

**PROTECTING SHARONVILLE FIRE DEPARTMENT PERSONNEL
FROM HEPATITIS C EXPOSURE**

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CERTIFICATION STATEMENT

I hereby certify that the following statements are true:

1. This paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

2. I have affirmed the use of proper spelling and grammar in this document by using the spell and grammar check functions of a word processing software program and correcting the errors as suggested by the program.

Signed: _____

Printed Name: Ralph L Hammonds Jr.

ABSTRACT

Sharonville Fire Department personnel often face potential exposure to HCV. This research identified ways to protect them from exposure and treat those who become infected with HCV.

The research questions were:

1. How do we properly protect EMS providers from contracting HCV?
2. How do we treat those who are or become infected?
3. What resources are available to pay for treatment of those infected?

The procedures followed included, literature from Bethesda Medical Library, Hamilton County Library, Internet, and personal communications.

The results included pertinent information about HCV, and methods of protecting and treating the employee. Recommendations included annual testing, revisiting our infection control policy, and instituting a needleless system. Further research on HCV prevalence among emergency workers is needed.

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INTRODUCTION

Statement of the Problem

Everyone in the fire service who makes emergency runs is faced with the real life risk of exposure to infectious diseases. These diseases range from the common cold to HIV and Hepatitis “C” (HCV). Although not as well publicized as HIV; HCV is the most common bloodborne pathogen emergency care providers will come in contact with and the easiest bloodborne virus to contract. At least 4 million Americans have been infected with HCV and eight to ten thousand will die from the disease this year. This number is about 35 times the number of people who will die from the much-publicized West Nile virus. HCV is not only more common in the general population than HIV, but the morbidity rates from HCV are approaching those of HIV and will surpass them in the next decade. The problem this study addresses is better ways to prevent the infection of the members of the Sharonville Fire Department. Since Hepatitis “C” is becoming more common in the general population, the risk of exposure is increasing for Emergency Care Providers.

Purpose of the Study

The purpose of this study was to develop better policies, procedures and barrier devices to prevent infection of Emergency Workers and manage those already infected. This information has been gathered using the evaluative and historic research methods.

Research Questions

The research questions this study investigates are:

1. How do we properly protect emergency workers from contracting HCV?
2. How do we treat those who are or become infected?
3. What resources are available to pay for treatment of those infected?

As a result of this research we will have a better understanding as to the cause and spread of this disease, along with appropriate protection and treatment pathways for our employees.

BACKGROUND AND SIGNIFICANCE

Hepatitis “C” is a relatively new version of Hepatitis initially known as Non “A” Non “B” Hepatitis. This disease process is not only a threat to the firefighter but also to his or her family and friends. This research will allow the Sharonville Fire Department to change to a proactive approach in our prevention efforts and be better prepared in the event of an exposure.

The first department to realize the magnitude of this problem was the Philadelphia, Pennsylvania Fire Department. Tragically, this problem was discovered after six percent of their firefighters had already been infected. The majority of the firefighters infected had no idea they were sick until testing positive for this disease. This leads to problems of identifying when and how the exposure occurred. Several studies conducted on the prevalence of HCV among firefighters by both the Centers for Disease Control (CDC) and independent researchers have drastically different conclusions. The CDC study indicates no difference in prevalence compared to the general population. Other studies have indicated up to a five percent increase in prevalence of HCV in emergency workers over the general population. The combination of the mode of transmission and the nature of a firefighter’s work would logically put them at a higher risk than the general population.

Hepatitis “C” is a viral disease of the liver, which is the largest internal organ of the body and very vascular. The liver lies just under the diaphragm in the upper abdominal cavity of the body. Its main function is to filter toxins and poisons in the blood. Saunders (2001) says ... “The liver plays a major role in iron metabolism, plasma protein production, detoxification of drugs and other substances circulating in

plasma and numerous other biochemical pathways.”(Pp163). The liver during its normal function creates bile that it secretes at a rate of 600 to 1000 milliliters per day. The bile has no digestive properties, but it is used to dilute stomach acids and emulsify fats. “The liver also plays a major role in the metabolism of certain foods and helps maintain a normal glucose concentration.” According to Saunders (2001, pp 163). In addition, the liver functions as a filter in the body by removing toxic particles. “ ... Blood proteins are also produced and released into circulation by the liver.” Saunders (2001, pp 163). These important functions are all adversely affected by the damage done to the liver by the Hepatitis “C” virus.

This virus attaches to the cells of the liver and mutates them changing their structure to create more HCV cells. These infected cells then circulate throughout the body. The mutant cells continue to reproduce, replace and destroy healthy cells in the liver. The liver, which is normally smooth, firm, and wedge shaped becomes inflamed or swollen when diseased. The liver then begins leaking enzymes known as alanine aminotransferase (ALT) into the blood.

This damage leads to fibrosis and eventually to Cirrhosis, which prevents blood flow causing the liver to shrink. Chronic Hepatitis “C” is a common cause of Cirrhosis of the liver, as is excessive drinking. Cirrhosis causes the liver to lose function and will lead to liver failure. Shering (2002, ¶ 2) says “Sometimes damage to liver cells includes altering the genes inside the cells in a way that causes them to become cancerous. Patients with chronic HCV are at a higher risk for hepatocellular carcinoma, a type of liver tumor”. According to Palmer (2000, pp 110)... “HCV can reside in the blood for many years, clandestinely doing damage to the liver even though a person feels fine.”

