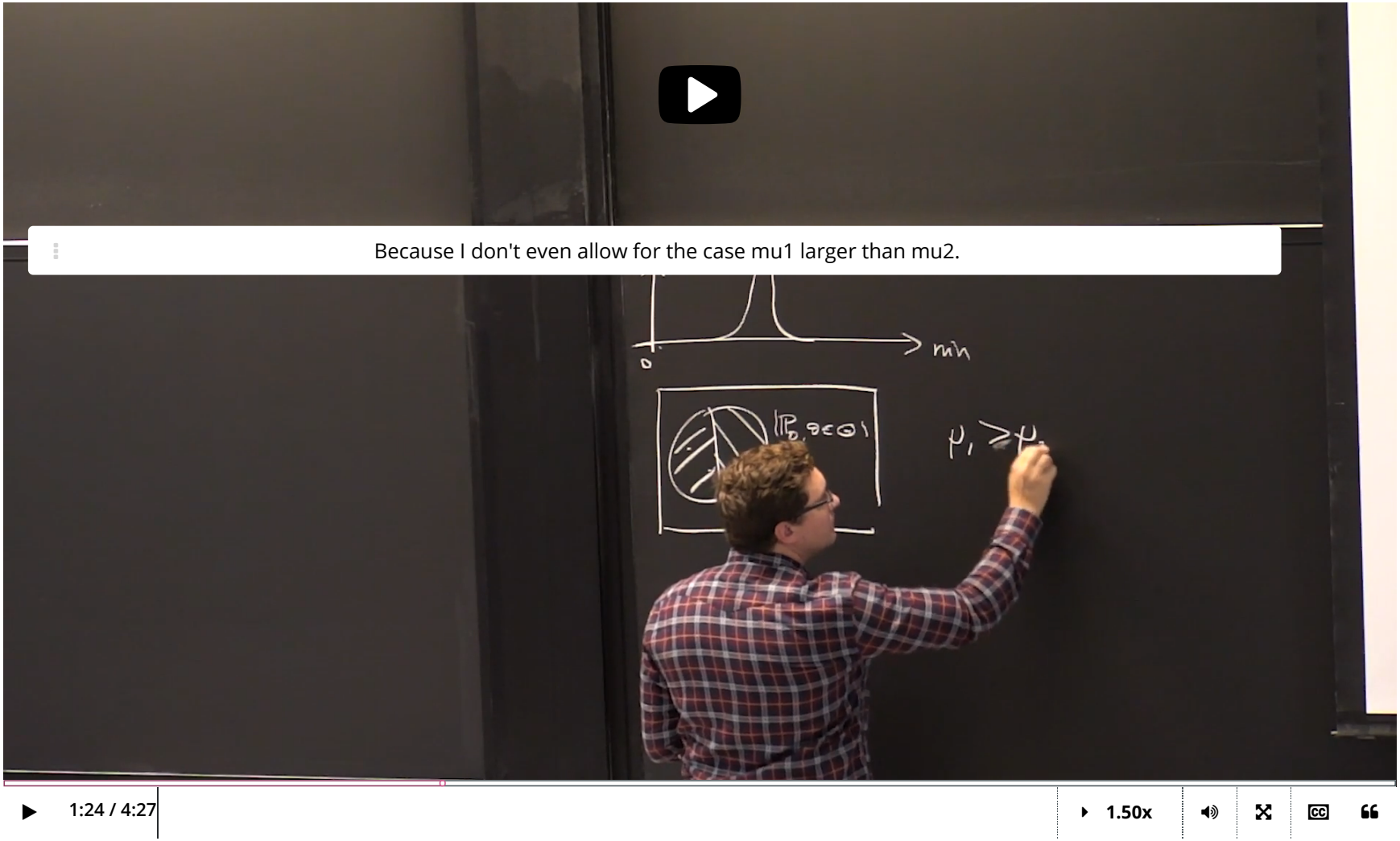
4. Introduction to Hypothesis Testing 3
Comparing Two Boarding Methods: Hypothesis



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Modeling Clinical Trials II

2/2 points (graded)

Let's use the same statistical set-up as in an earlier question. Recall that X_i denotes the **number of coughs per hour** for individual i in the treatment group, and Y_i denotes the number of coughs per hour for individual i in the control group. Assume the distributions on coughs per hour to be $X_1, \ldots, X_n \sim \text{Poiss}\left(\mu_{\text{drug}}\right)$ for the treatment group and $Y_1, \ldots, Y_n \sim \text{Poiss}\left(\mu_{\text{control}}\right)$ for the control group.

What is(are) the unknown parameter(s) in this example?

- Only μ_{drug}
- Only μ_{control}
- **Both μ_{drug} and μ_{control}** ✔
- Neither μ_{drug} nor μ_{control}

Which of the following statement about the efficacy of the cold remedy corresponds to $\mu_{\text{drug}} < \mu_{\text{control}}$?

