



Oral Epidemiology

Chapter 18

Objectives

Upon completion of the lecture, the student should be able to:

- Define epidemiology and its significance in dental public health.
- Analyze the multifactorial etiology of oral diseases using epidemiologic models.
- Differentiate between risk factors, indicators, and markers with clinical relevance.
- Evaluate epidemiologic study designs and their application in oral health research.
- Apply epidemiologic principles to improve community-based dental hygiene practice.

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Epidemiology

- Study of patterns (nature, cause, control) and determinants of the health and disease in defined populations
- Is it grounded in population thinking or thinking in terms of what will happen with the individual?
- Predictions can be applied to an individual within the population in terms of risk or probabilities
- Uses: To study, assess, identify, control, evaluate and research

Distribution of Disease

Endemic: relatively low but constant presence of disease in a particular geographic region.
Malaria-Africa

01

Epidemic: occurrence of disease in excess of normal in a specific community or region, usually occurring suddenly and spreading rapidly, often referred as an “outbreak”. 9 cases of measles in tarrant County, Tx in 2013, compared to normal rate of 0 to 2 each year

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Pandemic: Epidemic that crosses international borders to affect several countries:
Coronavirus

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Oral Epidemiology

Only study within epidemiology that is specifically confined to one component of the body and that is oral cavity

Without oral epidemiology would providers be aware of the association of oral diseases, risk factors and oral conditions? Y or N

Example: Clarified relationship of periodontal diseases, diabetes and blood dyscrasias, the bacterial origin of dental caries with sugar consumption, saliva quality etc

Disease is multifactorial

Multifactorial: A disease or condition has more than one causes!

Example: bacteria present, genetics, chromosomal disorders, nutrient deficiencies, social and economic factors etc



Determinants: A factor or event that can bring about a change in health.

Example: Social and economic environment, physical environment and individual characteristics and behaviors

Epidemiology Triangle

1. Agent: Biologic or Mechanical cause of a disease
“WHAT” factor

- Example : Specific bacteria in relation to dental caries, Brushing with a hard toothbrush in relation to abrasion

2. Host: Genetic or social factors that contribute to the person’s susceptibility or resistance. “WHO” factor

- Example: Tooth morphology, salivary flow, personal behaviors in relation to dental caries

3. Environment: external factors that contribute to disease transmission and severity “WHERE” factor

- Example: Smoking, nutrition

Measurement in Epidemiology

Morbidity: Extent of disease, disability or injury in a defined population.

Mortality: Refers to the death rate resulting from a specific disease or condition

Prevalence: Number of all existing cases of disease or health conditions at a given time

Incidence: Development of new cases of a disease or condition over a period of time

Eradication: Elimination of an infectious disease agent through surveillance and containment, contrasted to control, which is to keep the disease at a minimum level to that it no longer poses a health problem

Let's apply the definitions:

In US, 30000 people are diagnosed with oral or pharyngeal cancer each year is example of _____

In India, 130000 people die from oral cancer every year, this is estimated to be 14 deaths every hour is example of _____

Incidence: Annually, Tobacco users develop oral oral cancer lesions at a rate ranging from 5.2/1000 to 30.2/1000 is example of _____

Out of all adults with less than high school education 28.4% are smokers is example of _____

Elimination of polio in the US through vaccination is example of _____

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Other forms of measurements

- Count: Number of cases of the disease or condition in the population
- Is it simplest form of measurement or complicated?
- Does it provide enough information?
- Example: 20 patients presented in the community dental clinic for dental hygiene treatment with secondary herpetic lesions

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Other forms of measurement

- Proportion: Type of ratio that expresses the amount of disease or health condition with a fraction that presents it in relation to the size of the population, can be expressed as a percentage
- Does count becomes a proportion?
- Preceding example: 20 patients out of 200 or 10% presented with herpetic lesions

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Other forms of measurements

- Ratio: Expression of the magnitude of one occurrence of disease exposure in relation to another with a fraction; in contrast to a proportion, not necessary to have a relationship between the numerator and denominator
- Is proportion a type of ratio?

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Other forms of measurements

- Rate: Expression of disease in a population using a standardized denominator and including a time dimension, allows for a valid comparison
- Which of the following should be described as rate?
 - Prevalence or Incidence

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Other forms of measurements

- Index: Abbreviated, standardized measurement used to express, severity of problems and aid in data collection and analysis
- Does it give more information than a count, proportion and rate?

