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FUNDAMENTALS AND PRACTICES OF PREVENTIVE MEDICINE AND PUBLIC HEALTH

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Abstract

Preventive medicine is a specialty that focuses on the health of the population as a whole, rather than on specific diseases in individual patients. Its underlying philosophy is that health is a valuable asset that enhances quality of life and productivity, and that disease, injury, and other health problems should be prevented whenever possible. Public health is often viewed as synonymous with preventive medicine, as its objective is to improve and protect the health of the community and establish policies that prevent health problems. Preventive medicine and public health practitioners play a vital role in this by designing, implementing, and evaluating effective interventions.

The aim of this text is to provide a concise overview of preventive medicine and public health fundamentals, covering definitions, history, resources, levels of prevention, the epidemiologic triangle, and examples of public health intervention. It is hoped that this overview will be useful in understanding and conserving community health, and that it will inspire further public health endeavors. Preventive medicine and public health are terms that are often used interchangeably. Preventive medicine is a specialty recognized by the American Board of Medical Specialties that traditionally aimed to prevent diseases and injuries in specific populations, such as children in private practice. However, the emphasis transitioned to public health.

Public health is a broader field that encompasses preventive medicine professionals and non-physicians engaged in similar activities, including epidemiologists and health planners. Health is defined as "a complete state of physical, mental, and social well-being," not just the absence of disease. This definition has been contested, as it implies that those who are elderly or disabled are

unhealthy. Health is a valuable asset that enables individuals to lead happy lives, enhances productivity, and is fundamental to national growth and development.

1.2 **Keywords**

Preventive Medicine Preventive medicine, an important branch of medicine, is fundamentally concerned with the promotion of individual, community and environmental health, the prevention of the onset and progression of disease, and the assurance of the health of the public and the environment as an integral component of the continued and sustainable development of society (Schwaid, 2017). Public Health Public health is a derivative technology that applies preventive medicine theories and knowledge in an ecological context. Public health is defined as the practice of preventing disease, prolonging life and promoting health through organized efforts and the informed choices of society, organizations, public and private communities and individuals. Factually, public health is primarily concerned with community health and thus customarily regarded as a sub-discipline of, or closely related, to preventive medicine. However, public health and preventive medicine are distinct. Public health refers to the community aspect of health, health-related activities and health technologies, while preventive medicine refers to the individual aspect of health, health-related activities and health technologies. In other words, public health is community health, while preventive medicine is personal health.

1.3 **1. Introduction to Preventive Medicine and Public Health**

Preventive medicine is the practice of promoting health and preventing disease. It encompasses a range of activities at the individual, community, and societal levels. Public health focuses primarily on the health of populations or communities. Preventive medicine and public health are concerned with the promotion of health, the prevention of disease, and the management of health risks. As with many fields, they have evolved over time, with notable changes in philosophy, outlook, and concerns (Cowan, 2018). Nevertheless, the fundamentals and practices of preventive medicine and public health encompass many of the same principles, approaches, and issues. Public health won a field of action, but preventive medicine remained a field of training. Preventive medicine and public health are disciplines concerned with promoting health, preventing disease, and managing health risks. Both disciplines have evolved over time but share many fundamental principles and practices (Schwaid, 2017). Preventive medicine was incorporated into medical education early on, while public health grew as a response to deteriorating health conditions among populations and communities.

1.1. Definition and Scope

Preventive medicine is the science and art of preventing disease, prolonging life, and promoting health through organized community efforts. Preventive medicine and public health foster the evolution of society and improvement of quality of life. The combination of preventive medicine and public health is essential for human wellbeing and sustainability of our planet (Cowan, 2018). Preventive medicine emphasizes individual and clinical preventive care, which can be practiced by physicians, nurses, and allied health professionals. Community preventive care, which is the concern of public health, relies on knowledge on pathogenesis, transmission and control of health hazards at the population level (Schwaid, 2017). Although pathogenesis of diseases is well elaborated even for most recently discovered diseases, current epidemiological and biomedical technologies are often inadequate to control health hazards in the community. Infectious diseases are still the major threat of human population. Globalization, extensive use of antibiotics in agriculture, and emergence of bioweapons may potentiate the emergence, re-emergence, and

dissemination of infectious diseases. On the other hand, lifestyle-associated non-infectious diseases have become epidemic worldwide. Public health and preventive medicine must meet these global challenges.

1.2. Historical Context

Preventive medicine and public health are relatively new disciplines in the context of human civilization, as it generally is with any kind of systemic approach to illness. Immortality being the unattainable quest of humanity, illnesses as well as means of coping with them accompany the entire human history. Knowledge on illnesses, disease course, and possible coping and treatment options is as old as the written human history itself. From the ancient Sumerian "Medical Recipes" and the Egyptian papyrus documents, ancient Greek philosophers and physicians' outreach, and physicians' tales from faraway places told in religio-mythological books, knowledge on illnesses has been accumulating, coalescing, redistributing, and evolving across the globe (H. Tulchinsky & A. Varavikova, 2014).

Public health, as a response of societies to diseases affecting community health, has been evolving since the very beginning of organized societies. The oldest testimony on legal regulation of collective disease control, prescribing sanitation measures affecting the community, comes from the 10th century B.C.E., in the book of Leviticus from the Old Testament. It describes measures aimed at controlling the spread of a presumed contagious disease affecting individuals in Hebrew communities. Quarantine of diseased individuals and sanitation measures affecting whole households and community housing are prescribed. Such measures are to be undertaken as a response to the priest's observation of the apparently diseased individuals. Priest-medics played an important role in public health as it is known in contemporary terms — the disease control measures description is written in the form of commands to priests.

In the 5th century B.C.E., a Greek philosopher and physician Hippocrates described in his famous work how environmental factors affect population health and why some communities suffer from endemic diseases. He is also the author of the widely quoted Hippocratic Oath, progenitor of medical ethics in its contemporary understanding. The "History of the Peloponnesian War" describes a plague in Athens in 430 B.C.E., with a very detailed account of the disease course as well as people's and state's responses to it, which provides a basis for epidemiological inquiry still in use today. Throughout the ancient times, collective disease control measures were mostly prescribed by the tradition and enacted by priests.

1.3. Key Principles

Preventive medicine is defined as the branch of medicine concerned with preventing disease and promoting health. Public health is defined as the science and art of preventing disease, prolonging life, and promoting health through the organized efforts of society. Although public health was traditionally seen as society's responsibility, the recent emphasis on individual responsibility should not undermine the importance of societal obligations. Preventive medicine and public health practices are based on levels of prevention, principles of epidemiology, and the public health system (AbdulRaheem, 2023).

Preventive measures are taken before a disease is present to prevent its emergence. Potential risk factors are identified and mitigated to avoid new diseases. Examples of primary prevention include vaccination and health education programs. Preventive measures are undertaken after a disease is present but not symptomatic to prevent its progression to a more serious state. Screening programs

are undertaken to detect the disease at an asymptomatic stage and treat it before it progresses to a symptomatic stage. This is secondary prevention. Preventive measures are taken after the disease has been diagnosed and treated to prevent complications and recurrence. This is tertiary prevention.

1.4 2. Epidemiology in Public Health

Epidemiology is the scientific discipline that forms the foundation of public health. Epidemiology examines the distribution and determinants of disease in human populations. Epidemiology is derived from three Greek words: 'epidemos' meaning 'on or upon people', 'logos' meaning 'study' and, 'ium' meaning 'pertaining to' (Cowan, 2018). Epidemiology studies how disease is distributed in populations and what determines this distribution. The emphasis is on population rather than on individuals. The goal of epidemiology is to control the health problems of populations. Epidemiology is the essential core of any public health program. The practice of epidemiology combines knowledge of the natural history of disease with an understanding of population dynamics and the critical role of social and environmental factors in shaping human health. Public health is a proactive approach to resolving community health problems (Chun-Hai Fung, 2016). Public health relies on epidemiology to identify and define community health problems, but epidemiology is a broadly applicable set of tools for studying outcomes in populations. Knowledge of epidemiology can empower the concerned citizen.

2.1. Basic Concepts

Preventive medicine and public health are often used interchangeably. However, there is a subtle difference between them. Preventive medicine refers to activities performed by healthcare professionals to prevent diseases in individual patients. On the other hand, public health refers to the collective actions of society to prevent diseases in a community and population (Schwaid, 2017). An individual approach to disease prevention is not sufficiently effective. Many infectious diseases and community health problems should be addressed at the community level rather than at the individual level. The healthcare system should not be burdened with community problems that can be fixed without professional intervention (H. Tulchinsky & A. Varavikova, 2014).

Public health activities and community-level disease prevention are diligently performed everywhere, though legislators might not call it public health for political reasons. Well-known public health activities include pasteurization of milk, treatment of drinking water, sewage disposal, immunization, vector control, health education, regulation of nuisances, and enforcement of environmental standards. Other activities that benefit community health include zoning, urban planning, construction of parks and public recreation areas, regulation of industries, transportation systems, and tobacco and alcohol control.

2.2. Study Designs

Analytical studies, generally defined as studies that involve comparing groups of people, can be classified into two broad categories: observational and experimental studies. Observational studies are ones in which the investigator passively observes the exposure and disease status of each study participant. In contrast, in experimental studies, the investigator actively manipulates the exposure or intervention status of each study participant. The classic example of an experimental study is a randomized controlled trial or RCT, in which individuals are randomly assigned to either a treatment group or a control group (L. Sullivan, 2018). There are many different types of observational study designs. The three primary or fundamental observational study designs are

cohort studies, case-control studies, and cross-sectional studies. In cohort studies, the exposure status of study participants is ascertained first and then the outcome status is determined. In case-control studies, the outcome status of the study participants is determined first and then the exposure status is ascertained. In cross-sectional studies, both the exposure and outcome statuses are determined simultaneously.

2.3. Measures of Disease Frequency and Association

Essentially, epidemiology is the study of how disease is distributed in populations, and the factors that influence or determine this distribution. To describe distributions and patterns in disease, epidemiologists consider three key factors: who is affected by disease (the population at risk), how many people have or are at risk for disease (measures of frequency), and the time frame of disease occurrence (time).

Populations can be defined or grouped in a number of ways, including demographic characteristics (e.g., age, sex, race, income), geographic location, or risk factor exposure. Disease status determines whether individuals are included in a population at risk for a specified disease, and that disease's measure of frequency. Individuals who have the disease are often referred to as "cases." In contrast, individuals who do not have the disease are often referred to as "non-cases." Populations at risk for a specified disease do not include individuals who have that disease. For example, the population at risk for lung cancer includes only those individuals who do not have lung cancer, whereas the population at risk for heart disease includes only those individuals who do not have heart disease (Cowan, 2018).

All other things being equal, disease incidence should be directly proportional to population size. When comparing disease frequency across populations of varying size, it is necessary to calculate disease rates, which are the number of diseased individuals in a population divided by the total number of individuals in that population. Because population size is constantly changing, epidemiologists often express disease rates as the number of diseased individuals per unit of population (e.g., per 100,000 individuals per year).

1.5 3. Biostatistics in Public Health

Public health is the science and art of preventing disease, prolonging life, and promoting health through organized efforts and informed choices of society, organizations, public and private communities, and individuals. Public health practice includes the consideration of biostatistics, epidemiology, health services administration, social and behavioral sciences, and environmental health. Public health policy development drawn from research, monitoring, and evaluation, community organizing and mobilization, coalition building, and planning and policy advocacy.

