INMED International Medicine & Public Health

Advanced Preparation for Healthcare Professionals
Second Edition

Nicholas Comninellis, MD, MPH
Institute for International Medicine
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Institute for International Medicine
6400 Prospect Ave
Suite 338A
Kansas City, MO 64132
# INMED International Medicine & Public Health

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Nicholas Comninellis, MD, MPH
Author

President, Institute for International Medicine
Assistant Clinical Professor, University of Missouri-Kansas City School of Medicine

Dr. Comninellis served inner city citizens for a year at Shanghai Charity Hospital during the pre-prosperity era, and over a two-year period initiated a healthcare ministry in the war-besieged city of Huambo, Angola, in southern Africa. He also served one-month medical assignments in Honduras, Haiti, Zimbabwe, Burkina Faso, Niger and Kunming, China. Dr. Comninellis then worked for six years in the Kansas City public hospital system before launching INMED in 2003.

He attended the University of Missouri-Kansas City School of Medicine and the Saint Louis University School of Public Health, and was a family medicine resident at the University of Texas Southwestern Medical Center/John Peter Smith Hospital in Fort Worth, Texas. Dr. Comninellis also earned a diploma in tropical medicine from the Walter Reed Army Institute of Research. He is board certified in both preventive medicine and family medicine, and is author of six books on contemporary issues.

Micah Flint, MPA
Reviewer

CPO, Institute for International Medicine
Adjunct Faculty, Park University
Children’s Mercy Hospital and Clinics, Training Center Faculty

Micah Flint is an adjunct faculty member of the global health leadership program at Park University. Prior to his current position as Chief Programs Officer at INMED, he served as INMED’s Chief Executive Officer for five years.

Micah served three years as a Board Member for the Samaritan’s Emergency Medical Search and Rescue, an international non-governmental organization that provides disaster training and response. He is a regular volunteer at Baptist Medical Center in northern Ghana. Micah’s Masters Degree is in Public Administration with a focus on Healthcare Leadership and Disaster Management.

Micah served as part of the review committee for each chapter of this curriculum.
Chapter 1

International Public Health

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Welcome

*International public health* is the field devoted to the study and improvement of health of all people – especially those who are largely forgotten. It is a field that relies upon several associated disciplines for its effectiveness, including sociology, medicine, nursing, biostatistics and political science. International public health is in every sense a global subject. The interconnected nature of our world today means that everyone has a stake in international public health, for whatever aids or depresses the health of even the humblest, most remote people ultimately influences us all.

The INMED International Public Health chapter is covered in five modules:

- Module 1: Introduction To International Public Health
- Module 2: Health And Social Context
- Module 3: Strategy For Health
- Module 4: Effective Health Promotion
- Module 5: Effective Disease And Injury Intervention

**COMPETENCY OBJECTIVES**

At the completion of this chapter, participants will, in the context of a low-resource community, be able to:

- Advocate for literacy and general education
- Advocate for economic development
- Effectively promote health
- Effectively intervene against the leading causes of death and disability
Joe LeMaster, MD, MPH
Kansas University Medical Center engaged in service to Bhutanese and Nepali refugees in the United States
Formerly of the United Mission to Nepal, 1990-2000

Dr. LeMaster is a University of Kansas School of Medicine graduate who received a Masters degree in Public Health in Developing Countries from the London School of Hygiene And Tropical Medicine. Dr. LeMaster and his wife Judy lived in Nepal from 1990-2000. They served at Okhaldhunga Hospital, the only medical care facility for 300,000 people, where they promoted maternal-child health and conducted leprosy research.

Presently, Dr. LeMaster is at the University of Missouri-Columbia, teaching family medicine, researching community participation for improving the health of children, and engaged in service to Bhutanese and Nepali refugees in the United States.

Nancy Crigger, PhD, APRN, BC
Associate Professor, Department of Nursing
Graceland University in Kansas City, MO

Dr. Crigger is a family nurse practitioner and associate professor of nursing at William Jewell College in Liberty, Missouri. For two decades, she has instructed and lead teams of American nursing students in providing care in Central America. Dr. Crigger is widely published in topics of ethics, cultural competency best practices, and end-of-life care. Her formation includes an MA in philosophy and PhD in nursing from the University of Florida. Dr. Crigger is a member of the INMEd Board of Directors.

Micah Flint, MPA, also participated in review of these materials. See his bio on page 5.
Module One: Introduction To International Public Health

**What is International Public Health?**

*International public health* is the field devoted to the study and improvement of the health of people living in all communities and in all nations. It is a field that relies upon several associated disciplines for its effectiveness, including sociology, medicine, nursing, biostatistics and political science. International public health is in every sense a global subject. The interconnected nature of our world today means that everyone has a stake in international public health, for whatever aids or depresses the health of even the humblest, most remote people ultimately influences us all.

**Implications of International Public Health**

International public health carries broad implications for life on the entire planet. Five leading implications include:

- *International public health as a means of foreign policy*
  Foreign policy goals determine the international health priorities of a nation. Engagement in international public health activities is used as a means to create trade alliances, enhance international reputation, promote economic growth and democracy in other countries, and open new markets for trade.

- *International public health as a means to security*
  Policy is guided by a country’s interest to protect its own population with regard to issues such as bioterrorism, infectious diseases, drug resistance and disaster management.

- *International public health as a means to charity*
  Promotion of health is considered a major factor in the fight against poverty, a front on which both governmental and non-governmental organizations take a lead.

