Exploring the Fundamentals of Public Health Dentistry

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By

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Cambridge
Scholars
Publishing

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This book first published 2025

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-0364-5197-4
ISBN (Ebook): 978-1-0364-5198-1

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PREFACE

With the grace of almighty the work of several years of hard work has come to be fruitful with the construction of this book. The chapters are designed to be concise, understandable and interesting for the students of graduation, postgraduation and those preparing for entrance exams. We have tried to comprehensively include all the topics related to public health dentistry in a more meaningful and up to date way. Both the authors have contributed towards the completion of this textbook. All the matter wherever taken from due credit is given to the authors of the specific original matter. This textbook comes with references at the end of every chapter for further reading. We hope this book will be of use to all the students related directly or indirectly to the subject of public health dentistry.

Dr. Swati Balsaraf
Dr. Revant Chole

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ACKNOWLEDGEMENTS

I would like to express my profound gratitude to my Guide Late. Dr. Ajay Bhambal, Ex-Dean, Professor and Head, Department of Public Health Dentistry, People's College of Dental Sciences & Research Centre, for his valuable guidance, constant support and encouragement.

I am ever indebted to Department of Public Health Dentistry, SAIMS, INDORE, M.P India where the conception of the idea of writing this book took place where I worked as a senior lecturer and to my colleagues for their guidance and timely help without which this Textbook would not have been a success.

I would also like to express my thanks to the library staff of Aurobindo College of Dental Sciences, Indore, India for providing me literature and study material as well as for their constant support.

I would like to express my sincere thanks to my Family and Friends whose unwavering support stood by me throughout the years while writing this book.

Above all, I thank the publishing company for giving us a chance to publish our work.

- Dr. Swati V. Balsaraf
- Dr. Revant Chole

CHAPTER 1

PUBLIC HEALTH - A BRIEF PERSPECTIVE

Introduction

Concept and Philosophy

Based upon the felt needs of the population, the main goal of public health is to ensure that local people and populations are served and have access to effective promotive, preventive and curative health interventions as well as the highest quality of clinical services. Public health arose from the need of people themselves when due to industrialization the workers had to face poor living habitats and poor drainage and sewage system which lead to many diseases and thus arose the need for public health. Public health is a responsibility of not only state society but also the individual. Many efforts were made to control, prevent and promote health through organized community efforts.[1]

Charles Edward A. Winslow in 1920 defined public health as - "The science and art of preventing disease, prolonging life and promoting health and efficiency through organized community efforts for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organization of medical and nursing service for early diagnosis and preventive treatment of disease, and the development of the social machinery to ensure for every individual in the community a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to realize his birth right of health and longevity."[2]

History of Public Health

Public health started when the life began on Earth, which arose due to sympathy towards the ill person and care and compassion for the healing. Adam was considered the first doctor and Eve the first nurse.

Primitive Medicine

The concept of disease in which the ancient man believed was *the supernatural theory of the disease*. Medicine practiced was by means of charms, amulets, prayers, rituals, and sacrifices. They believed that practicing these would bring good health and luck for the person. Sacrificing animals in front of deity is still practiced and considered warding off evil which would happen to the person.

Fatalistic Theory implies that Gods reward or punish individuals on basis of their good or evil deeds.[2] The disease leprosy was considered as the punishment to the person as a result of his evil deeds, and that person was ostracized from the society and left to die his sole death.[3]

Indian Medicine (5000 BC)

The Ayurveda proposes the Tridosha *theory of disease* i.e. the disease is caused by disturbances in three humors in our body Vata (wind), Pitta (gall) and Kapha (mucous) in the body.

Chinese Medicine (2700BC)

Based on two principles – *Yang and the Yin.* The balance between these two means good health. They were pioneers of barefoot doctors. Yang was considered a positive masculine element and Yin a negative feminine element. Barefoot doctors would reach that part of population which was neglected and had no ready access to medicine facility.[4]

Egyptian Medicine (2000BC)

The Edwin Smith Papyrus and the Ebers Papyrus are best known for their medical skills.[4] There is mention of cure for hypertension, stomach ailments and many more which surprises the doctors of today that such treatment was available since Egyptian time.

