PROFESSOR: Welcome to Communicable Diseases Part 2: Programs, Control and Elimination Effort.

Learning objectives for this week are to identify disease prevention control and elimination effort, describe the progress towards the eradication of poliovirus and guinea worm, distinguish between control programs for HIV, malaria and TB and outline successful interventions against communicable diseases.

Thirty years after the last case of smallpox, it is believed that poliomyelitis and guinea worm could possibly be eradicate. The Global Polio Eradication Initiative is a largest public health program ever attempted. However, it is behind schedule to meet deadline. There are of three serotypes of wild poliovirus. Type 1 is involved in frequent outbreaks. Type 2 has been eliminated, and type 3 is geographically confined. Vaccine derived strains can also circulate. Polio is transmitted fecal-oral transmission, humans are the reservoir and the 95 of infected persons are asymptomatic.

The World Health Assembly adopted eradication of polio as a goal in 1988. The last case of polio in the United States was in 1979, and the western hemisphere has been certified polio-free since 1994. While polio has not been eradicated, there has been a significant decline in cases worldwide. In 1988, there were 350,000 paralytic cases. By 2008, or 20 years later, this had dropped to less than 2,000 cases.

There are only four countries where the virus remains endemic: Nigeria, India, Pakistan and Afghanistan. These four countries account for 93 percent of the world's cases of poliomyelitis. Unlike all other countries, they have never succeeded in interrupting the transmission of wild poliovirus. This map shows countries with new cases of wild polio infections from 2002 to 2006.

This map shows wild polio virus infection in 2010 in endemic countries.

The eradication campaign has not yet succeeded because there is not enough immunity in the target populations to interrupt transmission. In almost all cases, children are not getting vaccinated with enough doses to ensure lifelong immunity. In Nigeria, suspension of poliovirus immunizations in 2003 and 2004 were based on rumored safety risks associated with the vaccine. In Afghanistan and Pakistan, political instability and armed conflicts also make vaccinations logistically difficult and unpredictable. Consequently, a precise time line for eradication of Types 1 and 3 remains uncertain.

This slide outlines the financing from 1988 to 2010 for efforts to eradicate polio.

There are four strategies to stop polio: routine
immunization, national immunization days, surveillance and supplementary immunization activities or mop-up campaigns. Routine immunization is essential because it's the primary way that polio-free countries protect their children from the threat of imported polio. The idea is to catch children who are either not immunized or only part partially protected and to boost immunity in those who have been immunized. This way every child in the most susceptible age group is protected against polio at the same time, instantly depriving the virus of the fertile seabed on which its survival depends. WHO's advisory committee on polio eradication recommends that any polio-free country that detects imported wild poliovirus conduct at least three large-scale, house-to-house supplementary immunization activities using type-specific oral polio vaccine, initiating the first within 28 days of confirmation and continuing with at least two additional supplementary immunization activities after the last virus is detected.

Rotary International is the world's first service club organization. It has 1.2 million members and 33,000 clubs worldwide. Since 1985, volunteers from rotary international have worked to eradicate polio under the motto service above self. The Polio Plus Program is estimated to have raised $1.2 billion dollars for eradication of polio. It funds operational costs such as transportation, vaccine delivery, social mobilization and health worker training. It also funds national immunization days.

This slide outlines the polio eradication targets for 2010 to 2013. You can see that by the end of 2010, the goal is to cease all reestablished polio transmission outbreaks. By the end of 2011, cease transmission of polio transmission in at least two of the four endemic countries. By the end of 2012, cease all wild poliovirus transmission. As said earlier, target deadlines are behind at this point.

While we are behind schedule in meeting deadlines for the polio eradication plan, we are actually very close to achieving this goal. There has been a 99 percent reduction in cases since 1988. Poliovirus continues to have a strong hold in four countries, but fewer cases were reported in 2010. In 2009, over 361 million children were immunized in 40 countries, so we are very, very close. The hardest part is reaching every child.

