Evidence Based Medicine
Module 2 - Measurement: Key points

Variable types

Continuous
- May assume any value within a given range
- Examples: age, weight, height

Discrete (also known as categorical)

Types
- dichotomous aka binary (e.g. yes/no; good/bad);
- ordinal (e.g., the MRC scale)
- nominal (e.g., race)

- May only assume one of a select number of discrete values

Measures of Frequency

		Disease: Yes	Disease: No
Treated	Yes	a	b
	No	c	d

The exposure variable (aka, independent, explanatory, predictor) is whether the patient was treated

The outcome variable (ka, dependent) is whether the patient developed the disease

In this example, the frequency of a good outcome within the population may be expressed:

(a+c)/(a+b+c+d)

Similarly, the frequency of the exposure within the population may be expressed:

(a+b)/(a+b+c+d)

Prevalence: the frequency (or amount) of disease (or exposure) in a population at a given point in time

Incidence: the frequency with which **NEW** events occur

Risk: the probability of some event (0-1). However, without an indication of the time period, the quantification of risk is meaningless.

Risk can only be calculated when incident data is available – which is to say that it is necessary to follow people who are initially free of the outcome of interest and to identify those who developed the outcome during the period of follow-up

Formally defined as follows: (number of subjects who develop disease within a given period of time) / (number of subjects followed over the same period of time)

An important obstacle to estimating risk is the problem of a changing denominator (may change either due to competing risks (e.g. death from another cause before the appearance of the outcome of interest) or from loss to follow-up (e.g. participants may leave the study or move out of the geographic region that contains the study population). Because of this difficulty in estimating risk, alternate measures of disease frequency are required – rate is a measure that takes account of the problem of the changing denominator

Rate: a measure of the frequency with which disease accumulates in a population

it takes into account or accommodates the problem of a changing denominator. In calculating rate, the numerator is the same as for calculating risk. The difference, however, lies in the denominator. For rate, the denominator is a composite of the number of subjects followed and the duration of time over which they are followed

Rate may assume any value from zero to infinity

Odds: Like risk and rate, odds is also a measure of frequency

Ratio of a probability that some event will occur divided by the probability that same event will not occur

Why the need for Odds: risk requires incident data; Incident data isn't always available (e.g., incident data is not typically available is a case-control study). In a case-control study we can't measure risk, so instead we must measure odds (and often use odds as a surrogate measure of risk)

Measures of Association

To compare measures of frequency between two populations, we use measures of association. These measures are useful because they provide a single number that describes the "strength" of the association between variables:

- Difference measures
- Ratio measures

These may be expressed as absolute differences or relative differences

Relative Risk $\frac{\text{[Risk in the treated group] MINUS [Risk in the control group]}}{\text{[Risk in the control group]}}$

Absolute Risk: [Risk in the treated group] **MINUS** [Risk in the control group]

Relative Risk, although correct may be misleading and gives the impression of a more effective benefit:

Number Needed to Treat and Number Needed to Harm

NNT is defined as the number of patients who must be treated in order to see one additional better outcome

Number needed to harm (NNH) is defined as the number of patients who must be treated in order to see one additional worse (or harmful) outcome

NNT and NNH are calculated as the inverse (i.e. 1 divided by) of the absolute risk difference

For Example:	Disease in the Treated Group:	0.05	5%
	Disease in the Control Group:	0.04	4%
	Absolute risk difference:	0.01	1%
	Relative risk difference:		25%
	NNT:	1/0.01 = 100	

Odds Ratio

Represents a ratio of two ratios

Formal calculation is the "CROSS PRODUCT" = a*d / b*c

Odds ratio is **NOT** the same as the risk ratio

However, we often think of the odds ratio as a surrogate for the risk ratio and indeed it may occasionally serve this role **when the disease is rare**.

Thus, its use is for the following:

- incident data not available (e.g., case control study)

- the disease is rare