Version

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PUBLIC HEALTH PREPAREDNESS (PHP)
TRAINING PROGRAM

Training Course Materials

The Foundations of Public Health Series:

Chain-of-Infection Training Course

PUBLIC HEALTH PREPAREDNESS TRAINING COURSE MATERIALS

Handbook for the *'Chain-of-Infection' Training Course*

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Administrative Handling Instructions

1. The title of this document is:

    a. Handbook for the *'Chain-of-Infection' Training Course*

2. The information gathered in this handbook is classified as "For Official Use Only", (FOUO), and should be handled as sensitive information not to be disclosed. This document should be safeguarded, handled, transmitted, and stored in accordance with appropriate security directives. Reproduction of this document, in whole or in part, without prior approval from the Nevada Division of Public and Behavioral Health is prohibited.

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4. Points of Contact:

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Introduction

I

Welcome to the Online *'Chain-of-Infection'* Training Course

This online accessible training course is intended to be done at the trainee's own pace. The intent of this course is to create a common foundation of knowledge to build off of during future trainings, exercises and real-world activations of the public health system.

In this ongoing grant climate of '*do more with less'*, we here at the Nevada Division of Public and Behavioral Health's (DPBH), Public Health Preparedness (PHP) training and exercise program, are working on ways to continue bringing you training opportunities, but with little to no travel expenses associated with those trainings.

One of the strategies we have come up with is to provide training opportunities through an online format using a internet-accessible system called **Prezi**. For those of you who have never heard of Prezi, it is basically a more dynamic version of the old standby: *Microsoft (MS) Power Point*. Rather than transitioning from slide-to-slide like we have in the past on MS Power Point; with Prezi you *'fly'* through the transitions seamlessly. You'll see what I mean in a few moments.

Today's online training course should take about 15 minutes to complete.

System Requirements to Run Today's Training Course

Basic Computers Will Work Fine: The technical support team at Prezi has posted the following on their Prezi Basics web page:

The Prezi editor runs well on most contemporary computers, even netbooks. You can easily determine if your computer meets system requirements to watch prezis by:

1. *Checking out any prezi from www.Prezi.com/explore to see if it plays back smoothly on your computer.*

2. *Checking if you can play back YouTube videos while in full screen mode when in any prezi.*

High End Usage: If you would like to play a very large prezi (with many videos, animations, high resolution images, etc.), Prezi uses Adobe Flash technology to render prezis in real time, therefore you can create very high resolution presentations, but your playback performance will rely on the hardware. Here are some hardware recommendations:

1. *Fast processors and lots of memory will help more than a strong graphics card.*

2. *It can help to play a prezi through once, it will play more smoothly the second time (do not restart the prezi).*

Website: The www.Prezi.com website supports all major modern browsers (Internet Explorer 9 and above, Mozilla Firefox 3 and above, Google Chrome, Safari) but for the best experience we recommend using the most standard compliant browsers available (Firefox 3.6+, Chrome 4+, Safari 4+). Flash version 11.1 is required.

Prezi for Windows / Mac: For users who would like to access Prezi through Microsoft Windows:

- *2.33GHz or faster x86-compatible processor, or Intel Atom™ 1.6GHz or faster processor for netbook class devices*

- *Microsoft® Windows® XP, Windows Server 2003, Windows Server 2008, Windows Vista® Home Premium, Business, Ultimate, or Enterprise (including 64 bit editions) with Service Pack 2, Windows 7, or Windows 8 Classic*

- *512MB of RAM (1GB recommended)*

For users who would like to access Prezi through a Mac Operating System (OS):

- *Intel® Core™ Duo 1.83GHz of faster processor*

- *Mac OS X v10.6, v10.7, or v10.8*

- *512 MB of RAM (1GB recommended)*

High-Speed Internet Connection: In order to access today's training course, you will need access to a computer with a high-speed internet connection. We realize that for many of you in our rural counties, such a connection may be an issue. So in an effort to ensure that you can at least read along with what the audio recordings for each transition, we have provided a complete transcript of what those audio recordings cover.

Software Requirements: In addition to this internet connection requirement, we ask that your computer also have *Windows Player* installed. This will allow your personal computer (PC) to run the audio portions of the Prezi presentation.

