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Theoretical Epidemiology

PRINCIPLES OF OCCURRENCE RESEARCH IN MEDICINE

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5	0.2	1	4	0.404	0.198	2.0	1	4	0.099	0.096
		1	3	0.649	0.222		1	3	0.217	0.178
		1	2	0.797	0.171		1	2	0.359	0.233
		1	1	0.892	0.107		1	1	0.531	0.242
		1	0	0.955	0.049		1	0	0.742	0.176
		0	5	-0.596	0.198		0	5	-0.901	0.096
		0	4	-0.351	0.222		0	4	-0.783	0.178
		0	3	-0.203	0.171		0	3	-0.641	0.233
		0	2	-0.108	0.107		0	2	-0.469	0.242
		0	1	-0.045	0.049		0	1	-0.258	0.176
	0.4	1	4	0.292	0.185	2.5	1	4	0.082	0.082
		1	3	0.514	0.242		1	3	0.186	0.160
		1	2	0.683	0.221		1	2	0.317	0.221
		1	1	0.814	0.160		1	1	0.486	0.242
		1	0	0.918	0.082		1	0	0.708	0.185
		0	5	-0.708	0.185		0	5	-0.918	0.082
		0	4	-0.486	0.242		0	4	-0.814	0.160
		0	3	-0.317	0.221		0	3	-0.683	0.221
		0	2	-0.106	0.160		0	2	-0.514	0.242
		0	1	-0.082	0.082		0	1	-0.292	0.185
	0.6	1	4	0.232	0.168	3.0	1	4	0.071	0.073
		1	3	0.432	0.240		1	3	0.162	0.146
		1	2	0.605	0.241		1	2	0.284	0.210
		1	1	0.755	0.191		1	1	0.449	0.239
		1	0	0.886	0.107		1	0	0.679	0.191
		0	5	-0.768	0.168		0	5	-0.929	0.073
		0	4	-0.568	0.240		0	4	-0.838	0.146
		0	3	-0.395	0.241		0	3	-0.716	0.210
		0	2	-0.245	0.191		0	2	-0.551	0.239
		0	1	-0.114	0.107		0	1	-0.321	0.191
	0.8	1	4	0.194	0.152	4.0	1	4	0.055	0.058
		1	3	0.376	0.232		1	3	0.130	0.124
		1	2	0.546	0.248		1	2	0.236	0.189
		1	1	0.707	0.210		1	1	0.393	0.231
		1	0	0.858	0.125		1	0	0.633	0.196
		0	5	-0.806	0.152		0	5	-0.945	0.058
		0	4	-0.624	0.232		0	4	-0.870	0.124
		0	3	-0.454	0.248		0	3	-0.764	0.189
		0	2	-0.293	0.210		0	2	-0.607	0.231
		0	1	-0.142	0.125		0	1	-0.367	0.196
	1.1	1	4	0.156	0.133	5.0	1	4	0.045	0.049
		1	3	0.316	0.217		1	3	0.108	0.107
		1	2	0.480	0.250		1	2	0.203	0.171
		1	1	0.649	0.227		1	1	0.351	0.222
		1	0	0.822	0.145		1	0	0.596	0.198
		0	5	-0.844	0.133		0	5	-0.955	0.049
		0	4	-0.684	0.217		0	4	-0.892	0.107
		0	3	-0.520	0.250		0	3	-0.797	0.171
		0	2	-0.351	0.227		0	2	-0.649	0.222
		0	1	-0.178	0.145		0	1	-0.404	0.198
	1.5	1	4	0.124	0.113					
		1	3	0.262	0.198					
		1	2	0.416	0.244					
		1	1	0.589	0.238					
		1	0	0.782	0.162					
		0	5	-0.876	0.113					
		0	4	-0.738	0.198					
		0	3	-0.584	0.244					
		0	2	-0.411	0.238					
		0	1	-0.218	0.162					

Glossary

ABSTRACT   Theoretical (q.v.).

ABSTRACT-GENERAL   Theoretical (q.v.)

ACCURACY   Degree of lack of error (cf. PRECISION and VALIDITY).

ACQUIRED   Postnatal in origin (as opposed to congenital).

ACUTE
1. Of short duration.
2. Of sudden onset.

ADDITIVE MODEL   A regression model without any term whose X is a product of two other X's in the model representing separate items of information.

ADJUSTED MEASURE OF RELATION   (e.g., adjusted rate difference) A measure based on conditional comparative information (cf. CRUDE and STANDARDIZED).

ADJUSTED RATE   The projection of a crude rate to another (possibly hypothetical) population structure; that is, a weighted average of specific (conditional) rates, with the weights proportional to the sizes of the corresponding experiences in another population (cf. CRUDE and STANDARDIZED).

ADMINISTRATIVE   Having to do with actual delivery of health care in a particularistic setting (as opposed to its scientific premises).

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ADMISSIBILITY (into the study base)   The property of satisfying the criteria of membership (potential or actual) in the population whose experience constitutes the study base.

ALTERNATIVE HYPOTHESIS
1. In science—a hypothesis entertained as a "competitor" for the hypothesis at issue.
2. In statistics—the range of parameter values corresponding to the hypothesis at issue (as opposed to the null value or "null hypothesis").

ANALYSIS OF DATA   The process of summarizing, under a statistical model, the evidence in the data with reference to the object of research.

ANALYTIC EPIDEMIOLOGY   Misnomer for epidemiologic hypothesis testing (whose logic is synthetic, not analytic). In terms of a classical misapprehension, "analytic epidemiology" is viewed as the alternative to descriptive epidemiology (q.v.).

ANTAGONISM   One factor's inhibition of the effect of another.

APPLIED HEALTH SCIENCE   Scientific research with direct implications for health care (i.e., assessment of relative merits of alternative algorithms of care) (cf. BASIC HEALTH SCIENCE).

ASSESSMENT   Classification according to a scale of quantity (cf. EVALUATION).

ASSOCIATION   Occurrence relation (q.v.).

AT RISK   Not known to have zero risk (cf. CANDIDATE).

ATTACK RATE   In communicable-disease epidemiology, the proportion of candidates who come down with the illness in a particular (usually short) period of time, as in "secondary attack rate" (the proportion of the "contacts" of cases that comes down with the disease, presumably as a consequence of contact with a case).

ATTRIBUTABLE RISK   Misnomer for rate difference (q.v.).

BACKGROUND LEVEL (of a parameter of occurrence)   Level determined by characteristics other than that under study.

BASE   See STUDY BASE.

BASE POPULATION   The population whose experience (in a defined segment of time) constitutes the study base (q.v.).

