

Course title. The Biology and Public Health of Tuberculosis, HIV, and Malaria

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Brief course description. According to the World Health Organization, the three single-agent infectious diseases that kill the most people per annum are tuberculosis, caused by *Mycobacterium tuberculosis*; AIDS, caused by Human Immunodeficiency Virus, and malaria, caused by *Plasmodium falciparum* and related species. Why is the risk of contracting or dying from these infections not equally distributed among all people? Why are there no effective immunizations to prevent these infections? Why, given decades of public education, does anyone still catch these infections, let alone die of them? Answers to these questions are complex, involving not only biology but also insights from the social sciences and the interdisciplinary realm of public health. Thus, we will study the three infections from both biological and public health perspectives.

Goals of the course, fit with program mission, and learning outcomes. The ACM Botswana Program is explicitly designed for students with an interest in public health. Public health is an interdisciplinary endeavor involving biology, medicine, psychology, sociology, economics, and political science (among others). Tuberculosis, malaria, and HIV/AIDS are primary health concerns in Botswana, despite its investment in universal education and health care. These infectious diseases are also important health concerns in the United States, and we will compare how people living in each country experience having these infections.

After completing the course, students will be able to ...

1. Describe the global distribution of morbidity and mortality from tuberculosis, HIV/AIDS, and malaria
2. Describe the incidence and prevalence of the three infections in the U.S. and Botswana
3. Describe how race, class, gender, and other social categories affect the incidence, prevalence, and consequences of each infection in Botswana and the U.S.
4. Describe public health efforts to prevent each infection in Botswana and the U.S.
5. Describe the human immune system and the goals of immunization
6. Describe and explain critical aspects of the biology of tuberculosis, HIV/AIDS, and malaria, including
 - a. The structure and function of each causative agent, including virulence factors that cause signs and symptoms of disease
 - b. The structure and function of each of the major human systems targeted by each agent
 - c. Immune reactions to each agent
 - d. The physiological consequences of infection with each agent, including the impact on cells, tissues, organs, and organ systems of the human body
 - e. Current work to develop a successful immunization strategies to protect us from each agent

Course assignments

1 Quiz on the human immune system

3 Exams, one each on the biology of tuberculosis, HIV/AIDS, and malaria

3 Essays, one each addressing tuberculosis, HIV/AIDS, and malaria.

Grading scale and how grades will be determined. I will assign letter grades based on the percentage of points available that you earn. I will provide you with grading rubrics for each writing assignment.

94 - 100% = A	90 - 93% = A-	
87 - 89% = B+	84 - 86% = B	80 - 83% = B-
77 - 79% = C+	74 - 76% = C	70 - 73% = C-
65 - 69% = D	below 65% = NC (F)	

Quiz 1	50
Exam 1	150
Exam 2	150
Exam 3	150
Essay 1	100
Essay 2	150
Essay 3	250
Total	1000

- Quiz 1 covers the human immune system.
- Exam 1 covers the biology of tuberculosis.
- Exam 2 covers the biology of malaria.
- Exam 3 covers the biology of HIV/AIDS.
- Essay 1 is persuasive prose explaining the emergence of MDR/XDR tuberculosis and what must be done to stop its spread.
- Essay 2 is explanatory prose intended to teach college students about anti-malaria immunization strategies.
- Essay 3 is a formal thesis-driven paper comparing HIV/AIDS in Botswana and the U.S.

All quizzes and exams are closed book, closed notes, timed exams. This means that you may not use any written or recorded materials to help you during the exam, nor speak to anyone other than the instructor during the exam. It also means that the exam is due at a set time, as announced in class. Do not bring any materials other than a pen and a calculator with you to an exam; if you bring other materials to the exam, you will have to leave them with me for the duration of the exam.

I will award a grade of 0 on an exam to anyone who cheats on that exam.

I will award a grade of 0 to any essay that contains any plagiarized text. See [www] for my definition of plagiarism.

I reserve the right to administer "Pop Quizzes," which could reduce a student's final grade.

Policies on late work and attendance. There will be no early or make-up exams, so you must not miss any exam days. I will accept late essays with the following penalties:

1-7 days late = -25 points.

8-14 days late = -50 points

15+ days late = no credit for essay (0 points).

In the event of serious illness or a catastrophic personal event such as a death in the family, a student who can verify such an excuse may take a make-up exam or turn in an essay 7 days late with no penalty. BUT, students must inform me of such serious illness or catastrophes BEFORE the start of the exam in question, or before the due date of an essay. To verify the extent of such an illness or catastrophic personal event, within one week (7 days), you must provide me with a signed, legible note from a healthcare provider, religious leader, or the Office of International Students. The note must include a telephone number at which I may reach the signatory. It is my policy to send parents a condolence card in the event of a death in the family.