- *International public health as a means to investment*
  Promotion of health is pursued to maximize economic development by enhancing market stability and the quality of work force.

- *International public health as a means to reduce the global burden of disease*
  Risk factor reduction and control of diseases are both the leading motivators and the outcomes sought.¹

WHO ARE THE FORGOTTEN?

The field of international public health is by definition global in scope. Leaders in this field focus on the needs of people who are most disadvantaged, those who are largely forgotten. Indeed, enormous wealth and knowledge benefit the world’s affluent people, while some three billion persons subsist on less than US $2.50 per day.

These people are often separated from mainstream society by disparities in ethnicity, language, education, financial resources and geographic location. As a result, they strain to make a living on the minimal resources of their communities, often without the benefit of essential nutrition, basic housing, primary school education, safe water and elementary healthcare afforded to those more fortunate.¹

Where Are The Forgotten Located?

The greatest concentrations of forgotten people live in developing nations, particularly in the southern hemisphere. But forgotten people also exist alongside the affluent in wealthier nations. These individuals and families are often minorities, immigrants, economically disadvantaged and less educated. Every metropolitan area contains pockets of forgotten people living on the margins. The Kansas City area in the central United States, for example, is home to a great concentration of H’Mong. Originally from Laos, Burma and Thailand, people of this distinct culture suffer health

disparities far out of proportion to other North Americans.²

**Disasters Expose Forgotten People**

Forgotten people are frequently hidden from view of the media and mainstream society. However, a plethora of recent disasters that have been well-covered in the media have brought to light the chronic struggles of these individuals and families. The 2004 Indian Ocean tsunami, 2005 Pakistan earthquake, 2008 Myanmar cyclone, 2010 Haiti earthquake and 2010 Pakistan flood have drawn important attention to needs for both immediate relief and building resilience in these precarious communities.

**FORGOTTEN PEOPLE AND HEALTH INDICATORS**

Ascertaining various measures of health status can provide a snapshot of physical health for an entire community. The World Health Organization (WHO) continually tracks and publishes the following nine core health indicators for member nations:

- Mortality and burden of disease
- Cause-specific mortality and morbidity
- Epidemiology of selected infectious diseases
- Health service coverage
- Risk factors
- Health workforce, infrastructure and essential medicines
- Health expenditure
- Health inequities
- Demographic and socioeconomic statistics³

Such indicators are extremely useful for identifying intervention needs, distributing resources strategically, training personnel appropriately and managing epidemics.

**Most Commonly Used Health Indicators**

Three of the most commonly utilized measures of physical health are life expectancy at birth, mortality rate for children under age 5 years, and the national per capita expenditure for healthcare.


2008 Health Indicators

<table>
<thead>
<tr>
<th>Nation</th>
<th>Life Expectancy at Birth</th>
<th>Under 5 Mortality</th>
<th>Per Capita Health Expense</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Low-Income Nations</td>
<td>59 years (M 58/F 60)</td>
<td>11%</td>
<td>$16</td>
</tr>
<tr>
<td>All Africa</td>
<td>51</td>
<td>16%</td>
<td>$33</td>
</tr>
<tr>
<td>Angola</td>
<td>41</td>
<td>26%</td>
<td>$16</td>
</tr>
<tr>
<td>Liberia</td>
<td>44</td>
<td>23%</td>
<td>$6</td>
</tr>
<tr>
<td>Niger</td>
<td>42</td>
<td>25%</td>
<td>$6</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>40</td>
<td>27%</td>
<td>$6</td>
</tr>
<tr>
<td>Zambia</td>
<td>43</td>
<td>18%</td>
<td>$18</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>42</td>
<td>25%</td>
<td>$3</td>
</tr>
<tr>
<td>Iraq</td>
<td>56</td>
<td>5%</td>
<td>$14</td>
</tr>
<tr>
<td>All High Income Nations</td>
<td>80 (M 77/F 82)</td>
<td>0.7%</td>
<td>$2,672</td>
</tr>
</tbody>
</table>

Note: Economies are categorized according to 2007 GNI (Gross National Income) per capita, calculated using the World Bank Atlas method. The groups are: low income, $935 or less; lower middle income, $936 - $3,705; upper middle income, $3,706 - $11,455; and high income, $11,456 or more. ¹

Especially note that life expectancy for people living in low-income nations is a full 21 years shorter than for those in high-income nations, while life expectancy for Africa is 29 years shorter. The disparity in measures for child mortality and per capita health expenditures are no less disturbing.

Forgotten People And Causes Of Death

As health indicators are disparate for low- and high-income nations, so also are the leading causes of acute death within these nations:

10 Leading Causes Of Death

<table>
<thead>
<tr>
<th>Low-income Nations</th>
<th>High-income Nations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>Coronary heart disease</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>Stroke</td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>Lung cancers</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Pneumonia</td>
</tr>
<tr>
<td>Stroke</td>
<td>Chronic Obstructive Pulmonary Disease (COPD)</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease (COPD)</td>
<td>Dementia</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Colon cancers</td>
</tr>
<tr>
<td>Neonatal infections</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Malaria</td>
<td>Breast cancer</td>
</tr>
<tr>
<td>Premature birth, low birth weight</td>
<td>Stomach cancer</td>
</tr>
</tbody>
</table>

Note: In low-income nations, 6 out of 10 leading causes of death are infectious diseases, while in high-income nations, only 1 out of 10 causes of death, pneumonia, is infectious in nature.