BASELINE   The starting point of the risk period under study, or of follow-up.

BASIC HEALTH SCIENCE   Science (q.v.) motivated by intent to provide new theoretical foundations for innovations in health care (cf. APPLIED HEALTH SCIENCE).

BAYESIAN STATISTICS   Statistics concerned with the use of data in the modification of the probabilities (credibilities) of various values of the parameter of interest (cf. FREQUENTIST STATISTICS.)

BIAS
1. MEAN BIAS   Mean error, that is, difference between the *mean* of empirical values (over a large number of hypothetical replications) and the theoretical value.
2. MEDIAN BIAS   Median error, that is, difference between the *median* of empirical values (over a large number of hypothetical replications) and the theoretical value.
3. Tendency for error on the mean or median.

BIASED BASE   A study base formed conditionally on what it shows, or with membership that is outcome-selective (conducive to biased result).

BIASED RESULT   A result (empirical value) from a biased study or procedure, that is, a result with *median* bias.

BIASED SAMPLING   Sampling in which the sampling probability depends in an unknown way on a determinant of the observation

BIASED STUDY   A study with invalidity of design (conducive to a biased result).

BINARY   Consisting of (or viewed as if consisting of) two categories.

BIOMETRY   The discipline of how to study statistical problems in biology and medicine.

BIOSTATISTICS   Biometry (q.v.).

BLINDED STUDY   Study characterized by arrangements designed to assure the observers' and/or the subjects' lack of awareness of whether the subject is a member of the index or the reference series.

BLOCKING   Restriction of randomization; that is, the use of separate randomizations within categories of a covariate, with the aim of assuring similarity of the distribution of the covariate between the index and reference series (in the study base).

CANDIDATE   An individual who, by virtue of not having the state (illness) at issue, could logically experience its inception (even if, in light of substantive facts, the risk is known to be zero).

CANDIDATE TIME   The amount of candidate experience (in terms of the integral of the size of the candidate population over the period of observation).

CASE

1. In medicine—episode of illness, as in "a case of gonorrhea."
2. In epidemiology—a person representing a case (in the medical sense) of some state or event, as in "the interviews of cases."

CASE-CONTROL STUDY   Case-referent (case-base) study (q.v.).

CASE-REFERENT STUDY   A study involving the sampling design of enrolling all of the cases in the study base (in the direct referent of the empirical result) and, separately, a sample (not census) of the study base itself (or of its noncase segment).

CAUSAL RELATION   Occurrence relation reflecting a causal connection between the determinant and the outcome phenomenon (as opposed to confounding by extraneous determinants of the outcome parameter).

CAUSE   A category of a determinant, in relation to a particular reference category, capable of completing a sufficient cause in some instances in which the reference category is incapable of such completion. When, in this sense, a category (relative to a particular reference category) can be both a cause (in some instances) and a preventive (in some others), it is commonplace to mean by "cause" that causal instances are more common than preventive ones.

CENSUS   100% sampling, or 100% sample.

CENTILE   A fractile expressed in terms of a scale from 0 to 100% for the fraction involved, as in "the median is the 50th centile, or the 0.5 fractile."

CHARACTERISTIC (of person)

1. A dimension in which persons (units of observation) may be characterized, such as any risk indicator.
2. A realization in a dimension in which persons are characterized, such as any risk indication (q.v.).

CHI SQUARE   The square of a standard Gaussian variate (χ^2 with 1 df) or a statistic whose distribution conforms to that of the sum of two or more independent χ^2 1 df variates (χ^2 with 2 or more df).

CHRONIC   Long-lasting or long-term.

CHRONIC-DISEASE EPIDEMIOLOGY   Misnomer for epidemiology of noninfectious diseases.

CLINICAL   Having to do with patient care in a direct way (originally bedside).

COACTION (of factors)   Joint action.

COEFFICIENT OF CORRELATION   See CORRELATION COEFFICIENT.

COEFFICIENT OF REGRESSION   See REGRESSION COEFFICIENT.

COEFFICIENT OF VARIATION   Standard deviation divided by mean.

COHORT   A closed population (from Latin, cohors, enclosure); that is, a population whose membership is defined on the basis of some event, for ever after; that is, a population with fixed membership (cf. DYNAMIC POPULATION).

COHORT INCIDENCE   Proportion-type incidence (cf. incidence density)

COHORT STUDY   A study (of incidence or change) whose base is the experience of a cohort over time (as opposed to a dynamic-population study or a cross-sectional study).

COMMUNICABLE   Subject to transmission from one person to another, that is, contagious.

COMORBIDITY   Presence of associated illness.

COMPARABILITY OF EFFECTS   Identity of extraneous effects of the compared empirical categories of the determinant, as in "the treatment under study and the 'placebo' treatment have comparable effects (in studying the drug effect) if the extraneous (nondrug) aspects of the two treatments have identical effects, and if, in addition, the 'placebo' has no effect."

COMPARABILITY OF INFORMATION

1. Absence of differential errors in the outcome information between the compared populations (in the study base).
2. In case-referent studies, also absence of differential errors in the determinant information between the case series and the base sample.

COMPARABILITY OF POPULATIONS   Balanced distributions between populations representing the compared categories of the determinant, specifically distributions with respect to extraneous determinants of the outcome parameter (i.e., the property that randomization and "blocking" are designed to achieve in experiments).

COMPARATIVE STUDY   A study involving separate representations of the compared categories of the determinant (as opposed to a before-after study).

CONDITIONAL STATISTIC (estimate or test statistic)   Statistic derived with a restriction as to either the realization for an ancillary statistic (e.g., total number of cases), parameter space (e.g., all stratum-specific values of comparative parameter equal to a given theoretical value), or covariate.

CONFIDENCE INTERVAL   See ESTIMATE.

CONFOUNDER   An extraneous determinant of the outcome parameter in terms of which there is lack of comparability (q.v.) of effects and/or

DESIGN MATRIX   Distribution matrix (q.v.).

DETERMINANT (of occurrence)   A characteristic of individuals (constitutional, behavioral, or environmental) on which a parameter (q.v.) of occurrence depends (causally or noncausally).

DIAGNOSIS
1. The inferred (rather than necessarily the actual) state of, or event in, a person (or an object).
2. The process of arriving at an inference as to the state of, or event in, a person (or an object).

DICHOTOMOUS   Divided in two categories (cf. POLYTOMOUS and TRICHOTOMOUS).

DIFFERENTIAL (selection, errors, etc.)   Operating differently between/among the compared categories or series.