Mesopotamian Medicine (6000 years ago)

Hammurabi the king of Babylon proposed a code of hygiene. Medical students were busy practicing geomancy. [5] The doctors who suggested wrong treatment modality were in a state of losing their life at the hands of the king Hammurabi.

Greek Medicine (460-136 BC)[5]

They suggested the *theory of humors.* The four elemental fluids of the body – blood, phlegm, black bile and yellow bile correspond to the four humors – sanguine, phlegmatic, melancholic and choleric respectively and the disturbances in these humors cause disease.

Roman Medicine (1st century BC)

Public health was born in Rome. They built planned cities. They believed that disease is due to three factors; predisposing, exciting and environmental factors.[6]

The Greco – Roman World

The Greco-Roman approach towards Personal hygiene and environment sanitation remains unparalleled in history.

Middle Ages: (500-1500AD) (Dark ages)"

The Middle Ages were also known as "The Dark Ages". During this time, there was an ending to Roman ideology.

The two theories of epidemic disease which remained popular during 16th & 17th century were Miasmic Theory which held that diseases are caused due to polluted air, poisonous vapors which are nasty, foul smelling, and arise from decomposed matter. Contagion Theory held that epidemics resulted from transmission of germs.[2]

Revival of Public Health

The industrial revolution brought more complex health problems, which lead to the development of the concept of public health.

John Snow

His survey of cholera epidemic and their association with a water pump at Broad Street, London gave birth to applied epidemiology.[7] In his survey, it was found that a particular part of the society who took water supplied from the broad street pump had major cases of cholera. When the pump handle was taken off, people couldn't access water from that source, thus limiting the number of cases, and it was proved that cholera is a water-borne disease.[7]

Changing Concepts of Public Health

Disease Control Phase (1880–1920)

During this period, sanitary legislation and sanitary reform aimed to control man's physical environment.[2]

Health Promotional Phase (1920–1960)

Personal health services, mother child health services, school health services took front stage.

Social Engineering Phase (1960–1980)

Social and behavioral aspect of disease and health was given a new priority. Problems such as cancer, diabetes, drug addictions were addressed as the pattern of disease began to change.[3]

The World Health Organization

The World Health Organization (WHO) was established by the United Nations on April 7, 1948[1]

Health for All Phase (1981–2000AD)

The goal was the attainment of a level of health that will permit all people to lead a socially and economically productive life.

Future of Public Health

The growing population of the world is of biggest concern as the capacity to meet the needs for food, clothing, shelter health care, education, and employment has become difficult.[1]

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CHAPTER 2

DENTAL PUBLIC HEALTH

Dental Public Health

Dental Public health is a branch of Public health which deals with the disease and its study concerning the dental health conditions and states. It's a newer branch as compared to the public health. The shoe leather survey of dental fluorosis done by Trendley H Dean is an example of study in Dental public health. [1]

Dental Public Health according to American Board of Dental Public Health-

- Science and Art of preventing and controlling dental disease and promoting dental health through organized community efforts. It is that form of dental practice which serves the community as a patient rather than the individual.

Similarities Between Personal and Community Health Care:[2]

Sr. No.	Patient	Community
1.	Examination	Survey
2.	Diagnosis	Analysis
3.	Treatment planning	Programme planning
4.	Treatment	Programme operation
5.	Payment for service	Finance
6.	Evaluation	Approval

A public health dentist differs from a clinical dentist in many ways. The differences are listed as follows:

	Public Health Dentist	**Clinical Dentist**
1.	Individual patient is target	Community or group of individuals.
2.	History taking or Oral clinical examinations	Analysis of available health and morbidity records.
3.	Investigations like Radiography, blood test,biopsies, exfoliative cytology	Epidemiologic survey
4.	Diagnosis	Situational analysis of oral health status and needs and utilization of services.
5.	Treatment plan based on diagnosis, patient attitude and affordability	Action plan based on demands, available resources and priorities.
6.	Curative and restorative care.	Promotive and preventive care.
7.	Patient's consent and cooperation	Community participation
8.	Dentist alone, sometimes with an assistant	Health team professionals and para professionals, community volunteers.
9.	Appropriate dental procedure	Promotive and preventive measure at individual and community level.
10.	Recall, further sittings	Continuing care, self-care
11.	Funding by the patient	Generally, by local or government authorities.