A Better Measure: DALYs Lost

Analyzing absolute numbers of causes of death provides a limited perspective on the burden caused by disease or injury, because the age of the individuals at time of death is not considered. In this calculation, a child who dies at age 1 month carries the same weight as an elder who dies at age 90 years. Yet the gravity of the two deaths is vastly different in terms of anticipated life expectancy.

Analyzing absolute numbers of causes of death also provides a limited perspective on the bur-

den caused by disease or injury, because it does not take into account people who are disabled but do not die as a result of disease or injury.

The Disability-adjusted Life Years (DALYs) lost measure was developed to correct for these deficiencies. DALYs lost combines Years of Life Lost (YLL) due to premature death and Years Lived with Disability (YLD) based on severity and duration of nonfatal outcomes. One DALY lost equals one year of healthy life lost. The formula for DALYs lost due to a particular disease or injury is calculated by: DALYs lost = YLL + YLD

Looking at burden of disease and injury via DALYs lost can reveal deeper insight into the health of populations. The 1990 WHO World Health Report, for example, identified 5 of the 10 leading causes of disability as psychiatric in origin. Psychiatric and neurological diagnoses accounted for 1.4 percent of all deaths and 1.1 percent of years of life. But such diagnoses also accounted for 28 percent of all years lived with disability. Thus, psychiatric and neurological disorders, while not traditionally regarded as a major health concerns, have a tremendous negative impact on populations in terms of DALYs lost.

**Forgotten People And Causes Of DALYs Lost**

A comparison of the leading causes of DALYs lost between the poorest and wealthiest nations reveals:

<table>
<thead>
<tr>
<th>Lowest-income Nations</th>
<th>Highest-income Nations</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV/AIDS</td>
<td>Coronary artery disease</td>
</tr>
<tr>
<td>Lower respiratory infection</td>
<td>Depressive disorder</td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>Cardiovascular disease</td>
</tr>
<tr>
<td>Vaccine-preventable infectious diseases</td>
<td>Alcohol use disorder</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>Dementia</td>
</tr>
<tr>
<td>Malaria</td>
<td>Deafness</td>
</tr>
<tr>
<td>Unipolar depressive disorder</td>
<td>Chronic obstructive pulmonary disease (COPD)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>Road traffic injury</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Osteoarthritis</td>
</tr>
<tr>
<td>Road traffic injury</td>
<td>Bronchitis &amp; lung cancer</td>
</tr>
</tbody>
</table>

Note: In low-income nations, 5 out of 10 leading causes of DALYs lost are infectious diseases, while in high-income nations, none are infectious in nature. Infectious diseases overwhelmingly impact children and youths, therefore they weigh heavily when measuring DALYs lost.


Forgotten People And Diseases Of Poverty

Forgotten people have shorter lives and suffer from diseases of poverty. In contrast to exotic, ‘tropical’ maladies, common diseases of poverty cause immense human suffering, but often receive comparatively little attention or resources. Some diseases of poverty include:

- **Vitamin A deficiency**
  Some 250,000 to 500,000 children in low-resource communities throughout Africa and the Indian subcontinent go blind each year from dietary deficiency of vitamin A. Startlingly, about half of these children die within a year of becoming blind — often due to associated malnutrition and increased susceptibility to respiratory and diarrheal infections.¹

- **Obstructed labor (dystocia)**
  Some 20 percent of women experience dystocia during childbirth — that is, failure to progress with the natural birth process. In the modern medical setting, dystocia is relatively easy to diagnose and to manage. But in communities without such care, dystocia can result in a plethora of complications, including hemorrhage, uterine infection, brachial nerve damage, hypoxic brain injury, vaginal fistula, and death of both mother and baby. In fact, in low-resource nations, some 536,000 women and untold numbers of infants die each year from dystocia.²

- **Chagas disease**
  This parasitic infection is caused by the protozoan Trypanosoma cruzi and results in some 20,000 deaths each year in poorer communities of Central and South America.³ Infection typically occurs when blood-sucking assassin bugs bite sleeping humans in their humble dwellings, transmitting the protozoa. Symptoms are deceptively insidious, yet over time individuals develop disabling cardiomyopathy, dysphagia and dementia. Unfortunately, available medical treatments carry significant adverse effects and are often ineffective. Prevention is the key to combating Chagas disease.

There exist a plethora of other diseases of poverty, including certain orthopedic injuries, burns, hydrocephalus and river blindness (onchocerciasis), to name a few. In almost every case, these physical diseases are the end result of broad social conditions experienced by the afflicted.

---


Health problems faced today in lower-income nations are in many ways similar to those encountered by currently industrialized nations in the early 1900s. Some highlights of progress in international health include:

- **1750-1850**
  The Industrial Revolution resulted in extensive health and social improvements in cities in Europe and the United States, primarily through progress in housing, water and sanitation.

- **1850-1910**
  Increased understanding of the causes and modes of transmission of infectious diseases, particularly tuberculosis and influenza, led to effective prevention efforts, primarily though reduction in crowded living conditions.

- **1910-1945**
  Improvements in child mortality occurred primarily through control of communicable diseases and improved nutrition. This period also witnessed the establishment of schools of public health, international health foundations and intergovernmental agencies committed to public health.