DIRECTLY STANDARDIZED   Misnomer for standardized (q.v.). (Cf. INDIRECTLY STANDARDIZED)

DISCIPLINE   Field learning and practice.

DISEASE   A process of illness, as in "neoplastic disease " (in Latin, *morbus*; cf. DEFECT and ILLNESS)

DISTRIBUTION MATRIX   The distribution of the base experience according to the determinant(s), modifiers, and confounders in the occurrence relation.

DOMAIN OF STUDY   The type of situation in which the object of the study (occurrence relation) will be (was) explored, as in "the effects of Indomethacin in the domain of the premature neonate with patent ductus arteriosus."

DOSE-RESPONSE
1. Dependence between the level of a determinant (causal or preventive) and the magnitude of effect, as in "there was evidence of dose-response."
2. The relation between the level of a determinant and the magnitude of the effect, as in "linear dose-response."

DOUBLE BLINDED   Blinded with respect to both the observer(s) and the subjects.

DYNAMIC POPULATION   An open population; that is, a population whose membership is defined on the basis of some state, for the duration of that state; that is, a population with turnover of membership (cf. COHORT).

DYNAMIC-POPULATION STUDY   A study (of incidence) whose base is the experience of a dynamic population (of candidates) over time [as opposed to a cohort study (q.v.) or a cross-sectional study (q.v.)].

EFFECT
1. In science—the change in the outcome parameter brought about by a particular cause or preventive.
2. In statistics—the value of a parameter of relation, as in "the main effect of X_i."

EFFECTIVENESS   Efficacy (q.v.)

EFFICACY (of intervention)   Ability to bring about the intended change in the outcome or outcome parameter.

EFFICIENCY (of study)
1. Informativeness with a given cost (cost-efficiency).
2. Informativeness with a given size (size-efficiency).

EMPIRICAL
1. Operational (as opposed to conceptual), as in "empirical scale."
2. Based directly on experience, as in "empirical rate."

END POINT   An event that terminates follow-up, especially the event whose occurrence is under study.

ENDEMIC OCCURRENCE   The usual rate of occurrence (cf. EPIDEMIC).

ENTRY COHORT   A cohort defined as of the beginning of the risk period under study (i.e., at "baseline").

ENVIRONMENTAL   Having to do with the settings in which individuals (units of observation) exist [as opposed to constitutional (q.v.) or behavioral].

EPIDEMIC   An episode, or relating to an episode, of unusually common occurrence.

EPIDEMIOLOGY
1. That aspect of a medical science or discipline which deals with the (frequency of the) occurrence of phenomena of interest in that field, as in "the epidemiology of oncology" (neoplastic or cancer epidemiology), or "health care epidemiology."
2. The (frequency of) occurrence aspect of a phenomenon, as in "the epidemiology of sudden death."
3. Research into the occurrence (epidemiologic) aspect of a phenomenon, as in "practice of epidemiology."

EPISTEMOLOGIC   Having to do with theoretical (rather than procedural) aspects of how to learn about the objects of research, that is, with theory of methodology (cf. ONTOLOGIC).

ESTIMATE

1. INTERVAL ESTIMATE (confidence interval) An interval (for a parameter) constructed (from a particular set of data) in a way designed to assure that in a specified proportion of such applications (out of a large number of them) it covers the actual value of the parameter.

2. POINT ESTIMATE A 0% two-sided confidence interval; that is, a 50% one-sided confidence bound; that is, a value (for a parameter) computed (from a particular set of data) in a way designed to assure that in 50% of such applications (out of a large number of them) it exceeds, and in the other 50% it falls short of, the actual value of the parameter (cf. BIAS).

ESTIMATOR A function of data, designed to provide estimates; that is, a way (conceptual) of computing an estimate (q.v.) from data.

ETIOLOGIC FRACTION Of the actual total rate of occurrence (total load of cases), the proportion that is attributable to the cause at issue. It equals the proportion of actual cases that is attributable to the cause if there are no instances of preventive susceptibility (cf. PREVENTIVE FRACTION.)

ETIOLOGY Causal origin, or causal explanation.

EVALUATION Classification according to a scale of quality or preference (cf. OUTCOME EVALUATION, PRACTICE EVALUATION, PREMISE EVALUATION, and PROCESS EVALUATION). Also used (as a misnomer) for mere assessment (q.v.).

EVENT

1. An episode.

2. The transition (rapid) from one state to another.

EXACT MODEL/DISTRIBUTION A model/distribution that represents exactly the sampling distribution of data on the premise that the study experience represents a probability sample of the abstract reality ("super-population") under study.

EXPECTATION See EXPECTED VALUE

EXPECTED VALUE Mean of sampling distribution (q.v.), often, implicitly, on the "null hypotheses" (q.v.).

EXPERIMENT A study in which a determinant is intentionally perturbed for reasons none other than the goals of the study itself.

EXPLANATORY STUDY (of exposure or intervention) Study that addresses the effect of a particular agent in the exposure or intervention (cf. PRAGMATIC STUDY).

EXPOSURE

1. A particular (index) category of a (potential) environmental (as opposed to constitutional or behavioral) determinant, entertained as a cause or preventive for the phenomenon of interest, relative to a particular other (reference) category.

2. Experiencing the index (exposure) category of an environmental determinant (potential) of the outcome.

3. Environmental determinant.

4. Misnomer for any determinant (i.e., constitutional or behavioral as well as environmental), or its index category.

EXPOSURE ODDS In a case-referent study, the theoretical proportion of cases or members of the reference series representing the index category of an environmental determinant divided by the proportion representing the reference category.

EXPOSURE-ODDS RATIO In a case-referent study, the exposure odds of cases divided by that of reference subjects.

EXTERNAL VALIDITY Generalizability beyond the experience of the study (cf. INTERNAL VALIDITY).

EXTRANEOUS CHARACTERISTIC/FACTOR A characteristic/factor that is not part of the object of research (occurrence relation) per se, but that may have to be considered in the interest of validity or efficiency (as a conditioning factor); that is, a characteristic/factor that a covariate (q.v.) represents.

FACTOR

1. A cause or a preventive (e.g., a category of blood pressure relative to another).

2. A causal or preventive determinant (e.g., blood pressure).

3. Misnomer for determinant (q.v.) or a category of it.

FALSE NEGATIVE RATE The complement of sensitivity; that is, one minus sensitivity (q.v.).

FALSE POSITIVE RATE The complement of specificity; that is, one minus specificity (q.v.).

FRACTILE The value of a characteristic that corresponds to a given cumulative fraction (proportion) of its realizations, as in "the median is the 0.5 fractile of a distribution."

