- The proportion of subjects with a hip fracture on the protected hip and no hip fracture on the unprotected hip.

Using the discordant (different) pairs with the general format from Table 11-7, we have $b = 10$ and $c = 15$, so the test statistic is calculated as follows:

$$\chi^2 = \frac{(|b - c| - 1)^2}{b + c} = \frac{(|10 - 15| - 1)^2}{10 + 15} = 0.640$$

With a 0.05 significance level and degrees of freedom given by df = 1, we refer to Table A-4 to find the critical value of $\chi^2 = 3.841$ for this right-tailed test. The test statistic of $\chi^2 = 0.640$ does not exceed the critical value of $\chi^2 = 3.841$, so we fail to reject the null hypothesis. (Also, the *P*-value is 0.424, which is greater than 0.05, indicating that we fail to reject the null hypothesis.) The proportion of hip fractures with the protectors worn is not significantly different from the proportion of hip fractures without the protectors worn. The hip protectors do not appear to be effective in preventing hip fractures.

Table 11-8 Randomized Controlled Trial of Hip Protectors

		No Hip Protector Worn	
		No Hip Fracture	**Hip Fracture**
Hip Protector Worn	**No Hip Fracture**	309	10
	Hip Fracture	15	2

using TECHNOLOGY

STATDISK Enter the observed frequencies in the Data Window as they appear in the contingency table. Select **Analysis** from the main menu, then select **Contingency Tables.** Enter a significance level and proceed to identify the columns containing the frequencies. Click on **Evaluate.** The STATDISK results include the test statistic, critical value, and *P*-value, as shown in the display resulting from Table 11-1.

STATDISK

Degrees of freedom: 1

Test Statistic, X^2: 12.1619
Critical X^2: 3.841456
P-Value: 0.0005

MINITAB First enter the observed frequencies in columns, then select **Stat** from the main menu bar. Next select the option **Tables,** then select **Chi Square Test (Two-Way Table in Worksheet)** and enter the names of the columns containing the observed frequencies, such as C1 C2 C3 C4. Minitab provides the test statistic and *P*-value, the expected frequencies, and the individual terms of the χ^2 test statistic.

EXCEL Use XLSTAT. First enter the contingency table in rows and columns. Click on **XLSTAT** at the top. Select **Correlation/Association tests,** then select **Test on contingency table.** In the "Contingency table" box, enter the range of cells containing the frequency counts of the contingency table. For example, enter A1:B4 for a contingency table with two columns (A and B) and four rows. For the "Data format," select the **Contingency Table** option. Click on the **Options** tab, leave a checkmark next to "Chi-square test," and enter a value for "Significance level (%)." For example, enter 5 for a 0.05 significance level. Click **OK** and results including the chi-square test statistic and *P*-value will be displayed.

TI-83/84 PLUS First enter the contingency table as a matrix by pressing 2ND X^{-1} to get the MATRIX menu (or the MATRIX key on the TI-83). Select **EDIT**, and press ENTER. Enter the dimensions of the matrix (rows by columns) and proceed to enter the individual frequencies. When finished, press STAT, select **TESTS,** and then select the option **χ^2-Test.** Be sure that the observed matrix is the one you entered, such as matrix A. The expected frequencies will be automatically calculated and stored in the separate matrix identified as "Expected." Scroll down to **Calculate** and press ENTER to get the test statistic, *P*-value, and number of degrees of freedom.

STATCRUNCH Click on **Open StatCrunch.** Enter the row labels in the first column and enter the cell frequencies in the following columns. Click on **Stat,** select **Tables,** then select **Contingency.** Select the option of **with summary.** Enter the columns to be used, then click on **Calculate.** Results will include the test statistic and *P*-value.