T2D Scenarios and Estimators

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I am interested in what happens when the effect of L0 on L and the effect of L0 on D changes. In my mind this would lead to a selection of individuals, and an increased survival probability in the placebo group post T2D diagnose.

```r
N <-  10^5

compare_effects <- function(estimator, beta_L0_L, beta_L_D, beta_A0_L, beta_L0_D,
                            beta_A0_D, eta, nu, N) {
  B <-  max(length(beta_L0_L), length(beta_L_D), length(beta_A0_L), length(beta_L0_D), length(beta_A0_D

  # All other parameters are repeated
  if(length(beta_L0_L) < B) beta_L0_L <- rep(beta_L0_L, B)
  if(length(beta_L_D) < B) beta_L_D <- rep(beta_L_D, B)
  if(length(beta_A0_L) < B) beta_A0_L <- rep(beta_A0_L, B)
  if(length(beta_L0_D) < B) beta_L0_D <- rep(beta_L0_D, B)
  if(length(beta_A0_D) < B) beta_A0_D <- rep(beta_A0_D, B)

  # A matrix for the results
  res <- matrix(nrow = B, ncol = 2)

  for(i in 1:B){
    dataA <- simT2D(N = N, eta = eta, nu = nu, beta_L0_D = beta_L0_D[i],
                  beta_L0_L = beta_L0_L[i], beta_A0_L = beta_A0_L[i],
                  beta_L_D = beta_L_D[i], beta_A0_D = beta_A0_D[i], cens = 0)
    res[i,1:2] <- estimator(dataA)
  }
  return(res)
}

estimator1 <- function(data) {
  # T2D events
  T2D_events <- data[Delta == 2]
  # T2D people
  T2D_peeps <- data[ID %in% T2D_events$ID]

  # Setting T_0 to debut time of diabetes
  T2D_peeps[, Time_T2D := Time - min(Time), by = ID]

  # Removing the new Time 0
  T2D_peeps <- T2D_peeps[Delta != 2]

  # Proportion of treatment and placebo patients who have died before 1 year after T2D diagnose
  prop_treat <- nrow(T2D_peeps[Time_T2D < 1 & Delta == 1 & A0 == 1]) / length(unique(T2D_peeps[A0 == 1]$
  prop_plac <- nrow(T2D_peeps[Time_T2D < 1 & Delta == 1 & A0 == 0]) / length(unique(T2D_peeps[A0 == 0]$
```

```
  # The proportion dead
  return(c(prop_plac, prop_treat))
}
```