Biostatistics, also known as biometrics or biometry, is the branch of statistics that applies statistical methods to biological, health, and environmental studies. In public health, biostatistics is applied to design and analyze studies related to health and disease in populations, collect, summarize, and interpret data on health, and understand and apply quantitative methods and study designs used in epidemiology. Key public health studies using biostatistics and epidemiology include the Nurses' Health Study on the effects of cigarette smoking on health and the Framingham Heart Study on risk factors for heart disease. With advances in public health and biomedical research, technology and informatics, policy and regulatory solutions, and community improvement, persistent and emerging public health challenges remain (Zhang, 2018).

These challenges include health disparities and social determinants of health, food safety and security, obesity, nutrition, and physical activity, drug abuse, and alcohol and tobacco use,

infectious diseases, mental health, violence and injuries, maternal, reproductive, and child health, environmental health, globalization, and public health preparedness and response. Biostatistics is applied in public health to assess health status, burden of disease, disability, and risk factors in a population, quantify risk, determine the efficacy of interventions or treatments, and project future health impact, disease emergence or spread, and cost-effectiveness of alternative interventions (Samawi, 2015).

3.1. Descriptive Statistics

Statistics is generally recognised as the science of learning from data. The discipline and its methods encompass the collection of data (sampling, surveys, experiments, etc.), descriptive statistics (summarising data), statistical inference (estimation and tests of hypotheses), and modelling of stochastic processes ((W. Cooksey, 2020)). The term "statistics" is applied to numerical measures that describe data. A statistical summary of a variable usually includes one or more statistics that represent the central tendency of the variable, its spread or variability, and one or more statistics that measure the symmetry or shape of the distribution. Variations are also used to look for clusters of values over the entire range of the variable, that is, at all levels. In epidemiology, various indices of frequency, risk, rate, or probability are widely used that have a specific role and interpretation in the field of epidemiology, preventive medicine, and public health ((Zhang, 2018)). Statistical indices have been developed for use with a single variable (univariate) or two or more variables (multivariate). In addition to "descriptive" statistics that summarise existing data sets, there are methods of testing hypotheses and making inferences that go beyond the sample data.

3.2. Inferential Statistics

Inferential statistics involves classical hypothesis testing, the most commonly used statistical method for finding differences between groups. This procedure begins with an assumption that there is no difference between groups or that some population parameter equals some fixed value—this is the null hypothesis. A measurement or estimate (test statistic) is then obtained from the data, and the probability of obtaining that value, or a value more extreme, under the null hypothesis is calculated—this is the p-value (Kaplan et al., 2020). If the data are consistent with the null hypothesis (p-value ≥ 0.05), it is not rejected; otherwise, it is rejected in favor of the alternative hypothesis (p-value < 0.05). Common test statistics include the difference in means (or medians) (Samawi, 2015).

When comparing two groups, the Student t-test compares means but assumes that the data are normally distributed and the variance is equal in both groups. When these assumptions are violated, a non-parametric alternative, the Mann-Whitney U test, can be used to compare medians instead. Chi-square tests compare categorical data and assess whether the distribution of data across categories differs between groups. Although the chi-square test is robust to violations of its assumptions, it cannot be applied when expected frequencies are below 5. Fisher's exact test should be used when the sample size is small or if some expected frequencies are below 5. A one-way analysis of variance (ANOVA) determines whether the means of more than two groups are equal, but the data must be normally distributed and have equal variance. If these assumptions are not met, the Kruskal-Wallis test can be used. If the ANOVA is statistically significant, post hoc comparisons must be performed to determine which groups differ using, for example, Tukey's HSD.

3.3. Statistical Software

Statistical Software BIOS/PUBH 6541: Biostatistics Fall 2018 This course examines the role of statistics in public health and other sciences closely related to it, such as biomedical, environmental and occupational health, as well as behavioral science. It introduces concepts fundamental to biostatistical reasoning and techniques commonly used in the health science field, including sampling, probability, basic discrete and continuous distributions, descriptive statistics, hypothesis testing and statistical inference, confidence intervals, analysis of categorical data, linear regression and correlation, and nonparametric methods. The course emphasizes the development of students' critical thinking skills in the application of biostatistics to health data analysis, as well as the use of computer software to perform statistical analyses and interpret results in the context of public health studies. The course requires the use of SAS, a widely-used statistical software in public health research. Principles of Biostatistics The course examines the role of statistics in public health and other sciences closely related to it, such as biomedical, environmental and occupational health, as well as behavioral science. It introduces concepts fundamental to biostatistical reasoning and techniques commonly used in the health science field. Specific topics include sampling, probability, basic discrete and continuous distributions, descriptive statistics, hypothesis testing and statistical inference, confidence intervals, analysis of categorical data, linear regression and correlation, and nonparametric methods. Performance-Based Objectives At the completion of the course, students will be able to: 1. Demonstrate the understanding of fundamental probabilistic notions, properties, and applications to the analysis of public health and biomedical data; 2. Compute statistical quantities such as descriptive statistics, distribution functions, percentiles, and more complex statistics such as moments, probabilities on specified intervals, quantiles, and correlation coefficients; 3. Conduct statistical inference by defining hypotheses to be tested, type I error, type II error, p-value, and proper interpretation of the final results; 4. Perform simple and multiple linear regression, logistic regression, survival data analysis and interpret the statistical output to make proper inference; 5. Develop the skills of statistical computation, report writing, and oral presentations to effectively communicate biostatistical analysis of a public health study.

1.6 **4. Health Behavior and Promotion**

Health Behavior and Promotion is a four credit hour required course for PUBH majors. It is also a four credit hour elective for non-PUBH majors. It is an introduction to the discipline of public health and provides an overview of the core principles and practices in public health (D. Walker, 2015). Specific focus will be placed on descriptive epidemiology, health behavior, and promotion– one of the core research and practice areas in public health. By the end of the semester, students will be able to do the following: Describe significant public health issues, past public health successes and failures, and current public health trends in the U.S. and world; Define epidemiology, and describe the distribution and determinants of health and disease in populations; Describe the public health approach to assessing, planning, implementing and evaluating health programs; Discuss, in detail, social and behavioral theories that have been applied to the design and implementation of public health programs and interventions; and Participate in a needs assessment for a public health program.

4.1. Theories of Health Behavior

Health behavior can be defined as any activity undertaken by an individual, regardless of actual or perceived health status, which affects health. There are two general categories of health behavior. The first category includes behaviors that enhance health and well-being (e.g., exercise, proper

nutrition, stress management, engaging in health screening and clinical preventive services). The second category includes health risk behaviors that threaten health (e.g., tobacco use, alcohol and other drug use, unprotected sexual activity, violent behavior). Both kinds of behavior can be influenced by a multitude of social, physical, and individual factors. These factors motivate people to act in certain ways with respect to their health (D. Walker, 2015).

A theory is a set of concepts, definitions, and propositions that explain or predict these events or situations by illustrating the relationships between variables. A health behavior theory is a theory that explains how these factors influence health behavior or describes how health behavior can be changed. In general, health behavior theories can be grouped together into four categories: 1) Learning theories; 2) Cognitive behavior theories; 3) Stage theories; and 4) Other theories. The purpose is to provide a basic understanding of these theories and their application in health promotion programs (M. Simpson, 2018).

4.2. Health Promotion Strategies

Health promotion strategies constitute a significant part of preventative medicine, incorporating education, healthy public policies, community development, and partnership. In efforts to reduce morbidity and mortality rates arising from avoidable ailments, public healthcare policies aim to encourage healthier personal practices and lifestyle choices among populations. Health promotion efforts intend to attain the highest possible level of health, regarding physical, mental, and social well-being (Fairuz Nadya et al., 2016). Community health centers are responsible for organizing public health initiatives, comprising health promotion, preventative healthcare, therapy, and rehabilitation services addressing specific health-related issues. Notably, Bandung houses 24 community health centers (Puskesmas) that deliver public health services to the community. Each health center targets specific urban or rural electoral areas, offering unique health challenges and priorities. Despite health promotion activities being conducted by each Puskesmas, it is crucial to comprehend the specific health promotion strategies enacted in Bandung, thereby facilitating the selection and implementation of appropriate strategies in other locations. This research seeks to explore Bandung public health centers' (Puskesmas) health promotion strategies, focusing on the types of health promotion strategies and the advantages and obstacles regarding strategy implementation.

4.3. Community Interventions

By definition, communities comprise groups of people who share a common environment. Although contexts differ, a community essentially conflates place and social relations. A shared sense of belonging emerges from these bonds. Community relevance to health is twofold, addressing both the settings and networks where health is fostered and the subpopulations that accrue shared social identities and health vulnerabilities.

Community settings encompass schools, workplaces, neighborhood associations, and recreational spaces. Catalyzed by social movements and epidemiologic campaigns, collective actions in these venues sowed public health discourse in the early 1900s. The 21st century ushered in a renewed focus on community health settings via integrated and comparative approaches, such as community-based participatory research, natural capital assessment, and resilience analysis. These actions address obesity, tobacco use, violence, and air quality at local levels. Global covenants and soft law frames foster local initiatives, utilizing global health data as a basis for policy formulation.

Communities also act as social entities, with collective identities shaping social vulnerability. The health inequity debate centers on these social determinants and their intersections. Empirical studies examined immigrant incorporation, neighborhood socioeconomic contexts, and natural experiments on health disparities. At the policy level, attention to vulnerable groups surged post-welfare reform. Such identity-based approaches, however, risk entrenching discrimination and overlooking the ecological and systemic determinants of health inequities. Food sovereignty and community resistance movements reformulate democratic rights vis-à-vis neoliberal states and global markets, contesting commodification and dispossession of local resources and knowledge. Community interventions arose as a pragmatically driven response to sharp equity disparities and top-down health system criticisms. Good data and local actors' commitment foster bottom-up experiments. Democratic deliberation generates diverse contextual interventions. A community garden initiative piloted community gardens in city neighborhoods, promoting local food systems and social economy while involving vulnerable groups. Urban farming in postindustrial cities enriches food access, community capacity, and social and environmental resilience. Citizenship participation fosters new social and political identities, ideating health as habitat co-production.

1.7 5. Environmental Health

The environments in which we work, live, and play affect our health and quality of life. Environmental health is the study of how the environment affects human health. It encompasses the assessment and control of environmental factors that can potentially affect health. Risk factors that may affect health include chemical agents, biological agents, and physical agents in air, water, soil, food, and work places. Hazards in these media can arise from natural occurrences such as floods and hurricanes, industrial processes, and environmental accidents and spills, as well as from the everyday use of chemical products in homes and industries (Hill, 2015). The environmental health profession works toward the prevention of adverse health effects from these hazards and to promote a healthy environment. Environmental health practitioners work in various settings including private and public industries, local and state health agencies, hospitals, schools, non-government organizations, and consulting firms. They may specialize in air quality, water quality, occupational health, environmental assessment, risk analysis, healthy housing, and community health. Education and training in environmental health prepares students for a wide range of professional opportunities in both the public and private sectors.