Overall principles or guidelines followed in dental public health practice[3]

1. Public health work is done in areas where group responsibility is recognized.
2. Public health work relies on team effort.
3. Prevention of the disease is the main goal. Reason being - Ethical (prevention is better than cure).
4. Teamwork
5. Cost efficiency

6. Deals with the search for the cause of the diseases. (epidemiology)
7. Biostatistical methods give a comparative analysis of the population seen and form the basis for further studies.
8. Public health worker deals with the healthy as well as the sick.
9. Health education and communication of the local population.
10. Payment of health care made easy.

Tools of Dental public health:

1. Epidemiology
2. Biostatistics
3. Social sciences
4. Principles of administration
5. Preventive dentistry

1. Epidemiology:

It is defined as the study of the distribution and determinants of health related events in population and the application of this study in the prevention and controlling of diseases.

2. Biostatistics:

Statistics is the science of compiling, classifying and tabulating numerical data and expressing the results in a mathematical or graphical form. Biostatistics is that branch of statistics concerned with mathematical facts and data relating to the biological events.

3. Social sciences:

Social sciences usually include sociology, cultural anthropology and psychology. They frequently include economics, government and sometimes history as well.[4]

4. Principles of administration:

A dentist with a leadership role in a public health program needs to know many of the principles by which large enterprises are administered.

5. Preventive dentistry:

It is, in its broadest sense, all the dentistry and encompass those practices by individuals and communities that affect the oral health status. Preventive

dentistry can be practiced by introducing levels of preventions at primary secondary and tertiary levels on community, professional and individual levels.[5]

Services Provided Through Public Health Dentistry

1. Health Education in Community
2. Delivering dental treatments to the community through organized dental health camps especially in rural areas.
3. School health programs to deliver dental care of the mouth.
4. Application of caries preventive measures such as topical fluoride application, pit and fissure sealants.
5. Demonstration of new dental preventive methods and preventive and procedures to community.
6. Conducting dental public health activities and field experiences for dental students and dental student nurses.[6]

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CHAPTER 3

CONCEPT OF HEALTH AND DISEASE

Definition of health

According to WHO health is "is a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity"

This definition was later on modified as it lacked many dimensions of health which are important for assessment of health.[1]

Let us discuss various concepts of health

Changing Concepts of Health

Biomedical Concept

It is based on the "germ theory of disease". This concept considers body as a machine and any disease as the breakdown of the machine, and a doctor as a person who repairs the machine. This definition was later on refuted as it lacked consideration for other factors such as environmental, cultural, etc.

Ecological Concept

Man can never be separated from his environment. The environment plays significant role in health of a person so any maladjustment with environment can lead to disease causation. Thus, for a healthy and long life adjustment, the environment is essential.

Psychosocial Concept

The social, cultural, psychological, political and economic factors are also responsible for better and good health. Thus, refuting that it is just a biomedical phenomenon.

Holistic Concept

This concept states that health is a consequence of intermingling of all the sectors of society. Thus, it is a multidimensional phenomenon of all the aspects as mentioned above. It believed in the health promotion and protection of health. This concept of health is considered the most fulfilling and complete definition of health.[1]

Dimensions of Health

There are many dimensions of health, and the overall functioning of the body depends on intermingling and coordination of all dimensions of health.

