PLSC 308: Introduction to Political Research

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The Margin of Error (MOE)

Sampling error is the (random) difference between the value you want to know in the population and its respective value in the sample.

Characteristics:

- Intuition: "Repeated samples"
- A function of:
    - The sample size,
    - The sampling design, and
    - The size of the population.

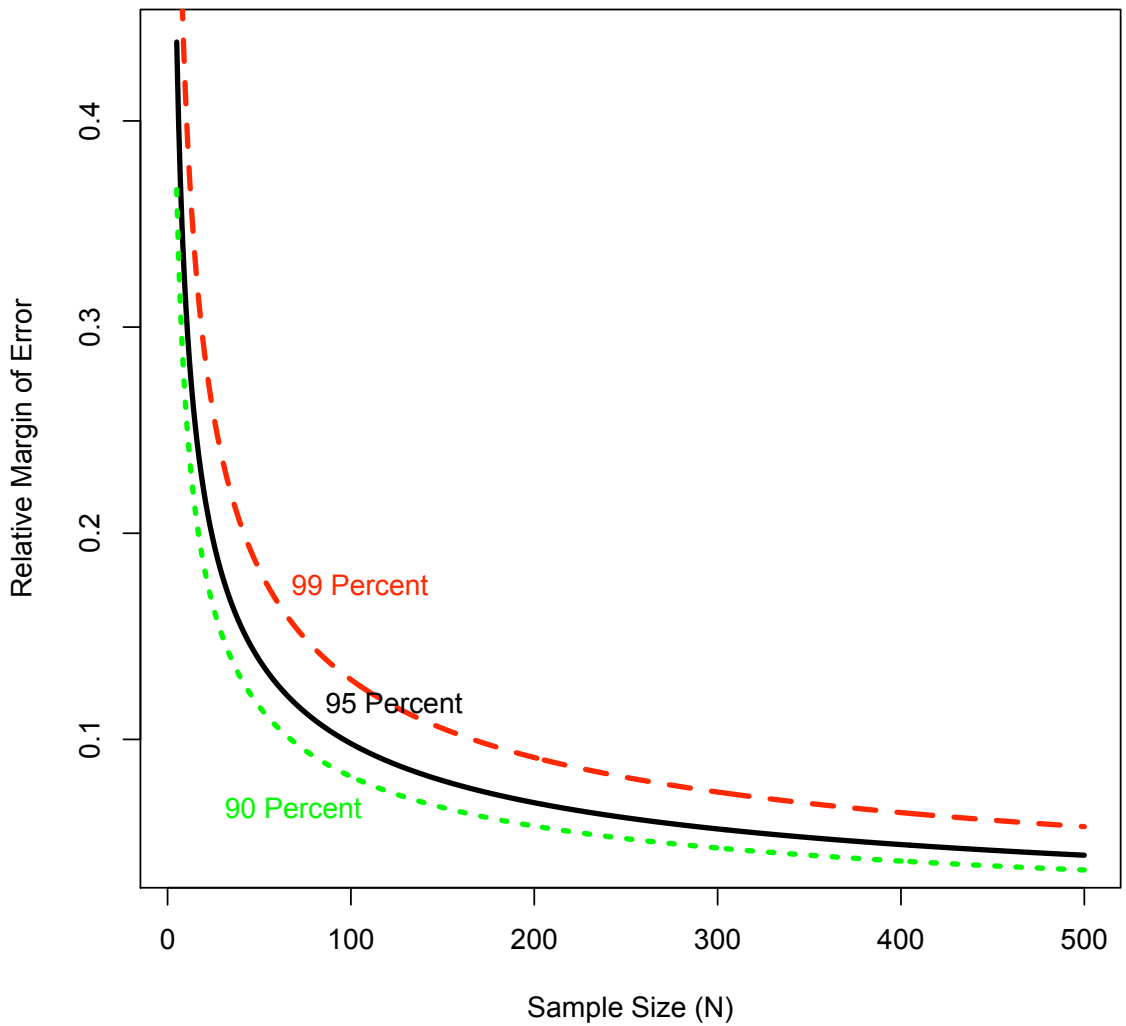
MOE Example

Consider the proportion Q of observations in the population that have some (binary) trait. For a simple random sample of size N, the margin of error (sampling error) for the sample proportion q is:

$$\text{Standard error} = \sqrt{\frac{q(1-q)}{N}}$$

We typically calculate relative sampling error for a given *level of confidence*...

