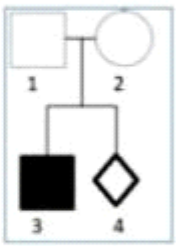
Calculation of the risk to have an affected child

A- To calculate the risk for autosomal recessive diseases:

The risk of the fetus to be affected = risk for each parent to be hybrid x risk for each parent to give the allele of the disease.

Given: The risk/probability for being hybrid/heterozygous in a certain population is 1/20.

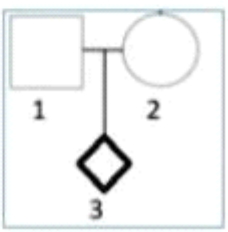
- **Case 1: Determine the risk for couple 1 and 2 to have an affected child.**



In the adjacent pedigree, the parents (1 and 2) are of normal hybrid since they are normal and have an affected child (3). Thus the risk for each one of them to be hybrid is 1 and the risk for each one of them to give the allele of the disease to fetus is ½.

Thus the risk to have an affected child = 1 x1 x ½ x ½ = 1/4.

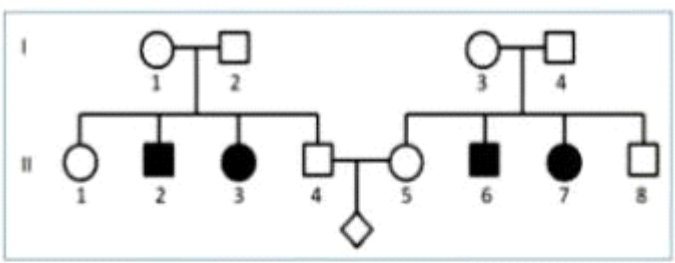
- **Case 2: Determine the risk for fetus 3 to be affected.**



In the adjacent pedigree, the risk for each of the parent (1 and 2) to be hybrid is 1/20 since they are normal and have no family history for the disease, so they take the risk for being hybrid as given in the population. Moreover, the risk for the each one of the hybrid parents to give the allele of the disease is ½.

The risk for the fetus to be affected by the disease is= 1/20 x 1/20 x ½ x ½ = 1/1600.

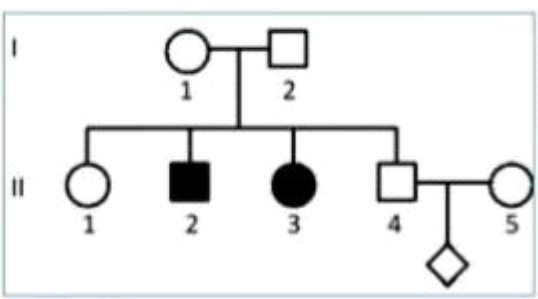
- **Case 3: Determine the risk for couple II (4 and 5) to have and affected child.**



The probability for II-4 and II-5 to be hybrid is 2/3 since they are normal having affected siblings and their parents are hybrid. Moreover, the risk for each one of them to give the allele of the disease is ½.

The risk for this couple to have affected children = 2/3 x 2/3 x ½ x ½ =1/9.

- **Case 4: Determine the risk for couple II (4 and 5) to have and affected child.**



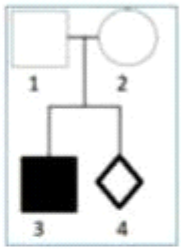
The probability for the father II-4 to be hybrid is 2/3 since he is normal and having affected sister and brother and his parents are hybrid and the probability for the mother to be hybrid is 1/20 since she is normal and have no family history for the disease, so she takes the risk for being hybrid as given in the population. Moreover, the risk for each one of the parents to give the allele of the disease to their children is ½.

The risk for this couple to have affected children = 2/3 x 1/20 x ½ x ½ =1/120.

C- To calculate the risk for X-linked recessive diseases:

Risk to have affected child = probability for the child to receive a chromosome from the father x probability for the mother to be hybrid x probability for the mother to give the allele of the disease.

❖ **Case 1: Determine the risk for couple 1 and 2 to have an affected child.**



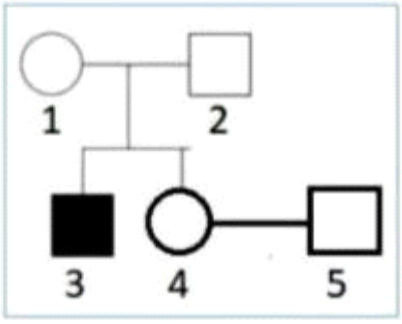
There is no risk for this couple to have affected daughters since the genotype of the father is X^NY and all his daughters will receive the X^N chromosome to become normal.

