Estimating $p_1 - p_2$

1. Attached is a poll from www.packpoll.com concerning opinions on gun control and concealed carry. The sample size is $n = 891$. How did packpoll determine the margin of error?

Comparing $p_1$ and $p_2$: independent samples

2. Assume $n_1 = 445$ responded to the first question Q1a (with non-assault-style Ruger rifle picture).
   Define
   \[ p_1 = \text{proportion of people who would respond that they support a ban on semi-automatic weapons when shown picture of a non-assault style rifle with the question.} \]
   \[ \hat{p}_1 = .39 \]

Assume $n_2 = 446$ responded to the second question Q1a (with assault-style Ruger rifle picture).

Define
\[ p_2 = \text{proportion of people who would respond that they support a ban on semi-automatic weapons when shown picture of an assault style rifle with the question.} \]
\[ \hat{p}_2 = .44 \]

Estimate of $p_1 - p_2$: $\hat{p}_1 - \hat{p}_2 = .39 - .44 = -.05$.

Bound on error of estimation: (assume $N_1 = N_2 = 10,000$)
\[
V(\hat{p}_1 - \hat{p}_2) = V(\hat{p}_1) + V(\hat{p}_2) = \frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2};
\]
\[
\hat{V}(\hat{p}_1 - \hat{p}_2) = \left(1 - \frac{n_1}{N_1}\right)\frac{\hat{p}_1(1-\hat{p}_1)}{n_1-1} + \left(1 - \frac{n_2}{N_2}\right)\frac{\hat{p}_2(1-\hat{p}_2)}{n_2-1}.
\]

Comparing $p_1$ and $p_2$ in the same sample

3. Consider Q2. Define
   \[ p_1 = \text{proportion who strongly support allowing students who are 21 and older to carry concealed weapons on college campuses} \]
   \[ p_2 = \text{proportion who strongly oppose allowing students who are 21 and older to carry concealed weapons on college campuses} \]
\[
\hat{p}_1 = .17, \hat{p}_2 = .29; n = 891, N = 10,000
\]
\[
V(\hat{p}_1 - \hat{p}_2) = \frac{(p_1+p_2)-(p_1-p_2)^2}{n-1} \approx V(\hat{p}_1) + V(\hat{p}_2) + 2 \frac{\hat{p}_1\hat{p}_2}{n-1}
\]
\[
\hat{V}(\hat{p}_1 - \hat{p}_2) = \hat{V}(\hat{p}_1) + \hat{V}(\hat{p}_2) + 2 \frac{\hat{p}_1\hat{p}_2}{n-1}
\]
\[
= \left(1 - \frac{n}{N}\right)\frac{\hat{p}_1(1-\hat{p}_1)}{n-1} + \left(1 - \frac{n}{N}\right)\frac{\hat{p}_2(1-\hat{p}_2)}{n-1} + 2 \frac{\hat{p}_1\hat{p}_2}{n-1}.
\]
These are the results of this semester’s first “Flash” Pack Poll, conducted through the internet, of a random sample of NCSU Freshman, Junior, and Masters Graduate students. The survey has a 34% response rate, and for the full sample a margin of error of +/- 3.2%.

For more information about the survey or further questions contact the Pack Poll at mike_cobb@ncsu.edu

Q1: Do you support or oppose a nationwide ban on semi-automatic weapons

Strongly Support........................................18%
Support....................................................23%
Oppose....................................................26%
Strongly Oppose.................................31%

Q1a: Do you support or oppose a nationwide ban on semi-automatic weapons (with non-assault-style Ruger Rifle picture)

Support....................................................39%
Oppose....................................................61%

Q1a: Do you support or oppose a nationwide ban on semi-automatic weapons (with assault-style Ruger Rifle picture)

Support....................................................44%
Oppose....................................................56%

Q2: Do you support or oppose a law that would allow students who are 21 and older to carry concealed weapons on college campuses?

Strongly Support........................................17%
Support....................................................24%
Oppose....................................................28%
Strongly Oppose.................................29%

Q3: Do either of your parents own a gun?

Yes....................................................56%
No....................................................39%
I don’t know......................................3%