MOE and Sample Size



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Sampling: An Example

	Name	sex	namegroup	score
1	ARNOLD, EMILY	F	AB	31
2	BERNICKER, BRENDAN	M	AB	62
3	CHEN, TIANGE	M	CD	61
4	DANIEL, ASHLEY	F	CD	82
5	KLARIC, ROMAN	M	KL	86
6	KLAVANS, JORDAN	M	KL	64
7	KNABB, CHRISTOPHER	M	KL	1
8	LAMAS, MATTHEW	M	KL	23
9	LEVIN, LOUIS	M	KL	67
10	LI, ZIYU	M	KL	51
11	MCCABE, MICHAEL	M	MN	69
12	MCDONNELL, HANNAH	F	MN	74
13	NAHVI, SUSAN	F	MN	48
14	PARIKH, YASH	M	OP	92
15	PELOSI, OLIVER	M	OP	29
16	RANKIN-WAHLERS, JADEN	F	QR	104
17	SALVESEN, BRIAN	M	ST	29
18	SHAFFER, JOHN	M	ST	27
19	SHIPMAN, MATTHEW	M	ST	19
20	THOMAS, CORY	M	ST	23
21	WAGNER, SEAMUS	M	WX	32
22	WESTERFER, JOSEPH	M	WX	30

Sampling Example (continued)

Population characteristics:

- **Overall mean = 50.2** ($N = 22$)
- Mean for males $= 45$ ($N_M = 17$)
- Mean for females $= 67.8$ ($N_F = 5$)
- No differences by last name

Simple Random Sampling via Random Numbers

	Name	sex	namegroup	score	rando
2	BERNICKER, BRENDAN	M	AB	62	0.03999592
8	LAMAS, MATTHEW	M	KL	23	0.04577026
1	ARNOLD, EMILY	F	AB	31	0.15904600
13	NAHVI, SUSAN	F	MN	48	0.18109621
15	PELOSI, OLIVER	M	OP	29	0.20124804
3	CHEN, TIANGE	M	CD	61	0.21879954
16	RANKIN-WAHLERS, JADEN	F	QR	104	0.25880982
10	LI, ZIYU	M	KL	51	0.26518667
11	MCCABE, MICHAEL	M	MN	69	0.30467220
21	WAGNER, SEAMUS	M	WX	32	0.31182431
9	LEVIN, LOUIS	M	KL	67	0.45609148
12	MCDONNELL, HANNAH	F	MN	74	0.50730687
5	KLARIC, ROMAN	M	KL	86	0.52569755
19	SHIPMAN, MATTHEW	M	ST	19	0.55333359
22	WESTERFER, JOSEPH	M	WX	30	0.62181920
20	THOMAS, CORY	M	ST	23	0.64640609
14	PARIKH, YASH	M	OP	92	0.75967064
18	SHAFFER, JOHN	M	ST	27	0.80735234
4	DANIEL, ASHLEY	F	CD	82	0.81059855
7	KNABB, CHRISTOPHER	M	KL	1	0.83134505
6	KLAVANS, JORDAN	M	KL	64	0.91465817
17	SALVESEN, BRIAN	M	ST	29	0.99215042

