

WHEN THE P-VALUE IS USED FOR HYPOTHESIS TESTING, THE NULL HYPOTHESIS IS REJECTED IF?

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UNDERSTANDING THE ROLE OF THE P-VALUE IN HYPOTHESIS TESTING IS FUNDAMENTAL FOR RESEARCHERS, STATISTICIANS, AND STUDENTS INVOLVED IN DATA ANALYSIS. THE P-VALUE SERVES AS A CRUCIAL METRIC THAT HELPS DETERMINE WHETHER THE OBSERVED DATA PROVIDES ENOUGH EVIDENCE TO REJECT THE NULL HYPOTHESIS. WHEN USED CORRECTLY, IT ENABLES DECISION-MAKING THAT IS BOTH STATISTICALLY SOUND AND SCIENTIFICALLY MEANINGFUL. IN THIS ARTICLE, WE WILL EXPLORE IN DETAIL WHAT IT MEANS TO REJECT THE NULL HYPOTHESIS BASED ON THE P-VALUE, THE CONDITIONS UNDER WHICH REJECTION OCCURS, AND COMMON MISCONCEPTIONS SURROUNDING THIS CONCEPT.

WHAT IS THE NULL HYPOTHESIS IN STATISTICAL TESTING?

BEFORE DIVING INTO WHEN THE NULL HYPOTHESIS IS REJECTED, IT IS ESSENTIAL TO UNDERSTAND WHAT THE NULL HYPOTHESIS (DENOTED AS H_0) REPRESENTS.

DEFINITION OF THE NULL HYPOTHESIS

- THE NULL HYPOTHESIS IS A STATEMENT OF NO EFFECT, NO DIFFERENCE, OR NO ASSOCIATION.
- IT SERVES AS THE DEFAULT ASSUMPTION THAT THERE IS NO RELATIONSHIP BETWEEN THE VARIABLES UNDER STUDY.
- THE GOAL OF HYPOTHESIS TESTING IS TO ASSESS WHETHER THE DATA PROVIDES SUFFICIENT EVIDENCE TO CHALLENGE THIS ASSUMPTION.

EXAMPLES OF NULL HYPOTHESES

- THE MEAN DIFFERENCE BETWEEN TWO GROUPS IS ZERO (E.G., $H_0: \mu_1 = \mu_2$).
- A NEW DRUG HAS NO EFFECT COMPARED TO A PLACEBO (E.G., $H_0: \text{THE DRUG'S EFFECT} = 0$).
- THERE IS NO CORRELATION BETWEEN TWO VARIABLES (E.G., $H_0: \rho = 0$).

UNDERSTANDING THE NULL HYPOTHESIS'S ROLE IS CRUCIAL BECAUSE THE ENTIRE HYPOTHESIS TESTING FRAMEWORK REVOLVES AROUND PROVIDING EVIDENCE EITHER TO REJECT IT OR FAIL TO REJECT IT.

THE P-VALUE: A MEASURE OF EVIDENCE

WHAT IS A P-VALUE?

- THE P-VALUE IS THE PROBABILITY OF OBSERVING DATA AS EXTREME AS, OR MORE EXTREME THAN, THE DATA ACTUALLY OBSERVED, ASSUMING THE NULL HYPOTHESIS IS TRUE.
- IT QUANTIFIES HOW COMPATIBLE THE OBSERVED DATA IS WITH THE NULL HYPOTHESIS.

INTERPRETING THE P-VALUE

- A SMALL P-VALUE INDICATES THAT THE OBSERVED DATA WOULD BE UNLIKELY IF THE NULL HYPOTHESIS WERE TRUE.
- A LARGE P-VALUE SUGGESTS THAT THE DATA IS CONSISTENT WITH THE NULL HYPOTHESIS.

WHEN DO WE REJECT THE NULL HYPOTHESIS?

THE ROLE OF SIGNIFICANCE LEVEL (α)

- THE SIGNIFICANCE LEVEL, DENOTED AS α , IS A PREDETERMINED THRESHOLD SET BEFORE TESTING.
- COMMON CHOICES FOR α ARE 0.05, 0.01, OR 0.10.
- IT REPRESENTS THE MAXIMUM PROBABILITY OF INCORRECTLY REJECTING THE NULL HYPOTHESIS (TYPE I ERROR) THAT THE RESEARCHER IS WILLING TO ACCEPT.