- This drug is less effective than the placebo.
- **This drug is more effective than the placebo.** ✔
- This cold remedy is more effective than the most commonly used one in the US
- None of the above

Solution:

Consider the first question. Since a priori (*i.e.*, before running the clinical trial), we do not know what the true mean of the control group or treatment group will be, this implies that μ_{drug} and μ_{control} are unknown parameters. Since there are two unknown parameter corresponding to two *different* samples, this is an example of a **two-sample hypothesis test** .

Now consider the second question. We examine the choices in order.

- "This drug is more effective than the placebo." is correct. If we knew the true parameters μ_{control} and μ_{drug}, we could just compare their values to determine if the drug was more effective than the placebo. And if $\mu_{\text{drug}} < \mu_{\text{control}}$, this implies that the number of coughs per hour is lower when the drug is administered vs. the placebo. Thus, it is reasonable to conclude that the drug is more effective than the placebo.

  Remark: In actual clinical trials, we do not have access to the true parameters, which is why we need to employ the methods of hypothesis testing to determine whether the treatment or placebo is more effective.

- "This drug is less effective than the placebo." is incorrect. See the explanation of the previous choice to understand why this is not a reasonable interpretation.

- "This cold remedy is more effective than the most commonly used one in the US" is incorrect. We have only compared this drug to the placebo, not to any other drug. Thus this is not a reasonable conclusion.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

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modeling assumptions

question posted 2 days ago by **dna47a**

Hello,

I am not sure what the Prof. meant to say about modeling assumptions? Is he saying that do not make modeling assumptions based on some past data that you have seen but instead make assumptions randomly without any bias? But in the lecture slides it looks like he is made assumptions based on data that he has seen about the two flights.

Thanks

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1 response

lyanhminh11
a day ago

I was unsure on this too so I did some reading on the p-hacking issue the professor mentioned. First it's probably good to dispell any confusion that looking at data might be wrong -- in the absolute sense, it's not. However, hypothesis test resulting from previously seen data is wrong. From the wikipedia article on data dredging:

> Applying a statistical test of significance, or hypothesis test, to the same data that a pattern emerges from [*and which you've already looked at*] is wrong.

The italicized part is my addition.

Reading the article is probably best, but in summary, a significant p-value obtained from already seen data has a higher chance of actually being statiscally insignificant, ie a type I error. The following is my synthesis of what could go wrong with the back-to-front vs wilma example in lecture based on my reading. I hope the community provide corrections, input or questions as it sees fit.

Suppose in the rear-to-front vs wilma example you had seen the summary statistics and because of that knowledge you formulate $H_0 : \mu_{b2fr} < \mu_{wilma}$ and $H_1 : \mu_{b2fr} \geqslant \mu_{wilma}$. Further suppose that you carry out the calculations and you find the the difference in times to be statisticallly significant leading you to reject the null. But because your hypotheses were informed by previous knowledge of the data, the result should not be viewed as statiscally signifcant.

Why? It might have been that the data you had was a false positive ie, the data collected was in fact generated from a distribution satisfying H_0. After all, the confidence level α at which you conducted the p-test means there is an $\alpha\%$ chance that you reject the null despite the samples you collected were in fact generated from the distributions satisfying H_0 unlikely though it might be. But it was seeing the data beforehand that informed how you then conjured up the set of hypotheses H_0 and H_1 (a set of hypotheses which would lead to a higher chance of yielding a publishable result ie rejecting the null). But as the data did in fact come from a distribution belonging to H_0 your result is a type I error. Thus it's important to draw up your hypotheses and thus testing procedures based on your intuition or domain knowledge, etc... absent seeing the data.

Do not read Wikipedia before the meal. It is proven that it cause reduction in production of stomach acid. (Prof. F.F. Preobrazenski).

posted a day ago by **Marabout**

@lyanhminh11, thanks for the article and brief summary presented here. So the conclusion is that we should not be making modeling assumptions based on data we have seen but make some random assumptions based on our intuition and test out whether our intuition was correct or not.

posted a day ago by **dna47a**

> Do not read Wikipedia before the meal. It is proven that it cause reduction in production of stomach acid. (Prof. F.F. Preobrazenski).

Well we'd want to know the p-value and the research methedology behind that claim right?

posted about 20 hours ago by **lyanhminh11**

Dear Lyanh Minh. I just have shown my reservations on using Wikipedia as a serious source of information. It is in no way concerns your remark. If you are interested on what I think about the professor's comment it is as follow: Of course, you can use past data on making assumptions and hypothesis, but to check them you need fresh/new data. Otherwise, it will be a sort of a bias. Indeed, if your data is 14, 44, 24, you can make an assumption that it always finishes by 4. If you use the same data to check your assumption it will show that your assumption is good ... So, the choice of an assumption should not be driven by the data that later be used to check the assumption.

posted about 13 hours ago by **Marabout**

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