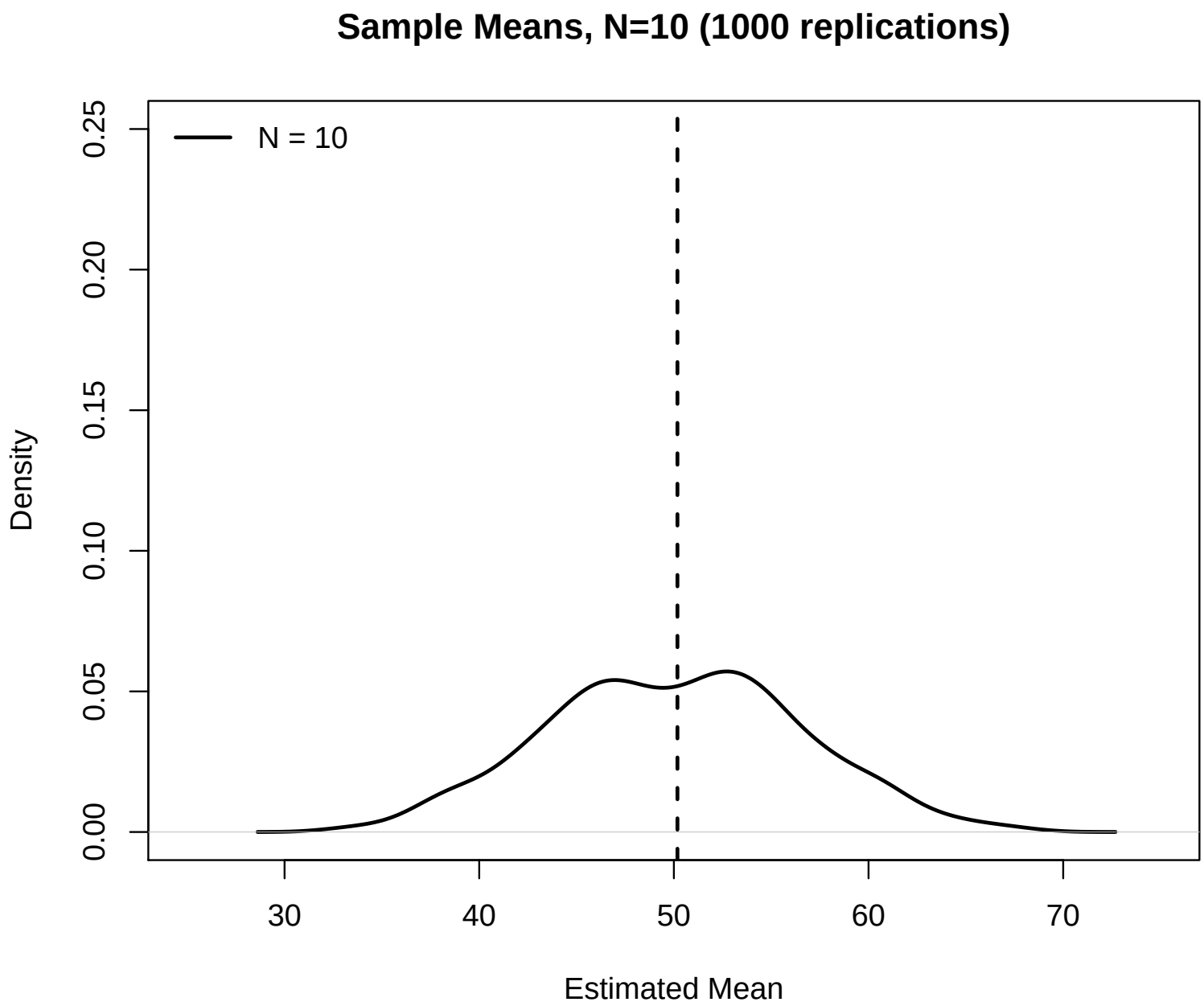
Simple Random Sample ($N = 10$)

Sample characteristics:

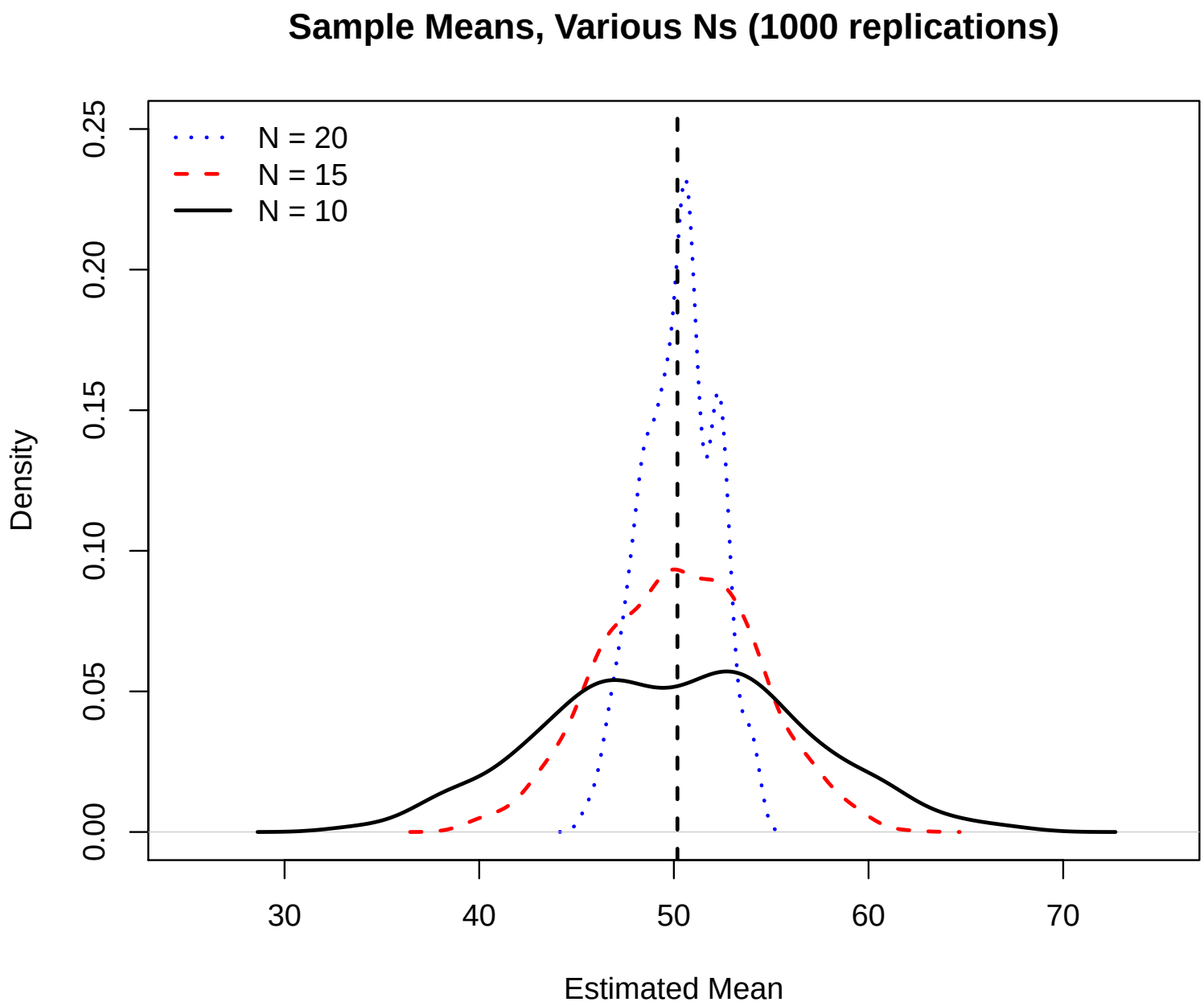
- **Overall mean = 51** ($N = 10$)
- Mean for males $= 46.7$ ($N_M = 7$)
- Mean for females $= 61$ ($N_F = 3$)
- No differences by last name

$$\text{Overall MOE} = \sqrt{\frac{0.51(1 - 0.51)}{10}} = 0.158 \text{ (15.8 percent)}$$

