



EpidemicProportions

Johns Hopkins Undergraduate Public Health Journal

Volume 3 Issue 1 Spring 2006



ACUTE VERSUS CHRONIC Diseases that Threaten Global Health

RESEARCH *Hari Prabhakar*
Hari Prabhakar explores social and biological causes affecting the onset of TB in India.

FEATURES *Philip Castrovinci*
Philip Castrovinci travels to the Philippines to assist doctors performing eye surgeries.

PERSPECTIVES *Dr. Groopman*
from JHSPH Environmental Health Sciences comments on birds and human health.

EDITORIALS *Sadajyot Brar*
Sadajyot Brar discusses the acute and chronic health impacts of Hurricane Katrina.

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FRONT COVER photography by Philip Castrovinci "This man has a hyper-mature cataract and is minutes away from receiving treatment. Patients in the United States rarely develop cataracts this mature." **Inside cover** photography by Philip Castrovinci and more can be found on pages 32-5. **BACK COVER** Photography by Claire Edington, Mtubatuba, South Africa June 2005.



FRONT ROW (left to right) Isabelle, Diana, Priyanka, Farha, Claire, Patrick **MIDDLE ROW** (left to right) Kathy, Valentina, Maneesha, Pauline, Elisabeth **BACK ROW** (left to right) Mary, Akash, Rishi, Alyssa, Angela, Lindsay **Not pictured** Ajay, Samantha, Phil, Jyoty, Kyra, Shelly

During an international health course at the Johns Hopkins Bloomberg School of Public Health last fall, Professor Michael Sweat asked his class of about 100 what they could find, without fail, in any corner of the developing world. The unanimous response? “Coke.” While clean drinking water, a fundamental necessity for the health of any population, is difficult if not impossible to come by, Coca-Cola, the iconic symbol of the West, is everywhere. Whereas big pharma finds little incentive to manufacture HIV/AIDS or TB medication at below cost, in 2001, the Coca-Cola Company posted net profits of \$621 million in Africa alone. The Company’s Chief Executive, Neville Isdell, remarked that strong international growth — particularly double-digit growth in Africa — shows that Coca-Cola is “the only truly global beverage company.” This statement begs the question — if Coke can go global, why can’t health?

Just like the international marketplace, public health is being globalized, so to speak. Over the past few years, the increasing use of the term “Global Health” (first coined in 1997 by the Institute of Medicine) reveals an emerging value base where health is considered to be the essential component and expression of global citizenship. In an increasingly linked global community, “Global Health” recognizes that health concerns transcend national boundaries, and should accordingly be addressed by cooperative actions and solutions. As opposed to “International Health” which denotes an “us vs them” type

mentality, Global Health seeks to eliminate the gap between the health needs of the world’s poorest and the resources of the world’s most wealthy. In sum, global health sets an agenda where health is a basic human right and should be protected and promoted by the global community.

The emergence of Global Health is an impressive call-to-arms, but it remains to be seen if remedying global health disparities will be considered as alluring an incentive to world governments and private industry as millions of dollars in profits have been to Coca-Cola.

This year’s journal seeks to demonstrate that global health awareness does exist - at least at the undergraduate level. With research and other hands-on experiences heralding from foreign locales such as South Africa, India, the Dominican Republic, the Philippines and Ethiopia, the 2006 edition of *Epidemic Proportions* portrays a student body of work committed to the advancement of global health concerns, whether it be from the lab or out in the field. Health problems are no longer acute or chronic, national or international. It’s time to go global.

We hope you enjoy this year’s *Epidemic Proportions*.

Claire Edington
Patrick Bogard
Editors-in-Chief

DR. KLAG "We look forward to strengthening our collaborations with faculty and students at Homewood and across the University."



Saving Lives Millions at a Time

Dr. Michael Klag Reviews an Educational Mission

Michael J. Klag, MD, MPH
Dean, Johns Hopkins Bloomberg
School of Public Health

PERSPECTIVE Dr. Michael J. Klag discusses the educational mission of JHSPH and the promise of new collaborations with colleagues and students at KSAS and WSE..

Photograph courtesy of NLM-PHIL/CDC

Now is a great time to be in public health! There is widespread recognition by the public, government, philanthropists and others of the importance of our field. The reasons for this recognition are the big challenges that we face. These problems include the health disparities in our country, the aging of the US population and attendant health needs, emerging infectious diseases (such as SARS and avian flu), suboptimal response to disasters, bioterrorism, environmental pollution, nutritional deficiencies, and the list goes on. Public health takes on big problems, using the results of our research to design interventions that improve the health of entire populations. Thus we help everyone, the rich as well as the poor. But because of the strong association of morbidity and mortality with lower socioeconomic status, the poorest of the poor are often helped the most.

Societal appreciation of our mission—*saving lives, millions at a time*—is reflected in the growth of

problems of the 21st century. Education is a unifying mission that will draw our faculty together and lead to additional fruitful research and practice collaborations.

The Bloomberg School of Public Health was established in 1916 as a global school that emphasizes research, mentorship and practice. We believe that no matter what field of endeavor our undergraduate students eventually pursue, training in public health will give them a broader and uniquely beneficial perspective on their work. The ability to view health issues on the population level, to appreciate the connectedness of people from around the world, and to frame problems from the viewpoint of prevention rather than amelioration after a disease or an event occurs provides a powerful framework to attack many diverse issues. We look forward to strengthening our collaborations with faculty and students at Homewood and across the University to enrich our School and to protect health around the world.

"Over 300 students are learning the power of population-based approaches using the disciplines of epidemiology, biostatistics, behavior change, and environmental engineering, among others. We need to make available more advanced courses that are tailored to our undergraduate students' needs and interests."

the Bloomberg School of Public Health. We now have approximately 1,900 students and 480 faculty members. One of the efforts of which we are most proud, however, is our participation in the education of Johns Hopkins undergraduates. Over 300 students are learning the power of population-based approaches using the disciplines of epidemiology, biostatistics, behavior change, and environmental engineering, among others. To keep this program vibrant and intellectually challenging, we need to make available more advanced courses that are tailored to our undergraduate students' needs and interests. Creating additional combined bachelor/master's programs in collaboration with colleagues in the Krieger School of Arts and Sciences and the Whiting School of Engineering is another goal. I have meetings scheduled with my counterparts at these schools, Drs. Falk and Jones, to assess how we can move ahead for the mutual benefit of our schools and students. On the East Baltimore campus, we are working with the Schools of Nursing and Medicine even more collaboratively than in the past to develop innovative programs that will prepare students to attack the big

Michael J. Klag, MD, MPH
Dean, JHSPH

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Joint Departmental Affiliations | Health Policy and Management, School of Nursing
Center and Institute Affiliations | Welch Center

Research Interests | Hypertension, Renal Failure, Precursors Study, Kidney Disease, Cardiovascular, Epidemiology, Genetic Markers, Health Policy and Management

Honors and Awards since 2000 | 2003 David M. Levine Excellence in Mentoring Award, 2004 Champion of Public Health Award

Causes of Tuberculosis in India

An Economic, Infrastructural, and Attitudinal Overview

student
research

by Hari Prabhakar
Public Health Studies, 2007

RESEARCH *The purpose of this article is to explore the social factors that play a role in the propagation of this widespread disease.*



ABSTRACT

While curative-based drug regimen programs such as the Revised National Tuberculosis Program of India (RNTCP) have been available for many years, the control of tuberculosis in India has been particularly complex and wholly ineffective.

INTRODUCTION

Mycobacterium tuberculosis has infected approximately one-third of the world's population, and in India, the morbidity and mortality caused by tuberculosis places it among the highest priorities for disease control.

METHODS

Tuberculosis in India is analyzed within a socio-cultural framework. It is understood that TB is caused by a combination of economic, infrastructural and attitudinal disparities.

DISCUSSION

An effective program of social health to combat tuberculosis in India will be one that considers economic inequalities that arise from the existence of the rich and the poor and the social inequalities that contribute to gender and age differentials.

Image courtesy of NLM-PHIL/CDC/Chris Zahniser, B.S.N., R.N., M.P.H. 2000. Indian public health care practitioner administering an oral vaccine to a child. After vaccination, one of the child's fingers would be marked.

India, as a whole, has long been characterized with considerable heterogeneity in terms of religion, territory, language, and caste. As a developing country with a burgeoning population of over one billion people, India is classified along with sub-Sahara Africa to be among those regions with the highest burden of infectious diseases, and most notably, tuberculosis. The *Mycobacterium tuberculosis* has infected approximately one-third of the world's population. In India, the morbidity and mortality caused by tuberculosis places it among the highest priorities for disease control.¹ Every year, 2.2 million people in India are newly infected with the disease, adding them to the 15 million existing cases, and over 450,000 die every annum.²

The tuberculosis pathogen primarily affects the lungs, causing pulmonary tuberculosis, though it has also been known to affect the intestines, bones and joints, lymph glands, skin, and other tissues of the body.³ While the clinical manifestations of this chronic disease are varied, the virulent tubercle bacilli in India have been known to multiply either very rapidly or very slowly. As a result, the faster multiplying strain is more susceptible to the bactericidal action of chemotherapeutic drugs, while the slower multiplying strains are the source of more persistent or dormant bacilli that are difficult to treat. These bacilli can remain alive for years without any adverse effects to its human host, though favorable breeding conditions can cause a dramatic relapse.²

While curative-based drug regimen programs such as the Revised National Tuberculosis Program of India (RNTCP) have been available for many years, the control of tuberculosis in India has been particularly complex and wholly ineffective. Apart from existing but limited medical infrastructure in urban and rural areas, Indian government health policy makers have failed to recognize the social factors that surround the control of tuberculosis and the social nature of the disease itself. Specifically, tuberculosis has long been considered a social illness, given that a majority of those individuals affected with it live in dense groups that share many characteristics with one another. Paluzzi notes that "this population density and communal life contributes heavily, along with the biological factors, to the epidemiology of the disease."⁴ Additionally, tuberculosis presents unique features that have their origins in the fact that Indian society has been stratified into castes or classes that are differentiated by their geographic orientation, gender, and means of subsistence. The means of subsistence for different groups, in turn, is what dictates the means and capability of resistance to tuberculosis itself.⁴ Formulating an

effective intervention against tuberculosis in India, therefore, requires its identification as a social disease, one that stems from geographic and economic inequalities, gender and age stratification, and government allocation of resources for and accessibility of social and preventive health services in impoverished areas.

The economic disparities among the Indian population come together to play a critical role in the presence of tuberculosis. These disparities arise from the growth of the working class and the concurrent growth of the urban and rural poor. With the growth of the export economy and the Indian government's emphasis on national development post independence from British rule, the newly emerging labor movement required the increasing presence of the working class in the social and political realms. The growth of factories, public utility infrastructure, and large-scale agricultural endeavors contributed to the rapid growth of the middle class and the radicalized working class in urban

for migrant workers. A recent study of the unemployed on the rural outskirts of Delhi indicates that unemployment and loss of income among unskilled workers correlates with the presence of tuberculosis in the area.⁷ These results, therefore, indicate that a synergy of economic conditions, unsanitary living conditions, and the health and nutritional status among India's urban and rural poor serve to create personal and social environments where the opportunistic tuberculosis bacteria spreads with virulent rapidity.

In addition to the economic factors, societal stratification by gender and the changing Indian family structure are also causal factors in the propagation of tuberculosis.⁸ The incidence of tuberculosis has been shown to be greater in men than in women. The social burdens and discrimination placed on and against women in Indian society, and its concurrent role in the gender differentials in tuberculosis, however, are not to be ignored. Due to the intrinsic stigma and social vulnerability of working class women in India,

by Hari Prabhakar
Public Health Studies

"The economic disparities among the Indian population play a critical role in the presence of tuberculosis. These disparities arise from the growth of the working class and the concurrent growth of the urban and rural poor."

and rural areas. The traditionally agrarian worker suddenly became linked with the growth of the modern economy, and the rural-urban migration commenced at a frantic pace. However, only a small percentage of these migrants found employment, and without a stable subsistence, they were forced into urban indigence.⁵ This working class was and remains characterized by abject poverty, which in turn translated into the predominant living conditions of the Indian poor: malnutrition, overcrowding, ill-ventilated houses, cramped and poorly ventilated work places, arduous workdays, homelessness, drug abuse, and alcoholism.⁴ In the industrial city of Mumbai, for example, over 50% of the impoverished live in slum-like conditions, with over 200,000 cases of tuberculosis arising from these areas.⁶ In many rural areas, the government housing provided to the poor has also been shown to be drastically deficient in drainage, ventilation, and size. Further observational studies also demonstrate that the economic burdens placed on the poor directly affect their preventive health-seeking behavior with respect to tuberculosis.⁶ Faced with financial difficulties, reduced capacity to do work, poor job performance, and consequences of health-related absences, the Indian working classes are shown to be less inclined to seek preventive health measures and tuberculosis education as a result of its financial consequences.⁶

Furthermore, unskilled workers in rural areas of India have no stable and durable employment, and the high concentration of the Indian population in rural areas results in job seekers far outnumbering the number of available jobs. As a result, the time it takes to secure a position, coupled with the meager remuneration and geographical distance of these menial opportunities, make social security a pipe dream

women are less likely to be allowed opportunities for social mixing with members outside of the community, including those with tuberculosis. As a result, many women are sequestered to their community, and post marriage, are held solely responsible for cooking, childcare, household maintenance, and overall family harmony.⁶ The social pattern of gender-based inequality in food distribution and immunizations to women in a resource-strained environment also increases susceptibility of women to the disease.⁹ Additionally, the prevalent but fallacious notion of men in western India that tuberculosis is attributed to sexual experiences with prostitutes and menstruating women further provides a basis for Indian communities to stigmatize women. The result, in turn, is that men are justified by Indian society to desert their wives and children and remarry, given the woman's blameworthiness and critical role in ill health. This "cross-gender mistrust of sexual promiscuity" places an even heavier burden of responsibility on women, which often leads to their hesitance in seeking preventive healthcare services and education pertaining to tuberculosis, in fear of increased stigmatization by their spouse and the community as a whole.¹ Faced with oppressive societal expectations, limited economic resources, and curtailed physical capabilities, Indian women who are abandoned by their husbands and by the community at large are unable to provide adequate food, sanitary living conditions, health care, and education for their children. In many cases, these women are forced to think of diseases as *karma*, the cultural metaphor for fate, and therefore are not willing or are unable

TUBERCULOSIS IN INDIA *continued on page 44*

The Case for Microbicides

HIV Awareness Among Women in Mtubatuba, South Africa

student
research

by **Claire Edington**
Public Health Studies, 2006

RESEARCH *Socio-cultural factors that discourage the use of condoms suggest an alternative method to HIV prevention.*



ABSTRACT

Assess the association between HIV awareness and perception of the risk for HIV infection and condom use among women enrolled in the preliminary phase of a microbicides clinical trial in rural KwaZulu Natal.

METHODS

This analysis used different measurements of sexual behavior from 181 HIV- negative Zulu women in order to determine which factors most influenced the decision to use a condom.

RESULTS

94% of the study population felt they were at risk of HIV. 82.4% felt like they were most at risk because they did not use condoms, and 82.3% felt at risk because their partner was unfaithful. 47% of the study population had never used a condom. Women whose partners made the decision whether or not to use a condom were the least likely to use a condom.

DISCUSSION

Identifying socio-cultural barriers to condom use will be critical in understanding the dynamics of the rapidly growing HIV/AIDS epidemic.

Photograph credit Claire Edington

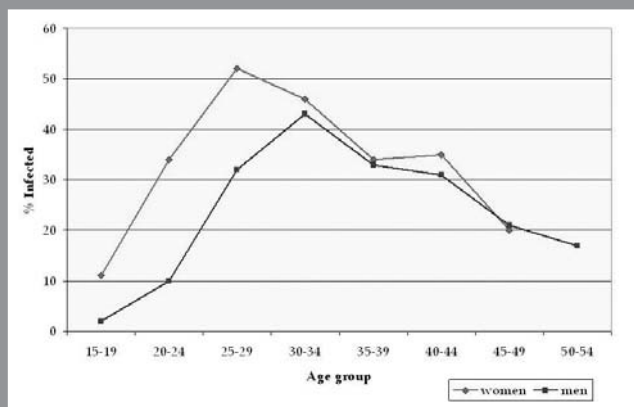
The Republic of South Africa, considered to be one of the most developed countries in Africa, is nevertheless home to one of the world's most rapidly growing HIV/AIDS epidemics. 5.3 million South Africans were estimated to be infected with HIV/AIDS in 2003. 13% of all the people living with HIV worldwide can be found in South Africa.

From the data in Table 1, it can be seen that young South African women are particularly at risk for HIV infection. 25% of women in South Africa are infected with HIV by the time they are 22 years old. The results of national antenatal surveys show that HIV prevalence among women attending antenatal clinics had risen from less than 1% in 1990 to almost 24% in 2001.¹ In a study undertaken in rural KwaZulu Natal, HIV prevalence as high as 37% was reported among 20-24 year old pregnant women.² Teenage pregnancy rates are also very high, with 35% of teenage girls reported to have been pregnant by the age of 19.³

Despite the high rates of HIV infection among women, the use of barrier methods of contraception in South Africa is reported to be very low. In a 2002 survey in rural KwaZulu Natal, less than one-third (29%) of all women reported use of a contraceptive method. Of those between the ages of 15 and 24 practicing contraception, 73% used the injectable hormonal contraceptive which is popular among younger users and women living in rural areas (however, injectables do not prevent HIV transmission).⁴ With high rates of young HIV positive pregnant women attending antenatal clinics, one would expect to see a move away from injectables as the main method of contraception and a move towards the use of condoms, which provides dual protection against sexually transmitted infections (including HIV) and unwanted pregnancy. Condom use, however, remains low.

Given the high prevalence of HIV in rural areas of KwaZulu Natal, the low use of condoms for contraception requires attention. Although in public health literature an increased perception of the risk of HIV infection has been strongly related to an increase in self-protective health behavior, women are often not in the position to refuse risky sex and insist on the use of a male condom.⁵ The ABC campaign (Abstain, Be Faithful, use Condoms) is therefore an insufficient prevention strategy, and alternatives, such as the development of vaginal microbicides, should be supported.

The primary aim of this study was to assess the association between condom use and perception of the risk for HIV infection among women enrolled in a preliminary phase of a microbicides clinical trial in rural northern KwaZulu Natal. The study used different measurements of



ABOVE TABLE 1 In 2003, in KwaZulu Natal, the country's most populous province, HIV prevalence was estimated at 38%, approximately 10% higher than the national average. N=13,006 Resident Men, 15-54, Resident Women 15-49. Courtesy of Africa Centre for Health and Population Studies, 2004.

Number of sex acts in 8 days	Freq.	Percent	Cum.
0	64	35.36	35.36
1	30	16.57	51.93
2	35	19.34	71.27
3	21	11.60	82.87
4	6	3.31	86.19
5	11	6.08	92.27
6	9	4.97	97.24
7	1	0.55	97.79
8	3	1.66	99.45
11	1	0.55	100.00
Total	181	100.00	

LEFT TABLE 1 Population-Based Sero-surveillance. N=13,006 Resident Men, 15-54, Resident Women 15-49. ABOVE TABLE 4A Number of Sex Acts Per 8 Days as Recorded in the Coital Diary.

ABOVE TABLE 4A 65% of women reported at least one sex act over the 8 day period surveyed on the coital diary. Only 17% reported more than 3 sex acts. Of these sex acts, 97% were always with regular partners and 84% had exclusively vaginal sex. 70.72% of women reported sex with a partner who is at least 5 years older.

sexual behavior (a self-completed coital diary and in-person interviews on sexual behavior and HIV awareness) in order to determine which factors most influenced the decision to use a condom. Identifying socio-cultural barriers to condom use will be critical in understanding the dynamics of the rapidly growing HIV/AIDS epidemic in the area, as well as establishing the need for the development of an alternative prevention strategy, such as vaginal microbicides.

METHODOLOGY Background The data for this analysis was collected by the Africa Center for Health and Population Studies in Mtubatuba, KwaZulu Natal, South

were an HIV negative serostatus and not being pregnant. 882 women were screened and 453 were eventually enrolled. HIV prevalence in this population was determined to be approximately 50%, and formed the main criteria of ineligibility among prospective participants.

As part of the preliminary phase of the study, enrolled female participants underwent the following: a demographic, sexual behavior and clinical interview, general and genital exams, HIV and syphilis testing with pre- and post-test counseling, safe sex education and condom distribution, urine pregnancy tests, gonorrhea and chlamydia testing,

by **Claire Edington**
Public Health Studies

"Microbicides are currently in the early stages of development and, unlike vaccines, have yet to receive private sector funding. The potential impact of microbicides worldwide is estimated to be huge."

Africa. The data was collected as part of a preliminary phase, in preparation for a phase III clinical trial of the Pro2000 gel microbicide, coordinated through the Microbicide Development Programme (MDP). Upon completion of this phase in the Fall of 2004, the Africa Centre was determined suitable as one of six Sub-Saharan African sites for the MDP.

The Africa Centre is located in the rural health district of Hlabisa, serving northern KwaZulu Natal province. Today, it is home to a predominantly rural, isi-Zulu speaking, resident population of 210,000. The economy is driven primarily by pensions, migrant labor, and subsistence farming. There are high levels of female mobility (70 internal movements per 1000 women, and 124 out-migration movements per 1000 women at the mid-year population in 2004). 38% of the population receives water from piped lines, and 20% directly from rivers. About 50% have access to pit latrines, while 28% have no access to toilet facilities.⁶

Subjects Recruitment for participation in the preliminary phase of the study was conducted through three maternal and child health clinics in Hlabisa: Somkhele, Mtubatuba and KwaMsane. The two main criteria for eligibility in the study

coital diary recording, and in depth interview and focus group discussions in a subset.

For the purposes of this analysis, only those who had completed all three measurements, including the coital diary, sexual behavior form and demographic forms were included as part of the study population (181 total).

Procedures This analysis focused exclusively on three sources of data: the coital diary, the sexual behavior questionnaire, and the demographic questionnaire. The coital diary is a two week log for women to record their sexual behavior including: frequency of sexual intercourse, type of sex (vaginal or anal), type of partner (regular or casual), and whether or not a condom was used. The diary was either pictorial (with images designating each variable category) or written in isiZulu. Women were asked to complete the diary immediately after each sex act in order to ensure accuracy of the measurement.

The sexual behavior and demographic questionnaires

MICROBICIDES SOUTH AFRICA *continued on page 45*

SARS Outbreak Exposes China

Unveiling a Policy Crisis with Worldwide Implications

student
research

by **Darren Kaw**
Public Health Studies, 2006

RESEARCH *The SARS outbreak in 2002 presented unique challenges which forced China to reevaluate how it handled disease.*

ABSTRACT

The Chinese government prioritized domestic and political concerns over its responsibilities to the world, causing SARS to spread much further.

INTRODUCTION

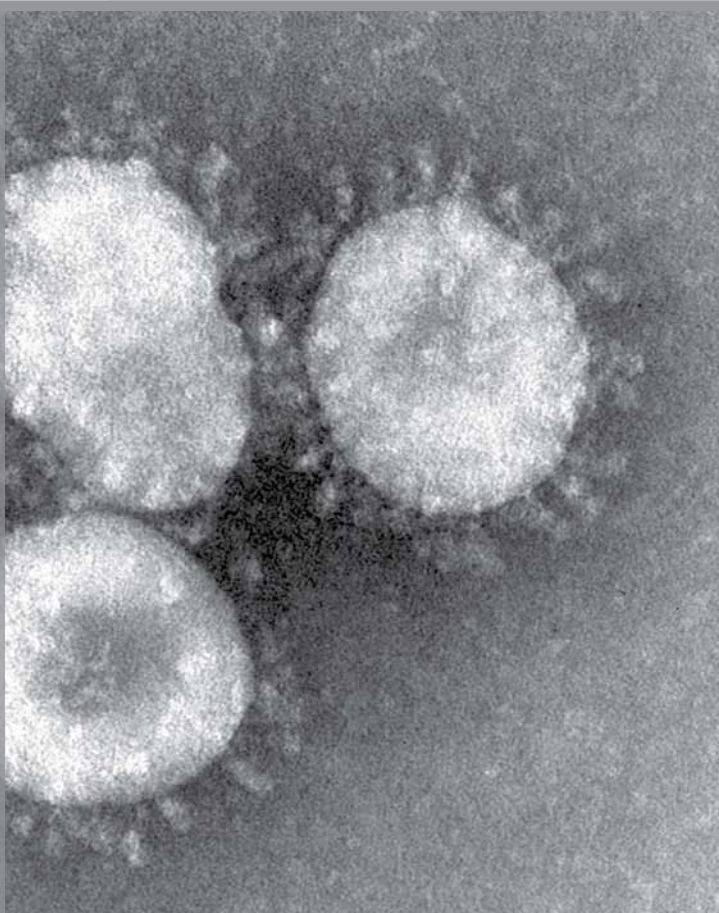
Severe Acute Respiratory Syndrome (SARS) is caused by a virus and is spread through air-borne droplets from sneezing, coughing, or talking.

METHODS

A policy analysis was applied to the SARS crisis in China. Its impact on world health and Chinese national health policy were evaluated.

RESULTS

Following the first case of SARS in China in 2002, Chinese health policy has undergone significant changes related to international cooperation, journalism, and AIDS.



ABOVE Coronaviruses are a group of viruses that have a halo, or crown-like (corona) appearance when viewed under a microscope. The coronavirus is now recognized as the etiologic agent of the 2003 SARS outbreak. Additional specimens are being tested to learn more about its etiologic link with SARS. Image courtesy of NLM-PHIL/CDC/Dr. Fred Murphy 1975.

As the twenty-first century broke one could not avoid news of China's rising world status. However, China's climb has been littered with stumbles. One of the most significant challenges China has faced has been the outbreak of Severe Acute Respiratory Syndrome (SARS) in 2002. SARS presented unique challenges which forced China to not only reevaluate how it handled disease domestically but also globally. SARS effected many health policy changes in China, specifically in terms of international cooperation, journalism, and AIDS.

The SARS crisis unveiled China's biggest problem. In a country where the government classifies infectious disease outbreaks as state secrets, transparency looms as the largest issue. The Chinese government frequently withheld information and prevaricated data from international entities. The case definition of SARS represents a prime example. In the beginning of the epidemic, Chinese doctors called SARS cases feidian, or "atypical pneumonia" for several

reasons. First, SARS struck concurrently with a bout of pneumonia. Doctors treating SARS realized they had a new strain of pneumonia that acted differently from common strains. In Guangdong, physicians compiled information about the clinical management of SARS into the No. 2 Report, which contained "the basic clinical features of the disease and set out a range of treatment options that included both Chinese and Western medical techniques." This report helped hospitals treat and contain atypical pneumonia more effectively; however, the uncertainty surrounding whether atypical pneumonia and SARS referred to the same disease delayed the World Health Organization's (WHO) attempts to obtain the report. This incertitude extended to many facets of the government's response to SARS, considering China did not even accurately relay basic epidemiological data such as case numbers to the WHO. The state secret status of epidemics played a role in creating skepticism in China's reported case numbers. Data distributed to international

organizations about the outbreak did not include military hospital cases. Because military hospitals report to their own chain of command, they have no obligation to the Ministry of Health. As a result, even the civilian authorities did not know the total number of SARS cases. All this came to a head when the WHO Director-General, Gro Harlem Brundtland, publicly accused China's case numbers as being deliberately underreported. China's initial refusal to have WHO inspection teams examine affected areas only exacerbated the situation. China repeatedly asserted that they had the outbreak of atypical pneumonia under control and did not require outside help. When the Chinese government finally granted access to medical facilities, the WHO teams quickly ran into another brick wall. The government restricted access to Guangdong, the epicenter of the outbreak. Chinese health officials removed SARS patients from hospitals about to be inspected by WHO teams, which ensured that the WHO officials would not discover SARS patients.