Various major environmental and occupational problems such as lead poisoning, asthma, climate change, and other air quality problems disproportionately affect lower socioeconomic groups. These groups tend to live in more polluted environments, which can exacerbate health problems such as heart disease and respiratory ailments (Afriyie-Gyawu, 2015). Furthermore, these groups typically lack the resources to remove themselves from such situations as compared to wealthier communities. Understanding these disparities requires a detailed understanding of both environmental processes and the social and economic conditions that dictate patterns of development.

5.1. Air Quality

Air pollution is a recent public health issue. In the European Union, about 80% of the urban population is exposed to air pollution above the levels recommended by the guidelines. The European Union (EU) paved the way for environmental health protection with the establishment of the Environmental Action Program in 1973, followed by the setting up of the in 1994 and the in 1996. However, important air pollution exceedances were registered across Europe in 1997,

prompting the European Parliament and Council to set legally binding limits for specific pollutants in the Air Quality Framework Directive (Iriti et al., 2020).

The ongoing COVID-19 pandemic highlighted new concerns about the transmission of SARS-CoV-2 through airborne particles. The publishes its "Air Quality in Europe" Report, which assesses air pollution figures across Europe and the related health impacts based on the data reported by the Member States and other information sources. In 2020, the addressed the health impacts of air pollution in its general assembly, defining it as the world's largest single environmental health risk factor. EU directives on air quality and climate change were adopted in 1996 and 2009, aiming to protect people from the harmful effects of air pollution and keep certain pollutants below defined thresholds. In 2019, the EU's Green Deal was presented as a roadmap to make Europe the first climate-neutral continent by 2050 and achieve a 55% reduction in greenhouse gas emissions by 2030.

5.2. Water and Sanitation

Water is essential for human existence. It is a pre-requisite for the provision of good health services. Good quality drinking water and proper sanitation are vital prerequisites for the socio-economic development of a society (K. C. Sridhar et al., 2020). It is of utmost importance to prevent contamination of drinking water and to ensure availability of water in sufficient quantity for personal hygiene. The health of the urban poor and their productive capacities are constrained largely by the lack of access to safe water and sanitation. The criticality of safe water and sanitation is well-established for the control of water-borne diseases. Each year, about 1.15 million children under five years die due to diarrhea-related causes, accounting for nearly 20% of deaths in this age group globally. Of all childhood deaths, 35% occur in India and up to 41% of these are due to diarrhea in children. Diarrhea is one of the water/sanitation/hygiene related diseases affecting children's health in India.

5.3. Occupational Health

Occupational Health is defined as a science that deals with all aspects of work environment including physical, chemical, biological, ergonomic, psychological, and other factors affecting the health, safety, and welfare of workers. The goal of occupational health is to foster a safe and healthy work environment. Occupational hazards include any hazard originating in or related to the industry, that may harm an employee's health and safety. Workplace problems that are likely to increase the risk to our health are referred to as occupational hazards. These problems can be classified as either biological or non-biological (ESSA ABED-AL SATTAR et al., 2023). A wide range of these risks, including physical, chemical, and psychological ones, provide challenges for healthcare practitioners.

Healthcare activities, however, involve a variety of occupational risks that could affect healthcare workers (HCWs) safety and ultimately health. Such risks negatively affect employees and their families, the health system, the community, and national development. The study, thus, was carried out to assess the level of adherence to preventive practices towards occupational hazards in the hospitals of Thi-Qar Governorate, Iraq, and its relationship to the demographic and occupational information of the healthcare workers. Out of 1336 healthcare workers, 355 of them were selected for the study using a simple random sampling technique. Data were collected using self-reported questionnaires that were designed in English and then translated into Arabic. Descriptive cross-sectional study was employed and five hospitals in Thi-Qar Governorate were selected. According

to the findings, 8% of the respondents have a moderate practice score regarding occupational hazards preventive practices. Years of work (≥15 years) and hours of work (≤5 h) had higher good practices than other categories. In conclusion, the study shows that most of the employees of the hospitals in Thi-Qar Governorate have "Moderate" commitments to safety measures regarding occupational hazards in their surrounding workplaces.

1.8 6. Nutrition and Food Safety

Health depends on food quality and supply, on maintaining environmental conditions that protect food from contamination, and on nutritional needs. Food safety practices, appropriate nutrition, and nutrition policies help protect the environment, the consumer, and the health of populations. Nutrition and food safety are priority areas for global health organizations. These organizations work with countries to decrease foodborne and waterborne diseases and to ensure food safety. Food safety is also relevant to prevent malnutrition in the context of food supply emergencies. Food safety means that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. Food safety hazards are substances in food that can cause a consumer to become ill or injured. Food that is not safe could contain biological, chemical, or physical hazards.

Foodborne illness is a public health problem for all countries but is particularly serious in lower-income countries. Improving food safety will promote health, support economic development, and reduce poverty. Simple food safety measures can be put in place at home. Guidelines have been developed that include: keep clean; separate raw and cooked; cook thoroughly; keep food at safe temperatures; use safe water and raw materials. Improving food safety can be complex and require significant investment, planning, and resources. For that reason, decision-makers in low-income countries are provided with guidance on cost-effective priority interventions to reduce foodborne disease. A systematic approach to food safety can be applied at all stages of the food chain from primary production to consumption.

Countries that are emerging from food supply emergencies, whether natural or man-made, should take adequate precautions against potential food safety hazards. An assessment of the food safety assurances should be the first consideration in deciding whether to accept food aid. Assessment of the nutritional adequacy of food aid should take place simultaneously with food safety assessment. Good hygiene practices, wholesale and retail, should be established to ensure food safety during distribution. Regular monitoring of food safety and adequacy should be instituted across the whole food aid program for as long as needed. Nutritional deficiencies manifesting acute clinical signs, or visible signs of deficiency, indicate severe deficiency. Nutritional deficiencies that are subclinical, or do not show overt clinical signs, can be detected using functional and/or biochemical indicators.

6.1. Nutritional Requirements

The following definitions and terms may be useful in the study and application of preventive medicine and public health as they relate to nutrition and food. Food is defined as a substance containing nutrients, which when ingested and assimilated, promotes growth, repair, energy, and maintenance of health. Food may be solid or liquid; nutrients - substances found in foods that are necessary for growth, reproduction, maintenance of health, and physical well-being. Essential nutrients cannot be synthesized by the body and therefore must be ingested (Hsu, 1994). Nonessential nutrients may be synthesized in adequate amounts by the body and therefore do not need to be ingested. Macromutrients (proteins, fats, and carbohydrates) are required in relatively

large amounts, while micromutrients (vitamins and minerals) are required in relatively small amounts.

Proteins (amino acids or polypeptides) are macronutrients essential in the diet for growth, maintenance, and repair of tissues. Amino acids are the building blocks of proteins. Animals can synthesize amino acids (nonessential amino acids), but 10 amino acids (essential amino acids) cannot be synthesized and must be obtained from dietary sources. Comprising 90 percent of body proteins, animal proteins are derived from hair, skin, muscles, organs, blood, and milk of mammals and poultry and the eggs of birds and reptiles. Plant proteins (soybeans, peas, peanuts, rice, corn, and wheat) also provide essential amino acids but generally less amino acids than animal proteins. A protein's biological value is a measurement of how efficiently a protein is converted to body tissue.

Lipids (fats) are macronutrients required in the diet to provide essential fatty acids (EFAs), energy, and lipid-soluble vitamins (A, D, E, and K). Lipids are organic compounds insoluble in water but soluble in organic solvents. Comprising 95 percent of dietary lipids, triglycerides are chemically composed of glycerol and three fatty acids and are either saturated or unsaturated, which may be either polyunsaturated or monounsaturated. Saturated fatty acids are generally solid at room temperature and are found in animal fats, while unsaturated fatty acids are generally liquid at room temperature and are found in plant fats. An estimation of daily caloric intake from fat is 15-30 percent. An excess intake of high-fat food has been linked with obesity, heart disease, breast cancer, and colon cancer. However, fats are calorically dense, with 2.25 times more energy per gram than proteins or carbohydrates.

6.2. Foodborne Illnesses

Foodborne illnesses are infections that are caused by an agent that typically multiplies in food before it is consumed. The infections can occur in food and water, with the former being more common. Foodborne illnesses mostly affect the gastrointestinal tract and are made up of a wide range of diseases that occur following ingestion of contaminated food (Acheson, 2009). Symptoms begin to appear a few hours or even days after ingestion of food. Foodborne illnesses can easily transmit from one person to another if the infection is not contained. In most cases, foodborne illnesses are of an infectious nature; various microorganisms infect the food and cause illnesses in those who consume it. In more severe cases, foodborne illnesses can also be due to chemical agents or toxins that occur in the food. Outbreaks of foodborne illnesses tend to occur in closed communities that share a common food source, such as schools, restaurants, recreational camps, and food processing establishments. Foodborne illnesses are one of the most widespread public health problems in the world today. Outbreaks of foodborne illnesses not only cause deaths, but also result in huge economic losses for the affected communities. Contaminated food is the main cause of diarrheal diseases worldwide, particularly in developing countries. Foodborne and waterborne diseases kill an estimated 2 million people every year, mostly children in developing countries. Globally, the burden of foodborne diseases is particularly high among the poor and disadvantaged. In the United States alone, various pathogens in food cause around 76 million illnesses every year.

6.3. Nutrition Policies

Nutrients are essential for normal growth and development and for proper physical and mental functioning. Nutrition has immediate and longterm impacts on health and well-being. Nutrition

plays an important role throughout life but particularly during critical periods of growth, development and physical change. Growth slows down after the first year of life but continues throughout childhood, with significant changes during adolescence as children grow into adults. Nutrition policies ensure that the food supply can meet the dietary needs of the population. Food policies can also affect food prices and food availability in different localities, thus ensuring equitable access to adequate diets. Efforts to reduce hunger and malnutrition typically use a combination of food and nutrition policies (Fanzo, 2016). There is an array of food and nutrition policies, some general and some specific to nutrition. General food policies create rules that deal with food, agriculture and trade, and that usually aim to increase food production and stabilize food prices. At the global level, the most important policies are those of the Food and Agriculture Organization of the United Nations and the World Trade Organization.

1.9 7. Infectious Disease Control

Control of communicable diseases involves a host of activities aimed at stopping or slowing down the transmission of the causative infectious agents. The goal of control of an infectious disease is to reduce its incidence, prevalence, morbidity, and mortality. Where control efforts have been successful, the disease is said to be under control. The elimination of a disease from a specified geographic area may be achieved through a focused set of intervention programs. For example, smallpox was eliminated from the world, and subsequently there has been no occurrence of the disease (H. Tulchinsky & A. Varavikova, 2000). Eradication is often taken to mean a more permanent intervention, with success resulting in a reduction to zero of the incidence of the disease and the presence in nature of the organism that causes the disease. The goals of international as well as national public health programs include both the control and the eradication of specific communicable diseases.

Public health applies a variety of tools for the prevention of infectious diseases and their transmission. These include education, active or passive immunization, chemoprophylaxis, control of vectors, health legislation, environmental improvements, and sanitation. It is important to note that most of these approaches are aimed at interrupting the chain of transmission. A chain of transmission of a communicable disease normally consists of an infectious agent, a reservoir, a portal of exit, a mode of transmission, a portal of entry, and a susceptible host. Infectious organisms enter a new host either directly through such means as personal contact, secretions, or body fluids; or indirectly through inanimate objects, food, water, air, vectors, or other intermediary means. Infectious organisms have a discharging site from the preceding host, usually through respiratory secretions, feces, urine, blood, or some other body discharge. Planning measures to control and eradicate specific communicable diseases is one of the principal activities of public health (Chun-Hai Fung, 2017).