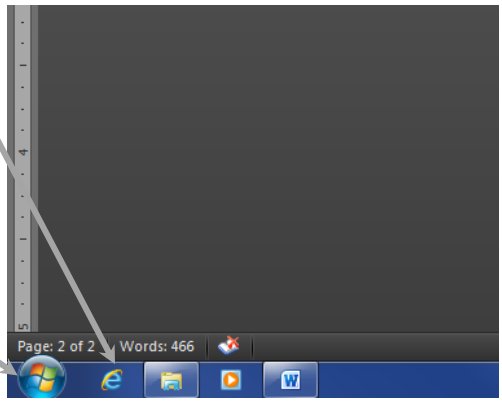
Sound Speaker(s): In order to listen to the presenter's recordings for each transition in today's course, please ensure that your PC has a speaker (or speakers) that are working, and as basic as this sounds: make sure the volume is turned on and up. If your system does not have a speaker, then you can follow along in this course handbook and read through each recording's content.

How to Access, Open and Watch the Prezi Presentation: Open the internet browser for your PC by double clicking on that browser's icon in the bottom-left corner of your screen like this:

If your computer is setup with a shortcut to your browser, like this, then click here:

If your computer does not have that shortcut, then click here:

When that opens, look for the Internet browser and double click on that.



Once your internet browser opens, you will need to copy/paste this web address into your browser. Please ensure that each letter/digit/symbol is copied into your browser; otherwise the presentation will not open for you.

By clicking on this **hyperlinked** web address below, it should automatically open the *Prezi* presentation for you. If not, then please copy and paste this web address into your PC's internet browser.

http://prezi.com/o4buyw6nv0kr/?utm_campaign=share&utm_medium=copy&rc=ex0share

Depending on your computer and the strength of its internet connection, it may take up to a minute for the online presentation to fully load; so please be patient while the website loads the online course.

Depending on your internet connection, this presentation may take a few seconds, to a few minutes, to load; so please be patient. Once the presentation does load, you can watch the course as it displays, on a portion of your PC's screen; or, you can expand it to fill your computer's entire screen by clicking on this symbol in the bottom-right corner of your screen:

Either way you choose to watch the Prezi presentation, in full screen mode or not, you will be advancing the presentation at your own pace, one transition at a time, by clicking the right-arrow at the bottom of the screen (circled above).

If you would rather watch and listen to this course like a movie, you can also click on this "Play" button in the bottom-left corner of the window, as indicated by this arrow.

Note: If you opt to watch the course in the full-screen mode, the software will pop-up a question about "*Allow full screen with keyboard controls?*" Just click on the Allow button.

From that point on, you will watch and listen at your own pace. If you need to go back and redo a previous slide (or as Prezi calls them: Path), then simply click that left-facing arrow at the bottom of your screen. Adjust your PC's volume and enjoy the course.

Chapter 1

Full-Transcript to the *Chain-of-Infection* Training Course

The U.S. Centers for Disease Control and Prevention (CDC) have created 10 essential public health services that public health systems throughout the country should be capable of. The eighth essential service is: "Assure a competent public and personal health workforce."

—Taken from the CDC website http://www.cdc.gov/nphpsp/essentialservices.html

In this installment of the '*Foundations of Public Health Series*' we will explore the process that infectious agents need to complete in order to make a person ill. How do they get from where they are, into our bodies? This is called the *Chain-of-Infection*. That will be followed up by a brief description of the various manifestations of disease that we would see in a person once an agent was transmitted into their body.

If you are taking this course at your own pace from your computer, then please allocate at least 15 minutes to complete this presentation. Each of the courses within this series are designed to build upon the knowledge gained in previous courses, so please do not jump from course to course out-of-sequence.

As with each of the courses within this series, here is the transcript of what was recorded for this course.

Path #1: Before we get going, please adjust your computer's volume control so you can hear the audio component of this training course. You can advance the presentation at your own pace, by clicking that right-facing arrow at the bottom of your screen, or by clicking that 'Play' button in the bottom-left corner of the screen.

Path #2: Hello, and welcome to today's presentation titled: *"The Foundations of Public Health Series: the Chain-of-Infection."* My name is **Doctor Tracey Green** and I am the Chief Medical Officer for the State of Nevada. I will be presenting today's material for this online-accessible training course. This series of online accessible

training course are intended for both public health and its partner agencies, so that we may all be speaking the same language when it comes to large-scale responses to infectious disease.