CRITERIA FOR REJECTION BASED ON P-VALUE

THE NULL HYPOTHESIS IS REJECTED IF:

- THE P-VALUE IS LESS THAN OR EQUAL TO THE SIGNIFICANCE LEVEL: $P\text{-VALUE} \leq \alpha$.

THIS CRITERION ENSURES THAT THE EVIDENCE AGAINST THE NULL HYPOTHESIS IS STRONG ENOUGH TO WARRANT REJECTION AT THE CHOSEN LEVEL OF RISK.

SUMMARY IN SIMPLE TERMS

- REJECT H_0 IF $P\text{-VALUE} \leq \alpha$.
- FAIL TO REJECT H_0 IF $P\text{-VALUE} > \alpha$.

THIS DECISION RULE FORMS THE BACKBONE OF CLASSICAL HYPOTHESIS TESTING.

UNDERSTANDING THE DECISION-MAKING PROCESS

STEP-BY-STEP FRAMEWORK

1. SET THE HYPOTHESIS: DEFINE H_0 (NULL HYPOTHESIS) AND H_1 OR H_A (ALTERNATIVE HYPOTHESIS).
2. CHOOSE SIGNIFICANCE LEVEL (α): DECIDE ON THE ACCEPTABLE RISK LEVEL.
3. COLLECT DATA: CONDUCT THE EXPERIMENT OR STUDY AND GATHER DATA.
4. CALCULATE THE P-VALUE: USE STATISTICAL TESTS TO COMPUTE THE P-VALUE BASED ON THE DATA.
5. COMPARE P-VALUE WITH α :
 - IF $P\text{-VALUE} \leq \alpha$, REJECT H_0 .
 - IF $P\text{-VALUE} > \alpha$, FAIL TO REJECT H_0 .

IMPLICATIONS OF REJECTION

REJECTING THE NULL HYPOTHESIS IMPLIES THAT THERE IS STATISTICALLY SIGNIFICANT EVIDENCE TO SUPPORT THE ALTERNATIVE HYPOTHESIS, THOUGH IT DOES NOT NECESSARILY PROVE IT.

COMMON SCENARIOS WHEN THE NULL HYPOTHESIS IS REJECTED

SCENARIO 1: SMALL P-VALUE ($P \leq \alpha$)

- THE OBSERVED DATA IS INCOMPATIBLE WITH THE NULL HYPOTHESIS.
- FOR EXAMPLE, IN CLINICAL TRIALS, A P-VALUE LESS THAN 0.05 MIGHT INDICATE THAT THE NEW TREATMENT HAS A

STATISTICALLY SIGNIFICANT EFFECT.

SCENARIO 2: P-VALUE EXACTLY EQUALS α

- WHILE RARE, IF THE P-VALUE PRECISELY EQUALS THE SIGNIFICANCE LEVEL, MANY STATISTICIANS PREFER TO REJECT THE NULL HYPOTHESIS, CONSIDERING THE EVIDENCE SUFFICIENT.

SCENARIO 3: MULTIPLE TESTING AND ADJUSTMENTS

- WHEN MULTIPLE HYPOTHESES ARE TESTED, ADJUSTMENTS LIKE THE BONFERRONI CORRECTION ARE USED.
- THE REJECTION CRITERIA ARE THEN BASED ON ADJUSTED SIGNIFICANCE LEVELS, BUT THE BASIC PRINCIPLE REMAINS: REJECT IF THE ADJUSTED P-VALUE IS BELOW THE THRESHOLD.

LIMITATIONS AND MISINTERPRETATIONS

MISCONCEPTION 1: P-VALUE IS THE PROBABILITY THAT H_0 IS TRUE

- THE P-VALUE DOES NOT TELL US THE PROBABILITY THAT THE NULL HYPOTHESIS IS TRUE.
- IT ONLY MEASURES HOW CONSISTENT THE DATA IS WITH H_0 .

MISCONCEPTION 2: REJECTION MEANS PRACTICAL SIGNIFICANCE

- A STATISTICALLY SIGNIFICANT RESULT ($p \leq \alpha$) DOES NOT NECESSARILY IMPLY PRACTICAL OR CLINICAL IMPORTANCE.
- EFFECT SIZES AND CONFIDENCE INTERVALS SHOULD BE CONSIDERED ALONGSIDE P-VALUES.

MISCONCEPTION 3: LARGE P-VALUES CONFIRM H_0

- A LARGE P-VALUE INDICATES INSUFFICIENT EVIDENCE TO REJECT H_0 , BUT DOES NOT CONFIRM H_0 IS TRUE.

