

Excess risk in the vicinity of point sources - a focused test adjusted for unobserved heterogeneity

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Introduction

Along with the establishment of population based cancer registries in Germany there is an increasing interest in environmental epidemiology. A frequent public concern is a potential clustering of disease in the vicinity of a point source. In the past, a large number of tests have been developed in order to investigate disease clustering. Mostly these tests are based on the distance to the point source. Sometimes an association between an excess risk and a point source occurs which may be explained by a covariate which was not taken into account. Frequently, potentially influential covariates are not known. Thus this paper presents a statistical test which takes such unobserved heterogeneity into account.

Methods

Several procedures, termed 'focused', specifically analyse disease surveillance data around pre-specified putative sources of environmental hazard. Waller and Lawson (1995) show that the Score test is a uniformly most powerful test for this kind of problem. This test is obtained when the score of a log linear model for the count data in the respective areas close to the point source with the inverse distance as a covariate is considered.

Since this test uses the distance to the point source as a surrogate measure for exposure, a potential association may be subject to confounding due to unobserved covariates such as social deprivation (Sans et al, 1995). Here we propose at least partial adjustment for confounding by including area specific random effects into the log linear model. The score is then estimated by plugging in the estimated random effects into the score equation. For the random effects several distributions are considered. Among those distributions are a simple normal distribution and a nonparametric mixture (Schlattmann und Böhning, 1993). The test is applied to the data published by Sans et al. (1995) investigating the association between a chemical plant and larynx carcinoma.

Results

In comparison to the standard score test the proposed test takes residual confounding into account and reduces the probability of false positive 'cluster alarms'.

Discussion

The analysis of so called disease clusters is an important topic in environmental epidemiology. A simple test based method which relies only on distance may be misleading. For the first time the approach proposed here takes unobserved heterogeneity for distance based tests into account.

References

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