

Review Article

ABC of dermatoepidemiology

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Abstract Today is the era of evidence-based medicine in all disciplines of medical sciences. Everyday, there is explosion of print and electronic information jumbled with many unfamiliar terms and it is virtually impossible for an unwary reader to deduce and infer from the literature. The present review gives an insight into the commonly used terms in the subject of dermatoepidemiology.

Key words Dermatoepidemiology, evidence-based medicine, epidemiology, biostatistics.

Background

Dermatoepidemiology is the application of epidemiologic principles and methods to problems arising in dermatology discipline of clinical medicine. During the last two decades, there have been numerous advances in evidence processing, including the production of streamlined guides to aid in critical appraisal of the literature, evidence-based abstraction services, online and other forms of electronic literature searching, growing numbers of high quality systematic reviews, and frequently updated textbooks in paper and electronic formats. Epidemiology has its own language and correct understanding of this language is mandatory for proper evaluation of medical information because straightforward concepts are at times hidden behind potentially misleading words. For dermatologists, understanding this discipline is as important as mastering other basic sciences¹⁻⁴.

Here is a short overview of the mostly used terms of clinical epidemiology and biostatistics that help in understanding the basic concepts and application of dermato-epidemiology. Since full description and explanation is beyond scope of this article, therefore terms are only defined or briefly introduced and these are given alphabetic order. However, it is also tried in the end, to group the terms according to various settings in which these are commonly used.

Glossary of epidemiological terms used in Evidence-based medicine (EBD)⁴⁻⁷

Absolute risk The observed or calculated probability of an event in the population under study.

Absolute risk difference The difference in the risk for disease or death between an exposed population and an unexposed population.

Absolute risk reduction The difference in the absolute risk (rates of adverse events) between study and control populations.

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Table 1 Epidemiological terms grouped as used in different clinical settings.

<i>No.</i>	<i>Studies/articles about</i>	<i>Epidemiology terms mostly applied</i>
1.	When undertaking studies or consulting articles about “Causation/Harm/Etiology”	Randomized Controlled Trial, Cohort, Case-control, Recall bias, Interviewer bias, Selection bias, Risk factors, Confidence intervals, Prognostic factors, Adjustment, Association, Case series, Comparison, Validity, Comorbidity, Confounders, Determinant, Exclusion criteria, Follow up, Odds ratio, Incidence, Precision, Strength of inference, Exclusion Criteria, Odds
2.	When undertaking studies or consulting articles about “Therapy”	Follow-up, Intention to treat analysis, Co-intervention, Absolute risk reduction, Relative risk reduction, Validity, Stratification, Strength of inference, Confounders, Exclusion Criteria, Randomized Controlled Trial , Blinded study Precision, Efficacy, Number Needed to Treat, Effectiveness, Co-interventions, Comparison, Bias
3.	When undertaking studies or consulting articles about “Diagnostic Tests”	Comparison, Validity, Bias, Likelihood ratios, Sample size, Sensitivity & specificity, Exclusion criteria, Gold standard, Precision, Predictive value, Prevalence, Reproducibility,
4.	When undertaking studies or consulting articles about “Prognosis”	Selection biases, Follow-up, Prognostic factor, Prognosis, Confidence intervals, co-morbidity, Survival curve, Validity, Referral filter bias, Cohort, Exclusion Criteria
5.	When undertaking studies or consulting articles about “Calculation” (Importance and precision of therapeutic results)	Control event rate, Experimental event rate Relative Risk, Relative Risk Reduction, Absolute Risk Reduction ,Number Needed to Treat , Confidence interval, Likelihood ratio, Odds Ratio, Predictive value, Sensitivity & Specificity

Adjustment A summarizing procedure for a statistical measure in which the effects of differences in composition of the populations being compared have been minimized by statistical methods.

Association Statistical dependence between two or more events, characteristics, or other variables. An association may be fortuitous or may be produced by various other circumstances; the presence of an association does not necessarily imply a causal relationship.

Bias (systematic error) Deviation of results or inferences from the truth, or processes leading to such deviation.

Blind(ed) study (masked study) A study in which observer(s) and/or subjects are kept ignorant of the group to which the subjects are assigned, as in an experimental study, or of the population from which the subjects come, as in a non-experimental or observational study. Where both observer and subjects are kept ignorant, the study is termed a **double blind** study. If the statistical analysis is also done in ignorance of the group to which subjects belong, the study is sometimes described as **triple blind**. The purpose of "blinding" is to eliminate sources of bias.

Case-series Report of a number of cases of disease.

Case-control study Retrospective comparison of exposures of persons with disease (cases) with those of persons without the disease (controls).

Causality The relating of causes to the effects they produce. Most of epidemiology concerns causality and several types of causes can be distinguished. It must be emphasized, however, that epidemiological evidence by itself is insufficient to establish causality, although it can provide powerful circumstantial evidence.

Co-interventions Interventions other than the treatment under study that are applied differently to the treatment and control groups. Co-intervention is a serious problem when double blinding is absent or when the use of very effective non-study treatments is permitted.

