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Meta-Analysis of Using Both Cohort and Case Control Study

Abstract

This article based on the meta-analysis of using both two measures of strength of association, which are cohort and case control study. Cohort study designs allow for the direct calculation of relative risks from incidences. The situation is more complicated for case-control studies, if meaningful prevalence's or incidences are not available. Generally speaking, if the risk is greater in exposed, bias term will be greater and the Odds Ratio will overestimate the Relative Risk. However, if incidence in exposed and unexposed is small, bias term will be close to 1.

Review Article

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Introduction

Meta-analysis, a systematic approach of identifying, evaluating, synthesizing, and if appropriate combining the results of relevant studies to arrive at conclusions about a body of research, which has been applied with increasing frequency to randomized controlled trials (RCTs), which are considered to provide the clearest evidence regarding an intervention [1].

Cohort Study

A cohort is epidemiologically defined as a set of people with particular traits who are checked on to determine the incidence or mortality of or from some certain diseases that may lead to death or introduce an effective result [2]. Cohort study, is an observational study in which the individuals are sorted, identified or pulled out according to their exposure status, Because exposure is identified earlier than the outcome, cohort studies have a strong ability to assess causality of a disease and thus have the ability to provide the strongest scientific evidence [3]. In this study, the healthy subjects (exposed & unexposed) are recorded in other to recognize the characteristics that were actually studied [4].

Measures of Risk and Association

In cohort study, measure of disease that describes the absolute risk is known as the incidence rate, which is the proportion of the subjects under the study who developed the disease within a specified period of time. Rushton [4], the numerator of the rate can be described as the number of diseased subjects while the denominator is usually the number of person-years of observation as shown below. The incidence rates for both exposed and unexposed subjects are calculated discretely.

The measure of association makes the most of comparative risk statement to study why a specific event occurs. The comparative risk statement defines the risk of developing a disease among individuals exposed to a suspected risk factor compared to those without exposure [5]. The comparative frequency measures include the risk ratio or relative risk and odd ratio or relative odd [5]. Relative risk is the ratio of the incidence rate of the key subjects to that of the control subjects. A relative risk of "1" indicates that the incidence rate is the same among the two groups, which are the exposed and unexposed subjects and point out a lack of correlation between exposure and diseases. A relative risk of less than "1" provides the evidence for a defensive outcome of the exposure (the incidence rate of disease among exposed is lower than that of unexposed group) while a relative risk greater than "1" indicates that exposed people are at higher risk of disease than unexposed group.

Current and Historical Cohort Study

Concerning the time when cohort study was introduced relative to the occurrence of the disease to be studied, the difference between the current and historical cohort studies can be distinguish, Cohort studies can be either prospective or retrospective. Historical cohort study is known as the retrospective cohort study, in this study, data on concerning the subjects or the occurrence of the disease are collected to the rear of the events that have taken place the cohorts of exposed and unexposed subjects from existing records, or health care registries [4]. In late years by some authors, historical cohort studies are referred to as retrospective cohort studies because information concerning the cohort studies is collected retrospectively. In the case of current cohort study, the information concerning the exposure are accumulated prior to the incidence of disease, hence the current cohort study is called the perspective cohort study [4]. The improvement of the studies by which the significant information about the members of the cohort are right away obtained from the members by the researchers, who then follow them up forward to determine the frequency of the outcomes in which they are attentive in, that is often called the prospective cohort studies [6].

The principle phase of cohort study is to identify healthy persons at starting point; firstly Convene the subjects in to exposed and unexposed groups, and then Follow-up of the cohort to estimate the incidence rate of the disease being studied the in two groups and compare the occurrence of the disease or risk in each cohort [3]. Some notable cohort studies include the US Nurses' Health Study which started in the year 1976 with 121,964 female nurses aged from 30-55, and 5 years of backing. Since then its focus has broadened extremely from the oral contraceptive-breast cancer links in which it was first backed cited in [3] to shell many exposures including the diet and a mass of outcomes. It has almost build up more than 30 years of follow-up and is still moving strong. It was very expensive to carry out, but the scientific and public health bear has been excellent. The Nurses' Health Study-2 commenced in in the year 1989 with 117,000 nurses aged from 25 to 42 and recruitment has recently started for a Nurses' Health Study-3.

The key point here is that the cohort studies describe incidence or natural history, they analyses predictors (risk factors) thus enables in calculation of relative risk. It also measure events in temporal sequence thus distinguishing causes from effects. Retrospective cohorts where available are cheaper and quicker but in analyzing cohort studies, Confounding variables are the major problem, Subject selection and loss to follow up is a major potential cause of bias.

Relative Risk

Relative risk compares the probability of an outcome among individuals who have specific characteristics. It is describe as the ratio of the outcome among exposed individual to the incidence among unexposed individual.

The data to be used in calculating the relative risk can be summarized in a 2x2 table below.