Week-by-week schedule.

Week 1 – Introduction to public health, epidemiology, and to tuberculosis, malaria, and HIV/AIDS

Week 2 – Human immune system

Week 3 – Human immune system and immunization; biology of tuberculosis

Week 4 – biology of tuberculosis; public health of tuberculosis

Week 5 – public health of tuberculosis; social inequality and tuberculosis

Week 6 – public health of tuberculosis; social inequality and tuberculosis

Week 7 – biology of malaria

Week 8 – public health of malaria; social inequality and malaria

Week 9 – public health of malaria; social inequality and malaria

Week 10 – public health of malaria; social inequality and malaria

Week 11 – biology of HIV/AIDS

Week 12 – public health of HIV/AIDS; social inequality and HIV/AIDS

Week 13 – public health of HIV/AIDS; social inequality and HIV/AIDS

Week 14 – public health of HIV/AIDS; social inequality and HIV/AIDS

Week 15 – public health of HIV/AIDS; social inequality and HIV/AIDS

The Biology and Public Health of Tuberculosis, HIV, and Malaria

Provisional reading list: I will likely assign some of these books and shorter texts.

Tuberculosis

1. Infections and Inequalities by Paul Farmer
2. Timebomb: The Global Epidemic of Multi-Drug Resistant Tuberculosis by Lee B. Reichman & Janice Hopkins Tanne
3. The Return of the White Plague: Global Poverty and the 'New' Tuberculosis by Matthew Gandy & Alimuddin Zumla
4. Selected World Health Organization (WHO) web pages on tuberculosis
5. Selected Centers for Disease Control and Prevention (CDC) web pages on tuberculosis
6. Selected news articles on tuberculosis from the journal Nature (2005-present)
7. Selected news articles on tuberculosis from the journal Science (2005-present)
8. Selected primary research articles or professional review articles in the social sciences and public health literature about social inequalities (gender, race, class, other) and tuberculosis. Examples could include:
 - The whole is greater than the sum of the parts: Recognising missed opportunities for an optimal response to the rapidly maturing TB-HIV co-epidemic in South Africa more options, Perumai et al. (2009) BMC Public Health
 - Global epidemiology of tuberculosis, Dye (2006) The Lancet
 - Evolution of tuberculosis control and prospects for reducing tuberculosis incidence, prevalence, and deaths globally, Dye et al. (2005) Journal of the American Medical Association (JAMA)
 - Global incidence of multidrug-resistant tuberculosis, Zignol et al. (2006) J of Infectious Diseases
 - The persistence of American Indian health disparities, Jones (2006), American J of Public Health
 - Does smoking explain sex differences in the global tuberculosis epidemic? Watkins and Plant (2006) Epidemiology and Infection.
 - Gender, equity: new approaches for effective management of communicable diseases, Theobald et al. (2006) Transactions of the Royal Society of Tropical Medicine & Hygiene
 - The Quiet Storm, Heysell (2009) J of the American Medical Association
 - Financing of global health: tracking development assistance for health from 1990 to 2007, Ravishankar et al. (2009) LANCET
 - A New Vaccine for Tuberculosis: The Challenges of Development and Deployment, Fletcher et al. (2009) J of Bioethical Inquiry

Tuberculosis (continued)

- Personal and societal health quality lost to tuberculosis, Miller et al. (2009) PLoS One
- Overseas Screening for Tuberculosis in US-Bound Immigrants and Refugees, Liu et al. (2009) New England J of Medicine
- Primary and secondary tuberculosis preventive treatment in HIV clinics: simulating alternative strategies, Basu, S et al. (2009) International J of Tuberculosis and Lung Disease
- Underreported threat of multidrug-resistant tuberculosis in Africa, Ben Amor et al. (2008) Emerging Infectious Diseases
- Baseline evaluation of routine HIV testing among tuberculosis patients in Botswana, Gammino et al. (2008) Int J Tuberc Lung Dis
- The rate of TB-HIV co-infection depends on the prevalence of HIV infection in a community, Datiko et al. (2008) BMC Public Health
- Evolution of tuberculosis control and prospects for reducing tuberculosis incidence, prevalence, and deaths globally, Dye, C et al. (2005) J of the American Medical Association
- XDR-TB in South Africa: No time for denial or complacency, Singh, et al. (2007) PLoS Medicine
- "The Red Man and the White Plague": Rethinking race, tuberculosis, and American Indians, ca. 1890-1950, C. W. McMillen (2008) Bulletin of the history of medicine.
- Tuberculosis and urban growth: Class, race and disease in early Phoenix, Arizona, USA, Grineski et al. (2006) Health & Place
- Racial and ethnic disparities in HIV/AIDS, sexually transmitted diseases, and tuberculosis among women, Steele et al. (2006) J of Women's Health
- Prevalence of tuberculosis infection in the United States population - The National Health and Nutrition Examination Survey, 1999-2000, Bennett et al. (2008) American J of Respiratory and Critical Care Medicine