- **1945-1990**
  In 1974, the United Nations Children’s Fund (UNICEF) promoted universal childhood immunization throughout the world, leading to drastic reduction in vaccine-preventable diseases. The Alma Ata Conference in 1978 galvanized the importance of primary healthcare. By 1981, smallpox was successfully eradicated. The HIV/AIDS epidemic began in the 1980s — a stark reminder that the challenge of infectious diseases remains prominent.

- **1990-2010**
  In the world’s poorest countries, attention was focused on combating the Big Three diseases: malaria, tuberculosis and HIV/AIDS. Simultaneously, there was growing recognition that chronic diseases also cause significant burden in the poorest communities, and that health resources must be directed towards hypertension, diabetes mellitus, chronic obstructive pulmonary disease and risk factor reduction.

In perspective, most credit for progress in health during the 1900s belongs to improve…

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ments in nutrition and measures to control infectious diseases — advancements that occurred hand in hand with overall progress in economic growth and general education.¹

Health Crises And Improvements

Health crises have prompted some of the most significant advancements in health. A looming water shortage in ancient Rome, for example, inspired design and construction of the first modern water supply system in the world — one that served as a model for many cities to follow. Suspicion that plague was being introduced by ships traveling from the Orient prompted port cities like Venice to enforce quarantine for such ships. Quarantine proved an effective means of controlling communicable diseases and has been used ever since.

Tuberculosis was a leading cause of death in the late 1800s, inspiring Louis Pasteur to develop critical concepts of microbiology and public health that lead to better control of tuberculosis, influenza and cholera in that era. In more recent years, developing nations utilizing these concepts have also witnessed dramatic declines in infectious diseases.

Injuries associated with World Wars I and II were accompanied by advances in medical interventions, including development of antibiotics, anesthesia and aseptic surgical technique. Similarly, the fields of emergency medicine and emergency medical services were born largely as a result of lessons learned in these wars.

International Health Movements

The end of World War II saw establishment of the United Nations, the World Health Organization (WHO), the World Bank, UNICEF, and a host of other entities whose organized efforts have led to measurable health progress, especially in developing nations. WHO’s successful smallpox eradication campaign inspired the Expanded Program on Immunization (EPI), which resulted in remarkable reduction of

¹ Ibid., 15-18, 282.
polio and measles, among other diseases.

Another notably successful campaign was UNICEF’s Child Survival Program. Building upon the acronym GOBI (growth charts, oral rehydration, breastfeeding and immunization), this program not only resulted in increased child health, but also reinforced the effectiveness of prevention efforts and the importance of local health leadership.

The critical nature of basic healthcare was emphasized at the 1978 WHO conference at Alma Ata in Kazakhstan, which was at that time part of the Soviet Union. While the significance of safe drinking water, contraception and adequate nutrition was never doubted, this conference raised awareness of the enormous value of such efforts. Before this landmark event, most attention in international health had been placed on controlling specific diseases and the provision of hospital services. The new emphasis on basic healthcare, or primary health care (PHC), was subsequently embraced widely as an effective and sustainable approach that also enhanced national identity. As a result of Alma Ata and the new emphasis on PHC, many national and non-governmental hospitals developed community health programs to provide PHC in their localities.

**Lessons From American History**

Health in many developing nations today is similar to that of the United States in 1900. In that year life expectancy was:

- White Males: 48
- White Females: 53
- Non-white Males: 32
- Non-white Females: 35

In 1900, the leading acute causes of death in the United States were not all that different from the leading acute causes of death in today’s poorest nations:

1. Tuberculosis
2. Pneumonia/Influenza
3. Diarrhea
4. Rheumatic heart disease

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2 Ibid., 255, 444, 446.

1. Rheumatic renal disease
2. Trauma
3. Cerebrovascular disease
4. Cancers
5. Bronchitis
6. Diphtheria

First Public Health Revolution

In the 1920s, health status in the United States increased rapidly. Health historians attribute this growth to increased availability of safe drinking water, modern sewage management, improved nutrition, and housing that prevented transmission of respiratory contagions. Medical care, and antibiotics in particular, played only a minimal role in this health advancement.

By 1940, life expectancy had increased remarkably by fifteen to twenty years:
- White Males: 62
- White Females: 67
- Black Males: 52
- Black Females: 55

Successful Control of Infectious Diseases

The leading acute causes of death in the United States in 1900 were infectious diseases. Progress in nutrition, sanitation, housing, vaccine development and access to safe drinking water caused these diseases to decline in prominence. Progress against infectious diseases was also aided by:

- Vector control against malaria, yellow fever, dengue and onchocerciasis (river blindness)
- Mass chemotherapy against onchocerciasis and hookworm
- Behavior change leading to reduction in diarrheal diseases, dracunculiasis, HIV, and STIs

These proven prevention modalities continue to be relevant to public health in today’s low-resource nations and communities.

Health Challenges Coming Full Circle

For millennia, infectious diseases were the leading scourge of humanity. With widespread economic development throughout the 1900s, chronic non-infectious diseases supplanted infectious diseases as the leading causes of death in wealthier nations. The HIV/AIDS epidemic, which appeared in the 1980s, and its often-accompanying tuberculosis, have returned attention to the role and import-

2 Ibid.
tance of infectious diseases. The emergence of virulent influenza epidemics compounded the renewed attention toward infectious diseases.