7.1. Immunization Programs

All vaccines result in a specific antibody response, a characteristic of the acquired immune system. Vaccines can induce a variety of immunological responses, but they most commonly induce antibody responses, also called humoral immune responses. Vaccination delivers antigens, either by infection or by artificial routes, inducing an immunological memory to protect against subsequent infections. Immunization programs aim to protect the population from infectious diseases through vital preventive health measures. Immunization is one of the most successful and cost-effective public health interventions of all time. Vaccines remain a cornerstone of public health, saving millions of lives every year. Smallpox was eradicated in 1980 thanks to global

immunization efforts, and polio is now endemic in only two countries. All countries implement immunization programs to varying degrees and with different vaccines and strategies. Vaccine-preventable childhood diseases are most commonly targeted, with routine immunization of preschool children minimizing morbidity and mortality. Recent decades have seen a focus on expanding immunization programs in low- and middle-income countries, where coverage is often poor. In Europe and North America, attention has turned to ensuring continued high coverage of childhood immunization to prevent re-emergence of vaccine-preventable diseases. Vaccination is largely undertaken on societal rather than individual grounds. Where there is societal benefit and the market fails to deliver sufficient vaccine, government has a role in ensuring vaccines are available and coverage is high. In the case of childhood vaccination, programs are implemented with careful consideration of scientific evidence, and vaccines are mandated for participation in society, with immunization records required for school attendance and other public services. Compliance is generally high, particularly in urban areas, where more than 95% of children are routinely vaccinated. Nevertheless, vaccine hesitancy is increasingly challenging high vaccination coverage and appropriate risk/benefit perception. Public health systems reassess their strategies and communications to ensure continued confidence in vaccination. Certain groups are particularly vulnerable to becoming under-vaccinated. Some countries have introduced penalties for non-vaccinated children, while others have sought to keep open access to public services. Primary and secondary preventive interventions are explored and discussed, with an emphasis on scientific evidence.

7.2. Surveillance and Outbreak Investigation

Surveillance on an appropriate population defines the baseline parameters of health and disease necessary to infer the significance of reported individual health events. Surveillance aims to (1) identify individual cases, (2) detect population patterns in identified cases, and then (3) convey information to decision-makers about population health patterns (Buckeridge & Cadieux, 2006). Public Health surveillance is an ongoing systematic collection, analysis, interpretation and dissemination of data regarding health events to public health authorities for a timely public health response. Surveillance has been used for infectious diseases since the 14th century when it was mandated in Marseilles, France after the bubonic plague. The term surveillance comes from the French word surveiller, or “to watch over.” The cholera epidemic in London (1854) was the first outbreak investigated from a public health perspective. The epidemiologic triangle was used to describe infectious disease outbreaks.

An outbreak is defined as greater than expected numbers of cases. The first step in outbreak investigation is to confirm that an outbreak has occurred. Surveillance data may be used to show that an increase in reported cases is different than expected. In a newly recognized disease or a disease with a currently poor surveillance system, the identification of significant numbers of cases may require a greater than usual reliance on research methods such as the review of hospital records or querying health care providers about recent similar cases. An investigator responds to a report of a possible outbreak by mobilizing the necessary resources for a public health response and assembling the information contained in the initial report.

7.3. Antimicrobial Resistance

Antimicrobial resistance (AMR) is emerging as a major public health challenge globally. AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to

medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death (Tassew, 2016). AMR directly threaten the successful treatment of an ever increasing number of common infectious diseases and undercuts the advances made in modern medicine and public health over the last century. Antimicrobial medicines such as antibiotics, antivirals, antimalarials, and antifungals have been developed to treat infectious diseases. However, organisms that cause these infections develop resistance to these drugs.

Efficient treatment of infections is driven by the availability of new antimicrobials and the effective use of existing antimicrobials. If an organism is resistant to the drugs used to treat it, the infection is termed multiresistant. There are estimates that multi-resistance will result in an additional 10 million deaths annually by 2050, making it a larger threat than cancer today. Efforts to prevent resistance development and spread, and to contain resistant pathogens, include improved hygiene and sanitary conditions, vaccination, rapid identification of pathogens and their resistance determinants, pathogen-specific treatment, and reduced use of broad-spectrum drugs.

1.10 8. Chronic Disease Prevention

Chronic diseases—including cardiovascular disease, cancer, and diabetes—have a long history as targets for public disease prevention efforts. Public health's emphasis on chronic disease prevention has been bolstered by the relative success of communicable disease control efforts in the 20th century, as well as the aging of populations and growing trends toward urbanization, sedentary lifestyles, and unhealthy diets in developing countries. Efforts have occurred both at the international level, catalyzed by the formation of international agencies early in the post-World War II era, as well as at the national level in countries such as the United States.

Cardiovascular disease is an umbrella term that includes a variety of diseases affecting the heart or blood vessels, including arrhythmias, heart attack, heart failure, hypertensive heart disease, stroke, and valve disease. Although the vast majority of cardiovascular disease is chronic in nature, acute events such as heart attack and stroke typically precipitate hospitalization, and in some cases death. It is thus common for health system expenditures relevant to cardiovascular disease to be dominated by acute care expenditures. At the same time, there is also a large spectrum of outpatient care activities, pharmaceutical treatments, and public health activities aimed at preventing and managing chronic cardiovascular disease. There is also significant intersection between the public health burden of chronic cardiovascular disease and acute events affecting patients, as for many other chronic diseases. With a policy focus on chronic disease, this section begins with an overview of these aspects as they pertain to cardiovascular disease.

In 2010, an estimated 8.3% of the population in the United States was affected by diabetes, with an additional 79 million adults considered pre-diabetic. Diabetes is also a target of chronic disease prevention efforts in public health. Efforts to manage or prevent diabetes are complicated by the existence of two distinct types: type 1 diabetes, in which the body does not produce insulin; and type 2 diabetes, which is largely the result of insulin resistance combined with an insufficient secretion of insulin by the pancreas. Type 1 diabetes typically emerges in childhood or adolescence and is not related to obesity. In contrast, the vast majority of diabetes cases in the population are type 2 and are often preceded by pre-diabetes (characterized by elevated blood glucose levels). Type 2 diabetes typically emerges later in life, often following years or decades of metabolic syndrome, which is characterized by hypertension, elevated blood lipids, abdominal obesity, and blood glucose dysregulation.

8.1. Cardiovascular Disease

The summary summarizes ten important cardiovascular disease (CVD) risk factors: unhealthful nutrition, physical inactivity, dyslipidemia, hyperglycemia, high blood pressure, obesity, considerations of select populations (gender and race), thrombosis/smoking, kidney dysfunction, and genetics/familial hypercholesterolemia (Edward Bays, 2020). Each item is summarized with the key reasons to know and consider. The intent is to focus on fundamental clinical considerations in preventive cardiology. This summary approach may benefit primary care clinicians who, despite usually being well-trained in cardiology, may welcome an overview of how CVD risk factors are best diagnosed and managed. As noted in the summary, many patients with CVD often have multiple CVD risk factors, and optimal CVD prevention usually requires a multifactorial approach. Therefore, a summary of ten CVD risk factors, as well as why they are important, is offered.

8.2. Cancer Prevention

The ultimate goal of preventive medicine is to avert disease rather than to treat it once it has developed. Screening tests to discover disease at an early stage share some similarities with prophylactic treatments to avert disease. Cancer prevention refers to interventions that reduce the incidence of cancer. There are an estimated 1.8 million new cancer cases in the United States in 2020 and over 600,000 cancer deaths. Globally, the burden of cancer is high and increasing, with an estimated 19.3 million new cases in 2020. In part because of the costs and challenges of treatment, identifying and adopting strategies for cancer prevention are becoming necessary (Liebmann, 2017). An overview of cancer prevention research efforts currently focuses on minimizing avoidable exposures to carcinogenic risks and on controlling lifestyle factors affecting individual risk of developing cancer.

Between 30% and 50% of cancer cases are estimated to be preventable through reduced exposure to tobacco, occupational carcinogens, and infectious agents, and adoption of lifelong healthy eating and a physically active lifestyle (W. Lampe, 2020). At the population level, the most important cancer prevention strategies are those applied in childhood, as exposure to many risk factors is cumulative over the life span and as effects of most protective factors are not apparent until decades after exposure. An important aspect of a recently released report is a shift in emphasis from the effects of specific foods and nutrients on cancer risk to a more holistic focus on patterns of diet and physical activity.

8.3. Diabetes Management

Diabetes is a chronic metabolic disorder that is characterized by an absolute or relative deficiency of insulin hormone, resulting in hyperglycemia or high blood sugar. On the basis of availability of insulin, diabetes can be classified into Type 1 diabetes and Type 2 diabetes. Type 2 diabetes is the most prevalent form of diabetes, accounting for nearly 85-90% of all diabetes cases. Diabetes is also classified as a macrovascular and microvascular disease due to the involvement of large and small blood vessels, respectively (Anand & Jain, 2024). Diabetes management aims to maintain an optimal blood sugar level and prevent diabetes-related complications. Management of pre-diabetes is essentially the same as management of diabetes; however, aggressive intervention in lifestyle modification combined with pharmacotherapy may be required in individuals with a high-risk profile. Intensive lifestyle intervention comprising weight loss, dietary changes, and increased physical activity should be the first approach in managing diabetes, with the goal of achieving a

weight loss of 5-10% of baseline body weight. Lifestyle interventions are essential in preventing and managing type 2 diabetes in the high-risk populace.

1.11 9. Maternal and Child Health

Maternal and child health is an important branch of public health. In many countries, reduction of maternal and child mortality and morbidity is one of the primary goals of health planners and decision-makers. Unsafe motherhood and high fecundity are risk factors for different diseases and ill-health conditions for mothers and their children. During pregnancy, a mother undergoes various physical and psychological changes. A mother needs special care and attention during this period. To ensure the overall well-being of a mother and her children, maternal and child health services are essential. The life cycle approach is an integrated approach to health care. It stresses the necessity of providing health care facilities for all the stages of life (from preconception to old age). Thus, maternal and child health care services are an integral part of the life cycle approach. Maternal and child health care services are preventive, curative, and promotional health care services, which focus on child health and maternal health. Child health care includes the health care services provided to children, right from conception till the age of five years. Similarly, maternal health care services include health care services that ensure safe motherhood and well-being for women. The concern for child health care services in developing countries began after the Second World War. The United Nations International Children's Emergency Fund (UNICEF) was established in 1946 with the objective of providing food and health care to children in war-torn Europe (Sanchez, 2013).