Below we calculate the proportion of dead T2D patients 1 year post T2D diagnose. We do this in when the effect of the drug on Death is -0.1. The effect of L_0 on T2D is let to vary from 0 to 2.5 by 0.15. The effect of A_0 on T2D is large $(= -1)$. And the effect of T2D on death is moderate $(= 1)$. There is no effect of L_0 directly on death.

```
res1 <- compare_effects(estimator = estimator1,
                        N = N,
                        eta = c(0.1,0.3,0.1),
                        nu = c(1.1,1.3,1.1),
                        beta_L0_L = seq(0, 2.5, by = 0.15),
                        beta_A0_L = -1,
                        beta_L_D = 0.5,
                        beta_A0_D = 0,
                        beta_L0_D = 0)

ggplot()+
  geom_line(aes(x = seq(0, 2.5, by = 0.15), y = res1[,1], color = "placebo"))+
  geom_line(aes(x = seq(0, 2.5, by = 0.15), y = res1[,2], color = "treatment"))+
  scale_color_manual(values = c("placebo" = "blue", "treatment" = "red"))+
  ylab("Proportion dead 1 year post T2D")+
  xlab("Effect of L0 on T2D")+
  labs(title = "Effect of the drug on Death is -0.1")
```
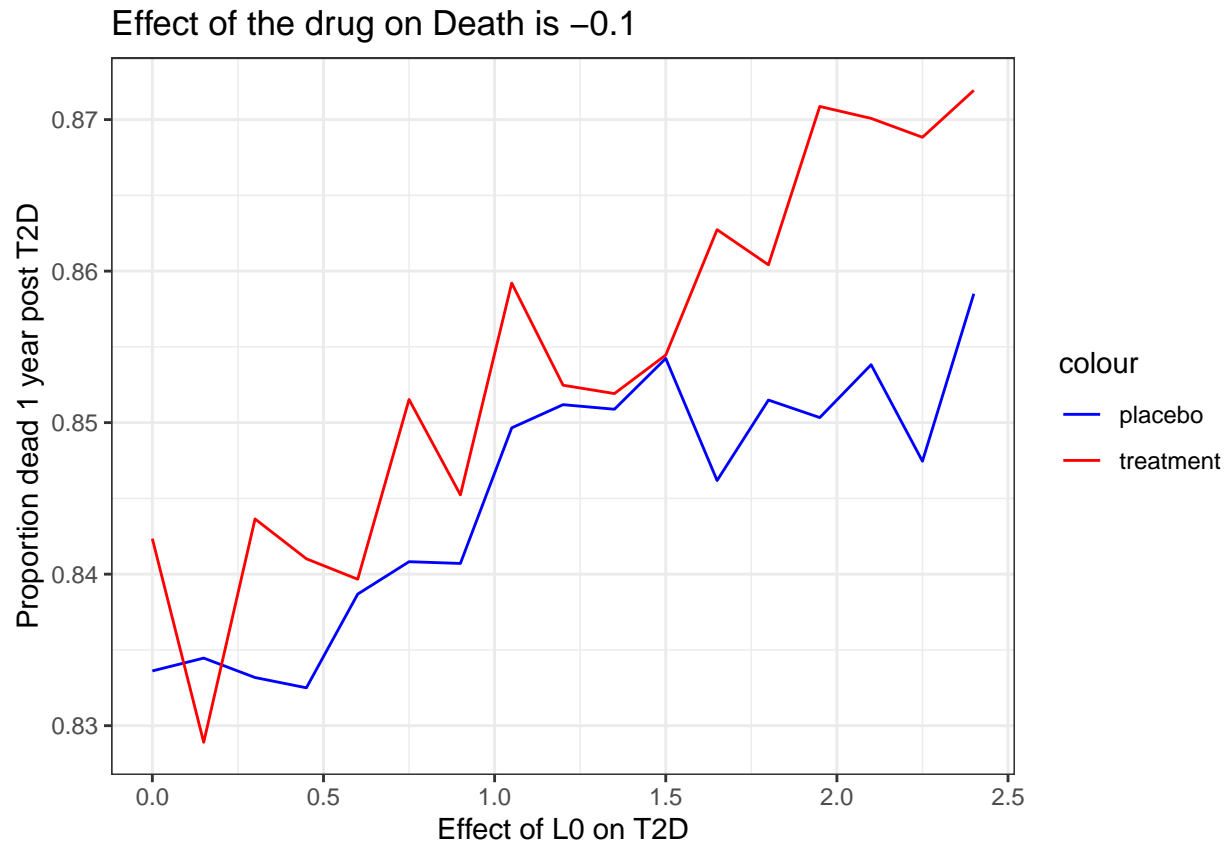
Effect of the drug on Death is −0.1
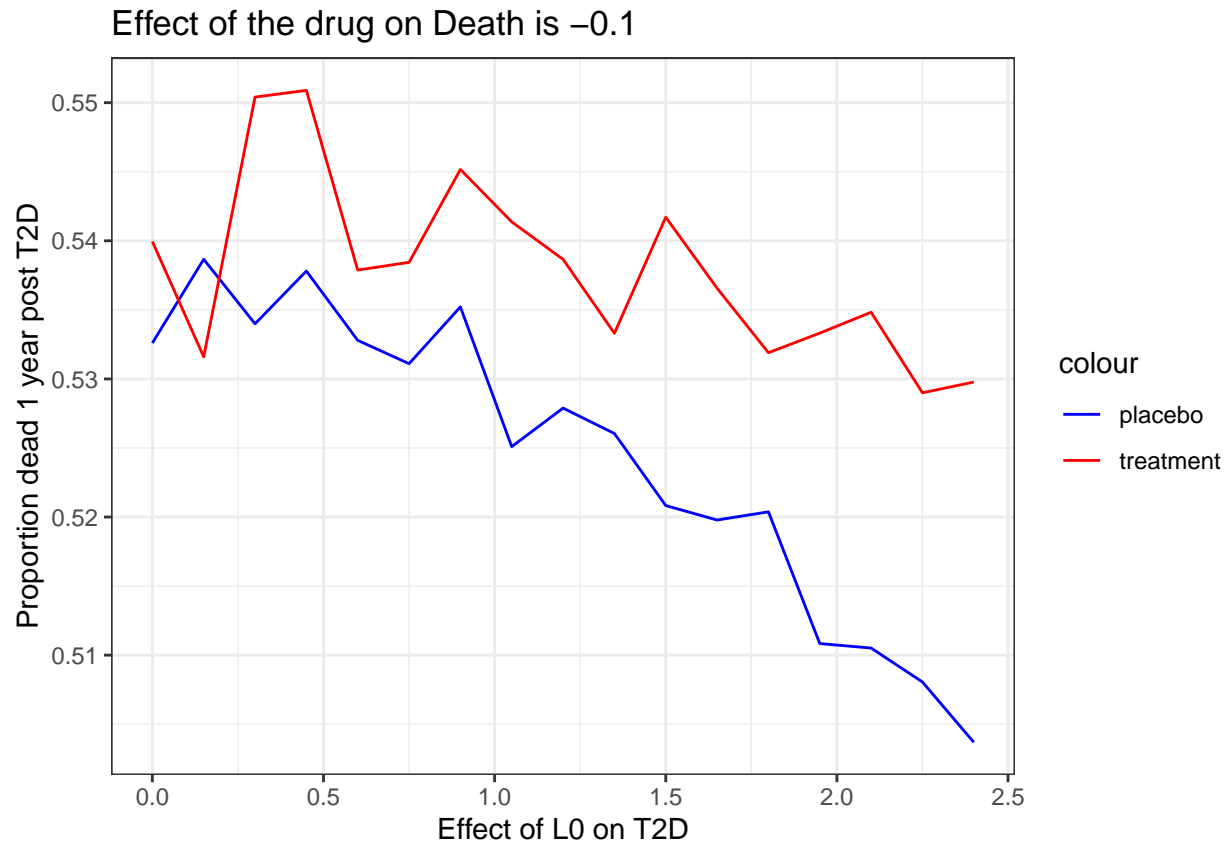
We do the same, now with the effect of L_0 directly on death is 1.

```
res2 <- compare_effects(estimator = estimator1,
                        N = N,
                        eta = c(0.1,0.3,0.1),
                        nu = c(1.1,1.3,1.1),
