

**SLIDE 1 TITLE**

**SLIDE 2**

Hello, I am Dr. Megan Davies, the State Epidemiologist and Chief of the Epidemiology Section for the NC Division of Public Health.

I welcome you to the first lecture of this course and thank you for taking the time to increase your knowledge and improve your disease investigation skills.

This lecture will introduce you to Global Public Health Issues, but more importantly, I hope to convey the importance of your contribution to the global understanding of diseases that impact our communities and our families. As you will see, any place in the world can be the center of a communicable disease epidemic.

**SLIDE 3**

At the end of this presentation, I hope that you will be able to

1. Name three major global public health communicable disease threats
2. Know the importance of travel history when investigating reports of communicable disease
3. Identify two reasons why chemoprophylaxis for malaria may fail

**SLIDE 4**

The focus of this presentation will be 3 major infectious disease global public health threats: HIV/AIDS, Tuberculosis, and Malaria.

According to the World Health Organization these three infectious diseases are the top three killers worldwide.

But before delving into these important topics, I want to briefly address some global health issues that have also captured the public's attention...and ours.

## **SLIDE 5**

Malaria and TB are old foes, and the HIV epidemic has been going on for over 20 years. We also face new and emerging infections, like the SARS pandemic of 2003 and the influenza A:H1N1 Pandemic of 2009. The threat of biological warfare and use of biological agents as weapons of mass destruction makes once eradicated diseases like smallpox a dreaded threat once more.

Severe Acute Respiratory Syndrome or SARS was first recognized in February 2003 when a deadly infection spread quickly within a Hong Kong hotel and rapidly within Hong Kong hospitals as a nosocomial infection. Widespread transmission followed with spread to other countries. The infection had a case fatality rate of 10%.

North Carolina had one of only eight laboratory-confirmed cases reported in the United States.

SARS was the first pandemic of the 21st Century and was caused by a new coronavirus, most likely originating from an animal reservoir (zoonotic infection).

Many of us served in the public health to pandemic influenza A:H1N1 in 2009 and 2010. Because the influenza virus is constantly undergoing genetic changes, we may well all be called upon to respond to the next influenza pandemic.

The risk of a bioterrorist attack was proven real in October 2001 when anthrax spores were deliberately sent through the US Postal Service, sickening 22 people, 5 of whom died. While the prospect of another deliberate biologic attack is unsettling, the surest way to detect and respond to a deliberately caused outbreak is by strengthening the systems used for detecting and responding to natural outbreaks, as the epidemiological and laboratory principles are fundamentally the same. So by investing your time in this course to increase your knowledge and skills in communicable disease investigation and control, you are also preparing for the next unexpected threat.

## **SLIDE 6**

The key drivers of global infectious diseases are economic. In the map shown here, I want you to pay attention to the distribution of health care dollars around the world. To no one's surprise, there is great disparity among countries on the percentage of dollars spent on health care. You will see as we look at the world-wide distribution of global infectious disease that morbidity follows the same mapping. I could have shown a map of gross national product, or some other more general economic indicator, and it would reflect the same reality. In fact, looking at healthcare spending gives a slightly distorted view, since the country that spends the

most money on healthcare, the USA, does not have the best health indicators performance (e.g. in infant death rates and life expectancy) in the world. The best results occur in other developed nations such as Canada, Western Europe, and Japan, where somewhat less money is spent. However, the main thrust of this slide is to show the poorest areas of the world, which will appear to stand out again when we look at morbidity of HIV, TB, and malaria.

## **SLIDE 7**

The human immunodeficiency virus (HIV) is a retrovirus that infects cells of the immune system, destroying or impairing their function. As the infection progresses, the immune system becomes weaker, and the person becomes more susceptible to infections. The most advanced stage of HIV infection is acquired immunodeficiency syndrome (AIDS). It can take 10-15 years for an HIV-infected person to develop AIDS; antiretroviral drugs can slow down the process greatly, and also decrease the amount of virus present in a person's blood.

HIV is transmitted through unprotected sexual intercourse, transfusion of contaminated blood, sharing of contaminated needles and between a mother and her infant during pregnancy, childbirth and breastfeeding.

In 2011, a multicenter international study, led by the University of North Carolina at Chapel Hill, demonstrated conclusively that when people with HIV are taking antiretroviral medications correctly, the amount of virus in their bodies is kept so low that they do not pass the virus on to others. In other words, treating HIV prevents transmission.

