Chapter 3

Measuring, Monitoring, and Evaluating the Health of a Population

ABSTRACT

Public health depends on information derived from monitoring population health status to identify community health problems, and to diagnose and investigate health problems and hazards in the community. These depend on vital statistics and disease reporting systems, including for non-communicable diseases, injuries, risk factors, health care resources, utilization of resources, and special disease registries such as for cancer, birth defects, and many others. Information technology and computerization allow data systems to be linked to assess the impact of health conditions and utilization of services providing vital information for epidemiological and economic analyses for policy development. Epidemiology and its associated quantitative disciplines of biostatistics and demography are augmented by social and behavioral qualitative research methods. The disciplines of health systems research provide evidence from population health monitoring crucial to policy and priority determination. This introductory chapter is augmented in subsequent chapters, and by specialized courses in public health education programs.

SUPPORT MATERIAL

Student Competencies: Transferrable Knowledge and Skills

The following are points of emphasis highlighting key principles that public health graduates are expected to understand and apply into practice. The key points arise from this chapter and other studies in specialized courses, seminars, readings during public health education, and continuing education. The selected skills and knowledge are divided into two parts. The first consists of core questions pertaining to immediate student requirements, while the second refers to competencies essential for successful public health practitioners. These include competencies recommended by the American Public Health Association in 2007, as well as those of the European Association of Schools of Public Health and the Public Health Agency of Canada's 2008 Report on Core Competencies. For more detailed competencies please consult the Association of Schools of Public Health website at: http://www.asph.org/document.cfm?page=851.

Part I: Core Questions

1. Describe five commonly used mortality rates and ratios.
2. What is the purpose of standardization of rates?
3. Describe the role of DALYs and QALYs in estimating the burden of disease in a population.
4. Describe the purpose of measuring sensitivity and specificity in determining the usefulness of a screening test.
5. What are the goals of epidemiology?
6. What is the importance of census taking and vital statistics in public health?
7. What is the significance of mandatory reporting of causes of death, infectious diseases, hospitalizations, and other diseases or health events in the New Public Health?
8. Define epidemiology and describe epidemiological methods of research.
9. Describe the importance of epidemiology in determining health policy.
10. Describe population distribution factors and their significance in epidemiology.
11. Define a normal distribution, standardization of rates and ratios.
12. Describe/define the following epidemiological concepts:
    - **(a)** incidence
    - **(b)** prevalence
    - **(c)** SMR
    - **(d)** DALY
    - **(e)** QALY
    - **(f)** YPLL
    - **(g)** relative risk
    - **(h)** life expectancy
    - **(i)** avoidable mortality
    - **(j)** standardization for age and gender: direct and indirect.
13. Which health events other than morbidity and mortality are important for monitoring population health status?
14. What are disease registries? Give examples and discuss their importance.
15. What is a hospital discharge information system and how can it be used in determining health policy?
16. What are the major approaches to evaluation of the health status of a population?
17. What are the potential biases of epidemiological studies?
18. Describe physiological and functional indicators of health status.
19. What are performance indicators?
20. What is the value of a district health profile?

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TABLE 3.5 Years of Potential Life Lost, All People Before Age 75 per 100,000 Population, for Selected Causes of Death, USA, Selected Years, 1980–2008 (Age Adjusted)

	1980	1990	2000	2005	2008
All causes	10,449	9,086	7,578	7,300	6,953
Diseases of heart	2,239	1,618	1,253	1,110	1,039
Ischemic heart disease	1,729	1,154	842	702	629
Cerebrovascular diseases	358	260	223	193	179
Malignant neoplasms	2,109	2,004	1,674	1,525	1,438
Trachea, bronchus, and lung	549	561	443	393	354
Colorectal	190	165	142	125	128
Prostate	85	97	64	55	53
Breast	463	452	333	296	275
Chronic lower respiratory diseases	169	187	188	181	182
Influenza and pneumonia	160	142	87	84	82
Chronic liver disease and cirrhosis	300	197	164	153	159
Diabetes mellitus	134	156	178	180	165
Human immunodeficiency virus	–	384	175	134	100
Unintentional injuries	1,544	1,162	1,027	1,133	1,095
Motor vehicle-related injuries	913	716	574	565	474
Suicide	392	393	335	347	368
Homicide	426	417	267	297	268

Note: Data are based on death certificates. Rates have been rounded.
Source: Health United States, 2011. Available at: http://www.cdc.gov/nchs/data/hus/hus11.pdf Table 27 [Accessed 3 January 2013].

