

## Epidemiological study designs- Examples of medical sciences

Maryam Askari<sup>1\*</sup>, Hassan ali Mahmoudi Kohani<sup>1</sup>, Nasim Namiranian<sup>1</sup>

1. Diabetes Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

**\*Correspondence:**

Maryam Askari, Diabetes Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

**Tel:** (98) 353 728 0217

**Email:** Askarim204@gmail.com

**Received:** 10 May 2020

**Accepted:** 12 July 2020

**Published in August 2020**

### Dear editor

**E**pidemiology is the study and analysis of distribution and determinants of health-related conditions or events including diseases, and the practice of this study to the control of diseases and other health problems (1). One of the basic issues in epidemiology and the beginning of a research project is conducting a suitable design for our study (2). The aim of this study is to brief explanation the classification of different types of epidemiological studies according to diabetes disease.

The researcher should design his/her own study design based on his/her research question, available resources, time and budget. Figure 1 shows the classification of epidemiological studies (Figure 1) (3,4)

### Descriptive studies

In descriptive studies, the researcher describes the variable (or variables) without any intervention (5):

### Case report

Detailed description of a patient or individual with different conditions. In this type of study, the researcher should describe the symptoms, signs, history of exposure, interventions and treatments used, and outcomes (6). For example: Kevat et al. study, entitled “A 5-year-old girl with type 2 diabetes” (7) and Rahmanian et al. study, entitled “Giant prolactinoma: case report and review of literature” (8).

### Case series

A case series study is similar to the case report study, but the number of studied patient is more than one (5) For example: Pappa et al. study, entitled “Diabetes Mellitus in Friedreich Ataxia: A Case Series of 19 Patients From the German-Austrian Diabetes Mellitus Registry” (9).

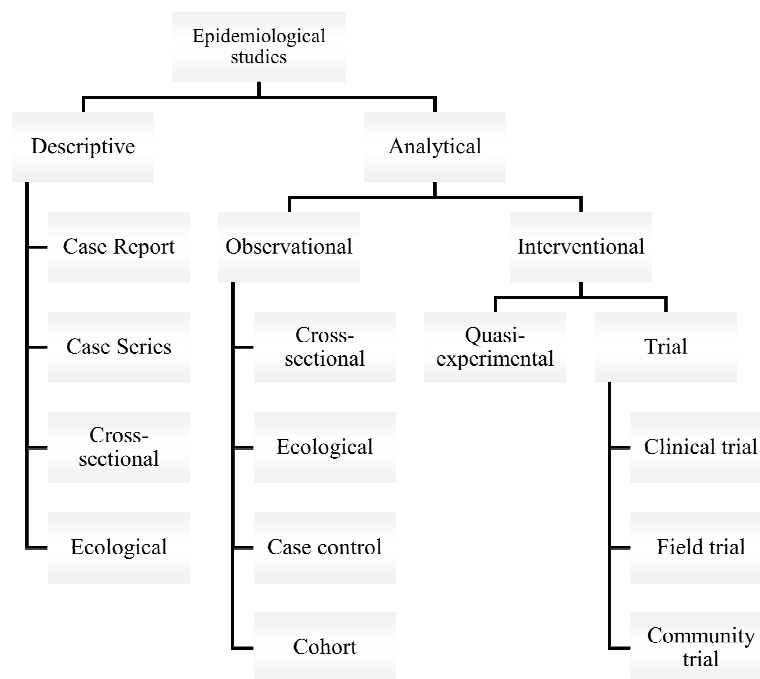


Figure 1. Classification of epidemiological studies

### Cross-sectional studies

Cross-sectional studies provide for researchers a snapshot of a population. This type of study can also be analytical (1). For example: Nguen et al. study, entitled “A cross-sectional study to evaluate diabetes management, control and complications in 1631 patients with type 2 diabetes mellitus in Vietnam (DiabCare Asia)” (10) and Afkhami-Ardekani et al. study, entitled “Prevalence and predictors of vitamin D insufficiency in adult population of yazd–The sun province in center of Iran” (11).