## **SLIDE 8**

This photograph taken in 2006 captures one face of HIV and AIDS in Africa today

These are AIDS Orphans in the Biwi/Mchesi area of Lilongwe, Malawi

In addition to the terrible personal tragedies that this picture represents, it also captures why AIDS is also considered a threat to global security. High rates of HIV infection in many countries in sub-Saharan Africa threaten whole societal structures and national economies.

HIV/AIDS remains one of the world's most significant public health challenges, particularly in low- and middle-income countries.

Thanks to recent advances in access to antiretroviral therapy (ART), HIV-positive people now live longer and healthier lives. In 2012, more than 9.7 million people living with HIV were

receiving antiretroviral therapy (ART) in low- and middle-income countries. The number of people on ART increased by 1.6 million in 2012, the biggest increase in one year to date. But there is still a long way to go. There are about 26 million people in low- and middle-income countries who should be on ART based on the WHO guidelines on the use of antiretroviral drugs for treating and preventing HIV infection. Until antiretroviral therapy is consistently available to all people infected with HIV, we will not be able to turn the tide of this worldwide epidemic.

#### **SLIDE 9**

Here the disease burden of HIV/AIDS around the world is shown. The distribution shows the high prevalence of disease in Sub-Saharan Africa.

For 2012, 35.3 million people are believed to be living with HIV/AIDS in the world.

More than 3 million children are living with HIV/AIDS, according to 2012 figures. Most of the children live in sub-Saharan Africa and were infected by their HIV-positive mothers during pregnancy, childbirth or breastfeeding. The number of children receiving ART increased from about 75 000 in 2005 to 355 000 in 2009.

HIV/AIDS is the world's leading infectious killer claiming an estimated 1.6 million lives in 2012.

#### **SLIDE 10**

This graph demonstrates the trend in HIV/AIDS over a dozen years in North Carolina.

The purple bars show the growing prevalence of HIV. This is actually a positive trend showing that treatment is resulting in longer survival. The white line with blue diamonds shows the rate of new cases reported annually. This rate has been decreasing over the last 4 years, confirming the effectiveness of antiretroviral treatment for prevention.

Beginning in 2006, North Carolina has been following a strategy of testing and referral to medical care and supporting HIV infected people to stay in care. An important element of this strategy is the work of local health department STD clinics to provide testing for HIV as well as other STDs, and to provide treatment for STDs. Untreated STDs such as syphilis and gonorrhea increase a person's vulnerability to infection with HIV. Timely and respectful delivery of STD services by local health department staff is critical to fighting the HIV epidemic in North Carolina.

HIV/AIDS has and will continue to be one of the greatest public health threats in the United States and globally. We must continually challenge ourselves to better understand and respond to the drivers of this pandemic, including sexuality, gender relations, and healthcare inequities.

[PAUSE]

Now I'd like to turn to another infectious disease that has huge global impact...tuberculosis

#### **SLIDE 11**

Tuberculosis, or TB, is an infectious bacterial disease caused by *Mycobacterium tuberculosis*, which most commonly affects the lungs. It is transmitted from person to person via droplets from the throat and lungs of people with the active respiratory disease.

In healthy people, infection with *Mycobacterium tuberculosis* often causes no symptoms, since the person's immune system acts to "wall off" the bacteria. The symptoms of active TB of the lung are coughing, sometimes with sputum or blood, chest pains, weakness, weight loss, fever and night sweats. Tuberculosis is treatable with a prolonged course of antibiotics.

Tuberculosis, or TB, was the second leading cause of death in the United States at the turn of the century, just behind pneumonia.

In 2012, North Carolina had 213 cases of TB reported.

#### **SLIDE 12**

In spite of the advent of antibiotic therapy in the 1950's, tuberculosis infections remain a devastating, global public health threat.

More than two billion people – one third of the world's total population – are infected with TB bacilli, the microbes that cause TB.

One in every 10 of those people will become sick with active TB in his or her lifetime. People living with HIV are at even greater risk of developing active infection.

This slide shows the estimated TB incidence rates worldwide for 2012. Approximately 8.6 million people fell ill with TB and 1.3 million died from TB. TB is a disease of poverty, affecting mostly young adults in their most productive years. Over 95% of TB deaths occur in low- and middle-income countries, and it is among the top three causes of death for women aged 15 to 44.

