### Measure

#### Absolute risk
- **Analogy:** Price
- Absolute risk (control) is the regular price.
- Absolute risk (exposed) is the sales price.

#### Absolute risk reduction (ARR)
- "percentage points lower"
- **Analogy:** Savings from a sale.
- Subtract the sales price from the regular price.

#### Absolute risk (control)
- Number who had outcome

#### Absolute risk (exposed)
- Number who could have had outcome

#### Example
- **Absolute risk** (DRUG group) = 10/100 = 0.10 = 10%
- **Absolute risk** (Placebo group) = 30/100 = 0.30 = 30%
- Over 5 years, 10% of the DRUG group died compared to 30% of the placebo group.
- DRUG lowered the chance of dying compared to placebo: 10% vs. 30% died over 5 years.

#### Relative risk (RR)
- **Relative Risk** = 10% / 30% = 0.1 / 0.3 = 0.33
- The DRUG group had 0.33 times the chance of dying compared to placebo: 10% vs 30% died over 5 years.
- The DRUG group had one third the deaths of the placebo group: 10% vs 30% died over 5 years.

#### Relative risk reduction (RRR)
- "% lower"
- **Analogy:** "% off" for the sale ("67% off regular price")

#### Example
- **Relative reduction** = 1 - 0.33 = 0.67 or 67%
- DRUG reduced the chance of dying by 67% compared to placebo: 10% vs 30% died over 5 years.
- DRUG lowered deaths by two thirds compared to placebo: 10% vs 30% died over 5 years.

### Bottom Line
- Always report absolute risks for each group (no matter what other numbers are used).
- For all risks, you need to be clear about 3 things: exactly what the outcome is (e.g. having a heart attack), over what time period the outcome occurred (e.g. 5 years) and in whom (e.g. adults with diabetes).
**Early Detection Statistics**

### Survival

- Number alive at a specified time after Cancer X diagnosis (typically 5 or 10 years)
- Number diagnosed with Cancer X

Comparing survival of patients diagnosed by different methods tells you nothing about the benefit of early detection.

Consequently, comparing survival across time (e.g., 1970 vs. 2008) or place (e.g., UK vs. US) – when patterns of testing are different – is misleading. They cannot tell you whether anyone is living longer.

10-year lung cancer survival was:
- 29% for patients diagnosed by screening chest x-rays
- 14% for patients diagnosed by symptoms

Lung cancer patients diagnosed by screening chest x-rays have a 10-year survival of 29% compared to 14% of lung cancer patients diagnosed by symptoms, like cough or weight loss.

Warning: This statement is misleading. It tells you nothing about about the benefit of screening.

### Mortality

- Number of Cancer X deaths over a specified time
- Total No. of people in study or population (i.e., with & without Cancer X diagnosis)

Reduced mortality in a randomized trial is the only reliable evidence for the benefit of screening.

In a randomized trial of chest x-ray screening, **10 year lung cancer mortality** was:
- 4% for the chest x-ray screening group
- 4% for the control group (not screened)

The **10-year lung cancer mortality** among the chest x-ray screening group was 4% versus 4% in the control group.

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**Measure** | **Definition** | **Example**
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**p value** | Probability that an observed effect size is due to chance alone
- if \( p > 0.05 \), we say “likely due to chance”, “not statistically significant”
- if \( p < 0.05 \), we say “unlikely due to chance”, “statistically significant”

Remember, even with a very low p value (“highly statistically significant”), results can still be very wrong: the study may be biased or confounded.

Relative risk reduction = 67%, \( p=0.0004 \)

The observed differences in the 5 year risk of death between the DRUG and placebo group is not consistent with chance alone (i.e., \( p=0.0004 \) – there is only a \( 4 \text{ in } 10,000 \) chance of seeing differences this big or bigger if DRUG and placebo were the same).

These results are very unlikely to be due to chance.

**Confidence interval (95% CI)** | Because the observed value is only an estimate of the truth, we know it has a “margin of error”.

The range of plausible values around the observed value that will contain the truth 95% of the time.

Relative risk reduction (95% CI) = 67% (36%–83%)

While our best estimate is that DRUG lowers the 5 year risk of death by 67%, the results of this study say it is possible that DRUG may lower the risk **by as little as 36% or as much as 83%**.