### Ecological studies (correlation studies)

The aggregated data for groups- The researcher is seeking to find an association between exposure and outcome in the population rather than in individuals (12). For example: Khazaei et al. study, entitled “Relation Between the Prevalence of Diabetes Mellitus and Human Development Index: A Global Ecological Study” (13).

### Analytical studies

These studies test the hypothesis and evaluate the causal relationships between variables (14).

### Observational studies

In these studies, the researcher does not perform any active intervention in the subjects (14), such as :

#### Cross-sectional studies

This was explained in the previous paragraphs.

#### Ecological studies

This was explained in the previous paragraphs.

**Case control studies:** In this study, participants are classified into two categories, case and control, based on outcomes. Next they are compare the exposure levels in the two groups (figure 2) (15). For example: Wang et al. study, entitled “A Case-Control Study of Risk Factors for Development of Type 2 Diabetes: Emphasis on Physical Activity” (16) and Lotfi et al. study, entitled “Socioeconomic Status and Osteoporosis Risk: A Case-control Study in Outpatient Women in Yazd” (17).

**Cohort studies:** In this study, participants are classified into two categories, exposed and non-exposed, based on exposure to suspected risk factor. Next participants in both groups will be followed to development the desired outcome (outcomes), then they are compared according the outcome (outcomes) in the two

groups (figur3) (18). For example : Eder et al. study, entitled “A Prospective Cohort Study in Patients with Type 2 Diabetes Mellitus for Validation of Biomarkers (PROVALID) – Study, Design and Baseline Characteristics” (19) and karimi et al. study entitled “Population Attributable Risk (PAR) of Hyperuricemia for Diabetes Mellitus in 20-74-Year-Old Population of Yazd during a 10-Year Longitudinal Cohort: Yazd Healthy Heart Cohort (YHHC) in Iran” (20).

Figure 2 shows direction of investigation in time in epidemiological studies (Figure 2).

**Interventional (experimental) studies**

In these studies, the researcher does active intervention in the some or all subjects (14), such as

**Quasi-experimental :** This study is designed to estimate the effect of causal intervention on the target population without randomization or control group or random assignment and/or no active manipulation (21). For example : Eknithiset et al. study, entitled “Effectiveness of a diabetes mellitus pictorial diary handbook program for middle-aged and elderly type 2 diabetes mellitus patients: a quasi-experimental study at Taladnoi Primary Care Unit, Saraburi, Thailand” (22).

**Trial:**

- **Clinical trial:** Clinical trial is a prospective study that investigates the effect and value of intervention(s) against a control in human beings (23). For example : Sudfeld et al. study, entitled “Efficacy of vitamin D3 supplementation for the prevention of pulmonary tuberculosis and mortality in HIV: a randomised, double-blind, placebo-controlled trial” (24) and Afkhami-Ardekani et al. study, entitled “Effect of vitamin C on blood glucose, serum lipids & serum insulin in type 2 diabetes patients” (25).

- **Field trial:** In this type of study, in contrast to clinical trials, healthy people who are likely to be at risk are used instead of sick people. Participants in this study are selected from the general population(26). Through this study, the researcher evaluates whether the intervention reduces the risk of disease (27). For example: Sfarjani et al. study, entitled “Family-based Intervention for Controlling Childhood Obesity: An Experience Among Iranian Children” (28).

- **Community trial:** Community trials are field trials in which totality of the community are intervened instead of individuals (26). For example: et al. study, entitled “The community-based prevention of diabetes

