**🧪 Imagine This Situation:**

You give a new **pain relief medicine** to a group of people.  
You want to know:

“**Does the medicine actually work, or is it just luck?**”

To answer this question, we use something called a **hypothesis test**.

**🚦 Step 1: What is a Hypothesis?**

A **hypothesis** is just an idea you want to test.

You make two:

| **Name** | **What It Means** |
| --- | --- |
| **Null Hypothesis (H₀)** | “The medicine does NOT work. Nothing has changed.” |
| **Alternative Hypothesis (H₁)** | “The medicine DOES work. It reduces pain.” |

**📊 Step 2: Collect Data**

You measure people’s pain before and after the medicine.

Example:

* Pain level **before**: Average = 6
* Pain level **after**: Average = 4.5
* Number of people = 30

Looks like pain dropped — but is that **real** or just **random chance**?

**⚖️ Step 3: Do a t-test**

The **t-test** checks:

“Is the difference (6 vs 4.5) big enough that it’s probably real?”

It gives you:

* A **t-statistic** → a number showing how big the difference is.
* A **p-value** → the **chance** that this difference happened **just by luck**.

**🔢 Example Result**

Let’s say:

* **t = 2.12**
* **p-value = 0.02**

**🚨 Step 4: Compare the p-value to Alpha**

Now, you choose a rule:  
Most people use **alpha = 0.05** (5%).

That means:

“If the p-value is smaller than 0.05, I’ll believe the medicine works.”

**🤔 What does the p-value tell you?**

| **p-value** | **What it means** |
| --- | --- |
| **Less than 0.05** | The result is **statistically significant** — the medicine likely works |
| **Greater than 0.05** | Not strong enough evidence — maybe it works, maybe not |

**✅ Final Decision**

If:

* **p = 0.02** (small!)
* That means there’s only a 2% chance this result happened by luck.

So you say:

“The medicine **does reduce pain** — the result is **significant**.”

**🎓 Simple Summary**

| **Term** | **Simple Meaning** |
| --- | --- |
| **Null Hypothesis (H₀)** | “No change” — the medicine doesn’t work |
| **t-value** | How big is the difference? |
| **p-value** | Is the difference likely due to **luck**? |
| **alpha = 0.05** | You’re OK with a **5% chance of being wrong** |
| **If p < 0.05** | You found a real effect — the medicine works! |