APPLIED EPIDEMIOLOGY AND PUBLIC HEALTH

Boryana Levterova
Medical University of Plovdiv, Bulgaria, Boryana.Levterova@mu-plovdiv.bg

Abstract: Epidemiology is both a science and a fundamental method of public health. Epidemiology is a philosophy and methodology that can be applied to learning and solving a very wide range of health problems. The "art" of epidemiology is the use of different research designs and statistical methods and the application of optimal strategies to successfully respond to specific health questions and to obtain the necessary information. The epidemiological method is used to generate much of the scientific information needed by public health professionals to design, implement, and evaluate the effectiveness of disease prevention and health promotion programs. We provide an up to date review of epidemiology and public health textbooks with and specifically explore the extent to which standard methodological works by epidemiologists provide all of the analytic tools needed by those assessing public health problems and priorities. Epidemiology has a rich history of successes in determining underlying causes of diverse health problems and in assessing the effectiveness of preventive approaches.
Keywords: applied epidemiology, application, public health

1. INTRODUCTUON

Epidemiology is both a science and a fundamental method of public health. It is a science that looks for the link between health or disease with various factors affecting the health of human populations. It is a piece of medicine that describes health and disease at a population level, not an individual level. Epidemiology is a philosophy and methodology that can be applied to learning and solving a very wide range of health problems. The "art" of epidemiology consists in the use of different research designs and statistical methods and the application of optimal strategies to successfully respond to specific health questions and to obtain the necessary information (Beaglehole et al, 1993). In order to broaden the scope and relevance of epidemiology for public health, science must go beyond etiological research, connect more closely with innovative technologies and recognize key social transformations.
Epidemiology has expanded in the last decades, demonstrating new applications and variations of traditional epidemiological designs and training methods. Epidemiology is often described as 'the science of public health'. Applied epidemiology is a key element in formulating effective public health interventions to disease prevention and health promotion (Thacker et al, 2001).

2. MATERIALS AND METHODS

It was performed a narrative literature review of textbooks on epidemiology and public health. This was assessed through online textbook searches, available literature at the Plovdiv Medical University Library and accessible scientific databases. Epidemiology has a rich history of success in identifying the root causes of various health problems and in evaluating the effectiveness of preventive approaches. At the basic of classical science is descriptive epidemiology, etiological studies and the search associations or causations (Keyes et al, 2014). For public health practice and policy, epidemiology operates with modern design with a focus on applied science.

3. APPLIED EPIDEMIOLOGY AND PUBLIC HEALTH

Epidemiology and the information generated by epidemiological methods are used in many ways. The main applications of epidemiology in the field of public health are multitudinous.

Public health surveillance

Public health surveillance is defined as „the systematic, ongoing assessment of the health of a community, based on the collection, interpretation, and use of health data “. The surveillance is tantamount to monitoring the pulse of society (Teutsch et al, 2000).

Such monitoring can:

- Serves as an early warning system for public health emergencies;
- Document the impact of implemented health interventions or monitor progress toward specific health goals;
- Observes and clarifies the epidemiology of health issues, on the basis of which priorities are identified and health policies and strategies formulated. (Thacker et al, 1988).

This is achieved through the systematic collection and evaluation of reports of morbidity, mortality or other health information, as well as the dissemination of this data and its interpretation to professionals involved in disease control and decision-making public healthcare.

Public health assessment

Public health professionals are responsible for the development, implementation and evaluation of health policies using epidemiological information as a basis for evidence-based health policy. In order to assess the health of a population or a part of society by person, place and time (descriptive epidemiology), the relevant data sources must be identified, and the following questions answered:

- ✓ What are the actual and potential health problems of the population?
- ✓ Where they take place?
- ✓ Which populations (or groups of individuals) have at increased risk?
- ✓ What problems have reduced over time?
- ✓ Which ones are increasing or have the potential to increase?
- ✓ How do these models relate to the level and distribution of available public health services? (Aschengrau et al, 2013).