Path #3: In this first course, we shall begin with the basics: how illnesses get from where they are to enter our bodies and make us ill. This requires a three-part process that we in public health call: the "*Chain-of-Infection*."

Path #4: So I will begin with a simple Q and A format: *How do germs make us sick*? To fully understand how that works, we need to understand a three-part process of how people become infected with a biological agent. This process is often referred to as the '*Chain-of-Infection*' and is a core concept provided in both medical, and public health degree programs. Once that is understood, then both public health and its sister agencies will use common vocabulary and grammar when addressing biological threats together.

Path #5: There are three components to the *chain-of-infection*, and in this field I will address them one at a time.

Path #6: The first is what we call an 'Agent', which is basically another way of saying: *something that can make a person or animal sick*.

Path #7: There are basically five types of agents that we, in public health, need to concern ourselves with when it comes to biological threats to the public. The first are viruses which are thought to be one of the oldest life forms on our planet. When classified with other life forms, viruses are literally in a class by themselves. They are unique in that they cannot do many of things other life forms do, on their own. The best example of that would be replication. In order for a virus to make more copies of itself, it requires a host cell to do so. These are also some of the smallest living things on our planet. To help give you an idea of how a virus' size measures up against that of a bacteria, or a cell; I will use a metaphor to help describe how the size of viruses compare to those of host cells and bacterium:

If you imagine that you are flying above a soccer stadium: the stadium around the soccer field would be a good representation of a cell's size, the field would represent the scale of a bacterium, and the soccer ball in the middle of that field would represent the size of a virus.

Next we have toxins, which are natural compounds made by some organisms, that are extremely lethal to others. The next example of an agent are parasites. These are the bugs you hear and see so much about on those television shows about people who went to developing countries on vacation and came back with a worm living in their intestines, etc. Finally we have fungi, which for any of you who have had bread go bad at home, you know what these little fuzzy guys look like. Although this would at first glance appear to be a poor class of biological agents for public health to worry about, their persistence is quite remarkable. We still

hear of mold issues (another term for fungi) in New Orleans following the floods of Hurricane Katrina in September of 2005. For any of you that have had mold abatement issues in your own home, you already know how tough it is to remove both the mold/fungi, and the billions of tiny spores they release.

Path #8: The next link in the infection chain is 'Transmission', which is the process of getting an agent from where it was into an unsuspecting person and/or animal.

Path #9: This is public health 101 sort of stuff, but it is always wise to go back over it, just so everyone is using the same terminology. This information comes out of a CDC document called the *"2007 Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings."* For those of you following along in the course handbook, I have added the web address to this document in case you want or need a copy for yourself. The mode of disease transmission we seem to hear the most about is that first one I've listed: **contact**. We hear about this especially during cold and flu season's winter months. These are those dirty doorknobs, elevator buttons, handrails, and handshakes that our parents always warned us about. Person A coughs and/or sneezes into their hands, then with those same hands, then goes on to touch all sorts of non-porous objects that the rest of us also touch. That transfer places the agent of **Person A** on the hands of **Person B/C/D** and so on. If any of those people touch their eyes, nose, mouth, open skin, etc., then Person A's agent is well on its way to infecting those other people, then the process repeats itself. You will notice the CDC has further divided this mode of transmission into two subtypes: direct and indirect. Here is how they define direct contact on page 16 of that document they published in 2007: *"Direct transmission occurs when microorganisms are transferred from one infected person to another person without a contaminated intermediate object or person."* The authors go on to define indirect contact transmission as well: *"this involves the transfer of an infectious agent through a contaminated intermediate object or person."* They go on to cite contaminated hands, patient care devices, and medical instruments as examples of these intermediate objects. http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html

Path #10: Here's an image of those contaminated door handles and handshakes that our mothers warned us about when we were children.

Path #11: Next we have **droplet** which are those tiny globules our body ejects when we cough and/or sneeze. Each of those tiny droplets act like a sort of life raft for agents looking to leave one host, with the intent of finding another. Each of those wet droplets will provide a mini ecosystem for germs to survive in, but this is a race against time. Once that droplet dries out, so too do the germs they provided a temporary home for. As small as they appear to the naked eye, these droplets are actually quite large when one considers the size of bacterium and viruses they house. When the droplets are ejected from the body, they do not

hang in the air for much time. Gravity ends up pulling them down to the ground within three to six feet from where they started. Non-porous floors (e.g. tiles) and surfaces (e.g. countertops, smooth walls, etc.) generally end up being where these droplets reside.