There is only risk to have affected boys.

The probability for the father to give Y to chromosome to his sons is 1. The mother is normal hybrid since she has an affected son (3) who received the X^d chromosome from her, thus her probability to give the X^d chromosome is ½.

The risk for this couple to have affected boys = 1x 1 x ½ = ½.

❖ **Case 2: Determine the risk for couple 4 and 5 to have an affected child.**



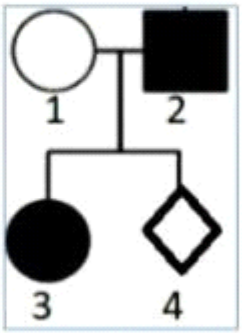
There is no risk for this couple to have affected daughters since the genotype of the father is X^NY and all his daughters will receive the X^N chromosome to become normal.

There is only risk to have affected boys.

The probability for the father (5) to give Y chromosome to his sons is 1. The probability of the mother (4) to be hybrid is ½ since her mother (1) is normal hybrid of genotype X^NX^d, which can give her sons any of these chromosomes, thus the probability of mother 4 to give the X^d chromosome is ½.

The risk for this couple to have affected boys =1 x 1/2 x ½ = ¼.

❖ **Case 3: Determine the risk for the fetus to be affected.**



If the fetus is a girl, the probability of mother 1 to be hybrid is 1 since she is normal but having and affected son that received the X^d chromosome from her, thus her probability to give the X^d chromosome is ½. Moreover, the father is affected, so his probability to give the X^d chromosome to his daughters is 1.

The risk to have affected daughter = 1 x ½ x 1 = ½.

If the fetus is a boy, the probability of mother 1 to be hybrid is 1 since she is normal but having and affected son that received the X^d chromosome from her, thus her probability to give the X^d chromosome is ½. Moreover, the father is affected, so his probability to give the Y chromosome to his sons is 1.

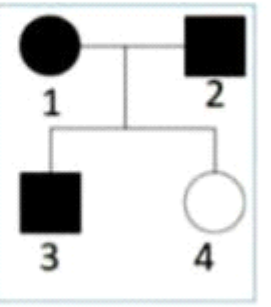
The risk to have affected son = 1 x ½ x 1 = 1/2.

B- To calculate the risk for autosomal dominant diseases:

Risk of the child to be affected = 1 – probability of the child to be normal.

= 1 – (probability of each parent to be hybrid x probability for each parent to give the normal allele)

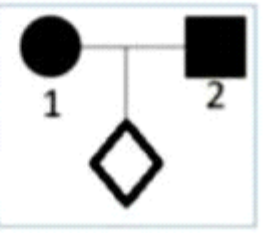
❖ **Case 1: Determine the risk for individual 3 to be affected.**



Both parents 1 and 2 are hybrid because they are affected by the dominant disease and have a normal daughter that received the recessive normal alleles from both of them. Thus the probability for each parent to give the normal allele is ½.

So the risk to have for individual 3 to be affected = 1 – (1x1x ½ x ½) = 3/4.

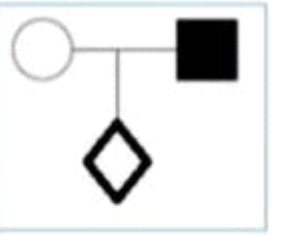
❖ **Case 2: Determine the risk for the fetus to be affected.**



Both parents are affected with the dominant disease, but they have no family history, so each one of them take the probability of being hybrid as given in a population which is 1/20. Thus the probability for each one of them to give the normal allele to the fetus is ½.

Risk for the fetus to be affected = 1 – (1/20 x 1/20 x ½ x 1/2) = 1599/1600.

❖ **Case 3: Determine the risk for the fetus to be affected.**



The mother is normal pure since normal is recessive, so her probability to give the normal allele to her children is 1. The father is affected with the dominant disease, but he has no family history, so he takes the probability of being hybrid as given in a population which is 1/20. Thus the probability for the father to give the normal allele to the fetus is ½.

Risk for the fetus to be affected = 1 – (1x 1/20 x 1/2) = 39/40.