In order to answer these and other questions, more detailed data must be collected and analysed to show whether health services are affordable, efficient and effective. Public health professionals, using epidemiological data and problem identification methods, define health goals for the population as well as indicators for measuring progress toward those goals.

Clinical and individual health decisions

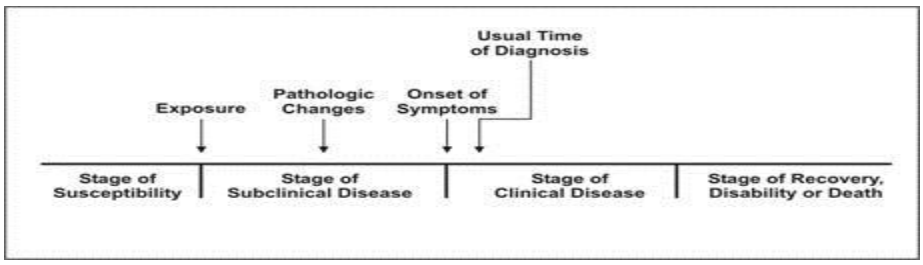
Epidemiology is crucial not only for public health but also for clinical practice. Practical medicine depends on data from population-based studies. For example, if a physician hears apical holosystolic murmur, how does he know it is mitral regurgitation? Where did this knowledge come from? Most often, the diagnosis is based on a correlation from a clinical finding (at auscultation of the heart with a stethoscope) and the findings of pathology during surgery or autopsy, as well as the results of catheterization or angiography in a large group of patients (Friis et al, 2014). In this way, the diagnosis process is population-based. The same applies to the prognosis of a disease. For example, the patient asks his doctor, "How long will I live, Doctor?" And the doctor replies, "six months to one year." How does the doctor make this prediction? Most often, this knowledge is based on the experience of large groups of the population who had the same disease at the same stage of the disease and at the same treatment. Again, the prediction is based on population data. Finally, the choice of appropriate therapy is also based on data obtained from epidemiological studies. (Gordis, 2014).

We may not be aware, but each of us uses epidemiological information to make our daily health decisions. (Aschengrau et al, 2013).

Studying the natural history of the disease

Epidemiology is also a tool in the study of the natural history of multiple infectious and non-infectious diseases (Figure 1), such as those associated with smoking - such as lung and cardiovascular disease or cancer of the mouth, bronchi and lung (Friis et al, 2014).

Figure 1. Timeline shows state of susceptibility, exposure, subclinical disease in which pathologic changes takes place, onset of symptoms, followed by usual time of diagnosis, clinical disease, followed by recovery, disability, or death (CDC, 1992).



Search for association or causation

Many epidemiological studies have focused on the search for a causal link between disease and risk factor. This is done to determine the exact cause and to take appropriate public health action. Epidemiology and laboratory science are constantly assembled to provide the evidence needed to establish causation. For example, in late July 1976, American Legionnaires returning from a state convention in Philadelphia began to fall ill with mysterious symptoms: pneumonia and fevers. Epidemiologists have been able to identify that there is a common source of the infection, it is transmitted through the air, caused by a bacterium unknown to date, and so far mostly attended the conference (Cordes et al, 1980). Legionella was discovered after an outbreak in 1976 among people who went to a Philadelphia convention of the American Legion. Those who were affected suffered from a type of pneumonia (lung

infection) that eventually became known as Legionnaires' disease. The first identified cases of Pontiac fever occurred in 1968 in Pontiac, Michigan, among people who worked at and visited the city's health department. It wasn't until Legionella was discovered after the 1976 outbreak in Philadelphia that public health officials were able to show that the same bacterium causes both diseases.