FREQUENTIST STATISTICS Statistics concerned with the frequency behavior (sampling distribution) of quantities (statistics) derived from data, without addressing the probabilities (credibilities) of various values of the parameter of interest (cf. BAYESIAN STATISTICS).

FUNCTION   Relation between a dependent quantity and its determinant(s).

GENERAL EPIDEMIOLOGY   Theoretical epidemiology (q.v.).

GENERAL POPULATION   A broadly defined (and thus ill-defined) population (and a concept of inherently no value in science).

GENERALIZATION
1. In science—inference (inductive) from the empirical (particularistic) to the theoretical (abstract-general).
2. In statistics—inference (usually "frequentist"-mechanistic) from a sample to a population (particularistic).

GENETIC   Having to do with the genome (chromosomes).

HEALTH   The state of being, or the extent to which one is, as functional and symptom-free as is commonly attainable at the age at issue, and freedom from unusual (for age) constitutional indications of future disability, symptoms or death; in other words, freedom from illness (q.v.) or the extent to which one is free from illness.

HEALTH CARE   Any activity or arrangement aimed at the maintenance or improvement of health (whether education, regulation, or service; whether preventive or therapeutic) or adaptation to illness (rehabilitative).

HEALTH-CARE RESEARCH   Research into the realities (as opposed to premises) of health care (cf. HEALTH SCIENCE).

HEALTH SCIENCE   Science (q.v.), either basic (q.v.) or applied (q.v.), relevant to health care (its premises).

HEALTHY WORKER EFFECT   Tendency of occupationally defined populations to show lower mortality than "the general population," conditionally on controllable covariates (usually age, gender, race, and calendar time).

HOMOSCEDASTICITY   Constancy of the variance (theoretical) of the outcome measure over the determinants at issue.

HYPOTHESIS   A tentative piece of scientific (theoretical) knowledge; that is, a scientific idea (cf. ALTERNATIVE HYPOTHESIS and NULL HYPOTHESIS).

ILLNESS   Ill-health; that is, disease (q.v.) or defect (q.v.).

IMPRECISION   Lack of total precision (q.v.).

INCIDENCE   The appearance of events (q.v.) of a particular kind in a population (of candidates over time) (cf. PREVALENCE).

INCIDENCE DENSITY   The ratio of the number of events to the corresponding population time (candidate time).

INCIDENCE PROPORTION   See COHORT INCIDENCE and CUMULATIVE INCIDENCE.

INCIDENT CASES   Cases that appear (as against those that exist or prevail).

INCONCLUSIVE STUDY   A study whose result is reasonably consistent with both the hypothesis at issue and its denial (cf. NEGATIVE STUDY and POSITIVE STUDY).

INDEPENDENCE   Lack of association (relation) or of synergism and antagonism.

INDEPENDENT VARIATE   A variate (statistical) representing a determinant of the dependent parameter in a regression model.

INDEX   A measure that provides for ranking.

INDEX CATEGORY (of a determinant)   A category that is of express interest, for example, a particular new treatment under study (as opposed to the reference category of the "standard" treatment or, alternatively, no treatment).

INDEX EXPERIENCE/GROUP/POPULATION/SERIES
1. The experience/group/population/series representing an index category (in the study base).
2. The experience/group/population/series around which a study base is built (as is commonplace in case-referent studies, for example).

INDICATION
1. Realization of an indicator, indicative of the state or event at issue, as in "symptomatic improvement as an indication of therapeutic efficacy," or "test positivity as an indication of disease."
2. Situation that prompts a particular type of action, as in "the small size of the index series as an indication for matching."

INDICATOR   A characteristic (variate) whose realization, or a test whose outcome, conveys information about the presence or future occurrence of the phenomenon at issue.

INDICATOR VARIATE   Statistical variate representing a binary characteristic, usually with values 1 and 0 corresponding to the two categories, respectively.

INDIRECTLY STANDARDIZED   Misnomer for standardized according to the distribution of the index experience. (This means standardization between any given index rate and the reference rate, but not among two or more index rates.)

INDUCTION PERIOD   The time lag from the beginning of the causal process to the manifestation of the effect.

INFECTIOUS   Due to a microorganism.

INFERENCE (in statistical science)   The movement, presumptive, from the results of data analysis toward new knowledge (q.v.) about the object of study; that is, interpretation of statistics.

INFORMATION
1. In statistics—with reference to a particular parameter, the inverse of the sum of variance and the square of mean bias of its point estimator; that is, the inverse of the average of squared deviations of point estimates from the parameter value itself.
2. In statistical science—data and statistics serving as evidence for the advancement of knowledge about the object of study.

INFORMATIVENESS (of study)   The degree of evidence from a study (as determined by validity, efficiency, and size).

INTERACTION   Mutual influence between two factors (the factors' influence on each other). Also used, as a misnomer, for interdependence (q.v.) of coaction and the modification (q.v.) of relation (need for product term in regression analysis).

INTERCEPT   The value (actual or hypothetical) of the dependent parameter in a regression function that corresponds to all the independent variates in the function equaling zero.

INTERDEPENDENCE (of coaction)   Dependence of the effects of two factors on each other; that is, synergism (q.v.) or antagonism (q.v.).

INTERNAL VALIDITY   Validity with reference to the study base itself (the direct referent of the study result; cf. EXTERNAL VALIDITY).

INTERVAL ESTIMATE   See ESTIMATE.

INTERVENTION   Willful perturbation of a determinant, aimed at influencing the outcome.

KNOWLEDGE (scientific)   Strong expert belief, especially a consensus belief, about a scientific proposition.

LATENCY PERIOD   The span of time for which a state remains inapparent.

LEVEL OF TEST   An a priori "critical" level (α) for a P-value, such that $P < \alpha$ is deemed "significant" (at level α), and $P > \alpha$ is considered "nonsignificant," in the sense of calling for "acceptance" and "rejection" of the hypothesis, respectively.

LINK   Lay locution for causal connection.

LINKED   Lay locution for causally connected.

LOGIT   Logarithm (natural) of odds (q.v.).

LONGITUDINAL RELATION (between outcome parameter and its determinant)   A relation in which the time referent of the information on the determinant is antecedent to that on the outcome parameter by an amount consonant with the nature of the theoretical relation under study (e.g., length of the induction period) (cf. CROSS-SECTIONAL).

LONGITUDINAL STUDY   A study whose base is a population's experience over time (as opposed to a population cross-section).

MAIN EFFECT   Regression coefficient of a nonproduct term.