Finally, it must be noted that over recent decades some developing nations have begun to catch up with the economic progress of their more wealthy neighbors. Such progress is not without negative consequences. India, for example, has witnessed remarkable industrial growth, accompanied by decreases in child mortality and increases in life expectancy. At the same time, India has witnessed significant increases in coronary heart disease and various forms of cancers — diseases most common in wealthier nations.⁴

### Study & Discussion Questions

1. Describe the characteristics or background of forgotten people who exist alongside affluent people in wealthier nations.

2. Describe what is meant by the term disability-adjusted life years (DALYs) lost. What are the two components measured?

3. Describe the transition in health challenges that is occurring in many developing nations.

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IMAGE SOURCES


Image 2: https://donate.gcfa.org/funddetails.aspx?name=mgef


Image 4: http://picasaweb.google.com/lh/photo/ljp1ElrY2GQEHmNLe1Lww


Image 6: http://www.alphapainclinic.in/services.php

Image 7: http://www.health-res.com/pictures-of-vitamin-deficiency/


Image 9: http://jnm.snmjournals.org/cgi/content-nw/full/49/Suppl_2/24S/FIG9

Image 10: http://www.a2zworldnews.co.cc/2010/11/what-is-smallpox.html

Image 11: http://www.model2431.net/pictures-of-african-models.html

Image 12: http://www.ssa.gov/oact/NOTES/AS112/as112.html

Image 13: http://tech.dir.groups.yahoo.com/group/civilengr/message/622?l=1
Chapter 2

Diseases of Poverty

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Welcome

A large number of diseases are particularly associated with poverty. Where functioning economies, education and healthcare systems are in motion, the prevalence of such diseases diminishes. But when these social components falter, as in times of disaster, economic depression or civil unrest, diseases associated with poverty routinely reemerge. This chapter is designed to equip clinicians to prevent, diagnose and treat the most prevalent and unfamiliar diseases of poverty.

This INMED chapter on Diseases Of Poverty is covered in eleven modules:

- Module 1: Introduction
- Module 2: Malnutrition
- Module 3: Enteric Infections
- Module 4: Viral Diseases
- Module 5: Malaria
- Module 6: Tuberculosis
- Module 7: Bacterial Diseases
- Module 8: Protozoal Diseases
- Module 9: Intestinal Helminth Infections
- Module 10: Tissue Helminth Infections
- Module 11: Disease Management Protocols

Competency Objectives

At the completion of this chapter, participants will, in the context of a low-resource community, be able to:

- Describe the epidemiology of the most common diseases of poverty.
- Correctly diagnose the most common diseases of poverty.
- Appropriately treat the most common diseases of poverty.
- Effectively prevent the most common diseases of poverty.
**Cameron Gongwer, MD, MPH**

Dr. Gongwer graduated from Indiana University School of Medicine, the London School of Hygiene and Tropical Medicine and the University of Ghana School of Public Health. In 1999, he became the first physician to serve at Ankaase Methodist Hospital in Ghana, West Africa, where he has mentored INMED students since 2005. Today Dr. Gongwer lives in Accra, Ghana, where he is part of a comprehensive HIV prevention and treatment intervention.

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**Joel Massey, MD**

Dr. Massey is a United States Air Force physician. He completed a Rural Family Medicine Fellowship at Texas A&M Health Science Center, is a graduate of the INMED International Medicine Intensive Course, and is a recipient of the INMED International Medicine Diploma, completing his practicum at the Hospital Vozandes in Ecuador. Dr. Massey also trained in tropical medicine from the Walter Reed Army Institute of Research and is board certified in family medicine.

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**Micah Flint, MPA**, also participated in review of these materials. See his bio on page 5.
Module 1: Introduction to Diseases of Poverty

Prevalent and Unfamiliar Diseases of Poverty

A large number of diseases are particularly associated with poverty. The term tropical diseases is sometimes used in this context. However, because such diseases may not necessarily be confined to tropical latitudes, a more useful term is diseases of poverty.

Where functioning economies, education and healthcare systems are in motion, the prevalence of such diseases diminishes — regardless of geographic latitude. But when these social components falter, as in times of disaster, economic depression or civil unrest, diseases associated with poverty routinely reemerge. A detailed explanation of the mechanisms by which poverty and disease are connected is found in chapter 1.

This chapter is designed to equip clinicians to prevent, diagnose and treat the most prevalent and unfamiliar diseases of poverty. Malaria and malnutrition, for example, are discussed in this chapter, for both are prevalent diseases of poverty and unfamiliar to many clinicians. Viral hepatitis and community-acquired pneumonia are not discussed, for though they are prevalent diseases of poverty, they are also ones quite familiar to most clinicians.

This chapter assumes that learners are already familiar with the principles of clinical decision-making and of basic disease management. This course is not intended to be a complete review of infectious diseases nor parasitology. For more complete study of diseases of poverty, excellent resources include Hunter’s Tropical Medicine¹ and Handbook of Medicine in Developing Countries.²

Description of advanced diagnostic techniques is not frequently mentioned in this course because such technologies are rarely available in low-resource settings. Medication dosages and adverse effects are intentionally not included and should be obtained from the most up-to-date resources.

Each disease explored in this chapter is approached in a systematic manner that includes background and causes, symptoms and signs, and diagnosis, treatment, prevention and control. Most of the diseases discussed are infectious in nature and could be organized in a variety of ways, including mode of transmission, presenting symptoms, and associ

² Palmer D, Wolf C. Handbook of Medicine in Developing Countries. 3rd ed. Christian Medical and Dental Association; 2008.
ated organ systems. For the purposes of this chapter, infectious diseases will be organized according to infectious agents.