Simple Random Sampling, repeated



Vary Sample Sizes



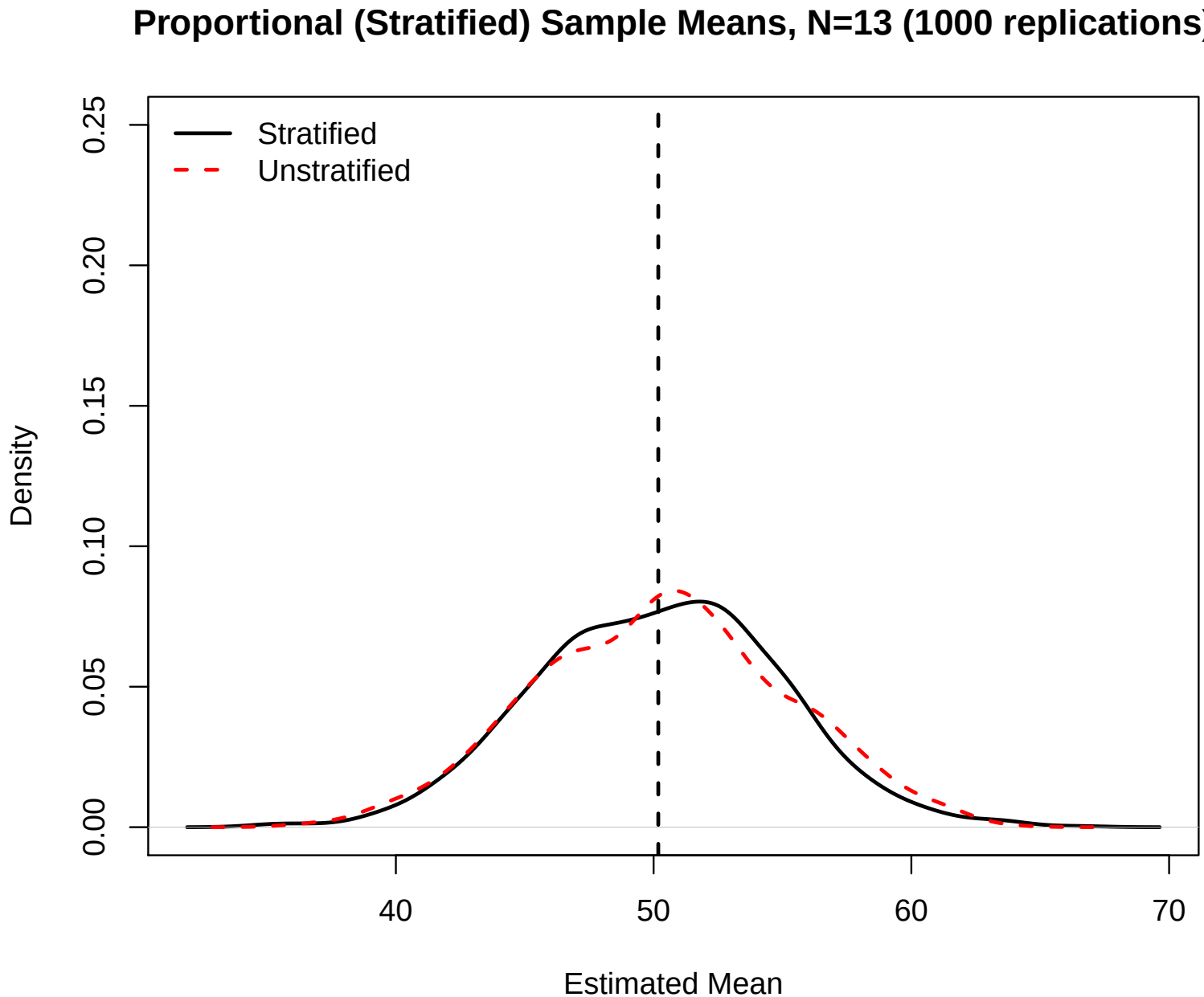
Stratified Sampling

Women are 22.7 percent of the population...

Proportional stratified sampling (say, select 3 women and 10 men randomly):

	Name	sex	namegroup	score	rando
1	ARNOLD, EMILY	F	AB	31	0.26093924
13	NAHVI, SUSAN	F	MN	48	0.79497190
16	RANKIN-WAHLERS, JADEN	F	QR	104	0.72192125
10	LI, ZIYU	M	KL	51	0.64051016
2	BERNICKER, BRENDAN	M	AB	62	0.30613168
3	CHEN, TIANGE	M	CD	61	0.43401093
5	KLARIC, ROMAN	M	KL	86	0.50771100
17	SALVESEN, BRIAN	M	ST	29	0.14978794
8	LAMAS, MATTHEW	M	KL	23	0.12362789
9	LEVIN, LOUIS	M	KL	67	0.62641954
6	KLAVANS, JORDAN	M	KL	64	0.05987933
21	WAGNER, SEAMUS	M	WX	32	0.08098174
22	WESTERFER, JOSEPH	M	WX	30	0.79409840

