Learning Curve

Need for and Practical Interpretations of the Person-Year Construct in Neuropsychiatric Research

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ABSTRACT

In observational studies, groups of interest may be carved out of predictors of interest. Thus, for example, if cardiovascular (CVS) health at age 50 years is the predictor of interest for dementia as the long-term outcome, groups of interest could comprise persons with poor, intermediate, and optimal CVS health at age 50. These groups would almost certainly be unbalanced in terms of sample size and duration of follow-up when incident dementia is assessed. The present article is a companion to the previous article in this column; it explains why the duration of follow-up needs to be factored into the sample size in each group, making person-years rather than persons as the unit for risk assessment. Next, this article explains how to reverse calculate an estimate of the number needed to treat (NNT) statistic in such situations. Finally, this article explains why the NNT so estimated is an approximation and not a true estimate of the NNT in the population.

Key words: Cardiovascular health, confounding, dementia risk, measures of effect size, number needed to treat, person-years unit

Sabia et al.\(^\text{[1]}\) described a prospective cohort study of 7899 subjects whose cardiovascular (CVS) health was assessed as poor, intermediate, or optimal at a baseline age of 50 years. These subjects were followed up for a median duration of 24.7 years, by when dementia had developed in 347 (4.4%) subjects. The incidence rate of dementia was 3.2, 1.7, and 1.3 per 1000 person-years, respectively, in subjects with poor, intermediate, and optimal baseline CVS health. In analyses adjusted for confounding variables, poor baseline CVS health was found to be a significant predictor of long-term dementia risk.

Looking at these results, the reader may ask (a) why the findings were expressed using a person-year unit and not as a percentage and (b) whether it’s worth taking care of one’s CVS health at age 50 in order to reduce one’s dementia risk; that is, are the statistically significant findings clinically significant? Each of these questions is answered in turn.

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Why was the person-year unit used?

Dementia is a disease of old age. People in poor CVS health may die early, before those vulnerable to dementia have a chance to develop the disease. Therefore, if dementia incidence is expressed as a percentage of the sample size, the risk of dementia in the poor CVS health group may falsely be assessed as low. In contrast, the risk of dementia will be assessed as higher in people with good CVS health because they lived long enough for dementia-related changes (in vulnerable individuals) to manifest. So, if the median duration of follow-up was systematically dissimilar in the poor, intermediate, and optimal CVS health groups, it could be fallacious to report dementia incidence as a percentage of the sample size.

In such situations, instead of using persons as a unit of sample size, person-years may be used. Person-years refer to the number of years for which persons contribute data. Thus, somebody who was followed up for 5 years would be a five person-year subject. Person-years are totalled in each group to yield the sample size in that group, as expressed in person-years. The risk of dementia in each group is then calculated based on person-years of follow-up. Because the incidence values would be very small for one person-year of follow-up, it is easier to express the values based on the uniform unit of, say, 1000 person-years of follow-up. Now, dissimilarities in follow-up across groups are no longer as important as they were.

As a side note, person-years of follow-up is not a perfect unit when dementia is an outcome. This is because 500 poor CVS health subjects may each be followed from age 50 to age 52 years, totaling to 1000 patient-years of follow-up, and 50 optimal CVS health subjects may each be followed from age 50 to 70 years, also totaling to 1000 patient-years of follow-up. The risk in the optimal health group will be higher (even with a person-year unit) because the poor health group was not followed up long enough for dementia to have a reasonable chance to manifest in individuals at risk.

Are the findings clinically significant?

The risk of dementia in the optimal CVS health group was reduced by 1.9 (i.e., 3.2-1.3) per 1000 person-years, relative to the poor CVS health group. An advantage of 1.9 per 1000 person-years is the same as an advantage of 1.9 per 100 × 10 years, and this is the same as an advantage of 1.9% across 10 years, and this is the same as an advantage of 3.8% across 20 years, and this is the same as an advantage of 4.75% across 25 years. Thus, in persons who are in optimal CVS health at age 50, the absolute incidence of dementia will be nearly 5% lower than that in persons who are in poor CVS health at age 50.

Note that 4.75% is 4.75/100, or 1 in 21. This means that 21 people would have to move from low to optimal CVS health groups for one extra person to be protected against dementia between age 50 and age 75 years. That is, the number needed to treat (NNT) is 21.[2] Given that the NNT in statin primary prevention trials in CVS disease studies are in the 1 in 50 to 1 in 200 range,[3] and given that dementia is serious and irreversible and of as much concern as CVS disease, an NNT value of 1 in 21 should be considered clinically significant.

As a side note, this was not a randomized controlled trial (RCT); So, inadequately measured, unmeasured, and unknown risk factors for dementia may not have been balanced across the three groups and would not have been adjusted for in the analyses. These confounds, therefore, could have augmented the benefits attributed to membership in the optimal CVS health group. So the estimated NNT is not a true NNT. The actual NNT value could be higher; that is, the actual benefit could be smaller. Furthermore, because cohort studies are observational studies and because observational studies can only identify an association, not cause (as RCTs might do), there is even a possibility that optimal CVS health is only a marker for lower dementia risk and not a cause of lower dementia risk.

The take-home message is that whereas it is desirable to maintain optimal CVS health for CVS reasons, the lower risk of dementia could be an added bonus.

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Conflicts of interest
There are no conflicts of interest.

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