The relative risk is the computed using the formula:

$$RR = \frac{incidence\ of\ disease\ in\ exposed\ group}{incidence\ of\ disease\ in\ non-exposed\ group} = \frac{risk\ of\ disease\ if\ exposed}{risk\ of\ disease\ if\ not\ exposed}$$

$$\text{The conditional probability is } = \frac{P(D+|E+)}{P(D+|E-)} = \frac{a/(a+b)}{c/(c+d)}$$

This indicates that the disease is relatively risk times more likely to occur among those exposed to the suspected risk factor than among those with no such exposure [5]. A relative risk of 1 corresponds to no increase in risk in the exposed group compared with the risk in the unexposed group.

There are many well-known examples of Cohort studies including the Framingham heart study, the UK study of doctors who smoke and Professor Neville Butler's studies on British children born in 1958. A recent example of a prospective cohort study by Davey Smith et al was published in the BMJ and a retrospective cohort design was used to assess the use of A&E departments by people with diabetes [7].

Case Control Study

Case-control is another type of observational study in epidemiology. in observational study, subjects are not randomized to exposed or unexposed groups, they are observed in order to clarify both their exposure and their outcome status and the exposure status is thus not clarify by the researcher. Case control study started by determining the case's history of the exposure and other variables or characteristics or both, since the beginning of the disease by means of interview or other sources of gathering information. Also the past history of the people without the disease and they are under the study (control) is recorded in the same way as case study. The aim here is to provide the estimates of the frequency and the subjects' amount of exposure in the control group being studied. Careful selection of cases and controls is the first step for achieving a successful case control study [1].

Odds Ratio in Case Control

The great measure of association in case control is odds ratio. It determine the how much higher the odds of exposure among case of disease compared with the controls. The odds ratio is the probability that an event will happened divided by the probability that an event won't happened [8]. From the Table 1,

$$\text{Odds ratio} = \frac{odds\ of\ exposure(case)}{odds\ of\ exposure(control)} = \frac{a/c}{b/d} = \frac{ad}{bc}$$

Odds ratio of "1 close to 1" signifies that the odd of exposure among cases is the same as the odds of exposure among controls hence the exposure is not associated with the disease. Also the odds ratio Greater than "1" suggests that the odds of exposure among cases is greater than the odds of exposure among controls, hence exposure may be a risk factor for the disease. And the odds ratio less than "1" indicates that the odds of exposure among cases is lower than the odds of exposure among controls hence exposure may be protective against the disease.

The Odds Ratio for a given exposure is usually obtained from logistic models or complex models while controlling for confounders like age, sex etc. In medical and epidemiological studies, the odds ratio is the great used measure to estimate the risk ratio or relative risk in the cohort studies. If the incidence rate of a study outcome is unusual, the estimate will be poor and can lead to misleading conclusion [9]. But in terms of "two fold risk" of a developing disease, odds ratio over estimates the relative risk [10].

Table 1: Odds Ratio in Case Control.

	D^+(Case)	D^-(Controls)	Total
Exposure(E^+)	a	b	a+b
Non-Exposure(E^-)	C	d	c+d
Total	a+c	b+d	N=a+b+c+d

Conclusion

Both cohort and case control study are epidemiological observational studies, in cohort study direct calculation of relative risks from incidences is allowed, but the situation is more complicated in case control study. If significant incidences

or prevalence's are not obtainable, then the odds Ratio is the valid and effective measure that can provides the needs. Computationally, both approaches lead to the same result but the case control study has a greater statistical power than cohort studies, which must often wait for a 'sufficient' number of disease events to accumulate.

Acknowledgement

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Conflict of Interest

None.

References

1. Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, et al. (2000) Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. JAMA 283(15): 2008-2012.
2. Song JW, Chung KC (2010) Observational studies: cohort and case-control studies. Plast Reconstr Surg 126(6): 2234-2242.
3. Baseada M, Aurélio M, Oliveira PDE, Câmara R, Parente M (2010) Cohort and Case-Control Studies in the Evidence-Based Medicine Era Estudos de Coorte e de Caso-Controle na Era da 3.
4. Rushton L (1975) Cohort and Case-control studies. Switzerland.
5. Rebecca KG, Clinton MM (1992) Cohort and Case-control studies. In clinical apidemiology and biostatistics. Williams & Wilkkins, Charleston, South Carolina, Baltimore, Maryland, USA, pp. 233-240.
6. Doll R (2001) Cohort studies: history of the method. II. Retrospective cohort studies. Sozial-Und Präventivmedizin 46(3): 152-160.
7. Mann CJ (2003) Observational research methods. Research design II: cohort, cross sectional, and case-control studies. Emerg Med J 20: 54-60.
8. Rothman K (2008) Case-control studies, John Wiley & Sons, USA.
9. Wang Z (2013) Converting Odds Ratio to Relative Risk in Cohort Studies with Partial Data Information. Journal of Statistical Software 55(5): 1-11.
10. Schmidt CO, Kohlmann T (2008) When to use the odds ratio or the relative risk? Int J Public Health 53(3): 165-167.