FACTORS INFLUENCING THE DECISION TO REJECT H_0

SAMPLE SIZE

- LARGER SAMPLES TEND TO PRODUCE SMALLER P-VALUES IF AN EFFECT EXISTS.
- SMALL SAMPLES MIGHT FAIL TO REJECT H_0 EVEN WHEN A TRUE EFFECT EXISTS (TYPE II ERROR).

EFFECT SIZE

- THE MAGNITUDE OF THE OBSERVED EFFECT INFLUENCES THE P-VALUE.
- SMALL EFFECTS MIGHT NOT LEAD TO REJECTION EVEN IF THE NULL IS FALSE.

CHOICE OF SIGNIFICANCE LEVEL (α)

- A MORE STRINGENT α (E.G., 0.01) REDUCES FALSE POSITIVES BUT MAY INCREASE FALSE NEGATIVES.
- THE CHOICE DEPENDS ON THE CONTEXT AND CONSEQUENCES OF ERRORS.

CONCLUSION: WHEN IS THE NULL HYPOTHESIS REJECTED?

IN SUMMARY, THE NULL HYPOTHESIS IS REJECTED IN HYPOTHESIS TESTING WHEN THE P-VALUE CALCULATED FROM THE DATA IS LESS THAN OR EQUAL TO THE PREDETERMINED SIGNIFICANCE LEVEL (α). THIS DECISION INDICATES THAT THE OBSERVED DATA IS UNLIKELY UNDER THE ASSUMPTION THAT THE NULL HYPOTHESIS IS TRUE, PROVIDING STATISTICAL EVIDENCE TO SUPPORT THE ALTERNATIVE HYPOTHESIS. HOWEVER, IT IS ESSENTIAL TO INTERPRET P-VALUES CAREFULLY, CONSIDERING THE STUDY DESIGN, EFFECT SIZES, AND CONTEXT, RATHER THAN RELYING SOLELY ON THE P-VALUE THRESHOLD. PROPER UNDERSTANDING AND APPLICATION OF HYPOTHESIS TESTING PRINCIPLES ENABLE RESEARCHERS TO DRAW MEANINGFUL CONCLUSIONS AND ADVANCE SCIENTIFIC KNOWLEDGE WITH CONFIDENCE.

FREQUENTLY ASKED QUESTIONS

WHEN IS THE NULL HYPOTHESIS REJECTED BASED ON THE P-VALUE IN HYPOTHESIS TESTING?

THE NULL HYPOTHESIS IS REJECTED WHEN THE P-VALUE IS LESS THAN OR EQUAL TO THE PREDETERMINED SIGNIFICANCE LEVEL (α), INDICATING STRONG EVIDENCE AGAINST THE NULL HYPOTHESIS.

WHAT DOES IT MEAN IF THE P-VALUE IS SMALLER THAN THE SIGNIFICANCE LEVEL IN HYPOTHESIS TESTING?

IT MEANS THERE IS SUFFICIENT EVIDENCE TO REJECT THE NULL HYPOTHESIS AT THE CHOSEN SIGNIFICANCE LEVEL.

CAN THE NULL HYPOTHESIS BE REJECTED IF THE P-VALUE IS EXACTLY EQUAL TO THE SIGNIFICANCE LEVEL?

YES, TYPICALLY THE NULL HYPOTHESIS IS REJECTED IF THE P-VALUE IS LESS THAN OR EQUAL TO THE SIGNIFICANCE LEVEL, INCLUDING WHEN IT IS EXACTLY EQUAL.

WHAT IS THE ROLE OF THE SIGNIFICANCE LEVEL (α) IN HYPOTHESIS TESTING WITH P-VALUES?

THE SIGNIFICANCE LEVEL (α) SETS THE THRESHOLD FOR DECISION-MAKING; IF THE P-VALUE IS LESS THAN OR EQUAL TO α , THE NULL HYPOTHESIS IS REJECTED.

IS A SMALL P-VALUE INDICATIVE OF A PRACTICALLY SIGNIFICANT RESULT?

NOT NECESSARILY; A SMALL P-VALUE INDICATES STATISTICAL SIGNIFICANCE BUT DOES NOT IMPLY PRACTICAL SIGNIFICANCE, WHICH DEPENDS ON CONTEXT AND EFFECT SIZE.

WHAT HAPPENS IF THE P-VALUE IS GREATER THAN THE SIGNIFICANCE LEVEL IN HYPOTHESIS TESTING?