Another disease that is very close to elimination is Dracunculiasis or guinea worm. This parasitic worm is an ancient disease previously known as the fiery serpent. 3.5 million cases were reported in the 1980s from 20 countries. It typically affects impoverished people with lack of access to clean water. This parasite migrates under the skin to emerge from the feet or joints and is a debilitating disease.

This map shows some of the places in which guinea worm is endemic.

This is the life cycle of guinea worm disease. You can see
that it is primarily transported through unclean water sources where people are either bathing or swimming and subsequently infected by the parasite.

It is believed that guinea worm disease is a vulnerable disease. Man alone is responsible for maintaining its fragile transmission cycle. It is therefore possible to permanently curtail transmission by applying simple measures. Some elementary steps include systematic filtering of drinking water derived from ponds and shallow, unprotected wells or from surface water, finely meshed cloth, or better still a filter made from 0.15 millimeter nylon mesh is all that is needed to filter out the cyclops from the drinking water. The construction of copings around wellheads or the installation or bore holes with hand pumps would prevent not only Dracunculiasis but also diarrheal diseases.

This graph those the number of cases reported worldwide from 2006 to 2009. You can see that the number of cases is dropping each year. Guinea worm eradication efforts focus on education campaigns, treatment of water sources with insecticides and filters for drinking water. There is no vaccine or medicine used.

In contrast to poliovirus and guinea worm disease, there are some diseases that we struggle to simply keep in check. Communicable diseases continue to cause a large burden on global health. The triple threat relates to HIV, malaria and tuberculosis. Eradication or elimination for these diseases remains a distant goal.

This slide summarizes the role of the Millennium Development Goal Number 6 on HIV and malaria and other infectious diseases.

Even in developed countries, HIV continues to be a problem. More than one million people are living in the U.S. with HIV. One out of five of these people do not know they are infected. It is estimated that every 9.5 minutes someone is infected, and in 2006, there were over 56,000 new infections. Despite the availability of antiviral medications, people with HIV still develop AIDS. More than 14,000 people with AIDS still die each year in the U.S.

This map shows the areas of highest prevalence for HIV infection in 2007.

In southern African, the combined effects of premature death and reduced fertility among HIV positive women have lowered population growth rates and dramatically reshaped the population structure. In a high prevalence country, such as (), the groups most heavily affected by HIV are infants and young children, and the 30 to 50 age group. The later normally constitute the core of the country's economically active and child raising populations. By contrast, the population pyramid of Ghana where HIV infection levels are much lower reflects a more conventional structure in a low income country.
This slide shows a time line of HIV and AIDS prevention efforts. You can see the past efforts to cease or control transmission of this infectious disease.

Thailand's 100% Condoms Program is one example of an effort to prevent or slow the spread of HIV. There is a widespread sex industry in Thailand and HIV prevalence in brothel sex workers increased from 3 percent in 1989 to over 15 percent in 1991. In 1991, a 100% Condoms Program was started, which said no condom, no sex. Condom use was monitored in brothels and brothel workers had regularly scheduled medical checkups. Education campaigns and free condoms were also implemented. If the public health authorities were able to trace a STD infection to a brothel, the brothel was fined. As a result, there was a dramatically lowered instance of HIV infection.

Known as the condom king, Mechai Viravaidya is a physician and fantastic public health program manager in Thailand. His activism revolutionized family planning in Thailand, helping to reduce its population growth from 3.2 percent a year in the 1970s to 1.2 percent in the mid-'90s. It is now less than 1 percent. He was so successful at changing the culture that today Mechai in Thai slang means condom. Together with the Thai government, Mechai and his grassroots population community development association established a national HIV prevention program that led to a dramatic 87 percent decrease in new HIV infections nationwide in the 1990s.

