

V1 2016 SLDM Surveys 1

Polls and Surveys

Milo Schield, Augsburg College
Member: International Statistical Institute
US Rep: International Statistical Literacy Project
Director, W. M. Keck Statistical Literacy Project
VP. National Numeracy Network

Sept 12, 2016
www.StatLit.org/pdf/2016-Schild-SLDM-Surveys-Slides.pdf

V1 2016 StatChad 2

Surveys of People

BENEFITS:

- Cheap: Survey Monkey
- Measure people’s attitudes, values, plans
- Monitor/evaluate performance

PROBLEMS:

1. Error: Measurement bias (ambiguous Q)
2. Error: Sampling bias (non-response bias)
3. Error: Subject bias (controversial topics)
4. Randomness (break into subgroups)

V1 2016 StatChad 3

1. Measurement Bias: Ambiguity of Questions

Possible answers:
 Strongly disagree Disagree Neutral Agree Strongly agree

Q1a. I (you) like this course
 Q1b. This course seems useful
 Q1c. You would recommend this course to a friend.

The first question is very broad – too broad
 The second question is much more focused.
 The third question is best: it involves an action.

V1 2016 StatChad 4

2a. Sampling Bias: Non-response bias (Qualitative)

Who is most likely to complete a phone survey?

- Elderly, those hoping to win a prize, those aware of, interested in or supportive of the topic

Who is least likely to complete a phone survey?

- Young, busy people, those ignorant of, uninterested in or antagonistic toward the topic,

V1 2016 StatChad 5

2b. Sampling Bias: Non-response bias (Quantitative)

60% of respondents like candidate A (40% for B)
 Response rate is 20%. Non-response (NR) 80%.
 Q. What NR bias would nullify the difference?
 >>> $0.60 \cdot 0.20 + X \cdot 0.8 = 0.50$
 $X = (0.5 - 0.12) / 0.8 = 0.38 / 0.8 = 47.5\%$ for A
 Q. Is this 47.5% for A plausible among NR?

V1 2016 StatChad 6

3a. Subject Bias: Qualitative

Which question will generate more subject bias?

- 1a. Have you ever cheated at school?
- 1b. Have you ever cheated on your partner/wife?
- 2a. How tall are you?
- 2b. How much do you weigh?

In both cases, the second question should generate more subject bias than the first

V1 2016 StatChad 7

3b. Subject Bias: Quantitative

60% of subjects say they will vote for A.
 Assume subject bias is only among this 60%.
 Q. What subject bias makes 50% the true answer?
 >>> $0.60 - X = 0.50$
 $X = 10\%$ of subjects [or one-sixth (10/60) of those supporting A] are misstating their intention: they don't really plan to vote for A.

V1 2016 StatChad 8

4a. Randomness

Margin of Error:

- An estimate of Randomness (sampling error).
- Not an estimate of the total error or bias
- Basis for a confidence interval

Survey Margin of Error is shown in good surveys.

- Valid for any answer by the whole group,
- Not valid for answers by subgroups

V1 2016 StatChad 9

4b. Confidence Intervals and Margin of Error (ME)

Confidence intervals are easily constructed:

- Left (bottom) end: Sample statistic minus ME
- Right (top) end: Sample statistic plus ME

Sample statistic (observed): Statistic in a random sample. **Population statistic** (unobserved): Statistic in population of interest

Confidence Interval: the range centered on the sample statistic that is likely (95% confidence) to contain the population statistic.

V1 2016 StatChad 10

4c. Statistical Significance (the non-overlap test)

If two confidence intervals fail to overlap (left below), their difference in means is **statistically significant**:

Margin of Error (ME): 4 Pctg. Points

B: 30% +ME -ME A: 45%

30% 34% 41% 45%

Non-overlapping confidence intervals; Difference is statistically significant

Margin of Error (ME): 8 Pctg. Points

B: 30% +ME -ME A: 45%

30% 37% 41% 45%

Overlapping confidence intervals; Difference is NOT statistically significant

If two confidence intervals overlap or touch (right above), their difference in means is **NOT** statistically significant.

V1 2016 SLDM Surveys 11

4d. Margin of Error (ME) for Sub-Groups

Margin of Error (ME) due to random sampling:

- Increases as sample size decreases
- Is proportional to $1/[\text{SquareRoot}(n)]$

Margin of error for a subgroup:

- If a subgroup is one-fourth of the total, then the subgroup ME is twice as big as that for the group
- $1/\text{SquareRoot}(1/4) = 1/(1/2) = 2$

V1 2016 SLDM Surveys 12

4e. Margin of Error for Sub-Groups

Suppose two-candidate survey ME is 3 points

- A has 54%; B has the rest (46%).

Q Is this 8 point difference statistically-significant?
 A Yes: confidence intervals do NOT overlap.

In same survey, 25% of subjects are adults with no college and 56% of them are for A (44% for B).

Q. Is 12 point difference statistically-significant?
 A. No (subgroup ME is 6 points; CI touch)

Polls and Surveys

Milo Schield, Augsburg College

Member: International Statistical Institute

US Rep: International Statistical Literacy Project

Director, W. M. Keck Statistical Literacy Project

VP. National Numeracy Network

Sept 12, 2016

www.StatLit.org/pdf/

2016-Schild-SLDM-Surveys-Slides.pdf

Surveys of People

BENEFITS:

- Cheap: Survey Monkey
- Measure people's attitudes, values, plans
- Monitor/evaluate performance

PROBLEMS:

1. Error; Measurement bias (ambiguous Q)
2. Error: Sampling bias (non-response bias)
3. Error: Subject bias (controversial topics)
4. Randomness (break into subgroups)

1. Measurement Bias: Ambiguity of Questions

Possible answers:

Strongly disagree Disagree Neutral Agree Strongly agree

Q1a. I (you) like this course

Q1b. This course seems useful

Q1c. You would recommend this course to a friend.