Malaria

Humanity's Burden: A Global History of Malaria (Studies in Environment and History) by James L.A. Webb Jr.

The Making of a Tropical Disease: A Short History of Malaria (Johns Hopkins Biographies of Disease) by Randall M. Packard

The Malaria Capers : More Tales of Parasites and People, Research and Reality by Robert S. Desowitz

Selected World Health Organization (WHO) web pages on tuberculosis

Selected Centers for Disease Control and Prevention (CDC) web pages on tuberculosis

Selected news articles on malaria from the journal Nature (2005-present)

Malaria (continued)

Selected news articles on malaria from the journal Science (2005-present)

Selected primary research articles in the social sciences and public health literature about social inequalities (gender, race, class, other) and malaria

- Incorporating a rapid-impact package for neglected tropical diseases with programs for HIV/AIDS, tuberculosis, and malaria - A comprehensive pro-poor health policy and strategy for the developing world, Hotez et al. (2006) PLoS Medicine
- Climate change and human health: present and future risks, McMichael et al. (2006) The Lancet
- "Rapid-impact interventions": How a policy of integrated control for Africa's neglected tropical diseases could benefit the poor, Molyneux et al. (2005) PLoS Medicine
- Urbanization, malaria transmission and disease burden in Africa, Hay et al. (2005) Nature Reviews Microbiology.
- Effect of artemether-lumefantrine policy and improved vector control on malaria burden in KwaZulu-Natal, South Africa, Barnes (2005) PLoS Medicine.
- Maternal and Child Undernutrition 3 - What works? Interventions for maternal and child undernutrition and survival, Bhutta et al. (2008) The Lancet.
- "I thought it was only ordinary fever"! Cultural knowledge and the micropolitics of therapy seeking for childhood febrile illness in Tanzania, Kamat (2006) Social Science & Medicine
- Social science research in malaria prevention, management and control in the last two decades: An overview, Mwensi (2005) Acta Tropica
- 'To help them is to educate them': power and pedagogy in the prevention and treatment of malaria in Tanzania, Montgomery et al. (2006) Tropical Medicine & International Health.
- Race, sex, and the neglected risks for women and girls in sub-Saharan Africa, Stillwaggon (2008) Feminist Economics
- Global mental health 1 - No health without mental health, Prince et al. (2007) The Lancet
- Is malaria a disease of poverty? A review of the literature, Worrall et al. (2005) Tropical Medicine & International Health
- How much would poor people gain from faster progress towards the Millennium Development Goals for health?, Gwatkin (2005) The Lancet
- The African millennium villages, Sanchez et al. (2007) Proceedings of the National Academy of Sciences of the USA

HIV/AIDS

HIV/AIDS: A very brief introduction by Alan Whiteside

28 Stories of AIDS in Africa by Stephanie Nolan

Sizwe's Test by Jonny Steinburg

Infectious Ideas: U.S. Political Responses to the AIDS Crisis by Jennifer Brier

Pneumocystis pneumonia – Los Angeles (first medical announcement of AIDS)

1112 and counting (provocative article from gay newspaper)

Newspaper articles from 1980's U.S.

- 1981 Nelson
- 1982 June Nelson
- 1982 August Nelson
- 1982 Schmeck
- 1982 Herman
- 1983 Simross
- 1984 Timnick
- 1985 Kleiman

Selected news articles on HIV/AIDS from the journal Nature (2005-present)

Selected news articles on HIV/AIDS from the journal Science (2005-present)

Selected primary research articles in the social sciences and public health literature about social inequalities (gender, race, class, other) and HIV/AIDS.