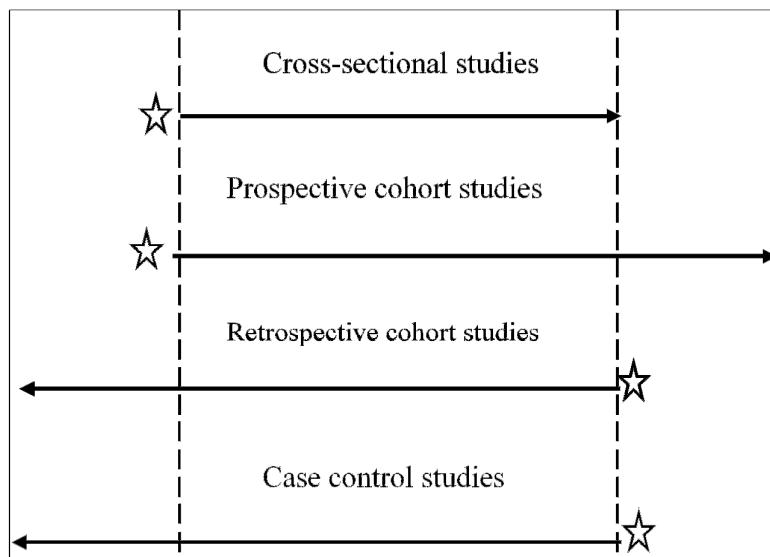


Figure 2. Direction of investigation in time

(ComPoD) study: a randomised, waiting list controlled trial of a voluntary sector-led diabetes prevention program” (29).

Field and Community trial are conducted in real conditions and not in ideal conditions (30).

Therefore, a researcher should follow these steps in conducting a research:

Choose of disease or condition under study

1. Consult with an epidemiologist or statistician
2. Choose the design with the available facilities
3. Study design
4. Perform the study
5. Analyze of study
6. Report of study

## References

1. Belbasis L, Bellou V. Introduction to epidemiological studies. In *Genetic Epidemiology*. 2018 (pp. 1-6). Humana Press, New York, NY.
2. Checkoway H, Pearce N, Kriebel D. Selecting appropriate study designs to address specific research questions in occupational epidemiology. *Occupational and environmental medicine*. 2007;64(9):633-8.
3. Rothman KJ, Greenland S, Lash TL. Types of epidemiologic studies. *Modern epidemiology*. 2nd ed: Lippincott Raven. Feb 1:74-5.
4. Bailey LA, Gordis L, Green M. Reference guide on epidemiology. *Reference Manual on Scientific Evidence*. 1994.
5. Aggarwal R, Ranganathan P. Study designs: Part 2–Descriptive studies. *Perspectives in clinical research*. 2019;10(1):34.
6. Garg R, Lakhan SE, Dhanasekaran AK. How to review a case report. Springer; 2016.
7. Kevat D, Wilson D, Sinha A. A 5-year-old girl with type 2 diabetes. *The Lancet*. 2014;383(9924):1268.
8. Rahmanian M, Meybodi HA, Larijani B, Mohajeri-Tehrani MR. Giant prolactinoma: case report and review of literature. *Journal of Diabetes & Metabolic Disorders*. 2013;12(1):3.
9. Pappa A, Häusler MG, Veigel A, Tzamouranis K, Pfeifer MW, Schmidt A, et al. Diabetes mellitus in Friedreich Ataxia: A case series of 19 patients from the German-Austrian diabetes mellitus registry. *Diabetes research and clinical practice*. 2018;141:229-36.
10. Nguyen KT, Diep BT, Van Lam H, Tran KQ, Tran NQ. A cross-sectional study to evaluate diabetes management, control and complications in 1631 patients with type 2 diabetes mellitus in Vietnam (DiabCare Asia). *International Journal of Diabetes in Developing Countries*. 2020;40(1):70-9.
11. Afkhami-Ardekani O, Afkhami-Ardekani A, Namiranian N, Afkhami-Ardekani M, Askari M. Prevalence and predictors of vitamin D insufficiency in adult population of yazd–The sun province in center of Iran. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2019;13(5):2843-7.
12. Fleegler EW, Lee LK, Monuteaux MC, Hemenway D, Mannix R. Firearm legislation and firearm-related fatalities in the United States. *JAMA internal medicine*. 2013;173(9):732-40.
13. Khazaei S, Rezaeian S, Nematollahi S. Relation Between the Prevalence of Diabetes Mellitus and Human Development Index: A Global Ecological Study. *Health Scope*. 2017;6(2):6.
14. Ranganathan P, Aggarwal R. Study designs: Part 1–An overview and classification. *Perspectives in clinical research*. 2018;9(4):184.
15. Setia MS. Methodology series module 2: case-control studies. *Indian journal of dermatology*. 2016;61(2):146.
16. Wang L, Yamaguchi T, Yoshimine T, Katagiri A, Shirogane K, Ohashi Y. A case-control study of risk factors for development of type 2 diabetes: emphasis on physical activity. *Journal of epidemiology*. 2002;12(6):424-30.
17. Lotfi MH, Fallahzadeh H, Owlia MB, Hamed A, Naderyan Fe'li S, Askari M. Socioeconomic Status and Osteoporosis Risk: A Case-control Study in Outpatient Women in Yazd. *Journal of Community Health Research*. 2018;7(2):105-11.
18. Song JW, Chung KC. Observational studies: cohort and case-control studies. *Plastic and reconstructive surgery*. 2010;126(6):2234.
19. Eder S, Leierer J, Kerschbaum J, Rosivall L, Wiecek A, De Zeeuw D, et al. A prospective cohort study in patients with type 2 diabetes mellitus for validation of biomarkers (PROVALID)–study design and baseline characteristics. *Kidney and Blood Pressure Research*. 2018;43(1):181-90.
20. Karimi A, Namayandeh SM, Fallahzadeh H, Rahmanian M, Soltani M, Hadiani L, et al. Population Attributable Risk (PAR) of Hyperuricemia for Diabetes Mellitus in 20-74-Year-Old Population of Yazd during a 10-Year Longitudinal Cohort: Yazd Healthy Heart Cohort (YHHC) in Iran. *Journal of Community Health Research*. 2018;7(4):200-6.
21. DiNardo J. Natural experiments and quasi-natural experiments. *Microeconometrics*: Springer; 2010. p. 139-53.