The first question is very broad – too broad

The second question is much more focused.

The third question is best: it involves an action.

2a. Sampling Bias: Non-response bias (Qualitative)

Who is most likely to complete a phone survey?

- Elderly, those hoping to win a prize, those aware of, interested in or supportive of the topic

Who is least likely to complete a phone survey?

- Young, busy people, those ignorant of, uninterested in or antagonistic toward the topic,

2b. Sampling Bias: Non-response bias (Quantitative)

60% of respondents like candidate A (40% for B)

Response rate is 20%. Non-response (NR) 80%.

Q. What NR bias would nullify the difference?

$$\ggg 0.60 * 0.20 + X * 0.8 = 0.50$$

$$X = (0.5 - 0.12) / 0.8 = 0.38 / 0.8 = 47.5\% \text{ for A}$$

Q. Is this 47.5% for A plausible among NR?

3a. Subject Bias: Qualitative

Which question will generate more subject bias?

1a. Have you ever cheated at school?

1b. Have you ever cheated on your partner/wife?

2a. How tall are you?

2b. How much do you weigh?

In both cases, the second question should generate more subject bias than the first

3b. Subject Bias: Quantitative

60% of subjects say they will vote for A.

Assume subject bias is only among this 60%.

Q. What subject bias makes 50% the true answer?

$$\ggg 0.60 - X = 0.50$$

X = 10% of subjects [or one-sixth (10/60) of those supporting A] are misstating their intention: they don't really plan to vote for A.

4a. Randomness

Margin of Error:

- An estimate of Randomness (sampling error).
- Not an estimate of the total error or bias
- Basis for a confidence interval

Survey Margin of Error is shown in good surveys.

- Valid for any answer by the whole group,
- Not valid for answers by subgroups

4b. Confidence Intervals and Margin of Error (ME)

Confidence intervals are easily constructed:

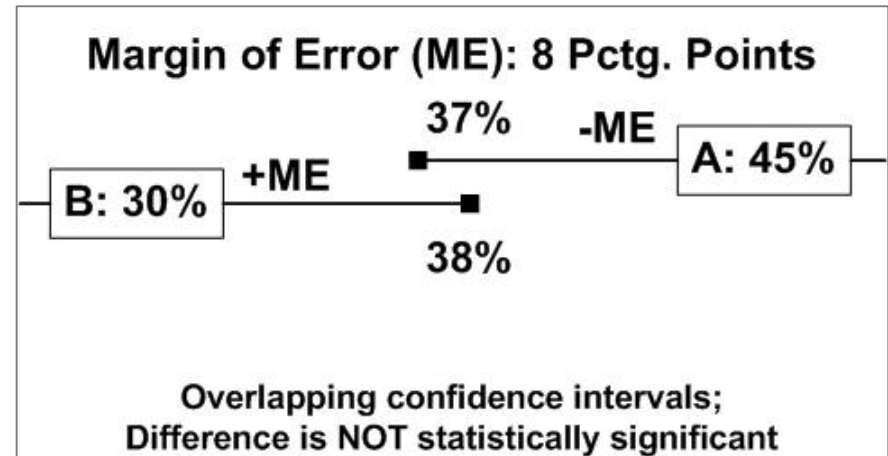
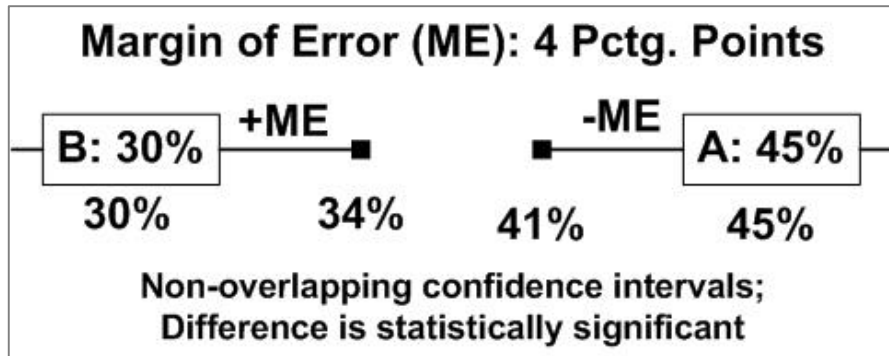
- Left (bottom) end: Sample statistic minus ME
- Right (top) end: Sample statistic plus ME

Sample statistic (observed): Statistic in a random sample. **Population statistic** (unobserved): Statistic in population of interest

Confidence Interval: the range centered on the sample statistic that is likely (95% confidence) to contain the population statistic.

4c. Statistical Significance (the non-overlap test)

If two confidence intervals fail to overlap (left below), their difference in means is **statistically significant**:



If two confidence intervals overlap or touch (right above), their difference in means is **NOT** statistically significant.

4d. Margin of Error (ME) for Sub-Groups

Margin of Error (ME) due to random sampling:

- Increases as sample size decreases
- Is proportional to $1/[\text{SquareRoot}(n)]$

Margin of error for a subgroup:

- If a subgroup is one-fourth of the total, then the subgroup ME is twice as big as that for the group
- $1/\text{SquareRoot}(1/4) = 1/(1/2) = 2$

4e. Margin of Error for Sub-Groups

Suppose two-candidate survey ME is 3 points

- A has 54%; B has the rest (46%).

Q Is this 8 point difference statistically-significant?

A Yes: confidence intervals do NOT overlap.

In same survey, 25% of subjects are adults with no college and 56% of them are for A (44% for B).

Q. Is 12 point difference statistically-significant?

A. No (subgroup ME is 6 points; CI touch)