

EDITORIAL

WHY AREN'T WE CONDUCTING COHORT STUDIES?

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The subject of epidemiology is based on a premise that disease is not a random phenomenon, i.e., for every occurrence there is a reason. If we know that reason (cause) we can prevent that occurrence (effect). The subject of Epidemiology strives to establish this particular cause and effect relationship. In the last seven decades epidemiology has been extremely successful in achieving its objectives. The most notable has been its success in exploring causes of many diseases without intervening into the human body. Such observational studies are case-control and cohort studies. Cohort study is considered the more robust of the two.^{1,2}

The word “cohort” is defined in modern epidemiology as “group of people with defined characteristics who are followed up to determine incidence of, or mortality from, some specific disease, all causes of death, or some other outcome.” Historically, this Latin word was used to refer to a unit of three hundred to six hundred men in the Roman army. Ten such cohorts formed a legion. An analogy can be drawn between the historical meaning of the word to its modern use in epidemiology because just like men in the army who march forwards, epidemiology uses the word to refer to a group of individuals who are followed forwards in time from exposure to the occurrence of an outcome.³ It was in early 1900s, when an epidemiologist by the name of W.H. Frost first used the word cohort in his publication while assessing age specific mortality rates and tuberculosis.⁴ Since then epidemiologists have referred to cohort studies using various names, which include longitudinal, incidence, prospective, follow-up, forward-looking and concurrent studies.³

Cohort study is an observational epidemiological study, which is conducted on a subset of a population who is, or has been or in the future may be exposed or unexposed to a factor, which is hypothesized to influence the occurrence of an outcome. This subset of the exposed and unexposed population or cohort is followed for a certain period of time to determine whether the incidence of the outcome is related to the suspected exposure or factor of interest.⁵ Many cohort studies have been undertaken to date. However the first few prospective cohort studies include the British doctors study comprising 34,000 male doctors, the American citizens study on 190,000 participants with different smoking habits, and the iconic Framingham Heart Study initiated in 1948 in Massachusetts conducted

on 5,000 middle aged residents of Framingham. The Framingham Heart Study was undertaken to investigate cardiovascular disease (CVD) epidemiology at a time when infectious diseases dominated epidemiology. And we owe to this “model for the cohort design” most of what we know today about CVD.^{6,7}

Cohort studies are of two main types: prospective or concurrent cohort study, and retrospective or historical cohort study. In the prospective cohort study the population exposed and unexposed to the factor under study is identified at the beginning of the study and is followed forwards in time to ascertain the outcome of interest. However, in the retrospective study design the population exposed and unexposed to the factor under study is ascertained through past records and the outcome of interest is determined at the time of study initiation. Hence both compare the occurrence of event of interest in an exposed and an unexposed group but the difference resides in the calendar time.^{8,9} Another design could be combination of both concurrent and historical types and is referred to as ambi-directional design.¹

Another advantage of a concurrent cohort design is the nested case-control study design or the case control in a cohort study. In such studies, cases of a disease, which occur in a cohort are identified and selected as cases. Then for each case a control is selected from among the same cohort members who haven't had the disease at the time of disease occurrence among the cases. This design is assumed to be an efficient and cost effective method of investigation.¹⁰

Cohort studies can be considered the “gold standard” amongst the observational epidemiological study designs. It is the cohort study, which fulfils Hill's *sine qua non* criterion of causality by establishing a temporal relationship between cause and effect. Additionally they are capable of investigating rare exposures, multiple outcomes of a given exposure, calculating incidence rate, relative risk, attributable risk and studying the natural history of disease. Their potential to provide the strongest scientific evidence is possible if the study is designed, conducted and analyzed in a rigorous manner giving appropriate consideration to errors, which may arise due to bias and confounding. The cohort study design is criticized for the long periods of follow up, the expense associated with them, the

large number of study subjects required and issues of attrition. It is for reasons of feasibility, both financial and logistic, as opposed to scientific desirability or superiority that other observational designs like cross-sectional and case-control are employed for epidemiological investigation. But the fact that cohort studies are the only observational studies, which generate valid associations, based on temporal sequence of events underscores their use as a powerful tool for epidemiological investigation.¹⁰ Additionally they are at times warranted when conducting randomized controlled trials is either not practical or is unethical, i.e., when the exposure under consideration is potentially harmful.¹¹