- **Physical Dimension**: this dimension states that body is a physical organ made of organs and organ systems and each cell in the body is working at optimum level and in harmony with other body organs.[2]
- **Social Dimension**: this dimension is based on the fact that a person's health depends on interpersonal relationships and his behavior and involvement in community.[2]
- **Mental Dimension**: states that mental health is as important as physical health, that the person is in complete harmony with their sense of self and their environment. They have not lost touch with the real world around them and are aware of themselves and their environment.
- **Spiritual Dimension**: this dimension states that health is also trying to achieve something intangible which satisfies a person's need for importance and meaning in life. They try to find what their purpose of life is through spirituality.[3]
- **Emotional Dimension**: Mental and emotional dimensions are closely related, and emotional dimensions are based on feelings as a person.
- **Vocational Dimension**: This dimension is work related and states that for well-being, a person's job related satisfaction is also significant. Health consequences are seen when a person loses their job or when a person faces mandatory retirement. Some sort of anxiety and depression is faced by many old-aged people.[4]

Determinants of Health

- **Biological**: The health of a person depends on his genetic makeup. Many diseases are related to genes such as mental retardation, diabetes and chromosomal anomalies.[3]
- **Behavioral and Sociocultural**: There are many diseases which are lifestyle associated, hence promotion of good health is important. Lack of sleep, poor nutrition, consumption of alcohol, cigarette is injurious to health, thus cultural factors, attitude, and customs are underpinned in it. [4]
- **Environmental**: environment could be internal or external. Internal environment means the lifestyle, eating habits or the internal environment of the body. External environment is related to all that is external to human body such as atmosphere or culture, which to a large extent determines the health of a person.
- **Socio Economic**: this encompasses education, occupation, and income of a family or person which determines the uptake of a good standard of living and thus health.[6]
- **Health System**: health care services would provide many disease control programs, maternal and child health and provision of safe food and clean water supply, thus promoting social and economic health of society.[7]
- Health indicators-

1. Mortality indicators
2. Morbidity indicators
3. Disability indicators
4. Nutritional status indicators
5. Health care delivery indicators
6. Utilization rates
7. Indicators of social and mental health
8. Environmental indicators
9. Socio-economic indicators
10. Health policy indicators
11. Indicators of Quality of life
12. Other indicators[1]

Levels of Health Care

- Primary health care:
  First level of contact between Individual and Health System.
  Care is provided by primary health centers and sub-centers.

- Secondary health care
  More complex problems are dealt with.
  District hospitals and community health centers.

- Tertiary health care
  Offers super-specialist care by regional/central level institutions.
  It also provides planning and managerial skills and teaching for specialized staff
  Supports and complements actions at PHC.[5]

Concept of Disease

Concept of Disease Causation

- Disease (definition as per Webster)
- A condition in which body health is impaired, a departure from a state of health, an alteration of the human body interrupting the performance of vital functions.

  A condition of the body or some part or organ of the body in which its function is disrupted or deranged.

- The supernatural theory of disease: medicine practiced was by means of charms, amulets, prayers, rituals, and sacrifices.
- Fatalistic Theory: *theory* implies that Gods reward or punish individuals on basis of their good or evil deeds.
- Demonistic Theory: Individuals suffering from the diseases were possessed by demons.
- The theory of humors: The four elemental fluids of the body – blood, phlegm, black bile and yellow bile correspond to the four humors – sanguine, phlegmatic, melancholic and choleric respectively and the disturbances in these humors cause disease.
- The concept of contagion: which held that epidemics resulted from transmission of germs.

- Miasmatic theory of disease: Theory which held that disease is caused due to polluted air, poisonous vapors which are nasty foul smelling arising from decomposed matter.
- Germ theory of disease: French bacteriologist, Louis Pasteur in 1860 demonstrated the presence of bacteria in air & advanced Germ theory of disease. & disproved the spontaneous generation theory. Robert Koch-1877, showed that Anthrax was caused by bacteria. The discoveries of Pasteur & Koch confirmed the Germ theory of disease.[4]

Types of Causes

Deterministic Cause: It Is Impossible To Say That We Know All The Causes Of Diseases So A Same Level Of Risk Is Assigned To All Patients Ex-Posed To The Known Causes. But There May Be Hidden Causes Which Make Us Assign An Average Value To Them, Which Eventually Become The Decid-Ing Cause For A Disease To Occur.

Necessary Cause: A Cause Without Which The Disease Cannot Appear.
Sufficient Cause: A Cause Which Inevitably Produces Or Initiates A Disease.