9.1. Prenatal Care

Prenatal care optimally begins before the first pregnancy, but it is necessary at least by the beginning of the first pregnancy. Educating adolescents that pregnancy is a normal physiological life event, and encouraging reproductive life planning to minimize risk pregnancies, is an important role of all primary health care providers. Preconception care is not just a women's health issue, but something that involves families and society in general. Healthy children today mean healthy citizens tomorrow, and therefore preconception care can impact a nation's infant mortality rate. Throughout the 1980's and 1990's many efforts were made to improve access to prenatal care early in pregnancy. Unfortunately, these efforts and the millions of dollars expended nationally on prenatal care have yet to meaningfully improve the health statistics for women and infants (Dyer, 2011). Although the majority of low-income women now enter prenatal care by the end of the first trimester, an astonishing one-third still receive no care at all or enter care only in the second trimester. Delayed prenatal care, it has been shown, contributes to the most serious poor birth outcomes—very low birth weight, infant mortality, and maternal mortality. Despite the overwhelming evidence that greater access to prenatal care improves pregnancy outcomes, there remain persistent disparities in access and birth outcomes nationally between racial minorities and white populations. In 1979, the concept of "Prepregnancy Care" began to appear in the medical literature. Shortly thereafter, and in recognition of the national crisis of elevated rates of low birth weight and infant mortality, this concept proliferated in the scientific literature as well as the popular media, and was catapulted to national prominence by then-Surgeon General C. Everett Koop, M.D., Sc.D.. In 1985, a seminal report prepared by the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists recognized the importance of pregnancy prevention, thoughtful preparation for pregnancy, and early entry into prenatal care. By 1989, major professional organizations had published guidelines dealing with aspects of

prepregnancy care. Under the heading "Guidelines for Perinatal Care," the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists published an important document in 1983 that addressed numerous components of prenatal care, but also emphasized the importance of preparation for parenthood and several risk screenings. Published by the U.S. Department of Health and Human Services in 1991, the Healthy People 2000 guidelines aimed, among other goals, to increase to 50 percent the proportion of primary care providers offering preconception care to their patients. The preamble emphasized the importance of optimal health before conception: "Preconception care—health promotion and risk reduction services offered to a woman before conception—can reduce the risk of poor pregnancy outcomes and improve a woman's health." Individual organizations have published sets of guidelines for preconception care. These guidelines have been summarized and grouped into four components: maternal assessment, vaccinations, screening, and counseling (Hanson et al., 2009).

9.2. Childhood Immunizations

Childhood immunizations prevent the spread of infectious diseases among children and the wider community. Vaccines stimulate the body's immune system to recognize and destroy disease-causing organisms without causing the disease itself. For childhood immunizations to be effective, the vaccines must be given on or before certain ages. Each vaccine has an assigned target age for community-wide effectiveness, while children can receive the vaccine in question on or before that target age.

Immunization services must be timely; immunization must be completed according to the schedule to be as effective as possible in preventing childhood morbidity and mortality. Immunization timeliness means having vaccination doses received at or before the recommended ages. A child policy requires that vaccines be administered on or before the target ages. The global eradication of some vaccine-preventable diseases requires that the vaccination coverage and timeliness be properly maintained in endemic countries.

Immunization is the most important preventive healthcare intervention for children worldwide. Vaccination coverage is a critical health outcome measure for a healthcare system. A child cannot be considered fully immunized unless all vaccinations are received at the correct ages. Vaccination coverage alone often overestimates the vaccination system performance, as a child may still have delayed vaccinations while being considered fully immunized. Vaccination delay describes the failure to receive a vaccination dose by its target age.

Until 2002, Japan had no national laws on child vaccination. As a consequence of an epidemic and the death of a child following the DTP vaccine, a number of provincial legislatures enacted laws requiring parental consent prior to vaccination. In 1995, a national law was enacted making DTP vaccinations voluntary while providing for free public vaccinations, thus transferring responsibility for vaccinations to the parents. Following these legislative changes, the proportion of parents refusing vaccinations increased sharply in some cities.

Immunization status is usually categorized as up-to-date, behind schedule, and out of compliance. Vaccination noncompliance denotes a pattern of administering vaccinations that fails to adhere to some specified policy. Understanding noncompliance and designing robust policies to prevent it are challenging due to the complexity of vaccination systems. Childhood immunization policy recognizes vaccines administered as adequate provided they meet timing requirements. A vaccination dose is considered timely if it is administered before or at the target age.

9.3. Breastfeeding Support

All infants should be breastfed from birth, receiving no other food or drink, not even water, for the first six months of life (exclusive breastfeeding). Continued breastfeeding is recommended along with appropriate complementary foods from six months to two years and beyond (Bissell, 2015). To protect, promote and support breastfeeding, the Ten Steps to Successful Breastfeeding should be implemented in every facility providing maternity services, alongside a system for monitoring compliance. The International Code of Marketing of Breast-milk Substitutes should be implemented and explained to mothers. Health authorities should ensure the availability of skilled personnel to support breastfeeding and establish mechanisms for a mother to stay with her infant. Policy-makers, health authorities and health care managers should work together to create a comprehensive policy framework outlining the responsibilities of health services in supporting breastfeeding and the involvement of other sectors (Peven et al., 2020).

Breastfeeding is a biocultural behavior with the potential for significant public health gains, but there are competing social forces and economic interests that inhibit the promotion and protection of breastfeeding globally. The Code is a unique global health policy instrument designed to protect breastfeeding from commercial pressures and conflicts of interest, and its implementation is an essential component of comprehensive breastfeeding programs. However, while there is evidence that breastmilk is the healthiest and most natural way to feed babies, decisions surrounding infant feeding are increasingly complex. Controversies and debates around infant feeding are prominent in popular media and social networking sites, and the biocultural narratives underpinning mothering practices and concerns about public health are both considered and challenged. In 2014, the World Health Assembly passed a resolution calling on member states to mitigate the inappropriate promotion of foods for infants and young children.

1.12 **10. Global Health and Health Disparities**

There are health disparities between and within countries. Some individuals are at increased risk for certain diseases because of their genetic background. Others are affected by environmental influences, such as exposure to pathogens, toxins, or a lack of healthful foods. Globalization brings pathologic organisms, agents, and influences into new areas. Nevertheless, the greatest burden of disease falls on low- and middle-income countries (LMICs) and poorer individuals within wealthier countries. Internationally, the largest gaps in health are related to income. Health disparities are exacerbated by the political and economic choices of wealthy countries and individuals (Hansen, 2018).

Health systems can mitigate or exacerbate health disparities. Some individuals are unable to take full advantage of their country's health system due to socioeconomic, racial, or geographical disadvantage. Health inequities within countries often mirror those between countries, as the poor, whether rural or urban, generally have the worst health. Wealthy countries do better than poorer countries on most health indicators, but within-country disparities persist. Education, income inequality, and minority status may all compound disadvantage (Hansen, 2016).

10.1. Global Health Initiatives

Global health is viewed as a worldwide effort to prevent disease, avert epidemics, and promote and protect health, particularly in disadvantaged populations. Global health initiatives may be broadly defined as actions and efforts by policy-makers, government agencies, and non-governmental organizations that take place in more than one nation and affect the health of populations. This may also include efforts by international agencies when they undertake activities

or actions that affect the health of populations. Global health initiatives include a wide variety of activities. Some involve changes in national or international policy regarding health or related activities that affect health; others involve funding to support health programs or research; still others involve the actual implementation of health programs or research activities. International health activities often originate with developing countries, but more frequently, they are responses to initiatives originated by industrialized countries or international organizations (Hansen, 2018). Preventive medicine is the clinical specialty that focuses on the health of individual patients on addressing personal health needs. Public health, in contrast, aims to improve the health of populations and communities, focusing on collective health needs, although both preventive medicine and public health undertake work involving both personal and population health. In general terms, global health activities are to public health, as international health activities are to preventive medicine. However, the fine line separating the two concepts becomes blurred because so many health activities encompass both personal clinical considerations and broader public health/collective concerns about health (Hansen, 2017).

10.2. Health Disparities in Populations

Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group, religion, socioeconomic status, gender, age, mental health, physical or sensory disability, sexual orientation, or geographic location. These disparities exist in the incidence, prevalence, mortality, and burden of diseases and other negative health outcomes. The social determinants of health—these conditions in which people are born, live, learn, work, and play—are largely responsible for health disparities. The social determinants of health inequities also include the policy and political systems that shape these conditions. Health inequities are often termed "health disparities" (B Thomas & L Gilbert, 2006). The terms "health disparity" and "health equity" emerged during the 1990s devoting attention to differences in the health status of population subgroups. Because the evaluation of public health programs relies heavily on measures of health status, any persistent differences in morbidity and mortality between population groups undermine the effectiveness of such programs and raise questions about equity in their design and implementation. Health equity is framed in terms of control over health and other resources: inequitable distribution of the social determinants of health leads to health disparities.

10.3. Social Determinants of Health

Socioeconomic factors, which have been described by several investigators as social determinants of health (SDH), affect the health status of individuals. In the year 2000, the World Health Organization Commission on Macroeconomics and Health published a report outlining approaches to achieving the millennium development goals: halving extreme poverty and hunger, promoting gender equality, ensuring universal access to education, improving child health, reducing maternal mortality, and combating HIV/AIDS, malaria and other diseases by 2015. The successes of the millennium development goals have varied across countries, revealing the importance of social determinants in impacting population health (Robb, 2015). Countries that can best address the social factors affecting health are most likely to succeed in achieving the goals. For example, India failed to achieve the goal of reducing the proportion of underweight children by 2015, in part because the country has become one of the most socially unequal countries in

terms of wealth. Globally, inequalities in health prevent the attainment of social and economic goals.

The health status of a population and its distribution depend on eight interrelated factors: constitutional factors, social determinants, health care services, and public health services; and three broader contextual factors, i.e., the economy, society, and its physical environment. Within these factors, a triple account of health is provided: health as a bio-physical state, global health as the health status of a population, and the health system.

1.13 11. Health Policy and Management

This course provides a comprehensive introduction and overview to public health management and administration. The course context is based on managerial decision making and the practical knowledge, tools, processes and strategies required by organizational management. Therefore, this course is designed for those who seek practical knowledge and tools for public health policy and management. To facilitate discussion and application of the practical knowledge and tools, this course is a seminar format and requires active participation. The public health policy and management basics will be introduced as lecture topics. In addition, component topics in public health policy and management will be assigned to students to research and present. These presentations will be the basis for seminar discussion, and students are expected to come prepared to discuss the topic in depth. This course overviews the basics of administration, including public health law, human resources management, budgeting and financing, health information management, performance measurement and improvement, ethics, leadership, communication, media relations, and legislative relations in public health; each introduced as processes are strategic planning, program development and evaluation, budget preparation, and constituency building for collaboration in public health policy and management. Public health policy and management basics are discussed in traditional public health settings, including state health departments and local health agencies (A. Apenteng, 2017). Emerging areas of public health policy and management are also discussed as contexts to apply practical knowledge, tools, and strategies (Reagan, 2016).

11.1. Healthcare Systems

Health systems, also known as healthcare systems or public health systems, are a series of interconnected and interdependent elements that work together to achieve common objectives in relation to health. These elements include organizations, institutions, resources, activities, and people involved in the planning, financing, and provision of health services. Health systems can vary in size, organization, and complexity, and can be classified based on their public or private ownership, arrangement, and financing. A health system's goal is to promote, restore, or maintain health. In other words, a health system is made up of the different organizations, institutions, and resources involved in delivering healthcare services to a population. (Kumara Behera et al., 2021) A health system is made up of all public and private organizations, institutions, resources, and activities that work together to create a health policy. The health system can be defined as the interaction between the services provided, the organizations that provide them, and the public that receives them. Health systems can also refer to specific health systems. Health systems can be classified based on their public or private ownership, internal arrangement, and financing. (H. Tulchinsky & A. Varavikova, 2014) describe the health care system as the public, not-for-profit, and private health sector organizations involved in the planning, organizing, financing, or delivering of health services.