IF THE P-VALUE EXCEEDS THE SIGNIFICANCE LEVEL, WE FAIL TO REJECT THE NULL HYPOTHESIS, INDICATING INSUFFICIENT EVIDENCE TO SUPPORT AN ALTERNATIVE HYPOTHESIS.

WHY IS THE P-VALUE CONSIDERED A MEASURE OF EVIDENCE AGAINST THE NULL

HYPOTHESIS?

BECAUSE A SMALLER P-VALUE SUGGESTS THAT THE OBSERVED DATA IS UNLIKELY UNDER THE NULL HYPOTHESIS, PROVIDING EVIDENCE TO REJECT IT.

CAN THE NULL HYPOTHESIS BE ACCEPTED BASED SOLELY ON THE P-VALUE?

NO, HYPOTHESIS TESTING TYPICALLY INVOLVES REJECTING OR FAILING TO REJECT THE NULL HYPOTHESIS; 'ACCEPTING' IT IS NOT STATISTICALLY RECOMMENDED BASED SOLELY ON THE P-VALUE.

HOW DOES THE CHOICE OF SIGNIFICANCE LEVEL AFFECT THE REJECTION OF THE NULL HYPOTHESIS USING P-VALUES?

A LOWER SIGNIFICANCE LEVEL MAKES IT HARDER TO REJECT THE NULL HYPOTHESIS, REQUIRING A SMALLER P-VALUE; A HIGHER LEVEL MAKES REJECTION EASIER.

ADDITIONAL RESOURCES

WHEN THE P-VALUE IS USED FOR HYPOTHESIS TESTING, THE NULL HYPOTHESIS IS REJECTED IF?

UNDERSTANDING THE ROLE OF THE P-VALUE IN HYPOTHESIS TESTING IS FUNDAMENTAL FOR RESEARCHERS, STATISTICIANS, AND DATA ANALYSTS ALIKE. THE PHRASE "WHEN THE P-VALUE IS USED FOR HYPOTHESIS TESTING, THE NULL HYPOTHESIS IS REJECTED IF" ENCAPSULATES A CRITICAL DECISION-MAKING PROCESS IN STATISTICAL INFERENCE. THIS GUIDE AIMS TO UNPACK WHAT THIS STATEMENT TRULY MEANS, HOW THE P-VALUE FUNCTIONS WITHIN THE FRAMEWORK OF HYPOTHESIS TESTING, AND UNDER WHAT CIRCUMSTANCES THE NULL HYPOTHESIS IS REJECTED. BY THE END OF THIS ARTICLE, YOU'LL HAVE A CLEAR, COMPREHENSIVE UNDERSTANDING OF THE CRITERIA AND REASONING BEHIND REJECTING THE NULL HYPOTHESIS BASED ON THE P-VALUE.

WHAT IS A P-VALUE AND WHY IS IT IMPORTANT?

BEFORE DIVING INTO THE SPECIFIC CONDITIONS UNDER WHICH THE NULL HYPOTHESIS IS REJECTED, IT'S ESSENTIAL TO UNDERSTAND WHAT A P-VALUE ACTUALLY REPRESENTS.

DEFINITION:

A P-VALUE IS THE PROBABILITY, UNDER THE ASSUMPTION THAT THE NULL HYPOTHESIS IS TRUE, OF OBTAINING A RESULT EQUAL TO OR MORE EXTREME THAN THE ONE OBSERVED. IT QUANTIFIES THE EVIDENCE AGAINST THE NULL HYPOTHESIS.

WHY IS THE P-VALUE IMPORTANT?

THE P-VALUE PROVIDES A MEASURE TO DETERMINE WHETHER THE OBSERVED DATA ARE CONSISTENT WITH THE NULL HYPOTHESIS. A SMALL P-VALUE INDICATES THAT THE OBSERVED DATA ARE UNLIKELY IF THE NULL HYPOTHESIS WERE TRUE, THUS PROVIDING A BASIS FOR QUESTIONING OR REJECTING THE NULL HYPOTHESIS.

THE ROLE OF THE NULL HYPOTHESIS IN HYPOTHESIS TESTING

THE NULL HYPOTHESIS (DENOTED AS H_0) IS A DEFAULT STATEMENT OR CLAIM THAT THERE IS NO EFFECT, NO DIFFERENCE, OR NO ASSOCIATION BETWEEN VARIABLES. IT SERVES AS A BASELINE FOR STATISTICAL TESTING.

EXAMPLES OF NULL HYPOTHESES:

- THERE IS NO DIFFERENCE IN MEANS BETWEEN TWO GROUPS.
- A NEW DRUG HAS NO EFFECT COMPARED TO A PLACEBO.
- THE CORRELATION BETWEEN TWO VARIABLES IS ZERO.