Several reasons contributed to the lack in transparency in the government. Primarily, Chinese officials feared that their jobs could be jeopardized if they reported the SARS statistics. Additionally, the concurrent transition of power from China's President Jiang Zemin to Hu Jintao in the spring of 2003 intensified the desire to avoid trouble. Being the first peaceful transfer of power in communist China era,

restaurants. Civet cats are a delicacy yet a possible animal reservoir for the disease. In addition, the Ministry of Health temporarily shut down the live animal markets that typically sold civet cats. The government also demonstrated its rapid response in an environment normally under control, the laboratory. In April 2004, SARS viral samples infected several researchers in a Beijing laboratory. Health officials immediately informed the party Central Committee and the State Council, who ordered the Ministry of Health to implement the SARS emergency response mechanism. These measures included quarantine of the research personnel and extensive contact tracing. In addition, they shared disease data with the WHO, the Taiwan Red Cross Organization, Hong Kong, and Macaonese health officials. Health officials established fever checkpoints at sites of mass transportation, such as airports and rail centers. Officials sent anyone found with a fever to the hospital for a checkup. The Chinese government succeeded in implementing these interventions to control future outbreaks of SARS. While these are positive changes, there are signs that the Chinese government has not completely learned its lesson. The policies seem tailored to an acute response, rather than addressing a broader range of changes. One such possible area of reform is the flow of information.

Information Flow: Singapore vs. China The SARS case

by Darren Kaw
Public Health Studies

"This incertitude extended to many facets of the government's response to SARS, considering China did not even accurately relay basic epidemiological data such as case numbers to the WHO."

it drew the entire country's attention. Authorities wanted everything to go smoothly; consequently, they downplayed any bad news.

SARS Tests the Defenses After the first wave of SARS subsided, the Chinese government knew there was a high probability that SARS would strike again. Aware of the intense scrutiny in the first outbreak, the government effectively implemented several policy changes to combat future cases of SARS. SARS tested these defenses when it returned in 2004. A 32-year-old man with pneumonia checked into a hospital in Guangzhou, where subsequent laboratory tests suggested that he had SARS. When China first learned of the probable recurrent SARS case in late December 2003, they contacted the WHO immediately. Chinese laboratories sent viral samples to foreign labs to confirm their own preliminary findings. Once confirmed, health officials traced his contact history and applied necessary quarantines. The Ministry of Health even requested that the WHO send an expert to aid with data interpretation and application.

The openness and willingness of the government to cooperate with the WHO sharply contrasted the earlier attempts at covering up. In a sign of prioritizing health before economy, Guangdong's provincial government ordered the slaughter of 10,000 civet cats in all animal markets and

further shows information flow remains crucial to public health policy. The speedy dissemination of information leads to effective health policies. For example, Singapore's time on the WHO's infected country list was second only to Vietnam. The media played a large role in SARS's rapid containment by providing public health information. The creation of an exclusive SARS channel and a daily press conference with the Minister of Health in Singapore highlight the difference with mainland China. The SARS channel ran daily from noon to midnight and encouraged Singaporeans to not fear SARS. The overriding theme was for people to go on with their lives. The Minister of Health Lim Hng Kiang emphasized this by addressing rumors in a daily press conference. This direct line of communication helped allay the public's fear as the Minister's forthrightness built credibility for the government. There are many other factors that helped Singapore control SARS better than China. Singapore is a small island nation with a very strong centralized government while China is the fourth largest nation in the world and has a decentralized government. Despite these differences, a stronger media response would have helped China. It is clear a liberal press improves

SARS CHINA POLICY CRISIS *continued on page 47*

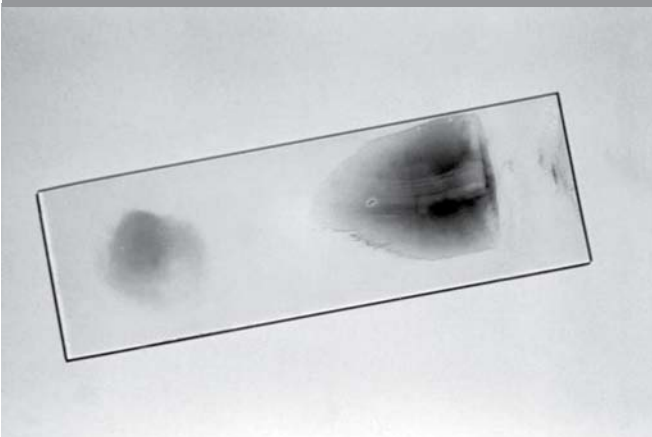
Sex Differences in Malaria Infection

Gender-Based Study of Parasitic Infection in Rodents

student
research

by Pamela Klein
Public Health Studies, 2007

RESEARCH Male rodents infected with malaria have a higher mortality rate than females infected with the same strain.



ABSTRACT

The objective of this study was to determine the roles of innate and acquired immune responses, as well as the specific effects of IFN- γ , as mediators of sex differences in *P. chabaudi* infection.

METHODS

Adult male (n = 15/genotype) and female (n = 15/genotype) wild-type (WT), T-cell deficient, B-cell deficient, combined T- and B-cell deficient, and IFN- γ knock-out mice were inoculated with *P. chabaudi* infected erythrocytes. Mortality rates, parasitemia, body mass, body temperature, and anemia were recorded and analyzed.

RESULTS

Overall, males were 3.5 times more likely to die from malaria infection than females, with these differences being most pronounced among T-cell deficient, B-cell deficient, and both T and B cell deficient mice.

DISCUSSION

Innate immunity may be responsible for sex differences in rodent malaria infection with *P. chabaudi*. Once IFN- γ was completely removed from the immune response, all mortality differentiation between males and females was abolished.

This stained slide displays the appearance of both a thick, and thin blood film ready for malaria examination. Image courtesy of NLM-PHIL/CDC/Steven Glenn, Laboratory Training & Consultation Division (1979).

Many vertebrate species indicate differences in parasite infections by gender. In humans, the incidence of malaria infection is generally similar between men and women,^{1,2} but male infection is more severe with a higher parasite load.^{2,3,4} Symptomatic differences are also observed between the sexes.^{5,6,7} During rodent malarial infection, males are more likely to develop severe reactions to infection. Females demonstrate higher immune responses as well as lower rates of morbidity and mortality when compared with male mice.^{8,9,10,11} Innate immunity is crucial to the control of primary rodent malaria infection, while adaptive immunity is responsible for the recovery and chronic maintenance and control of infection. *Plasmodium chabaudi*, a rodent malaria parasite, is often used to induce a non-lethal infection in immunocompetent mice and examine the immune mechanisms mediating resistance to infection.¹² CD4+ T cells play a crucial role in the regulation of infection, activating the adaptive immune response, based on cytokine output.¹³ Th1 cells are predominant during the acute, primary infection and induce protection via a nitric oxide-dependent mechanism which results in production of cytokines IL-2, IFN- γ , and TNF- β .¹⁴ On the other hand, Th2 cells aid in the development of antibody-producing B cells.^{13,15} Th1 cells are activated throughout the primary infection, while Th2 cells are activated during parasite clearance. Th1 responses are highest prior to peak parasitemia, at which point the Th2 mechanisms become predominant.¹³ *P. chabaudi* is the most widely used model of malaria immunoregulation with a balance between the Th1- and Th2-mediated mechanisms.¹²

Studies examining the interplay between innate and acquired mechanisms have typically only examined females^{16,17,18}, possibly because males have a higher susceptibility to infection.^{8,9,10,19} As such, the immune mechanisms underlying this sex-based difference in infection presentation as a function of innate versus acquired immunity has not yet been investigated. Many studies manipulate sex hormones and examine the effects of these manipulations on immune presentation.¹⁹ However, this assumes that the response to infection is mediated by the endocrine system.

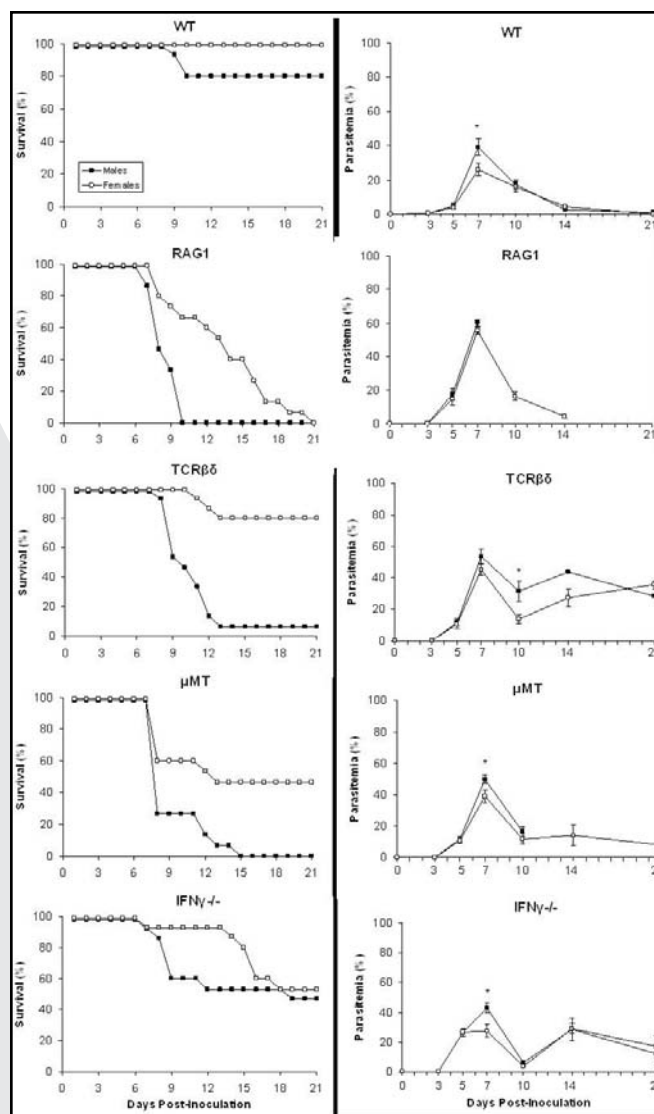
This study utilized a complementary approach of manipulating specific factors in the immune system and examining the effect of these manipulations on sex differences in response to infection. In order to analyze the importance of both the innate and acquired immune systems, wild-type (WT) mice were compared with B-cell (μ MT) deficient mice, T-cell receptor (TCR $\beta\delta$) deficient mice, and T- and B- cell deficient mice (RAG1). The role of the

cytokine IFN- γ was also examined through the use of IFN- γ deficient mice.²⁰ Because IFN- γ is produced by natural killer (NK) cells and T-cells¹⁵, results from all examined strains are related to the possible source-specificity of IFN- γ . Previous studies have indicated that immunocompromised mice with deficiencies in either T- or B-cells have higher peak parasitemia and mortality than wild-type mice, indicating that both antibody-dependent and antibody-independent mechanisms are involved.^{16,21} Our study analyzed whether different subsets of immune cells contribute to sex differences in response to the *P. chabaudi* infection.

Innate immunity has been linked to control of peak parasitemia in an antibody-independent mechanism, while an acquired immune response is responsible for control of chronic infection.¹³ If adaptive immune responses of T- and B-cells mediate sex differences in malaria infection, then mice of both sexes lacking both T- and B-cell mechanisms (RAG1) should be equally susceptible to infection. If B-cell mechanisms (i.e. antibody production) mediate the sexual dimorphism in *P. chabaudi* infection, then female B-cell deficient mice (μ MT) should be as susceptible or more to infection than their male counterparts. If T-cell-dependent mechanisms (e.g., activity of CD4+ T-cells) mediate sex differences in malaria infection, then removal of the T-cell receptor, as in TCR $\beta\delta$ mice, should result in males and females being equally susceptible to infection. Previous data illustrates that IFN- γ responses are significantly higher in female than male WT mice and may contribute to sex differences in morbidity and mortality during *P. chabaudi* infection. The data regarding IFN- γ should indicate the importance of the cytokine as well as the cell type supplying the cytokine. Wild-type and B-cell deficient mice have IFN- γ production from both NK cells and T-cells, while the T-cell receptor knock-out and T and B-cell knockout mice only produce IFN- γ from innate immune cells, such as NK cells, due to their lack of T-cell receptors. IFN- γ knock-out mice are deficient in all sources of IFN- γ production. If IFN- γ mediates sex differences in response to malaria parasites, then female IFN- γ deficient mice should be equally susceptible or more susceptible to infection than males.

METHODS Thirty (15 male and 15 female) mice on a C57BL/6 background served as the experimental animals for each strain. Wild-type mice were C57BL/6 mice without modification. μ MT mice were used as B-cell deficient mice and TCR $\beta\delta$ mice were used as T-cell receptor knock-outs for both $\alpha\beta$ and $\gamma\delta$ receptor deficiencies. RAG1 mice were used as T- and B-cell knock-outs and IFN γ -/- were deficient in IFN γ from all possible sources (e.g. T- and NK cells).²⁰ Each mouse was inoculated with 10^6 *P. chabaudi* infected erythrocytes from adult BALB/C donor mice and monitored 0, 3, 5, 7, 10, 14, and 21 days post-inoculation (dpi) for parasitemia, body mass, rectal body temperature, and anemia. The mice were monitored for mortality daily.

Body temperature was measured by briefly restraining the mice in a 50 ml conical tube while a rectal temperature was measured (Physitemp, Clifton NJ). To monitor body mass, the mice were contained in a cylindrical container, which had previously been set to zero, while the



ABOVE FIGURE 1 – Mortality and Parasitemia: Parasitemia data (parasitized RBC / total RBC) are presented as mean + SEM of the surviving animals at each time point p.i. (starting $n = 15/\text{sex/genotype}$). * $P < 0.05$, mixed ANOVA.

measurement was taken from a digital scale. To measure anemia, blood was collected from the saphenous vein²² in a heparinized capillary tube and centrifuged, after which RBC volume was measured relative to total blood volume. Body mass, anemia, and body temperature were monitored as general indicators of morbidity during malaria infection and analyzed using mixed ANOVAs followed by planned comparisons. Parasitemia was measured by preparing Giemsa stained thin blood smears on microscope slides. Parasitemia was calculated by counting the number of parasites/total number of erythrocytes in a minimum of 3 random fields and analyzed using mixed ANOVAs with planned comparisons.

RESULTS Body Temperature: For WT, μ MT, TCR $\beta\delta$, and RAG1 mice, females exhibited less severe hypothermia than their male counterparts. For both male and female μ MT and TCR $\beta\delta$ mice, there was a decrease in body temperature

Nuclear Power and National Security

The Consequences and Future of Nuclear-Phase Out

student
research

by **Supria Ranade**
Environmental Sciences, 2006

RESEARCH *The public health hazards associated with nuclear power have forced countries to search for safer alternative fuel sources.*

ABSTRACT

Nuclear power generation has been a major source of electricity for over fifty years. However, due to its hazard to global public health and two catastrophic accidents, nuclear development has quickly been halted.

METHODS

Through the study of three countries on the forefront of nuclear phase-out, this paper outlines how each country must alleviate the nuclear power crisis.

RESULTS

The chief factors that affect the control and replacement of nuclear power are directly related to the economics of the country and governmental support at both the local and federal levels.

DISCUSSION

Nuclear power has a great effect on national security, the environment, and public health. Only a concerted effort between government, industry, and the public will ensure a successful phase-out.

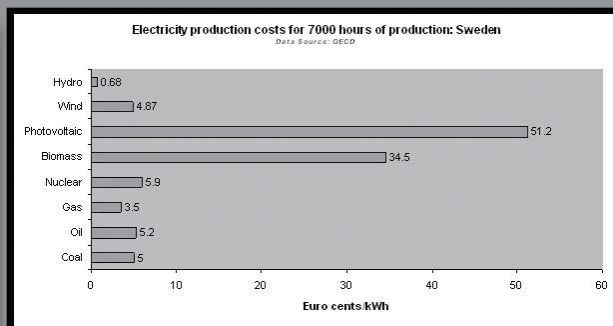
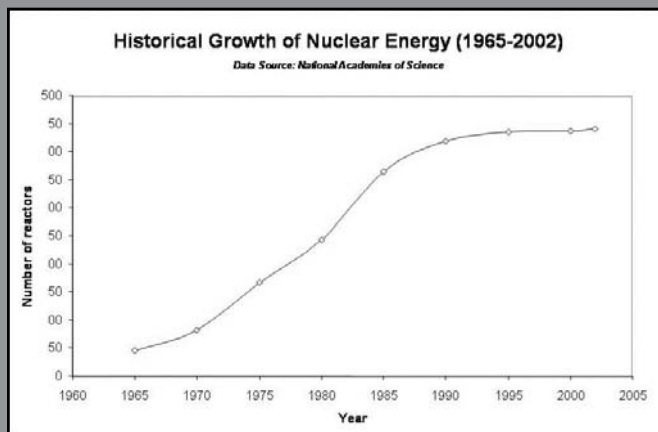


ABOVE *This image depicts the Three Mile Island nuclear power plant near Middletown, Pennsylvania, which was the site of a March 28, 1979 power plant accident. The accident at the Three Mile Island Unit 2 (TMI-2) nuclear power plant was the most serious in U.S. commercial nuclear power plant operating history, even though it led to no deaths or injuries to plant workers or members of the nearby community. It brought about sweeping changes involving emergency response planning, reactor operator training, human factors engineering, radiation protection, and many other areas of nuclear power plant operations. It also caused the U.S. Nuclear Regulatory Commission to tighten and heighten its regulatory oversight. Resultant changes in the nuclear power industry and at the NRC had the effect of enhancing safety. Image courtesy of NLM-PHIL/CDC.*

Electrical power produced by nuclear energy was a technology developed in 1951, shortly after World War II. Viewed as the new alternative to fossil fuels, energy produced from uranium fission was hailed as the global solution to climate change. Following its implementation in the United States, nuclear energy was incorporated in the UK (1953), Russia (1954), France (1956), and Germany (1961)¹. Widespread acceptance of this new technology, however, proved to be short lived. Two major accidents, Three Mile Island in the United States (1979) and Chernobyl (1986) in the former Soviet Union, caused international public uproar and prompted a temporary halt in nuclear development worldwide. The damage in Three Mile Island was primarily caused by the over-heating of a reactor core, and although small releases of radioactive gases were measured off site, there were no fatalities reported due to radiation exposure.

The reactor core melt-down of Chernobyl, however, released five percent of the radioactive gases due to the lack of a containment building. Called the “worst accident in the history of nuclear power,”² this event resulted in 31 immediate fatalities and thousands more in the aftermath due to radiation exposure. The two accidents forced many countries to reconsider their nuclear plants and policies³ and presently, most of Western Europe, with France as the exception, have not constructed new reactors since 1987. On the contrary, construction and operation of facilities in the developing world is climbing at a rapid pace. India, Pakistan, South Korea, China, and most recently Iran have developed fission technology, shedding new concerns on the future of international security and raising new issues for public health.

Despite continued promotion of nuclear power as clean



LEFT FIGURE 1 Growth trend of nuclear energy demonstrated by the number of total reactors built every five years (Reference 4).

ABOVE FIGURE 2 Costs of Swedish electricity according to source (Reference 18).

technology in the United States and France, other countries such as Sweden, Belgium, and Germany have decided to ‘phase out’ nuclear power in the near future. The term ‘phase out’ signifies an end to nuclear power generation for both military and commercial purposes as well as an increasing reliance on renewable and alternative fuel resources. Reasons cited for this transition include rising costs of nuclear facility maintenance, radiation hazards, and problems of spent nuclear fuel disposal.^{5,6}

The decision to phase-out nuclear power, however, does not come without controversy. Currently, nuclear power supplies 17 percent of the global electricity production⁷, and decommissioning these facilities would potentially cause 1)

PWRs, also known as Light Water Reactors (LWR).

The disposition of spent nuclear fuel (SNF) remains a contested issue in nuclear development. Although waste produced by the nuclear cycle is comparatively much smaller in solid mass than the waste produced by industry, chemical companies, and coal mines, SNF is exponentially more hazardous. SNF remains highly radioactive and generates large amounts of heat – resulting in the need for its immediate and long-term confinement after use. Nuclear production waste has three categories according to the levels of radioactivity: low level waste (LLW), intermediate level waste (ILW), and high level waste (HLW). LLW normally consists of material that has come into contact with small

by **Supria Ranade**
Environmental Sciences

“As the international community grapples with the question of sustainability, this emerging energy revolution marks a sober realization of the increasing connection between national security, the environment, and public health.”

new fuel dependencies on hydrocarbons thereby accelerating global warming and 2) reliance on a comparatively underdeveloped renewable energy sector, which would incur high electricity costs.^{8,9} Furthermore, nuclear waste storage facilities, i.e. deep geological repositories, have been reviewed extensively by governmental agencies, such as the United States National Academies of Science, which maintain that repositories meet engineering requirements for containing and preventing the escape of radionuclides into the environment.⁴

Nuclear Energy: A Short Background Nuclear energy can be converted into heat using two different methods: fission of an atom or fusion of two atoms together. Current nuclear reactors are based on fission of either U^{235} and U^{238} . In a controlled nuclear reaction taking place in the reactor core, a free neutron collides with any fissile atom that splits, releasing gamma rays, lighter radioactive isotopes, and most importantly, heat. Most of the world’s reactors are thermal reactors¹⁰, and the most widely used are the Pressurized Water Reactors (PWR). Both Sweden and Belgium use

amounts of short-lived radioactivity, such as syringes, overalls, and other equipment. LLW is also generally the type of waste associated with nuclear facility decommissioning.¹¹ ILW generates small amounts of heat, but large quantities of radiation, requiring those who handle it to wear proper shielding. HLW is waste produced by fissile material in the reactor core, and must be cooled for extended periods of time before handling. Additionally, HLW is very radioactive, and often contains daughter isotopes such as Cesium-137, Strontium-90, and Plutonium-239, some of which have half-lives of up to 24,000 years.¹¹

Nuclear Waste Storage For these reasons, it is widely accepted that the safest way of removing the waste from the environment is to bury it in what is termed a ‘deep geological repository’ - an enclave buried 500-1000 meters underground. Once the fuel is disposed and the repository is filled, the repository cannot be opened in any way, so

NUCLEAR PHASE-OUT *continued on page 51*

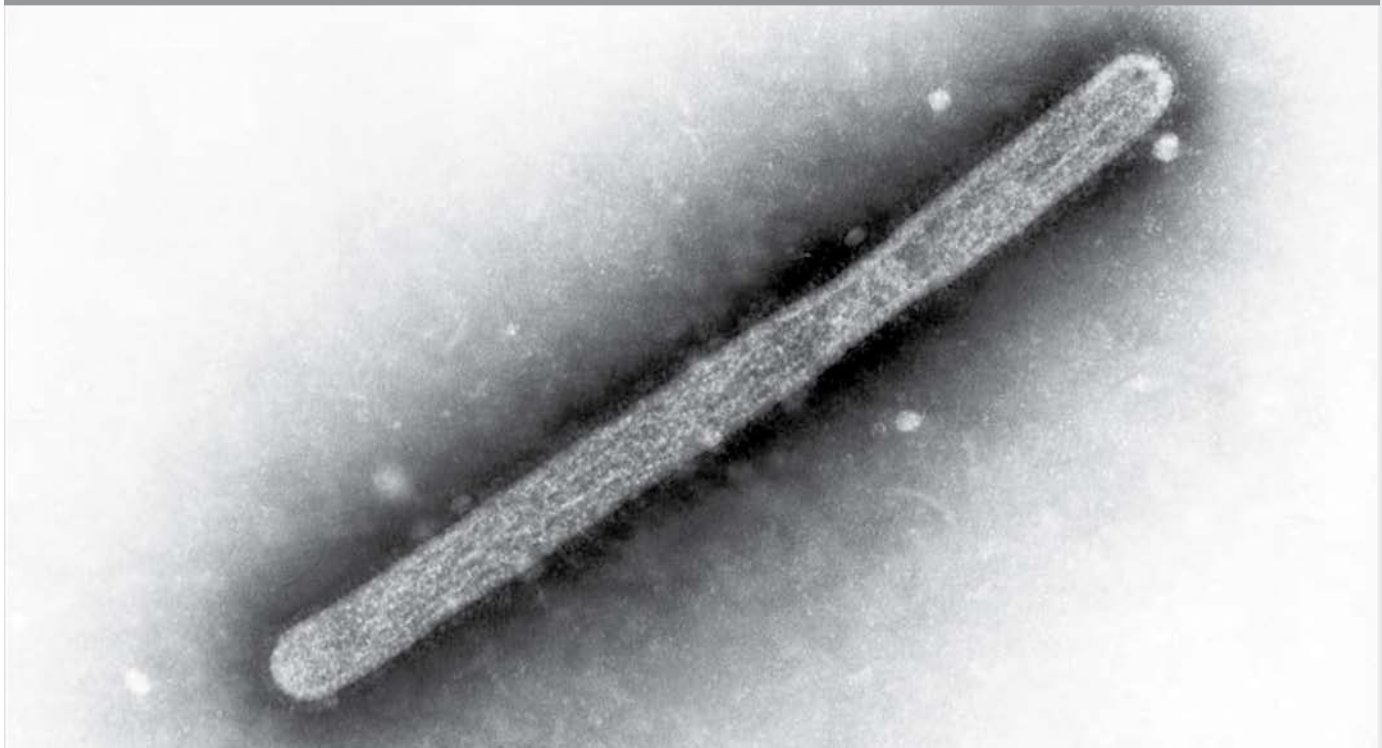
Reacting to an Avian Flu Pandemic

Preventive Measures to Strike Down H5N1 May Come Too Late

student
editorial

by **Samantha Flanzer**
Public Health Studies, 2008

EDITORIAL *Rethinking the battle against avian flu and how America and the international community can better control the looming crisis.*



ABOVE This transmission electron micrograph (TEM), taken at a magnification of 108,000x, revealed the ultrastructural details of two avian influenza A (H5N1) virions, a type of bird flu virus, which is a subtype of avian influenza A. At this magnification, one may note the stippled appearance of the roughened surface of the proteinaceous coat encasing each virion. Although this virus does not typically infect humans, in 1997, the first instance of direct bird-to-human spread of influenza A (H5N1) virus was documented during an outbreak of avian influenza among poultry in Hong Kong. While combating the problems already posed, public health officials must also prepare for the possibility that the virus will undergo yet another reassortment that allows for contagiousness among humans. Image courtesy of NLM-PHIL/CDC/Cynthia Goldsmith/Jackie Katz.

Imagine 16 million Americans dead within a time frame of 12 to 36 months. Another 80 million lie sick.¹ And no, this is not a terrorist attack. It is the worst case scenario of an avian influenza pandemic as envisioned by the U.S. Center for Disease Control and Prevention.