MALFORMATION   An anatomic defect of developmental origin.

MATCHING
1. Selection of the base sample in such a way that its distribution according to a covariate becomes more similar to that of the case series than would tend to be the case if it were selected independently of the case series.
2. Selection of the comparison group for the study base in such a way that its distribution according to a covariate becomes more similar to that of the other group than would tend to be the case if it were selected independently.

MATCHING RATIO   The ratio of the size of a matched base sample (case-referent matching) or matched comparison group (base matching) to that of the index series/group.

MEDIAN BIAS   See BIAS

MEDIAN UNBIASED ESTIMATOR   Estimator whose sampling distribution has the actual parameter value as its median (cf. BIAS).

MEDICAL
1. Having to do with medicine, that is, with the prevention, diagnosis, or treatment of, or rehabilitation for, illness.
2. Having to do with medicinal (as opposed to surgical) therapy.

MEDICINE
1. The health field, as in "preventive medicine."
2. The field of diagnosis and medicinal treatment of internal, somatic illness.

METAMETER (of a measure)   A transform of a measure.

METHOD   A planned means of achieving a preset end (as opposed to serendipity) (cf. PRINCIPLE).

METHODOLOGY   The body of methods in a discipline (cf. EPISTEMOLOGIC).

MODEL   A formal, simplified representation of, or the terms in which to consider, the object of study.

MODIFICATION   Inconstancy of a parameter of occurrence relation over another subject characteristic.

MODIFIER (of a relation)   A characteristic (of individuals) on which a parameter of occurrence relation depends.

MOR   See MORTALITY ODDS RATIO.

MORBIDITY   The occurrence of illness.

MORTALITY   The occurrence of death.

MORTALITY ODDS   Occurrence odds (q.v.) for a given cause of death relative to another (or a series of others).

MORTALITY ODDS RATIO   Ratio of mortality odds between two categories of a determinant.

NEGATIVE CONFOUNDING   Confounding that reduces, or even reverts, the empirical relation (relative to the theoretical one).

NEGATIVE STUDY   A study that detracts from the hypothesis at issue (cf. INCONCLUSIVE STUDY and POSITIVE STUDY).

NOMINAL P-VALUE   A P-value that is not subject to the usual interpretation.

NOMINAL SCALE   A scale without any quantitative implications (not even those of ranking) (cf. ORDINAL SCALE and QUANTITATIVE SCALE).

NONEXPERIMENTAL STUDY   A study that is not experimental (q.v.).

NOSOCOMIAL   Having to do with hospitals.

NUISANCE PARAMETER   An extraneous parameter that needs to be estimated (in assessing a parameter of express interest).

NULL DISTRIBUTION   The distribution that corresponds to the null hypothesis (q.v.).

NULL EXPECTATION   The mean of null distribution (q.v.).

NULL HYPOTHESIS   The denial, parsimonious, of a hypothesis (e.g., the proposition of no relation between an outcome parameter and its potential determinant, given a hypothesis of such a relation).

NULL VALUE   Parameter value corresponding to null hypothesis

NULL X^2 Statistic designed to have chi square (q.v.) distribution on the null hypothesis (q.v.).

OBJECT OF STUDY   That which is under study (in epidemiology, an occurrence relation).

OBJECTIVE OF STUDY   That which is to be achieved by a study (i.e., advancement of knowledge about the object of study).

OBJECTIVITY   The quality of being subject to agreement by independent qualified examiners.

OBLIQUE COHORT   A cohort whose zero time is distributed across the risk period under study (cf. ENTRY COHORT).

OBSERVATIONAL STUDY   Misnomer for nonexperimental study (q.v.). All empirical studies, experimental as well as nonexperimental, are observational (i.e., based on observation).

OCCURRENCE
1. A particular instance of a phenomenon, as in "this occurrence of complication."
2. The frequency (statistical) aspect of a phenomenon, as in "the occurrence of complications."

OCCURRENCE FUNCTION   Occurrence relation (q.v.).

OCCURRENCE ODDS
1. For a single theoretical rate of the form of a proportion (and for risk), the ratio of that rate (risk) to its complement (i.e., to one minus that rate or risk).
2. For two theoretical rates, having to do with alternative types of state or event in the same base, the ratio of the rate for one type to that for the other.

OCCURRENCE RELATION   The relation of a parameter of occurrence (e.g., incidence rate) to one or more characteristics of persons (or other units of observation).

ODDS   Ratio of probability (P) to its complement $(1-P)$ [i.e., $P/(1-P)$]. (See EXPOSURE ODDS and OCCURRENCE ODDS).

ODDS RATIO   The ratio of two odds (q.v.).

O/E RATIO   Observed-to-expected ratio (as to number of cases; for expected number, see NULL NUMBER).

ONTOLOGIC   Having to do with theoretical aspects of how to view nature and formulate the objects of research (cf. EPISTEMOLOGIC).

OR   Odds ratio (q.v.).

ORDINAL (QUASI-QUANTITATIVE) SCALE   A scale with implications for ranking, but not for absolute quantification of differences or ratios (cf. NOMINAL SCALE and QUANTITATIVE SCALE).

OUTCOME   The end stage of a process, as in "the health outcome following treatment" (distinct from the effect of treatment).

OUTCOME EVALUATION (of health care)   Premise evaluation (q.v.), or indirect process evaluation (q.v.).

OVERMATCHING   Matching that reduces the amount of information per subject; that is, matching of base sample to case series on a covariate that will not be controlled as a confounder nor explored as a potential modifier but is a correlate of the determinant in the study base.

P-VALUE   A statistic so derived that its sampling distribution is on the "null hypothesis" uniform in the zero-to-one range, with a shift to the left in this range on the hypothesis itself.

PARAMETER
1. In medicine—a characteristic of interest in individual patients, as in "diagnostic parameter."
2. In mathematics—a constant (as opposed to a variable).
3. In mathematical statistics—a constant in a statistical (distribution) model.
4. In epidemiology—a population measure of occurrence, or occurrence relation, empirical or theoretical.

PARSIMONIOUS   Conforming to the principle of parsimony.

PARSIMONY (principle of)
1. Regarding concepts—one is to restrict the invocation of concepts to the minimum sufficient.
2. Regarding ideas—one is not to accept hypotheses (alternatives to the parsimonious null outlook) except in the face of reasonably compelling evidence.

PARTICULARISTIC   Specific to a particular time and/or place (as opposed to abstract-general).

PARTICULARISTIC STUDY   A study whose ultimate object is particularistic (administrative, rather than scientific).

PERCENTILE   Centile (q.v.).

