

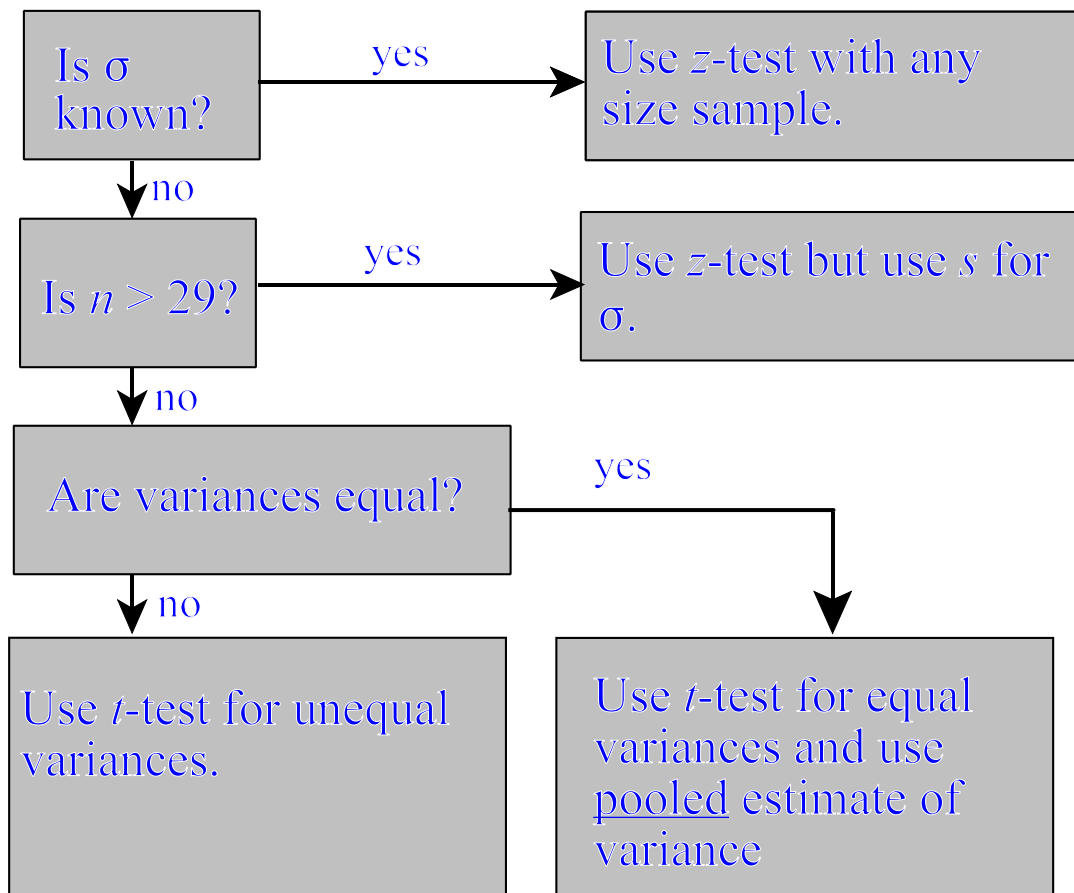
Comparison of Statistical Tests

	Parametric	Nonparametric	Frequency
Data type	Ratio, Interval	Ordinal	Nominal
Single sample	z-test, t-test	Sign test, K-S test*	χ^2 Goodness- of-fit
Two independent samples	z-test, t-test (2 types)	Wilcoxon Rank-sum (Mann-Whitney U)	
Two dependent samples	Paired t-test	Paired Sign, Wilcoxon Signed-ranks	
More than two independent samples	One-way ANOVA	Kruskall-Wallis	
Two factors	Two-way ANOVA		χ^2 Test of Independence
Correlation	Pearson	Spearman	Phi*

* not studied in this course

Flow Diagram for Choosing the Correct Independent Samples t -Test

Similar to flow diagram used for single sample means. But requires a test for equality of variances (**homogeneity of variance**). Generally the sample's mean and standard deviation are used with the t -distribution. The t -distribution becomes indistinguishable from the z -distribution (normal distribution) when $n > 29$. Samples must be independent.



Power of a Statistical Test

Power: ability of a statistical test to detect a real difference

1. probability of rejecting the null hypothesis when it is false (i.e., there is a real difference)
2. equal to $1 - \beta$ (1 - probability of Type II error)

Ways of Increasing Power

- a. **Increasing α** will increase power but it also increases chance of a Type I error
- b. **Increasing sample size** (increases costs)
- c. **Using ratio or interval data** versus nominal or ordinal. Tests involving ratio/interval data are called “**parametric**” tests. Those involving nominal and ordinal data are called “nonparametric” tests.
- d. Using “**repeated measures**” tests, such as, the repeated measures *t*-test or ANOVA. By using the same subjects repeatedly, variability is reduced.
- e. If variances are equal use **pooled estimates** of variance (e.g., Independent groups *t*-test)
- f. **Increasing measurement precision** increases probability of finding a significant difference.
- g. Using samples from **extremes of the distribution**. Reduces generalizability of experiment results.
- h. **Standardizing testing procedures** reduces variability.
- i. Using **one-tailed** vs. two-tailed tests. Problem occurs if results are in wrong tail. Not recommended.

Possible Reasons for a Significant Correlation

1. There is a **direct cause-and-effect relationship** between the variables. That is, x causes y. For example, positive reinforcement improves learning, smoking causes lung cancer and heat causes ice to melt.
2. There is a **reverse cause-and-effect relationship** between the variables. That is, y causes x. For example, suppose a researcher believes excessive coffee consumption causes nervousness, but the researcher fails to consider that the reverse situation may occur. That is, it may be that an nervous people crave coffee.
3. The relationship between the variables may be **caused by a third variable**. For example, if a statistician correlated the number of deaths due to drowning and the number of cans of soft drinks consumed during the summer, he or she would probably find a significant relationship. However, the soft drink is not necessarily responsible for the deaths, since both variables may be related to heat and humidity.
4. There may be a **complexity of interrelationships** among many variables. For example, a researcher may find a significant relationship between students' high school grades and college grades. But there probably are many other variables involved, such as IQ, hours of study, influence of parents, motivation, age and instructors.
5. The relationship may be **coincidental**. For example, a researcher may be able to find a significant relationship between the increase in the number of people who are exercising and the increase in the number of people who are committing crimes. But common sense dictates that any relationship between these two variables must be due to coincidence.