A pandemic such as this would be an international crisis. It looms over all levels of government as an almost impossible challenge, bringing to light acute, inevitable holes in health care systems while underlining chronic preventive issues worldwide. Its origins explain why a pandemic strain of the avian flu poses such a serious global threat. Carried by wild aquatic birds while migrating, avian flu is a serious risk to the domestic bird population. Highly contagious, the virus can wipe out nearly 100% of a farm's poultry population in as little as 48 hours.²

But the virus's path of destruction extends further. Its genetic makeup enables it to mix its genes with that of other viruses – a process known as reassortment. Reassortment can lead to the emergence of an entirely new strain capable of jumping across species. That is exactly what occurred in Hong Kong in 1997. The H5N1 strain

mutated allowing for transmission from birds to humans. Since then, it has swept across the Asian continent and is now slowly extending into Europe. H5N1 has caused more than 80 human deaths, the majority of which have been the result of close contact with infected poultry. However, rare occurrences of human-to-human transmission have been reported. Acute symptoms include flu-like fever, cough, and sore throat, but can stretch further to include eye infections, pneumonia, and acute respiratory distress. These resulting medical complications and deaths signify the first acute ramifications of an avian flu outbreak.

While combating the problems already posed, public health officials must also prepare for the possibility that the virus will undergo yet another reassortment that allows for contagiousness among humans. This occurrence would signify the appearance of a new and deadly strain and the start of an avian flu pandemic.

Officials can only try to prevent such a turn of events and prepare the world for what may be inevitable. Putting that task in perspective, compare the U.S. numbers for the seasonal flu outbreaks. According to the CDC, a

normal flu season yields a .008 percent mortality rate. This translates to 200,000 hospitalized Americans and 38,000 dead. It also amounts to a 12 billion dollar annual blow to the economy in terms of medical costs and productivity losses. An avian flu pandemic would have a mortality rate at least 250 times that of the seasonal flu, ranging anywhere from two to 20%.¹ Its repercussions would be unimaginable.

Seattle, Washington, with the help of the Los Alamos National Laboratory and the University of Washington, tried to map out the effects of a potential bird flu outbreak. Given a duration of 182 days, they estimated the cumulative number of individuals infected would near 830,000 in Seattle alone. At the outbreak's peak, 90,000 would be sick simultaneously. One in ten would require hospitalization.³

How could hospitals care for such a flood of patients? The bottom line is that they cannot. As a result, criteria for care, defined by age, progression of disease, medical history, etc, would be established to ration medical attention, and force thousands of sick persons to fend for themselves. Should an epidemic reach the U.S. doorstep, a panicked and exhausted nation will surely turn to the federal government for help. Currently, President Bush's \$7.1 billion plan preparing the nation for an influenza

To date, Congress has appropriated less than four billion of President Bush's \$7.1 billion plan.⁵ Only \$334 million is allocated to assist foreign countries to cope with a possible avian flu pandemic. It is clear - this nation's government is not yet serious about tackling the problem at its source.

In rural areas of Asia and Turkey, the avian flu is currently ravaging. Poultry farms in these less economically developed regions typically sacrifice hygiene standards for profits in the exploding industrialized livestock production market. Poultry live in cramped, unsanitary conditions often times with a number of other species, creating the perfect breeding ground for infectious diseases such as the bird flu to spread and reassort.

Many farmers in both urban and rural settings require intensive education on the importance of proper hygiene for both their families and animals. Furthermore, governments responding to, or at high risk of, avian flu outbreaks must be prepared to offer financial compensation to farmers reporting diseased birds. Non-governmental organizations such as the World Health Organization and developed nations like the United States need to lead in this initiative by providing funding. Such actions would signal to the international community the avian flu's critical importance and set the stage for others to follow.

by Samantha Flanzer
Public Health Studies

"A normal flu season translates to 200,000 hospitalized Americans, 38,000 dead, and a 12 billion dollar annual blow to the economy. An avian flu pandemic would have a mortality rate at least 250 times that of the seasonal flu."

pandemic, places large emphasis on the stockpiling of antiviral drugs and the further enhancement of vaccine productions. However, this course of action remains a gamble. There is no guarantee of their effectiveness as of yet, on a nonexistent pandemic strain. In addition, the process to identify, mass produce, and then stockpile these vaccines may stretch into 2009 or 2010.⁴ Does the nation, let alone the world, have enough time for this drawn out plan of action?

In examining the situation on both a domestic and global scale, it is clear many chronic issues within the governmental framework and social structure of nations need to be addressed. First, our domestic preparations are flawed. The U.S. lacks sufficient health infrastructures and a proven vaccine to deal with a crisis of this magnitude. However, it is unlikely this nation could ever have sufficient resources to completely stop an avian flu pandemic. Rather, focus should be on the control and moderation of the disease's impact. While crucial to strive for this on a domestic level, it is imperative that these efforts be translated on an international level as well. The government needs to stress now greater international assistance and prevention on a global level to contain the disease's spread. The avian flu is an international problem yet to cross America's borders.

Not only is there the hygiene of poultry farms to consider, but also the health of wildlife. Bird flu, and many other modern infectious diseases, originate in the wild and go on to infect domestic populations and humans. As the July/August 2005 Foreign Affairs points out, the international community does little to "track the threats to and dangers from wild plants and animals."

Right now the World Animal Organization has a volunteer committee made up of six individuals, meeting three days a year to discuss global diseases in wildlife.⁶ While the health of wildlife is an understandably broad, seemingly impossible facet of public health to tackle, it still requires greater attention and funding. Again, this is another example of a preventive and measure that America has the opportunity to take a stand and support.

Senior Fellow for Global Health at the Council on Foreign Relations, Laurie Garrett, warns that an avian flu pandemic would be "the most catastrophic outbreak in human history." Neither America, nor the world, can afford to take this issue lightly. The very possibility requires concerted, urgent action with the dollars to back it. The United States needs to do more in leading these efforts.

AVIAN FLU PANDEMIC *references on page 54*

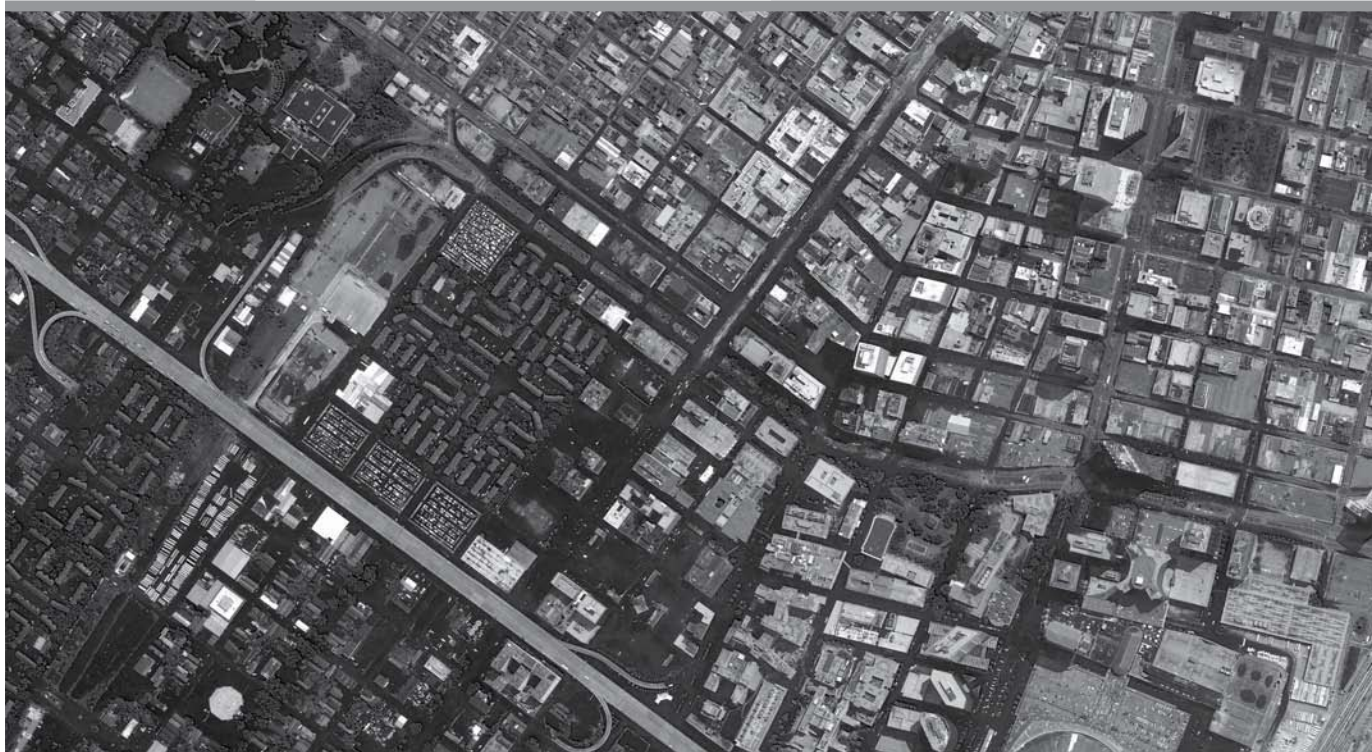
Public Health Reporting on Katrina

The Acute and Chronic Health Effects of a Hurricane

student
editorial

by **Sadajyot Brar**
Public Health Studies, 2007

EDITORIAL Hurricane Katrina disrupted basic utilities, food-distribution systems, health-care services and communications.



ABOVE Downtown New Orleans, image collected September 3, 2005. Image courtesy of DigitalGlobe **BOTTOM RIGHT** "Saw the levee break" sign in an abandoned yard in New Orleans. In a survey of evacuees in shelters in the Houston area conducted by the Washington Post, the Kaiser Family Foundation and the Harvard School of Public Health, 33% reported health problems or injuries due to the hurricane, of which 78% are currently receiving care for their ailments. Photography by Tom McBride.

Hurricane Katrina was one of the most expensive recent natural disasters in the United States. The total damage reached \$75 billion. It was the third most powerful storm of the season and the sixth-strongest Atlantic hurricane ever recorded. 1,418 people have died thus far. As of January 18, 2006, more than 3200 people remain unaccounted for.¹⁰ The hurricane primarily affected Louisiana, Mississippi, and Alabama. On August 29, 2005, the storm surge breached the levee system that once protected New Orleans from Lake Pontchartrian and the Mississippi River. Most of the city was flooded by water from the lake. Katrina has been an example of the lack of swift, effective action on the part of Federal Emergency Management Agency (FEMA) and the national government.

After the media attention, government "scandals," and the relief frenzy finally plateaued, one is left to wonder what the impact of such a devastating disaster will become. How will the results unfold themselves? From a public health standpoint, there are many health problems that have resulted due to Katrina, such as PTSD or post traumatic stress disorder. Of the survivors, it is estimated that 25-30% are likely to develop anxiety disorders, depression or other clinically significant problems.³ These disorders may affect

their long-term functioning unless they seek out counseling or therapy.

The possibilities of health problems that could develop from or become exacerbated by the hurricane are endless. In a survey of evacuees in shelters in the Houston area conducted by the Washington Post, the Kaiser Family Foundation and the Harvard School of Public Health, 33% reported health problems or injuries due to the hurricane, of which 78% are currently receiving care for their ailments.⁵ 41% report chronic health conditions such as heart disease, hypertension, diabetes, and asthma.⁵ In this survey group, 98% were from New Orleans. While advances in warning technology and timely evacuation have decreased hurricane-related mortality,⁷ since 1990, indirect causes of death and injury from hurricanes such as electrocutions, clean-up injuries and carbon monoxide poisonings have become more prominent.⁷

Hurricane Katrina disrupted basic utilities, food-distribution systems, health-care services and communications in large portions of Louisiana and Mississippi. This leads to several potential public health problems that are targets for future investigation, including displacement, drinking water quality, West Nile virus,

emotional fallout and toxic contaminants.

Displacement refers to the movement of people from their homes to shelters or other places of temporary housing while waiting to return to their homes. "It impacts the physical and mental health of refugees," says W. Courtland Robinson, PhD at the Johns Hopkins Bloomberg School of Public Health's Center for Refugee and Disaster Response.⁶

According to Dr. Georges Benjamin, executive director of the American Public Health Association, in the aftermath of Katrina, "the biggest problem is people drinking water which is contaminated or food which is spoiled... Often food that looks good isn't and water that looks safe has high bacteria counts. This is one of ... [the] biggest challenges."² The lack of drinking water and sewage treatment causes an additional problem. "Without electricity, water pumps and waste water treatment plants cannot function. To make matters worse, flood waters can overload the sewage system contaminating flooded areas," says Kellogg Schwab PhD, co-director of the Center for Water and Health at the Bloomberg School of Public Health (JHSPH).⁶ There is a strong possibility of water contamination and cholera, E. coli and noroviruses are likely to spread.

The mixing of untreated sewage, decomposing bodies and livestock, toxic chemicals and oils from domestic, agricultural, and industrial sources into floodwaters, leads to

potential health risks. The immediate threats include disease contagions being spread from decomposing bodies, both by water and by animal vectors such as mosquitoes. Longer term threats will reveal themselves as the floodwaters recede, including biochemical residue which could severely impact surface and ground water, soil, and urban environments. Thus far, their effects are largely unknown, however speculation among public health professionals currently suggest West Nile, cholera and E. coli.

West Nile is a possibility, but may not necessarily happen. It is possible for residents to see an increase in the number of mosquitoes in the coming weeks to the region. The excess standing water caused by massive flooding could provide fertile breeding grounds for the insects. With more mosquitoes, this increases the risk of diseases like West Nile. The symptoms in its most serious form can be fever, encephalitis, and death. However Douglas Norris, PhD at the Department of Molecular Microbiology and Immunology at JHSPH cautions that it is too early to say whether or not it will be a serious health concern.

There are greater concerns than just the above. The greatest health risk for the general public in this emergency may come from water-borne microorganisms and toxins. Exposure to these microorganisms and toxins may increase the risk of developing lung disease.¹ Standing water resulting

by Sadajot Brar
Public Health Studies

"The greatest health risk for the general public in this emergency may come from water-borne microorganisms and toxins. Exposure to these microorganisms and toxins may increase the risk of developing lung disease."



from the flood is a source for microorganisms to grow and become airborne, making these areas problematic for habitation. Damp buildings and furnishings promote the growth of microorganisms, dust mites, cockroaches, and mold, which can aggravate asthma and allergies and may cause the development of asthma, wheeze, cough, and hypersensitivity. Out of all the inspected homes, 46% have had visible mold growth.⁹

The Institute of Medicine conducted a study in 2004 that found an association between damp indoor spaces, mold, and upper respiratory symptoms. Upper respiratory symptoms are defined as nasal congestion and throat irritation and lower respiratory symptoms, which include cough, wheeze and exacerbation of asthma.⁹ These findings indicated that in post-hurricane New Orleans, after the hurricane, the indoor environmental conditions provide exposures that potentially put residents at risk for these negative health outcomes. Prior measurements of airborne endotoxin from bacteria in homes averaged $<1.0 \text{ EU/m}^3$ with indoor levels usually less than outdoor levels. After the hurricane in New Orleans, the mean indoor endotoxin levels were more than 20 times higher than the 1.0 EU/m^3 average.

HURRICANE KATRINA HEALTH *continued on page 54*

Understanding Asymptomatic BV

The Acute and Chronic Effects of a Common Infection

student
editorial

by **Angela Kim**
Public Health Studies, 2008

EDITORIAL 65 million people in the US live with a viral sexually transmitted disease, with 19 million new cases occurring each year.



ABOVE This 1940 wartime poster urged servicemen to "Say No" to prostitution, in order to help in the reduction of venereal disease cases among soldiers during World War II. This was one of the numerous public health posters from World War II that warned soldiers against contracting venereal diseases. Its use of images rather than just text was an extremely powerful tool in the fighting the spread of V.D. not only among the military, but in the United States as well. Image courtesy of the NLM-PHIL/CDC 1940.

One out of every four women in the world has bacterial vaginosis at any given time.¹ Besides being an associated risk factor for adverse pregnancy outcomes (still birth, prematurity, perinatal infections), bacterial vaginosis is strongly associated with increased susceptibility to sexually transmitted infections (STIs).¹ The CDC estimates that there are 65 million people in the US living with a viral sexually transmitted disease, with 19 million new cases occurring each year.² If bacterial vaginosis (BV), a polymicrobial infection of the vagina, could be prevented from occurring, what would happen to these adverse effects on pregnancy and STIs? Perhaps we would see a decrease in the number of premature births and the number of people with gonorrhea, HIV, or pelvic inflammatory diseases.^{1,3,4,5} BV is the most common cause of vaginal discharge and often does not raise alarm among women since symptoms are often mild. However, the associated long-term risks can be quite serious, and therefore, researchers are working hard to discover what causes this polymicrobial infection and why. Further information and evidence about what bacterial vaginosis really is at the pathogenic level can provide the answers to initiating better public health prevention methods and

solutions.⁶ If bacterial vaginosis really is associated with the increased risk of STIs like HIV, further groundbreaking discoveries about BV can be invaluable to public health prevention of STIs.

Bacterial vaginosis is a condition where the natural balance of normal bacteria in the vagina becomes disrupted, with symptoms including a thin homogeneous, white, milky discharge, and a fishy odor. However, nearly 50% of all women with BV are asymptomatic. That means that many women with BV may not even know their vaginas are in vulnerable states, susceptible to acquiring other serious infections. Bacterial vaginosis usually occurs right after the start of the menses, so this may make it even harder to detect the thin discharge and odor.⁷ This clearly presents a problem because many women will not get the proper and easy treatment that may prevent future recurrences of BV or other serious chronic diseases. Also, because the symptoms of BV are generally mild, a female, out of embarrassment and lack of alarm, may not come in to the clinic to get checked and treated, thinking that it will clear up on its own. Although it will clear up as the balance of bacteria eventually gets restored, not getting treated may lead to higher rates

of reoccurrences and may be leaving the body highly susceptible to sexually transmitted infections.

Bacterial vaginosis is the result of an imbalance of good and bad bacteria in the vagina. The healthy female body contains a normal vaginal flora of microorganisms, including the predominant lactobacilli. For some unclear reason, this balance is disrupted and there is an overgrowth of bad bacteria and an undergrowth of the healthy lactobacilli, which produces hydrogen peroxide and lactic acid. Since lactobacilli are responsible for keeping the vagina acidic (approximately pH 4), a decreased count of lactobacilli decreases the acidity of the vagina to levels of pH 5-6. This is not sufficiently acidic to fend off the bad bacteria and other microorganisms. When a woman's lactobacilli count is not at the normal level, she is at higher risk for STIs (Researchers do not yet know if it is a causal risk, and have no way yet to measure and observe an increase in susceptibility). Once a woman has had BV, she is highly susceptible to getting BV again. This can occur as often as each monthly menses cycle when the menstrual flow reduces the acidity of the vagina, increasing her risk of contracting a sexually transmitted infection every month.

Pregnant women should all be aware of the birth complications associated with bacterial vaginosis. If a woman is pregnant and has BV, early detection and treatment

lab is studying the effects of acidity on bacteria most closely associated with BV, and trying to determine to what extent lactobacilli fend off BV bacteria by acidifying the vagina, using lactic acid and acetic acid. Under acidic conditions, lactic acid and acetic acid are membrane permeable and can enter cells and kill them by acidifying the cytoplasm.

Although it has yet to be clearly determined what causes bacterial vaginosis, studies have shown that there are associated risk factors of BV. They are: douching (for it kills healthy lactobacilli that maintains the vagina's acidic pH), having multiple sex partners, the early onset of sexual activity, using intrauterine devices, and the presence of other STIs.^{10,11,3,12} Although bacterial vaginosis can occur in females who have never engaged in sexual activity, it is more commonly known to be sexually related.

What would be the best preventive methods? Abstinence or at least practicing safe sex. Because BV increases the chance for infectious diseases to flourish in the vagina, condoms should only be used to prevent contact. People are failing to use the current easiest and most convenient method of STI prevention, even though it is readily available—the number of condoms made each year is one per person.

What will it take to catch people's attention and raise awareness? The public fears HIV, yet lacks awareness of bacterial vaginosis. BV may significantly increase a woman's

by Angela Kim
Public Health Studies

“The public fears HIV, yet lacks awareness for bacterial vaginosis. BV may significantly increase a woman's vulnerability to HIV, yet women continue to douche and participate in risky sexual behavior with multiple partners.”

of it may decrease her risk of spontaneous abortion, premature labor, and pelvic inflammatory disease (PID).¹ Bacterial vaginosis increases the risk of premature labor sevenfold.⁸ When a woman has BV, the overgrowth of bad bacteria in the vagina can ascend to the upper genital tract causing pelvic inflammatory disease (PID). Pelvic inflammatory disease is an infection, or inflammation, of the upper female genital tract including the fallopian tubes and the ovary. This disease can lead to pre-term labor, can affect fetal brain development, and lead to infertility. PID affects more than one million women annually.

The pathogenesis of bacterial vaginosis is unknown. The question remains: what causes the decrease in acidifying lactobacilli and an increase in anaerobic bacteria such as *Gardnerella vaginalis*? At University of Illinois at Chicago, Lin Tao, associate professor of oral biology, and Sylvia Pavlova, senior research specialist, thought that the decrease in lactobacilli was a result of an agent that was infecting the lactobacilli and killing them. They were in fact able to isolate a bacteriophage of lactobacilli. The 1999 study concluded that bacterial vaginosis may be caused by viruses that infect the lactobacilli, and that these viruses may be sexually transmitted.⁹

What are the current studies going on at Johns Hopkins University? At the Homewood campus, Dr. Richard Cone's

vulnerability to HIV and other diseases, yet women continue to douche and participate in risky sexual behavior with multiple partners. Then again, most women do not even know that these are associated risks of BV, and they are not being told that BV can increase the risk of STIs. That is because even doctors do not know much about bacterial vaginosis. Doctors know how to clinically diagnose BV using the conventional Amsel test, and know the appropriate measure to treat BV by prescribing a simple 7-day dosage of metronidazole; yet they have no way to prevent it from recurring. It is the responsibility of researchers and public health officials to educate both the public and the primary clinicians so that more women will come to realize the seriousness of bacterial vaginosis. Just because bacterial vaginosis is an easily treated acute condition that is often mild or asymptomatic does not mean that BV does not have significant impact on reproductive health. Researchers are studying BV in different angles, and hope to find the answers to some key questions. First, what causes BV? Is it a bacteriophage infecting the lactobacilli, or some other unknown agent? Second, what are the mechanisms by which BV might increase the risks of sexually transmitted infections

BACTERIAL VAGINOSIS *references on page 55*

Chronic Health Problems in Baltimore

Among them Pervasive Asthma and Rampant Drug Abuse


student
editorial

by **Ajay Gurbani**
Public Health Studies, 2008

EDITORIAL *Chronic health problems in Baltimore disproportionately impact those who do not have access to health care.*

Let's fight air pollution.



 **Your Lung Association**
cares about every
breath you take.
The Christmas Seal People.

ABOVE "Let's fight air pollution" American Lung Association National Campaign, c1977 (photomechanical print). Image courtesy of the National Library of Medicine.

An asthma attack can be a very frightful experience for a young child. Waking up in the middle of the night, barely able to breathe and making an emergency visit to the hospital is a terrifying encounter that happens to millions of children across the nation every year. Even more terrifying is the fact that the prevalence of this respiratory illness and the resultant suffering that these children experience is disproportionately higher in certain cities than others.

In Baltimore, children suffer from asthma at a rate much higher than the national average. Emergency room visits related to asthma are more than twice as prevalent in Baltimore as in the rest of Maryland and more than three times as prevalent as in Washington, D.C.¹ Asthma is a chronic health problem augmented by the air pollution and weather trends of modern society. Such environmental factors provide a feasible explanation for these statistics as they can result in a concentration of asthma cases in certain regions and cities with high amounts of pollution, such as

Baltimore. As long as Baltimore continues to be one of the most polluted cities in the nation, its residents will suffer the consequences of the continuing pervasiveness of asthma. Aside from asthma, however, there are many other chronic problems that are more prominent in the city of Baltimore over others in the nation.

Substance abuse is one such chronic problem. The abuse of alcohol and illegal drugs is a global health problem which has been present throughout recorded history. It is an obstacle that will never be completely overcome despite the immeasurable amount of effort that has been used in its opposition. The war against illegal drugs and drug abuse is one that is being fought across America, and in no place more so than in Baltimore. Baltimore is considered to be one of the nation's drug capitals, ranking among the top of the country's largest cities in numbers of cases of abuse. In 1999, Baltimore was ranked first in the nation for emergency room visits related to drug use.² Since then, money spent on treatment for drug abuse by the city has almost doubled. Despite this effort, drug abuse remains a huge problem in Baltimore—an indication of the pervasiveness of the issue. Baltimore's drug problem has also been linked to the spread of sexually transmitted diseases. In 1998, it was reported that residents of Baltimore were being infected by syphilis at a rate 30 times the national average. Furthermore, gonorrhea infects the city residents at a rate more than eight times the national average. During the same period in which the rate of STIs of other major cities in America was steadily decreasing, Baltimore's was increasing. Many have attributed this trend to the growth of drug abuse, particularly that of crack-cocaine, in the city during the late 1990s. Sharing drug paraphernalia and the use of sex as a payment for drugs are possible explanations for these increases.³ Baltimore's problem with STIs extends beyond those that are drug-related, however. Baltimore accounts for about half of Maryland's cases of HIV/AIDS patients while it only accounts for 12% of the state's population. Nationally, Baltimore ranks 4th amongst all cities in reported cases. These statistics demonstrate the magnitude of the disease's problem in the city. This problem is stratified by race and gender, with minorities and males experiencing much higher incidence.¹

Maryland is currently ranked as number six of the US states with the highest annual cancer death rates.⁴ Therefore, residents of Maryland in general have a relatively high

BALTIMORE CHRONIC *references on page 55*

Homelessness and West Nile Virus

America's Most Susceptible Population to Infection

student
editorial

by Akash Bhatnagar
Public Health Studies, 2008

EDITORIAL *The chronic condition of homelessness increases susceptibility to the acute illness such as West Nile Virus among others.*



ABOVE This 1990 photograph depicts a homeless man. The difficulty of maintaining a homeless individual's health is a consequence of inadequate nutrition, poor hygiene, lack of safe shelter, high-risk behaviors, and barriers to accessing quality health care including lack of health insurance. Image Courtesy of the NLM-PHIL/CDC/Dr. Edwin P. Ewing, Jr.

When asked to name several common chronic problems in the United States, many individuals would state diabetes, AIDS, arthritis, and cancer. However, homelessness is a chronic problem that is often overlooked by Americans. Data from the National Law Center on Homelessness states that 2.3 to 3.5 million persons experience homelessness in the United States every year. Homeless individuals are considered to be at higher risk for several medical conditions due to their unique circumstances.

Homelessness can be defined as a chronic condition that forces its victims to endure many hardships and requires ongoing care for a prolonged period of time. The difficulty of maintaining a homeless individual's health is a consequence of inadequate nutrition, poor hygiene, lack of safe shelter, high-risk behaviors, and barriers to accessing quality health care including a lack of health insurance. Especially during the summer, these common adversities can lead to increased

exposure to the natural elements and subsequently, vector-borne diseases. One emerging infection of concern among the homeless in the United States is West Nile Virus.

In the United States, infected mosquitoes, primarily members of the *Culex* species, transmit West Nile virus. The transmission cycle involves mosquitoes as vectors and birds as reservoir hosts. Birds become reservoir hosts when infected by mosquitoes that carry the virus. The birds then carry the virus in their bloodstream for one to four days after becoming exposed. Some infected birds survive and develop life-long immunity, allowing mosquitoes to feed on them again. However, others fall sick and may die. The virus can also be transmitted to humans, horses, and several other animals by the bite of an infected mosquito. But humans and horses are considered as only incidental hosts because usually these mammals do not develop an infectious level of virus circulating in their blood stream.

