\*\*Part 1: Confidence Interval and Interpretation\*\*

Let p̂ be the sample proportion of vaccine-eligible people who received the flu vaccine. We have p̂ = 978/2350 ≈ 0.416.

To construct a 99% confidence interval for the population proportion \*p\*, we use the formula:

p̂ ± Z<sub>α/2</sub> \* √[(p̂(1-p̂))/n]

where:

\* Z<sub>α/2</sub> is the critical Z-score for a 99% confidence level (α = 0.01), which is approximately 2.576.

\* n is the sample size (2350).

Plugging in the values:

0.416 ± 2.576 \* √[(0.416(1-0.416))/2350]

≈ 0.416 ± 2.576 \* √(0.0000926)

≈ 0.416 ± 0.0248

Therefore, the 99% confidence interval is approximately \*\*(0.3912, 0.4408)\*\*.

\*\*Comment on the belief:\*\*

The 99% confidence interval (0.3912, 0.4408) contains the value 0.45 (representing the initial belief of 45% vaccination rate). Therefore, based on this survey data, we \*\*cannot reject\*\* the belief that 45% of vaccine-eligible people received the flu vaccine at the 1% significance level. The observed sample proportion is within the range of values plausible under the assumption that the true population proportion is 0.45. However, it's important to note that the interval suggests that the true proportion could be lower or slightly higher than 45%, and there's uncertainty due to sampling variability.

\*\*Part 2: Sample Size Calculation for Canadian Survey\*\*

We want to find the smallest sample size \*n\* such that the margin of error (E) is less than or equal to 0.02 at a 99% confidence level. The margin of error is given by:

E = Z<sub>α/2</sub> \* √[(p\*(1-p))/n]

Since we are aiming for the worst-case scenario (largest possible margin of error), we use p = 0.5 (this maximizes the variance). Solving for n:

0.02 ≥ 2.576 \* √[(0.5\*(1-0.5))/n]

0.02/2.576 ≥ √(0.25/n)

(0.02/2.576)² ≥ 0.25/n

n ≥ 0.25 / ((0.02/2.576)²)

n ≥ 4147.36

Since we must have a whole number of individuals in the sample, the smallest sample size that guarantees a margin of error less than or equal to 0.02 is \*\*4148\*\*.