Although systematic reviews and meta-analyses are considered to generate the gold standard of evidence and are placed at the top of the hierarchy of studies generating scientific evidence, it is important to remember that systematic reviews synthesize best available evidence from trials or observational studies. Systematic reviews will provide stronger inferences if the available trials are of high quality and observational studies are rigorously conducted. Having discussed the major limitation of trials above, it is imperative that unbiased cohort studies are undertaken especially for establishing causality to add to the pool of studies to be appraised by the gold standard for evidence, i.e., systematic reviews.¹²

Here a few questions arise. Knowing very well the paramount significance of cohort studies designs why aren't we conducting them? Why aren't we generating valid associations between exposure and outcome? Why do we depend upon studies conducted in the west for scientific evidence? Why aren't researchers from Pakistan adding to the repository of cohort studies? Why don't we see cohort studies from Pakistan being appraised in systematic reviews and meta-analyses? Many reasons can be stated but one plausible explanation deterring our accomplished researchers from embarking on this journey is the huge financial cost they entail. Agreed! Don't blame them! The author herself encountered

these problems while establishing the diabetes tuberculosis treatment outcome (DITTO) cohort. Apart from financial costs, time is an important resource in this context. Our research culture does not allow exercise of patience and spaghetti research seems to be the preferred choice owing to multiple reasons.

All such reasons could be connected to finances, which are not easily available in this country for research activities. Owing to the monumental costs involved in cohort studies, I exhort academic institutions, the Higher Education Commission, universities and others to facilitate researchers who want to take up cohort studies by providing scholarships. Financial costs, rigour, and long periods of research may be there but the harvest we would reap in terms of creating evidence of cause and effect relationship could be priceless as mentioned earlier in the case of Framingham study etc.

REFERENCES

1. Hennekens CH, Buring JE. Case-control Studies. In: Mayrent SL, ed. *Epidemiology in Medicine*. Philadelphia: Lippincott Williams & Wilkins; 1987:132–52.
2. Katz DL, Elmore JG, Wild DMG, Lucan SC. *Jekel's epidemiology, biostatistics, preventive medicine, and public health*. 4th ed. Philadelphia: Saunders, Elsevier; 2013.
3. Grimes DA, Schulz K. Cohort studies: marching towards outcomes. *Lancet* 2002;359(9303):341–5.
4. Song JW, Chung KC. Observational studies: cohort and case-control studies. *Plast Reconstr Surg* 2010;126(6):2234–42.
5. Last JM. *A dictionary of epidemiology*. 4th ed. New York: Oxford University Press; 2001.
6. Doll R. Cohort studies: history of the method. *Prospective cohort studies*. *Soz Präventivmed* 2001;46(2):75–86.
7. Oppenheimer GM. Framingham Heart Study: the first 20 years. *Prog Cardiovasc Dis* 2010;53(1):55–61.
8. *Godis L. Epidemiology*. 3rd ed. USA: Elsevier Saunders; 2004.
9. Ernster VL. Nested case-control studies. *Prev Med* 1994;23(5):587–90.
10. Szklo M, Nieto FJ. *Epidemiology. Beyond the basics*. 2nd ed. USA: Jones and Barlett publishers; 2007.
11. Mann CJ. *Observational research methods. Research design II: cohort, cross sectional, and case-control studies*. *Emerg Med J* 2003;20:54–60.
12. Mithun Pai BH, Rajesh G, Shenoy R. Research design hierarchy: Strength of evidence in evidence-based dentistry. *J Interdiscip Dent* 2012;2(3):158–63.

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