Despite humans and horses being classified as incidental hosts, there have been numerous cases where these mammals have developed clinical illness or symptoms. Specifically in humans, clinical features of West Nile Virus include fever, headache, fatigue, and body aches. WNV causes severe illness in a smaller portion of individuals and can be fatal in certain high-risk groups such as the elderly. The most severe symptoms of West Nile Virus are permanent neurological damage or inflammation of the brain, both of which can be fatal.

For the average person, prevention of West Nile Virus is simple and requires minimal resources. The CDC recommends using insect repellent that contains DEET, wearing long sleeves, pants, and socks while outdoors, avoiding peak mosquito hours, and draining standing water. However, homeless individuals have limited resources to protect themselves. Poverty prevents homeless individuals from having sufficient money to buy insect repellent in order to prevent bug bites. Furthermore, many homeless individuals are unable to seek refuge in emergency shelters (mostly by circumstance due to limited availability of shelter beds, but sometimes by choice) and are forced to sleep in open spaces, thus increasing their exposure to disease-carrying mosquitoes from dusk to dawn. This problem becomes more acute in the summer when the mosquito activity is at its peak. Yet another problem is that homeless individuals often reside in areas where there is standing water. Rain water may accumulate in old containers or it

CHRONIC HOMELESSNESS *references on page 56*

Research Models for Global Health

Johns Hopkins Bloomberg School of Public Health (JHSPH)

special
section

by **Lindsay Brown & Mary Kwon**
Editors of Perspectives

Background photograph courtesy of NLM-PHIL/CDC/World Health Organization and Stanley O. Foster M.D., M.P.H. (1975)

For this year's edition of *Epidemic Proportions*, we decided to expand the Perspectives Section from three to nine articles. The 2006 issue includes pieces from a variety of departments in order to confer to our readers a better understanding of the wide range of investigation and outreach that falls under the scope of the field of Public Health Studies. The following pages include submissions from and interviews with both faculty and students at the Johns Hopkins Bloomberg School of Public Health (JHSPH).

Dr. Les Hanakahi, of the Biochemistry and Molecular Biology Department, studies the process of how DNA repair systems work, a mechanism whose failure can lead to oncogenic consequences for a patient. Associate Professor Holly Grason directs the Johns Hopkins Women's and Children's Health Policy Center at the JHSPH. Her work involves the construction of frameworks derived from epidemiological and evaluation research to reveal the links between health states across life stages and between generations. Professor Lynda Burton shares her experiences with the JHSPH Health Policy and Management Department, particularly in her work related to health care services for the elderly. Research Associate Elizabeth Johnson describes the Biostatistics department as an exciting, stimulating and challenging environment with leading experts in statistical research including disease surveillance, clinical trials, aging and genetics. Second year PhD student Morgan Marks shares his experiences with a burgeoning facet of the Epidemiology Department, Molecular Epidemiology. Professor Katz, with the International Health department, seeks to reduce morbidity and mortality in under-served populations around the world. Dr. Ying Zhang's research, with the Department of Molecular Microbiology & Immunology, aims to address the problems of Tuberculosis (TB) drug resistance and persistence, two major challenges for TB control. Dr. Rajiv Rimal, with the Health, Behavior, and Society department, works to understand the role of human behaviors in disease. Faculty member in the Environmental Health Sciences Department, Dr. John Groopman, shares his interests in the Public Health Field, specifically in regards to environmental health issues and the connection between bird flu and aflatoxin. He also shares his personal experience in the field, remarking that "while one can plan a career in a linear way, it is often those unusual and unexpected opportunities which can change the course of your path if you are flexible enough." We hope you find these articles both informative and engaging as you journey through the various descriptions of some of the exciting research unfolding at JHSPH.

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Maps were integral to achieving successful disease eradication campaign outcomes, for it enabled public health practitioners, and local volunteers to track cases once discovered and inhabitants who'd been in contact with such cases using epidemiologically sound science. There were different types of maps that arose during the process, and this image depicts a detailed view of a "Containment map" that was created using what is termed a "circular mapping" technique (CDC/WHO; Stanley O. Foster M.D., M.P.H.).

DR. GROOPMAN "A nesting of avian and human health occurred nearly 50 years ago and its impact on human health has been profound."



Birds and Human Health

Historical View of Avian Flu and Coexistence

by **John Groopman, PhD**
Environmental Health Sciences

PERSPECTIVE Dr. John Groopman gives historical context to the current threat of avian flu to the global health infrastructure, commenting on patterns of transmission from birds.

Photograph courtesy of NLM-PHIL/CDC

The public health crises surrounding Avian Flu and West Nile Virus have brought to the fore the transmission of disease from birds to people. This focus tends to overshadow the critical partnership that birds have had with human health for centuries. One of the classic examples is the role that the canary played as a biosensor for carbon monoxide levels in mines. Many miners' lives were saved by the toxicological sensitivity of canaries to this gas and their use was eliminated from mines only twenty years ago. A less well known nesting of avian and human health occurred nearly 50 years ago and its impact on human health has been profound.

Around 1960, tens of thousands of turkeys being raised for market in England died quite suddenly from acute liver

and biologists. Working with the late George Buchi in the Department of Chemistry, the structure of the mold toxin causing these poultry deaths was identified: aflatoxin. This structural work contributed to George Buchi's election to the National Academy of Sciences.

The story could have ended at this point except for the observation that aflatoxin was extremely toxic and was then found to be a powerful liver carcinogen. Indeed, it is perhaps the most potent liver carcinogen known in experimental settings. As often happens in science, there was now an intellectual fork in the path about how to follow up this initial work. It was well known that human liver cancer is a major disease in Asia and Africa; killing over 500,000 people each year. Further the mean age of diagnosis was

"Decades later, we recognize that not only does aflatoxin cause human liver cancer, it acts in conspiracy with the human hepatitis B virus (HBV) to increase the risk of this cancer. The work has now grown to over 10,000 scientific publications and the declaration by the World Health Organization"

failure. As potential sentinels of human health, many public health officials were mobilized to track down the cause of this epidemic. The usual suspects, bacteria and viruses, were ruled out. A keen observation that a feed meal fed to these flocks was moldy, provided a new insight into the cause of this toxicity. One of the leading toxicologists in England at that time was the late Peter Magee, who earlier in his career had helped to characterize a major liver toxin in the workplace. He was invited to lead the effort to identify this new liver toxin. Years later, Peter Magee told me that while this was a fascinating problem, "I was really intent on my scheduled sabbatical so I suggested that this problem be passed onto some colleagues at MIT in Cambridge."

There is a favorite aphorism in public health attributed to Louis Pasteur that "Chance favors the prepared mind." Many times in your career things are dropped in your lap and you have to choose to take up a new challenge or stay on the same path. This was the choice for a young post-doctoral fellow at MIT, Gerald Wogan, who took up the opportunity to identify the toxin causing Turkey X disease. Much of the biological research of the early 1960's was single investigator research; interdisciplinary collaborations were rare and environmental toxicology was a very small field. Gerald Wogan recognized that to attack this problem he needed to bring together a multidisciplinary team of chemists

between 40-50 years. Could aflatoxin be a contributor as a product of moldy staple foods consumed in these high liver cancer regions? Many basic science studies were opened up by the discovery of aflatoxin and this was the public health path. By partnering with epidemiologists and public health scientists, Wogan and his colleagues took on the challenge of exploring the possible role of aflatoxin in human liver cancer.

Now, decades later, we recognize that not only does aflatoxin cause human liver cancer, it acts in conspiracy with the human hepatitis B virus (HBV) to increase the risk of this nearly always fatal cancer. The work that started with being handed a problem by chance has now grown to over 10,000 scientific publications and the declaration by the World Health Organization that aflatoxin is a human carcinogen. This contaminate also dictates the price that a farmer receives for commodities such as corn and peanuts in world trade since it is next to impossible to prevent mold growth in crops. This work has a major impact on public health because prevention requires both the resources and ability to vaccinate against HBV but also the need for resources to improve agricultural practices in the poorest areas of the world. This story represents how complex diseases, such

BIRDS AND HUMAN HEALTH *continued on page 56*

DR. HANAKAHI "Comprehending how DNA DSBs are repaired by NHEJ will allow us to understand how this apparatus may fail to function."



The Molecular Mechanism Non-homologous End-joining in Human Cells

by **Les Hanakahi, PhD**
Biochemistry & Molecular Biology

PERSPECTIVE Dr. Les Hanakahi works to understand how DNA ends that are exposed by a DSB are recognized, protected from degradation and efficiently re-joined.

Photograph courtesy of NLM-PHIL.

In 2006, the American Cancer Society estimates that 1.4 million new cancer cases will be diagnosed in the United States – this figure includes 25,870 new cases that will be discovered in Maryland. The American Cancer Society also estimates that in 2006 cancer fatalities in the United States will reach 564,830 – including the 10,440 cancer deaths that will occur in Maryland. Maryland ranks 12th highest overall in cancer mortality rates among the 50 states and Washington, D.C.

Cancer is caused when cancer cells grow and divide more rapidly than the cells around them. This growth can be caused by mutations or changes in the genetic information (genes) contained within every cell. A contributing source of mutations in human cells is the DNA Double Strand Break

repair of DSBs by mammalian NHEJ. During my post-doctoral training at the Imperial Cancer Research Fund in London, England, I discovered that IP_6 stimulates NHEJ in vitro. This finding opened new possibilities for the investigation of the molecular mechanism of NHEJ. If we can determine how one part of a complex machine works, the understanding that we gain may provide us with insights on the properties of the other parts, and how everything comes together to function as a whole. Toward this end graduate student Joyce Cheung and research technician Brian Kilonzo are currently attempting to determine how IP_6 functions in mammalian NHEJ, both in vitro and in vivo.

Controlling DNA repair in cancer cells to augment radiation therapy Approximately 50% of cancer patients

"The repair of DNA DSBs is critical for cell viability. As such, an understanding of the mechanisms that repair DNA DSBs in human cells is of great interest. Comprehending how DNA DSBs are repaired by NHEJ will allow us to understand how this apparatus may fail to function – often with oncogenic consequences."

(DSB). When both strands of DNA are physically broken, as in a DSB, several things can happen. These potential outcomes can be ordered in increasing severity as: i) the degradation of DNA ends exposed by the break resulting in the loss of small amounts of genomic information, ii) the loss of segments of genomic DNA resulting in the loss of large amounts of genomic information or iii) the relocation of segments of DNA resulting in a change in genomic structure.

Some DNA DSBs occur as part of normal cell processes, while others are the result of exposure to chemicals or ionizing radiation. Regardless of the source, our cells must repair DNA DSBs on a daily basis and this repair is critical to the maintenance of genomic integrity and cell survival. An important DSB repair processes in human cells is Non-Homologous End-Joining (NHEJ). NHEJ is a DSB repair process in which DNA ends that share no sequence homology (overlap in DNA sequence) are rejoined to restore the integrity of the genome. The primary focus of my research is to understand, in molecular detail, how DNA ends that are exposed by a DSB are recognized, protected from degradation, and efficiently re-joined by the mammalian NHEJ apparatus.

A small chemical in DNA repair - basic research opportunities Much of the research being done in my lab centers on the participation of a small chemical, IP_6 , in the

will undergo radiation therapy as part of their treatment. This method of cancer treatment uses exposure to high doses of radiation to kill or weaken cancer cells in the hopes of reducing tumor mass. A large part of this effect is due to DNA DSBs caused by the radiation. If the DNA of a cancer cell can be sufficiently damaged, the cell will not survive and the mass of the tumor will decrease. In normal cells, DNA DSB repair NHEJ is important for the preservation of genomic integrity and assures that cells will function normally. In irradiated cancer cells, NHEJ continues to repair DNA DSBs caused by radiation therapy and allows cancer cells to continue surviving, growing and dividing, which increases tumor mass.

The discovery that IP_6 stimulates mammalian NHEJ in vitro suggests the exciting possibility that small chemicals like IP_6 may be used to control the efficiency of NHEJ in tumor cells. Toward this end my lab is participating in a collaborative effort with a drug discovery group at Cancer Research UK to identify compounds that inhibit interactions between IP_6 and components of the mammalian NHEJ apparatus. Decreasing NHEJ efficiency would be useful in preventing the restoration of genome integrity, and therefore

HANAKAHI DNA RESEARCH *continued on page 57*

DR. ZHANG'S research aims to address the problems of TB drug resistance and persistence, two major challenges for TB control.



The Persistence of TB

Controlling an Overlooked Infectious Disease

by Ying Zhang, PhD
Microbiology & Immunology

PERSPECTIVE *Contrary to what many people think about the incidence of tuberculosis (TB), it is actually a very prevalent disease, remaining a major infectious disease worldwide.*

Photograph courtesy of NLM-PHIL.

Contrary to what many people think about the incidence and prevalence of tuberculosis (TB), it is actually a very prevalent disease, remaining a major infectious disease worldwide, infecting 8 million people annually and killing 2 million of them. Dr. Ying Zhang's research aims to address the problems of TB drug resistance and persistence, two major challenges for TB control

The Department of Molecular Microbiology & Immunology (MMI), capably chaired by Dr. Diane Griffin, is incredibly diverse in terms of research topics. MMI "integrates many disciplines (biochemistry, infectious diseases, virology, parasitology, molecular biology, immunology, ecology structural biology) concerned with the study of the transmission, immunobiology, and

Many people in the developed world think TB is a disease of the past and is no longer a threat due to BCG vaccine and chemotherapy. Seeing the decline of TB in the United States in the 1970s, public health authorities became complacent and dismantled by the TB control program. The consequence was a major multi-drug resistant TB (MDR-TB) outbreak in HIV-positive individuals in the late 1980s and early in 1990s in New York City. The lesson was costly, costing \$1 billion to control that epidemic. We now learned that no country is immune from TB and as long as we have TB in other parts of the world, it can be transmitted quickly by air transportation from one part of the world to another in 24 hours. Not only has TB never been eradicated, but it has been a leading cause of infectious morbidity and mortality in developing

"Public health problems can best be addressed by understanding basic biological mechanisms. Our research aims to advance the understanding of the biology of disease and to use this knowledge to solve public health problems. Research takes place in the laboratory, in the clinic, and in the field."

pathogenesis of bacterial, parasitic, viral, and immunological diseases of public health importance. Research is done at the population, organismal, cellular, and molecular levels. The central premise of this broad approach to the study of disease is that public health problems can best be addressed by understanding basic biological mechanisms. Our research aims to advance the understanding of the biology of disease and to use this knowledge to solve public health problems. Research takes place in the laboratory, in the clinic, and in the field, as the faculty works to combat such enormous public health problems as malaria, sexually transmitted diseases, mosquito-borne encephalitis, tuberculosis, diarrhea, measles, AIDS, and autoimmune diseases" (<http://www.jhsph.edu/dept/MMI/>). The department has undergone major expansion in recent years by establishing the Malaria Research Institute (MRI) through a major donation of \$100 million, which has allowed the department to recruit new faculty working on malaria and significantly improved the research facilities of the department. The mission of MMI is to improve public health through basic research which will lead to knowledge important for the development of new interventions such as new drugs or vaccines or new approaches to disease prevention for more effective disease control.

Tuberculosis (TB) is an ideal model for public health.

countries, and the disease incidence has been on the rise in recent years due to HIV infection. In fact, TB is ranked among the top three infectious diseases along with AIDS and malaria. Despite the availability of the BCG vaccine and chemotherapy, TB remains a major infectious disease worldwide. Each year there are 8 million new TB cases and 2 million deaths, primarily in developing countries.

Although TB can be cured, the current therapy is too long and takes at least 6 months, which creates problems of drug toxicity, poor patient compliance, and TB drug resistance. The reason for the lengthy therapy is thought to be due to the presence of persisters TB bacteria that are not effectively killed by the current TB drugs. Therefore, there is increasing interest to develop new drugs that target persister bacteria in order to shorten the duration of the current therapy. In addition to the drug resistance and persister problem, another problem is that one third of the world population is latently infected with tuberculosis bacteria. The worry is that HIV infection, which weakens the body's immune system and threatens to allow the dormant TB bacteria to become reactivated or make the individual more susceptible to TB infection, will worsen the TB situation.

THE PERSISTENCE OF TB *continued on page 57*

DR. BURTON "A question is whether older persons who receive their medical care in an HMO have different health and cost outcomes."



Health Policy & Management

Providing Patient Care Beyond the Physician

by **Lynda Burton, ScD**
Health Policy and Management

PERSPECTIVE Lynda Burton's experience in the JHSPH Health Policy and Management Department. She tells about her work and benefit of being on faculty at JHSPH.

Photograph courtesy of NLM-PHIL/CDC

I am an Associate Professor in the Department of Health Policy and Management at the Bloomberg School of Public Health, and, within the Department, I am in the Division of Health Services Research. In Health Services Research there are a wide range of interests, centered around studying services for vulnerable populations such as children, minorities, and older persons. My focus has been on studies of health services for older persons, and on gerontology, the science of aging.

The research that I do relates to services for older persons. One large scale community-based study was to offer preventive services to Medicare beneficiaries to determine if their health and the cost of care would improve. The study in Baltimore was one of five across the country. In

The integration of services for older people with chronic illness is a special interest of mine, and I have been intrigued by the possibility of improving communication among the many physicians that are involved in the care of a patient, and with communication between the physicians and patients and in some cases family members. Health information systems based on electronic media, including electronic health records, offer great promise. However, the medical field has been slow to adopt electronic health records. Colleagues and I reviewed what barriers existed to moving to this modernization. We reviewed many of the attempts to introduce electronic health records that are interoperable, that is, could be shared among health providers while maintaining the confidentiality of the patient. Many regional

"Teaching is a part of my job that has been very rewarding. Nothing better than leaving a class, knowing that students were engaged and learning ... An added benefit of being at the Bloomberg School is the opportunity to teach undergraduates in Public Health Studies at Homewood."

Baltimore we were able to show modest health improvement without raising the overall costs to Medicare. However, that was not the case in the other cities in which the study was carried out. Congress had funded these Medicare Preventive Services Demonstrations and Evaluations to help them decide whether to add a benefit for preventive services for older persons, and if so, what type of services. As it turned out, in spite of mixed results, Medicare has been adding these services over the years.

Another study, this time working with investigators at The University of Maryland at Baltimore, was to determine the prevalence of dementia among nursing home residents. We interviewed nursing home staff, and family members, collected data from their medical charts and submitted these data to a team of neurologist and psychiatrist, who made the decision as to whether the nursing home resident had dementia. Later, we looked at the type and amount of health services used by residents and the costs, comparing those with dementia to those without this designation.

A question that is often asked is whether older persons who receive their medical care in an HMO have different health and cost outcomes and satisfaction with care than a comparable group who receive care in traditional fee-for-service system. We were able to study this question in a community setting in Baltimore.

solutions are being tested but major problems remain with cost and governance of such systems.

Teaching is a part of my job that has been very rewarding. Nothing better than leaving a class, knowing that students were engaged and learning. Nothing more deflating than leaving a class, sensing that the interchange of knowledge was either sluggish or non-existent. I have taught a course in gerontology for master's and doctoral students at the School of Public Health. Actually, several Homewood undergraduates usually enroll, and the mix of students makes for interesting discussions. I also teach methods of health services research to graduate students, traditionally in a classroom setting but also through a web-based distance education venue.

Being on the faculty of the Bloomberg School is exceptional for several reasons: the student body, who are entering careers in public health and have a keen interest in learning and solving problems; the remarkably diverse faculty; and the proximity of the medical school faculty, with whom we collaborate on research projects. An added benefit of being at the Bloomberg School is the opportunity to teach undergraduates in Public Health Studies at Homewood. This program introduces students to many of the issues in public health, both in the US and internationally, and I believe is influential in bringing students into this field.

DR. RIMAL "I do hope that the work I do will help us develop effective interventions that can assist people make healthy behavioral choices."



Health, Behavior, and Society

Department Studies Behavior and Assesses Risk

Rajiv Rimal, PhD

Article by Maneesha Jamnadas

PERSPECTIVE The newest department at JHSPH stems from the Health Policy and Management Department and studies human behaviors, diseases, and perceptions of risk.

The Health, Behavior, and Society department is the newest department at JHSPH, branching off from the Department of Health Policy and Management. This sector of public health realizes the role of human behaviors in disease and well-being. It continually asks how to understand and manage risk and evaluates methods to improve healthy behaviors that lead to disease prevention. Along with other public health tools, this program relies on social and behavioral sciences, communications, economics, and marketing.

The HIV epidemic, which is particularly prevalent in Africa, has sparked research into methods to improve healthy behaviors and prevent the further spread of the epidemic. One of the many researchers searching for a cure is Dr. Rajiv Rimal, PhD.

Dr. Rimal was originally trained in communications.

He studies how people communicate with each other and the impact of communication on health. Now a member of the Johns Hopkins Bloomberg School of Public Health, Dr. Rimal is concentrating on health-related behaviors and their impact on the health and well-being of people. His passion for studying human behavior and his fascination with human motivations have led him to study the reasons behind people's actions when it comes to making health-related decisions.

Dr. Rimal studies the interaction of communication and health-related behavior, specifically with HIV in the African countries of Malawi and Namibia, where the Johns Hopkins University has been running HIV prevention campaigns for

RIMAL BEHAVIOR AND HEALTH continued on page 57

DR. KATZ travels to the Himalayan country of Nepal in order to oversee various research projects such as randomized community trials.



International Health Focus

Combating Mortality and Morbidity Abroad

Joanne Katz, ScD

Article by Mary Kwon

PERSPECTIVE Professor Joanne Katz, together with the International Health Department, leads an effort to combat mortality and morbidity internationally through nutritional studies.

Placing her two hands together, Professor Joanne Katz, on a typical day, bows and greets the local women in Nepal with a soft smile. "Namaste, hello," she says. Several Nepali women gather together in order to participate in Katz's effort to fight mortality and morbidity in under-served populations around the world. As an integral part of the International Health department at the Johns Hopkins Bloomberg School of Public Health, Professor Katz leads a commendable endeavor to discover ways to improve infant, adolescent, and maternal health in various places across the globe from Baltimore to Bangladesh and Nepal. One research project consists of randomized community trials evaluating the impacts of micronutrient supplements such as vitamin A, iron, and zinc on human mortality, morbidity, and development in Nepal. A variety of sources and efforts support Katz's research project in Nepal. The School of Public Health faculty, the research team stationed in Nepal, doctors, masters and doctoral students, translators, the local community, and several hundred indigenous female employees all significantly contribute to the project.

The Project in Nepal Usually twice a year, for a period of two weeks, Professor Katz travels to the Himalayan country of Nepal in order to oversee various projects. Currently, the research team has just completed randomized community trials to evaluate the effects of iron and/or zinc supplementation on preschool child mortality, morbidity, and development, to study the consequences of newborn washing with chlorhexadine on infant survival and morbidity, and to assess the impact of different cord care regimens on cord infections in neonates. The project also included a study on the effects of adolescent pregnancy on maternal and infant nutritional status and infant growth in a nutritionally deficient population in rural Nepal. Over 500 indigenous women and men work together with doctors and students to deliver micronutrient supplements to the community, collect data, conduct interviews, and translate as the rest of the research team analyzes the data utilizing biostatistics.

KATZ INTERNATIONAL FOCUS continued on page 58

JOHNSON "I am typically involved with 4 to 8 consulting projects and work with one Biostatistics faculty member on a statistical research project."



Biostatistics and Humanity

Applied Statistical Methods in Public Health

by Elizabeth Johnson
Research Assoc in Biostatistics

PERSPECTIVE Elizabeth Johnson is a member of the JHSPH Department of Biostatistics. She tells about her research experiences and the benefits of being on the faculty at JHSPH.

Photograph courtesy of NLM-PHIL/CDC

After completing my master's degree in Statistics at North Carolina State University, I came to work at the Bloomberg School of Public Health as a research associate in the Biostatistics department. I was hired primarily to serve as a consultant in the Biostatistics Center. This center provides the Johns Hopkins community (and non-Hopkins community) with statistical expertise and consulting services. I also serve as a research assistant to faculty members in the Biostatistics department who are working on developing and applying statistical methodology.

I have a strong interest in teaching and have been given the opportunity to instruct the undergraduate introductory course in Biostatistics required for the undergraduate public health majors at the Homewood campus. In the past, I

Specifically, we are comparing the risk of hospitalization and total number of hospitalizations across groups of schizophrenic patients defined by antipsychotic use (heavy, moderate and low use categories defined by the number of days the patient is prescribed antipsychotic medication). We use extensions of regression analyses that take into account the fact that we observe the patients over several years and health care utilization and antipsychotic use for any given patient will be similar over time (i.e. patients who have many hospitalizations at the beginning of the study will tend to also have many hospitalizations at the end of the study).

I am also working with Dr. Ron Brookmeyer and Katie Ziegler (Ph.D. candidate in Biostatistics) on a

"For either a student or young professional in Biostatistics, Bloomberg is an exciting, stimulating and challenging environment. The diversity of the faculty, staff and students allow opportunities to learn about traditions and experiences from all over the world. The passion for both work and play is contagious."

have served as a teaching assistant for courses offered at the Bloomberg School of Public Health and taught short courses at Hopkins and Johnson & Johnson.

After my second year at Hopkins, I began taking coursework again and am currently a part-time PhD candidate in the Biostatistics department. My tentative graduation date is May 2007. At any given time, I am typically involved with 4 to 8 consulting projects and work with one Biostatistics faculty member on a statistical research project. For one of my current projects, I am working with Dr. Don Steinwachs and several other researchers from the department of Health Policy and Management at the Bloomberg School of Public Health and Psychiatry and Behavioral Sciences in the School of Medicine. We are analyzing data from the longitudinal study of Patterns and Outcomes of Care for severely mentally ill (SMI) Medicaid recipients. Adult Medicaid recipients classified as highly probable or probable SMI were followed from July 1993 through June 2000 to examine mental health treatment, utilization of mental health services and the impact of a managed care program. This project was conducted in collaboration with the State of Maryland Medical Assistance Program and the Mental Hygiene Administration. We are using the data to explore health care utilization among schizophrenic patients.

project to estimate and project the world-wide prevalence of Alzheimer's disease. This work is sponsored by Elan Pharmaceuticals, Inc. and is an extension of previous work completed by Dr. Brookmeyer and Sarah Gray (add reference) that estimated and projected the prevalence of Alzheimer's disease in the U.S. The estimates and projections will be used by policy makers to allocate appropriate resources for Alzheimer's patients, will be used by mental health researchers to develop intervention strategies and develop treatment programs. We will also determine the affect of severity of illness and potential mental health interventions on the projected prevalence. To estimate and project the prevalence rates, we need information on the world-wide incidence of Alzheimer's, world-wide mortality rates for persons with and without Alzheimer's disease and world-wide population projections. We are in the process of obtaining this information using published data from cohort studies of Alzheimer's disease and national and international databases that provide mortality rates and population projects.

For either a student or young professional in Biostatistics, Bloomberg is an exciting, stimulating and

BIOSTATISTICS AND HUMANITY *continued on page 58*

PROFESSOR GRASON and colleagues at WCHPC are developing and disseminating frameworks and models derived from evaluation research.