Epidemiologic Triad

The epidemiologic triad consists of three predisposing factors which cause disease when allowed to intermingle with each other for a sufficient period of time.

1. Host factors: host factors are such as human body, tooth, age, gender, economic, or education of an individual.
2. Agent factors: they can be physical, chemical or biological factors
   Physical factors such as sharp objects and heavy machine parts are leading cause of injury at work place.
   Chemical factors such as chemicals in battery factory workers leads to erosion, acid burns or chemical poisoning.
   Biologic factors are bacteria, viruses, fungi or protozoa.
3. Environmental factors: factors such as climate, rain fall, geographic area, location, soil, temperature, saliva
4. Time: time is an essential factor because the duration for which the other three factors interact results in disease progression.[6]

Iceberg Phenomenon

Floating tip – what physician sees in community – clinical cases

Vast submerged portion – hidden mass of disease – latent, presymptomatic & undiagnosed or carrier cases

Water line – demarcation b/n apparent and in apparent cases

Multifactorial causation: It was proposed by Pettenkofer of Munich. This causation helped in explaining the modern diseases such as hypertension, diabetes, obesity because they were due to multiple factors. [7]

Web of causation: Web of causation was given by McMohan & Pugh. It is applicable in certain chronic diseases in which the causative agent may be unknown, and the disease is a result of interaction of multiple factors.

Risk Factors

Risk factors are those determinants or variables whose presence increases the chances for disease to occur. For e.g., Diabetes, hypertension and obesity are risk factors for Brain Stroke.

Natural History of Disease

It represents the course of disease from its initial stage to termination either as recovery, disease or death.

Prepathogenesis phase: Agent has not entered man, but factors which favor its interaction with human host are already existing in the environment.

Pathogenesis phase: Begins with entry of agent in the susceptible host. IT may result in disability disease or death or recovery.[8]

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CHAPTER 4

EPIDEMIOLOGY - PRINCIPALS AND METHODS

Epidemiology

Introduction

Epidemiology is a relatively new science, emerged in 19th century. In strictest terms, it means study of epidemics. Epidemiology is made from the word EPI= upon and demos means people and logy = study. Thus, epidemiology also means study which is done on people.

Components of Epidemiology

- Disease frequency
- Distribution of the disease
- Determinants of disease

Aims of Epidemiology

1. To describe the distribution and magnitude of health and disease problems in human populations.
2. To identify etiological factors (risk factors) in the pathogenesis of disease.
3. To provide the data essential to the planning, implementation and evaluation of services for the prevention, control, and treatment of disease and to the setting up of priorities among those services.[1]

Objectives

1. To identify the etiology or the cause of a disease and the risk factors- that is, factors that increase a person's risk for a disease.
2. To determine the extent of disease found in the community.
3. To study the natural history and prognosis of disease.

4. To evaluate both existing and new preventive and therapeutic measures and modes of health care delivery.
5. To provide the foundation for developing public policy and making regulatory decisions relating to environmental issues.[2]

Tools of Measurement

1) Rates
2) Ratios
3) Proportions

1. **Rate**: It measures the occurrence of some particular event in a population during a given time period. It indicates the change in some event that takes place in a population over a period of time.

$$\text{Death rate} = \frac{\text{Number of deaths in one year}}{\text{Mid-Year population}} \times 1000$$

2. **Ratio**: It expresses a relation in size between two random quantities.

X:Y or X / Y

3. **Proportion**: A proportion is a ratio which indicates the relation in magnitude of a part of the whole.

Measurements of Morbidity

1. Incidence
2. Prevalence

Incidence:

- Measure of number of new cases of disease (or other events of interest) developing in a population during a specific period of time. E.g. Annual incidence, five-year incidence. It is also a measure of the probability that unaffected persons will develop the disease. Useful when examining an outbreak of a health problem.
- Incidence per 1000=

No. Of new cases of a disease occurring in the population during a specified period of time X 1000/ number of persons at risk of developing the disease during that period of time.