Proportional Stratification: Results

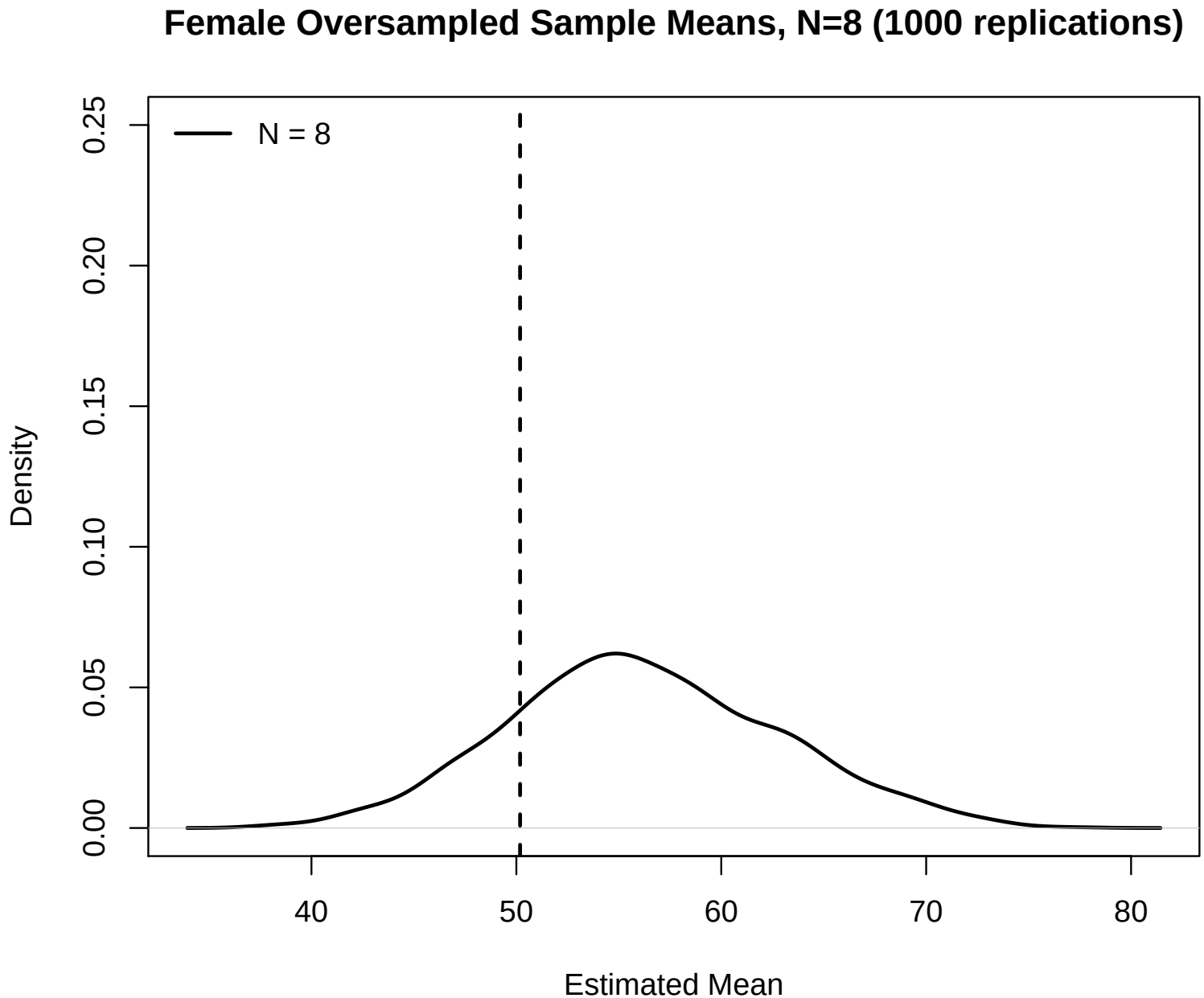


Stratified Sampling

Oversampling women (say, a 50-50 male-female split):

	Name	sex	namegroup	score	rando
1	ARNOLD, EMILY	F	AB	31	0.0939031
13	NAHVI, SUSAN	F	MN	48	0.2346178
16	RANKIN-WAHLERS, JADEN	F	QR	104	0.4263274
4	DANIEL, ASHLEY	F	CD	82	0.5336345
10	LI, ZIYU	M	KL	51	0.1426833
2	BERNICKER, BRENDAN	M	AB	62	0.1178203
3	CHEN, TIANGE	M	CD	61	0.5439105
5	KLARIC, ROMAN	M	KL	86	0.7212281

Oversampling: Results



Cluster Sampling

Sample on `namegroup` with $N_c = 3$

	Name	sex	namegroup	score
3	CHEN, TIANGE	M	CD	61
4	DANIEL, ASHLEY	F	CD	82
5	KLARIC, ROMAN	M	KL	86
6	KLAVANS, JORDAN	M	KL	64
7	KNABB, CHRISTOPHER	M	KL	1
8	LAMAS, MATTHEW	M	KL	23
9	LEVIN, LOUIS	M	KL	67
10	LI, ZIYU	M	KL	51
17	SALVESEN, BRIAN	M	ST	29
18	SHAFFER, JOHN	M	ST	27
19	SHIPMAN, MATTHEW	M	ST	19g
20	THOMAS, CORY	M	ST	23

Mean score = 44.1...

Midterm Matters...

- In-class (75 minutes), 3/1/2016
- Closed-book / closed-notes / etc.
- Materials:
  - Chapters 1 - 7 of the text
  - Class lecture material
- Format:
  - Definitions
  - Short answer questions
  - A short "essay"
- **Worth 20% of course grade (200 points)**