Field investigation

One of the first actions by epidemiologists to develop a disease outbreak is to study it. The investigation may be limited to a telephone call to the physician who found the disease to confirm or clarify the circumstances of the case reported. But it may also require an on-site investigation into the hearth, which will require the coordinated efforts of dozens of specialists. This is necessary to characterize the scale of the affliction and to identify the cause of the disease. These studies seek to elucidate the cause of the disease, the number of patients, and the number of contact persons (Goodman et al, 1990). The identification and treatment of patients and contact persons or their isolation in certain diseases prevents the disease from spreading further. For example, when the cause of the disease is some food or medicine, media reports about the non-use of this product can prevent many additional cases from occurring. Sometimes the purpose of field studies is to study the natural history of a disease, its clinical spectrum and the risk factors for its occurrence. Only then are they determined which intervention methods would be appropriate to prevent the disease. For example, in the 2003 SARS epidemic, cases were first identified on the basis of knowledge of the clinical picture, and then common characteristics of the risk population were sought - across time, place and individual differences. Severe acute respiratory syndrome (SARS) is a viral respiratory illness caused by a coronavirus, called SARS-associated coronavirus (SARS-CoV). SARS was first reported in Asia in February 2003. Over the next few months, the illness spread to more than two dozen countries in North America, South America, Europe, and Asia before the SARS global outbreak of 2003 was contained. This has helped to study the epidemiology of the disease, how it has transmitted the virus and formulate appropriate recommendations for stopping the spread of the infection (Huang, 2004).

Analytic studies

Outbreak surveillance and field studies are usually sufficient to identify the causes, the routes of transmission of the pathogen and the appropriate disease control and prevention measures. This is especially true for infectious diseases. However, analytical studies that use more rigorous epidemiological methods are sometimes required. Surveys and field studies formulate hypotheses about the causes and modes of transmission, and analytical studies evaluate the plausibility of these hypotheses.

Initially, the outbreaks of the disease are investigated using descriptive epidemiology. The descriptive approach involves examining the frequency (incidence) and distribution of the disease across time, place, and persons affected. Rates are calculated and sections of the population at higher risk of developing the disease are identified. Sometimes, when the relationship between exposure and disease is very strong, the investigation stops until descriptive epidemiology and control measures can be applied immediately. An example is John Snow's field study of the 1854 cholera epidemic (Hempel, 2007).

A distinctive feature of analytical studies is the use of a control group for comparison. Epidemiologists must be qualified in all aspects of a study. The epidemiological study involves several stages: design, planning, organizing and conducting, processing, interpreting and presenting the results.

- ✓ Design includes: defining an appropriate research strategy and project, written justifications and protocols, calculating the sample size, deciding on the selection criteria for the persons to be included in the study (e.g. defining 'cases'), selecting a suitable group for comparison, creating questionnaires, etc.
- ✓ Planning and organizing a survey includes: securing appropriate permissions and approvals (including permission from the Ethics Committee), retrieving data, selecting methods for processing information, securing funds, and more.
- ✓ Results processing - information analysis begins with a description of the characteristics of the study participants. It goes on to calculate ratios, create comparative tables (eg Table 2x2) and calculate the strength of association (eg Relative Risk or Chance Ratio), significance tests (such as $\chi 2$ test,), confidence intervals (CI) and other analyses. Many epidemiological studies require more sophisticated analytical techniques, such as stratified analysis, regression analysis, and modelling.
- ✓ Data interpretation involves prospective results interpretation and identification of key ideas, comparisons and making well-grounded recommendations. The strengths and weaknesses of the study should be taken into account (Dicker, 2006).

Evaluation

Epidemiologists systematically use quantitative approaches to assess public health and other health activities. Assessment is "a process of systematically and objectively defining established public health goals in terms of feasibility, relevance, effectiveness, efficiency and impact" (Beaglehole et al, 1993).

The process itself can be focused on a single stage or a combination of stages: evaluation focused on plans (plan evaluation), activities (process evaluation), impact (summary assessment) or results (Oleske, 2014). For example, evaluating a compulsory immunization program can evaluate the effectiveness of the process - as a percentage of persons immunized or as a result - of a disease that is preventable with a vaccine.

4. CONCLUSION

Applied epidemiology is a key element in formulating effective public health initiatives to prevent disease and promote community health. By studying the factors affecting health and disease in the population, it serves as a basis for building a logical approach to protecting and promoting public health.

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