Time for some brainstorming

Oral cancers account for 3% of cancers in men and 2% of cancers in women in the US, the ratio of oral cancers in men versus women is 3:2 is an example of _____

42,000 Americans are expected to be diagnosed with oral or pharyngeal cancer in 2013 is an example of _____

57% of those diagnosed with oral or pharyngeal cancer in 2013 are expressed to die within 5 years is an example of _____

Rate of oral cancer in the US in 2013 is expected to be approximately 13 cases per 100000 people

Rate of oral or pharyngeal cancer are expressed in terms of how many are diagnosed at each stage of severity (Stages I, II, III and IV) is an example of _____

Clinical Assessment Methods to Measure

- Is clinical assessment same as clinical examination?
- Does it involve clinical diagnosis and corresponding treatment plan?
- They are non-diagnostic but aid in identifying unrecognized disease
- Two types of clinical assessment
 1. Basic screening
 2. Epidemiologic screening

Basic Screening

Rapid assessment
accomplished in short
time by visual
detection.



What tools are used
to perform basic
screening?



Provides information
about gross dental,
oral lesions, oral
disease

Epidemiologic examination

Is it same as basic screening?

Tools used: Dental instruments and a light source

Epidemiologic examination is used with most dental indexes.

Terminology related to validity and reliability of Measurement in Epidemiology

Validity: Accuracy of a measurement; measurement results are true or accurate

• OR

Validity: Ability of a measure to accurately classify people with and without disease

Sensitivity: The ability to identify all screened individuals who actually have the disease; influences validity

Specificity: The ability to identify only non-diseased individuals who actually do not have the disease; influences validity

Predictive Value: Combination of sensitivity and specificity.

• OR

Predictive Value: Ability of a test to accurately measure a disease or condition

Terminology continued

Reliability: Consistency of a measure to present the same result when it is repeated or
Consistency or reproducibility of a measurement over time


Inter-rater reliability: Agreement among two or more examiners as they apply a test or
index

Intra-rater reliability: Consistency of a single examiner in the application of a test or
instrument multiple times

Calibration: Standardization of examiners as they apply epidemiologic measurements

Terminology continued

Positive reversal: Change of a measurement made in the error in a logical direction



Negative reversal: Change of a diagnosis in an illogical direction over a period of time

Knowledge Check:

The ability of the DMF to identify caries when it is present is an explanation of _____

The accuracy of a DMF to indicate caries experience in children is an explanation of _____

The ability of the DMF to measure caries with accuracy without the use of other diagnostic tools is an explanation of _____

The consistency of an examiner to get the same results when repeating the DMF on the same child is an explanation of _____

The ability of the DMF to identify the absence of caries when the tooth has no carious lesion is an explanation of _____

Knowledge Check Continued

Training and standardization of the examiners on the use of DMF to measure caries is an explanation of _____

Two examiners agree when they measure DMF on the same individual in a study is an explanation of _____

One examiner is consistent when measuring DMF at several examination on the same individual is an explanation of _____

Caries is present when DMF is measured the first time and is absent when DMF is measured the second time is an explanation of _____

Caries is absent when DMF is measured the first time and is present when DMF is measured the second time, if the second measure is inaccurate is an explanation of _____

Oral Epidemiology Surveillance and Reports

- Surveillance: The observation of the disease process in populations
- Two types of Surveys: Passive and Active
- Passive: Data collected is voluntary
 - Example: HIV reported by dental personnel who are carriers, but the authorities do not actively solicit the data
- Active: Data collected out in the field to identify cases of disease
 - Example: basic screening survey

Oral Epidemiology Surveillance and Reports

Who conducts the Surveillance Activities?

SEER provides data of virtually all cancer, including oral cancer in the US

Refer to page 240, 241,242

Healthy People 2020

Vision is to create a society where people live long, healthy lives.



Four foundation health measures serves a guide:

General health status

Health-related quality
of life and well-being

Determinants of health

Disparities

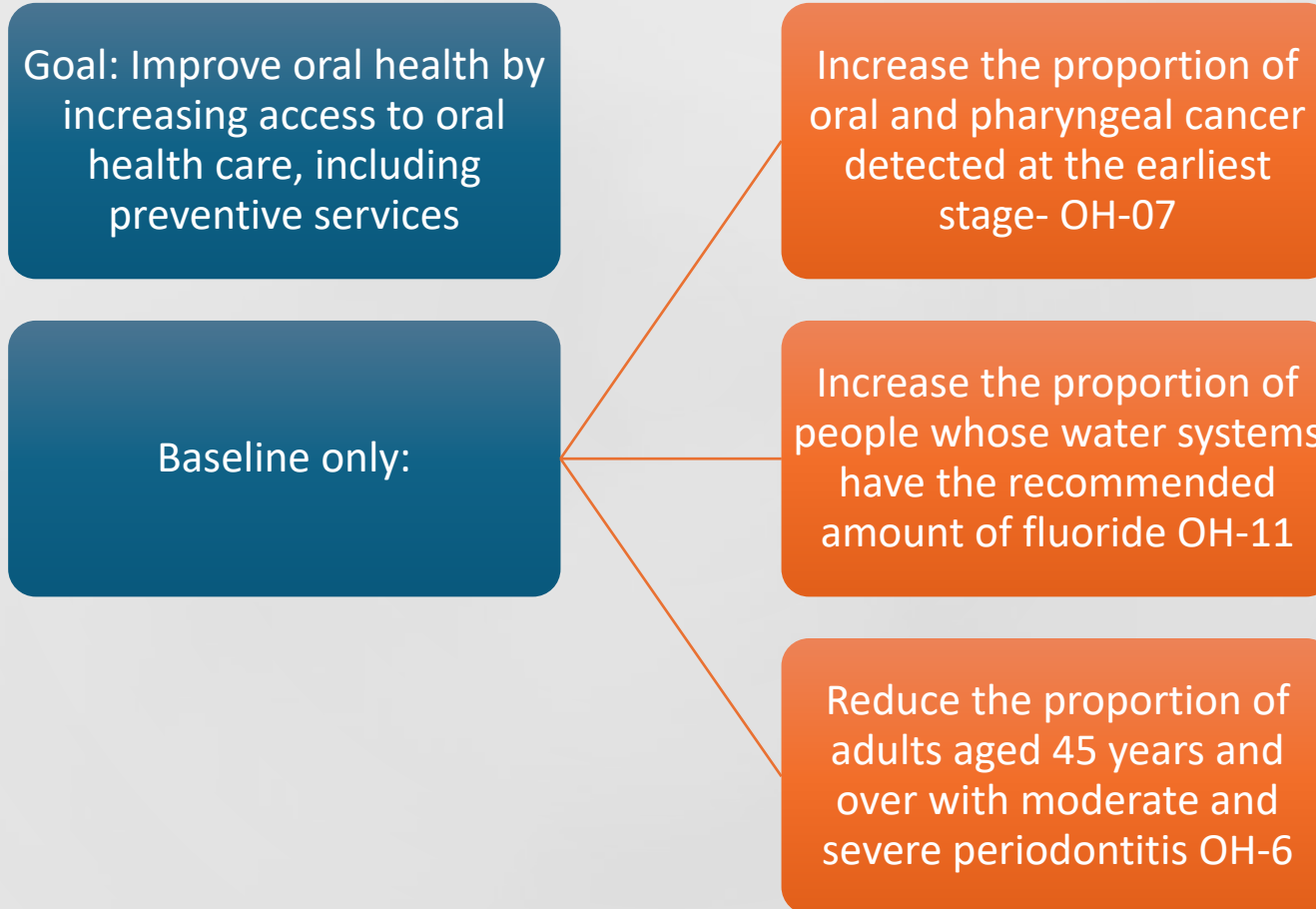
Healthy People 2020 continued

Goal: To prevent and control and craniofacial diseases, conditions and injuries and improve access to related services

Specific focus area of healthy people 2022 is oral health

Leading health indicator topics refer to pg: 242,243,244,245

Healthy people 2030



Healthy people 2030 Continued

1. Improving

- Reduce the proportion of adults with active or untreated tooth decay OH-03
- Reduce the proportion of children and adolescents with active and untreated tooth decay OH-02

2. Target met or exceeded

- Increase the use of the oral health care system OH-08
- Reduce the proportion of older adults with untreated root surface decay OH-04

3. Little or no detectable change

- Reduce the proportion of children and adolescents with lifetime tooth decay OH-01

Healthy people 2030 Continued

Getting worse

- Reduce the proportion of adults aged 45 years and over who have lost all their teeth OH-05
- Increase the proportion of low-income youth who have a preventive dental visit OH-09
- Increase the proportion of children and adolescents who have dental sealants on 1 or more molars OH-10

Developmental

- Increase the number of states and DC that have an oral and craniofacial health surveillance system OH-D01

Evolution of healthy people

- Is a collaborative and evolving program.
- Data driven and measures progress in 10-year intervals
- Refer to page 246,247 for goals and achievement
- Who are the key players in Healthy People's strategically aligned effort?
 - The Office of Disease Prevention and Health Promotion
 - The Assistant Secretary for Health
 - Health and Human Services
 - National Center for Health Statistics
 - Federal Agencies as well as non-HHS agencies

Risk and Causality

- Causality also referred to as cause and effect or causation.
- Causality means a particular exposure results in a particular outcome
- It is routinely used in dental hygiene practice to make decisions about what prevention and treatment programs to implement with individual patients or a population
- Risk means the probability that a specified event will occur

