

**The role of epidemiology in oral health research**

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**Abstract**

The clinical epidemiological interest has increased considerably lately and the application of epidemiological methods in the clinical activity is an aspect that takes into account the medical staff, as well as hospital managers and political makers. Descriptive epidemiological studies are used in assessment of a population health status, which allow evaluation of the prevalence of a disease, or of analytical studies, which are more complex and allow evaluation of the causal relationship between the disease and the risk factors. Moreover, clinical trials are the only experimental epidemiological studies, when well conducted and structured, can lead to the emergence of new drugs,

dental materials or curative interventions, more efficiently and possibly at reasonable costs.

**Keywords:** Oral Health, Epidemiology, Population Research.

**Introduction**

Epidemiology is defined as “the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the prevention and control of health problems” [1]. Epidemiological research on the oral health population is particularly useful, for different reasons:

First of all it helps to establish the number of sick people in the population, the prevalence of oral

pathology. These search studies allow the detection of underprivileged population segments from a socioeconomic point of view, as well as of those with an increased risk of contracting the disease.

-Second of all, epidemiological research allows knowing the real need for specialized treatments, the work force in the oral health care system and contributes to the introduction at this level of

-Third of all, analytical epidemiological studies allow establishing the causal relationship between the disease and the risk factors and allow the introduction of new and more effective materials / treatments /drugs into practice [2].

The present review paper emphasizes the importance of epidemiological studies in oral health clinical research, by reviewing the most important types of studies and their applications in dental field.

According to FDI facts, oral disease affects billion people worldwide, with untreated tooth decay (dental caries) impacting almost half of the world's population (44%), making it the most prevalent of all the 291 conditions included in the Global Burden of Disease Study Globally, between 60–90% of school children and nearly 100% adults have tooth decay, often leading to pain and discomfort [3].

In these situations, the accurate knowledge of the prevalence of oral diseases in all regions of the world represents an important topic on the table of political decision-makers and a necessity of oral health programs.

### **The importance of descriptive studies in oral health research**

Descriptive epidemiological studies provide a description of the health status of a population and are the first step in carrying out epidemiological research. Descriptive studies do not attempt to analyze the links between exposure and effect.

### **Case report and case series**

A case report or case series provides a careful description of a patient or several patients with a common disease or syndrome. Examples include descriptions of a patient's clinical course with an unusual facial infection, the presentations of cases with oral tuberculosis, a group of patients with fluconazole-resistant candidiasis or an unusual presentation of allergy in the oral cavity. The description should be complete and include other characteristics that may have influenced disease severity or symptoms. A case report is meant for use by another clinician who may evaluate a similar case [4].

Case reports and series must be viewed only as hypothesis generating, such as calling attention to a new clinical finding.

The classic example is the discovery of HIV infection. In New York and Los Angeles, the investigators noted in 1981 some unusual disorders of the immune system in a range of patients: Kaposi sarcoma and pneumonia with *Pneumocystis carinii*. The hypothesis of viral etiology appears and in 1982 appears the name of disease: Acquired Immune Deficiency Syndrome [5].

Other example of case series study is the study that established the relationship between therapy with bisphosphonates (used in the management of metastatic disease to the bone and in the treatment of osteoporosis) and osteonecrosis of the jaws on a sample of 63 patients with the diagnosis of refractory osteomyelitis and a history of chronic bisphosphonate therapy [6].

Of the descriptive studies, the most important ones in the study of oral pathology are **cross-sectional studies** used to calculate the prevalence of oral diseases in a population.

There are countries that regularly carry out such studies on representative samples of the population, focusing on

personal and demographic characteristics, behaviours towards health, which are examined in relation to age, sex and ethnicity.

A study of this kind is the National Health and Nutrition Examination Survey (NHANES), used for the annual assessment of oral and nutritional status of 5,000 subjects from US, aged 2-64 years [7].

Data collected in 1999-2004 found that 85.6% of people aged 20 to 34 had caries experience, while the prevalence was 94.3% in people aged 35 to 49, and 95.6% in people aged 50 to 64. Also of note was that there was an effect of gender: men had fewer caries compared to women (90.6% vs. 92.7%). The proportion of adults with untreated dental caries in the period 2005-2008 varied between 19.6% in people aged 65 to 74 and 25.1% [8].

When combined, the 2011-2012 data showed that roughly 27% of adults, aged 20-64, had untreated tooth decay. The authors of the NHANES study observed some differences in DMF scores based on race, also a difference in DMFT and DMFS scores between the genders: women demonstrate higher scores compared to men of the same age.

Another study developed in Thailand, found that 96.3% of children fewer than 6 years of age had dental caries and the DMFT and DMFS index in children with 12 years was 8.1 and 2.4, respectively. In the same study it was found that a large number of children who participated in this study consumed daily sugary foods and this has been correlated with the onset of dental caries [9]. In Romania, such studies have been carried out at regional level, both for children and adults, with no national study recently. For example, the studies conducted by Professor Rusu in 1986 and Professor Petersen in 1992, in Iasi, in 12-year-old children, found a DMFT of 3.1 in 1986 and 4 in 1992. [10, 11].

A study conducted in Iasi found a prevalence of 66.7% of dental caries in adults aged 35-44 years, and a value of 10.33 of the DMFT indicator [12]. In 2009-2019, in a study conducted in the counties of Moldova, the prevalence of dental caries was found to be 70.2% in the urban area and 72.7% in the rural area [13].