PHENOMENON   A state or event.

PMR   See PROPORTIONATE MORTALITY RATIO.

POINT ESTIMATE   See ESTIMATE.

POLYCHOTOMOUS   Misnomer for polytomous.

POLYTOMOUS   Divided in several categories (cf. DICHOTOMOUS and TRICHOTOMOUS).

POPULATION   See COHORT, DYNAMIC POPULATION, and CROSS-SECTIONAL POPULATION.

POPULATION ATTRIBUTABLE RISK   Etiologic fraction (q.v.).

POPULATION-BASED STUDY   Misnomer for study with primary base (q.v.).

POPULATION CROSS-SECTION   See CROSS-SECTIONAL POPULATION.

POPULATION TIME   The amount of population experience in terms of the integral of population size over the period of observation (cf. CANDIDATE TIME).

POSITIVE CONFOUNDING   Confounding that exaggerates the empirical relation (cf. NEGATIVE CONFOUNDING).

POSITIVE STUDY   A study that supports the hypothesis at issue (cf. INCONCLUSIVE STUDY and NEGATIVE STUDY).

POSTERIOR PROBABILITY   Credibility in light of the evidence from the study (cf. PRIOR PROBABILITY).

POTENTIAL CONFOUNDER   An extraneous characteristic that, in a priori terms, cannot be deemed not to be a confounder (q.v.).

POWER OF TEST (statistical)   Probability that the P-value will be less than the chosen level of the test conditionally on a particular (nonnull) value of the parameter at issue.

PRACTICE (of health care)   Activity undertaken on the presumption that it preserves or promotes health (rather than for learning whether it does) (cf. PRACTICE EVALUATION and PROCESS EVALUATION).

PRACTICE EVALUATION   Research (administrative) aimed at description (classification) of practice in terms of a scale of quality (cf. PROCESS EVALUATION).

PRAGMATIC STUDY (of exposure or intervention)   Study that addresses the effect of the exposure/intervention in terms of its operational definition, without regard to the particular agent(s) involved (cf. EXPLANATORY STUDY).

PRECISION   Reproducibility; that is, degree of lack of random error (as opposed to bias) in quantification; that is, degree of constancy of error in quantification.

PRECURRENCE PERIOD   The waiting time until the occurrence of the event at issue.

PREMISE EVALUATION   Research (scientific) into the tenability of a premise (scientific) of health care.

PREVALENCE   The existence (as opposed to the inception or termination) of a particular state among the members of a population.

PREVALENCE RATE   The proportion of a population that is in a particular state.

PREVALENT CASES   Cases that exist (as of given point in time).

PREVENTIVE

1. A category of a determinant, in relation to a particular reference category, incapable of completing a sufficient cause in some instances in which the reference category is capable of it (particularly if these instances are more common than those of causation); that is, the reference category of a cause.
2. A category of a determinant, in relation to a particular reference category, capable of blocking (''neutralizing,'' or ''frustrating'') a sufficient cause in some instances in which the reference category is incapable of it (particularly if these instances are more common than the converse ones).

PREVENTIVE FRACTION   Of the hypothetical total rate of occurrence (total load of cases) that would obtain were the preventive to be totally absent, the proportional reduction that is attributable to the preventive (cf. ETIOLOGIC FRACTION).

PRIMARY BASE   A base defined directly (rather than indirectly through a series of cases) (cf. SECONDARY BASE).

PRIMARY DIAGNOSIS   Diagnosis related to the reasons for, or causes of, the patient's coming to attention.

PRIMARY INFORMATION   Information in the sense of elementary data (as opposed to derived data or information).

PRIMARY OBJECTIVES (of a study)   Objectives that justify the study (as opposed to those that the study justifies, i.e., secondary objectives).

PRINCIPLE (of research)   A guideline for decision-making in research (ontologic as well as epistemologic or methodologic).

PRIOR PROBABILITY   Credibility in the absence of the evidence from the study (cf. POSTERIOR PROBABILITY).

PROBABILITY

1. Relative frequency, as in ''the probability that a 95% confidence interval will cover the value of the parameter is 95%.''
2. Credibility, as in ''the prior probability of the hypothesis.''

PROBABILITY SAMPLE   A sample resulting from probability sampling (q.v.).

PROBABILITY SAMPLING   Sampling in such a way that each member of the sampled population has a known and independent probability (chance) of selection into the sample.

PROCESS EVALUATION (of health care)   Practice evaluation (q.v.). [Note: quality scales have to do with process, not outcome, so that outcome evaluation (q.v.) addresses premises of practice rather than practice (health care) itself, except indirectly.]

PROGNOSIS   Expected future course in the sense of expected utility (disutility). (It is determined by the utilities of the various possible outcomes together with their respective probabilities.)

PROGRAM   A regimented undertaking of indefinite duration (cf. PROJECT).

PROJECT   A regimented undertaking of a priori limited duration (cf. PROGRAM).

PROPORTIONAL RATE   Proportionate rate (q.v.).

PROPORTIONATE MORTALITY RATIO   Ratio of proportionate rate for mortality between two categories of a determinant.

PROPORTIONATE RATE   The proportion that (the rate for) a given type of state or event represents out of (the rate for) two or more types of state or event.

PROSPECTIVE BASE   A study base whose experience is concurrent with the execution of the study.

PROSPECTIVE EXPERIENCE (of a cohort)   The experience subsequent to the time as of which the cohort is defined (zero time).

PROSPECTIVE STUDY   A study with a prospective base.

PROTOCOL OF STUDY   A written documentation of a study plan.

PUBLIC HEALTH

1. The health of a community of people.
2. Care for the health of a community of people.
3. Social medicine; that is, public (social) aspects of health and health care (personnel, organization, finance, program policy, etc.).

QUALITATIVE SCALE   A nominal scale.

QUALITATIVE STUDY   A study whose objective is modification of the credibility of a hypothesis.

QUANTITATIVE SCALE   A scale that provides not only for ranking but also for quantification of differences (interval scale) and/or ratios (ratio scale).

QUANTITATIVE STUDY   A study whose object is the magnitude of a parameter (e.g., of relation) in a general way (rather than in the limited sense of a qualitative study).

QUANTITATIVE METHODS   Statistical methods (a recent euphemism).

QUASI-EXPERIMENTAL   Nonexperimental.

QUASI-QUANTITATIVE (scale)   Ordinal, with scores assigned to categories.

RANDOM ERROR   The difference between error and its average (in quantification).

RANDOM SAMPLE   A probability sample (q.v.).