**Leading Causes Of Death And Disability**

A useful orientation to diseases of poverty is to identify those that account for the greatest death and disability. What measure of gravity for death and disability is most appropriate? Absolute cause of death statistics are limited in that the age of the individuals at time of death is not considered. An infant who dies at age 1 month carries the same weight as an adult who dies at age 80. Yet the gravity of the two deaths is very different in light of anticipated life expectancy. Another deficiency in analyzing absolute cause of death metrics is that nonfatal disabilities are not included.

The Disability-adjusted Life Years (DALYs) lost metric was developed to correct for these deficiencies. DALYs lost is a measure that combines Years of Life Lost (YLL) due to premature death and Years Lived with Disability (YLD) based on severity and duration of nonfatal outcomes. One DALY lost equals one year of healthy life lost. In the world’s poorest nations, the leading diseases and injuries causing DALYs lost are:

<table>
<thead>
<tr>
<th>Disease or Injury</th>
<th>Percentage of Total DALYs Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV/AIDS</td>
<td>9.0</td>
</tr>
<tr>
<td>Lower respiratory infection</td>
<td>8.2</td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>5.5</td>
</tr>
<tr>
<td>Vaccine-preventable infectious diseases</td>
<td>5.5</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>5.0</td>
</tr>
<tr>
<td>Malaria</td>
<td>4.9</td>
</tr>
<tr>
<td>Unipolar depressive disorder</td>
<td>3.1</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>3.0</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>2.9</td>
</tr>
<tr>
<td>Road traffic injury</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Note: In this context, economies are classified according to 2007 GNI (Gross National Income) per capita, calculated using the World Bank Atlas method. Low-income nations are defined as those with $935 or less income per capita per year.

Not surprisingly, HIV/AIDS, lower respiratory infection, diarrheal diseases, vaccine-preventable diseases, low birth weight and malaria are the leading causes of DALYs lost, for these diseases primarily impact those who are young in age.

**On The Balance: Chronic Diseases**

Clearly, infectious diseases have been the leading causes of human morbidity and mortality throughout history. Today, the burden of infectious diseases has greatly diminished

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in wealthier countries, though community-acquired pneumonia and occasionally influenza continue to cause significant mortality. In developing nations, infectious diseases remain the leading causes of both death and DALYs lost, especially among children and young adults. However, as nations develop, an epidemiologic transition occurs from primarily infectious diseases to chronic non-communicable diseases. Today, arteriosclerotic disease, particularly coronary artery disease, is also among the top causes of DALYs lost in multiple developing nations. Leading risk factors for development of arteriosclerotic disease include chronic diseases hypertension and diabetes mellitus, as well as tobacco abuse and unhealthy diet.

These facts demand a fresh look at the infectious diseases paradigm that continues to govern most approaches to healthcare in low resource communities. Managing chronic, non-infectious diseases usually requires unique strategies that include lifestyle modification, risk factor reduction and continuity of care. Health leaders must rethink priorities in disease prevention and management in light of the growing burden caused by chronic, non-infectious diseases and their necessary interventions.

**Study & Discussion Questions**

1. Describe what is meant by the term disability-adjusted life years (DALYs) lost. What are the two components measured?

2. In terms of DALYs lost, what are the leading health problems in the world’s poorest nations?

3. What is the significance today of chronic non-communicable diseases in developing nations?

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**Image 2.** This malnourished patient in southern Africa suffers not from AIDS but from diabetic ketoacidosis.
IMAGE SOURCES

Image 1: Author image
Image 2: INMED image library
Module 2: Malnutrition

MALNUTRITION IN PERSPECTIVE

By definition, *malnutrition* refers to the entire spectrum of nutritional disorders, including deficiency syndromes and overnutrition or obesity. The latter is a growing concern in some low-resource settings. However, in common usage, *malnutrition* usually refers to deficiencies of protein, energy or micronutrients. At times, the term *undernutrition* is also used in this context. Maternal and child undernutrition contributes an estimated 3.5 million deaths each year, which represents 35 percent of the disease burden in children under 5 years of age and 11 percent of the total global burden of disease as measured by DALYs lost.¹

PROTEIN-ENERGY MALNUTRITION (PEM)

Protein-Energy malnutrition (PEM) is the most frequently observed form of malnutrition in developing nations and low-resource communities. It results from chronic deficiencies in protein and energy/calories such that requirements for growth, physiologic function and activity are not met. In its most mild form, PEM can present as undernutrition discerned only by anthropometric measurements. At the other extreme, PEM can present as:

- Marasmus — Marked by weight loss, stunted growth, extreme muscle wasting, and loss of adipose tissue with no peripheral edema. Results primarily from the combined effects of PEM.

- Kwashiorkor — Marked by fatigue, growth failure, peripheral edema, sparse hair with discoloration, hypoalbuminemia, and preservation of subcutaneous fat. Results from protein malnutrition, but total body weight may not be decreased given the accumulation of edema.