For Women and Children Policy Driven Public Health at the WCHPC

Holly Grason
Article by Laurel Murphy

PERSPECTIVE Holly Grason directs the Johns Hopkins Women's and Children's Health Policy Center at the Bloomberg School of Public Health (WCHPC-JHSPH).

Associate Professor Holly Grason will tell you that serendipity brought her to a career in public health and to her specific work at the Bloomberg School of Public Health. Such "accidents" seem to happen to many other leaders in the field—Dean Alfred Sommer, MD MHS, for example. Professor Grason first encountered public health through involvement in community and state programs for children with disabilities. This work in the disability field landed her a policy development position in Maryland's Children's Medical Services (CMS) Program, which is responsible for state-level public health oversight of the system of care for children with chronic illnesses or disabilities. Experience at CMS gave Professor Grason unique, on the job training in public health; there she was able to observe policymaking in action and was mentored in public health perspectives, methods and tools. Her next career step expanded Professor Grason's public health knowledge and expertise as she subsequently became Deputy Director of the national Association of MCH Programs, based in Washington, DC. During her five years at AMCHP she conducted research

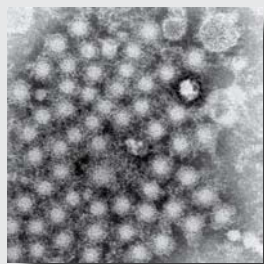
and policy analysis and policy development related to the functions, organization and financing of state level services for women and children.

As the field of public health is inherently multi-disciplinary, it is actually not too surprising that Grason, a student of history, political science, and child psychology ultimately found her niche as the Director of the Johns Hopkins Women's and Children's Health Policy Center (WCHPC). Faculty, students and staff working within this center synthesize and translate research to support the work of government healthcare officials and other policy makers at the local, state, and national level. Recognizing the importance of stepping outside the bounds of theory and statistics and into the organizations charged with devising policies and programs, Professor Grason spends about one-third of her time in the field working with state public health professionals nationwide. She asserts that in

WCHPC POLICY DRIVEN HEALTH *continued on page 59*

Photograph courtesy of the Women's and Children's Health Policy Center.

MORGAN MARK conducts research in Molecular Epidemiology, the merging of Molecular Microbiology, Immunology, and Epidemiology.



Molecular Epidemiology Second Year PhD Student Comments on the Field

Morgan Marks
Article by Lindsay Brown

PERSPECTIVE Epidemiology is the scientific study of factors affecting the health of populations, and epidemiological studies serve as the foundation for large scale preventative measures.

Morgan Marks is a PhD student in the Epidemiology Department at the Bloomberg School of Public Health. The department is largely focused on the study of infectious disease and the social determinants of disease. Epidemiology is the scientific study of factors affecting the health of populations, and epidemiological studies serve as the foundation for large scale preventative measures. Considered a foundation of public health research, the Epidemiology Department seeks to identify risk factors for disease and determine optimal treatment approaches. Marks' focus is specifically in a burgeoning facet of the department: molecular epidemiology.

Many departments look at biomarkers to make inferences about disease causation. The problem with this is that there is no universal, firm understanding regarding the collection of these biomarkers, or the science behind these

tests, among departments. Marks' interest lies in making sure these questions are asked.

Molecular Epidemiology is in many ways a merging of the Molecular Microbiology and Immunology Department and the Epidemiology Department: hard science and the science of inclusion, a union to make inferences about health and disease causation.

Epidemiology looks at external causes to gain clues about disease. MMI does just the opposite: looking at disease causation from a cellular level through modeling. In short, both look at the mechanisms behind disease but with different perspectives and through different models. Molecular Epidemiology draws on ideas from both of these

MOLECULAR EPIDEMIOLOGY *continued on page 59*



ABOVE "These people live in the hamlets that surround the clinic. Everyday, on our walks from the doctor's house to the clinic, everyone comes out to say hello." **BELOW** "The eye patches are positioned after the surgery and removed the next morning. The man in scrubs with the coffee mug is Dr. Robert Castrovinci, my father." Photography by PHILIP CASTROVINCI.





ABOVE "This is a picture of me dilating patients' eyes before surgery. The iris must shrink in order for the surgeon to have better access to the lens." PHIL "Blindness is a unique sociological, as well as medical problem. A blind person has more difficulty doing even the simplest task. Typically, someone must assist the blind person with daily, routine activities." **MORE** on page 34



Treating Preventable Blindness

Solutions to Detrimental Eye Problems in the Philippines

student
feature

by Philip Castrovinci
Public Health Studies, 2008

FEATURE *Philip Castrovinci travels to the Philippines to learn from ophthalmologists who dedicate their lives to helping people see.*



ABOVE *Dr. DeVenecia screens every patient. The slit-lamp microscope is the main instrument for examination. Most of the patients have never had an eye exam.*

On the same beaches where General MacArthur invaded the Philippines, there is another battle: the battle on global blindness. Here in San Fabian, Pangisanan, the Free Rural Eye Clinic screens patients from all over the Philippines who are too poor to see a private ophthalmologist. The clinic has an on-site surgical care with two operating rooms, multiple procedural and laser rooms, and waiting areas for the hundreds of patients and helpers who come to the clinic daily.

The clinic is the invention of Dr. Guillermo DeVenecia and his wife, the head nursing supervisor, Marta DeVenecia. Dr. “DeVe” is a Filipino native who grew up in the area where his clinic now sits. For eight months out of every year, both Marta and Dr. DeVe live in San Fabian. He is professor emeritus of ophthalmology at the University of Wisconsin and the first full-time ophthalmologist at the university. Dr. DeVe and Marta have been coming to the Philippines since the early eighties traveled from hospital to hospital conducting free cataract surgery and eye care. In 2001, they built a stationary clinic where the patients can now come to them. Starting in the eighties Dr. DeVe also invited his former students, who are now established clinicians all over the United States, to conduct eye surgery. One of these clinicians is Dr. Robert Castrovinci, my father. For the past

two years, I have followed him to San Fabian to witness the front lines of global blindness.

Eighty percent of the world’s blindness is treatable, with the majority of which comes from two ophthalmic conditions: cataracts and glaucoma. Economic loss to global blindness totals \$42 billion today, and could grow to \$110 billion by 2020 if present trends continue and intervention stays the same.

Blindness is a unique sociological, as well as medical problem. A blind person has more difficulty doing even the simplest task. Typically, someone must assist the blind person with daily, routine activities. The effects of the blind have now doubled, withdrawing resources from other societal uses. The distribution of blindness is not uniform throughout the world or in a given population.

Persons older than 50 constitute 82% of the world blind, but make up only 19% of the population. 1.4 million children are blind in the world as well, leading to significant numbers of “blind years.” In all socioeconomic populations and age groups, more women are blind than men throughout the world. Geographically, 80% of the world’s blindness exists in developed countries. Given that 75% of the world’s blindness is avoidable, there remains the hope for successful intervention, starting with cataracts.

According to the Wilmer Eye Institute, a cataract is the clouding of the lens in the eye. As the lens turns more opaque, less light can reach the retina and vision gradually deteriorates. Seventy percent of all Americans, over the age of sixty, show signs of incipient cataracts. Although cataracts occur predominantly in older people, pediatric cataracts are not uncommon. As the average life expectancy grows and the world population grows older, these eye conditions prevalent among the elderly will take a larger toll on eyesight. Cataracts can only be removed through surgery.

In developed countries, cataract surgery is a non-invasive procedure known as phacoemulsification—a technical term that describes the use of ultrasound to break up the cataract through an incision 3 millimeters wide. Eye drops are used to dilate the iris to expose more of the lens. Only eye drops are needed in most cases to anesthetize the area. Through the same small incision, the ophthalmologist inserts an intraocular lens that can restore or even improve the eyesight. The small incisions will heal on their own, and the surgeon will then bandage the eye. Although today this outpatient procedure takes 15 to 30 minutes, cataract surgery was not so simple 30 years ago when the phacoemulsification was not yet developed.

Back then the cataract incision was several times larger—sometimes the incision would cut 180 degrees

patient develops bilateral cataracts, the lens becomes more solid and then when at advanced stages, the lens turns to liquid. By this stage the patient is blind.

In the Philippines, patients came to us the first day blind—with barely any light perception. By the time they leave, their vision is restored to near 20/20, provided they have no other ocular problems like macular degeneration or glaucoma.

Cataract surgery is a procedure that can restore sight in less than an hour, and recovery is less than a week. Considering that 47.8% of worldwide blindness is caused by cataracts, cataract intervention is highly successful using phacoemulsification and charitable cataract surgery missions that use the manual extraction method. However, 14% of the world's blindness is caused by glaucoma.

Glaucoma is a condition where intraocular pressure builds in the eye, damaging the optic nerve. The pressure reduces vision slowly by narrowing the field of view, essentially creating tunnel vision and eventually blindness. Unlike cataracts, glaucoma is a condition where the recovery rate is directly proportional to the time of intervention. If glaucoma is caught early and treated properly, the prognosis is much better than if left untreated. Early treatment includes eye drops that need to be taken everyday. Later treatment includes laser treatment every few months or surgery to

by Philip Castrovinci
Public Health Studies

“Economic loss to global blindness totals \$42 billion today, and could grow to \$110 billion by 2020. As the average life expectancy grows, these eye conditions prevalent among the elderly will take a larger toll on eyesight.”

around the cornea, the clear part of the eye where one can see the iris. Since the cornea is the most sensitive part of the body, more substantial anesthesia called a retro-bulbar anesthesia, was necessary. This procedure involved the insertion of a needle into the areas around the eye to inject anesthesia behind the eye. This carried the risk of blood pressure getting too high and the peripheral eye area hemorrhaging with blood. Retro-bulbar hemorrhage usually resulted in the cancellation of the surgery.

Once the cataract is removed from this large incision, small sutures are used to close the wound. This manual extraction technique takes 30 to 60 minutes, and healing time takes a few days. The sutures can break, complicating the procedure. The open eye creates a larger opportunity for post-surgical infection. However, suturing is unnecessary in phacoemulsification, which means that there is little room for the post-operation complications. This procedure is heavily utilized overseas and is the main procedure of the Free Rural Eye Clinic.

At the Free Rural Eye Clinic (FREC) the patient must develop bilateral cataracts as a requirement for treatment to ensure that the patient lacks sufficient economic means for treatment. I found it ironic that in the United States, patients must prove their ability to pay for the surgery, while at FREC patients must lack the means to pay for the surgery. After a

mechanically correct the pressure. Adequate eye screening in the United States is common, and glaucoma is often readily identified but not easily treated.

As with all medications, the eye drops used to treat glaucoma only work if taken. It is estimated that many glaucoma patients use their eye drops as little as 25% of the time. One may perhaps attribute noncompliance to the fact that glaucoma drops leave an unpleasant aftertaste. Nevertheless, non-compliance is a problem in both the United States and in resource-poor settings. However, screening for eye conditions like glaucoma is not as comprehensive in resource-poor settings. Patients usually seek treatment only when the case becomes so advanced as to make the patient blind. By this point it is too late to receive successful treatment.

Here we have two conditions, cataract and glaucoma; both are decidedly chronic problems that take effect especially when a person grows older. These are both chronic conditions because of their relationship to age and the development without an external force like a pathogen or war. There is no such thing as an epidemic of cataracts. Even though they are both chronic conditions, the outcome

PREVENTABLE BLINDNESS *continued on page 59*

Health and Opportunity in Hato Mayor

Challenges for Women and Children in the Dominican Republic

student
feature

by **Jaya Ghidiyal**
Public Health Studies, 2008

FEATURE *Jaya Ghidiyal explores the economic and social issues facing residents of Hato Mayor and its effects on their health today.*



ABOVE Boy with swollen abdomen due to bilharzia (schistosomiasis) a rampant disease in the Caribbean region. Image courtesy of NLM-PHIL/CDC.

This past winter break I volunteered for one week in Hato Mayor del Rey, a provincial capital of roughly 80,000 in the eastern region of the Dominican Republic, to further my interest in International Health. During my time there, I worked with Centro de Desarrollo Integral ARRAS (CDIA), a small, grassroots community organization that focuses on providing basic educational opportunities to disadvantaged children in a shantytown to the east of the city.

Although education in the Dominican Republic is required and provided free of charge for children 7 to 14, many children in their teens have missed their chance at preliminary education due to the destruction caused by Hurricane George in 1998. During the hurricane, as part of the overall property damage suffered, many families lost the official birth certificates that are required for their children to enroll in public schools, further exacerbating the problem of low birth registration that exists in rural communities. It is estimated that from 1999-2003, only 66% of births in rural areas of the Dominican Republic were registered. Without these papers, children are prevented from accessing much-needed education and health services provided by the government, a circumstance that augments the disadvantages already facing the poor youth.

In response to this problem, CDIA, along with its

partner Community Service Alliance (CSA) in Santo Domingo, helps families obtain the documents they need, and simultaneously runs a small school for those children who are not formally enrolled in the public school system. Eighty children, ranging in age from 3 to 14 years old, attend this school either during the morning or the afternoon sessions. In the past, the school had been free of charge, but in an effort to promote more parental responsibility, children are now encouraged to bring five Dominican pesos a week to help with the cost of snacks and school supplies—an amount less than 25 cents in the United States. Teachers of CDIA are paid through church donations and small contributions from local businesses. Through these efforts CDIA is able to build a strong foundation for children, while aiding their assimilation into the public school system.

Increasing access, however, is not enough. Although survey data of Dominican households from 1996-2003 reveal that 83% of children enrolled in the primary school system attend, the definition of “attendance” in this self-reported survey data is misleading. In this rural community of Hato Mayor, for example, many of the children who are enrolled in school are frequently seen playing in the streets or looking for odd jobs during class time. Students’ attendance was by no means consistent, often amounting to only once or twice

a week. While I would help with writing, drawing, singing, and snack time once school began, a significant portion of my time was also spent visiting homes to encourage parents and children to attend the school sessions CDIA provided.

The problem of attendance among children in Hato Mayor is likely to reflect low levels of parental supervision. Fathers are absent in most families, and mothers spend long hours in local positions or have often left permanently to work in more promising cities. Households can be a mixture of grandparents and chance relatives. Children are left to take care of the house and their younger siblings, making it even more difficult for them to attend school. The large number of children in each household intensifies the problem because not enough individual adult care can be provided to each child. Although overall fertility rates in the Dominican Republic have declined in the last few decades, averaging slightly over three children per woman of reproductive age, most families in the neighborhood have four or more children and information regarding contraceptive practices is virtually nonexistent. There remains a large gap in contraceptive availability between married and single women, as well as urban and rural women. While the USAID estimated contraceptive prevalence at 66% for married women in 2002, the actual rate was significantly lower, 48% for all women. In addition, rural women in the community

real age of the children was as large as five to seven years. The adults, in contrast, did not appear to have been affected by the same nutritional conditions during development. Most of the adult residents in this area of Hato Mayor are either first or second generation migrants, a product of better economic times before the recent changes in the nation's manufacturing and agricultural sectors. Home to large sugar growing plantations, unemployment in Hato Mayor has risen as agriculture has lost ground to service, tourism, and light manufacturing industries, causing many of the new generation to face the additional challenges of hunger and missed educational opportunity.

Because 70% of the Dominican population lives in urban areas, mostly in the capital city of Santo Domingo and other cities scattered throughout the country, rural areas lack public attention, leading to low economic and health indicators. Nearly 67% of those living in urban areas have access to adequate sanitation facilities compared to only 43% of those in rural areas. In the community I visited, the latrine below was shared by four families. This gap in sanitation is reflective of a similar disparity in water resources. In 2002, UNICEF estimated that 98% of urban residents had access to adequate drinking water compared with 85% in rural areas. I stayed in a home bordering a shantytown that was fortunate to have indoor plumbing. Nevertheless, municipal

by Jaya Ghidiyal
Public Health Studies

"The effects of malnutrition can be seen in the distended bellies of toddler and preschool age children and the small, stunted size of older children. Upon asking a child's age, I was often surprised to find that they were much older."

in which I worked would at times engage in high risk sexual behaviors in exchange for food or money, increasing their chance of pregnancy and sexually transmitted infection. Whereas women could expect to receive an immediate benefit of two hundred pesos (less than \$7 US) as compensation for a sexual exchange, the future consequences of their actions could not be expressed in simple monetary terms. As of 2003, HIV prevalence among the adult Dominican population was estimated at 1.7% compared to a regional prevalence of 0.7% in Latin America and the Caribbean. In the small neighborhood where I worked, two people were infected with HIV, and one mother was awaiting test results for her one year old child.

Reports of mothers who would sell their bodies in exchange for several days of food indicate the problem of food availability. I witnessed this problem through both my observation of neighborhood children and my observation of market prices. Meat is beyond the reach of most families, although feet, innards, and other often discarded parts of the animal as well as processed slabs are more common. The effects of malnutrition can be seen in the distended bellies of toddler and preschool age children and the small, stunted size of older children. Upon asking a child's age, I was often surprised to find that they were much older than I expected. Sometimes the difference between an expected age and the

water would only run several times a week, and was stored in large trash containers and buckets that were utilized to bathe and flush the toilet. Residents of the shantytown rely on a water tower and an accompanying system of poorly installed plastic piping that leads to communal taps. While residents are generally able to accommodate their needs to the source, quality is uncertain. Water is transported through above ground pipes and then undergoes long periods of storage making it highly susceptible to contamination. The gray water in these neighborhoods then accumulates in a network of above ground trenches and funnels to the nearby river.

Though I have presented only one community among many in the province of Hato Mayor, the problems in this small community may be representative of larger problems throughout the region. Despite the need, I saw almost no international NGOs or government organizations operating to provide assistance in the area. Much of the help available is the product of local efforts. Esperanza International, a micro credit organization, has opened within the town and is successfully assisting 99 women with small scale loans that they can use to build credit and generate income. In partnership with CSA, CDIA is currently working to establish

DOMINICAN REPUBLIC HEALTH *continued on page 60*

Public Health Pilgrimage to Geneva

WHO Internship Gives Inspiration and Puts Faith into Action

student
feature

by **Kimberly Buxton**
International Studies, 2006

FEATURE *Kimberly Buxton shares a personalized account of her summer internship at the World Health Organization in Geneva.*



ABOVE "Some had come just for an excuse to be in Europe and to have a good time, while others allowed their work to consume their entire experience." Photograph by Kimberly Buxton.

"The attainment by all peoples of the highest possible level of health." I felt a rush of pure exhilaration as I stood in front of these words, in six official languages, so ornately enshrined in the plaque. It was the first day of my internship at the World Health Organization and I was ecstatic that this had all in fact become a reality. However, it was in reading its *raison d'être* that I was overwhelmed by the feeling of sheer awe of the organization - of its grandeur and of what it represented.

The World Health Organization (WHO) is the specialized coordinating agency of the United Nations for international public health, serving 192 member states. The organization defines "health" in its most comprehensive sense, where it is "the state of complete, physical, mental and social well-being, and not merely the absence of disease or infirmity." In its aspiration to secure the highest standard of health, the WHO functions to provide guidance through technical assistance, setting standards, and cooperating with governments and non-governmental organizations (NGOs) to ensure better health outcomes worldwide.

There I was, a humble intern, timidly standing in front of one of the most formidable organizations in the world. It was on that same day that one of the fellow interns took me out to the balcony and asked me, "What do you want from

this internship?" While I had found it oddly prying of him to ask me this, in retrospect, I am extremely grateful for the serious reflection it compelled me to do. I shortly realized in meeting other interns that priorities greatly varied among them. Some had come just for an excuse to be in Europe and to "have a good time", while others allowed their work to consume their entire experience. Of course, I intended on appreciating what Geneva and its surroundings had to offer; enjoying the summertime *fetes* in the city, hiking in the Swiss Alps, and taking a road trip to Italy for a weekend were all included in my list of "To Dos". However, I knew that I wanted much more from the internship experience. I was idealistic - I had hopes for a balance during my time there.

Without a doubt, I took the internship seriously. As one can imagine, an internship at the WHO is one of the most coveted for a student of the public health discipline. Though not officially from this background, I applied for the internship as the logical next step in the trajectory I was following, primarily regarding the HIV/AIDS epidemic. My commitment to the fight was initiated during a medical missions trip to South Africa my junior year, when I saw the lives the epidemic destroyed and the relentless cycles of poverty it exacerbated in communities. Henceforth, my experience with patients at the HIV/AIDS clinic of the Johns

Hopkins Hospital had exposed me to the stark reality of the epidemic in our nation. The cruel difference between the developed and developing worlds, I realized, boiled down to that of treatment – a giver or destroyer of life. Thus, I had applied for the internship as a general introduction to international health policy and more specifically, to the actions in place to bridge the treatment gap for those affected worldwide.

The HIV/AIDS department was well along its “treat 3 million by 2005” or 3 x 5 Initiative by the time I had arrived. While the exact goal would not be reached by the end of the year, more than one million people were in fact placed on treatment with the prospects of life ahead of them. A few days into the internship, at an update briefing, I was struck by the deep sincerity in department director Jim Kim’s voice as he articulated “We must mourn for those whom we have lost, but we must be elated for those we did save.” It was through these words that I sensed that his work was truly for the *individuals* out there, affected by the epidemic. Unlike some of his colleagues, I could see that he at least had not been entirely jaded by the bureaucracy of the “Ivory Tower” or the obscurity of being away from “the field”. What Dr. Kim said in that meeting resonated with me, as I was quickly reminded of why I was there to begin with – to help in the fight, in whatever way possible.

was happening around me, and from the interactions with people in my department.

Through passive observation, I was able to grasp and comprehend the challenges the department faced and the progress it was making. Despite the banality of the day-to-day work, I saw that people were prodigiously hard-working – an indication of their underlying commitment to the overall cause. However, I caught glimpses of frustration arising from the constant tension between the department’s heavy outcome-led orientation and the financial restrictions limiting its capacity to perform. With each individual imparting his or her own expertise, there was also a high degree of territorialism, particularly between the medical doctors and the rest. This territorialism not only characterized relations within the department, but also between the WHO and UNAIDS (the Joint United Nations Programme on HIV/AIDS) due to the lack of clarity on the appropriate role of each agency. Nevertheless, with the “universal access” agenda in place mid-summer, I observed a strong push towards increased partnership inter- and intra-departmentally in the hopes for a true concerted effort in the fight.

Initially, I felt intimidated by being amidst such experienced and established people (both colleagues and interns alike). However, from the very first day the openness and warmth that they showed me was humbling.

by Kimberly Buxton
International Studies

“I was feverishly going through my articles one day, when a colleague on the team came up beside me and kindly reminded me, ‘You’re also here to sit back and just learn.’ It was so easy to be completely engulfed.”

My supervisor Kevin Moody, a treatment advocate, gave me a vague and open-ended assignment of searching through the published literature on the topic of HIV treatment adherence factors. As I gained more knowledge on the issue, the importance of treatment adherence also became increasingly clear and evident. With no foreseeable prospects of a cure, advances in drug therapies and medical management were nevertheless offering the prospects of treating HIV as a chronic, rather than terminal illness. In the hopes that millions would be placed on treatment in the coming years, I saw that the next impending issue would inevitably be to sustain them on the treatment for the rest of their lives. Inadequate adherence, I learned, would not only lead to treatment failure, but would also engender serious public health implications due to the high potential of viral drug-resistance. With a sense of urgency in mind, I composed an exhaustive literature review of over four hundred articles on the topic by the end of the internship. I was feverishly going through my articles one day, when a colleague on the team came up beside me and kindly reminded me, “You’re also here to sit back and just *learn*.” It was so easy to be completely engulfed into the work at hand that I oftentimes would overlook what was accessible to me. Rather than the programs and seminars I attended, the true learning came from just being a mere onlooker of what

I learned that people were generally accessible, and that it was really up to me to make the initiative. I frequently had coffee with experts and physicians who were willing to advise me on my project and also provide answers to my questions concerning their trajectories, specialties and even their personal lives. Many underlined the importance of “getting your hands dirty,” asserting the necessity of years “in the field” not only for qualification purposes, but also to understand and formulate effective policy for public health through experience. On a more personal level, I witnessed the difficulty of balancing the work they believed in and their personal responsibilities to their families (who often were not with them in Geneva). Under their mentorship I gained clarity about my future path and insight into some of the challenges that would inevitably arise along the way. As for my fellow interns, I appreciated the strong sense of solidarity among us in the department, despite the diversity of backgrounds and specific interests. In particular, through our exchange of thoughts and convictions, I developed a deeper sensitivity to the issues of global injustice and inequalities.

The path where I find myself today has been neither straightforward nor quickly manifested; rather, it has

PILRIMAGE TO GENEVA *continued on page 60*

Hospice Care South of Johannesburg

The Limits of Home-Based Care for HIV/AIDS in South Africa

student
feature

by **Jeremy Gottlich**
International Relations, 2007

FEATURE *Jeremy Gottlich presents his observations at the Hospice for home-based care for HIV/AIDS patients in South Africa.*



ABOVE Soweto based office managed by international Hospice organization. Sign above Soweto based office operated by five trained home-care nurses. Photograph by Jeremy Gottlich.

Home-based care in South Africa is not a service that is uniform throughout the country. It is divided between private and public health care. Private home-based care is a business in which medical aid companies benefit from lower costs as compared to hospital care. Home-care costs much less than hospital visits for both the patients and medical aid companies. Although the cost is lower, it continues to remain unaffordable for many people, especially those patients with HIV/AIDS in the predominantly black areas of South Africa. Public home-based care is a less formal way to help individuals who need the attention of home care workers for reasons of immobility and personal care. It also is a free service provided by Hospice. In Soweto, located half an hour south of Johannesburg, hardly any of the inhabitants have medical aid coverage and patients rely on home-based care; hospitals and clinics are a last resort. Yet, each visit to the hospital costs 35 Rand, equivalent to \$5 or \$6. Most people in Soweto cannot afford to visit places with proper medical care. The demand for the home care sisters of Hospice is furthermore enormous, limiting the number of visits the nurses, or “sisters” can make. Along with the lack of hospital space, nurses, and doctors, HIV/AIDS is becoming an even greater epidemic in Soweto. The complications with this disease are present not only in

the health of the population, but also in the strain placed on all the health facilities. The Hospice in Soweto has five trained home-care nurses who divide up the patients among themselves. Hospice is an international organization dedicated to helping patients live in comfort in their last days. In Soweto, the nurses take an active role in extending a hand to the community by providing home-based care. Almost all the patients have HIV/AIDS, and dealing with such a tremendous patient load is nearly impossible.

Sustaining Hospice's Programs in Soweto, South Africa I was introduced to Hospice in Soweto by Mrs. Lee Dandridge, a nurse based at the Hospice in Houghton, a wealthy suburb of Johannesburg. She began by informing me of the limitations that Hospice faces and the areas in which increased funding would benefit Hospice. Hospice faces a lack of space to effectively manage patient inflow and the training of nurses. They also lack a source of sustainable funding. These limitations have cut down on the amount of people Hospice can employ to teach home-based care as well as the amount of trainees they can absorb at one time. Although the training program is excellent, as seen by the high demand of their trainees in NGOs and the government, these new nurses cannot find jobs in Soweto including with

the Hospice. The only training facility is in Soweto, posing yet another obstacle for building up sufficient amounts of home-care workers to more effectively manage the HIV/AIDS epidemic. Mrs. Dandridge believes that although Hospice has funding to build a bigger facility, it would be incapable of sustaining it. Funding effective training programs like the one Hospice provides in Soweto would be an influential first step in creating more trained healthcare personnel.