THE ALTERNATIVE HYPOTHESIS (H_1 OR H_A) IS WHAT RESEARCHERS OFTEN SUSPECT OR HOPE TO SUPPORT, SUCH AS THERE

BEING A DIFFERENCE OR AN EFFECT.

WHEN THE P-VALUE IS USED FOR HYPOTHESIS TESTING

IN HYPOTHESIS TESTING, THE P-VALUE IS USED AS A DECISION-MAKING TOOL. BASED ON THE P-VALUE AND PRE-DETERMINED SIGNIFICANCE LEVEL (α), RESEARCHERS DECIDE WHETHER TO REJECT THE NULL HYPOTHESIS.

STANDARD PROCEDURE:

1. STATE THE NULL HYPOTHESIS (H_0) AND THE ALTERNATIVE HYPOTHESIS (H_1).
2. CHOOSE A SIGNIFICANCE LEVEL (α), OFTEN 0.05.
3. COLLECT DATA AND COMPUTE THE TEST STATISTIC.
4. CALCULATE THE P-VALUE ASSOCIATED WITH THE TEST STATISTIC.
5. COMPARE THE P-VALUE TO α TO DECIDE WHETHER TO REJECT H_0 .

THE CORE QUESTION: WHEN IS THE NULL HYPOTHESIS REJECTED?

"THE NULL HYPOTHESIS IS REJECTED IF THE P-VALUE IS LESS THAN OR EQUAL TO THE SIGNIFICANCE LEVEL (α)."
THIS STATEMENT IS A CORNERSTONE OF CLASSICAL HYPOTHESIS TESTING.

MATHEMATICALLY:

- NULL HYPOTHESIS IS REJECTED IF $P\text{-VALUE} \leq \alpha$
- NULL HYPOTHESIS IS NOT REJECTED IF $P\text{-VALUE} > \alpha$

THIS THRESHOLD (α) REFLECTS THE MAXIMUM PROBABILITY OF A TYPE I ERROR (INCORRECTLY REJECTING A TRUE NULL HYPOTHESIS) THAT THE RESEARCHER IS WILLING TO ACCEPT.

DETAILED EXPLANATION: WHEN THE NULL HYPOTHESIS IS REJECTED

1. THE P-VALUE IS LESS THAN OR EQUAL TO THE SIGNIFICANCE LEVEL ($P\text{-VALUE} \leq \alpha$)

THIS IS THE PRIMARY CRITERION FOR REJECTION. WHEN THE P-VALUE IS SMALLER THAN OR EQUAL TO THE PRE-SPECIFIED SIGNIFICANCE LEVEL, IT INDICATES THAT THE OBSERVED DATA ARE UNLIKELY UNDER THE ASSUMPTION THAT THE NULL HYPOTHESIS IS TRUE.

IMPLICATION:

- THERE IS SUFFICIENT EVIDENCE TO REJECT H_0 IN FAVOR OF H_1 .
- THE OBSERVED EFFECT OR DIFFERENCE IS STATISTICALLY SIGNIFICANT.

EXAMPLE:

SUPPOSE A CLINICAL TRIAL TESTS WHETHER A NEW MEDICATION LOWERS BLOOD PRESSURE.

- NULL HYPOTHESIS (H_0): THE MEDICATION HAS NO EFFECT (MEAN DIFFERENCE = 0).
- SIGNIFICANCE LEVEL (α): 0.05.
- CALCULATED P-VALUE: 0.02.

SINCE $0.02 < 0.05$, WE REJECT THE NULL HYPOTHESIS AND CONCLUDE THAT THERE IS STATISTICALLY SIGNIFICANT EVIDENCE THAT THE MEDICATION AFFECTS BLOOD PRESSURE.

2. THE P-VALUE IS GREATER THAN THE SIGNIFICANCE LEVEL ($P\text{-VALUE} > \alpha$)

IN THIS CASE, THE DATA DO NOT PROVIDE ENOUGH EVIDENCE TO REJECT H_0 .

IMPLICATION:

- THE OBSERVED RESULTS ARE CONSISTENT WITH THE NULL HYPOTHESIS.
- THERE IS INSUFFICIENT EVIDENCE TO SUPPORT THE ALTERNATIVE HYPOTHESIS.

IMPORTANT NOTE:

FAILING TO REJECT H_0 DOES NOT NECESSARILY MEAN H_0 IS TRUE; IT SIMPLY INDICATES THAT THE DATA DO NOT STRONGLY CONTRADICT IT.