Cohort study Follow-up of exposed and non-exposed defined groups, with a comparison of disease rates during the time covered.

Comparison group Any group to which the index group is compared. Usually synonymous with control group.

Co-morbidity Coexistence of a disease or diseases in a study participant in addition to the index condition that is the subject of study.

Confidence interval The range of numerical values in which we can be confident (to a computed probability, such as 90 or 95%) that the population value being estimated will be found. Confidence intervals indicate the strength of evidence; where confidence intervals are wide, they indicate less precise estimates of effect. The larger the trial's sample size, the larger the number of outcome events and the greater becomes the confidence that the true relative risk reduction is close to the value stated. Thus the confidence intervals narrow and

"precision" is increased. A 95% confidence interval signifies that if the experiment were repeated 100 times, the value obtained would be expected to be outside the confidence interval 5 times. Because its width corresponds to the most likely range of values to contain the true value, the confidence interval is a measure of precision.

Confounding variable, Confounder A variable that can cause or prevent the outcome of interest, is not an intermediate variable, and is associated with the factor under investigation. A confounding variable may be due chance or bias. Unless it is possible to adjust for confounding variables, their effects cannot be distinguished from those of factor(s) being studied.

Control event rate The percentage of the control/non-exposed group who experienced outcome in question.

Descriptive statistics organize and summarize data; examples include mean and distribution of observed values

Dose-response relationship A relationship in which change in amount, intensity, or duration of exposure is associated with a change-either an increase or decrease-in risk of a specified outcome.

Determinant Any definable factor that effects a change in a health condition or other characteristic.

Effectiveness a measure of the benefit resulting from an intervention for a given health problem under usual conditions of clinical care for a particular group; this form of evaluation considers both the efficacy of an intervention and its acceptance by those to whom it is offered, answering the question, "Does the

practice do more good than harm to people to whom it is offered?".

Efficacy a measure of the benefit resulting from an intervention for a given health problem under the ideal conditions of an investigation; it answers the question, "Does the practice do more good than harm to people who fully comply with the recommendations?".

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Endemic when the disease burden stays consistently high, such as HIV in parts of Africa, it is described as endemic.

Epidemic When the incidence of a disease grows rapidly in the community, it is called epidemic.

Exclusion Criteria Conditions which preclude entrance of candidates into an investigation even if they meet the inclusion criteria.

Experimental event rate The percentage of intervention/exposed group who experienced outcome in question.

Follow-up Observation over a period of time of an individual, group, or initially defined population whose relevant characteristics have been assessed in order to observe changes in health status or health-related variables.

Gold standard A method, procedure, or measurement that is widely accepted as being the best available.

Incidence The number of new cases of illness commencing, or of persons falling ill, during a specified time period in a given population and is usually measured as cases per 100,000 persons per year. For example, in 2001, 0.02% of persons living in the United States developed new melanomas (incidence), whereas 544,000

individuals were living with a history of melanoma (prevalence). Incidence is a rate or risk and refers to the probability of getting the disease during a time interval. Prevalence is the proportion of persons with disease in the community.

Inferential statistics These serve to generalize from the sample (a smaller set of people selected for the study) to the entire population of similar individuals.

Intention to treat analysis A method for data analysis in a randomized clinical trial in which individual outcomes are analyzed according to the group to which they have been randomized, even if they never received the treatment they were assigned. By simulating practical experience it provides a better measure of effectiveness (versus efficacy).

Interviewer bias Systematic error due to interviewer's subconscious or conscious gathering of selective data.

Lead-time bias If prognosis study patients are not all enrolled at similar, well-defined points in the course of their disease, differences in outcome over time may merely reflect differences in duration of illness.

Likelihood ratio Ratio of the probability that a given diagnostic test result will be expected for a patient with the target disorder rather than for a patient without the disorder. It compares the likelihood of that result in patients with disease to the likelihood of that result in patients without disease:

Mapping A computer process whereby the search system matches a term entered to the closest subject headings in the database.

Medline An electronic index to the contents of biomedical and health sciences journals published since 1966. Medline includes Index Medicus, the Index to Dental Literature, and the International Nursing Index.

MeSH Medical Subject Headings, the thesaurus for Medline; a controlled vocabulary providing consistent terminology for concepts covered by the database.

Morbidity It is a measure of illness or injury, and for dermatologic conditions, is often associated with a measure of symptomatology, inability to work, or impaired social function. Several validated indices quantify aspects of skin disease morbidity such as quality of life, taking into account the multifactorial relationships between skin conditions and physical, emotional, and psychosocial outcomes.

Mortality It is the incidence of death in a population.

Nonparametric tests apply to values not assumed to follow a particular distribution, such as qualitative variables.

Number needed to treat The number of patients who must be exposed to an intervention before the clinical outcome of interest occurred; for example, the number of patients needed to treat to prevent one adverse outcome.

