ERIC Notebook

Second Edition

Calculating Person-Time

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What is person-time?

Person-time is an estimate of the actual time-at-risk – in years, months, or days – that all participants contributed to a study. In certain studies people are followed for different lengths of time, as some will remain free of a health outcome or disease longer than others. A subject is eligible to contribute person-time to the study only so long as that person does not yet have the health outcome under study and, therefore, is still at risk of developing the health outcome of interest. By knowing the number of new cases of the health outcome and the person-time-at-risk contributed to the study, an investigator can calculate the rate of the health outcome or disease, or how quickly people are acquiring the health outcome or disease.

Calculating rates

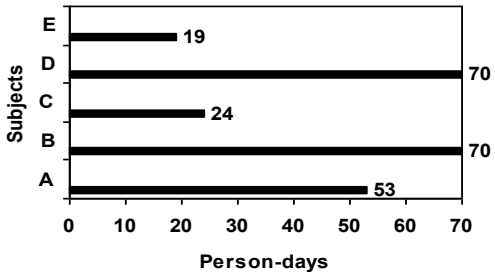
The rate is the number of new (incident) cases during study follow-up divided by the person-time-at-risk throughout the observation period.

$$\text{Rate} = \frac{\#\ of\ new\ cases}{total\ person\text{–}time\ at\ risk}$$

The denominator for a rate (person-time) is a more exact expression of the population at risk during the period of time when the change from non-disease to disease is being measured. The denominator for the rate changes as persons originally at risk develop the health outcome during the observation period and are removed from the denominator.

Calculating person-time for rates

Now suppose an investigator is conducting a study of the rate of second myocardial infarction (MI). He follows 5 subjects from baseline (first MI) for up to 10 weeks. The results are graphically displayed as follows:



The graph shows how many days each subject remained in the study as a non-case (no second MI) from baseline. From this graph the investigator can calculate person-

time. Person-time is the sum of total time contributed by all subjects. The unit for person-time in this study is person-days (p-d).

Time contributed by each subject:

Subject A: 53 days

Subject B: 70 days

Subject C: 24 days

Subject D: 70 days

Subject E: 19 days

Total person-days in the study: 53+70+24+70+19=236 person-days

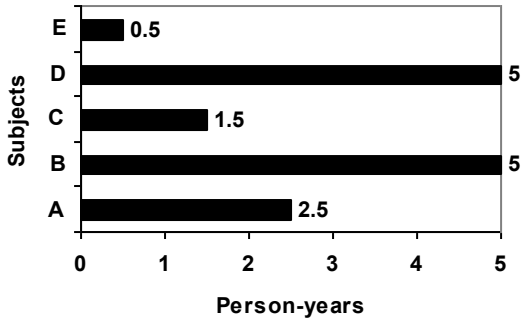
236 person-days (p-d) now becomes the denominator in the rate measure. The total number of subjects becoming cases (subjects A, C, and E) is the numerator in the rate measure. Therefore the rate of secondary MI is 3/(236 p-d), which is 0.0127 cases per person-day. By multiplying the numerator and denominator by 1000, the rate becomes 12.7 cases per 1000 person-days. The denominator, person-days, can be converted into other time units (such as hours or years) appropriate to the disease or health outcome being studied.

Secondary MI may be expressed in cases per person-year (p-y) by: (0.0127 cases/p-d) x (365 p-d/1 p-y) = 4.6 cases/p-y

Estimating when a person becomes a case

Now suppose an investigator is studying the rate of prostate cancer in men with a family history of prostate cancer. Subjects are examined once a year for up to five years. In order to calculate person-time when an investigator is only examining patients at specified intervals (once a year) the investigator must determine when a newly diagnosed case acquired the disease within the last year. In order to determine the amount of person-time adequately, an investigator may decide that the onset of prostate cancer occurred at the midpoint of the time interval between being disease free and becoming a case. This is because the investigator does not know precisely when subject A developed prostate cancer (just that it was sometime between exams two and three).

The following graph displays the amount of time until onset of prostate cancer for each subject.



Time contributed by each subject:

Subject A: 2.5 years

Subject B: 5 years

Subject C: 1.5 years

Subject D: 5 years

Subject E: 0.5 years

Total person-years in the study:

(2.5+5+1.5+5+0.5)=14.5 person-years

14.5 p-y is the denominator in the rate of prostate cancer. The rate is 3/(14.5 p-y), or 0.207 cases per p-y. By multiplying both the numerator and denominator by 1000 the rate becomes 207 cases per 1000 p-y.

Terminology

Rate: the number of new cases of disease during a period of time divided by the person-time-at-risk

Person-time: estimate of the actual time-at-risk in years, months, or days that all persons contributed to a study

References

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