The CDC (2001, ¶ 12) states, “Chronic liver disease is the tenth leading cause of death among adults in the United States.” The CDC (2001, ¶ 12) further states “... HCV associated chronic liver disease is the most frequent indication for liver transplantation among adults.”

According to the CDC (2001, ¶ 1)

“A national survey (the third National Health and Nutrition examination Survey [NHANES III]) of the civilian, non-institutionalized U.S. population found that 1.8 percent of Americans (3.9 million) have been infected with HCV, of whom most (2.7 million) are chronically infected with HCV. These estimates of prevalence are likely conservative, because the survey excluded incarcerated and homeless persons, groups that have a high prevalence of HCV infection. Most infected persons were aged 30-49 years when the survey was done in the early 1990's.”

LITERATURE REVIEW

HCV is contracted through the direct transmission of blood from one person to another. According to Bruce and Montanarelli (2002, pp 21) “Unlike HIV the hep c virus doesn’t ‘die’ when exposed to air. Researchers are not sure how long it can survive outside the body, but some believe it may live for three to four weeks in dried blood.” This compounds the risk of infection for our people; not only during the run detail but also by contaminated equipment either during clean up or at the station. “The majority of responders who have contracted the disease are 15 –20 year veterans, points out Les Yost of Philadelphia Fire Fighters Local 22” (Dittmar, 2001 ¶ 11).

According to Palmer (2000, pp109) “... HCV can only enter the bloodstream by first getting through the protective covering of the skin. This is known as the percutaneous route.” The most common way of transmission is from contaminated needles either from drug use or needlestick injuries. The CDC (2001, ¶ 1) states, “HCV virus (HCV) infection is the most common chronic bloodborne viral infection in the United States...” According to Palmer (2001, pp110) “Even a speck of blood so small it is undetectable to the human eye can carry a great deal of HCV particles.”

Rosenstock (2000, ¶ 5) stated:

“Although, we do not know exactly how many work-related needle sticks occur each year across the country, estimates indicate that 600,000 to 800,000 such injuries occur annually, about half of which go unreported. A recent CDC study estimates that an average of 385,000 needlestick injuries occur annually in U.S. hospital settings.”

According to Schering, (2002, ¶ 1) "...The chances of transmitting the HCV virus through a needlestick are greater than the chances of transmitting HIV in this manner." Rosenstock (2000, ¶ 5) reports, "Of the total new HCV infections that have occurred annually (declining from 112,000 in 1991 to 38,000 in 1997), 2 to 4% have been in healthcare workers exposed to blood in the workplace". This information further proves the need for needle and sharp device protection for our people.

This protection has been addressed by both Occupational Safety and Health Administration (OSHA) and by state law. The U.S. Department of Labor Occupational Safety and Health Administration standard 29-CFR for Bloodborne Pathogens – 1910.1030(d) (2) (vi) states "Contaminated needles and other contaminated sharps shall not be bent, recapped, or removed except as noted in paragraphs (d)(2)(vii)(A) and (b)(2)(vii)(B)... .. Shearing or breaking of contaminated needles is prohibited." The Needlestick Safety and Prevention Act (2000) amended OSHA law by adding a new section to the bloodborne pathogens standard:

... "An employer, who is required to establish an exposure control plan shall solicit input from non managerial employees responsible for direct patient care who are potentially effective engineering and work practice controls and shall document the solicitation in the exposure control plan."

This change, with the addition of "Engineering Controls," added the needleless requirement to OSHA law.

According to Ohio Law,

" (A) Except as provided in division (B) of this section, each public employer of healthcare workers shall do the following:

- 1) include, as part of the employer's engineering and work practice controls, needleless systems, sharps that are manufactured with engineered sharps injury protection, and other devices that comply with the United States Occupational Safety and Health Administration's Bloodborne Pathogens Standards". (Ohio Revised Code [ORC] 4167.28, 2003, § a, 1).

The National Fire Protection Association (NFPA) addresses the prevention of needle stick injuries in NFPA 1581 by requiring the use of sharps containers. NFPA 1581 5-3.3

"Except for automatic or self-sheathing, needles shall not be manually recapped, bent or broken. Following use, all sharp objects shall be placed immediately in sharps containers. Sharps containers shall be located in all patient transport vehicles and shall be readily available in such items as drug boxes, trauma kits and IV kits."

These regulations cover the use and disposal of all sharps used in the field including IV catheters, hypodermic needles and lancets. Proper disposal of these items will further decrease the possibility of an exposure.

The debate continues as to the prevalence of HCV in the fire service and how the exposures have occurred. Rischitelli, McCauley, Lambert, Lasarev, and Mahoney (2002, ¶ 2) found:

"The risk of HCV virus (HCV) in public safety workers, including corrections officers and firefighters, is an area of public health concern; however, our previously published systematic literature review found few published studies of the prevalence of HCV among this occupational group. Little is known on the

distribution of risk factors for HCV transmission in these populations, but it is assumed that in the decades before widespread adoption of universal precautions, public safety workers were routinely exposed to blood and body fluids.”

The prevalence of HCV is a very controversial topic between the researchers and the fire service. There were five fire departments that have participated in studies involving the CDC none of which has proven a greater prevalence among first responders over the general public.