RATE (of occurrence)   Frequency in population experience (empirical or theoretical).

RATE DIFFERENCE   Difference of rate between two categories of a determinant, especially the rate in an index category expressed as its difference from that in a reference category.

RATE RATIO   Ratio of rate between two categories of a determinant, especially the rate in an index category expressed as its ratio to that in a reference category. (cf. RELATIVE RATE.)

RD   Rate difference (q.v.).

REALIZATION   Value or category occurring in a particular instance.

REFERENCE CATEGORY   The category (of a determinant) that is viewed as the alternative to a category of direct interest; that is, the category that provides comparative, or reference, information for the experience in the index category (often about the null value of the outcome parameter), as in "the rate ratio for the heavily exposed, with 'never exposed' as the reference category."

REFERENCE GROUP/POPULATION   The group/population representing the reference category (in the study base).

REFERENCE SAMPLE   A series of individuals (units of observation) enrolled to supply reference information for a case series; that is, a sample of the study base (in a case-referent study).

REFERENT   That to which something refers, as in "the referent of the empirical occurrence relation, in direct, technical terms, is the study base."

REGRESSION   The relation of a parameter to its determinant(s).

REGRESSION COEFFICIENT (in linear regression)   The ratio of the "effect" of a unit increase in a determinant (on the dependent parameter) to that unit increase.

REGRESSION TOWARD THE MEAN   A tendency of a repeat observation, after an appreciable period of time, to be closer to the mean than the original one.

RELATION   See OCCURRENCE RELATION.

RELATIVE RATE   The magnitude of a rate (an index rate) expressed in terms of its ratio to a reference rate.

RELATIVE RISK   The magnitude of a risk (an index risk) expressed in terms of its ratio to a reference risk; also a misnomer for relative rate (q.v.).

RELIABILITY   Misnomer for reproducibility.

REPRESENTATIVE OF THE STUDY BASE   A member of the base sample.

REPRESENTATIVE SAMPLE
1.   Unbiased sample.
2.   Sample whose distribution conforms to that of the sampled population.

REPRODUCIBILITY   Precision (q.v.).

RESEARCH   Activity aimed at the advancement of knowledge (scientific or nonscientific).

RESISTANT   Not susceptible (q.v.).

RESPONSIVENESS   Susceptibility.

RESTRICTED   See CONDITIONAL.

RESULT OF STUDY
1.   A product of data analysis; that is, a statistic, as in "the result section of a paper."
2.   A consequence of a study (change in view).

RETROSPECTIVE BASE   A study base whose exprerience is antecedent to the implementation of the study.

RETROSPECTIVE EXPERIENCE (of a cohort)   The experience preceding the time as of which the cohort is defined (zero time).

RETROSPECTIVE STUDY   A study with a retrospective base. (Some use the term, as a misnomer, for a case-referent study).

RISK   The probability that an event (untoward) will occur.

RISK FACTOR   Causal risk indicator; also used (as a misnomer) as a synonym for risk indicator (q.v.).

RISK FUNCTION   A formal (mathematical) expression of risk in relation to its determinants (indicators of risk).

RISK INDICATION   Realization of risk indicator (q.v.).

RISK INDICATOR   A characteristic on which risk depends; that is, a determinant of risk; that is, a determinant of expected (theoretical) incidence for people of the type at issue.

RISK RATIO   Ratio of risk between two categories of a determinant, especially in the sense of relative risk (q.v.).

RR   Rate ratio (q.v.) or risk ratio (q.v.).

SAMPLING DISTRIBUTION (of a statistic)   Distribution in hypothetical replications of the study, infinite in number.

SAMPLING FRAME   A list of the members of a population, used as a basis for sampling.

SCALE   A set of mutually exclusive and all-inclusive categories.

SCIENCE (natural)
   1.   Scientific knowledge—a systematized body of theoretical knowledge (about a particular category of natural phenomena), as in "the insights of the science of neoplasia (oncology)."
   2.   Scientific research—activity aimed at the advancement of *theoretical* knowledge (about nature), and conforming to the rules of logic, as in "good science."

SCREENING   Routine (particularly mass) examination of individuals for indications of illness or of high risk for illness.

SECONDARY BASE   A base defined, indirectly, as the population experience, the entirety of it, from which each potential case, had it occurred, would have been enrolled in the case series of the study.

SECONDARY DIAGNOSIS   Diagnosis unrelated to the reasons for the patient's coming to attention.

SECONDARY OBJECTIVES   Objectives that the study justifies (as opposed to those that justify the study, i.e., primary objectives).

SENSITIVITY OF INDICATION
   1.   The proportion (theoretical) of instances in which the indication is manifest when the state at issue is present, or when the event at issue has taken place (cf. SPECIFICITY and FALSE NEGATIVE RATE).
   2.   The proportion (theoretical) of instances in which an indication comes about (the indicator turns positive) as a reflection of the event at issue.

SENSITIVITY OF STUDY   See POWER OF TEST.

SIGNIFICANCE LEVEL   See LEVEL OF TEST.

SIGNIFICANT (statistically)   See LEVEL OF TEST.

SIMPLE RANDOM SAMPLING   Probability sampling with identical selection probabilities (cf. STRATIFIED SAMPLING).

SINGLE BLINDED   Blinded with respect to the observers or the subjects but not both.

SIZE EFFICIENCY   See EFFICIENCY.

SOCIAL MEDICINE   See PUBLIC HEALTH.

SMR   See STANDARDIZED MORTALITY RATIO.

SOURCE POPULATION   A population from which the base population is selected (by the use of exclusions).

SPATIOTEMPORAL   Having to do with place and time.

SPECIFICITY (of indication)
   1.   The proportion (theoretical) of instances in which the indication is absent when the state at issue is absent, or the event at issue has not taken place (cf. SENSITIVITY and FALSE POSITIVE RATE).
   2.   The degree to which the indication, when present, is indicative of the state or event at issue.

SPURIOUS
   1.   Apparent (as against real).
   2.   Misnomer for confounded (as against causal/preventive).

STANDARD DEVIATION   Square root of variance (q.v.).

STANDARD ERROR   Estimate (point) of the standard deviation of the sampling distribution (of a point estimator of a parameter).

STANDARDIZED RATE   A rate adjusted to a structure (distribution, set of weights) viewed as a standard (common structure) for the purpose of comparison(s).

STANDARDIZED RATE DIFFERENCE/RATIO   Difference/ratio of two mutually standardized rates. (This defines an *internally* standardized rate difference/ratio; two or more *mutually* standardized measures of association involve a common internal standard.)