Mixed forms of the two syndromes are common in both children and adults, and the distinction between PEM and pure protein malnutrition has little clinical significance. Infants and younger children are more susceptible to PEM, though PEM may occur at any age. PEM is particularly more likely in the presence of malaria, trauma, burns, diarrheal illnesses, diabetes mellitus, pregnancy and lactation, and it may be encountered in hospitalized patients who have inadequate nutritional support.²


² Administration Committee on Coordination/Sub-Committee on Nutrition (ACC/SCN). Fourth report of the world nutrition situation: Nutrition throughout the life cycle. Washington,
**Protein-Energy Malnutrition Diagnosis**

Symptoms and signs of mild to moderate PEM include:

- Stunted growth and reduction in subcutaneous fat in adults
- Stunted growth, wasted body habitus, delayed puberty, and retarded cognitive and psychosocial development in children
- Decreased handgrip strength
- Reduced volume of breast milk with low fat content

Symptoms and signs of severe PEM include:

- Muscle wasting in the extremities
- Loss of subcutaneous fat
- Atrophy of temporalis and interosseus hand muscles
- Decreased skin elasticity
- Delayed wound healing
- Decubitus ulcers
- Dry, reddish-brown, sparse hair
- Lethargy, early satiety, vomiting and constipation
- Heart rate, blood pressure and core body temperature may be below normal

Diagnosis of PEM can be aided by anthropometric procedures. Such information is also vital for determining the prevalence of malnutrition and monitoring the effectiveness of interventions. There are well-standardized methods for assessing nutritional status based upon measures of weight, length, height, mid-upper arm circumference (MUAC), and skin folds. Severe acute malnutrition, for example, is present in children ages 6-60 months who have an MUAC of less than 115 mm.¹

Diagnosis of PEM is usually straightforward; however, differentiation must also be made from forms of pellagra, nephrosis, cardiac failure, cystic fibrosis and malabsorption, each of which can mimic signs and symptoms of PEM. Laboratory findings may be useful in confirming PEM and include reduced plasma albumin, decreased lymphocyte count, decreased blood urea nitrogen (BUN), decreased plasma transferrin and hypoglycemia.

**Protein-Energy Malnutrition Treatment**

Management of acute PEM can be separated into two stages. The first stage is stabilization: to immediately correct hydration and acid-base alterations. Immediate treatment of severe anemia and coexisting infections may also be required. Oral rehydration solutions can be used in all but the most moribund patients, in which case intravenous solutions may be indicated. Useful indicators of improving stabilization are the normalization

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Image 2. Measuring skin fold thickness is a common anthropometric procedure for assessing nutritional status.
of vital signs, resumption of urination, and increasing level of consciousness. Death in the first few days of PEM treatment is usually due to electrolyte imbalance, hypoglycemia, infection, hypothermia or circulatory failure. Jaundice, petechiae, low serum sodium and stupor are ominous signs.

The second stage is refeeding. This can begin as soon as clinical status is reasonably stable and rehydration is complete. For infants and children, supply adequate calories by adding sugar and cereal to a mild diet. Attention should be given to adequate micronutrient replacement with zinc, magnesium, vitamin A, folate and iron. Small, frequent feedings around the clock are better tolerated in the early stages of treatment. Gradual introduction of high-energy foods can then be made, such as candies, cakes, puddings, meats, eggs and fruit juices. Yogurt, where available, can be given in place of milk products for populations at high genetic likelihood of lactose intolerance. It may be necessary to initiate refeeding slowly in persons who have advanced PEM or kwashiorkor because of damage to the intestinal mucosa. Three to four months of optimal feeding is often required to restore body weight and composition.

F-100 and F-75 (also known as Formula 100 and Formula 75) are specially designed milk products for severe malnutrition. Resulting from research by the French organization Action Against Hunger, these formulas are now used by all major humanitarian aid organizations to treat acute malnutrition. F-75 is considered the “starter” formula for initial refeeding, and F-100 is the “catch-up” formula for continued growth. Both are very high in energy, fat and protein. Basic ingredients include concentrated milk powder, food oil, dextrin and vitamin complexes.

F-75 starter formulas (75 kcals per 100 ml):
- Full-cream dried milk (35 grams), sugar (100 grams), oil (20 ml), electrolyte/mineral solution (20 ml) and water to make up 1000 ml total volume.
- Full-cream cow’s milk (300 ml), sugar (100 grams), oil (20 ml), electrolyte/mineral solution (20 ml) and water to make up 1000 ml total volume.

F-100 catch-up formulas (100 kcals per 100 ml):
- Full-cream dried milk (110 grams), sugar (50 grams), oil (30 ml), electrolyte/mineral solution (20 ml) and water to make up 1000 ml total volume.
- Full-cream cow’s milk (880 ml), sugar (75 grams), oil (20 ml), electrolyte/mineral solution (20 ml) and water to make up 1000 ml total volume.

Initial refeeding is frequently performed in a renutrition center. Such centers are a common healthcare intervention in low-resource communities. In addition to providing nutrition, family members and caregivers are instructed in optimal nutritional practices. During the period of renutrition, micronutrient supplementation is routinely supplied via multivitamin, iron and folic acid supplements. Attention to coexisting medical illnesses may also be indicated.¹

Protein-Energy Malnutrition Prevention

Prevention of PEM is rooted in assuring civic and economic stability. Attention to nutrition education, breastfeeding, and well child care, prenatal and elder care can also help mitigate nutritional deficiencies and identify at-risk individuals. Throughout, caretakers and healthcare personnel must be aware of the increased nutritional needs of persons during illness and infection.¹

Micronutrient Deficiencies

Micronutrients are nutrients required by humans in small quantities to support an important range of physiological functions. Some are microminerals, or trace elements, including iron, zinc, cobalt, chromium, copper, iodine, manganese and selenium. Other micronutrients include the organic compounds known as vitamins.