According to the CDC MMWR Weekly (2000, ¶ 12)

“ Because of several limitations, the five studies could not exclude the possibility that some first responders had acquired HCV infection from job-related exposures. First, the small sample size and limited information on both occupational (percutaneous, mucosal, or skin exposures to blood) and non-occupational risk factors may have affected the evaluation of potential sources for infection. Second, the findings do not necessarily represent all first responders in the selected locations of the United States. Third, if first responders are less likely to have non-occupational risk factors for HCV infection than the general population, then the expected prevalence in these workers might be lower”.

Treating the infected employee should be approached as aggressively as possible. The proactive approach involves initial training and baseline testing of the employee either at the time of employment or during annual physicals for current employees.

According to Dittmar (2001, ¶ 10) "...Since accurate testing for HCV wasn't available until 1992... anyone tested for blood exposures before this time should be retested...."

Dittmar (2001, ¶ 11) further states, "Firefighters may have been exposed before universal precautions, gloves and face masks were instituted.

Rischilli et al. (2002, ¶ 2) states,

"The CDC reported that the seroprevalence of HCV in health care workers (including emergency medical and public safety workers) is no greater than that of the general population and that routine screening for HCV is not indicated in these workers. Nevertheless, concerns remain about the potential of occupational transmission of HCV."

Testing for HCV has multiple steps; initial testing may include using a test commonly performed to measure the safety of donated blood. This test is called an ELISA III, which according to Palmer (2000, pp 123)

"...is the test used since May 1996 to screen blood products in the United States for HCV. This test detects the antibody against five of the HCV antigens and is, therefore, more accurate than ELISA II. This blood test can detect the HCV at approximately six to eight weeks after exposure to HCV. All ELISA tests are typically reported as being positive or negative."

The results of these tests must be confirmed with a secondary test called RIBA 2.0, which became commercially available in June 1993. This test is used for people with a low risk for infection, meaning they have no apparent risk factor. This test is suitable for the exposed worker and should be done at the time of exposure, six weeks after the

exposure, six months from the date of exposure and finally at the one year anniversary. Bruce and Motanarelli (2002, pp16) say “If you believe you have been infected with HCV in the last several months consult a specialist about your treatment options as soon as possible. A recent study found that early treatment might prevent HCV from becoming chronic.” This testing will also identify the genotypes of the infection. Bruce and Motanarelli (2002, pp12) further state,

“Although there are infinitely many variations of HCV, eleven basic genotypes or genetic variations have been identified. Some strains of HCV are so distinct that some scientists think they are actually different viruses...” “... The most common in North America is called 1a and the most common in Europe is 1b. Types 4 through 11 are very rare in the United States.”

Once an employee has tested positive for HCV it is imperative that the employee receive aggressive medical treatment, as well as professional counseling. The treatment of this disease will begin by determining the genotype of the disease in order to establish the best treatment path for the patient. Currently there are two types of therapy for these patients, monotherapy and combination therapy. There are two drugs, Peginterferon and Ribavirin being used in combination therapy.

According to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK, 2003 ¶ 37) “Combination therapy is now recommended for HCV and interferon monotherapy is applied only when there are specific reasons not to use ribavirin”. The combination therapy is the most effective however; it also has significantly more side effects. The side effects of Ribavirin range from nausea to

sudden cardiac death. Treatment therapy for HCV will last from 24 to 48 weeks depending on the type: combination therapy is 24 weeks long and monotherapy lasts 48 weeks. The cost of this therapy ranges from \$18,000 to \$20,000 for a treatment cycle for the medication alone. Peginterferon is given as a subcutaneous injection in doses from 75 to 180 micrograms per week. Ribavirin is an oral medication taken twice daily with a daily dose from 800 to 1200 micrograms. The NIDDK (2003, ¶ 40) state

“Combination therapy leads to rapid improvements in serum ALT levels and disappearance of detectable HCV RNA in up to 70 percent of patients. However, long term improvement in HCV occurs only if HCV RNA disappears during therapy and stays undetectable once therapy is stopped.”

The importance of prompt treatment of those infected with acute HCV cannot be overstated. According to the NDDK (2003, ¶ 49)

“Because such a high proportion of patients with acute infection develop chronic HCV, prevention of chronicity has become a focus of attention. In small studies, 83 to 100 percent of persons treated within 1 to 4 months of onset have had resolution of the infection.”

The last resort for treatment appears to be organ transplant to replace the failing liver. In addition to the physical treatment the emotional and psychological needs must also be met and treated.

The infected person will experience a wide range of emotions. Bruce and Montanarelli (2002, pp4) state “Many of us experience the five stages of grief. These include: Denial and Isolation, Anger, Bargaining, Depression, and Acceptance.” Many of those infected will not have the support structure in place to allow them to deal with the

news. Some may lose support of friends and family as they inform them of their infection. Family and friends may become judgmental and may lose sight of the fact that the exposure occurred while performing patient care. This will be difficult for the employee to deal with, and they will need the support of their peers and their employer. This support will be needed not only by the firefighter, but their family as well.