The Home Care Patients For two days a week, I would make visits to patients' homes with various home-care workers. The first real obstacle I noticed from the beginning was the difficulty the sisters had navigating the streets. In most neighbourhoods, it was extremely hard to find the correct street and address. The addresses are not in a consistent numerical order, and it is difficult to find where the numbers are posted on any given house. Once at the houses, I began to notice themes that seemed to dictate how well a patient was battling HIV/AIDS. Primarily, patients who were taking his/her ARV treatment in a correct and consistent manner were the ones with more energy. They could sit up in bed or walk around, and in some cases, there were individuals who had responded incredibly well to ARV treatment. These patients were walking with no visible signs

attend day cares where they received support from other patients and care workers. Some patients were also advised to seek the help of social workers to cope with the lack of family support or the loss of close friends or family from the virus.

The Sisters of Hospice in Soweto All of the home-care workers at Soweto's Hospice are female nurses. They are dedicated individuals who deal with a range of HIV/AIDS patients as well as a few cancer patients. The sisters that I followed all came from a nursing background in a hospital. One nurse in particular told me how much more fulfilling it was actually going to the homes of patients and having both a medical and social impact on their lives. They all have found a different satisfaction in becoming a home-care sister because they feel the home is a much better place to treat a patient. The common denominator I witnessed was the confidence that each sister had in dealing with HIV/AIDS patients, and the respect that they commanded from every patient. Although they respected every patient, I saw that they were also overwhelmed by the number of patients. They often had to make concessions by not seeing patients that were feeling better and instead focused on category three patients, the ones that were deathly ill. Although they lack the physical space, data management systems, and numbers

by Jeremy Gottlich
International Relations

"Most of patients, despite having seen a doctor, do not know how to correctly take their ARV treatments and drugs for other complications. They need the sisters to teach them how to live with HIV/AIDS."

of HIV/AIDS and had giant smiles on their faces. It was a pleasure to see the sister congratulate them on their health and praise the work of ARV treatment. The second major theme was the amount of support patients were receiving from family and friends within the household. There was one patient who had responded very well to ARV treatment, although it was obvious that the patient was depressed and suffering from a lack of family support. She did not care that she felt better—she only spoke of moving to a support home with her children and her desperate attempts to fill out the required applications for continued treatment. Family support was easily recognizable, because in those cases a family member accompanied the patient while the sister was conducting her visit. The family members were keen to listen to every detail to ensure the efficient application of the treatment.

The patients I saw often received home-care in addition to visits to hospitals and clinics where they could receive services that the home-care sisters could not provide. The main services included measurement of CD4 count (the primary way of analyzing the disease's presence in a patient), treatment and medicine for complications arising from the disease, ARV treatment, and doctor's advice on severe complications including blindness, deafness, TB, and severe pain. Some of these patients were advised by the sister to

for the caseloads in Soweto, they continue to go out daily and monitor every detail about a patient's health, hospital visits, and family situations.

Conclusion HIV/AIDS is a growing social health concern. Public home-based care is effective but can only do so much with limited resources. Furthermore, Hospice cannot continue to be the sole provider of home-based care in Soweto. Instead, the government should provide an affordable home-based care program. From what I witnessed, the government could emulate much of the work already being done by medical aid companies in South Africa. The government could also use similar data management systems to maintain a field of coverage in the poorer neighbourhoods most affected by the epidemic. Home-care is a cheaper and more effective method to treat patient suffering from the medical and social burdens of HIV/AIDS. Most of patients, despite having seen a doctor, do not know how to correctly take their ARV treatments and drugs for other complications. They need the sisters to teach them how to live with HIV/AIDS and guide them through the social issues attached to this stigmatized virus.

SOWETO HOME CARE *more photographs on page 61*

Acute Gastroenteritis in Ethiopia

The Childhood Illnesses Causing Diarrhea and Dehydration

student
feature

by **Rishi Mediratta**
Public Health Studies, 2008

FEATURE *Acute gastroenteritis is a childhood illness causing diarrhea and dehydration, killing thousands of children.*



ABOVE *The poor hygiene practices among Ethiopian families can cause acute gastroenteritis in children. Photography by Rishi Mediratta.*

Ethiopia, located in the Horn of Africa, is one of the world's poorest countries. A host of innumerable acute and chronic health conditions, including respiratory tract diseases, intestinal parasites, gastroenteritis, HIV/AIDS, tuberculosis, malaria, cancer, and other rare tropical diseases plague the country. Despite the severity, magnitude, and prevalence of the medical illnesses in the population, there exists only one physician per 35,000 people. Limited access to physician care combined with ineffective management and prevention of disease help explain the average Ethiopian lifespan of 48 years. There is no doubt that Ethiopia is facing an urgent public health crisis.

The magnitude and severity of poverty among Ethiopian children is shocking. Almost 17% of all children born in Ethiopia die before the age of five due to acute gastroenteritis, a prevalent childhood condition that is caused by diarrhea and dehydration. This problem is especially acute in Ethiopia because of the lack of rudimentary facilities, very low socio-economic standards compared to that of their more developed counterparts, and poor

personal sanitary practices. Factors such as the hygiene of the mother and child, hand washing practices, access to safe drinking water, and the existence of a clean latrine are critical when understanding diarrhea in children.

There is, however, hope for Ethiopia. For example, Rick Hodes, an American physician who worked extensively at the Johns Hopkins Hospital, dedicates his life to help those Ethiopians most seriously affected by this public health crisis. In the winter of 2005, I had the opportunity to travel to Addis Ababa, Ethiopia, to volunteer alongside Dr. Hodes in his research endeavors. Aside from running an orphanage in his house, he is also responsible for the health of thousands of Ethiopians. In addition, Dr. Hodes volunteers at the Mother Teresa's Missionaries of Charity to provide care for the poorest of the poor. He also coordinates a program that sends children who require spinal and heart surgery to the U.S. and Ghana for treatment. Dr. Hodes is undoubtedly saving a myriad of lives by helping improve the health of those he treats and increasing the quality of life for these Ethiopians.

Although being unfamiliar with the native Amharic language precluded me from talking with members in the community, I witnessed firsthand the difficult lives of those in lesser developed nations. Many Ethiopians simply live day-to-day without any hope for the future and survive under extremely appalling and hazardous conditions. For example, a family of six normally lives in a house the size of an average bedroom. While nearly all families living in the city of Addis Ababa have access to tap water in their compound, families living in the countryside in northern Ethiopia have less access to water. Ethiopians also share water and a pit latrine with four to ten families living in close contact. Additionally, most Ethiopian mothers' concept of hand washing entails just using water without any soap. This problem translates into poor hygiene for their child and can increase the prevalence of diarrhea in the population.

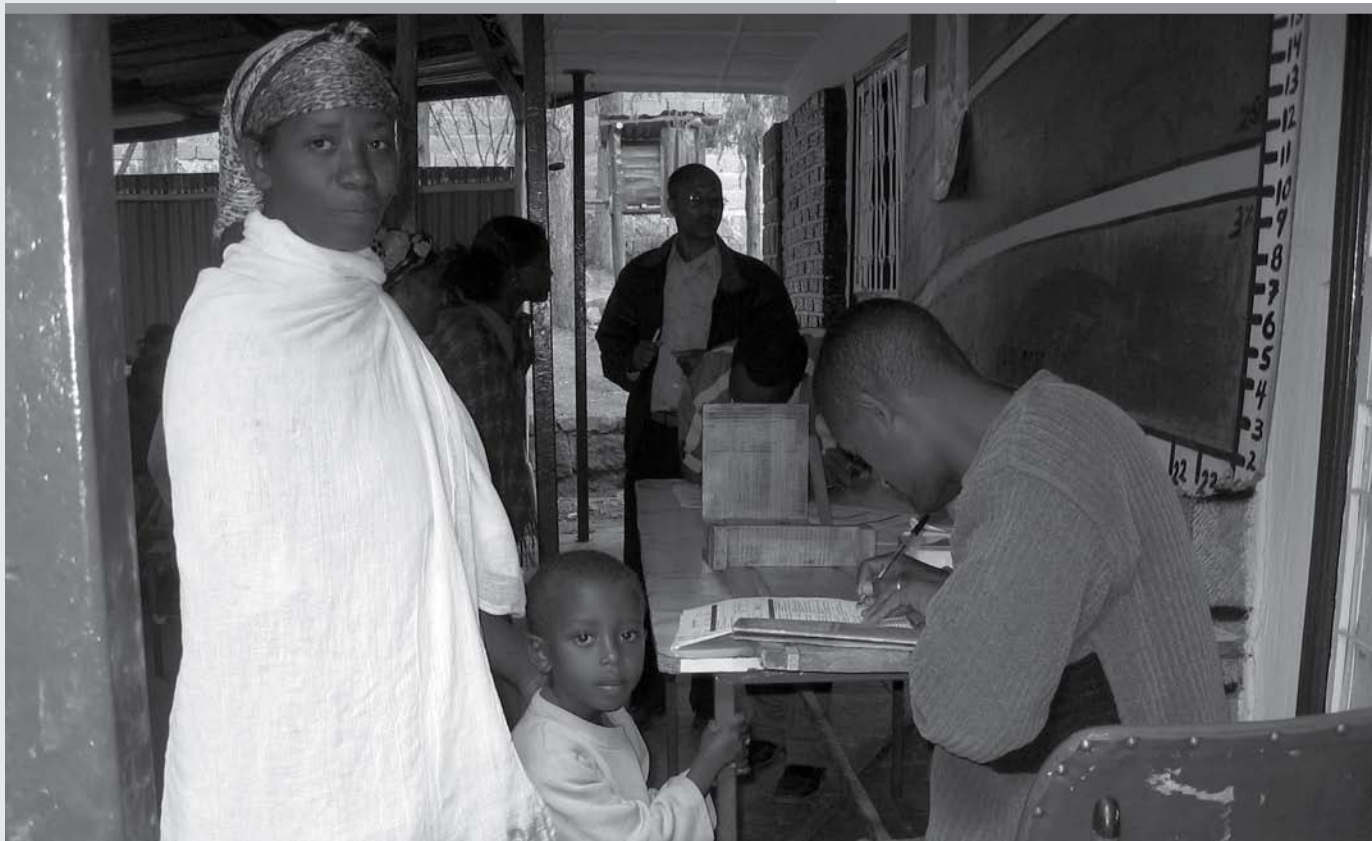
Proper hand washing is a very simple yet critical means of preventing diarrhea and stopping the oral-fecal transmission of disease. While Ethiopian women wash their hands with water after defecation, before eating every meal, and before preparing food, they do not wash their hands with soap. Bar soap is accessible in local kiosks for two Birr, equivalent to 25 cents. However, this is quite costly to them given that the average Ethiopian only makes 8 birr a day. As a result of this lack of soap use, women neither wash their hands properly nor encourage their children to do so. Even if soap is present in the household, it is often used only to wash clothes. It indeed remains a challenge

ACUTE GASTROENTERITIS *continued on page 61*



by Rishi Mediratta
Public Health Studies

“A significant amount of work must be done in the field of public health before we can effectively prevent diarrhea in developing countries. My experience in Ethiopia confirms the need for a continual assessment of hygiene behaviors.”



to access public health educational communications and preventive services.⁶ Once again, this inadvertently sets the stage for propagation of tuberculosis within the community.

Historically, the extended family has functioned as the predominant unit of family structure in India, and not surprisingly, the economic resources necessary to support such a large family unit are beyond the scope of India's poor. When coupled with widespread illiteracy, adverse familial relationships, stress related disorders, and inadequate housing that characterize these impoverished populations, a clear impact on health outcomes and tuberculosis transmission is discerned.⁸ Moreover, these socio-economic factors weigh heavily on the elder members of the community who are unable to be self-sufficient, and thus, must rely on the extended family unit for support. Without adequate economic resources, nutrition, and mobile access to healthcare, the aged become increasingly susceptible to tuberculosis, as demonstrated by a study of a rural area of the Varanasi district, which revealed that the incidence of illness, most notably tuberculosis, was 77% among woman over 60, and 61% among men over 60.⁸ Ironically, the gradual shift in Indian society from a joint to a nuclear family system has also increased the susceptibility of tuberculosis among the aged, given that the nuclear system has lowered the status and priorities of the elderly with respect to healthcare and living conditions.⁸ Undoubtedly, these findings suggest a need for increased social responsibility for the health and well-being of India's aging population.

Finally, the misallocation of resources in the Indian governmental healthcare system has incapacitated government primary healthcare centers, the main source of preventive health services and education for tuberculosis-prone locations such as slums and rural areas.⁶ Approximately 75% of healthcare infrastructure and manpower is said to be concentrated in urban areas, where only 27% of India's population reside.¹⁰ Government preventive healthcare facilities are characterized by shortages in personnel, lack of vaccines and other medical supplies, and educational materials pertaining to the transmission of tuberculosis. Furthermore, many of these facilities are located at inconvenient distances from the vulnerable populations, which in turn, prohibit access to any available health services as a result of curtailed mobility. This inaccessibility of healthcare facilities and tuberculosis education programs translate into a lack of knowledge about the causes, transmission, and treatment of tuberculosis, along with a heightened risk of the disease's propagation. An observational study in a tuberculosis-ridden slum of Mumbai revealed that its inhabitants were aware that "germs" played a causal role in the disease, but they were unable to explain how this related to their living conditions, family practices, and nutritional status. Moreover, the nearest primary healthcare center was inaccessible to the affected area.⁶ In short, without accessible governmental tuberculosis education programs, populations vulnerable to tuberculosis do not have the knowledge or a firm societal support system

to take preventive measures in order to combat the disease.

From an attitudinal perspective, India has also been criticized for its excessive research and developmental focus on the fields of tertiary care and new biology, rather than the pressing public health issues that the nation faces. As a result, these achievements in medical research have had little impact on healthcare delivery and the combating of infectious diseases that are the primary causes of mortality and morbidity among the Indian population.¹¹

Tuberculosis in India remains a social disease, and therefore, must be addressed through a widespread program of social health. With the advent of efficacious pharmacological agents and the rise of biomedicine, discourse on tuberculosis has rigidly been defined and characterized in India by literature that stresses the use of antibacterial drugs in a curative framework. Rather than considering the social factors of disease, attention has increasingly been shifted to the individual and his/her behavior rather than the behavior and assumptions of the society as a whole. An effective program of social health to combat tuberculosis in India will be one that considers economic inequalities that arise from the existence of the rich and the poor, the social inequalities that contribute to gender and age differentials in disease susceptibility, and the access barriers to tuberculosis prevention and education services that face individuals who need them the most.

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MICROBICIDES SOUTH AFRICA *continued from page 9*

were conducted as in-person interviews at the clinic. The sexual behavior form (SBF) was administered two weeks following enrollment, and thus covered the same period of time as the coital diary. The SBF addressed questions of condom use, vaginal hygiene and sexual relationships. The demographic questionnaire (DEM) was administered at the time of enrollment. The DEM addressed basic demographic inquiries such as age, education, residential and relationship details, employment, as well as questions on HIV/AIDS knowledge and awareness, perception of HIV risk, and previous experience with HIV tests.

Coital diaries were poorly designed, and therefore were often incomplete and inconsistent. Because it was unclear as to the date (at which point in the week) each woman would start completing the diary, only the last 8 days of each diary were counted to ensure consistency across all diaries. Individual sex acts were classified into 27 categories, accounting for both known and unknown variables. For example, vaginal sex with a regular partner and no condom use was accorded its own "sex type" category. Individual sex acts were tallied first by day, and then by week. Due to the low number of sex acts per week, all data from the coital diaries were aggregated to the week.

RESULTS Demographic Profile The age of the women in the study population ranged from 15 to 55. Approximately 70% of the women surveyed in this study were under the age of 30, and 50% were under the age of 25. 29% of the study participants never attended high school, 53% attended high school but failed to reach Standard 10, and 18% had completed high school or had higher education. 38% of women surveyed cohabit with their husband or regular partner, while the majority (62%) live away from their partner.

Sexual Behavior 65% of women reported at least one sex act over the 8 day period surveyed on the coital diary. Only 17% recorded more than 3 sex acts. Table 4A shows the frequency of the number of sex acts recorded over 8 days. Of these sex acts, 97% were always with regular partners and 84% had exclusively vaginal sex. 71% of women reported sex with a partner who is at least 5 years older.

Condom Use On the sexual behavior form (SBF), 53% of the women reported having used a male condom at least once while 47% had never used a male condom. 17% reported always using a condom. Over the 8 day study period recorded by the coital diary, of those who had at least one sex act, 38% used a condom at least once, while 62% failed to use a condom at all. In terms of condom use decision-making, 36% of women said their partner made the decision and 32% said condom use was decided together. 9.5% said

they decided themselves, while 21% cited "other."

HIV Knowledge and Awareness The study population's HIV knowledge and awareness were very high. For example, 96% of study participants knew that sex with a person infected with HIV/AIDS is a means of HIV transmission. No more than 16% of the participants were incorrect about how HIV is transmitted. 93% believed it is possible for a healthy-looking person to have HIV.

HIV Perception of Risk Study participants were also asked to estimate the prevalence of HIV in their community, on a scale of 0-10 individuals out of 10 being infected. About 75% overestimated on the population level of HIV prevalence. However, when estimating in reference to their peer group (women under 30 years), only 40% overestimated the HIV prevalence for this sub-group (which is approximately 50%). When asked "Do you think that you are at risk of becoming infected with HIV?" 94% of women responded in the affirmative.

When asked why they feel at risk for HIV, not using condoms was cited the most often, with an 82% response. An "unfaithful partner" was cited the second most often, with an 82% response. The responsibility of non-use of condoms was attributed overwhelmingly to the partner(s). When asked why they did not use condoms, 78% said because their partner(s) did not want to use them, followed by 31% who said they could not ask their partner to use a condom. No one cited condom availability or price as a reason for not using condoms. Beliefs about condom inefficacy were very low with 3% who said they believed that they did not work. Only 5% said they do not approve of condoms. Only 2.4% cited "no risk of STI or HIV infection" as the reason for not using condoms.

ANALYSIS In sum, in this study population there was an underreporting of number of partners and number of sex acts per week, which are typically low risk factors for HIV. All women enrolled in the study knew they are HIV negative (all were tested for eligibility into the study), yet the overwhelming majority (94%) still felt they were at risk for HIV.

With HIV knowledge high, and perception of the risk for HIV infection high (as measured, for example, by estimates of population level prevalence), one would expect to see more health seeking-protective behavior in the form of condom use. (Condoms were considered available and effective by 95% of the study population). In fact, non-condom use was the most frequently cited reason for why women believed they were at risk for HIV. However, non-condom use was most frequently linked to the partner (78% said partner did not want to use one and 31% felt they could not ask their partner). The majority of study participants – 36% - said that their partner made decisions to use a condom. Although 32% said they made the decision with their partner, given the high perception of risk among women in the study, it seems clear that men may have more decision-making power when it comes to condom use.

The following factors were examined to determine if any would increase the likelihood that a condom was used at least once in the 8 day period studied: who was making

the decision to use a condom, age difference between the partners, the education level of the woman, the age of the woman, whether or not the woman was cohabiting with her partner, and the number of sex acts per 8 days (one vs. more than one sex act). The factors were chosen based on a literature review that cited these as possible confounders of HIV infection.

Limitations A major limitation in this data set is the small sample size. Because condom use was so low, testing for positive condom use along this set of variables yielded fairly large confidence intervals, and most odds ratios were not statistically significant. Nevertheless, the data still points to a strong trend of low condom use, particularly when it comes to the partner making the decision on whether or not to use a condom.

DISCUSSION Prevention strategies like the ABC campaign aimed at abstinence, monogamy and condom use are insufficient when women are not in the position to refuse risky sex; women's risks for HIV infection need to be addressed by forms of education and prevention with regard for the relations of power that underscore their lives. Rather than concentrate exclusively on sexual behavior itself, it is important to develop a more ecological approach to the understanding of high risk sexual practices and why risky behavior persists despite population awareness of its negative health consequences.⁷ For example, in this study population, why was condom use reported to be so low when HIV awareness and perception of risk for HIV were so high among participants?

Several recent studies have focused on the socio-cultural issues surrounding sexual behavior among individuals at risk for HIV infection. A recent study of adolescents in KwaZulu Natal, for example, concluded that sexual negotiation and decision-making were influenced, and often overridden, by a complex set of social and cultural factors which far

outweighed the threat of HIV infection.⁷

The study cited the socio-cultural context of sexual dynamics in the Zulu community, in which sexual negotiation skills among adolescents are not fostered, and in which segregated gender roles are culturally sanctioned. In the polygamous and patrilineal Zulu world view, women are submissive and obsequious, recognized primarily in their role in childbearing, while men are forthright and assertive. These gender roles help contribute to poor sexual negotiation where there is an emphasis on women's fidelity and expression of love through sex, in sharp contrast to the powerful isoka imagery for men, an ideal which appears to be a well-entrenched aspect of Zulu masculinity.⁷

In addition, condoms are seen as symbols of infidelity and lack of trust, and they are linked primarily with prevention of HIV and other STIs, not contraception. HIV, associated with immoral segments of society and promiscuity, is also heavily stigmatized in the community and is a taboo subject of discussion. Therefore, to initiate a conversation on condom use is viewed as an admission, or accusation, of infidelity as well as potential HIV infection, and may have a de-stabilizing effect on intimate personal relationships leading to potential economic instability and/or interpersonal violence. In this way, for many women the psycho-social benefits of unsafe sex over insistence on condom use is a rational choice.⁸

In this complex environment where condoms, HIV and gender roles all have a powerful symbolism attached, condom promotion strategies are insufficient to stop the spread of HIV. For women who perceive themselves at risk for HIV yet do not have the authority to demand condom use by their partners, microbicides, or substances applied vaginally to help prevent HIV transmission, may become an important option for women in the future. As a method controlled entirely by the woman, microbicides acknowledge

TABLE 9 **BELOW FIGURE** Table 9: Odds Ratios for Condom Use According to Various Factors

	Percent Ever used condom In last 8 days	(N)	Odds	[95% Confidence Interval]	
Who makes decision to use condom					
Together	55.00	(11)	1.22222	0.50648	2.94942
Partner	7.41	(2)	0.08000	0.01895	0.33775
Self	80.00	(4)	4.00000	0.44708	35.7878
Other	20.00	(2)	0.25000	0.05309	1.17726
Age difference between partners					
Within 5 years	39.39	(13)	0.65000	0.32334	1.30667
Partner is 5 years younger	0.00	(0)	0.00000		
Partner is between 5 and 9 years older	37.35	(31)	0.59615	0.38213	0.93005
Woman's education level					
Below high school	33.33	(11)	0.50000	0.24246	1.03109
High School	45.00	(27)	0.51515	0.49200	1.36062
Standard 10 (High School degree) or higher	25.00	(6)	0.33333	0.13232	0.83973
Age of woman					
15-19 years	40.00	(6)	0.66667	0.23729	1.87297
20-24 years	56.76	(21)	1.31250	0.68491	2.51515
25-29 years	35.71	(10)	0.55556	0.25645	1.20350
30-34 years	23.08	(3)	0.30000	0.08256	1.09006
35-39 years	16.67	(1)	0.20000	0.02537	1.71188
40-44 years	22.22	(2)	0.28571	0.05935	1.37534
45-49 years	25.00	(1)	0.33333	0.03467	3.20451
Cohabiting with partner					
Yes	42.42	(28)	0.73684	0.45225	1.20053
No	31.37	(16)	0.45714	0.25303	0.82590
Number of sex acts per week					
One	36.67	(11)	0.57895	0.27552	1.21656
More than one	37.93	(33)	0.61111	0.39632	0.94232

the socio-cultural context of sexual behavior, and how women may not be able to demand condom use yet still require protection from sexually transmitted infections.

Microbicides are currently in the early stages of development and, unlike vaccines, have yet to receive private sector funding. With results like the ones from this study, showing that an overwhelming majority of women consider themselves at risk for HIV but who are unable or unwilling to demand condom use, microbicides represent a viable prevention strategy. The potential impact of microbicides worldwide is estimated to be huge. In 2002, computer modeling studies by the London School of Hygiene and Tropical Medicine determined that a 60% efficacious microbicide introduced into 73 low income countries and used by only 20% of women would avert 2.5 million HIV infections over three years in women, men and infants.⁹ With rates of HIV infection increasing among women worldwide, microbicides are a promising alternative in the absence of an HIV vaccine. The use of social science methods in examining sexual behavior, and the political, economic and socio-cultural context of the HIV epidemic will be critical in fighting the global AIDS epidemic.

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SARS CHINA POLICY CRISIS *continued from page 11*

information flow; however, the constraints the media face in China make effective communication more complicated.

The Media in China Propaganda departments often set guidelines for the media that emphasize stability and positive news. Propagandists often order a blackout if a topic is deemed too controversial. The early days of the SARS outbreak illustrated this phenomenon. In February 2003, SARS began to spread through Guangzhou's hospitals. Using their contacts in the hospitals, journalists started interviewing hospital staff about the mysterious disease. As the first articles ran, the Communist Party propaganda department prohibited further reports on SARS "to avoid public fear and instability." The media proceeded to report on various aspects related to the spread of SARS, such as the haphazard buying of medication and governmental restrictions against price gouging. Finally, the propaganda department ordered a general blackout on all reports of SARS except for official statements. These restrictions only extended the fuse for the SARS powder keg, ending with the explosive accusation of a cover-up by retired military surgeon Jiang Yanyong. This revelation catalyzed the government into addressing SARS and other news in a more open manner.

SARS Changes the Media China's media has become freer because of SARS. For example, May 2003 marked the Chinese government's first official public acknowledgement of a military accident. Military accidents had earlier shared the same cloak of secrecy that shrouded disease outbreaks. In early May, an oxygen shortage on Submarine 361 suffocated all 70 sailors onboard. The media was allowed to provide national coverage of Wen Jiabo and Jiang Zemin's memorial for the families of the deceased. Public outcry for greater transparency in the government in light of the earlier SARS cover-up factored centrally in this reversal.

There were also direct changes to the way the media functioned. The subscription model for newspapers was overhauled in June 2003. Instead of relying on forced state patronage, the government finally required newspapers to seek their own subscriptions. Newspapers started competing with each other for business. Thus, they started reporting more interesting events, such as scandals, corruption, and disease outbreaks. In February 2004 the government officially endorsed the media as one of eight measures to control corruption, which further emboldened the press. There clearly remains a problem with local officials not fully communicating with the central government. Therefore, the media has a role in bringing corruption to the attention of the central government.

These changes reveal some fundamental changes in the media's operation and how its role has been expanded beyond acting as a political mouthpiece. China can still improve, as demonstrated by one particularly egregious incident involving a Ministry of Health website. The site

provided links to outside news sites reporting on SARS. However, the links actually pointed back to their own servers, which housed duplicate pages of those linked to supposedly “outside” sources. Thus, the appearance of a broad range of new sources is apparent while the government still retains ultimate control of what users can see. The government’s lack of trust to the people nevertheless continues to be a major obstacle to the media’s freedom. If left unaddressed, the people’s distrust could mirror the government’s distrust of the people.

HIV/AIDS Policy Changes While China’s policy changes as a result of SARS seem very uneven, one area of progress is AIDS. Indeed, the country has made it a point to address the AIDS situation, going as far as making it a focal point in the 11th Five Year Plan, marking the first time the government considers public health a priority. In the past, economic growth has been the driving force of the Five Year Plans. Although SARS caused its share of problems, it has not become “China’s Chernobyl”. However, the government realizes continued focus on economic growth at the expense of public health will lead to social discord. China has specifically made HIV/AIDS a central target of public health intervention in the 11th Five Year Plan.