Path #12: In this demonstration photo from the CDC, you can get a sense of the sheer volume of droplets ejected during an uncovered sneeze.

Path #13: Unlike droplets that are ejected from the body and immediately fall to the ground, **airborne** transmission involves agents that are so small they can remain suspended in the air for an appreciable amount of time. These pose a particular challenge to infection control specialists in hospital settings, because an infectious person in one hospital room could infect other patients in neighboring rooms that they never even came in direct contact with, and so on. In cases like this, pressure negative rooms would be called into use to help limit the possibility of the agent escaping. Those are special rooms that draw air inward; so if a door or window is opened, the outside (aka: clean) air is drawn inward, rather than the contaminated air pushed outward.

Path #14: This image gives you an idea of how far droplets can travel, versus how far airborne particles may travel. Precautions against the airborne transmission of an infectious agent require a great deal more planning and logistics.

Path #15: **Vehicle** transmission is when something inanimate carries an agent to the body; good examples of this would be food and water. Foodborne illnesses gain a lot of national attention each time we hear about salmonella outbreaks amongst people who ate a certain vegetable from a certain farm, etc. We also seem to be hearing a lot about cruise ships that are battling large-scale Norwalk Virus (aka: Noro virus) outbreaks aboard ship, etc.

Path #16: Improperly cooked foods are a classic example of a vehicle borne transmission of an agent.

Path #17: **Vector** transmission is when something animate like a flea, a fly, a tick, or mosquito, carries an agent to the body, and delivers that agent usually through a bite. Classic examples of vector-borne transmission of disease would be Yellow Fever, malaria, West Nile Virus, etc.

Path #18: Here is the most dangerous thing humanity can face in developing parts of the globe: the lowly mosquito. In my opinion, is the deadliest living thing in the world.

Path #19: Finally we have the third and final link to this chain-of-infection, the Host (that's you and I, along with our pets).

Path #20: This is a good opportunity to cover something called the *Portals of Entry* to a body that agents could use to gain access. The first is of course those skin and mucous membranes we hear so much about: the ears, the eyes, and the nose. Next we have the respiratory tract that includes the upper (nose, sinuses, throat), and the lower tracts such as the bronchial tubes and the lungs. The third portal of entry listed here is the digestive tract, followed by the genitals and urinary tract which of course would involve sexually transmitted infections or STIs, and finally we have the placenta. That is when an agent is passed from a mother to her unborn fetus through the placenta in the womb.

Path #21: That's if for the three components to the Chain-of-Infection. We realize this is basic refresher information, but we have included this in the Fundamentals of Public Health Series because in large-scale outbreaks of disease, you will hear public health partners discussing how we plan on breaking the chain-of-infection.

Path #22: So now that we have established a basic understanding of how an agent transmits itself from where it was to our bodies, now we will focus in on the consequences of that infection. Once the three components to the chain-of-infection have occurred, then what are the manifestations of disease?

Path #23: The more common form of disease would be a local infection. These small-scale and localized infections involve one part of the body, and are generally much easier to treat.

Path #24: Here are some basic examples of a local infection: *cellulitis* (aka: infection of the skin), an *abcess*, and *conjunctivitis* (aka: infection of the eye).

Path #25: Systemic infections are larger in scale, and often involve the whole body, or an entire system within the body.

Path #26: This list provides some examples of what I mean. Respiratory infections such as influenza, sepsis (aka: infection of tissue), septicemia (aka: blood poisoning), bacteremia (aka: the presence of bacteria within the blood).

Path #27: That covers the basics concerning the Chain-of-Infection. In the next installment to this series of online accessible training courses, we will be looking at the interventions that would be brought to bear, in order to break this chain-of-infection. These interventions are something that we here in Nevada refer to as the "*Public Health Toolbox*."

Path #28: OK, that's it for this course. Before I move on to the next, if you should have any questions concerning what I have already covered up this point, please e-mail them to at the following e-mail address: dmackie@health.nv.gov or feel free to call 775-443-7919.