Odds A proportion in which the numerator contains the number of times an event occurs and the denominator includes the number of times the event does not occur.

Odds ratio (cross-product ratio, relative odds)
A measure of the degree of association; for example, the odds of exposure among the cases

compared with the odds of exposure among the controls.

Parametric test If the statistical test involves an assumption that the population follows a well-defined distribution, it is called a parametric test.

P value describes the likelihood that an observed association has arisen by chance alone, whereas, in fact, no such difference exists in the population. By convention, the default null hypothesis that no association exists is rejected if the corresponding *P* value is less than .05. Thus, a *P* value of less than .05 means that a difference observed in the study would be expected to occur by random chance alone, ie, if no real difference exists, in less than 5% of repetitions of the study.

Precision The range in which the best estimates of a true value approximate the true value.

Predictive value In screening and diagnostic tests, the probability that a person with a positive test is a true positive (i.e., does have the disease), or that a person with a negative test truly does not have the disease. The predictive value of a screening test is determined by the sensitivity and specificity of the test, and by the prevalence of the condition for which the test is used.

Positive predictive value = True positive / (True positive + False positive)

Negative predictive value = True negative / (True negative + False negative)

Prevalence It is the proportion of individuals affected by disease at a specific point (point prevalence) or range (period prevalence) of time. It is determined by the rate of new cases, the duration of disease, and the number of affected

individuals who get better, move in or out of the population, or die.

Prognosis The possible outcomes of a disease or condition and the likelihood that each one will occur.

Prognostic factor Demographic, disease-specific, or co-morbid characteristics associated strongly enough with a condition's outcomes to predict accurately the eventual development of those outcomes. Compare with risk factors. Neither prognostic nor risk factors necessarily imply a cause and effect relationship.

Prospective study Study design where one or more groups (**cohorts**) of individuals who have not yet had the outcome event in question are monitored for the number of such events which occur over time.

Randomized controlled trial Study design where treatments, interventions, or enrollment into different study groups are assigned by random allocation rather than by conscious decisions of clinicians or patients. If the sample size is large enough, this study design avoids problems of bias and confounding variables by assuring that both known and unknown determinants of outcome are evenly distributed between treatment and control groups.

Random error It is inherent to all observations.

Recall bias Systematic error due to the differences in accuracy or completeness of recall to memory of past events or experiences.

Referral filter bias The sequence of referrals that may lead patients from primary to tertiary centers raises the proportion of more severe or unusual cases, thus increasing the likelihood of adverse or unfavorable outcomes.

Relative risk The ratio of the probability of developing, in a specified period of time, an outcome among those receiving the treatment of interest or exposed to a risk factor, compared with the probability of developing the outcome if the risk factor or intervention is not present.

Relative risk reduction the extent to which a treatment reduces a risk, in comparison with patients not receiving the treatment of interest.

Reproducibility (Repeatability, Reliability): The results of a test or measure are identical or closely similar each time it is conducted.

Retrospective study: Study design in which cases where individuals who had an outcome event in question are collected and analyzed after the outcomes have occurred (Case-control study).

Risk factor Patient's characteristics or factors associated with an increased probability of developing a condition or disease in the first place. Compare with prognostic factors. Neither risk nor prognostic factors necessarily imply a cause and effect relationship.

Selection bias A bias in assignment or a confounding variable that arises from study design rather than by chance. These can occur when the study and control groups are chosen so that they differ from each other by one or more factors that may affect the outcome of the study.

Sensitivity (of a diagnostic test): The proportion of truly diseased persons, as measured by the gold standard, who are identified as diseased by the test under study.

Sensitivity = True positives / (True positives + False negatives)

Specificity (of a diagnostic test): The proportion of truly nondiseased persons, as measured by the gold standard, who are so identified by the diagnostic test under study.

Specificity = True negatives/(False positive + True negative)

Stratification Division into groups
Stratification may also refer to a procedure²⁶⁶ control for differences in confounding variables, by making separate estimates for groups of individuals who have the same values for the confounding variable.

Strength of Inference The likelihood that an observed difference between groups within a study represents a real difference rather than mere chance or the influence of confounding factors, based on both p values and confidence intervals. Strength of inference is weakened by various forms of bias and by small sample sizes.

Survival curve A graph of the number of events occurring over time or the chance of being free of these events over time. The events must be discrete and the time at which they occur must be precisely known. In most clinical situations, the chance of an outcome changes with time. In most survival curves the earlier follow-up periods usually include results from more patients than the later periods and are therefore more precise.

Type I error In hypothesis testing, a type I error arises when a statistical test falsely rejects the null hypothesis of no association. **Alpha** is the probability of making a type I error.

Type II error Failing to reject the null hypothesis when an association in fact exists. **Beta** is the probability of making a type II error.

Validity The extent to which a variable or intervention measures what it is supposed to measure or accomplishes what it is supposed to accomplish.

The **internal validity** of a study refers to the integrity of the experimental design. The **external validity** of a study refers to the appropriateness by which its results can be applied to non-study patients or populations.

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