Outcome types

	Dichotomous variables	Continous variables
Definition	A *dichotomous variable* is one that takes on one of only two possible values when observed or measured.	When a measure is continuous, that is the outcome for each participant consists of a measurement on a numerical scale. A measurement is taken from each person in a group, and then the results are summarized – commonly as a mean value (to give us an idea of the average of the group).
Examples	Vaccination status, gender, smoking status, etc.)	Blood pressure, age, weight, height, test scores
Effect measures	Risk ratio, odds ratio, risk difference	Mean difference

1. Dichotomous outcomes
   When studies measure dichotomous outcomes, they compare the chances of an event between two groups (such as the intervention and control groups) to decide which of the two groups has a better outcome. Examples:

Headaches?

- →Yes
- →No

Table 2. Contingency table for dichotomous outcomes

	Headaches	No headaches	Total
Regular coffee	17	51	68
Decaffeinated coffee	9	55	64
Total	26	106	132

Note that the studies sometimes don't report the actual number of events in each group, but report a percentage. This can be easily converted to the number of events if you have the sample size for each group.

Vaccination?

- →Yes
- →No

Table 3. Dichotomous variables expressed as percentage

Table 2. Mean Physician Before and After Vaccination Rates as Function of the Small-Group Process Intervention

	Vaccination Rate, %*	
	1990-1991 Before Intervention†	1991-1992 After Intervention‡
Control arm, n=28	46.50 (21.04)	46.07 (20.65)
Intervention arm, n=23	47.56 (23.70)	62.78 (20.64)

*Note that even if not expressed, you can easily calculate the percentage of those not receiving vaccination (in control arm before intervention: 100%-46.5%=34.5%)

1.1 Effect measures expressing the difference between two groups:

1.1.1 Risk ratios (=relative risk)

To calculate the risk ratio (RR), take the risk in the intervention group, and divide it by the risk in the control group.

	Headaches	No headaches	Total
Regular coffee	17	51	68
Decaffeinated coffee	9	55	64
Total	26	106	132

Risk in the intervention group: 17/68
Risk in the control group: 9/64
Risk ratio (RR): (17/68)/(9/64)=1.79
Meaning: When the RR is greater than one, the intervention increased the risk of an event compared to the control. When the RR is less than one, this implies that the intervention reduced the risk of an event compared to the control. If the RR is equal to one, this implies the risk of an event is equal in the intervention and control group. The value of one is the point of no effect for any ratio measure.

1.1.2 Odds ratios

The odds ratio (OR) takes the odds of an event in the intervention group, and divides them by the odds in the control group.

	Headaches	No headaches	Total
Regular coffee	17	51	68
Decaffeinated coffee	9	55	64
Total	26	106	132

Intervention odds: 17/51
Control odds. 9/55
Odds ratio: (17/51)/(9/55)=2.06
Meaning: An OR greater than one means that the intervention increased the odds of event. In this case, an OR of 2.06 implies that the odds of a headache was just over two times, or double, the odds in the control group. You could also express this as a percentage, e.g. 106% higher than the odds in the control group.

If the OR was less than one, this would imply that the intervention reduced the odds compared to the control. For example, an OR of 0.06 would mean that the intervention had reduced the odds of headache to 6% of the odds in the control group, or reduced the odds by 94%.

1.1.3 Risk difference (absolute risk reduction)

To get the risk difference, you should subtract – take the risk in the intervention group, and subtract the risk in the control group. In this case, 0.25 – 0.14, which gives an RD of 0.11.

	Headaches	No headaches	Total
Regular coffee	17	51	68
Decaffeinated coffee	9	55	64
Total	26	106	132

Meaning: the risk difference is greater than zero implies that intervention increased the risk of event. Where the risk difference is less than zero, it would imply that the intervention reduced the risk of event compared to the control. If the risk difference is equal to zero, it would imply that there was no difference in risk between the two groups, and therefore no intervention effect.

1.1.3.1 Expressing risk difference in words:

Percentage points:

A percentage point change indicates an absolute effect while a percentage change indicates a relative effect. For example, if your risk in the control group is 14%, a 50% increase would increase that risk by half (7%) to 21%. A 50 percentage point increase would increase the risk from 14% by 50 to 64%.

Natural frequencies

An alternative way of expressing absolute differences is to talk about them in natural frequencies – for example, numbers out of 100, or per 1,000, or per million. Consumers find these values particularly easy to understand. In this case, you would start by noting that 14 out of 100 people had a headache in the control group – this represents what would happen anyway, without the intervention. With caffeine, 11 more people experienced a headache (making a total of 25 out of 100).

2. Continous outcomes

When a measure is continuous, that is the outcome for each participant consists of a measurement on a numerical scale. A measurement is taken from each person in a group, and then the results are summarized – commonly as a mean value (to give us an idea of the average of the group).

Examples: Blood pressure, age, weight, height, test scores, etc.

2.1 Effect measures

2.1.1 Mean difference

The MD is the mean value in the intervention group, minus the mean value in the control group. The result is then expressed in units on the scale used to measure the outcome.

Example

Irritability in this case is measured in each study participant using a self-reported questionnaire that is used to calculate a numerical score.

Irritability score	Mean	SD	N
Regular coffee	20	9.1	65
Decaffeinated coffee	33	8.6	67

20-33 is -13 points. Like a risk difference in dichotomous outcomes, this is an absolute measure – if the result is zero, this implies there is no difference in the average score between the two groups. Zero is the point of no effect. If the result is a positive number, then the intervention group scored higher on the scale. If the result is negative, the intervention group scored lower on the scale.