22. Eknithiset R, Somrongthong R. Effectiveness of a diabetes mellitus pictorial diary handbook program for middle-aged and elderly type 2 diabetes mellitus patients: a quasi-experimental study at Taladnoi Primary Care Unit, Saraburi, Thailand. *Journal of Multidisciplinary Healthcare*. 2017;10:327.
23. Friedman LM, Furberg CD, DeMets DL, Reboussin DM, Granger CB. *Fundamentals of clinical trials*. Springer; 2015.
24. Sudfeld CR, Mugusi F, Muhigi A, Aboud S, Nagu TJ, Ulenga N, et al. Efficacy of vitamin D3 supplementation for the prevention of pulmonary tuberculosis and mortality in HIV: a randomised, double-blind, placebo-controlled trial. *The Lancet HIV*. 2020 1;7(7):e463-71.
25. Afkhami-Ardekani M, Shojaoddiny-Ardekani A. Effect of vitamin C on blood glucose, serum lipids & serum insulin in type 2 diabetes patients. *Indian Journal of medical research*. 2007;126(5):471.
26. Bonita R, Beaglehole R, Kjellström T. *Basic epidemiology*. World Health Organization; 2006.
27. Smith PG, Morrow RH, Ross DA. *Field trials of health interventions: a toolbox*: OUP Oxford; 2015.
28. Esfarjani F, Khalafi M, Mohammadi F, Mansour A, Roustae R, Zamani-Nour N, et al. Family-based intervention for controlling childhood obesity: an experience among Iranian children. *International journal of preventive medicine*. 2013;4(3):358.
29. Smith JR, Greaves CJ, Thompson JL, Taylor RS, Jones M, Armstrong R, et al. The community-based prevention of diabetes (ComPoD) study: a randomised, waiting list controlled trial of a voluntary sector-led diabetes prevention programme. *International Journal of Behavioral Nutrition and Physical Activity*. 2019;16(1):112.
30. Fors López MM. Los ensayos clínicos y su contribución a la salud pública cubana. *Revista Cubana de Salud Pública*. 2012;38:771-80.