

Constraint Estimation for the Population Attributable Risk

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Abstract

In epidemiology and public health intervention, population attributable risk (PAR) is an important measure of the potential impact that reduction in exposure to a risk factor may have on the incidence of a given disease. For a psychiatric study carried out in Western Pennsylvania, existing method of estimation in the literature cannot guarantee the additivity of the estimated PARs. Currently published methods result in the estimated PAR attributable to all risk factors functioning as a whole overestimate or underestimate the sum of individual PARs, each attributable to a risk factor. The additivity of the estimated PARs has been a long-time remaining open problem in biostatistics. In this paper, we present a method of constraint estimation to solve the problem. Estimators from the new method satisfy the constraint that the overall estimated PAR equals the sum of the corresponding individual PARs. The constraint estimators are obtained via the method of stratification by cross-classifying all dichotomous risk factors, taking into account the confounding effects. Data set in an ischemic heart disease study is included to illustrate the proposed method. In the case study of adolescent suicide in Western Pennsylvania, the constraint estimates of PARs unfold the fact that restricting access to guns in home is by far the most efficient public health intervention, while psychopathology plays a different but important role in preventing adolescent suicide.

Keywords: Population attributable risk, adjusted population attributable risk, stratification, case-control study, maximum likelihood estimator, child and adolescent suicide.

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