Prevalence studies are relatively easy to perform, when compared to the analytical ones, but if a national population research is desired, some problems related to the size of the population studied, the representativeness of the sample, and the confounding factors may arise [14].

The importance of observational analytical studies in oral health research. The incidence is another indicator of the frequency of the diseases, and its utility cannot be disputed. The study that allows the calculation of incidence is the cohort study. There are 2 types of cohort studies: prospective and retrospective studies.

In prospective cohort studies the investigators design the study, recruit subjects, and collect baseline exposure data on all subjects, before any of the subjects have developed any of the outcomes of interest. The subjects are then followed into the future.

The Framingham Heart Study, the Nurses' Health Study, and the Black Women's Health Study are good examples of large, productive prospective cohort studies. In each of these studies, the investigators wanted to study risk factors for common chronic diseases [15]. The Framingham Heart Study is a long-term, ongoing cardiovascular cohort study of residents of the city of Framingham, Massachusetts. The study began in 1948 with 5,209 adult subjects from Framingham, and is now on its fourth generation of participants.

Prior to the study almost nothing was known about the epidemiology of hypertensive or arteriosclerotic cardiovascular disease. Much of the now-common

knowledge concerning heart disease, such as the effects of diet, exercise, and common medications such as aspirin, is based on this longitudinal study [15].

A prospective cohort study in dentistry was conducted between 1986 and 2004 on a sample of 48,374 subjects aged 40-75 years in the US, with the purpose of establishing the relationship between periodontal disease and different types of cancer: colorectal, melanoma, lung, bladder and prostate.

The conclusion of the study was that participants with a history of periodontal disease have a reduced risk of developing cancer, compared with those who have no periodontal disease (OR =1.14, 95% CI 1.07–1.22) [16].

**Retrospective studies** also group subjects based on their exposure status and compare their incidence of disease. However, in this case, both exposure status and outcome are ascertained retrospectively.

**The case-control analytical study** is also an observational study used to establish the causal relationship between a disease and the etiological factor.

For example, the study named Oral Health of Parkinson's Disease Patients had the aim to examine the oral health status of Parkinson's disease (PD) patients, and to compare their oral health status to that of a control group. 74 PD patients and 74 controls were interviewed and orally examined. The conclusion was that more PD patients than controls reported oral hygiene care support as well as chewing/biting problems, taste disturbance, tooth mobility, and xerostomia, whereas dentate patients had more teeth with carious lesions, tooth root and biofilm[17].

#### **Clinical trials- experimental analytical studies in oral health research**

If a research study is testing an intervention as a treatment or an improved diagnostic for disease management, the study is a clinical trial. Intervention

includes anything that can alter the course of a disease, such as a pharmaceutical agent, a medical device, a surgical technique, a behavioural intervention, or a public health programme. Clinical trials typically are classified into phases (Phase I, II, III, or IV) that indicate their size and stage of development. A Phase I study is used to establish dose and safety of a drug or intervention. Once the dose and other parameters are established, the next phase (Phase II) begins. Many designs are employed for Phase II trials, which are conducted to determine initial efficacy of a new intervention. The most straightforward design is a Randomized controlled trial. The goal is to find the superior treatment and determine whether a future, larger trial is warranted. Phase II trials may be conducted at a single center or only enroll a population from one geographic area. A Phase III study is necessary to establish the efficacy of an agent. Large Phase III trials usually enroll hundreds to thousands of subjects at several clinical centers.

A Phase IV trial determines how well an efficacious treatment works in practice. This could include assessing how well the community of patients can comply with a drug schedule, such as taking a drug three times per day, and the frequency and severity of side effects associated with long-term use of a drug. These studies determine the effectiveness of a therapy [18]. It is estimated that 50 new clinical trials are published every month in the dentistry field [19]. In Dentistry the clinical trials are used for testing: a new filling material restoration, the clinical efficacy of different toothpaste formulations, used to evaluate pain levels in oral cancer patients in order to develop new drugs. For example, in United Kingdom, the clinical trial: Improving the quality of dentistry (IQua D), used to compare the effectiveness and cost-effectiveness of theoretically-based personalized oral

hygiene advice or periodontal instrumentation at different time intervals or their combination, for improving periodontal health in dentate adults with 63 dental practices (44 in Scotland and 19 in north east England [20]. Another example of clinical trials is: Endosseous Dental Implant Failure Clinical Trial in Borås, Denmark, with the aim to compare the clinical outcome of implants made of titanium-zirconium with a proven implant made of titanium and is used for 96 patients who need dental implant. The investigators can conclude that the materials are equivalent if there is no difference between implant types available. Since, titanium-zirconium alloy has a higher stiffness than titanium, the investigators will be able to provide patients with thinner implant and thus costly and painful treatments to optimize the width of the bone in the installation area should be avoided [21].

### Conclusions

Epidemiology is one of the tools used in public health. Knowledge of the disease burden in populations is essential for health authorities, who seek to use limited resources to the best possible effect by identifying priority health programs for prevention and care.

Epidemiology is also concerned with the course and outcome (natural history) of diseases in individuals and groups. Epidemiology is a basic medical science with the goal of improving the health of populations, and especially the health of the disadvantaged groups. Different types of epidemiological studies can be used for the study of a certain aspect related to oral health, according to the issue in research: prevalence (cross-sectional study), incidence (cohort study), etiology (case-control study), and intervention (clinical trial).

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