Some possible choices:

- Concurrent sexual relationships help to explain Africa's high HIV prevalence: implications for prevention, Epstein and Halperin (2004) *The Lancet*
- Food insufficiency is associated with high-risk sexual behavior among women in Botswana and Swaziland, Weiser et al. (2007) *PLoS Medicine*
- Mortality of HIV-1-infected patients in the first year of antiretroviral therapy: comparison between low-income and high-income countries, Braitstein et al. (2006) *The Lancet*
- Antiretroviral therapy in resource-poor settings - Decreasing barriers to access and promoting adherence, Mukherjee et al. (2006) *J of Acquired Immune Deficiency Syndromes*
- Putting it together: AIDS and the millennium development goals, Hecht et al. (2006) *PLoS Medicine*
- The persistent problem of malaria: Addressing the fundamental causes of a global killer, Stratton et al. (2008) *Social Science & Medicine*
- Global health and the Bill & Melinda Gates Foundation, Targett et al. (2009) *The Lancet*
- Climate change and infectious diseases in North America: the road ahead, Greer et al. (2008) *Canadian Medical Association J*
- Multifocal autochthonous transmission of malaria - Florida, 2003, Selover et al. (2004) *J of the American Medical Association*.

HIV/AIDS (continued)

- Learning From Successful Interventions: A Culturally Congruent HIV Risk-Reduction Intervention for African American Men Who Have Sex With Men and Women, Williams et al. (2009) American J of Public Health.
- Alcohol Use and Sexual Risk Behavior among College Students: Understanding Gender and Ethnic Differences, Randolph et al. (2009) American J of Drug and Alcohol Abuse.
- Love, Sex and Power – Considering women’s realities in HIV prevention, Amaro (1995) American Psychologist.
- Managing men: women's dilemmas about overt and covert use of barrier methods for HIV prevention, MacPhail et al. (2009) Culture Health & Sexuality
- Gender role and relationship norms among young adults in South Africa: Measuring the context of masculinity and HIV risk, Harrison et al. (2006) J of Urban Health—Bulletin of the New York Academy of Medicine.
- Gender differences in condom use behavior? The role of power and partner-type, Woolf and Maisto (2008) Sex Roles,
- The association of partner abuse with risky sexual behaviors among women and men with HIV/AIDS, Bogart et al. (2005) AIDS and Behavior
- Feminization of the HIV epidemic in the United States: Major research findings and future research needs , Wingood (2003) J of Urban Health—Bulletin of the New York Academy of Medicine
- A new look at an old method: The diaphragm , Harvey et al. (2003) Perspectives on sexual and reproductive health.
- HIV and AIDS-related stigma and discrimination: a conceptual framework and implications for action, Parker and Aggleton (2003) Social Science & Medicine
- Racial and gender disparities in receipt of highly active antiretroviral therapy persist in a multistate sample of HIV patients in 2001, Gebo et al. (2005) J of Acquired Immune Deficiency Syndromes
- Best-evidence interventions: Findings from a systematic review of HIV behavioral interventions for US populations at high risk, 2000-2004, Lyles et al. (2007) American J of Public Health
- Gender differences in clinical progression of HIV-1-infected individuals during long-term highly active antiretroviral therapy, Nicastrì et al. (2005) AIDS
- Domestic violence, sexual ownership, and HIV risk in women in the American deep south, Lichtenstein (2005) Social Science & Medicine
- Sexual and Reproductive Health of Persons Aged 10-24 Years - United States, 2002-2007, Gavin et al. (2009) Morbidity & Mortality Weekly Report

HIV/AIDS (continued)

- Dating violence among school students in Tanzania and South Africa: Prevalence and socio-demographic variations, Wubs et al. (2009) Scandinavian J of Public Health
- Race, place and AIDS: The role of socioeconomic context on racial disparities in treatment and survival in San Francisco, Arnold et al. (2009) Social Science & Medicine
- "I have an evil child at my house": Stigma and HIV/AIDS management in a South African community, Campbell et al. (2005) American J of Public Health
- Conspiracy beliefs about the origin of HIV/AIDS in four racial/ethnic groups, Ross (2006) J of Acquired Immune Deficiency Syndromes
- Racial/ethnic and age disparities in HIV prevalence and disease progression among men who have sex with men in the United States, Hall (2007) American J of Public Health
- Characteristics of persons with heterosexually acquired HIV infection, United States 1999-2004, Espinoza (2007) American J of Public Health
- Racial and ethnic disparities in HIV diagnoses for women in the United States, McDavid et al. (2006) J of Acquired Immune Deficiency Syndromes
- The effect of socioeconomic status on the survival of people receiving care for HIV infection in the United States, Cunningham et al. (2005) J of Health Care for the Poor and Underserved

Web pages by activist communities:

<http://www.tac.org.za/community/>

<http://www.actupny.org/>

<http://truthaids.org/v2/>

Biology with emphasis on evolution and defenses against infectious disease¹

Students with less preparation in biology

Selected readings and accompanying games from the educational section of nobelprize.org

http://nobelprize.org/educational_games/medicine/cell/ ;
http://nobelprize.org/educational_games/medicine/dna_double_helix/ ; http://nobelprize.org/educational_games/medicine/gene-code/ ;
http://nobelprize.org/educational_games/medicine/immunity/

Selected online material about the biology of tuberculosis

http://nobelprize.org/educational_games/medicine/tuberculosis/read_more.html
<http://www.who.int/topics/tuberculosis/en/> (specific links)
<http://www.cdc.gov/tb/> (specific links)

Selected online material about the biology of malaria:

http://nobelprize.org/nobel_prizes/medicine/laureates/1902/ross-or.html
<http://www.cdc.gov/malaria/history/laveran.htm>
http://nobelprize.org/educational_games/medicine/malaria/ ;
http://nobelprize.org/educational_games/medicine/tuberculosis/ ;

Selected online material about the biology of HIV/AIDS

<http://www.thebody.com/>
<http://www.tac.org.za/community/treatmentliteracy> (selections)
<http://hivinsite.ucsf.edu/InSite?page=KB> (selections)

Nature Encyclopedia of Life Sciences reviews for entry-level undergraduates, such as

Cell structure by Lane (2001)
Genetic Code, Introduction by Watanabe (2002)
Viruses by Minor (2002)
Bacterial cells by Beveridge (2001)
Immune system by Davies (2008)
Immunity: Humoral and cellular by Honeyman & Harrison (2004)

¹ Students will take a biology placement exam to determine which of two sets of readings, class activities, and exams are most appropriate for that student. Students with fewer than 3-4 semesters (or equivalent) of Biology will likely be placed into the group with less preparation, while students with more preparation will be in the other group. Graded course exams for each group of students will be different. See p. 8 for readings for students with more preparation in Biology.

Students with less preparation in biology (continued)

Nature Encyclopedia of Life Sciences reviews for entry-level undergraduates, such as

Immunity to infection by Pederson (2007)

Malaria by Sherman (2001)

Mycobacteria: biology by Sidders and Stoker (2007)

Acquired Immune Deficiency Syndrome by Silciano (2006)

Students with more preparation in biology

Primary research articles (including some historical examples) on *Mycobacterium tuberculosis*, *Plasmodium*, and HIV/AIDS.

Riley et al. 1959 (aerial dissemination of TB)

Barre-Sinoussi et al. 1983 (first report of HIV)

Gallo et al. 1983; (co-published report of HIV)

Nature Encyclopedia of Life Sciences reviews for upper-level undergraduates on immunology and on the biology of tuberculosis, malaria, and HIV, such as

Cells of the Immune System by Todd (2005)

Immune System: evolutionary pressure of infectious agents by Warr and Pilstrom (2001)

Lymphocytes by Klaus (2001)

T Lymphocytes: Helpers by Kondo and Martin (2001)

Lymphocytes: antigen-induced gene activation by Criado & Madrenas (2005)

Immune Response: Evasion and Subversion by Pathogens by Milon and David (2005); from ELS

Tuberculosis by Davies (2007)

Tuberculosis: Immunity by Orme (2007)

Antimycobacterial drugs by Gillespie (2003)

Malaria: immunity by Hafalla et al. (2007)

Plasmodium by Sherman (2001)

Antiprotozoan drugs by Fivelmal et al. (2009)

Genetics of malarial resistance and susceptibility by Verrelli (2008)

HIV life cycle and inherited coreceptors by Bukrinsky (2006)

HIV Infection: Genetics by McNicholl et al. (2006)

AIDS: Clinical Manifestations by Dore & Cooper (2003)

Students with more preparation in biology (continued)

Selections from NobelPrize.org related to tuberculosis, malaria, and HIV/AIDS.

http://nobelprize.org/nobel_prizes/medicine/laureates/1902/ross-lecture.pdf

http://nobelprize.org/nobel_prizes/medicine/laureates/1907/laveran-lecture.html

http://nobelprize.org/nobel_prizes/medicine/laureates/1905/koch-lecture.html

http://nobelprize.org/nobel_prizes/medicine/laureates/2008/barre-sinoussi-lecture.html (video of lecture)

http://nobelprize.org/nobel_prizes/medicine/laureates/2008/montagnier-lecture.html (video of lecture)