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Olli Miettinen: Estimability and Estimation in Case-Referent Studies.
American Journal of Epidemiology 1976; 103:226-235.

Miettinen's "Estimability and Estimation in Case-Referent Studies" was the first (and for many years the only) published attempt to present a complete and coherent quantitative theory of estimation in case-control studies. The paper covers a lot of ground, and the reader is warned that it is probably the most dense and difficult of Miettinen's works. But this paper also marks the first appearance in mainstream epidemiologic literature of a good number of central concepts of modern case-control theory.

Perhaps most importantly, Miettinen carefully distinguished cumulative incidence (incidence as a proportion of a cohort falling ill, or "risk") from incidence density (cases per unit of person-time), a distinction that was known to pre-20th century epidemiologists but had become submerged in more recent times [Vandenbroucke, 1985]. Miettinen also delineated the types of case-control sampling schemes and assumptions needed to estimate ratios of the different types of incidence. In particular, he explicated the notion of incidence-density sampling (longitudinal sampling of controls over the case-incidence period) and showed that under certain conditions the odds ratio from density-sampled studies would estimate the incidence-density ratio, without the need of the rare disease assumption. Earlier work of Thomas [1972] and Kupper et al., [1975] had shown that under certain conditions cumulative incidence ratios could be estimated from odds ratios without the rare disease assumption, and so with the appearance of Miettinen's paper the classical link between the case-control odds ratio and rare diseases could be discarded.

But Miettinen's paper covers much besides odds ratios—he dealt with estimation of absolute rates, etiologic (attributable) fractions, and rate differences as well. The paper also includes one of Miettinen's more controversial innovations, the test-based principle of interval estimation. This principle was shown to be fallacious by Halperin [1977]. Although test-based intervals worked well enough with crude and Mantel-Haenszel odds ratios to become incorporated into case-control methodology in the years following their introduction, they can work quite poorly with other measures [Greenland, 1984]. Fortunately, ensuing statistical developments have rendered test-based limits unnecessary (e.g., see Kelsey et al., [1986], Rothman [1986]).

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