# Confidence Interval for Flu Vaccine Recipients and Sample Size Determination

## Part 1: Constructing a 99% Confidence Interval

To construct the 99% confidence interval for the proportion of vaccine-eligible people who received the flu vaccine:

Given information:

- Sample size n = 2,350

- Number of vaccine recipients x = 978

- Confidence level = 99%

Step 1: Calculate the sample proportion p̂

p̂ = x/n = 978/2,350 = 0.4162 or approximately 41.62%

Step 2: Calculate the standard error (SE)

SE = √[p̂(1-p̂)/n] = √[(0.4162)(0.5838)/2,350] = 0.0102

Step 3: Find the critical value for 99% confidence

For 99% confidence, z\_α/2 = 2.576

Step 4: Calculate the margin of error (ME)

ME = z\_α/2 × SE = 2.576 × 0.0102 = 0.0262

Step 5: Compute the 99% confidence interval

CI = p̂ ± ME = 0.4162 ± 0.0262 = (0.3900, 0.4424)

Therefore, I am 99% confident that the true proportion of vaccine-eligible people who received the flu vaccine is between 39.00% and 44.24%.

#### Comment on the belief about 45% vaccination rate:

Since 45% lies outside the 99% confidence interval (0.3900, 0.4424), there is statistically significant evidence at the 1% level to contradict the belief that 45% of vaccine-eligible people received the flu vaccine. The data suggests that the true proportion is likely less than 45%.

## Part 2: Determining Minimum Sample Size for Canadian Survey

To determine the smallest sample size needed for a margin of error ≤ 0.02 with 99% confidence:

Given information:

- Desired margin of error = 0.02

- Confidence level = 99% (z\_α/2 = 2.576)

Since we don't have prior information about the Canadian proportion, we should use p = 0.5 to ensure the most conservative (largest) sample size estimate.

Using the formula: n = [z\_α/2²p(1-p)]/E²

n = [(2.576)²(0.5)(0.5)]/(0.02)²

n = (6.636)(0.25)/(0.0004)

n = 4,147.5

Since sample size must be a whole number, the minimum required sample size is 4,148 vaccine-eligible people.