ADDITIONAL CONSIDERATIONS AND NUANCES

WHILE THE BASIC RULE IS STRAIGHTFORWARD, SEVERAL FACTORS INFLUENCE WHETHER THE NULL HYPOTHESIS IS REJECTED OR NOT:

A) CHOICE OF SIGNIFICANCE LEVEL (α)

- COMMONLY SET AT 0.05, BUT CAN BE MORE STRINGENT (E.G., 0.01) OR LENIENT (E.G., 0.10) DEPENDING ON THE CONTEXT.
- A LOWER α REDUCES THE CHANCE OF TYPE I ERRORS BUT INCREASES THE RISK OF TYPE II ERRORS (FAILING TO REJECT A FALSE NULL).

B) THE MAGNITUDE OF THE P-VALUE

- VERY SMALL P-VALUES (E.G., 0.001) PROVIDE STRONG EVIDENCE AGAINST H_0 .
- P-VALUES CLOSE TO α (E.G., 0.051 WHEN $\alpha=0.05$) CAN BE A GRAY AREA, OFTEN PROMPTING FURTHER ANALYSIS OR LARGER SAMPLE SIZES.

C) CONTEXT AND PRACTICAL SIGNIFICANCE

- STATISTICAL SIGNIFICANCE DOES NOT NECESSARILY IMPLY PRACTICAL OR CLINICAL SIGNIFICANCE.
- A VERY SMALL P-VALUE MAY CORRESPOND TO A TRIVIAL EFFECT SIZE IF THE SAMPLE SIZE IS LARGE.

COMMON MISINTERPRETATIONS

- "A SMALL P-VALUE PROVES THE ALTERNATIVE HYPOTHESIS." — FALSE. IT SUGGESTS EVIDENCE AGAINST H_0 BUT DOES NOT CONFIRM H_1 .
- "A LARGE P-VALUE MEANS H_0 IS TRUE." — FALSE. IT INDICATES INSUFFICIENT EVIDENCE TO REJECT H_0 BUT DOES NOT CONFIRM ITS TRUTH.
- "REJECTION OF H_0 MEANS THE HYPOTHESIS IS PROVEN." — FALSE. HYPOTHESIS TESTING IS ABOUT EVIDENCE, NOT PROOF.

SUMMARY: WHEN THE NULL HYPOTHESIS IS REJECTED

IN ESSENCE, THE NULL HYPOTHESIS IS REJECTED IN HYPOTHESIS TESTING WHEN:

- THE P-VALUE CALCULATED FROM THE DATA IS LESS THAN OR EQUAL TO THE PREDETERMINED SIGNIFICANCE LEVEL (α).
- THIS INDICATES THAT THE OBSERVED DATA ARE UNLIKELY UNDER H_0 , PROVIDING SUFFICIENT EVIDENCE TO REJECT IT.
- THE DECISION IS MADE WITHIN THE CONTEXT OF THE STUDY'S DESIGN, DATA QUALITY, AND THE CHOSEN SIGNIFICANCE THRESHOLD.

FINAL THOUGHTS: THE DECISION-MAKING FRAMEWORK

- SET YOUR SIGNIFICANCE LEVEL (α) BEFORE DATA COLLECTION.
- CALCULATE THE P-VALUE AFTER DATA ANALYSIS.

- COMPARE THE P-VALUE TO α :
- If $P\text{-VALUE} \leq \alpha$ REJECT H_0 .
- If $P\text{-VALUE} > \alpha$ FAIL TO REJECT H_0 .
- INTERPRET THE RESULTS IN CONTEXT, CONSIDERING EFFECT SIZES, CONFIDENCE INTERVALS, AND PRACTICAL IMPLICATIONS.

UNDERSTANDING "WHEN THE P-VALUE IS USED FOR HYPOTHESIS TESTING, THE NULL HYPOTHESIS IS REJECTED IF" IS FUNDAMENTAL TO CONDUCTING RIGOROUS STATISTICAL ANALYSIS. IT GUIDES RESEARCHERS IN MAKING INFORMED, TRANSPARENT DECISIONS BASED ON THE DATA, BALANCING THE RISKS OF FALSE POSITIVES AND FALSE NEGATIVES, AND ULTIMATELY ADVANCING KNOWLEDGE WITH STATISTICAL INTEGRITY.

When The P Value Is Used For Hypothesis Testing The Null Hypothesis Is Rejected If

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