TABLE 3.10 International Classification of Diseases, 10th Revision (ICD-10)

Disease Group	Code
Certain infectious and parasitic diseases	A00–B99
Neoplasms	C00–D48
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	D50–D89
Endocrine, nutritional, and metabolic	E00–E90
Mental and behavioral disorders	F00–F99
Diseases of the nervous system	G00–G99
Diseases of the eye and adnexa	H00–H59
Diseases of the ear and mastoid process	H60–H95
Diseases of the circulatory system	I00–I99
Diseases of the respiratory system	J00–J99
Diseases of the digestive system	K00–K93
Diseases of skin and subcutaneous tissue	L00–L99
Diseases of musculoskeletal system, connective tissue	M00–M99
Diseases of the genitourinary system	N00–N99
Pregnancy, childbirth, and puerperium	O00–O99
Certain conditions originating in perinatal period	P00–P95
Congenital malformations, chromosomal abnormalities	Q00–Q99
Symptoms, signs, and abnormal clinical or laboratory findings not classified elsewhere	R00–R99
Injury, poisoning, and some other external causes	S00–T98
External causes of morbidity and mortality	V01–Y98
Factors influencing health and contact with health services	Z00–Z99

Source: World Health Organization. International Classification of Diseases (ICD). Available at: http://www.who.int/classifications/icd/en/ [Accessed 10 January 2013].

Box 3.10 Data Recorded on US Standard Certificate of Death, Revised 2003

1. Name
2. Gender
3. Social security number
4. Age at last birthday (< day in hours; < 1 year in months)
5. Date of birth
6. Birthplace
7. Residence – state, city, town of residence, street address, apartment no., zip code
8. Member of armed forces ever, Y/N
9. Marital status
10. Surviving spouse – maiden name
11. Father's name
12. Mother (maiden name)
13. Informant's name, relationship, mailing address
14–17. Place of death, name of hospital, institution, county, state
18–21. Method and place of disposition, burial/cremation – location
22–23. Funeral director's signature, license number
24–31. Date pronounced dead and time, signature of doctor pronouncing death, license number, date signed
32. Causes of death, and duration
- Immediate (final) cause (e.g., pneumonia)
- Preceding cause (e.g., chronic ischemic heart disease)
- Underlying cause (e.g., diabetes)
- Other significant conditions

33–34. Autopsy, Y/N; did findings complete cause of death?
35. Did tobacco use contribute to death?
36. Female – pregnancy-related?
37. Manner of death – natural, accident, suicide, homicide, to be determined
38–41. Date, time, place of injury, work-related
42–44. Describe injury
45–49. Physician's signature, address, license number, date
50. Registrar date filed
51. Education of decedent
52. Decedent's race and ethnicity – Hispanic, black, white, Puerto Rican
53. Decedent's race – white, black, American Indian, Asian Indian, Chinese, etc.
54. Decedent's usual occupation
55. Kind of business/industry

Source: *Centers for Disease Control and Prevention/National Center for Health Statistics. US standard certificates of death. Available at: http://www.cdc.gov/nchs/data/dvs/death11-03final-acc.pdf [Accessed 7 January 2013].*

Box 3.13 New York State Community Health Data Set

Indicators	1. Demographic & Socioeconomic Characteristics 2. Physical Activity and Fitness 3. Nutrition 4. Tobacco Use 5. Substance Use: Alcohol & Other Drugs 6. Family Planning 7. Violent & Abusive Behavior 8. Unintentional Injuries 9. Oral Health 10. Maternal & Infant Health 11. Child & Adolescent Health 12. Heart Disease & Stroke 13. Cancer 14. Chronic Conditions 15. HIV Infection 16. Sexually Transmitted Disease 17. Immunization 18. Infectious Diseases 19. Occupational Health
1. Demographic & Socioeconomic Characteristics	Unemployment Population Below Federal Poverty Level (Below 100%, Below 200%) Population Uninsured for Medical Care (People <18, Total Population) 2000 US Census Bureau State and County Profiles (Demographic, Social, Economic, Housing) 2010 US Census Bureau State and County Profiles (Demographic, Housing) 2010 American Community Survey (ACS) American Community Survey estimates and 2010 Census data tables are available in the New American FactFinder and Summary Profiles of New York State and Counties
2. Physical Activity and Fitness	Prevalence of Adults Not Participating in Leisure Time Physical Activity Children in WIC Viewing TV ≤2 Hours per Day, 0–4 years, Low SES Prevalence of Overweight and Obesity
3. Nutrition	Underweight Children (Age 0–4) Obese Children (Age 2–4) Anemic Children (Age 6 Months–4 Years) Percent Infants Breastfed at 6 Months Daily Consumption of Five or More Servings of Fruits & Vegetables
4. Tobacco Use	Prevalence of Current Cigarette Smoking Prevalence of Regular Smoking Among High School Students Prevalence of Smoking During Pregnancy Use of Cigarettes Among Middle and High School Students
5. Substance Use	Drug-Related Hospitalizations Alcohol-Related Motor Vehicle Deaths/Injuries Prevalence of Binge Drinking; Among High School Students
6. Family Planning	Pregnancy Rates by age groups 1–14, to 18–19 Birth Rates total and buy age groups 1–14, up to 18–19 Teenage Birth Percentage (Age 15–17) Induced Abortions Out-of-Wedlock Births Prevalence of Sexual Intercourse Among High School Students
7. Violent & Abusive Behavior	Suicide Mortality Adolescent/Young Adult (Age 15–19) Suicide Mortality Homicide Mortality Self-Inflicted Injury Hospitalization; Total and Age 15–19 Assault Hospitalization

