

Given the claim from Example 1 that “with the XSORT method, the proportion of girls is greater than the proportion of 0.5 that occurs without any treatment,” we apply Steps 1, 2, and 3 in Figures 8-1 and 8-2 as follows.

**Step 1:** Identify the claim to be tested and express it in symbolic form. The claim is that “with the XSORT method, the proportion of girls is greater than the proportion of 0.5 that occurs without any treatment.” Using  $p$  to denote the probability of getting a girl with the XSORT method, we express that claim in symbolic form as  $p > 0.5$  (so that  $p$  is greater than 0.5, where 0.5 is the assumed probability of a girl when no XSORT treatment is used).

**Step 2:** Give the symbolic form that must be true when the original claim is false. If the original claim of  $p > 0.5$  is false, then  $p \leq 0.5$  must be true.

**Step 3:** This step is in two parts: Identify the alternative hypothesis  $H_1$  and identify the null hypothesis  $H_0$ .

- Identify  $H_1$ : Using the two symbolic expressions  $p > 0.5$  and  $p \leq 0.5$ , the alternative hypothesis  $H_1$  is the one that does not contain equality. Of those two expressions,  $p > 0.5$  does not contain equality, so we get

$$H_1: p > 0.5$$

- Identify  $H_0$ : The null hypothesis  $H_0$  is the symbolic expression that the parameter *equals* the fixed value being considered, so we get

$$H_0: p = 0.5$$

The result of the first three steps is the identification of the null and alternative hypothesis:

$$H_0: p = 0.5 \text{ (null hypothesis)}$$

$$H_1: p > 0.5 \text{ (alternative hypothesis)}$$

**Note About Always Using the Equals Symbol in  $H_0$ :** The symbols  $\leq$  and  $\geq$  were sometimes used in the null hypothesis  $H_0$ , but that practice has become obsolete. Professional statisticians and professional journals now use only the equals symbol for equality. We conduct the hypothesis test by assuming that the proportion, mean, or standard deviation is *equal to* some specified value so that we can work with a single distribution having a specific value, so the null hypothesis is the statement that we assume true for the purpose of conducting the test.

**Note About Forming Your Own Claims (Hypotheses):** If you are conducting a study and want to use a hypothesis test to *support* your claim, the claim must be worded so that it becomes the alternative hypothesis (and can be expressed using only the symbols  $<$ ,  $>$ , or  $\neq$ ). You can never support a claim that some parameter is *equal to* a specified value.

## Step 4: Select the Significance Level $\alpha$

### Objective

Identify the value of the significance level  $\alpha$  so that we have a specific criterion for distinguishing between sample results that could easily occur by chance and sample results that are unlikely to occur by chance.