According to www.Hep-C-Alert.org the cost of this disease for lost wage and medical benefits is estimated at \$1.5 billion a year. The employer carries insurance through Worker's Compensation to cover these expenses if the illness can be proven to be job related. The Bureau of Workers' Compensation classifies exposure incidents into two categories. These categories are exposures with and without physical injury. The claims with physical injury (i.e. Needle stick injuries) are not automatically denied; however, claims without physical injury are automatically denied. This denial pertains only to compensable claims and do not relate to treatment. The Ohio Senate passed Senate bill 223 in March of 2003, which modifies Ohio Revised section 4167. This further clarified what is and what is not covered by Workers' Compensation. N.J. Scott (personal communication, December 19, 2003) stated "While claims filed for exposure without physical injury are disallowed, there are certain employees who are eligible for reimbursement by BWC or a self-insuring employer, for preventative testing and treatment, even though they don't have a compensable claim." According to N.J. Scott (personal communication, December 19, 2003)

"...provides that BWC or a self-insuring public employer will pay for post exposure medical care for peace officers, firefighters, or emergency medical workers (first responder, EMT, EMS, etc) who, in the course of and arising out of

their employment, come in contact with blood or other body fluids of another person and do not sustain a physical injury. It applies to all State Fund employers administered by BWC, whether public or private, and to self-insuring public employers”.

Ohio Law defines the non-injury exposure as...

“This includes but is not limited to a splash or splatter in the eye or mouth including mouth to mouth resuscitation and when a worker has a cut in the skin or another opening in the skin such as an open sore, wound lesion abrasion or ulcer that comes in contact with another persons body fluid”. (Ohio Revised Code 4123.02.6, 2003, § A)

This bill however does not cover any contact to airborne infections. This bill addressed concerns about known exposures and treatment after the exposure.

The one area that has not been addressed is presumption of the illness being job related. This has been addressed in other states due to the high risk of exposure faced by emergency responders. Currently there is provision of presumption when it comes to HIV, cardiovascular and pulmonary disease. Several states have the presumption of HCV in law to protect the employee. These states have made a connection between risk of exposure and actual infection of the employee. One such state is Pennsylvania House Bill No. 1698 passed in 2001. This bill provides for education on prevention, screening, and treatment for emergency workers.

PROCEDURES

In order to answer the questions posed, there were several sources used to gather data. These sources included trade journals, electronic media and published works by authors considered to be experts in the field. The literature review was conducted using several sources for information including, Hamilton County Public Library, Tri Health Corporate Medical Research Library and electronic sources. There was some personal correspondence by email with a BWC representative for clarifications on state laws and the way claims are handled. The information gathered was analyzed, and pertinent information separated from non-pertinent information. This segregation of information allowed the author to remain focused on the questions of the paper. Consideration was given to the use of a survey; however, the sample size would have not been sufficient to generate reliable results. Due to the sensitive nature of the topic, honest answers would have been difficult to obtain. Once the information was gathered, it was reviewed and graded as being of use or not. Information deemed useful was then subdivided by research question. The pertinent information from these sources was then extracted for use in developing this research document. Careful consideration was given to removal of personal and political bias on the part of some of the authors of these documents.

Definition of Terms

AIDS: Acquired Immune Deficiency Syndrome, a communicable disease caused by Human Immunodeficiency Virus (HIV). (United States Fire Administration [USFA], 2002, page 133).

ALT (Alanine Aminotransferase) and **AST** (Aspartate Aminotransferase): a common test used to monitor liver damage in people who have hepatitis C. ALT and AST are enzymes used for the metabolism of amino acids. Liver cells release these enzymes into the bloodstream when they die. Elevated enzymes indicate inflammation and possibly HCV. (The First Year Hepatitis C, Page 243, Copyright 2002)

Antibody: A component of the immune system which eliminates or counteracts a foreign substance (antigen) in the body. (United States Fire Administration [USFA], 2002, page 133).

Antigen: A foreign substance which stimulates the production of antibodies in the immune system. (United States Fire Administration [USFA], 2002, page 133).

Bile: substance that reduces large fat globules into smaller droplets of fat that are more easily broken down. (The Human Body In Health & Disease, Third Edition, Page G-5, Copyright 2002)

Bloodborne Pathogen: Pathologic microorganisms that are present in human blood and that can cause disease in humans. (OSHA) Note: the term “blood” includes blood, blood components, and products made from human blood. (United States Fire Administration [USFA], 2002, page 133).

Body Fluids: “Fluids that have been recognized by the CDC as directly linked to the transmission of HIV and/or HBV and/or to which Universal Precautions apply:

blood, semen, blood products, vaginal secretions, cerebrospinal fluid, synovial fluid, pericardial fluid, amniotic fluid, and concentrated HIV or HBV viruses.” (OSHA) (United States Fire Administration [USFA], 2002, page 133).

Body Substance Isolation (BSI): An infection control strategy that considers all body substances potentially infectious. This protective measure is accomplished through barrier protection using personal protective equipment (gloves, masks, protective eyewear, gowns, and resuscitation devices, as appropriate) to prevent personal contact with any body fluids or other potentially infectious material. (United States Fire Administration [USFA], 2002, page 134).

Cardiovascular: Pertaining to the heart and blood vessels. (The Human Body in Health and Disease, 2002, page G-7)

CDC (Centers for Disease Control and Prevention): A branch of the Department of Health and Human Services, Public Health Service, that serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States. (United States Fire Administration [USFA], 2002, page 134).