The government’s response to SARS and AIDS shared some parallels in the beginning stages. These included periods of official denial and cover up attempts. The Henan blood scandal caused an equally large out roar in the international community as SARS did when the world truly realized the extent of the problem. Commercial blood collection companies operated heavily in rural areas, particularly Henan province. Farmers sold their blood to augment their income from farming. Unsanitary practices, such as pooling of blood, reusing needles, and not sterilizing equipment lead to estimates as high as one million infected people. However, the experience from SARS has influenced the government’s approach to AIDS. SARS exposed several health system inadequacies; which not only affected the handling of SARS but of AIDS as well. For example, the sluggish response to SARS was in part due to the lack of a central command center that could direct the country’s efforts. Another problem was the lack of a large scale surveillance system to track SARS cases. Such a surveillance system is essential in containing any infectious disease outbreak. The creation of a central coordinating office and a surveillance network for HIV/AIDS was inspired by the effectiveness of similar mechanisms employed against SARS. Such a direct application of experience from SARS is encouraging and the more progressive policies created as a result of SARS are indicative of farther reaching change.

Macro-Level Policy Recommendations The conservative role of politics and history makes policy change on a macro level hard to implement. Consider free communication, which China has historically not encouraged. As shown by SARS, restricting transparency often creates more panic than an upfront admission would have. Media blackouts did not prevent information from getting out as mobile phone users text-messaged each other about the first cases of SARS. Many of these messages were rumors and in the

absence of official reports, caused even more confusion. Once the central government became transparent with SARS, it was quickly brought under control. Free flow of information builds trust in the government. Instead, China is regressing on this issue with plans for mandatory registration of all mobile phone users. This would make anonymous text-messaging almost impossible, making it easy for the government to control information and “improper political commentary.” This action demonstrates a lack of trust of the people by the government. The removal of personal freedoms combined with poorly controlled disease outbreaks can lead to the instability the government fears so much. A level of trust is not only needed between a government and its people, but also with other nations. Freer communications can increase trust between China and other nations as well as within its own borders.

Conclusion The challenges presented by SARS serve as a good indication of how China will respond to future difficulties. Only after serious problems with international cooperation and media transparency was China able to handle the domestic and international pressures from SARS. Public health is an essential issue that cannot be ignored. While some progress has been made in improving relations with international agencies such as the WHO and in giving the media more freedom, the lessons from SARS must continue to be applied. Otherwise China’s peaceful rise will end in a violent crash.

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MALARIA SEX DIFFERENCES *continued from page 13*

through 10 dpi, with a return to baseline by 21 dpi. Female IFN γ -/- mice showed an initial decrease in body temperature, with a return to baseline at 10 dpi and a subsequent relapse at 14 dpi, which is quite different from the female WT mice. The male IFN γ -/- mice demonstrated a consistent drop in body temperature through 10 dpi with a return to baseline at 14 dpi in a pattern similar to that as the WT mice. Male IFN γ -/- mice exhibited more hypothermia at 10 dpi than females, although females showed increased hypothermia at 14 dpi.

Body Mass: Female WT and RAG1 mice lost less body mass than their male counterparts. μ MT and TCR $\beta\delta$ mice showed a decrease in body mass through 10 dpi with a return to baseline by 21 dpi. μ MT males lost less body mass than females at 3-5 dpi. TCR $\beta\delta$ males lost more body mass than females at 3-7 dpi but that difference was no longer present at 10 dpi. Female IFN γ -/- mice showed an initial decrease in body mass, with a return to baseline at 10 dpi and a subsequent relapse at 14 dpi, while the male IFN γ -/- mice

demonstrated a consistent drop in body mass through 10 dpi with a return to baseline at 14 dpi; the dimorphic response to infection resulted in male IFN γ -/- mice to exhibit a greater decrease in body mass than females at 10 dpi, although females showed a greater decrease at 14 dpi.

Anemia (% Red Blood Cells): In WT mice, females had less severe anemia (higher % red blood cells) than male mice. In μ MT and TCR $\beta\delta$ mice, both males and females exhibited a decrease in red blood cell percentage through 10 dpi with a return to baseline at 21 dpi. RAG1 mice showed a similar pattern for both males and females with a decrease through 7 dpi. Female IFN γ -/- mice showed an initial decrease in red blood cells with a return to baseline at 10 dpi and relapse at 14 dpi. Male IFN γ -/- mice showed a consistent drop through 10 dpi with a return to baseline at 14 dpi. Males indicated more severe anemia than females at 10 dpi, although the female anemia was more extreme by 14 dpi.

Parasitemia: In all strains, peak parasitemia was reached at 7 dpi. In WT, μ MT, and RAG1, this peak was followed by a reduction in parasitemia. TCR $\beta\delta$ and IFN γ -/- mice, however, showed an additional increase in parasitemia at 14 dpi after reaching peak parasitemia at 7 dpi. WT, μ MT, and IFN γ -/- males exhibited higher parasitemia than females, whereas TCR $\beta\delta$ and RAG1 mice showed similar parasitemia counts in both males and females. Both male and female IFN γ -/- mice showed the highest parasitemia in the acute phase (prior to reaching peak parasitemia) whereas TCR $\beta\delta$ mice reached the highest peak parasitemia when compared with the other strains.

Mortality: Across all strains, males were 3.5 times more likely to die from malaria infection than females according to a Cox Hazard regression analysis (95% CI: 2.13, 5.71). In WT mice, males (20%) were more likely to die from infection than females (0%). Based on log rank analyses, female μ MT, TCR $\beta\delta$, and RAG1 mice showed prolonged survival over males. As such, the average day of death was significantly earlier for males than females in μ MT (m = 8 dpi, f = 13 dpi), TCR $\beta\delta$ (m = 10 dpi, f = 21 dpi), and RAG1 (m = 8 dpi, f = 14 dpi) mice. IFN γ -/- mice indicated similar survival rates for both males (47%) and females (53%), although males began to die sooner than females.

DISCUSSION Among the male mice, the removal of T-cells, B-cells, or both T- and B-cells resulted in an increased chance of death and a higher evidence of morbidity, as measured by body mass, body temperature, anemia, and parasitemia. Females, on the other hand, indicated increased mortality with the removal of B-cells, T- and B-cells, and IFN γ -/- mice. This suggests that both T- and B-cells play critical roles in the clearance of acute parasite infection as well as in the recovery stage. Therefore, both Th1 and Th2 modes are utilized in the rodent immune response.

Male mice exhibited higher morbidity overall than females for the RAG1, TCR $\beta\delta$, and μ MT strains. Removal of either T- or B-cells resulted in 100% male mortality whereas removal of both T- and B-cells resulted in 100% female mortality. The disparity between male and female responses was greatest in the RAG1, TCR $\beta\delta$, and μ MT strains. Because innate immune mechanisms are intact among

RAG1, TCR $\beta\delta$, and μ MT mice, sex differences in infection may be a function of the innate immune responses of macrophages, dendritic cells, and natural killer cells.

With the mice lacking IFN γ , similar mortality was observed between males and females. This was the only strain to successfully abolish the sex differences in mortality. The IFN γ produced by WT and μ MT mice came from all cellular sources, including NK cells and T-cells. On the other hand, only innate immune cells (e.g. NK cells) were responsible for IFN γ production in the RAG1 and TCR $\beta\delta$ mice. The IFN γ knockouts were the only mice not to have innate immune cell-produced IFN γ , and, in fact, no IFN γ at all. Therefore, the absence of IFN γ from both innate immune cells and T-cells are necessary to remove the sex difference in mortality. This also indicates that IFN γ is necessary for both the clearance of parasites during the acute stage of the infection (Th1) as well as in the recovery phase (Th2). Based on morbidity results, the complete lack of IFN γ was more detrimental to the females than the males when compared with wild type males and females. This could indicate an increased reliance on IFN γ in females for protection from infection.

While our original counts of 15 males and 15 females of each strain presented a relatively large sample size for this type of a study, mortality was a measured source of data. The TCR $\beta\delta$ and μ MT strains resulted in 100% male mortality and 100% female mortality, which were reached with the RAG1. As such, data regarding recovery from infection could not be completed for all mice, significantly decreasing the sample size used in statistical calculations. Additionally, the B-cell deficient mice can occasionally have “leaky” knockouts which do not completely remove all B-cell components. This too might adversely affect the statistical data.

Further investigation into innate immune responses in malaria infection focusing on the exact mechanisms of that innate response would be warranted. This could examine the specific roles of innate immunity components in the clearance of parasites and the recovery of infection. Additionally, further research into the possibility of IFN γ -mediated sex differences in infection could examine other indicators of malarial infection and the interplay of IFN γ with other cytokines.

CONCLUSION In many vertebrates, the severity of parasitic infections can differ between the sexes. This study indicated that innate immunity may be responsible for sex differences in rodent malaria infection with *P. chabaudi*. Specifically, IFN γ played a crucial role in this study. Once IFN γ was completely removed from the immune response, all mortality differentiation between males and females was abolished. As little is currently known about the mechanisms mediating these sex differences in humans as well as other species, further investigation is necessary for potential medication and vaccine development.

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interest lies in the epidemiology and microbiology of infectious diseases. She serves on the executive boards of the Public Health Student Forum and JHU Mock Trial Association and is an active member of the Hopkins Symphony Orchestra and Alpha Phi Omega.

Contributor Roles Ms. Klein and Ms. Garver, a PhD candidate at the Bloomberg School of Public Health, collected and evaluated all samples and data. Statistical analyses were performed by Ms. Garver and Dr. Klein, who is a Research Associate at the Bloomberg School of Public Health. Thanks to Dr. Klein for revisions on this paper.

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Terminology ^aA cytokine produced by the immune system in response to an infective agent. ^bThe measurement of an organism’s parasite load calculated as % infected red blood cells in a specific visual field.

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to prevent any form of radiation exposure or deliberate tampering. The repository is designed by using detailed science and engineering methodology. Radiation barriers include outer carbon steel sets to prevent any flow outside the structure, gas (water vapor, carbon dioxide and nitrogen) to stabilize the radioactive isotopes, stainless steel, a titanium drip shield, and crushed tuff ballast.¹ Potential geological rock structures are chosen for their long-term stability and their ability to contain a facility as large enough to store massive amounts of spent fuel. Groundwater flow, corrosion and solid mass movement (mudslides), are all natural environmental processes that have been incorporated into the design of the repository because of their potential ability to transport radioactivity to human and living habitats.¹² Despite recurrent models illustrating geological stability, it has been postulated that drilling deep into the ground can destabilize solid rock structures.¹³ Mineral complexities in rock strata lead to a host of physical variations, and long-term methods to predict the behavior of these natural geological barriers remain uncertain.¹³

Nuclear Waste Reprocessing Nuclear phase-out critics have pointed to reprocessing as a possible way to both recycle the fuel for future use and to also reduce the amount of long-term radioactivity.¹ Reprocessing can reduce the amount of radioactivity of natural uranium by 10 to 15 percent by a process called PUREX (plutonium uranium extraction), which separates uranium and plutonium from other isotopes. PUREX, however, has been cited to be a potential security hazard.¹⁴ The fuel pellets are divided up by a laser behind lead shields, and then dissolved in boiling nitric acid, emitting radioactive gases in the process. The plutonium is then extracted from the acid solution leaving large amounts of high-level radioactive liquid waste ("sludge") behind. The cooling process takes several years and many plants do not consider the process economical.¹

Surface Storage Containing the radioactive waste on site in large concrete casks for several decades is another alternative to immediate repository storage.¹⁵ Using this method, the waste from all nuclear power plants in a country could potentially be shipped to 'one roof', or one national location, so that monitoring and security measures are better facilitated. There are several benefits for keeping the waste on the surface and sealed, the major reason including that over time, fissile materials cool down, making them easier to handle and transport.¹⁵ Therefore, prolonged storage may be beneficial because it reduces the potential for a release of very dangerous radioactive material due to transport, handling or a possible attack. With the improvement of medical and industrial technology, the cooled down waste products may actually be beneficial in other applications as well.¹⁶ On-site surface storage has been criticized, however, in light of security concerns. Actual construction would have to take place hundreds of miles from residential locations to ensure distance in an event of radiation release.

Conclusion Due to the nature of such wastes, it has been postulated that if society was to continue producing

radioactive material, the probability of a secure energy future is not as high when compared to renewable energy.¹³ These precise hazards imposed on society from radioactive waste generation, as well as the possibility of a technical malfunction, have lead several countries to reconsider their dependence on nuclear fuel, as in the cases of Sweden, Belgium, and Germany.

Case Studies 1. Sweden

Ironically Sweden has one of the world's most abundant supplies of low grade uranium totaling to about 10,000 metric tons of uranium in ores containing between 500 and 2,000 grams of uranium per ton.¹⁷ In addition to large uranium reserves, Sweden has largely internalized the production of nuclear energy production, having local conversion, enrichment, fuel fabrication, interim storage, and most importantly two candidate sites for deep geological repositories. The Swedish nuclear program began in 1945, around the same time as the programs in the United States and France. By 1978, there were 12 nuclear power plants running on nuclear technology, and by the late 1980s, nuclear power constituted about 30 percent of the total national electricity supply. During the last few decades, Swedish energy consumption has been characterized by falling oil consumption and rising electricity consumption. By 1990, the country was consuming about 440 TWh of electricity, with 145 TWh coming from nuclear power.¹⁸

By 1972, after the completion of the fifth reactor, it was evident that the use and expansions of nuclear power in Sweden was increasingly dominated by partisan conflict over safety and regulation. Despite efforts to rationalize the use of the reactor by emphasizing the technological advantages over fossil fuels, the event at Three Mile Island drove the Swedish government in 1980 to phase out nuclear power by 2010. Since the 1980s the Swedish government has decided to de-couple the electricity sector from federal to private control, thereby increasing investments in natural hydropower reserves and solar power plants.¹⁹ By 2001, renewable energy constituted about 29 percent of the total primary energy supply, with improvements in biomass fuel (six percent increase since 1970), hydropower reserves (four percent increase since 1970) and wind/solar power (3 percent increase since 1970).¹ Nuclear energy in 2001 was lowered to 36.5 percent of the total primary energy supply and maintaining the decision to phase out will require additional resource development.¹ Recently, the Swedish government mandated the production of renewable energy to increase from the current six TWh, of a total of 150 TWh, to 16 TWh hours in the next eight years, and stipulated that a certain quota of all electricity bought by consumers must come from solar or wind power or biomass. This system, although more expensive than fossil fuel energy, is subsidized by another mandate, called 'green certificates'. In a system of 'green certificates' electricity suppliers who buy renewable electricity must also buy a green certificate for each megawatt hour sold.¹⁸ Producers are thus paid twice, from both the electricity and from the certificate. This policy was designed to compensate for the higher cost of renewable energy. Therefore, the prospect of renewable energy as a

viable substitute for nuclear power holds truer today than in 1997.

If renewable energy is able to substitute nuclear energy in Sweden, it is useful to compare the different costs of production (Figure 2). The OECD estimates that nuclear energy costs about 5.9 Eurocents per kilowatt hour, but wind power only costs 4.87 Eurocents per kilowatt hour, and hydroelectric power costs 0.68 Eurocents per kilowatt hour. When comparing the relative costs, renewable technologies are shown to be cheaper than nuclear energy. In addition to comparing the costs of production, another issue to consider is the external costs of production. External costs are defined by economists as the costs of environmental cleanups, environmental legislation as well as public health concerns arising from industry. Although nuclear power has an external cost of 0.7 Eurocents per kilowatt hour¹⁸, it is important to note that the category is calculated by taking into account all environmental incidents that have occurred using the specified fuel. Public health literature defines a 'hazard' to be equal to the toxicity multiplied by the probability of the event occurring.¹⁴ Despite the fact that there have been only two major incidents of nuclear reactors failing, the hazard is a thousand times more dangerous than any other fuel used.

2. Belgium

Belgium's energy supply history is consistent with most of Western Europe, except in the case of coal. Due to increasing environmental concerns with acid rain deposition and mercuric residue in the atmosphere, Belgium ceased all coal mining operations in 1991²⁰. Although coal still represents about 13 percent of the total primary energy supply in Belgium, nuclear power has largely replaced most forms of electricity production. Additionally hydrocarbon resources such as oil, gas and coal are imported from abroad. Even uranium amalgams are imported from the Congolese region in Africa, for Belgium contains no substantial reserve for nuclear fuel.

Since the second half of the twentieth century, Belgium has been experiencing population growth, resulting in a significant increase of electricity demand. During the period 1950-1970, primary energy consumption grew on average 3.9 percent.²⁰ As a result of the three oil shocks in the 1970s, Belgian nuclear facilities increased from two to four, in order to buffer the rising cost of electricity production. This decision was largely centered around Belgium's desire to decrease its market vulnerability to imported fuels.^{18,21} In terms of macroeconomic benefits, nuclear energy production had the potential to offer stable prices with decreased dependency on imported fuel. In light of the international talks on climate change and industrial pollution, Belgium saw the nuclear industry as a way to reduce CO₂ and SO_x emissions as well.^{18,21}

By 1962, Belgium had adopted its first experimental reactor, the BR3 Mol, and commercial application began in 1974. By 1985, Belgium was operating four current nuclear reactors, and all electricity production came under the company Electrabel. Unlike Sweden electricity production has always been deregulated into the private sector with

limited government involvement, increasing the potential for alternative energy development. After the two accidents in Three Mile Island and Chernobyl, the Belgian government in 1988 planned to cease further construction of nuclear facilities, despite a planned design of a fifth reactor. The decision to phase out power, however, was not a significant policy debate in Belgium until 2000.⁵ By 2002, the Belgian parliament had passed a bill to close down the first nuclear reactor by 2014 and to phase out all nuclear power by 2025.²² Reasons for phasing out nuclear power included the problem of spent fuel storage and public health hazards.²⁰

Public health concerns of spent nuclear fuel, however, are especially important in a country such as Belgium. Belgium is a country of 30,514 square kilometers with 10.2 million inhabitants. It has a high population density of 335 persons per square kilometers with over 95 per cent of the population is classified as urban.¹⁸ Therefore, the possibility of a nuclear malfunction would be catastrophic in such a small country. Although three of the four nuclear reactors are located on the periphery of the country, Belgium borders France and Germany, two other countries with relatively high population densities as well. Additionally, with one disposition site, Belgium runs the risk of overstocking its spent fuel pools – an event which could lead to an overheating of the pools and a consequent nuclear accident. Renewable alternatives, however, remain a pending question. Currently, about 3 percent of the total electricity production is directly from renewable energy in the form of hydroelectric and wind power.⁷ Although in 2001 the Belgian government set a goal to increase renewable contribution to 6 percent by the year 2014,²² this still would not compensate for the absence of nuclear energy. The renewable sector primarily consists of wind (0.9 percent of total renewable energy supply), hydropower (6.3 percent), and biomass fuels (92.8 percent). Although the Belgian Walloon region's Soltherm Program was set to develop a sustainable solar-water heating industry in the region by the year 2010, this is one of the only examples in Belgium where local authorities are funding the expansion of renewable industries, and is cited as being the most active.²¹ Furthermore, because Belgium has a highly deregulated electricity system, the continued responsibility for achieving the targeted renewables share lies primarily with the individual management at the regional level. Green certificate systems similar to Sweden are largely dependent on regional electricity supply – and with the supply being variable, these trends are difficult to predict for the whole country.

Renewable energy growth trends in renewable energy remain promising. After Chernobyl and TMI the Belgian government increased renewable investments by 8.91 million US dollars,¹⁹ with a 16 percent funding increase per year for wind power, and a 4 percent annual increase in solar power development. Although the success of this sector is largely dependent on the investment by both local and federal bodies, it is often regarded as the most expensive type of energy production.¹³ Additional government funding for research and development projects will therefore have to be invested before renewable energy can become a nuclear

substitution.

3. Germany

Nuclear energy research and development has been supported by the German government since 1956 under atomic energy programs, and since 1977, under many general energy programs. In 1977, the German parliament passed a bill that included a special levy on electricity consumption to support the use of domestic hard coal, nuclear energy, and renewable energy sources.

In 1987, a licensing dispute caused the shut down of the Mulheim-Karlich PWR reactor because of its outdated engineering design. In response, the country started working closely with France to develop a European Pressurized Water Reactor (EPWR), which was equipped with more safety and self-shut down mechanisms. In 1998, after pending legislation was finally passed, the German government voted to phase out nuclear power by 2020 due to cited concerns of environmental security and public health.²³ The platform of German leadership also included many provisions for renewable energy research and development, and currently the Germans are among the leaders in innovative energy solutions. In December of 2004, Germany opened the world's largest solar park – a joint project executed by Shell Solar, GEOSOL, and WestFonds. The power generated from the solar park will be able to meet new energy demands of about 1 800 households and save about 3 700 tons of carbon dioxide emissions annually.²⁴ Six percent of the total electricity supply now comes from renewable energy, with the main channels including biofuels (69 percent), hydropower (17 percent) and solar/wind power (14 percent).¹⁹ Furthermore, Germany holds more than a third of global wind power capacity and two thirds of solar/ photovoltaic capacity installed in the European Union.¹⁹ Under the EU Directive for Electricity Produced from Renewable Energy, Germany has emerged as the leader in all of these research areas and commits to increasing the share of renewable energy to 25 percent by the year 2020. The success of the industry has been attributed to the government research support and funding for other development programs.

Discussion Successful phase out of nuclear power requires a diverse solution set which spans energy demands of the present and the future¹³. The increased development in renewable alternatives, and well as current efficiency improvements to diesel and gasoline fuel will pave roads in mitigating global climate change by reducing aerosol emissions. On the policy side, coordination between government, industry, and the public will be required to ensure the transition from nuclear to alternative fuel sources. As the international community therefore grapples with the nebulous question of sustainability, this emerging energy revolution marks a sober realization of the increasing connection between national security, the environment, and public health.

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HURRICANE KATRINA HEALTH continued from page 19

One of the more obvious health effects of Katrina is emotional distress on the affected population. In the future, there is expected to be much anxiety about lost family members, jobs and housing situations. A large number of people may suffer from PTSD and other anxiety disorders.⁶ Many people are unemployed and in surveys have indicated emotional concerns among members of their family. Nearly half of the respondents of a recent CDC investigation had high levels of distress and dysfunction, indicating the necessity of mental health services. However, the CDC's research indicates that only one fourth said a household member needed counseling services, and few had used any counseling services, demonstrating the strong possibility that many Katrina victims may not yet have recognized their symptoms.⁸ Clearly this major acute incident has created emotional stress, physical displacement, and lifelong disability that have increased residents susceptibility to other harmful health conditions.

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BACTERIAL VAGINOSIS *continued from page 21*

and poor pregnancy outcomes? Finally, is there some method or treatment that women can use to prevent BV?

Bacterial vaginosis cannot be categorized under a specific category of acute or chronic. It can be labeled as both because it is easily treatable with simple prescription drugs, but it is an often recurrent condition that leads to long-term risks of pregnancy complications and STIs.

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BALTIMORE CHRONIC *continued from page 22*

risk of developing cancer as compared to residents of other states. In comparison with these state averages, Baltimore reported similar levels of incidence of not only all cancers in general, but comparable rates amongst the different types as well.¹ These statistics indicate that while Baltimore's incidence and mortality due to cancer may be high on a national scale, they are on par with other counties and cities in Maryland itself. In addition, Baltimore has rates comparable to the rest of Maryland, as well as the entire United States, in the top ten leading causes of death. Heart disease is the leading cause of death in Baltimore as it is across the nation, with an incidence rate of about 240 per 100,000 people. In fact, Baltimore only varies significantly from the state and national averages in one leading cause of death besides cancer. The rate of septicemia in Baltimore is twice as high as the rest of the nation. Similar to the incidence of cancer, however, this rate is concordant with that of the state of Maryland.⁵

As is evident through analysis of statistics, Baltimore is affected more heavily by certain chronic conditions than the rest of the nation. These chronic conditions include asthma, substance abuse, sexually transmitted diseases, and septicemia. Nevertheless, with other illnesses, Baltimore citizens are affected at a level similar or equal to residents of other cities across the country. Ultimately, however, the biggest disparity arises between Baltimore and other U.S. cities when access to health care and treatment for these illnesses is considered. Approximately one-fifth of the families in Baltimore

live at or below the poverty line. This accounts for a rate that is almost twice the national average. In concordance with this disparity in economic status, there is a disparity also in access to health care. Poor, uninsured families are often not able to afford the proper health care to treat their medical ailments. Although Baltimore has some diseases which affect its residents disproportionately when compared to other cities across the U.S., the most important discrepancy is between economic status and ability to access health care. Until these social causes are corrected, Baltimore citizens will continue to suffer from health problems at a higher rate than their peers in other American cities.

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CHRONIC HOMELESSNESS *continued from page 23*

may be purposely stored for further use by the homeless. Homeless individuals allow this water to accumulate which can serve as a breeding ground for mosquitoes.

In addition to the problems listed above, most of the homeless population suffers from being uninsured. In 2003, 45 million Americans did not have health insurance. If a homeless individual is infected with West Nile Virus, lack of health insurance may cause the virus to go undetected or untreated and lead to serious health complications. This happens because homeless individuals discourage themselves from seeking medical help due to their inability to pay for it.

The factors mentioned above pose a difficult challenge for health care providers to protect the homeless population from acquiring West Nile Virus. Despite this, there have been efforts by health clinics specifically for the homeless community to protect them from becoming infected by West Nile Virus. One specific example is the Fourth Street Clinic in Salt Lake City, UT. The Fourth Street Clinic provides primary health care to the Salt Lake City area's homeless population. During the summer of 2005, the Fourth Street Clinic, in collaboration with other homeless service providers, convened a West Nile Task Force. The task force targeted several areas in Salt Lake City frequented by homeless individuals to distribute

mosquito repellent that contained DEET. The West Nile Task Force was able to reach approximately 130 homeless individuals educate them about WNV and distribute DEET products. This project was considered a small success and more elaborate efforts are planned to reach all homeless individuals in the area. This outreach campaign may serve as a model for other communities and assist in planning emergency services for the homeless.

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BIRDS AND HUMAN HEALTH *continued from page 25*

as cancer, have complex multi-factorial etiologies and the need for multi-pronged public health prevention strategies. Any one of these individual areas can be a lifelong effort, but to really solve public health problems you need to work across disciplines. This year Gerald Wogan was awarded the General Motors Cancer Foundation Mott Prize, which is given for the most outstanding recent contribution related to the cause or prevention of cancer. The bigger prize is probably the recognition that while one can plan a career in a linear way, it is often those unusual and unexpected opportunities which can change the course of your path if one is flexible enough.

HANAKAHI DNA RESEARCH *continued from page 26*

cell viability, and could be used to augment traditional radiation therapy.

Searching for additional pieces to the human NHEJ puzzle To understand how a complex machine works we need to identify all of the pieces that go into making the machine function. While several of the factors required for NHEJ in human cells have been identified, genetic evidence clearly indicates that one or more additional factors have yet to be identified. Graduate student Brenda Salerno will use biochemical approaches to isolate and identify additional factors necessary for efficient human NHEJ. Once all of the protein factors that participate in human NHEJ have been identified, we will be able to begin to truly understand how the human NHEJ apparatus functions, how it can fail, and how it may be controlled.