The Centers for Disease Control and Prevention has initiatives in Africa, the former Soviet Union, Central and South America which have all had a positive impact on the disease. Thus progress has been made worldwide in decreasing the incidence, but there is still an enormous amount of work to be done.

This map shows that over one half of the world's countries have an incidence of over 100 cases per 100,000 population.

**SLIDE 13:**

Multi-drug resistant tuberculosis (MDR TB) presents an additional challenge to TB prevention and control. MDR-TB is now present in virtually all countries surveyed.

Multidrug-resistant tuberculosis (MDR-TB) is a form of TB caused by bacteria that do not respond to, at least, isoniazid and rifampicin, the two most powerful, first-line anti-TB drugs.

The primary cause of MDR-TB is inappropriate treatment. Inappropriate or incorrect use of anti-TB drugs, or use of poor quality medicines, can all cause drug resistance.

Disease caused by resistant bacteria fails to respond to conventional, first-line treatment. MDR-TB is treatable and curable by using second-line drugs. However second-line treatment options are limited and recommended medicines are not always available. The extensive chemotherapy required (up to two years of treatment) is more costly and can produce severe adverse drug reactions in patients.

In some cases more severe drug resistance can develop. Extensively drug-resistant TB, XDR-TB, is a form of multi-drug resistant tuberculosis that responds to even fewer available medicines, including the most effective second-line anti-TB drugs.

About 450 000 people developed MDR-TB in the world in 2012. More than half of these cases were in India, China and the Russian Federation. It is estimated that about 9.6% of MDR-TB cases had XDR-TB.

**SLIDE 14**

The global challenges to controlling tuberculosis have a direct impact on you as a communicable disease nurse in your county. This slide shows that as we succeed in decreasing new cases of tuberculosis in the North Carolina, we are seeing a higher proportion of new TB cases occurring among foreign-born persons in our state. Remember, more than two billion people in the world are infected with TB bacilli and one in every 10 of those people will become

sick with active TB in his or her lifetime. So some people may come to the United States in apparent good health, with an undiagnosed latent TB infection that will activate if the person's immune system becomes less effective (e.g. from aging or as a result of starting chemotherapy). So it is very important to check not only recent travel history when investigating TB cases, but also if your patient lived in another country many years ago.

It is also imperative to use good infection control practices when evaluating possible TB patients, and to involve the Communicable Disease Branch TB nurse consultants as soon as possible.

#### **SLIDE 15**

This map shows the counties with TB cases in North Carolina.

If not treated, each person with active TB can infect on average 10 to 15 people a year. This is why each and every active TB case in this state is followed up so intensively for treatment and contact investigation. The local health department CD nurses are on the frontline of TB control in North Carolina.

#### **SLIDE 16**

Malaria is a life-threatening parasitic disease transmitted by mosquitoes. It was once thought that the disease came from the fetid marshes, hence the name mal aria (bad air). In 1880, scientists discovered the real cause of malaria, a one cell parasite called plasmodium. Later they discovered that the parasite is transmitted person to person through the bite of a female Anopheles mosquito, which feeds on blood from mammals.

In the human body, the parasites multiply in the liver, and then infect red blood cells.

Symptoms of malaria include fever, headache, and vomiting, and usually appear between 10 and 15 days after the mosquito bite. If not treated, malaria can quickly become life-threatening by disrupting the blood supply to vital organs. In many parts of the world, the parasites have developed resistance to a number of malaria medicines.

Key interventions to control malaria include: prompt and effective treatment with artemisinin-based combination therapies; use of insecticidal bed nets by people at risk; and indoor residual spraying with insecticide to control the vector mosquitoes.

## **SLIDE 17**

Approximately half of the world's population is at risk of malaria. Most malaria cases and deaths occur in sub-Saharan Africa. However, Asia, Latin America, and to a lesser extent the Middle East are also affected. In 2013, 97 countries and territories had ongoing malaria transmission.

It causes more than 200 million acute illnesses and over 600,000 deaths annually.

It is encouraging to note that increased malaria prevention and control measures are dramatically reducing the malaria burden in many places. Malaria mortality rates have fallen by 45% globally since 2000 and by 49% in the WHO African Region. Still most deaths occur among children living in Africa where a child dies every minute from malaria.