Cell: the basic biological and structural unit of the body consisting of a nucleus surrounded by cytoplasm and enclosed by a membrane. (The Human Body In Health & Disease, Third Edition, Page G-7, Copyright 2002)

Chronic: long-lasting, as in chronic disease. (The Human Body In Health & Disease, Third Edition, Page G-9, Copyright 2002)

Cirrhosis: degeneration of liver tissue characterized by the replacement of damaged liver tissue with fibrous or fatty connective tissue. (The Human Body In Health & Disease, Third Edition, Page G-9, Copyright 2002)

Combination Therapy: the combination of interferon and ribavirin used to treat hepatitis. (The First Year Hepatitis C, Page 245, Copyright 2002)

Communicable: able to spread from one individual to another. (The Human Body In Health & Disease, Third Edition, Page G-10, Copyright 2002)

Communicable (Contagious) Disease: A disease that can be transmitted from one person to another. (United States Fire Administration [USFA], 2002, page 135).

Contagious: Infectious disease that can be transmitted from one person to another from either direct or indirect contact. (United States Fire Administration [USFA], 2002, page 134).

Contamination: Soiling or pollution, as by the introduction of organisms into a wound or onto equipment. (United States Fire Administration [USFA], 2002, page 134).

Decontamination: The use of physical or chemical means to remove, inactivate, or destroy bloodborne, airborne, or foodborne pathogens on a surface or item to the point they are no longer capable of transmitting infectious particles. (NFPA 1581) (United States Fire Administration [USFA], 2002, page 134).

Digestive System: organs that work together to ensure proper digestion and absorption of nutrients. (The Human Body In Health & Disease, Third Edition, Page G-13, Copyright 2002)

Disease: An alteration of health, with a characteristic set of symptoms, which may affect the entire body or specific organs. (United States Fire Administration [USFA], 2002, page 134).

Disease Transmission:

Direct: Communicable disease is transmitted from one person to another due to contact with infected blood, body fluids, or other infectious material. (United States Fire Administration [USFA], 2002, page 135).

Indirect: Communicable disease is transmitted from one person to another without direct contact. (United States Fire Administration [USFA], 2002, page 135).

Infectious: An illness or disease resulting from invasion of a host by disease-producing organisms such as bacteria, viruses, fungi, or parasites. (United States Fire Administration [USFA], 2002, page 135).

Disinfection: “A procedure which inactivates virtually all recognized pathogenic microorganisms but not necessarily all microbial forms (ex. Bacterial endospores) or inanimate objects.” (OSHA) (United States Fire Administration [USFA], 2002, page 135).

Elisa: Enzyme-linked immunosorbent assay. A test used to detect antibodies to the AIDS virus, indicating infection. For accuracy, a positive ELISA test is always repeated. If still positive, a Western Blot test is then performed to confirm the diagnosis. (United States Fire Administration [USFA], 2002, page 135).

Emergency Medical Care: The provision of treatment to patients, including first aid, cardiopulmonary resuscitation, basic life support, advanced life support a, and other

medical procedures that occur prior to arrival at a hospital or other health-care facility. (NFPA 1581) (United States Fire Administration [USFA], 2002, page 135).

Emergency Medical Operations: Delivery of emergency medical care and transportation prior to arrival at a hospital or other health care facility. (NFPA 1581) (United States Fire Administration [USFA], 2002, page 135).

EMS (Emergency Medical Services): A group, department, or agency that is trained and equipped to respond in an organized manner to any emergency situation where there is the potential need for the delivery of prehospital emergency medical care and/or transportation. EMS can be provided by fire department, private, third service, or hospital-based systems or any combination thereof. (United States Fire Administration [USFA], 2002, page 135).

Emulsify: in digestion, when bile breaks up fats. (The Human Body In Health & Disease, Third Edition, Page G-14, Copyright 2002)

Endocrine: secreting into the blood or tissue fluid rather than into a duct; opposite of exocrine. (The Human Body In Health & Disease, Third Edition, Page G-14, Copyright 2002)

Endocrine System: the series of ductless glands that are found in the body. (The Human Body In Health & Disease, Third Edition, Page G-14, Copyright 2002)

Enzyme: biochemical catalyst allowing chemical reactions to take place. (The Human Body In Health & Disease, Third Edition, Page G-15, Copyright 2002)

Exposure: Eye, mouth, other mucous membrane, non-related skin, or parenteral contact with blood, other body fluids, or other potentially infectious material.

(United States Fire Administration [USFA], 2002, page 135).

Fat: one of the three basic food types; primarily a source of energy.

(The Human Body In Health & Disease, Third Edition, Page G-16, Copyright 2002)

First Responder: Personnel who arrive first on the scene at emergency incidents and have the responsibility to act. Includes, fire, police, EMS, and other public safety workers. (United States Fire Administration [USFA], 2002, page 136).

Gene: one of many segments of a chromosome (DNA molecule); each gene contains the genetic code for synthesizing a protein molecule such as an enzyme or hormone.

(The Human Body In Health & Disease, Third Edition, Page G-18, Copyright 2002)

Gloves, Emergency Medical: Single-use, patient examination gloves that are designed to provide a barrier against body fluids meeting. (NFPA 1581)

(United States Fire Administration [USFA], 2002, page 136).

HCV: the virus that causes hepatitis C.

