

Interpretation

Based on these results, we conclude that for families with two children, the number of girls should usually fall between -0.4 and 2.4 , so 2 girls is not an unusually high number of girls (because 2 falls between -0.4 and 2.4). (In this case, the minimum usual value is actually 0, because that is the lowest possible number of girls, and the maximum usual value is 2 because that is the highest possible number of girls.)

Identifying Unusual Results with Probabilities: The Rare Event Rule for Inferential Statistics

If, under a given assumption (such as the assumption that boys and girls have the same chance of being born), the probability of a particular observed event (such as 879 girls in 945 births) is extremely small, we conclude that the assumption is probably not correct.

Probabilities can be used to apply the rare event rule as follows:

Using Probabilities to Determine When Results Are Unusual

- **Unusually high number of successes:** x successes among n trials is an *unusually high* number of successes if the probability of x or more successes is unlikely with a probability of 0.05 or less. This criterion can be expressed as follows:
 $P(x \text{ or more}) \leq 0.05$.*
- **Unusually low number of successes:** x successes among n trials is an *unusually low* number of successes if the probability of x or fewer successes is unlikely with a probability of 0.05 or less. That is, x is an unusually low number of successes if $P(x \text{ or fewer}) \leq 0.05$.*

*The value 0.05 is not absolutely rigid. Other values, such as 0.01, could be used to distinguish between results that can easily occur by chance and events that are very unlikely to occur by chance.

CAUTION The above criteria are not exactly equivalent to those used for the range rule of thumb. Chapter 8 introduces more formal and exact methods that will replace the above criteria and the range rule of thumb.

Unusually High or Unusually Low Number of Successes: Not Exactly, but “At Least as Extreme”

In Section 4-2 we stated that a number of successes is unusually low or unusually high if that number is far from what we typically expect. We will now refine that description by using a probability value to judge whether a particular number of successes among n trials is unusually high or unusually low. Use the probability of getting x or any other values that are more extreme; do not use only the probability of exactly x successes. For example, suppose you were tossing a coin to determine whether it favors heads, and suppose 1000 tosses resulted in 501 heads. We can use methods from Section 5-3 to find the following two probabilities:

- $P(\text{exactly 501 heads in 1000 tosses}) = 0.0252$ (so exactly 501 heads is *unlikely*)
- $P(501 \text{ or more heads in 1000 tosses}) = 0.487$ (so 501 heads is *not unusually high*)

We use the second of the preceding two probabilities for determining whether 501 heads in 1000 tosses is an unusually high number of heads. (We do not base our