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# 6. Hypothesis Testing in the Regime of Small Sample Sizes - Preparations

## Concept check: Small Sample Sizes

1/1 point (graded)
Recall the clinical trials problem set-up.

Suppose that $n = 10$ and $m = 12$, so that the sample sizes are quite small. Consider the analysis of the one-sided, two-sample test performed in the videos in the previous vertical (and in Slide 7 of slides for Unit 4), where we defined a test statistic for $H_0 : \Delta_d = \Delta_c, H_1 : \Delta_d > \Delta_c$.

Should you expect this analysis to be accurate when the sample size is this small? (Choose all that apply. Correct responses must have a correct answer, 'Yes' or 'No', and also a correct explanation.)

- [ ] Yes, because Slutsky's theorem is a non-asymptotic result.
- [ ] Yes, because the asymptotic analysis given is independent of the sample size.
- [x] No, because the calculation presented on the given slides was an asymptotic analysis (*i.e.*, we assumed $n \to \infty$).

- [x] No, because, informally, Slutsky's theorem only gives a good approximation when the sample size is very large.

**Solution:**

We first examine the correct choices, which are the third and fourth responses.

- The third choice "No, because the calculation presented on the given slides was an asymptotic analysis (*i.e.*, we assumed $n \to \infty$)." is correct. If $n = 10$ and $m = 12$, then both samples are quite small. Therefore, we cannot expect to apply limiting results, such as Slutsky's theorem, and derive accurate results.

- The fourth choice "No, because, informally, Slutsky's theorem only gives a good approximation when the sample size is very large." is also correct. We know that in the large $n, m$ limit that the sample variance converges to the true variance, but we cannot assume that the same is true for relatively small $m, n$.

Now we examine the first and second choices, both of which are incorrect.

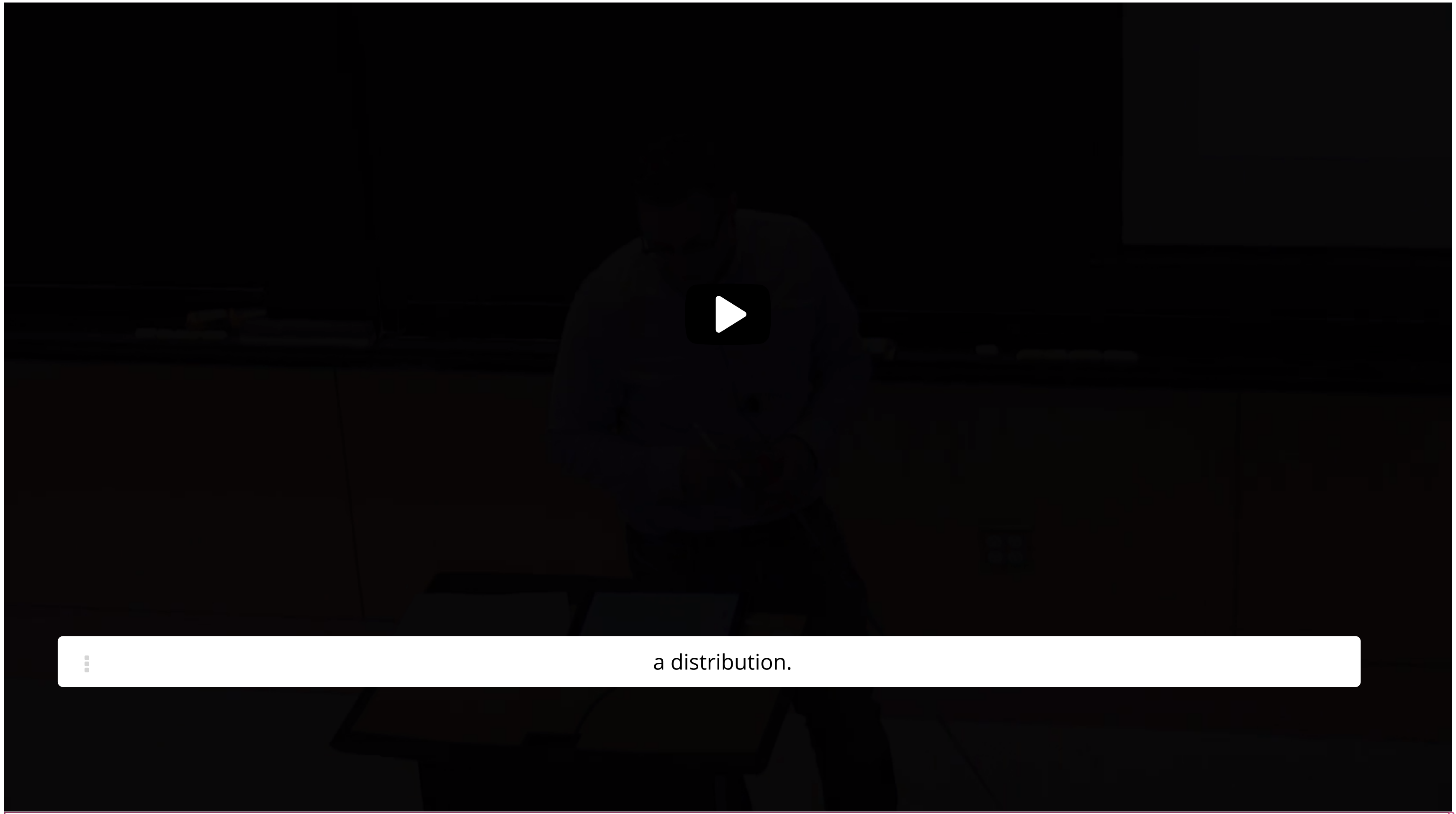
- "Yes, because Slutsky's theorem is a non-asymptotic result." is incorrect. We have shown in the previous part that the correct answer is "No." Moreover, the statement of Slutsky's theorem involves a limit as the sample size $n, m \to \infty$. Hence, this theorem is an *asymptotic* result.

- "Yes, because the asymptotic analysis given is independent of the sample size." We know that the correct answer is ‘No' from above, and moreover, the asymptotic analysis depends on the sample size growing to infinity. Hence, the explanation is also incorrect.

Submit You have used 2 of 2 attempts

Answers are displayed within the problem

## The Small Sample Sizes Problem

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? [Concept check: Small Sample Sizes](#)
In the previous video, we applied Sluksky with n=70 and m=50. Now we can not. Is there any "cutoff" sample size? Which sample size is "small" and which is "large"? 4

the last video 3

[Staff] Errors in the subtitle
I think all of the "quintile" in the subtitle should be "quantile". Professor Rigollet also writes "quantile" at 3:21. 3