STANDARDIZED MORTALITY RATIO   Empirical rate ratio for mortality involving incidence density of death and standardization according to the distribution of the index experience; that is, O/E ratio of deaths, with E estimated with allowance for some covariates (usually age, gender, and calendar time).

STATIONARY POPULATION   A dynamic population whose profile is invariant over time.

STATISTIC   A measure summarizing (some aspect of) the evidence in the data.

STATISTICAL SCIENCE   Scientific research concerned with frequency of occurrence of a phenomenon (as is epidemiologic research within various medical sciences); it is not a science unto itself.

STATISTICS
1. The discipline that deals with collecting, summarizing, and interpreting data (demographic statistics).
2. The branch of mathematics that deals with random variates (mathematical statistics).

STRATIFIED ANALYSIS   Analysis in which elementary comparative information (about the studied relation) is abstracted within subdomains (strata) of some covariates, with such information then accumulated over the strata (in the form of summary statistics).

STRATIFIED SAMPLING   Sampling designed to have unequal sampling fractions among subdomains (strata) of the sampled population.

STUDY (in science)   A project designed to yield evidence for the advancement of knowledge (q.v.).

STUDY BASE   The population experience (particularistic) captured in a study (as a basis for inference about nature in the abstract); that is, the direct referent of the empirical result of a study; specifically, in occurrence research, the study base is the population experience manifesting the occurrence under study, but the relevant realizations of its determinants may be previous to the time segment that the base represents.

STUDY DESIGN
1. A plan as to the type of evidence a study is to yield, and as to the approach to obtaining and summarizing such information.
2. The process of developing a study plan.

STUDY POPULATION   The population whose experience constitutes the study base.

STUDY SUBJECT   A member of the study population, especially one on whom information is obtained and incorporated in the analysis.

SUBJECT-MATTER   The phenomenon under study and related phenomena (as opposed to the principles or methods of studying it).

SUBJECTIVE   Not objective (q.v.); involving view(s).

SUBSTANTIVE   Having to do with subject-matter (rather than principles or methods of studying it).

SUPERPOPULATION   An abstract population of infinite size, viewed as the source of the studied (base) population, and also as the target population of inference.

SURVEY   A particularistic and descriptive study.

SUSCEPTIBLE (person or unit of observation)
1. Causally susceptible—the event at issue would/does develop conditionally on the index but not the reference category of the determinant at issue.
2. Preventively susceptible—the event at issue would/does develop conditionally on the reference but not the index category of the determinant at issue.
3. Responsive to the index, but not the reference, category of the determinant.

SYNERGISM   Cooperative action between two factors; the effect of one is enhanced by the other (and conversely).

TARGET POPULATION   The population of interest in a particularistic study.

TEST (statistical)
1. Frequentist—computation of P-value.
2. Bayesian—computation of likelihood ratio, or likelihood ratio function, and then the posterior probability corresponding to a particular prior probability (or its distribution).

THEORETICAL
1. Having to do with principles (general) rather than subject-matter knowledge, as in "theoretical epidemiology."
2. Without specificity as to time or place; that is, abstract or abstract-general, as in "the theoretical proposition that smoking causes lung cancer," and "theoretical rate."

THEORETICAL EPIDEMIOLOGY   The discipline, or principles, of studying epidemiologic problems, that is, (frequency of) occurrence of phenomena of health care interest in population experiences. See EPIDEMIOLOGY.

THERAPEUTIC   Having to do with treatment of cases of illness (as opposed to prevention or rehabilitation).

TRACKING   Incomplete regression toward the mean; that is, correlation between repeat observations. (This concept has meaning in quantitative terms only.)

TRICHOTOMOUS   Divided in three categories (cf. DICHOTOMOUS and POLYTOMOUS).

TYPE I ERROR   The "rejection" of a correct "null hypothesis."

TYPE II ERROR   The "acceptance" of an incorrect "null hypothesis."

UNIT OF OBSERVATION   A member of the study population.

VALIDITY OF MEASUREMENT (quantitative)   Lack of bias (q.v.).

VALIDITY OF STUDY   Lack of median bias (q.v.).

VARIABLE
  1. Subject to variation.
  2. Variate.

VARIANCE   Average of squared deviations from the mean.

VARIATE   A characteristic as represented in a statistical model, potentially taking on differing realizations among the units of observation (the members of the study population).

ZERO TIME (of a cohort)   The time (individual or calendar) as of which the criteria of membership are satisfied; that is, the boundary between the retrospective and prospective experiences of a cohort.

References

Armitage, P. (1975). *Sequential Medical Trials*, 2nd ed. Blackwell Scientific Publications, Oxford.

Axelson, O., Andersson, K., Hogstedt, C., et al. (1978). A cohort study on trichloroethylene exposure and cancer mortality. *JOM*, **20**, 194–6.

Axelson, O., Dahlgren, E., Jansson, C-D., et al. (1978). Arsenic exposure and mortality: A case-referent study from a Swedish copper smelter. *Br. J. Ind. Med.*, **35**, 8–15.

Barnard, G.A. (1947). Significance tests for 2 × 2 tables. *Biometrika*, **34**, 123–38.

Barndorff-Nielsen, O. (1976). Nonformation. *Biometrika*, **63**, 567–71.

Birch, M.W. (1964). The detection of partial association. *J. R. Stat. Assoc.*, **26**, 313–24.

Birnbaum, A. (1962). On the foundations of statistical inference (with discussion). *J. Am. Stat. Assoc.*, **57**, 269–326.

Borow, K. M., Green, L. H., Castaneda, A. R., et al. (1980). Left ventricular function after repair of tetralogy of Fallot and its relationship to age at surgery. *Circulation*, **61**, 1150–8.

Boston Collaborative Drug Surveillance Program (1971). A relation between breast cancer and S blood-antigen System. *Lancet*, **1**, 301–5.

Boston Collaborative Drug Surveillance Program (1972). Excess of ampicillin rashes associated with allopurinol or hyperuricemia. *N. Engl. J. Med.*, **286**, 505–7.

Breart, G. L., Miettinen, O.S., Peckam, G. J., et al. (1985). Effect of maternal glucocorticoid administration on pulmonary and ductal maturation of the fetus. To be published.

Breslow, N. E. and Day, N. E. (1980). *Statistical Methods in Cancer Research*. Vol. 1. The analysis of Case-Control Studies. International Agency for Research on Cancer, Lyon.

Bronshtein, I. N. and Semendyayev, K. A. (1973). *A Guide Book to Mathematics*. Verlag Harri Deutsch, Frankfurt/Main, pp. 161–3.