## **SLIDE 18**

Epidemics are ongoing in much of Africa.

Malaria parasites do develop resistance to one drug after another and many insecticides are no longer useful against mosquitoes transmitting the disease.

There are currently no licensed vaccines against malaria or any other human parasite. One research vaccine against *P. falciparum* is currently being evaluated in a large clinical trial in 7 countries in Africa. A WHO recommendation for use will depend on the final results from the large clinical trial. These final results are expected in late 2014, and a recommendation as to whether or not this vaccine should be added to existing malaria control tools is expected in late 2015.

Effective low-cost strategies are available for treatment, prevention and control. The interventions include insecticide-treated bed nets; intermittent preventive treatment in pregnancy, and antimalarial drug combination therapy.

## **SLIDE 19**

So, what about North Carolina? We do not have any endemic cases of malaria in North Carolina, but we do see cases in travelers. On average, local health departments investigate a total of about 40 cases of malaria a year.

When you investigate a case of malaria in your county, it is critical to document a thorough travel history, and if the patient was prescribed medications for prophylaxis. The two major reasons that anti-malarial chemoprophylaxis fails are (1) the parasite infecting the patient is

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resistant to the medication prescribed, and (2) the patient did not take the medication as instructed. If a patient became infected despite correctly taking anti-malarial prophylaxis appropriate for the area where he or she traveled, your information will be important in detecting the emergence of new patterns of resistance that can ultimately lead to changes in prophylaxis and treatment recommendations. If your patient was prescribed appropriate prophylaxis but failed to take it, understanding the barriers to taking the medication could be important to designing patient education materials or different approaches to malaria prevention.

As a local health department Communicable Disease nurse, you form an essential part of the worldwide network of public health workers striving to prevent and control infectious diseases.

#### **SLIDE 20**

Shown here is an extremely useful reference book for private physicians and clinics that provide immunizations and guidance for travelers internationally. It is available on line at [www.cdc.gov](http://www.cdc.gov)

#### **SLIDE 21**

Finally, I would like to talk a few minutes about what you do and why it is so important...even vital...to our nation's health and to world health. As a local health department Communicable Disease nurse, you form an essential part of the worldwide network of public health workers striving to prevent and control infectious diseases. Just as you depend on colleagues in other counties, states, and countries to do their jobs well and thoroughly, each of those colleagues worldwide depends on you.

Today's highly mobile, interdependent and interconnected world provides many opportunities for the rapid spread of infectious diseases. Infectious diseases are now spreading geographically much faster than at any time in history. An estimated 2.1 billion airline passengers travelled in 2006; an outbreak or epidemic in any one part of the world is only a few hours away from becoming an imminent threat in your community.

Infectious diseases are not only spreading faster, they appear to be emerging more quickly than ever before. Since the 1970's, newly emerging diseases have been identified at the rate of one or more per year. There are now nearly 40 diseases that were unknown a generation ago. In addition, during the last five years, WHO has verified more than 1100 epidemic events worldwide.

What were North Carolina Communicable Disease Nurses doing during the SARS Epidemic of 2003?

How did North Carolina Communicable Disease Nurses respond to the Influenza Pandemic of 2009-2010?

**SLIDE 22**

Let me give you examples of how NC communicable diseases nurses made a difference. In 2003, we had the one case of SARS in North Carolina occur in Orange County. Orange County communicable disease nurses interviewed that patient, placed that patient under isolation, counseled that patient's family on quarantine, and monitored that patient with twice daily telephone calls throughout his isolation period. The CD nurses at the Orange County Health Department also followed healthcare workers in the doctor's practice that treated that patient before the diagnosis was made. These nurses were critical to containing SARS to one patient in Orange County and one patient in North Carolina during that pandemic. In 2009, when the pandemic H1N1 strain emerged, early cases were detected in Carteret and Craven counties. The communicable disease nurses in those counties vigorously investigated each new case and determined if those cases were linked to each other, or had independently been exposed while traveling. Their investigation was critical to determining how infectious this pandemic strain was and what actions we needed to take, not only in North Carolina, but in the United States and worldwide, to contain it. So, I thank those nurses and I thank you and again, welcome you to the North Carolina public health course. Thank you.