Hypothesis Test (2024 Spring EN5423 - week06)

Your student id # _____

Quiz

Environmental Policy Decision: Banning a Chemical Substance

Consider a scenario where a government regulatory body is evaluating whether to ban a chemical substance suspected of causing harm to the environment. The decision hinges on whether the substance is indeed harmful as alleged.

- **Null Hypothesis (H_0):** The chemical substance does not cause significant harm to the environment.
- **Alternative Hypothesis (H_a):** The chemical substance causes significant harm to the environment.

Decisions and Outcomes

1. **Reject H_0 (Decide to ban the substance)**
   - **If H_0 is actually true (the substance is not harmful):**
     - **Outcome:** Type I Error (False Positive).
     - **Example:** The regulatory body bans the chemical, leading to increased costs for industries that rely on it, potential job losses, and the use of less efficient alternatives. This decision could negatively impact the economy without providing environmental benefits.
   - **If H_0 is false (the substance is harmful):**
     - **Outcome:** Correct decision.
     - **Example:** The ban effectively prevents environmental damage, protecting ecosystems and public health, which justifies the economic costs.
2. **Fail to Reject H_0 (Decide not to ban the substance)**
   - **If H_0 is true (the substance is not harmful):**
     - **Outcome:** Correct decision.
     - **Example:** The substance continues to be used, supporting economic activities without causing harm to the environment.
   - **If H_0 is false (the substance is harmful):**
     - **Outcome:** Type II Error (False Negative).
     - **Example:** Continued use of the substance leads to significant environmental degradation, harming ecosystems and potentially causing health problems for the population.

Question 5: In the context of deciding whether to ban a chemical substance suspected of harming the environment, which of the following scenarios describes a Type I Error?

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a) The substance is banned, preventing potential environmental damage, but later evidence shows it was actually harmless.

b) The substance is not banned, and subsequent environmental degradation confirms its harmful effects.

c) The regulatory body conducts further research to confirm the substance's effects before making a decision.

d) An alternative chemical, believed to be safer, is introduced to replace the banned substance.

Answer: a) The substance is banned, preventing potential environmental damage, but later evidence shows it was actually harmless.

Explanation

Option a) exemplifies a Type I Error (False Positive) in this environmental policy decision context: the action of banning a substance based on the belief that it is harmful when it is, in fact, not harmful. This leads to unnecessary economic and social costs. This scenario underscores the importance of accurate scientific assessment and regulatory caution in environmental policy, balancing the need to protect the environment with the potential consequences of regulatory actions.