Using a virus to investigate the molecular mechanism of human NHEJ In an orthogonal approach to investigating NHEJ, graduate student Timra Gilson has begun to study the action of viral oncoproteins (proteins that cause cancer) on the human NHEJ apparatus. Adenovirus is a double-strand DNA virus that, during infection, knocks out the human NHEJ apparatus. Investigating the role of the adenoviral oncoproteins in NHEJ inactivation may help us to understand the human NHEJ apparatus – how it works and what its weak spots are. Such investigation might reveal ways in which we might discover or design therapeutic agents to control the efficiency of human NHEJ.

An understanding of the effect of the role of adenoviral oncoproteins in the inhibition of human NHEJ also will illuminate a previously underappreciated and intriguing aspect of the interaction of adenoviruses with their host cells. A comprehensive description of adenoviral oncoprotein action within the NHEJ pathway may also suggest targets for potential antiviral agents for other DNA viruses that depend upon inactivation of NHEJ in their growth cycles.

Conclusion The repair of DNA DSBs is critical for cell viability. As such, an understanding of the mechanisms that repair DNA DSBs in human cells is of great interest. Comprehending how DNA DSBs are repaired by NHEJ will allow us to understand how this apparatus may fail to function – often with oncogenic consequences. Knowledge of how this mechanism works may also provide us with insight as to how it may be controlled – DNA DSB repair in tumor cells might be decreased to augment traditional radiation therapy. My laboratory combines a traditional basic science approach with translational research in an effort to understand human NHEJ and to discover drugs that might modulate human NHEJ in cancer cells.

THE PERSISTENCE OF TB *continued from page 27*

Drug-resistant TB is becoming an increasing public health problem and poses a significant threat to the disease control in some parts of the world. Improved understanding of the mycobacterial persistence and the mechanisms of drug

resistance, as well as developing drugs that are active against drug-resistant and persisters bacteria, are critical for better control of TB.

The current research my lab focuses on addressing the problems of TB drug resistance and persistence, which represent two major challenges for TB control. We are working on understanding the biology of mycobacterial persistence, mechanisms of action of the first-line TB drug pyrazinamide (PZA), new mechanisms of isoniazid and PZA resistance, development of molecular tests for rapid detection of drug-resistant TB by using microarray, development of TB drugs that target persisters TB bacteria in order to shorten the current lengthy TB therapy. In addition to TB research, we also work on the biology of cancer, focusing on cancer stem cells and development of drugs targeting such cells.

The effective control of TB as a public health problem requires a multi-pronged approach and efforts at multiple levels, including political commitment and governmental support, building appropriate health infrastructure, vaccination program, proactive case-finding, and wide expansion of DOTS chemotherapy program. Basic research aimed at finding more rapid diagnostic tools, better vaccines, and above all better chemotherapy that shortens the TB treatment from 6 months to a few weeks, is clearly crucial for more effective TB control. The ecological approach such as improving sanitation, living environment/standard, nutrition, mental or psychological health, targeted mass prophylaxis and immunomodulatory means aimed at tilting the balance in favor of the host is also important for TB control. This model of effective TB control can be applied to the control of other infectious diseases or indeed chronic diseases. As the well known TB researcher and ecologist Rene Dubos said, “to achieve the goal of disease control and public health and Saving Lives Millions At a Time, we need to ‘Think Globally and Act Locally.’”

RIMAL BEHAVIOR AND HEALTH *continued from page 29*

the past three years. Dr. Rimal creates and distributes surveys to the local public in order to raise awareness about HIV and its dangers to the population of Africa. Through these surveys, Dr. Rimal is able to better understand what people think of the disease, such as whether they are aware of precautionary measures and how HIV is transmitted.

Through his research and work, Dr. Rimal hopes to promote less risky behavior and interpersonal concerns about HIV and AIDS. He believes that people’s notions of risk influence their perceptions. In particular, he is studying how people are influenced by societal norms. This led Dr. Rimal to formulate ideas on how to develop interventions which reduce HIV in Africa. Perceived risk (how people’s risk perception of a certain disease affects their behavior) is especially important to the Health, Behavior, and Society department. Specifically, Dr. Rimal studies people’s response to risk perception of HIV and their behavior. He states, “I do hope that the work I do will help us develop effective interventions that can assist people to make healthy behavioral choices and engage in healthy behaviors.”

KATZ INTERNATIONAL FOCUS *continued from page 29*

Nepal Beginnings The data collected in the studies intrigues Professor Katz. Particularly enthralled by the study of biostatistics, Professor Katz received a Bachelors degree in statistics from the University of Cape Town in South Africa and obtained a Masters at Princeton University. Twenty-three years ago, Professor Katz found a position at the Johns Hopkins School of Medicine Ophthalmology department as a biostatistician studying the ocular effects of vitamin A in humans. In the early 1980s, the Indonesian government began a program that delivered vitamin A to communities in order to prevent blindness. The government discovered an approximate 34% reduction in mortality after the first year of study. Based on the Indonesian data, Katz along with others in the department became interested in conducting studies regarding nutrient deficiencies in various countries documented for vitamin A deficiencies. Nepal thus became an area of focus in the late 1980s, and a new project was born.

Experimental results Working in Nepal since 1989, the research team has produced an immense amount of data. Fifteen years ago, Professor Katz became intrigued by one particular finding. In 1992, a group of preschool children in Nepal were given vitamin A supplements every four months. Children who were 6 months and older showed a 30% reduction in their mortality rate compared with those who received placebo supplements. The children who were younger than 6 months, on the other hand, did not similarly show a reduction in mortality rate. Thus, the team attempted to use an alternative method to supply infants with vitamin A supplements at an earlier stage of development. In the second stage of the study, pregnant mothers were provided with vitamin A, beta-carotene, or a placebo for three years. The two specific nutrients are important for immune and barrier functions in epithelial cells, and beta-carotene also has anti-oxidant properties. Approximately 45,000 women participated in the trial. At the end of three years, data revealed that the supplements had no effect on the survival of the infants. However, the supplements did reduce the women's risk of mortality during pregnancy by about 45%. Professor Katz found the results particularly remarkable for several reasons. The team had first hypothesized that the vitamin A and beta-carotene supplements would transfer from the mother to the child while the infant resided in the mother's womb. The results, however, showed that the supplements had no effect on the child's survival but rather that of the pregnant mother. Based on the study, Professor Katz speculates that since the mothers' nutritional levels were extremely low during pregnancy, the mother's body absorbed the nutrition rather than transferred it to the fetus. The study also challenged the assumption that pregnancies are most risky for reasons such as inadequate or lack of obstetrician care and unhygienic environments. This study showed that the nutritional health of the pregnant woman could also impact her survival. The project, as others before it, once again stressed the underlying importance of studying the impact of nutrient deficiencies.

Nepali Politics International relations, politics, and economics all play vital roles in the field of public health. Certain health policies are established by government authorities, political

instability often disrupts access to health care, and a country's economic policies can determine specific allocations of medical resources. The developing country of Nepal has faced and continues to face political challenges that will inevitably affect the health of the population. Since the beginnings of the research project, the team has seen the dynamics of the Nepali political system fluctuate considerably. The project, however, has been able to proceed steadily thus far.

The Nepali project commenced in 1989 when Nepal was still under an absolute monarchy. At one particular point during the project, Nepal and India became involved in a trade dispute which caused massive fuel and kerosene shortages. One year later, in 1990, the monarchy of Nepal was overthrown while communism crumbled throughout Eastern Europe. Although a constitutional democratic monarchy was established, issues including social justice, land distribution, and education continued to be important challenges. In this circumstance, a Maoist movement started taking root in 1994. Analogous to the Shining Path guerrillas in Peru, the Maoist rebels often call for roadblocks and strikes. Although the studies are often disrupted, the research team has nevertheless been able to remain neutral and continue its health work.

Combat Studies have revealed the impacts of nutrient supplements on mortality and morbidity for many years. Katz's international projects continue to uncover ways to reduce mortality and morbidity in under-served populations. Through the efforts of many, vitamin supplements are supplied twice a year to all 75 districts in Nepal. The Nepali government supports a program to announce and deliver the supplements to the community. While the supplements themselves are relatively cheap, the logistics of the distribution process is more complicated and adds to the cost of the program. Although supplements are the way in which vitamin A is delivered in Nepal, other countries have used different approaches to getting micronutrients to those that need them. South Africa is able to deliver micronutrients to the population by fortifying food. Nepal, however, is unable to effectively reach the majority of the population through fortification because food is processed locally while South Africa has some foods that are processed centrally and can therefore be fortified more easily. As the research team continues to work, Katz hopes to discover which nutrients have the most beneficial health effects and how to best distribute those essential nutrients to under-served populations throughout the world.

BIOSTATISTICS AND HUMANITY *continued from page 30*

challenging environment. The department of Biostatistics at Bloomberg offers an extensive training program administered by the leading experts in statistical research including disease surveillance, clinical trials, aging and genetics. In addition to developing skills as a Biostatistician, collaboration with public health faculty and students at Bloomberg provides opportunities to develop expertise in scientific specialties and contribute to projects which are significant to the public health of people in this nation and around the world.

On a personal note, I cherish the friends I have made at Bloomberg and Johns Hopkins. The diversity of the

faculty, staff and students allow opportunities to learn about traditions and experiences from all over the world. The passion for both work and play of the faculty, staff and students is contagious. There is never a dull moment at Bloomberg!

WCHPC POLICY DRIVEN HEALTH *continued from page 31*

order to effectively influence public health practice and policy, academicians must find ways to walk in both worlds or to find partners who can do that for them.

Professor Grason further notes that public health professionals seeking to influence public policies are challenged by demands for “quick fixes.” Our society has come to expect that solutions to all health problems are possible through single, passive interventions, such as surgery or medication. Moreover, our political system is structured such that elected officials seek issues to champion that will yield relatively immediate results, providing them success stories to bolster their next political campaign. Indeed, much progress in health status has been made through medical interventions developed over the last century. Yet solutions to the intractable population health concerns that underlie the acute health problems treated with medicine—such as obesity, substance abuse, and violence—require multi-level interventions implemented concurrently, consistently, universally and over time. It is increasingly clear that policies supporting a lifecourse perspective that emphasizes primary prevention must prevail if further progress is to be made in this 21st century. Today’s challenge for public health practitioners involves rationalizing and focusing available resources in ways that optimize effectiveness of the fragmented health policy initiatives and resource streams that have emerged from our political culture.

To this end, Professor Grason and her colleagues at the WCHPC are developing and disseminating frameworks and models derived from epidemiological and evaluation research to demonstrate the links between health states across life stages and between generations. Recognizing that social factors and that a woman’s environment and resources have strong influences on both infant and maternal health, their models depart from the presumption that solutions are biomedical and can be addressed principally by expanding access to prenatal care. The obvious unhealthy effects of obesity in the American population as a whole, and numerous indications that obesity has harmful effects on childbearing provide an illustration of the nature of Professor Grason’s work. No single strategy appears to be effective in the long term for weight loss in adulthood. There is also a tension between the needs of the fetus and the needs of the mother during the pregnancy with regard to weight gain. The ideal approach to obesity is primary prevention applied in childhood and adolescence. To address this growing problem, the WCHPC team has designed a public health framework to translate data and research into a coherent model of multi-level population-based strategies aimed at addressing health problems like obesity. Their analyses illustrate how public policies and public and private sector professional practice can be re-examined to improve outcomes for women in all time periods and aspects of reproductive potential, which can, in turn, enhance outcomes for their offspring, both at birth and beyond.

MOLECULAR EPIDEMIOLOGY *continued from page 31*

mechanisms to gain a richer idea of the relationship between exposure and outcome.

Marks gained a firm background in “bench work” science as an undergraduate. After graduation he was trained in research by working in a lab that validated tests in human populations. Here he learned about how to deal with the issues of quality control, quality assurance, bias, and misclassification. Marks decided to get his Masters in Epidemiology at Hopkins, where he was exposed to how Epidemiology could be applied to all aspects of disease research. After receiving his Masters, Marks went back to the lab, this time in charge of maintaining quality control, developing protocols, data analysis, and writing papers. Only then did Morgan decide to get his PhD at Hopkins, with the idea of furthering his knowledge as to how to directly apply lab studies to human populations. One area in which he is currently involved is the role of hepatitis viruses on the morbidity and mortality of high risk populations, such as injection drugs users. Hepatitis D works in concert with Hepatitis B, and his work involves validating the PCR based assays for measurement of RNA to determine how this relationship functions.

Morgan is in his second year of studies towards a PhD. At Hopkins, in your first year of doctoral studies in the Epidemiology Department, Morgan explains that it can be hard to get funding unless you are specifically interested in studying chronic illnesses, since most students who come into the program are more interested in focusing on infectious disease. Consequently, since infectious disease is the most popular concentration within Epidemiology, it is particularly difficult to get funding in that area of studies. Once a PhD student passes his first year exams, Hopkins covers funding for 85% of a student’s tuition for the duration of his studies. Usually, students in the Epidemiology Department take about five years to complete their PhD. Marks explains that Hopkins’ Epidemiology Department is markedly methods based in its teaching regarding Infectious Disease. There are usually around thirty five students per year who enter the program; Marks being one of only two in his class whose studies focus on lab work. Jokingly, he says that most people fall into Epidemiology simply because they like science but don’t want to work in a lab. After completion of his studies Morgan, unlike most of his peers, is not interested in entering Academia, but wants to pursue a career in consulting—further demonstrating the flexibility of the field.

PREVENTABLE BLINDNESS *continued from page 35*

of treatment is very different between them.

Volunteer eye missions to developing countries that perform cataract surgery are very successful and word spreads quickly about how people go to the doctor and can see again. Therefore, this is a prime example of a chronic problem treated acutely with a procedure. Glaucoma missions are not as successful. Sometimes people will not go to these missions because they knew someone

who went and their vision became worse. Here the chronic problem is treated with a chronic treatment that may extend to the end of the patient's life. Unfortunately, the best "treatment" for glaucoma is early detection with eye screening, a procedure that may be unavailable in resource-poor settings. The dedicated work of Guil and Marta DeVenecia exemplify the importance of the credo: an ounce of prevention is worth a pound of cure.

This is the life work of Guil and Marta DeVenecia.

CITATIONS

1. "By 2020, 76 Million Worldwide Could Go Blind Without Prevention." JHSPH. March 28, 2003. http://www.jhsph.edu/publichealthnews/press_release/PR_2003/Frick_Vision2020.html
2. Magnitude and causes of visual impairment. WHO. November 2004. <http://www.who.int/mediacentre/factsheets/fs282/en/>

DOMINICAN REPUBLIC HEALTH *continued from page 37*

another school, within which they hope to provide basic clinical services and adult education. The school is under construction, but national and local governments have provided little help with the project, and CDIA has turned to religious organizations as its primary source of funding.

During my trip, I encountered many volunteers from evangelical groups in the United States that were distributing charitable items to the locals along with their religious messages. One such mission was based about two miles from the neighborhood in an agricultural zone and served as a base of operations for over 250 missionaries. These volunteers, who were mostly retirees and students on winter vacation, had come to distribute clothes, toys, and eye glasses that were donated to the compound from numerous churches across the United States. However, as generous as their effort is, such religious programs are not without drawbacks. While these groups display strong organization and effort, they also tend to have little knowledge of social, economic, cultural, and health related issues that face the community. In addition, religious messages often tend to take time away from other educational activities. In the CDIA's small school, for instance, children spent at least a quarter of their three hour school period singing religious songs. There is also a risk that sensitive, but important issues such as contraception and STI prevention may be avoided in such programs. Despite these shortcomings, however, religious organizations currently represent one of the few means of support for area families that have been ignored by the government.

Having seen few signs of a response from the municipal government at the local level or the Ministry of Health at the national level, I questioned an official upon my return to the capital. Before leaving the country, I was able to meet with Dr. Suriel, Director of Family and Community Health at the PAHO regional office of the WHO in Santo Domingo. I mentioned my experience in Hato Mayor and questioned him about initiatives that PAHO was employing on the ground in rural areas of the region. Dr. Suriel admitted that he could not name any one organization in particular, asserting that PAHO's work was more on a national level and only reflected the directives set by the Ministry of Health. PAHO followed

national goals, conducting epidemiological investigations and analyzing statistics to ensure that progress was being achieved on a national scale in accordance with the objectives of the current administration. Currently, most of the health focus is concentrated at the Dominican's western border which mirrors Haiti's extremely poor health conditions. While an emphasis on statistics is understandable, I believe that the success of national initiatives is largely dependent on coordination at the grassroots level. In this way rural communities can be successfully reached even while attention is aimed at the areas with the 'worst numbers.' Without promotion and feedback on 'top down' initiatives from those in the communities affected, health and social improvements in the Dominican Republic are likely to be slow, misdirected, and inefficient, giving those in need little anticipation of a better future.

The social, educational, and health challenges that face the residents of Polo Arriba are not unique. They are shared by millions of persons in thousands of villages all across the world. One does not need to spend two weeks in a rural Dominican community in order to understand that there is no magic solution to poverty. While in Hato Mayor, I found myself questioning the real value of my experience. What had I learned that I had not already known before? Were efforts that didn't result in complete change even worth attempting? It is easy to feel a sense of hopelessness when surrounded with such desperate conditions, and the children of Polo Arriba also seemed to echo such sentiments. While they were happy to see American volunteers, they felt that the attachments formed with these visitors were only temporary, and would be forgotten as soon as the volunteers returned to the United States. In many ways, I knew the children were right; so, before my two weeks ended, I decided to help my friend start a letter writing campaign through which college students could share aspects of their lives with children in Hato Mayor. I photographed families and collected children's drawings to send to students with the hope that they could experience a connection similar to the one I shared, and perhaps even sponsor a child with a \$25 donation that would cover the costs of books, clothes, and/or school supplies. A small endeavor like this one may not overcome the large day to day obstacles Dominican children face, but if it can give them hope for the future, an endeavor certainly worth undertaking.

PILGRIMAGE TO GENEVA *continued from page 39*

been marked by clarifying and defining experiences. I certainly consider my internship experience one of these experiences. In hindsight, my time there meant much more to me than the "perfect balance" of work, learning, and pure enjoyment that I had sought from early on. It was an *inspiration*, in both the spiritual and professional sense.

I have always been an avid believer in the biblical verse: From everyone who has been given much, much will be demanded (Luke 12:48). My gratitude for this tremendous opportunity has reinforced this conviction. I now have a stronger sense of a moral responsibility to serve a world full of such grave need. The internship has shed light on how exactly I can do this or - in other words - how to put my *faith into action*. I ultimately desire to be

both a physician and an international civil servant in order to directly alleviate those suffering from HIV/AIDS or other infectious diseases in our nation and worldwide.

Medical school will have to wait a few years though. My research on HIV treatment adherence during the internship has provided an immediate impulse to participate in some fieldwork beforehand. Next year, as the recipient of the Walsh Scholarship, I will be researching the “best practices” of HIV chronic care by communities in resource-poor settings, namely Rwanda and South Africa. I hope to utilize the findings towards a scholarly paper and as the thesis topic for a Master’s program at the London School of Economics the following year. More importantly, as a firm believer in “research linked to service”, I will be applying the “best practices” to directly help in Ugunja, Kenya, whose HIV/AIDS program is still in its infancy and operating on limited resources.

The internship at the World Health Organization undoubtedly marked a turning point in my life. I am sure that the experiences that lie ahead will be just as defining, if not, as inspirational. As I sit here, excited about what awaits me in the future, I am also overcome by a profound feeling of an impending moral burden. I’m reminded of that verse from Luke: *Kimberly, with great privilege, there is an even greater responsibility...*

ACUTE GASTROENTERITIS *continued from page 42*

to develop an effective program that adequately stresses the benefits of proper hand washing in the community and its far-reaching implications for the affected population’s public health.

Additionally, there are several factors that prevent physicians and local health authorities from properly treating diarrhea among children in Ethiopia. For example, it is common for the Ethiopian children to experience some dehydration and persistent diarrhea. Although mothers usually bring the children to the clinic immediately after the first symptoms of diarrhea, they rarely follow up with the doctor about their child’s condition. In fact, Ethiopian mothers consider it normal for their child to have diarrhea for two weeks even though in some severe cases children experience pure blood defecation, which can ultimately be life threatening. Secondly, children do not receive increased fluids and nourishment during their illness. This not only prolongs their episodes but makes the recovery more difficult. Lastly, inadequate hand washing practices, water protection, and feces disposal contribute to diarrhea.

A significant amount of work must be done in the field of public health before we can effectively prevent diarrhea in developing countries. My experience in Ethiopia confirms the need for a continual assessment of hygiene behaviors and a deeper understanding of the rationale behind current practices. With the help of physicians such as Dr. Hodes, community health workers, and the participation of the Ethiopians, successful and permanent change seems within reach, carrying with it the potential to greatly enhance the lives of the poor.



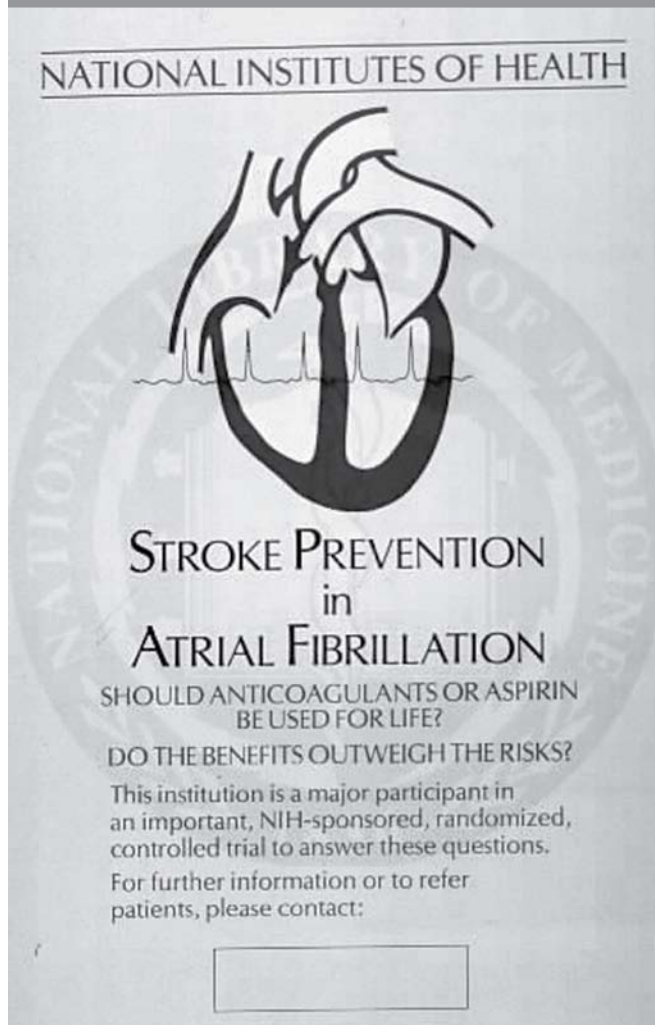
A Community Uniting to End Stroke

Joining Hopkins Students in Stroke Prevention and Treatment

student
feature

by **Aditya Rachakonda**
Public Health Studies, 2008

FEATURE *Experiences as a Hopkins student in helping families cope with strokes throughout the Baltimore community.*



ABOVE NIH Stroke Prevention in Atrial Fibrillation poster. Image courtesy of the NLM.

Stroke is the third largest cause of death, ranking behind heart diseases and all forms of cancer. Strokes kill more than 163,500 Americans each year, and estimated costs for strokes are nearly \$54 billion per year. Despite these startling statistics, many people, especially the elderly who are at a higher risk for stroke, are unaware of the symptoms of these cerebral attacks. Believing that stroke is not preventable, many people have no motivation for adopting healthier habits that could potentially prevent stroke. Further conceptualizing strokes as untreatable, most victims fail to act upon their symptoms; the average victim waits more than 12 hours before presenting his/her symptoms in the emergency room. Because stroke has a narrow treatment window, the time after onset of stroke is extremely crucial and can result in severe damage to the brain if not treated

in a timely manner. Therefore, it is extremely important for the public to have a good understanding of stroke by recognizing its symptoms and knowing that the symptoms are treatable with emergency care. This is precisely the goal of the Hopkins Association for Stroke Awareness (HASA) – to make the public aware of stroke, its symptoms, and the urgency needed for proper treatment.

HASA is a student-run organization at the Johns Hopkins University, and was formed in 2004 by four undergraduates majoring in Neuroscience. Currently, HASA involves its members both in a stroke-screening program at the Johns Hopkins Hospital (JHH) Emergency Room as well as a stroke-rehabilitation program also at JHH. The primary objectives of the stroke-screening program at the ER are to identify patients who may have experienced stroke or are at a high risk of one, and to provide these patients with proper medical attention. In addition, this program also works to educate members of the community of the symptoms of stroke and the urgent care required to treat such symptoms. The objective of the stroke-rehabilitation program is to provide service to those who have experienced stroke and are suffering from its effects. Activities at the rehabilitation clinic include running neurological tests on patients, watching and assisting with simple physical therapies, and helping patients with cognitive deficits perform recreational therapies. Hoping to alleviate some of the suffering of the victims, HASA members also spend time alongside patients and engage them in conversation and activities

Incorporating an educational portion to the program, students in the stroke-rehabilitation program present a thirty-minute stroke talk to patients and their family members. This presentation outlines the common symptoms and treatments of stroke, how to prevent stroke, and issues with recovery and rehabilitation. In addition to these programs at the hospital, members of HASA will soon be providing stroke education to various high schools and colleges as well as senior citizen centers in the surrounding area.

In June 2006, five members of HASA will participate in “Train to End Stroke”, a fundraising campaign for the American Stroke Association (ASA). Members will travel to Kailua-Kona, Hawaii to participate in the 12th annual Kunitake Farms Kona Marathon. HASA’s goal is to raise funding for research, advocacy, and educational programs of the ASA. Information on the “Train to End Stroke” campaign may be found at the following link: <http://TeamDCBaltimore.Kintera.org/Kona> (Sponsor Participants: Bo Gu, Brittany Lin, Aalap Shah, Christina Warner, Allisandra Wen).



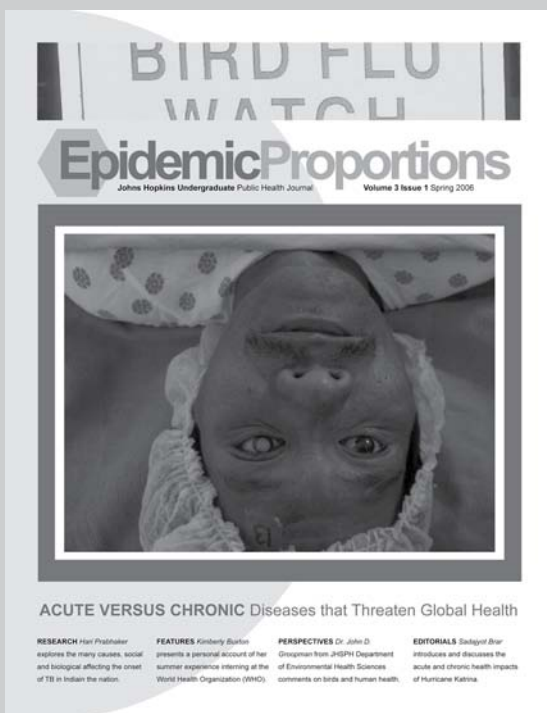
EpidemicProportions

Johns Hopkins Undergraduate Public Health Journal

Volume 4 Issue 1 Spring 2007

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