11.2. Health Policy Analysis

Health policy analysis is a procedure for examining health policies to improve them. Policy analysis can empower health care providers and researchers to identify, improve, and prioritize health policies. Policy analysis procedures are outlined to encourage use of this method in primary care research settings. During a clinical encounter, a question arose regarding the appropriateness of Pap smear screening after total hysterectomy for benign disease. Recommendations regarding cytological testing after hysterectomy are ambiguous and a clinical policy analysis was conducted. This example provides a model for health policy analysis. The goal is to encourage primary care researchers unfamiliar with policy analysis to consider using it (Engelman et al., 2019).

Bardach's policy analysis framework is introduced, which provides a step-by-step guide for conducting policy analyses. To illustrate the use of policy analysis procedures, an example of a clinical policy analysis is presented. The policy analysis's background, how it was conducted, and the analysis's findings are shared. The intention is to provide a model for researchers to conduct policy analyses in primary care settings. A clinical encounter prompted a health policy analysis. During a routine well-woman examination, a woman in her 50s with no history of cervical cancer screening presented for Pap smear cytology. Chart review revealed she had undergone a total hysterectomy for fibroids, a benign disease. A precepted copractice was established in a family medicine residency clinic where most patients were in midlife. The encounter and chart review raised questions about a health policy related to women's health services in primary care.

11.3. Healthcare Financing

Preventive medicine and public health programs require ongoing, stable funding, and healthcare financing is the key consideration for long-term sustainability. The required action depends on the type of activity being funded, including whether it is a new initiative or an expansion of an existing program, and whether it is grant supported, state funded, or local agency funded. Consideration also needs to be given to ensuring that a given funding source continues and remains adequate for the activity or program being funded (P. Mays, 2012). Healthcare financing arrangements are critical for health promotion and disease prevention. Various financing mechanisms exist, including taxes on alcohol, cigarettes, and unhealthy food; fees for service; compulsory insurance contributions; local authority budgets; specific allocations from national budgets; and international donor assistance (Watabe et al., 2016). Some countries adopt innovative mechanisms for funding health promotion initiatives. Health promotion foundations, funded by a specific percentage of revenues from tobacco, alcohol, or unhealthy food taxes or by specific public agency levies on industry revenues, have been established in several countries.

1.14 **12. Emergency Preparedness and Disaster Management**

Background and Need

This chapter discusses the fundamentals and practices of emergency preparedness and disaster management as a component of preventive medicine and public health. Since ancient times, individuals and communities have faced various disasters. With increasing population densities and industrialization, the vulnerability to disasters has increased. A disaster is an event that causes serious disruption of the functioning of a community or society. Major natural disasters like cyclones, floods, landslides, earthquakes and tsunamis, along with industrial accidents, fire, civil unrest and terrorism, can be considered emergencies and disasters.

Disaster management is the process of planning and preparation for disaster response, post-disaster recovery, and taking steps to mitigate and reduce the risk of disasters. It is a continuous cycle

comprising prevention, preparedness, response, rehabilitation, and recovery phases. The institutional framework for disaster management in India includes the National Disaster Management Authority, State Disaster Management Authorities, District Disaster Management Authorities, and the National Disaster Response Force.

12.1. Natural Disasters

Natural disasters that have periodically hit the earth cause loss of life and the destruction of places inhabited by human beings. Earthquakes, tsunamis, volcanic eruptions, landslides, droughts and floods are examples of natural disasters. In general, the occurrence of natural disasters is beyond human capability to predict, except for the aftermath of destruction that has occurred. Although impossible to avoid, natural disasters are almost inevitable, efforts to minimize the impact of natural disasters can be undertaken by rare planning (Wasilah & A Tauhid, 2018).

The urban space arrangement is expected to be capable of protecting urban residents from the threat of natural disasters. Arrangement of urban space through planning should be conducted prior to natural disasters. However, many cities were established without considering the threat and vulnerability from incoming natural disasters. Therefore, efforts to minimize the impact of natural disasters should be addressed into cities that have been impacted by natural disasters for the second time. In the literacy, disasters occurring in cities are defined as urban disasters. Urban disasters occur due to a combination of natural disasters happening in urban areas and the complexity of socio-economy caused by urbanization. As a consequence, the spatial planning in the city context becomes important to reduce the impact of natural disasters.

12.2. Pandemic Response

Pandemic containment strategies focus on prevention of infection and rapid mitigation of transmission. Prioritization of strategies to prevent, mitigate, or rapidly contain a pandemic focuses on areas for global collaboration involving , specific countries, and public health institutions. Epidemiology and surveillance, rapid containment of transmission, and preparedness plans for all countries are important areas of focus for the global community. Moreover, pandemic vaccine development and expansion of production capacity comprise priority actions with the greatest likelihood of success (T. Friend, 2007).

Given that has warned governments that global risk characterization has progressed to the pandemic alert period, prepandemic vaccination coupled with vaccination at the onset of a pandemic represents a global intervention strategy with the greatest likelihood of success. Control and mitigation measures involving antiviral drug treatment and prophylaxis, along with home isolation of cases and school closure, could complement vaccination efforts. Considerations regarding the characteristics of a pandemic, and the best control measures for responding to it, could not be known until after the new virus emerges. Response and containment are vital components to global intervention, and these may be built best by investing resources in a proactive vaccination strategy. Priming of the global population with prepandemic vaccine would be followed by development and distribution of strain-specific vaccine. The speed of vaccine development, industrial capacity to produce vaccine, and the ability to make vaccines available to the global population are the challenges facing the international community (Hoven et al., 2022). A sense of urgency must prevail among all nations which need to share responsibility for pandemic influenza planning.

12.3. Community Resilience

Community resilience is an emerging multi-disciplinary concept in the context of environmental risks and public health issues. A systematic review was carried out to analyze the current state of research on community resilience in the face of environmental risks and public health challenges, discussing key research themes, methods, and study areas while identifying research gaps. The findings of the review suggest that the resilience concept has been adapted to communities in the face of environmental risks and public health challenges. To promote community resilience, five components of the "One Community at a Time" framework are identified: (1) social capital and networks; (2) local knowledge and learning; (3) effective governance and leadership; (4) preparedness and response capacity; and (5) adaptive infrastructure and resources (Ma et al., 2023). For designing public health measures and policies to build resiliency, the significance of prosaic understandings of communities as social spaces and on-going community-based activities can also be useful.

In the face of the COVID-19 pandemic, community resilience has become crucial for public health during the outbreak and post-epidemic recovery. Community resilience is vital in effectively mitigating the impact of disasters and rapidly recovering from their aftermaths. The concept of community resilience is still being explored and refined across multiple disciplines in the context of various hazards and disasters (Zhang et al., 2021). Many studies highlight the significant role of social networks in building community resiliency. Community social networks are considered vital in public health emergency management, as they facilitate information dissemination and resource sharing. Community social capital is pivotal in enhancing community resilience by facilitating access to information, resources, and support services from internal and external social networks. Social solidarity and reciprocity strengthen ties among community residents, which helps build trust and cooperation and promotes the collective ability to adapt to and recover from hazards.

1.15 13. Research Methods in Public Health

Public health is a discipline concerned with preventing disease, prolonging life, and promoting health in populations. The field encompasses research, policy development, and education. Public health practitioners work in a variety of settings, including local and state health departments, nonprofit organizations, universities, policy think tanks, and hospitals. Public health practice employs the “core functions” framework. The first function is assessment, which includes monitoring public health status, investigating health problems, and identifying community health assets. The second function is policy development: developing policies and plans, fostering community partnerships, and promoting health policies. The third function is assurance: ensuring access to healthcare, enforcing health regulations, and evaluating health services. Ultimately, public health aims to improve the health of communities.

Research in public health is a systematic investigation to evaluate one or more components of a public health program. Evaluation studies examine programs that are already underway, while research studies consider new interventions. Public health research and evaluation can take many forms: comparative effectiveness studies, needs assessments, routine program monitoring, and policy analysis and advocacy. Most public health research and evaluation is conducted in community settings, providing the opportunity to work in partnership with communities. Public health research and evaluation help to document the effectiveness of interventions, examine the

impact of policies, increase the evidence base for best practices, guide resource allocation, and ensure accountability (Cowan, 2018).

13.1. Qualitative Research

The discussion of research methods in public health would not be complete without reference to qualitative research. Qualitative research is defined as "any research that produces findings not arrived at by statistical procedures or other means of quantification" (Stickley et al., 2022). The qualitative paradigm is based on different epistemological and ontological assumptions than the quantitative paradigm. Consequently, qualitative research involves different kinds of questions, designs and methods, validity checks, and forms of analysis and presentation. Quantitative health research (public health and clinical epidemiology) dominates the academic and professional public health landscape. The relevance and importance of qualitative health research is often overlooked or underestimated, particularly by those trained in and used to quantitative approaches to research.

13.2. Quantitative Research

The processes of biostatistical design, analysis, and discovery address research questions arising in public health and clinical epidemiology. The principles and methods of biostatistics are introduced from a public health and clinical epidemiology perspective. Simple concepts of clinical epidemiology—population, exposure, disease, time, and data—are reviewed. Statistical modeling concepts are introduced as a framework for understanding how the fundamental principles of probability govern the validity of epidemiologic research and biostatistical analyses. Under this framework, biostatistical study design, data analysis, and result interpretation are viewed as the construction and interrogation of probability-based models that relate data to research hypotheses (Schwaid, 2017). This organization emphasizes the scientific method, which is fundamental to public health practice, as the model for good biostatistics, focusing on the important principles of validity that should be the goals in designing and interpreting biostatistical analyses in public health studies. It is essential for good public health practice to know the fundamentals of epidemiologic research and the biostatistical methods applied to that research. Good public health practice relies on the peer-reviewed public health literature to keep current on research and findings that support an evidence basis for effective public health practice (J. Hayat et al., 2017). However, studies have shown a need for experimental and statistical literacy and knowledge to understand published research. An understanding of basic epidemiologic and statistical concepts is necessary for researchers to design studies properly and for research consumers to criticize the validity of designs and analyses.

13.3. Ethical Considerations

Ethics, a sub-discipline of philosophy, concerns values and acceptable standards of human behavior. Ethical considerations in public health emerged in the late 1980s and 1990s due to criticisms of health inequalities and perceived coercive restrictions on individual freedom regarding behavior modification and life expectancy. Practical public health ethics was catalyzed in 1999 by the establishment of the CDC Public Health Ethics Unit, focusing on ethics integration in practice, education, and research. Ethics case studies, widely utilized in medicine, have been successfully developed for public health, enhancing understanding of ethical dilemmas in the field (H. Tulchinsky, 2018). An ethical dilemma arises when an individual is faced with two or more alternative courses of action, each with moral consequences, making it impossible to choose a

course of action without a moral harm. Ethical dilemmas should be resolved through several steps: 1) Identifying and clarifying the ethical dilemma posed; 2) Analyzing it in terms of alternative courses of action and their consequences; 3) Weighing the consequences of each possible course of action in order to choose one; and 4) Monitoring the course of action chosen in order to rectify it if unforeseen negative consequences arise.