                        beta_L0_L = seq(0, 2.5, by = 0.15),
                        beta_A0_L = -1,
                        beta_L_D = 1,
                        beta_A0_D = 0,
                        beta_L0_D = 1)

ggplot()+
  geom_line(aes(x = seq(0, 2.5, by = 0.15), y = res2[,1], color = "placebo"))+
  geom_line(aes(x = seq(0, 2.5, by = 0.15), y = res2[,2], color = "treatment"))+
  scale_color_manual(values = c("treatment" = "red", "placebo" = "blue"))+
  ylab("Proportion dead 1 year post T2D")+
  xlab("Effect of L0 on T2D")+
  labs(title = "Effect of the drug on Death is -0.1")
```

Effect of the drug on Death is −0.1

We conduct the simulations one last time, now the effect of L_0 directly on death is 2.

```r
res2 <- compare_effects(estimator = estimator1,
                        N = N,
                        eta = c(0.1,0.3,0.1),
                        nu = c(1.1,1.3,1.1),
                        beta_L0_L = seq(0, 2.5, by = 0.15),
                        beta_A0_L = -1,
                        beta_L_D = 1,
                        beta_A0_D = 0,
                        beta_L0_D = 2)

ggplot()+
  geom_line(aes(x = seq(0, 2.5, by = 0.15), y = res2[,1], color = "placebo"))+
  geom_line(aes(x = seq(0, 2.5, by = 0.15), y = res2[,2], color = "treatment"))+
  scale_color_manual(values = c("treatment" = "red", "placebo" = "blue"))+
  ylab("Proportion dead 1 year post T2D")+
  xlab("Effect of L0 on T2D")+
  labs(title = "Effect of the drug on Death is -0.1")
```

Effect of the drug on Death is −0.1