(The First Year Hepatitis C, Page 247, Copyright 2002)

HCV RNA: hepatitis C virus ribonucleic acid; the genetic material of the HCV virus. The PCR test detects the presence of the virus by detecting HCV RNA in the blood. (The First Year Hepatitis C, Page 247, Copyright 2002)

Health: physical, mental, and social well-being; the absence of disease. (The Human Body In Health & Disease, Third Edition, Page G-19, Copyright 2002)

Hepatitis: inflammation of the liver due to viral or bacterial infection; injury; damage from alcohol, drugs, or other toxins; or other factors. (The Human Body In Health & Disease, Third Edition, Page G-20, Copyright 2002)

Health-Care Worker: “An employee of a health care facility including, but not limited to, nurses, physicians, dentists, and other dental workers, optometrists, podiatrists, chiropractors, laboratory and blood bank technologists and technician, research laboratory scientists, phlebotomists, dialysis personnel, **paramedics, emergency medical technicians**, medical examiners, morticians, housekeepers, laundry workers, **and others whose work may involve direct contact with body fluids** from living individuals or corpses.” (OSHA, bold added.) (United States Fire Administration [USFA], 2002, page 136).

Hepatitis: inflammation of the liver due to viral or bacterial infection; injury; damage from alcohol, drugs, or other toxins; or other factors.
(The Human Body In Health & Disease, Third Edition, Page G-20, Copyright 2002)

Hepatitis A (Infectious): Viral infection normally spread by fecal contamination.
(United States Fire Administration [USFA], 2002, page 136).

Hepatitis B (HBV, Serum): Viral infection spread through blood contact, and also as a sexually transmitted disease. Infection may result in chronic hepatitis, liver cancer, cirrhosis of the liver, or death.
(United States Fire Administration [USFA], 2002, page 137).

Hepatitis C (HCV): Viral infection spread through blood contact. Currently, no prophylaxis is available. (United States Fire Administration [USFA], 2002, page 137).

HIV Infection (HIV Positive): A person who has tested positive for HIV antibodies on two ELISA tests, confirmed with Western Blot testing. HIV-infected patients can spread the virus through blood and body fluids.

(United States Fire Administration [USFA], 2002, page 137).

Human Immunodeficiency Virus: The causative agent of AIDS. HIV type 1 causes most cases of AIDS. A second virus, HIV-2 is a less common cause of the disease. (United States Fire Administration [USFA], 2002, page 137).

Incubation Period: The time from exposure to the disease until the first appearance of symptoms. (United States Fire Administration [USFA], 2002, page 138).

Infection: Growth of pathogenic organisms in the tissues of a host, with or without detectable signs of injury. (United States Fire Administration [USFA], 2002, page 138).

Infection Control Officer: “The person within the fire department who is responsible for managing the department infection control program and for coordinating efforts surrounding the investigation of an exposure.” (NFPA 1581)
(United States Fire Administration [USFA], 2002, page 138).

Infection Control Program: “The establishment’s oral or written policy and implementation of procedures relating to the control of infectious disease hazards where employees may be exposed to direct contact with body fluids.” (OSHA)
(United States Fire Administration [USFA], 2002, page 138).

Infectious: Capable of causing infection in a suitable host.
(United States Fire Administration [USFA], 2002, page 138).

Infectious Waste: “Blood and blood products, pathological wastes, microbiological wastes, and contaminated sharps.” (MMWR) (United States Fire Administration [USFA], 2002, page 138).

Inflammation: group of responses to a tissue irritant marked by signs of redness, heat, swelling, and pain.

(The Human Body In Health & Disease, Third Edition, Page G-22, Copyright 2002)

Intravenous (IV): into or within the vein.

(Dr. Melissa Palmer's Guide To Hepatitis Liver Disease, Page 407, Copyright 2000)

Member: "A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. A member can be full-time, part-time, paid, or unpaid, can occupy any position or rank within the fire department, and might or might not engage in emergency operations." (NFPA 1581)

(United States Fire Administration [USFA], 2002, page 138).

Microorganism: A living organism, usually visible only with a microscope, including bacteria, viruses, fungi, and parasites.

(United States Fire Administration [USFA], 2002, page 139).

Monotherapy: treatment with only one drug or agent.

(Dr. Melissa Palmer's Guide To Hepatitis Liver Disease, Page 408, Copyright 2000)

Morbidity and Mortality Weekly Report (MMWR): A weekly publication from the Centers for Disease Control and Prevention presenting up-to-date information on communicable diseases. (United States Fire Administration [USFA], 2002, page 139).

Mucous Membrane: The lining of the nose, mouth, eyes, vagina, and rectum. Mucous membranes are not as durable as other skin; contact of infected body fluids with intact mucous membranes may transmit disease.

(United States Fire Administration [USFA], 2002, page 139).

Mutations: small changes in genetic material.

(The First Year Hepatitis C, Page 248, Copyright 2002)

Occupational: Related to the performance of duties and responsibilities of the job. (United States Fire Administration [USFA], 2002, page 139).

Exposure: “Reasonably anticipated skin, eye, mucous membrane, or parental contact with blood or other potentially infectious materials that may result from the performance of an employee’s duties.” (OSHA) This definition excludes incidental exposures that may take place on the job, that are neither reasonable or routinely expected, and that the worker is not required to incur in the normal course of employment. (United States Fire Administration [USFA], 2002, page 139).

Illness: “An illness or disease contracted through or aggravated by the performance of the duties, responsibilities, and functions of a fire department members.” (NFPA 1500) (United States Fire Administration [USFA], 2002, page 139).

