Risk Assessment

1. General Tips

- **AND:** Means multiply (×).
- **OR:** Means add (+).
- **Independent:** Each pregnancy is completely independent of the previous ones.

2. Carrier Shortcuts

If a healthy person has a family history of an autosomal recessive disease:

- **Affected Sibling (Brother / Sister)** → Probability he/she is a carrier = **2/3**.
- **Affected Nephew / Niece** → Probability he/she is a carrier = **1/2**.
- **Affected Uncle / Aunt** → Probability he/she is a carrier = **1/3**.
- **No Family History** → Use the population carrier frequency (e.g., **1/25** for CF).

3. The Golden Rules of "1"

- **Tested Carrier:** If the question says a parent is tested and found to be a carrier, put **1**.
- **Fetus Gender is Known:** If the question states the mother is carrying a **girl** or a **boy** (gender is already known), put **1** (Do NOT multiply by 1/2).

*Note: Only multiply by **1/2** if the question asks for a future prediction (e.g., "What is the chance they will have an affected girl?").*

Past Paper Question Explanation:

A couple approached you because of a current pregnancy and a family history with phenylketonuria (PKU). The mother told you that her sister is affected with PKU and the father told you that his uncle is affected with PKU. You performed an ultrasound and the fetus turned out to be a female. What is the risk for the couple to have UNAFFECTED FEMALE with PKU? Assume a population frequency of 1/100?

Note: PKU is an autosomal recessive disease.

Step-by-Step Solution:

1.Find Mom's Carrier Probability (P(Mom is Carrier)):

Her sister is affected (Affected Sibling).

According to our shortcut rule, her probability is 2/3. (Disregard the 1/100 population frequency

for her because she has a family history).

2.Find Dad's Carrier Probability (P(Dad is Carrier)):

His uncle is affected (Affected Uncle).

According to our shortcut rule, his probability is 1/3. (Disregard the 1/100 population frequency for him too).

3.Find the Fetus Genotype Probability (Unaffected):

The question asks for an UNAFFECTED child, not an affected one.

If both parents are carriers (Aa × Aa), the cross gives: 1/4 Affected (aa) and 3/4 Unaffected (AA or Aa).

4.Find the Gender Probability:

The ultrasound already showed that the fetus is a female (Known Gender Rule).

Since the gender is already a known reality, we put 1 (We do NOT multiply by 1/2).

Final Equation Calculation:

Risk = P(Mom Carrier) × P(Dad Carrier) x P(Parents having an Unaffected child)

Risk = ⅔ × ⅓ × ¾

Risk = ⅙