Continued

Box 3.13 New York State Community Health Data Set—cont'd

8. Unintentional Injuries	Unintentional Injury Mortality – Total, Motor Vehicle Unintentional Injury Hospitalization – Total and Age Groups Unintentional Falls Hospitalization – Total and By Age Groups Traumatic Brain Injury Hospitalization Poisoning Hospitalization
9. Oral Health	Oral Cancer – Mortality, Incidence Mortality (Age 45–74) Oral Health Visits Percent of Adults Who Have Visited a Dentist, Dental Hygienist, or Dental Clinic within the Past Year
10. Maternal & Infant Health	Infant; Neonatal, Post-Neonatal Mortality Spontaneous Fetal Deaths 20+ Weeks Low Birthweight (<2500 g);Very Low Birthweight (<1500 g) Short Gestation (<37 Weeks) Early Prenatal Care Late/No Prenatal Care Newborn Drug-Related Discharges Maternal Mortality
11. Child & Adolescent Health	Number and Percent of Children Tested for Lead By Age and County of Residence for Children <9 Months; <18 Months; <36 Months; Under Age Six Years Newly Identified Elevated Blood Lead Levels (EBLLs); Early Childhood (Age 1–4) Mortality; Childhood/Adolescent (Age 5–14) Mortality and Adolescent/Young Adult (Age 15–19) Ambulatory Sensitive Conditions – Age 0–4 and Age 5–14; Asthma, Gastroenteritis, Otitis Media, Pneumonia
12. Heart Disease & Stroke	Mortality – Cardiovascular Disease Mortality Cerebrovascular Disease (Stroke) Mortality; Diseases of the Heart Mortality; Coronary Heart Disease Mortality Hospitalizations – Cardiovascular Disease; Cerebrovascular Disease (Stroke); Coronary Heart Disease; Hypertension (Age 18+) Prevalence of Cholesterol Screening Percent of Adults Diagnosed with High Blood Pressure Prevalence of Cardiovascular Disease
13. Cancer	Mortality – Lung and Bronchus, Breast, Uterine Cervix, Colorectal Incidence – Lung and Bronchus, Breast (Female), Uterine Cervix, Colorectal BRFSS – Percent of Women Aged 18 Years and Older Who Had a Pap Smear in the Past 3 Years; Percent of Women Age 40 Years or Older Who Had a Mammogram Within the Last 2 Years; Percent of People Age 50 Years or Older Who Have Ever Received a Sigmoidoscopy or Colonoscopy
14. Chronic Conditions	Cirrhosis Mortality Diabetes Mortality Chronic Lower Respiratory Disease Mortality Prevalence of Current Asthma Among Adults; Asthma Mortality and Asthma Hospitalization by Age Group Diabetes Hospitalization; Hospitalization Diabetes (Primary Diagnosis) Hospitalization Diabetes (Any Diagnosis); BRFSS/ Prevalence of Diabetes
15. HIV Infection	AIDS Mortality AIDS Case Rate HIV Case Rate
16. Sexually Transmitted Disease	Early Syphilis; Gonorrhea; Gonorrhea (Age 15–19) Pelvic Inflammatory Disease Hospitalization Chlamydia by gender and age group
17. Immunization	Pertussis, HIB Prevalence of Pneumococcal Pneumonia Immunization (Age 65+) Prevalence of Influenza Immunization in Last Year (Age 65+) Immunization Status at Age 2 Years
18. Infectious Diseases	Tuberculosis Hepatitis A; Hepatitis B; Lyme Disease
19. Occupational Health	Pneumoconiosis Hospitalization Asbestosis Hospitalization Work-Related Hospitalization Elevated Blood Lead Levels Among Adults (≥10 μg/dl)

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children; SES = socioeconomic status; BRFSS = Behavioral Risk Factor Surveillance System; AIDS = acquired immunodeficiency syndrome; HIV = human immunodeficiency virus; HIB = *Haemophilus influenzae* type b.
Source: *New York State Community Health Data Set [revised 11 November 2011]. Available at: http://www.health.ny.gov/statistics/chac/chds.htm [Accessed 11 January 2013].*

Part II: Knowledge and Skills

1. Compare measures of morbidity and mortality in terms of their meaning, usefulness, and applicability.
2. Describe a multifactorial systematic approach to evaluation of health of a population.
3. Design and implement a monitoring system for health service interventions and structures.
4. Critically analyze public health related research by identifying potential confounding and modifying variables within the study.
5. Consider the hierarchy of evidence, and how it influences application and interpretation of results when evaluating research studies.
6. Understand how transparency (e.g., data available from public sources) can inspire confidence in the public health profession, while a lack of transparency can lead to distrust and foster negative attitudes.
7. Produce epidemiological documentation (tables, figures) based on information from epidemiological surveillance systems (e.g., WHO European Region Health for All database).
8. Estimate epidemiological parameters such as incidence, prevalence, relative risk, odds ratio, and attributable risk.
9. Identify sources and types of bias (selection bias, information bias, analytical, and publication bias).

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