Injury: “An injury sustained during the performance of the duties, responsibilities, and functions of a fire department member.” (NFPA 1500) (United States Fire Administration [USFA], 2002, page 139).

Organ: group of several tissue types that performs a special function. (The Human Body In Health & Disease, Third Edition, Page G-29, Copyright 2002)

Pathogen: A microorganism that can cause disease. Pathogens can be bacteria, viruses, fungi, or parasites. (United States Fire Administration [USFA], 2002, page 139).

Pegylated Interferon: time release interferon. Pegylation is the process of adding a molecule of polyethylene glycol to interferon. The polyethylene glycol acts like a suit of armor – making the interferon time release and increasing absorption, so that patients

only have to inject the interferon once a week, rather than three times a week. This pharmaceutical is thought to have less severe side effects than regular interferon.

(The First Year Hepatitis C, Page 248, Copyright 2002)

Percutaneous: through the skin.

(Dr. Melissa Palmer's Guide To Hepatitis Liver Disease, Page 410, Copyright 2000)

RIBA 3: (Recombinant Immunoblot Assay): test for HCV antibodies used to verify a positive result on the less accurate ELISA 3.

(The First Year Hepatitis C, Page 249, Copyright 2002)

Ribavirin: a pharmaceutical drug that may slow the genetic machinery of the HCV virus and may also help preserve some immune functions; used in combination with interferon to treat hepatitis C. (The First Year Hepatitis C, Page 249, Copyright 2002)

Seroconversion: A change in the status of one's serum test. For example, someone initially tests negative for HIV, then tests positive at a later date.

(United States Fire Administration [USFA], 2002, page 140).

Sharps: "Any object that can penetrate the skin including, but not limited to needles, lancets, scalpels, and broken capillary tubes." (OSHA)

(United States Fire Administration [USFA], 2002, page 140).

Sharps Container: "Container that is closable, puncture-resistant, disposable, and leakproof on the sides and bottom; red in color or displays the universal biohazard symbol; and designed to store sharp objects after use." (NFPA 1581)

(United States Fire Administration [USFA], 2002, page 140).

Sterilization: "The use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial endospores." (OSHA)

(United States Fire Administration [USFA], 2002, page 140).

Stomach: an expansion of the digestive tract between the esophagus and small intestine.

(The Human Body In Health & Disease, Third Edition, Page G-38, Copyright 2002)

Universal Precautions: Infection control strategy developed by the CDC for **hospital workers**. Universal precautions are based on the concept that blood and **certain** body fluids (any body fluids containing visible blood, semen, vaginal secretions, tissues, cerebrospinal fluid (CSF), synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid) of all patients should be considered potentially infectious for HIV, HBV, and other bloodborne pathogens.

(United States Fire Administration [USFA], 2002, page 141).

Vaccine: A suspension of attenuated or killed microorganisms (bacteria, viruses or rickettsiae), administered to prevent or reduce the chance of contracting infectious diseases. (United States Fire Administration [USFA], 2002, page 141).

Vascular: full of blood vessels.

(Dr. Melissa Palmer's Guide To Hepatitis Liver Disease, Page 414, Copyright 2000)

Virus: microscopic, parasitic entity consisting of a nucleic acid bound by a protein coat and sometimes a lipoprotein envelope.

(The Human Body In Health & Disease, Third Edition, Page G-42, Copyright 2002)

Limitations of the Study

There were several limitations encountered during this study. The first limitation is the amount of good data available for use on this topic. There is sufficient data as to the cause and treatment of HCV. The problem arises in the area of prevalence in relationship to emergency workers. The other limitation was finding good scientific based non-biased information on the topic. The limited studies performed appeared to have been skewed by personal or professional bias on the topic.

RESULTS

HCV, is the easiest bloodborne disease to contract and a threat faced by our people on a daily basis that is more prevalent than HIV. This disease can only be contracted through direct blood contact through an opening in the skin. The primary risk factors are blood transfusion prior to 1993, history of IV drug abuse or multiple sex partners. The primary occupational exposures noted are through percutaneous needle stick injury, open sores or wounds that are unprotected. These routes cause the body fluids of others to enter the blood stream of the employee. Following proper body substance isolation procedures and education about the disease and the modes of transmission are two areas, which can improve the protection of our people. The use of engineered protection devices for sharps can dramatically reduce the chance of exposure from a needle stick injury. These devices are mandated both by state and federal laws to be incorporated into the infection control policy of every department. The use of barrier devices and safer needle systems can drastically reduce the exposure of the employee to the disease.

The treatment path of those infected should start long before an exposure occurs. This treatment path should begin with educating the employee. This education should not only deal with the disease and the modes of transmission, but it should also deal with proper use of the barrier devices. There should also be testing for the disease as part of the pre-employment physical for the employee. In the case where pre-employment testing was not done it should be included in the annual physical. Post exposure testing should be done immediately after an exposure, then again at six weeks, six months and one year after exposure. Early aggressive pharmacological

treatment has shown to prevent acute HCV from becoming chronic. This treatment must also include counseling for the employee and their family. Counseling should also include further education on the risk factors for the family and friends of the infected employee. It is imperative that the employee receives support from the employer as well as their family.