1.16 14. Public Health Informatics

Public health informatics has emerged as a critical area of focus for health departments, particularly in light of challenges like the COVID-19 pandemic. In this context, a roundtable session will be held to explore issues faced in public health informatics and technology, and solicit ideas and suggestions from participants. The Office of Public Health Informatics at the Georgia Department of Public Health is actively working to enhance the efficiency and effectiveness of health department programs through informatics initiatives, focusing on information system assessment, basic planning and standards, GIS/GT technology, and expanding data collection methods. Similarly, the Georgia OPHI is developing a comprehensive multi-year plan to address the most pressing informatics needs within the state's health department.

Public health informatics as applied to public health agencies and organizations focuses on the PRISM model as its framework, with four main domains: decision support, measurement and accountability, communication, and capacity building (A. Jones, 2018). In public health, informatics is viewed as "the systematic study and innovative application of information and computer science and technology, with associated social scientific understanding, to programs, services and research in public health," considering both technology and social science aspects. The development and implementation of a public health informatics framework will be discussed, along with specific examples for each of the four framework domains, emphasizing public health's unique needs in informatics development.

14.1. Data Collection and Management

Data collection and management by local health departments (LHDs) is a complex endeavor, complicated by system level and organizational factors. The processes and use of information systems (IS) utilized for data collection, management, and sharing by LHD employees were described. Public health practice involves the use of mix of state-supplied and locally implemented IS supported by paper records (R Vest et al., 2014). Each LHD in this study used at least one shadow system to maintain a duplicate set of information. Experiences with IS functionality and the extent to which it supported work varied by programmatic area, but inefficiencies, challenges in generating reports, limited data accessibility, and workarounds were commonly reported.

Current approaches to data management and sharing do not always support efficient public health practice or allow data to be used for organizational and community decision making. These findings suggest the need for interorganizational collaboration, increasing organizational capacity, workflow redesign, and end user training. Since a database could be damaged or lost in many ways, backup files are kept, and the backups are made regularly on external storage devices. Multiple backups with at least last three generations of the database are kept since errors found in a recent data set might require reviewing the previous copy of it. One backup copy is kept at the IVI, which is geographically separated location from the field sites (Ali et al., 2006). Digital data files are encrypted when they are transmitted via internet to minimize risks of data safety and confidentiality.

14.2. Health Information Systems

The collection, analysis, interpretation, and dissemination of health data are central to health information systems (HIS). At a minimum, a HIS includes a hardware platform, software applications, data structures, and protocols that support public health monitoring and reporting. At the local health department (LHD) level, the public health HIS also comprises a set of specialized databases and data systems, such as vital statistics registration systems, immunization registries, sexually transmitted disease tracking systems, and environmental health systems. LHDs usually electronically file the data collected by these systems to state health agencies for further processing and analysis. These systems may also connect with non-public health databases, such as criminal justice, education, transportation, and housing datasets. These interconnections can support comprehensive analysis and monitor a broad range of health determinants and outcomes.

In 2008, the National Association of City and County Health Officials (NACCHO) conducted a study to assess the capacity and HIS of LHDs across the United States. This study was supported by an increasing number of requirements from the state health agencies concerning health monitoring and reporting in the aftermath of the September 11 terrorist attack. LHDs were encouraged or mandated to implement new HIS to collect and manage data on specific health events or activities and report to state agencies. These requirements imposed new expectations regarding the HIS capabilities of LHDs, which ultimately created disparities between larger urban LHDs with more resources and smaller rural LHDs with limited health data monitoring and reporting capabilities (R Vest et al., 2014). Many LHDs expressed concerns regarding the informational needs at specific public health practice domains and requested assistance in designing HIS to address these needs. This prompted researchers and state public health officials to investigate the HIS at LHDs, focusing on the classifying, analyzing, and identifying gaps in HIS efforts at LHDs.

14.3. Epidemiological Surveillance

Epidemiological surveillance is the continuous systematic collection, analysis, and interpretation of health data to facilitate public health action. Public health surveillance is essential for epidemic preparedness and response. It is used to monitor trends, outbreaks and other public health events, as well as to evaluate the impact of interventions and guide future planning and resource allocation. Epidemiological surveillance is a systematic ongoing collection, analysis and interpretation of health data primarily for public health action (Zhang, 2016). It includes routine monitoring of health events, investigations of unusual health events, collection of ad hoc special studies, and review and analysis of health system records.

Health event monitoring has two components: regularly reported health events and events that are not routinely reported but may require investigation. The former is epidemiological surveillance; the latter involves public health investigations (Zhang, 2015). With health data systems developing rapidly, health surveillance now encompasses not only traditional reporting systems but also monitoring of informal health events and the use of new data sources, such as web search queries, social media or other indirect proxies for health.

1.17 **15. Occupational and Environmental Health Regulations**

Concepts of Environmental and Occupational Health Hazards and Safety Occupational and Environmental Health Regulations Occupational Health Hazards, Safety & Public Health Concepts of Environmental and Occupational Health Hazards and Safety Environmental and Occupational Health Hazards Environmental Health Hazards Exposure to chemicals in food, air,

water, and soil effects of hazards in the natural environment Industrial Development and Urbanization Industrial Disasters Industrial Waste Industrial Life Style Exposure to methanol, heavy metals, sodium... Respectively affects air, water, and soil Other Health Hazards Over population Noise, vibration... Occupational Health Hazards Health Hazards at Workplace Biohazards Physio-chemical hazards Mechanical accidents Chemical hazards Exposure to extreme heat and temperature Hazards caused by Deficiencies Poor Design Poor Maintenance Unsafe Work Procedures Over Burdening Poorly Planned Work Schedules Unsafe Manipulation of Hazardous Materials Environmental & Occupational Health Hazards Global climatic change Effects of UV radiation Depletion of ozone Pollution Commercial Use of Chemicals and Heavy Metals Transfer of Hazardous wastes

15.1. Workplace Safety Regulations

Before the United States Department of Labor was created, individual states were finding the need to enact laws for the purpose of protecting the safety and health of workers. Increases in industrial production demands were leading to increasing numbers of injuries, illnesses and death. Activists for labor and social reform focused on establishing health and safety regulations (C LAINE, 2019). The first law of this kind was enacted by the State of Massachusetts, with a requirement for factory inspection that covered machine guarding, elevators, and fire exits. By the 1890s several other states followed with the promulgation of regulations ranging in topic from factory inspections to health hazards. Additionally, a uniform system for collecting information and collecting records was also developed, allowing injury information to be collected from all over the United States.
On June 27, 1906 President Theodore Roosevelt signed into law two bills intended to protect the health and safety of workers. One of the new laws required that certain factories and other workplaces be inspected to ensure compliance with safety regulations. The other law restricted the employment of young children. The act resulted in the establishment of the Bureau of Labor Standards in 1933, which conducted workplace inspections to enforce compliance with health and safety regulations.

15.2. Environmental Protection Laws

Environmental protection laws at the federal, state and local levels have been enacted to avoid and/or reduce adverse effects on human health and the environment from exposure to chemicals. These laws govern the use and disposal of chemicals and require that certain chemicals be reported, investigated, monitored and remediated. The laws aim to protect drinking water wells and surface water from chemical contamination; restrict the use and disposal of certain chemicals for the sake of air, water and soil protection; limit the use of chemicals that are harmful to the environment and promote the development of safer chemicals; and require companies to disclose their chemical use in order to protect the community and environment (E. Meidinger et al., 2018).

15.3. Regulatory Compliance

Compliance with environmental regulations has been a significant challenge for the pharmaceutical industry. Low levels of compliance could pose adverse effects on public health and the environment. A number of challenges for compliance with environmental regulations are identified and highlighted. These challenges have resulted in costly noncompliance situations for pharmaceutical companies and have raised the public risk profile of noncompliance companies. The healthcare industry is critical to the improvement of life quality and longevity. However,

healthcare companies' noncompliance with government regulations can generate negative public health implications. In the public healthcare setting, noncompliance pharmaceutical companies can consider risky because the public health of the exposed population is at risk. From a framework analysis, public health is illustrated. Specifically, the complexity of the manufacturing process and the fund requirements to comply with government regulations are challenges to overcome for pharmaceutical companies in developing regions (Jagun, 2018).

1.18 16. Health Communication Strategies

Health communication is the study and use of communication strategies to inform and influence individual and community decisions that enhance health. It encompasses health information, health promotion, risk communication and crisis communication. Health communication strategies should be planned in a way that communicates the right message to the right people at the right time and through the right channel (Tolulope Animawun, 2018). When planning health communication strategies, health organisations should allow a health communicator to guide them on the strategies to use. If their budget does not allow for the hiring of a health communicator, they should ensure that at least one person on the planning committee has an understanding of health communication strategies to ensure that appropriate strategies are employed.

There are various channels that can be used to communicate health information, such as new media, social media, print media, community meetings, and door-to-door visits. New media has provided health communicators with a fast and cost-effective way of communicating health messages. Examples of new media include the internet, e-mail, and mobile technology. Social media platforms such as Facebook and Twitter can also be classified as new media. Social media platforms allow for two-way communication which encourages feedback. Health communicators are able to monitor users' comments on the health information that has been disseminated and adjust future messages accordingly. This was evident during the Ebola outbreak in West Africa in 2014 where many people believed that Ebola was a Spiritual disease that could only be cured by traditional healers. This perception prompted an outbreak of violence against health workers. However, once Health Communicators employed the use of social media platforms to understand and correct people's misconceptions, the violence decreased.

16.1. Risk Communication

People and communities have a right to participate in decisions that affect their lives. Decisions about risk need to be made in public, and deliberation should involve and be guided by the public (D. Haddow & S. Haddow, 2014). The goal should be to produce an informed public that is involved, interested, and collaborative rather than merely passive. A basic set of principles should guide risk communication efforts. Show respect for the public by involving the community early. Efforts to inform and educate the public should take place before a crisis occurs to build trust. When a crisis happens, the public should feel they can work collaboratively with the institution and that mutual trust exists. Clarify that decisions about risks will be based on factors of concern to the public. People are often more concerned about trust, credibility, control, benefits, and fairness than they are about technical risk data. If your audience feels they are not being heard, they cannot be expected to listen to anything else you might have to say.

Effective risk communication is a two-way activity rather than a one-way monologue (Alaszewski, 2005). Do not make assumptions about what people know. Listen, monitor social media, and make an effort to find out what people are thinking and how they are feeling. Involve all parties interested in the issue, not just the groups you think represent the public. Identify with your audience; be

open about your own feelings and concerns. Recognize people's emotions; in a dispute, two sides may be looking at the same issue but from different perspectives. Let people know that you understand their concerns. Understand that audiences often have hidden agendas and broader considerations beyond the immediate focus of concern. Be honest, frank, and open—establish trust and credibility. Make corrections if errors are made and be sure to indicate the new course of action. Disclose risk information as soon as possible, even if some data are uncertain, rather than waiting until everything is known.

16.2. Media Relations

Each public health agency needs to have a designated media relations officer and a plan for dealing with emergencies and complex activities. In most jurisdictions, the arrangement will consist of a combination of agency resources and local media representatives. The media are a key ally in getting messages out to the general population. The intention should be to build a positive and constructive relationship based on openness and honesty (D. Haddow & S. Haddow, 2014). Activities should include everything from social events to formal briefings.

