CORRESPONDENCE

Prevalence odds ratio *v* prevalence ratio—some further comments

Editor,—The effect measure used when presenting results from a cross sectional study is, in general, either the prevalence odds ratio (POR) or the prevalence ratio (PR). Lee and Chia,[1] Strömberg,[2] Axelson *et al*,[3] and Lee[4] discuss the pros and cons of these two effect measures. I would like to give some further comments on this issue.

Axelson *et al* present hypothetical examples to show that the use of the POR may imply "confounding even when the study base is unconfounded in terms of prevalence data".[3] I think that their description is somewhat misleading. As in their example, consider a dichotomous exposure and another dichotomous factor, F, which both affect the prevalence of the study disease. Assume that the fraction of exposure does not depend on F, so F is not a confounder.[5] Axelson *et al* use hypothetical data, which when stratified on F, produce stratum specific PRs equal to the crude PR and, of course, the adjusted PR as well, whereas the stratum specific PORs differ from the crude PORs and hence the adjusted POR equals a value between those two PORs; this occurs because the exposure specific prevalence ratios with respect to the other factor F coincide. One can also construct an example where the stratum specific PRs differ, whereas the stratum specific PORs are equal; this occurs when the exposure specific PORs for F coincide (table). In that case, the adjusted PR is between the stratum specific PRs, whereas the stratum specific and adjusted PORs are equal, although the crude and adjusted POR may be different. To sum up in other words, these examples show that F may modify the effect of exposure without being a confounder in the conventional meaning; moreover, F may modify the POR and not the PR, and vice versa. Note that, when F does not influence the fraction of exposure, the stratum specific PORs can be equal to each other and still differ from the crude POR (table), whereas this cannot happen when the PR is the effect measure of interest. Effect modification can be examined in the analysis of the data.[5 6]

From an aetiological point of view it is often desirable to estimate effects of exposure on incidence of disease. It is sometimes possible to obtain incidence based effect estimates from cross sectional data. For example, under certain stationarity assumptions, a POR can be converted into an incidence ratio.[5] The association between prevalence and incidence is derived from a complex theory that is based on more or less restrictive assumptions.[7 8] Most commonly, investigators who apply a cross sectional study design focus on exposure effect on prevalence rather than incidence, as such effect can be directly estimated from cross sectional data. If prevalence is the disease measure at issue, one may argue that the PR is easier to interpret than the POR (Axelson *et al*[3]). On the other hand, I do not think that the POR lacks intelligibility (Lee and Chia[1]); instead of reflecting the ratio of two prevalences, it simply reflects the ratio of two prevalence odds. Furthermore, from a statistical point of view, the POR is preferable to the PR (explained later).

Lee and Chia as well as Axelson *et al* apply Cox's proportional hazards model for estimating an adjusted PR.[1 3] To use a statistical model for estimation, it is fundamental to know what type of dependent parameter the model involves. As is well known, the dependent parameter of Cox's proportional hazards model corresponds to intensity (hazard) and the one of the logistic regression model corresponds to probability. Because prevalence is probability and not intensity, Lee and Chia advocate the use of Cox's proportional hazards model by assuming "constant follow up time".[1] They claim that the effect estimate from Cox's model then approximates the relative risk (Lee and Chia use the term rate ratio,[1] whereas Lee[4] uses the term cumulative incidence ratio) by referring to Breslow's paper,[9] which considers censored survival data. Except for the fact that risk as well as prevalence corresponds to probability, their reasoning is confusing: for example, the assumption "constant follow up time" has no clear meaning in a cross sectional study and the relation between prevalence and incidence (incidence corresponds to intensity) is not the same as the one between risk and incidence. In fact, by replacing a log-linear model for the prevalence odds—that is, a logistic model—with a log-linear model for the prevalence, as Lee and Chia propose, the prevalence parameter is not constrained to take values between 0 and 1, but above 0.[6] Therefore, a log-linear model aimed at directly estimating a PR rather than a POR is not satisfactory. As far as I know, there is no useful statistical model for directly estimating a PR with adjustments for several covariates. Such an estimate can be obtained from the logistic model by a straightforward transformation,[6] although further research is needed to provide an appropriate confidence interval.

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Prevalence ratio (PR) and prevalence odds ratio (POR) as effect measures of exposure based on a hypothetical set of cross sectional data. In particular, the table shows the impact of another factor, F, which affects the prevalence of disease, but not the fraction exposed

	Exposed	*Non-exposed*	*PR*	*POR*
F present	500/1000*	250/1000	2·00	3·00
F absent	250/1000	100/1000	2·50	3·00
Total	750/2000	350/2000	2·14	2·83

*(Number of prevalent cases)/(number of people) = the prevalence.

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NOTICES

International symposium on biological monitoring in occupational and environmental health, 11–13 September 1996, Espoo, Finland

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