Special incidence rates

1. Attack rate
2. Secondary attack rate
1. An attack rate is defined as:

No. of people at risk in whom a certain illness develops
Total number of people at risk.
A person who acquires the disease from an exposure (e.g.,: contaminated water) is called a PRIMARY CASE. A person who acquires the disease from exposure to a primary case is called a SECONDARY CASE.
USES

1. To control disease.
2. For research into etiology and pathogenesis, distribution of diseases.
3. For checking efficacy of preventive and therapeutic measures.

Cumulative Incidence: The proportion of individuals who become diseased during a specified time period. Time period can be a calendar year, 6 months, 3 years, 5 years, etc.[3]

Prevalence

It is defined as the number of existing cases of disease or other condition in the population at a specific time divided by the number of persons in the population at that time.

Prevalence per 1000=
No. of cases of a disease present in the population at a specified time X 1000
No. of persons in the population at that specified time

- Prevalence is of Two Types

a) Point prevalence
b) Period prevalence

- Point prevalence

Formula:

$$= \frac{\text{number of all current cases (old and new) of a specified disease existing at a given point in time}}{\text{estimated population at the same point in time}} \times 100$$

Period prevalence:

$$\text{Interval} = \frac{\text{Number of existing cases (old and new) of a specified disease during a given period of time}}{\text{Estimated mid-interval population at risk}} \times 100$$

Uses[4]

1. Helps to estimate the magnitude of health/disease problems in the community and identify potential high – risk populations.
2. For administrative and planning purposes, e.g., hospital beds, manpower needs, rehabilitation facilities.

Relationship between prevalence and incidence

$P = I \times D$

= Incidence X Mean duration

CONVERSELY

Incidence = P/D

Duration = P/I

Measures of Public Health Impact

Relative Risk: Measure of the *strength of association*, and indicator used to assess the possibility of a causal relationship.

Attributable Risk (AR): Measure of the potential for *prevention of disease* if the exposure could be eliminated (assuming a causal relationship).

Among the exposed, how much of the disease that occurs can be attributed to a certain exposure is of primary interest to the practicing clinician.

Attributable Risk (AR):
$AR = I_{exposed} - I_{nonexposed}$ = "Risk Difference"

Epidemiologic Methods[1]

1) Observational studies

a) Descriptive studies
b) Analytical studies:

1. Ecological/Correlation - with populations as unit of study.
2. Cross-sectional/Prevalence - with individuals as unit of study.
3. Case-control/Case-reference: with individuals as unit of study
4. Cohort / Follow-up: with individuals as unit of study

2) Experimental studies/Intervention studies

a) Randomized controlled trials/clinical trials, with patients as unit of study
b) Field trials/community intervention studies, with healthy people as unit of study
c) Community trials, with communities as unit of study

Observational Studies[2]

Case Reports (Case Series)

Report of a single individual or a group of individuals with the same diagnosis

Advantage: You can aggregate cases from disparate sources to generate hypotheses and describe new syndromes. Example: hepatitis, AIDS, "pool fingers"

Limitations: You cannot test for statistical association because there is no relevant comparison group

Cross-Sectional Studies

Cross-sectional studies or prevalence studies measure disease and exposure simultaneously in a well-defined population.

Advantages

1. Prevalence studies cut across the general population, not simply those seeking medical care
2. They are good for identifying the prevalence of common outcomes, such as arthritis, blood pressure or allergies

Limitations

1. You cannot determine whether exposure preceded disease
2. Since you determine prevalent rather than incident cases, results will be influenced by survival factors

Correlational Studies [4]

Correlational studies (ecological studies) use measures that represent characteristics of entire populations (a real aggregates) to describe outcomes in relation to some factor of interest such as age, time, utilization of services, or exposures.

Advantages

1. You can generate hypotheses for case-control studies and environmental studies.
2. You can target high-risk populations, time-periods, or geographic regions for future studies.

Limitations

1. Because data are for groups, you cannot link disease and exposure in individuals

- Example: Percentage of teenagers taking driver's education and fatal teenage car accidents study done by National Safety Council.

2. You cannot control for potential confounders.
3. Data represent average exposures rather than individual exposures, so you cannot determine a dose-response relationship.