A number of principles apply to dealing with the media in an emergency. Everything should be done to ensure that initial media releases go out as soon as possible after there is something worth reporting. In a crisis, news will be gathered from whichever source is available. If the agency is not proactive, the risk is that inaccurate information will spread. Media releases should be in plain English and include relevant facts, figures, and contact details for further information. If there is no new information to report, it is better not to do anything than to issue "no comment" or ill-informed reports, which may fuel speculation. Do not give "off the record" comments or background information. Everything should be treated as public information.

16.3. Health Literacy

Health literacy is defined as people's access to, understanding of, and ability to apply health information in order to make informed health decisions that foster health-enhancing behavior and improve quality of life. Health literacy has emerged as a significant public health concern, particularly because low health literacy is particularly prevalent among groups at risk for poor health outcomes and health inequities (Arriaga et al., 2022). The Health Literacy Population Survey Project 2019–2021 represents a collaborative effort of a multidisciplinary group of ten institutions across eight countries, collecting basic information on the health literacy of adult populations in Europe, Latin America, and the Middle East. Health literacy was measured using the 12-item instrument Health Literacy Survey HLS19-Q12. The analyses reported here are focused on a nationally representative sample (N = 1,025) of Portuguese adults aged 18 years or older. In each sample, data were collected regarding socio-demographic characteristics, health status, determinants of health literacy, and levels of health literacy. The dimensions of health literacy were calculated using the HLS19-Q12 instrument, with the grouping of items corresponding to health promotion, disease prevention, and health care.

1.19 **17. Evaluation of Public Health Programs**

Public Health Programs Ideally Should Be Evaluated Before, During, and After Implementation

Implementation of new policies and interventions can be evaluated in terms of whether the policy or intervention works as intended; uptake and adherence to the intervention; and the factors that affected implementation. In particular, it is important to consider the fidelity of the implementation (whether it was delivered as intended), the dose delivered, the reach or the coverage of the target

population, and context (external factors affecting implementation). Process evaluation of health policy and intervention also involves assessing how various social and economic factors may have affected implementation, such as the motivation and skills of staff conducting implementation, the training providers, and the availability of materials critical to implementation (L. Alfonso, 2015). Outcomes of policies and interventions can be evaluated in terms of the effectiveness or impact of the policy or intervention on the target behavior or health outcomes, as well as on unintended effects. Effectiveness examines whether there was an effect under usual conditions, while efficacy examines whether there was an effect under ideal conditions. Impact evaluation could look at both short-term outcomes (changes in knowledge and attitudes) and longer-term outcomes (changes in behavior and health). In addition, policies and interventions may also have unintended outcomes that should be evaluated.

17.1. Program Planning and Implementation

This chapter presents the fundamentals and practices of program planning and implementation in preventive medicine and public health. It covers essential concepts in program planning, including needs assessment, resources, partnerships, and the prioritization and design of strategies. Public health programs are systematic efforts to improve health. It includes data collection and analysis to assess health needs and determine effective interventions. Successful programs address actual needs, use data, and consider social, cultural, economic, and political contexts.

Public health programs can be community-driven or externally funded. Community-driven programs encourage local problem-solving, while externally funded programs address urgent health concerns. In either case, public health professionals provide expertise in needs assessment, research, and intervention design. Prior to funding proposals, a preliminary program plan outlining key issues and intended actions is usually developed. Program planning typically involves seven steps: conducting needs assessments, defining program goals and objectives, planning program strategies, program management and operation planning, planning program evaluation, securing necessary resources, and reporting.

The "domino model" uses a series of dominos to illustrate how one event leads to another. In the context of program planning and evaluation, it shows how planned actions produce anticipated consequences. The model emphasizes the importance of clear definitions to ensure the intended linkages between actions and outcomes. In public health program planning, objectives should be clearly defined; otherwise, it is uncertain whether outcomes were achieved. The role and significance of needs assessments, objectives, and evaluations in the program planning process are also discussed.

17.2. Process and Outcome Evaluation

Two major types of evaluation, outcome and process, are important in public health programs. Outcome evaluation examines measurable health changes in a community due to the intervention. It looks at whether the program achieved its goals, including changes in knowledge, attitudes, behaviors, and health status (Branscum & Hayes, 2013). A successful outcome evaluation relies on a clear definition of evaluation goals and objectives and selection of appropriate indicators and measurement techniques. Process evaluation, on the other hand, focuses on understanding what happened during the program implementation. It assesses program fidelity, including adherence to the original design, intensity, time frame, and setting. Other aspects of process evaluation include examining staff participant characteristics, training, and understanding the causal link

between program activities and expected health outcomes. Good process and outcome evaluations are essential for effective public health programs. Process evaluations identify problems that may interfere with achieving outcome objectives, while outcome evaluations help justify funding for similar future projects. State health departments often face challenges in conducting effective program evaluations due to the lack of evaluation staff, unqualified staff, and negative perceptions from grantees. However, with awareness and commitment, health departments of all sizes can develop and conduct useful evaluations.

17.3. Quality Improvement

A commitment to quality improvement (QI) is critical and foundational for public health agencies seeking accreditation through the Public Health Accreditation Board (PHAB). QI is a systematic process that seeks to improve the quality of services through ongoing review and improvement of processes, products, or services. Public health agencies implement QI activities to promote efficient use of resources, increase productivity, enhance the quality of programs and services, and improve the health outcomes of communities and populations (Southern University, 2013). A collaborative study evaluated QI in public health, focusing on the impact of one QI project on public health outcomes and agency culture. An overview of public health QI and study methods and findings is presented, along with future directions for QI in public health. The study aimed to assess the impact of a selected QI project on the public health outcome and agency culture of one health department within a large, multi-county public health agency in Georgia.

1.20 **18. Interdisciplinary Approaches in Public Health**

Public health, by nature, is an interdisciplinary field. Health problems and health-related behaviors are complex entities that are influenced by a number of environmental, social, behavioral, and genetic factors. Data collected from research in one discipline can often be used to shed light on hypotheses in another discipline. For example, trends in mortality statistics can generate hypotheses for consideration in an epidemiology study that would then collect primary data in a different way. Findings of an epidemiology study can then be investigated in more detail with a different approach - possibly a laboratory-based study in biochemistry, physiology or microbiology. The interplay of different disciplinary approaches to the same problem often enhances understanding of the complex system under study. This is one of the reasons that researchers are often encouraged to think outside their comfort zone - and perhaps a different discipline or mode of research would lead to new ideas and questions to be pursued.

The definitions of disciplines as applied to public health are relatively open-ended. Epidemiology is the basic science discipline of public health. It is concerned with the distribution and determinants of health and disease in a population. Biostatistics provides the statistical methods and mathematical modeling used in epidemiology studies, as well as in health service and planning studies and a number of other types of studies in public health. Although oftentimes considered a separate discipline, toxicology is intimately involved with epidemiology studies designed to look at the effects of environmental exposures. Laboratory-based disciplines that have a role in public health include microbiology, biochemistry, and physiology. Public health also employs a number of non-science disciplines, including health economics, political science, sociology, psychology, and anthropology. Each of these has a unique approach to public health problems. Health economics, for example, considers public health problems in terms of costs and benefits, including willingness to pay. Political science investigates the influences of the political system and governance on public health.

18.1. Collaboration with Other Disciplines

Public health needs support from various sectors, especially in low- and middle-income countries, due to ever-growing health concerns from natural and man-made hazards. Thus, it is essential to understand the collaboration between law enforcement agencies and public health institutions during public health emergencies. Efforts have been made in many countries to advance collaboration between law enforcement and public health institutions to protect the lives of individuals and communities. Such collaborations face numerous challenges, however, institutions gain a lot in terms of shared resources, expertise and trained personnel, which helps during normal times and acute emergencies (Sharma & Mahbub Hossain, 2019). In complex scenarios like natural disasters, terrorist threats, riots, violence, and outbursts of epidemic diseases, law enforcement agencies and public health institutions share their resources and expertise to protect and restore the health of individuals and communities. In these situations, one institution takes the lead while the other assists. However, the rules, responsibilities, and operating procedures of each institution should be specified. Such collaborations also benefit the institutions and the nation as a whole (C.K. Choi, 2016). Maintaining law and order can be an extra burden for public health authorities during public health emergencies but having a law enforcement agency on board can ease this burden.

18.2. Team-Based Care

Team-based care may be particularly valuable in chronic disease management and integrating behavioral health services into primary care. In the team-based primary care delivery model, each team member's unique expertise complements the others, allowing better time management and workload distribution. The addition of a health coach for chronic disease management has relieved workload for other team members by assuming care coordination and self-management education for patients, permitting greater attentiveness during clinical visits. Team-based care promotes patient-centered approach, thanks to staff efforts in understanding patients' background and needs, which improves the quality and efficiency of primary care services. This model is suggested to allow a better understanding of patients' behavioral and social factors that affect health. However, implementing effective teams in primary care practices often requires overcoming various obstacles, which might be similar across cases but reformulated based on local contexts (Thies et al., 2020).

18.3. Interprofessional Education

Interprofessional service-learning provides an innovative and impactful way to implement, assess, and enhance interprofessional education. Interprofessional service-learning projects in community settings can expose health sciences students to culturally and socio-economically diverse populations and help them develop many competencies needed to be effective healthcare providers. With strong community partners and support from an academic health center, this model can be easily replicated and adapted in various community settings for multiple health professions. Health care is by nature interprofessional, and the education of health professions students must foster appreciation for the roles and skills of different providers and collaboration (Buff, 2012). To develop and maintain effective interprofessional education (IPE) programs, an understanding of the target population, a clear educational framework, commitment from all stakeholders, and adequate resources are essential. Community settings provide access to diverse individuals in need of care and support students' understanding of the social determinants of health.

Health care education is undergoing massive changes because of the supply-and-demand mismatch between healthcare providers and changing populations' needs. Population health is a promising paradigm to address this mismatch, involving partnerships and collaboration across various sectors to improve outcomes and reduce health disparities. Population health training should be infused within health professions education to prepare providers for ongoing and future changes through collective accountability (S. Anderson et al., 2019). In this context, interprofessional education (IPE) is viewed as a transformative strategy to enhance the collaborative practice of health professionals in delivering population health. For IPE to be impactful, it must be embedded in foundational health professions education, care delivery, and community service.

1.21 19. Conclusion

Preventive medicine (PM) specialty and its practitioners should evolve as prescribed by the preceding ideas and tenets, towards three mutually-supporting directions of change. The first prescription is for PM practitioners to embrace and boldly expand their 3 proposed core functions. Each PM specialty should strive for an adequate "knowledge bases" architecture to optimally perform the 3 proposed functions and to embrace preventive care knowledge pioneered by other disciplines. The second prescription is to prepare for optimal delivery of 10 proposed essential services. Each PM specialty should define a tiered "service delivery" system. Wider collaboration with other disciplines's specialists in service delivery will be needed and should be envisioned as complementary to and enhancing PMI services. The third prescription is for PM specialization to be pursued within the framework of medicine, with a "narrow" specialty within a specialty approach (T. Jadotte & S. Lane, 2021). The prevention imperatives and the PM specialty evolution prescriptions collectively overcome the perennial identity, equivalence and viability problems that plague current PM.

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