The 1990 World Summit for Children identified deficiencies in three micronutrients as most common and posing the greatest health risks in developing countries: iodine, iron and vitamin A. Since then, additional light has been shed on the impact of folic acid and zinc deficiencies.²

Risk factors for micronutrient malnutrition include the presence of:

- Monotonous diet
- Low intake of animal source foods
- Low prevalence of breastfeeding
- Low micronutrient density of complementary foods
- Increased physiologic demands for growth (such as pregnancy and lactation)
- Increased demand due to infection and disease
- Protein-energy malnutrition (PEM)
- Malabsorption (such as diarrhea and intestinal parasites)
- Increased excretion (such as schistosomiasis)
- Seasonal variations (such as food availability and shortages)
- Social deprivation, illiteracy and low education
- Poverty, displacement and poor economic status

UNICEF-advocated programs for elimination of micronutrient deficiencies emphasize the following interventions in low-resource communities:

- Vitamin A supplementation for children age 6–59 months
- Zinc supplementation for those with diarrheal disease
- Iron and folic acid supplementation for women of childbearing age
- Universal salt iodization
- Behavior-centered nutrition education³

Iodine Deficiency

Iodine is a trace element particularly essential for thyroid function. Deficiencies in iodine lead to hypothyroidism, with signs and symptoms that include extreme fatigue, mental slowing, depression, goiter, weight gain and low body temperature. Iodine deficiency also causes an increase in risk of stillbirth, infant mortality and developmental delay.

The journal Lancet declared in 2008:

"According to the WHO, in 2007 nearly two billion individuals had insufficient iodine intake, a third being of school age. ... Thus iodine deficiency, as the single greatest preventable cause of mental retardation, is an important public health problem."

Iron Deficiency

Iron deficiency leading to anemia is the most common nutritional disorder in the world. The leading causes of iron deficiency include:

- Inadequate dietary intake
- Blood loss during menstruation
- Intestinal blood loss from parasitic infections, particularly hookworms

Other risk factors for iron deficiency include:

- Low intake of meat/fish/poultry
- High intake of cereals and legumes
- Preterm delivery or low birth weight
- Pregnancy and adolescence
- Low intake of vitamin C (necessary for iron absorption)
- Malaria and schistosomiasis infection

Iodine is plentiful in seafood. Iodine deficiency is most common in remote, high altitude, and semi-arid regions of the world removed from the sea. The addition of iodine to table salt, in the form of potassium iodide, has largely eliminated iodine deficiency in wealthier nations. Iodine has also been added to other foods, including flour, water and milk, in areas of greatest deficiency. However, iodine deficiency remains a significant public health problem in developing nations, as well as in some areas of Europe, where salt is harvested by non-commercial means.

Individuals with iron deficiency are at greater risk for:

- Delay in child physical and mental development
- Increased child morbidity and mortality
- Increased maternal mortality
- Decreased adult work productivity

Symptoms and signs of iron deficiency include slow onset of pallor, fatigue and generalized weakness. In advanced cases, dyspnea may be present. Other less specific symptoms and signs include pica, hair loss, constipation, tinnitus, depression, missed menstruation and angular cheilitis. The diagnosis is most easily confirmed by findings of hypochromic, microcytic anemia on a complete blood count.

Effective interventions for iron deficiency in low-resource communities include:

- Community education regarding anemia prevention
- Sanitation efforts to prevent hookworm infection
- Treatment of hookworm infection
- Fortification of foods with iron, particularly wheat flour and flour products
- Provision of iron and iron/folic acid supplements
- Prevention and control of malaria and schistosomiasis infection

### Vitamin A Deficiency

Some 250,000 to 500,000 children in low-resource communities throughout Africa and the Indian subcontinent go blind each year from dietary deficiency of vitamin A. Severe deficiency causes irreversible corneal damage, leading to partial or total visual impairment. Startlingly, about half of these children die within a year of becoming blind, usually due to associated PEM and increased susceptibility to respiratory and diarrheal infections. Vitamin A deficiency also puts children at especially increased risk for measles. In pregnant women and children, vitamin A deficiency causes night blindness and may increase the risk of maternal mortality.

Risk factors for developing vitamin A deficiency include:

- Low intake of dairy products, eggs and B-carotene from fruits and vegetables
- Presence of intestinal parasitic infections, particularly ascariasis

Recognized interventions against vitamin A deficiency include:

- Breastfeeding

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2. Ibid.
Promotion of vitamin A-rich diets (fruits and vegetables)
Vitamin A supplementation
Food fortification with vitamin A

In areas with vitamin A deficiency, children age 6 to 59 months should receive two doses each year. In many countries, vitamin A supplementation is combined with immunization and other well child care services. Vitamin A supplementation is inexpensive and has been documented to reduce the risk of death for a child deficient in vitamin A by 23 percent. In 1997 alone, some 300,000 child deaths were prevented by vitamin A supplementation in developing countries.³

**STUDY & DISCUSSION QUESTIONS**

1. What is the first priority in the management a child with acute protein-energy malnutrition?
2. What are the general recommendations for preventing micronutrient deficiencies in the world’s lowest-income nations?
3. Describe interventions to prevent vitamin A deficiency.

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