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Risk attributes

- Risk factor: Modifiable attribute or exposure known to be associated with a health condition or disease
 - Example: Smoking and Perio disease.
 - Identified with longitudinal studies (over time)
 - Has an established risk role; can be used to infer causality
 - Should be important consideration in making recommendations

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Risk attributes

- Risk indicator: Modifiable attribute
 - Identified with cross-sectional, correlational and limited longitudinal
 - Has a possible risk role, cannot be used to infer causality
 - Should be applied with care when making recommendations

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Risk attributes

- Risk marker: Also called a risk predictor or a demographic risk factor is an attribute that is associated with the increased probability of disease but is not considered to have a causal role in its development
 - Nonmodifiable : age, gender, race. SES etc
 - Not useful in controlling disease
 - Helps to identify target populations for dental public health programs
 - Cross-sectional and correlational studies

Epidemiologic Studies

Null hypothesis: A negative statement that proposes no relationship or difference between two variable

Alternative hypothesis: Also called research hypothesis, a positive statement that proposes a relationship or difference between two variables

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Experimental Studies

- Are Interventional meaning the conditions of the study are manipulated to try to affect the outcome, with one or more variable manipulated
- Purpose: To test a hypothesis related to a comparative question and establish a cause-and-effect relationship
- Example: A study to test the effect of using a power toothbrush versus a manual toothbrush on brushing frequency
- Experimental group: Group that receives experimental intervention
- Control group: Group that does not receive the intervention
- The control group can receive 3 types of treatment
 - Passive control: receives no treatment
 - Active control: receives standard or current treatment
 - Placebo: fake treatment that stimulates the experimental treatment

Experimental Studies continued

- Three types of variables
 1. Independent variable: the variable manipulated
 2. Dependent variable: the variable measured to determine
the effect of the independent
variable
 3. Extraneous variables: other variables that can influence the
the relationship between the
variables of interest in the study

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Experimental Studies continued

- Two types of trials:
 - 1. Clinical trials: well controlled and alter natural progression of a disease or condition
 - 2. Field trials: carried out on people who may or may not be patients

Clinical trial

- Application procedure: Refers to an instructions given to study participants, application by a person who will apply it correctly or professional supervision if self-applied
- Classified as:
 1. Efficacy: To test whether an agent or treatment regimen works
Example: electric tooth to reduce gingivitis
 2. Effectiveness: To test the way an agent or treatment regimen works in everyday conditions after its efficacy has been established
Example: electric toothbrush tested in general population of varied ages, abilities and oral health status

Non-experimental Studies

Occurrence of health and disease as they naturally occur in a population.

Also referred as observational studies

Variables are not manipulated

Three classifications of non-experimental studies are

- Descriptive
- Analytic
- Ecological

Non-experimental studies continued

Descriptive: Used to answer questions about the status or presence of a disease or condition in the population, measured at one point in time, can be repeated to determine change and trends

Variables are measured and reported in descriptive studies

Example: Description of oral hygiene habits in a population surveyed; survey can be repeated over time to measure changes in oral hygiene to establish a trend

Non-experimental studies continued

Analytic studies: Also known as developmental studies

Used to answer questions and test hypotheses about an association or relationship between health and disease and other elements related to risk

Two types of variables

- Exposure: The variable thought to affect the disease or condition being studied, similar to the independent variable of an experimental study
- Outcome: The disease or condition thought to be affected by the exposure, similar to the dependent variable in the experimental study

Three types of analytic research studies are

Cohort: One population or subset with common characteristics is observed and measured over time; longitudinal; prospective

Example: Observation of the effects of poor oral hygiene habits in children over a 10-year period.

Case control: Group with disease is compared to group without disease establish functional relationship, retrospective


Example: Comparing data in a group with gingivitis to a group without gingivitis

Cross-sectional: One group surveyed at one point in time

Example: Oral hygiene habits to gingivitis in a population surveyed

Non-experimental studies continued

Ecological: Compare previously recorded population data from two or more populations



Example: Existing data from different populations are used to attempt to oral hygiene and gingivitis

Validity of Epidemiologic Studies



Validity: The accuracy of a study, which is affected by procedures and controls used while conducting the study



Internal validity refer to the accuracy of the results of the study

Example: fluoride exposure and caries rate



External validity refers to the accuracy of generalizing the results from the sample to the population at large.

It is affected by how well the sample represents the population

Summary

We learned fundamental concepts of oral epidemiology.

We discussed multifactorial etiology about oral diseases.

We explored key epidemiologic measurements such as prevalence, incidence, ratios and rates.

We also reviewed epidemiologic study designs which include experimental and observational studies.

We discussed how to improve community based dental hygiene practice.