BASIC CONCEPTS OF STATISTICAL TECHNIQUES

Besides measures of central tendency and variability, other, slightly more complicated statistical techniques can be used. Before we explain each in detail, however, you must understand some general information about statistical techniques.

Two Categories of Statistical Tests

The two general categories of statistical tests are **parametric** and **nonparametric.** Using the various tests in each category requires meeting the assumptions for those tests. The first category, parametric statistical tests, has three assumptions about the distribution of the data:

- The population from which the sample is drawn is normally distributed on the variable of interest.
- The samples drawn from a population have the same variances on the variable of interest.
- The observations are independent.

Certain parametric techniques have additional assumptions. The second category, nonparametric statistics, is called **distribution free** because the previous assumptions need not be met.

Whenever the assumptions are met, parametric statistics are often said to have more **power,** although there is some debate on this issue. Having more power increases the chances of rejecting a false null hypothesis. You frequently assume that the three criteria for use of parametric statistics are met. The assumptions can be tested by using estimates of **skewness** and **kurtosis.** (Only the meaning of these tests is explained here. Any basic statistics textbook provides considerably more detail. For a helpful discussion on skewness and kurtosis, see Newell & Hancock, 1984.)

To understand skewness and kurtosis, first consider the normal distribution in figure 6.3. This is a **normal curve,** which is characterized by the mean, median, and mode being at the same point (center of the distribution). In addition, $\pm 1s$ from the mean includes 68% of the scores, $\pm 2s$ from the mean includes 95% of the scores, and $\pm 3s$ includes 99% of the scores. Thus, data distributed as in figure 6.3 would meet the three assumptions for use of parametric techniques. Skewness of the distribution describes the direction of the hump of the curve (labeled *A* in figure 6.4) and the nature of the tails of the curve (labeled *B* and *C*). If the hump (*A*) is shifted to the left and the long tail (*B*) to the right (figure 6.4*a*), the skewness is positive. If the shift of the hump (*A*) is to the right and the long tail (*C*) is to the left (figure 6.4*b*), the skewness is negative. Kurtosis describes the vertical aspect of the curve, such as whether the curve is more or less peaked than the normal curve. Figure 6.5*a* shows a more peaked curve, and figure 6.5*b* shows a flatter curve.

Table 2 in the appendix shows a unit normal distribution (z) for a normal curve. The column z shows the location of the mean. When the mean is in the center of the distribution, its z is equal to .00; thus, .50 (50%) of the distribution is beyond (to the right of) the mean, leaving .50 (50%) of the distribution as a remainder (to the left of the mean). As the mean of the distribution moves to the right in a normal curve (say to a z of $+1s$), .8413 (84%) of the distribution is to the left of the mean (remainder) and .1587 is to the right of (beyond) the mean. This table allows you to determine the percentage of the normal distribution included by the mean plus any fraction of a standard deviation. Suppose that you want to know what percentage of the distribution would be included by the mean plus one-half (.50) of a standard deviation. Using table 2 you can see that it would be .6915 (remainder), or 69%.

For chapters 8 and 9, consider that the three basic assumptions for parametric statistical tests have been met. This is done for two reasons. First, the assumptions are very robust to violations, meaning that the outcome of the statistical test is relatively accurate even with severe violations of the assumptions. Second, most of the research in physical activity uses parametric tests.

parametric statistical test—Test based on data assumptions of normal distribution, equal variance, and independence of observations.

nonparametric statistical test—Any of a number of statistical techniques used when the data do not meet the assumptions required to perform parametric tests.

distribution free—A term used to describe nonparametric statistical tests, because the data distribution requirements for a parametric test do not have to be met.

power (statistical)—The probability of rejecting a false null hypothesis.

skewness—Description of the direction of the hump of the curve of the data distribution and the nature of the tails of the curve.

kurtosis—Description of the vertical characteristic of the curve showing the data distribution, such as whether the curve is more peaked or flatter than the normal curve.

normal curve—Distribution of data in which the mean, median, and mode are at the same point (center of the distribution) and in which $\pm 1s$ from the mean includes 68% of the scores, $\pm 2s$ from the mean includes 95% of the scores, and $\pm 3s$ includes 99% of the scores.

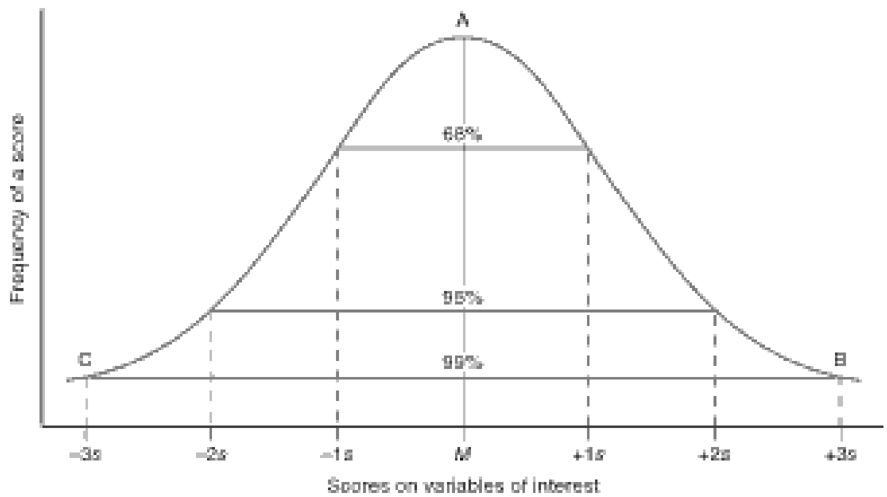

Figure 6.3 The normal curve.

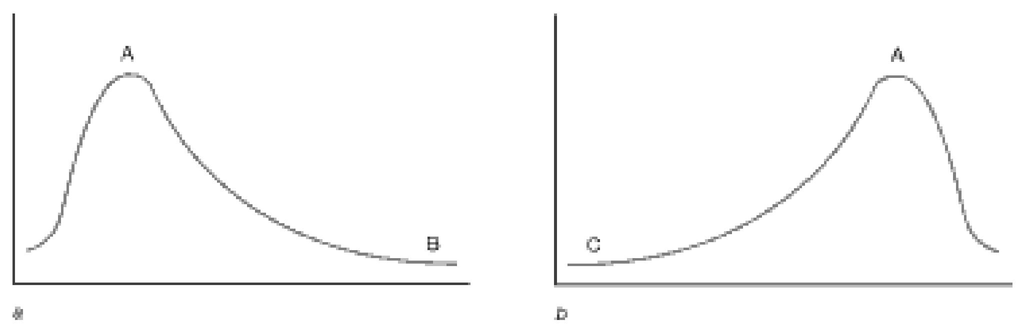

Figure 6.4 Skewed curves: *(a)* positive skewness; *(b)* negative skewness.

Figure 6.5 Curves with abnormal kurtosis: *(a)* more peaked; *(b)* more flat.