This time line shows selective events in the development of treatments for HIV and AIDS. The number of people receiving antiretroviral drugs in low and middle income countries has increased tenfold in only six years, reaching almost three million people by the end of 2007. The rapid expansion of treatment access and a resource limited setting is saving lives, improving quality of life and contributing to the rejuvenation of households, communities and entire societies. Intensified action is needed to ensure timely delivery of HIV treatment to children who are significantly less likely than adults to receive antiretroviral drugs. Locally, coverage of antiretroviral treatment for women is higher than or equal to that of men. The populations most at risk of HIV exposure, such as injecting drug users, face considerable barriers to HIV treatment access, often as a result of institutionalized discrimination. Low testing rates reduce the impact of HIV treatment because individuals who are diagnosed late in the course of infection have a poorer prognosis. A number of countries, however, are successfully using a range to approaches to increase knowledge of HIV serostatus. Despite the existence of affordable medications, too few people living with HIV and tuberculosis are receiving treatment for both conditions. This situation contributes to substantial, avoidable morbidity and mortality. Weaknesses in health care systems are slowing the scale of HIV treatment programs underscoring the need for
intensified action to strengthen these systems. Antiretroviral therapy scale up is helping to drive significant improvements in health care infrastructure in resource limited settings. Among the developments needed to ensure the sustainable of HIV treatment are more affordable second and third line therapy, as well as greater successes in preventing new HIV infections.

On World AIDS Day 2003, WHO and UN AIDS released a detailed and concrete plan to reach the three by five target of providing antiretroviral treatment to three million people living with AIDS in developing countries and those in transition by the end of 2005. This is a vital step towards the ultimate goal of providing universal access to AIDS treatment to all who needs it. Thirty million people have died in two decades. Forty million more people are infected. In poor countries, six million people with HIV/AIDS need immediate ART, but less than 8 percent get it. Worst hit is Sub-Saharan, Africa. With 28.5 million people infected, HIV/AIDS has destroyed communities, health care systems and put a shadow upon the future of entire communities.

Pepfar v.1 was signed into law in 2003 and identified 15 focus countries with the greatest need to receive a majority of the funding. Twelve of these countries were in Sub-Saharan, African, two in Latin America and one was in Asia. The reauthorization of Pepfar in 2008 shifted away from the focus country approach by authorizing the development of a partnership framework model for regions and countries with the aim of ensuring long-term sustainability in country leadership. Through bilaterally funded programs, Pepfar now works in partnership with host nations to support treatment, prevention and care for millions of people in more than 85 countries.

This slides shows the grains and increases of antiretroviral treatment coverage in the 15 Pepfar focus countries.

This slide shows the differences in approaches to HIV prevention. In Uganda, ABC stands for abstain, be faithful and if you can't be faithful, use a condom. Pepfar Version 1 used ABCs to mean abstinence for youth; B for being tested for HIV and being faithful in marriage and monogamous relationships; and C for correct and consistent use of condoms for those who practice high risk behaviors.

The World Health Organization attempted to eradicate malaria globally in the 1950s and '60s, but failed. Now the best strategy is control, but elimination is considered a possibility for some regions. Symptoms of malaria include intense fever in 24 to 72-hour intervals, nausea, headaches, muscular pain. It is transmitted by the Anopheles mosquito.

Malaria is an ancient disease and infects over 500 million people annually. It causes approximately three million deaths a year, and an African child dies every 30 seconds from malaria. 2.2 billion people are at risk. Antimalaria drugs are available
but resistance is a huge problem.

This map shows area of malaria transmission and reported drug resistance in 2004.

In 2005, the United States launched the President's Malaria Initiative or PMI. It was led by US AID but implemented together with the Centers For Disease Control. It was a five-year initiative, spending $1.2 billion to rapidly scale up prevention and treatment programs for malaria. Targets were 15 countries with high malaria burden in Sub-Saharan African. It was reauthorized in 2008 for another $5 billion, as part of the Global Health Initiative, and continues to expand its support to 17 focus countries. The goal was to decrease by half the burden of malaria in the majority of at-risk populations in Africa.

