

# CHL 8010: Week 10

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## Set Simulation Parameters

```
# Setting up necessary parameters and libraries
library(kableExtra)
# Number of simulations
m <- 1000
alpha1 <- 0:2
results_unadj = numeric(3)
results_adj = numeric(3)

for (j in 1:3) {
  type1_err_unadj = numeric(m)
  type1_err_adj = numeric(m)

  for (i in 1:m) {
    set.seed(2024 + i)
    alpha <- 0.05
    n <- 500 # Sample size
    pz <- 0.2 # Probability of Z = 1
    alpha0 <- 0 # Logit probability of x = 1 in non-smokers (z = 0)
    alpha2 <- 2
    beta0 <- -3 # Logit prob of y = 1 in non-coffee drinkers (x = 0) and non-smokers (z = 0)
    beta1 <- 0
    beta2 <- 2

    # Generate confounder Z from a binomial distribution
    z <- rbinom(n, size = 1, prob = pz)

    # Compute probability of observing X = 1 from the inverse logit function
    px <- exp(alpha0 + alpha1[j] * z) / (1 + exp(alpha0 + alpha1[j] * z))

    # Randomly generate binary variable X from the above probability
    x <- rbinom(n, size = 1, prob = px)

    # Randomly generate binary variable Y from the inverse logistic function
    py <- exp(beta0 + beta1 * x + beta2 * z) / (1 + exp(beta0 + beta1 * x + beta2 * z))
    y <- rbinom(n, size = 1, prob = py)

    # Combine three random variables into a data frame
    dat <- data.frame(lung = y, coffee = x, smoke = z)
```

```

# Fit unadjusted logistic regression model
unadj.mod <- glm(lung ~ coffee, data = dat, family = "binomial")
unadj.coef <- summary(unadj.mod)$coef
unadj_p <- unadj.coef[2, 4]

# Fit adjusted logistic regression model
adj.mod <- glm(lung ~ coffee + smoke, data = dat, family = "binomial")
adj.coef <- summary(adj.mod)$coef
adj_p <- adj.coef[2, 4]

# Record type 1 error rates
type1_err_unadj[i] <- as.numeric(unadj_p < alpha)
type1_err_adj[i] <- as.numeric(adj_p < alpha)
}

# Store results
results_unadj[j] <- mean(type1_err_unadj)
results_adj[j] <- mean(type1_err_adj)
}

# Final results for type 1 error
kable(cbind(alpha1, results_adj, results_unadj))

```

alpha1	results_adj	results_unadj
0	0.043	0.043
1	0.038	0.218
2	0.041	0.537