In 2003, The State of Ohio made resources available to treat these employees through changes in the Workers' Compensation law. These changes not only make it easier to get payment for testing and initial treatment, it also makes compensation for lost time easier to obtain. Those cases where there is no injury (splash exposures) will be the hardest for which to obtain ongoing support through BWC. Cases that involve a needle stick injury are considered a compensable claim through BWC. Due to the long incubation period of this disease, it will be necessary to document each exposure so that if a problem arises later a clear connection can be made. Thorough record keeping and careful documentation can make the difference in a future claim being approved or denied.

DISCUSSION

The threat of contracting a bloodborne infection is a problem the fire service has been dealing with for years. Great strides have been made in this area, however more work needs to be done. As a result of being concerned with the transmission of other communicable diseases such as tuberculosis, HIV and Hepatitis, we have instituted policies and procedures to have our people wear a myriad of protection and barrier devices for their protection. These devices include gloves, gowns, masks and eye protection along with better disposal techniques to contain and identify contaminated items. The threat of HCV does not go away with the patient. This threat remains through the cleanup and decontamination stages of the run. As stated by Bruce and Montanarelli "Unlike HIV the hep c virus doesn't "die" when exposed to air. Researchers are not sure how long it can survive outside the body, but some believe it may live for three to four weeks in dried blood." (2002, pp21)

The area in which we seem to be lacking is protection from needle stick injuries. The high cost of some of these devices has made it cost prohibitive for some departments in the fire service. The original intentions of these devices were to protect healthcare providers from the HIV virus; however, they may be more important now for protection against HCV. According to Palmer "...HCV can only enter the bloodstream by first getting through the protective covering of the skin. This is known as the percutaneous route." (2000, pp109)

There are many devices currently on the market that provide protection from needle stick injuries. The high cost of these devices is miniscule in comparison to the cost of treating an infected employee. The best protection for our people from this

disease is a combination of training about the disease and the implementation of better barrier devices. Training should incorporate risk factors for exposures both in occupational and social settings. This will enable them to reflect on their past to identify past behaviors or medical procedures that would potentially put them at risk.

The implementation of better barrier devices should be instituted with the goal of a totally needleless system to reduce exposure to percutaneous needle sticks. These devices along with the currently accepted practice of wearing body substance protection will further protect our people. Additionally, we should encourage our people to limit the use of needles in the back of a moving EMS unit as this provides additional opportunity for them to be inadvertently stuck with a needle.

Treatment of the exposed or already infected worker should include aggressive medical treatment as well as professional counseling. According to the National Institute of Diabetes and Digestive and Kidney Diseases ... "Combination therapy is now recommended for HCV and interferon monotherapy is applied only when there are specific reasons not to use ribavirin". (NIDDK, 2003) The combination therapy is the most effective however; it also has significantly more side effects. Once the infection is detected, a qualified specialist in infectious disease should decide the treatment pathway. Along with treatment for the disease, counseling and treatment of the psychological side of this disease should be incorporated into the overall care for the employee. Bruce and Montanarelli (2002) state, "Many of us experience the five stages of grief. These include: Denial and isolation, Anger, Bargaining, Depression, and Acceptance." (2002, pp4)

Proving the exposure occurred on the job can be critical in assuring payments for treatment and lost wage compensation. The cost of primary medical care for this disease process can be astounding with drug cost alone at nearly \$20,000 annually. N.J. Scott (personal communication, December 19, 2003) states "While claims filed for exposure without physical injury are disallowed, there are certain employees who are eligible for reimbursement by BWC or a self-insuring employer, for preventative testing and treatment, even though they don't have a compensable claim." The burden of proof for this type of on the job exposure rests primarily with the employee and not the organization for which he works. This burden of proof is where the employer can be of great assistance to the employee as well as their family. Support for the employee from the organization not only makes things flow smoother through the red tape of a workmen's compensation claim, it also shows compassion for the infected employee. The most effective way of identifying the infection early is yearly testing of each employee. Bruce and Motanarelli say "A recent study found that early treatment might prevent HCV from becoming chronic." (2002, pp16). Although annual testing is not currently recommended by the Centers for Disease Control (CDC), it could assist in narrowing the search for the cause of infection. The early recognition will allow for early and more aggressive treatments. Early treatment will not only help to combat the disease and potentially control the amount of damage; it may also prevent it from becoming chronic.

RECOMMENDATIONS

The research conducted has brought to light several areas where improvement can be made within the Sharonville Fire Dept. We have solid infection control policies in place to guide our people on the proper procedures. However, we need to provide them with additional barrier devices. The need to re-evaluate our practices and eliminate all possible sharps without engineered safety devices is an immediate change that will take place. There is also the need for additional education in infection control and modes of transmission. As part of this education emphasis must be placed on reporting all exposures, regardless of how minor they may seem.

The treatment of the exposed employee must be taken to the next level. This has been accomplished through the contracting of an Infectious Disease Specialist to evaluate and treat our employees. This specialist will evaluate and treat any employee who has had a significant exposure. The Sharonville Fire Department has agreed to pay for this treatment should it not be covered by BWC.

Further research is necessary to determine if the infection rate in emergency workers is more than that of the general public. The perceived problem in this area does not appear to be as drastic as first believed. The assumption of a higher prevalence of infection could not be supported. Further research is also needed to determine the amount and cause of needle stick injuries in EMS workers.

The Sharonville Fire Department will, as part of the annual physical, begin HCV testing even though at this time the CDC does not recommend it. This is due to the successful treatment rates for early detection. The cost of this testing when weighed against the benefit of early detection is miniscule.

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