1]*a23-(1-se[2])*a13-(1-se[3])*a12)
ll7 <- max(max(ll71, ll72), max(ll73, ll74))
ul71 <- (1-se[1])*se[2]*se[3]+(1-se[1])*a23-se[2]*a13-se[3]*a12
ul72 <- se[1]*(1-se[2])*se[3]-se[1]*a23+(1-se[2])*a13-se[3]*a12
ul73 <- se[1]*se[2]*(1-se[3])-se[1]*a23-se[2]*a13+(1-se[3])*a12
ul74 <- (1-se[1])*(1-se[2])*(1-se[3])+(1-se[1])*a23+(1-se[2])*a13+(1-se[3])*a12
ul7 <- min(min(ul71, ul72), min(ul73, ul74))
```

```
l1l <- min(ll7,ul7)
u1l <- max(ll7,ul7)
a123 ~ dunif(l1l,u1l)

ll81 <- -(sp[1]*sp[2]*sp[3]+sp[1]*b23+sp[2]*b13+sp[3]*b12)
ll82 <- -((1-sp[1])*(1-sp[2])*sp[3]-(1-sp[1])*b23-(1-sp[2])*b13+sp[3]*b12)
ll83 <- -((1-sp[1])*sp[2]*(1-sp[3])-(1-sp[1])*b23+sp[2]*b13-(1-sp[3])*b12)
ll84 <- -(sp[1]*(1-sp[2])*(1-sp[3])+sp[1]*b23-(1-sp[2])*b13-(1-sp[3])*b12)
ll8 <- max(max(ll81, ll82), max(ll83, ll84))
ul81 <- (1-sp[1])*sp[2]*sp[3]+(1-sp[1])*b23-sp[2]*b13-sp[3]*b12
ul82 <- sp[1]*(1-sp[2])*sp[3]-sp[1]*b23+(1-sp[2])*b13-sp[3]*b12
ul83 <- sp[1]*sp[2]*(1-sp[3])-sp[1]*b23-sp[2]*b13+(1-sp[3])*b12
ul84 <- (1-sp[1])*(1-sp[2])*(1-sp[3])+(1-sp[1])*b23+(1-sp[2])*b13+(1-sp[3])*b12
ul8 <- min(min(ul81, ul82), min(ul83, ul84))
l2l <- min(ll8,ul8)
u2l <- max(ll8,ul8)
b123 ~ dunif(l2l,u2l)

r2[1:8] ~ dmulti(p[1:8],n)
for ( i in 1:8)
{
d[i] <- r[i]*log(max(r[i],1)/(p[i]*n))
d2[i] <- r2[i]*log(max(r2[i],1)/(p[i]*n))
}
bayesp <- step(sum(d[]) - sum(d2[]))
}

#data specification
list(r=c(18,2,31,7,1,0,11,3663), n=3733)

# Specification of initial values for the three chains used
```

list(pr=0.5, se=c(0.88 , 0.51 , 0.91), sp=c(0.99 , 0.99 , 0.95), a12 = 0.0012 , a13 = 0.0342 , a23 = 0.008999999999999998 ,a123 = -0.000233999999999995 , b12 = 0.00490000000000001 , b13 = 0.0045 , b23 = 0.0045 , b123 = -0.00216 , r2=c(18,2,31,7,1,0,11,3663))

list(pr=0.5, se=c(0.93 , 0.75 , 0.95), sp=c(0.93 , 0.99 , 0.99), a12 = 0.0175 , a13 = 0.0215 , a23 = 0.0125 ,a123 = -0.0045 , b12 = 0.0043 , b13 = 0.0043 , b23 = 0.00490000000000001 , b123 = -0.002064 , r2=c(18,2,31,7,1,0,11,3663))

list(pr=0.5, se=c(0.99 , 0.99 , 0.99), sp=c(0.93 , 0.99 , 0.95), a12 = 0.00490000000000001 , a13 = 0.00490000000000001 , a23 = 0.00490000000000001 ,a123 = -0.002352 , b12 = 0.0043 , b13 = 0.0215 , b23 = 0.0045 , b123 = -0.00172 , r2=c(18,2,31,7,1,0,11,3663))