There are some positive indicators that a malaria vaccine may be possible. Significant progress is being made towards this goal. In 1985, there were no malaria vaccines in clinical trial. By 2006, 16 candidates were in clinical development with several others in early testing. One vaccine was in late-stage clinical trials and could be licensed as early as 2011.

In the absence of a vaccine, insecticide treated bed nets are one of the most successful prevention efforts and are a personal production to reduce illness and death from malaria. Several studies have shown that insecticide treated bed nets reduce under-five child mortality from all causes by 20 percent and is a very effective control measure. WHO recommends all people in at-risk areas use them, especially vulnerable groups of pregnant women and children. Providing enough nets and resources for delivery in Africa remains a major challenge.

Mycobacterium tuberculosis or TB is a bacterial infection that is contagious by human-to-human airborne transmission. Humans are the only significant natural reservoir. One-third of the world's population are carriers, but only 5 to 10 percent of individuals infected become sick or infectious. It is the second highest cause of death due to infectious disease. Antibiotic therapy takes six to 12 months to cure the disease. However, recent developments of multidrug-resistant TB are of great concern. HIV and TB go hand in hand. Individuals who are infected with HIV are at a greater risk for development of TB. Recent prevention efforts have focused on DOTS, or directly observed therapy short course, in which public health officials observe individuals taking their medications on a daily basis. This DOTS implementation is designed to help prevent development of resistance due to noncompliance.

The map shows the estimated new cases of tuberculosis in 2007.

This map shows the percent of new TB cases that are judged to be multiple drug resistant from 1994 to 2007. As you can see, drug resistant tuberculosis has continued to spread internationally and is now approaching critical proportions. A focus on providing care in low resource, high burden areas is
critical for preventing the transmission of drug resistant TB in
health care settings, especially among HIV infected persons. In
November of 2006, a federal TB task force convened to discuss
the possible US government response to the global threat of
multidrug resistant TB. In 2007, an action plan was developed
which is currently undergoing review.

XDRTB is the abbreviation for extensively drug resistant
tuberculosis. One in three people in the world is infected with
dormant TB germs. Only when the bacteria become active do
people become ill with TB. Bacteria become active as a result
of anything that can reduce the person's immunity, such as HIV
advancing age or some medical condition. TB can usually be
treated with a course of four standard or first line anti-TB
drugs. If these drugs are misused or mismanaged, multidrug
resistant TB can develop. MDRTB takes longer to treat with
second line drugs, which are more expensive and have more side
effects. XDRTB can develop when these second line drugs are
also misused or mismanaged and therefore also become
ineffective. Because XDRTB is resistant to first and second
line drugs, treatment options are seriously limited. It is
therefore vital that TB control is managed properly.

DOTS is an inexpensive and highly effective means of
treating patients already infected with TB and preventing new
infections in the development of drug resistance. Between 1995
and 2003, more than 17.1 patients were treated under the DOTS
strategy. Worldwide, 182 countries were implementing the DOTS
strategy by the end of 2003 and 77 percent of the world's
population was living in regions where DOTS was in place. DOTS
programs reported 1.8 million new TB cases through lab testing
in 2003. A case detection rate of 45 percent and the average
success rate for DOTS treatment was 82 percent.

Here are the practice questions for this week's lecture.

In summary, communicable diseases are very important to the
global burden of disease. Eradication, near elimination and
control of infectious disease are possible through effective
public health programs. Extensive funding and resources are
needed to implement effective control and elimination programs.
HIV/AIDS and malaria take an enormous toll in Sub-Sahara,
Africa. HIV/AIDS is also fueling the TB epidemic. Communicable
diseases have considerable economic and social consequences.
(End of presentation.)

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KERRY HARPER, CSR
813.404.2488, www.HRICART.com