Report to Congress

Hepatitis C Virus Infection Among U.S. Military Personnel: An Assessment Of Risks and Screening Strategies

Office of the Assistant Secretary of Defense

Health Affairs

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Executive Summary

The Fiscal Year (FY) 1999 Senate Armed Services Committee Report directed the Department of Defense (DoD) to study the extent of service-connected hepatitis C infection, to include the advisability and feasibility of testing for hepatitis C virus (HCV) during separation and retirement physicals (enclosure 1). The Department previously had initiated a comprehensive research strategy to study hepatitis C virus infection among military members. Investigations begun in 1998 included: 1) the first large-scale, randomized sero-epidemiological investigation of over 20,000 military personnel; 2) analysis of DoD hospital records of inpatient admissions for acute and chronic viral hepatitis during the last 20 years; and, 3) cost analysis of testing for HCV infection.

In this report to Congress, the Office of the Assistant Secretary of Defense (Health Affairs) provides the initial results of these studies.

In the sero-epidemiologic investigation, the overall prevalence of hepatitis C infection among 10,000 active duty personnel serving in 1997 was 0.48% (about 5 per 1000 troops). Troops less than 35 years of age had the lowest risk of HCV infection (0.1%), which is 1 infected person per 1000 personnel. The highest risk was found among individuals 35 years of age and older (1.7% prevalence), nonwhite racial/ethnic groups, and enlisted personnel; women generally had a lower risk of infection.

For recruits enlisting in 1997, the prevalence of infection was just 0.1% (1 per 1000 recruits). The risk of infection for Reservists was similar to active duty personnel after adjusting for age. The prevalence of infection in active duty personnel who had been on duty since the Vietnam era was actually lower (1%) than the prevalence (3%) among other military personnel of similar age (greater than 40 years old). Individuals retiring from the military in 1997 were on average 45 years old and had a prevalence of infection of 1.7%.

As expected in any mass screening of a low risk population, questionable test results were common, which required extensive re-testing to determine who actually was infected. For example, in the testing of recruits the number of inconclusive results was actually higher than positive test results, which required additional analysis by polymerase chain reaction assays that have yet to be approved by the FDA.

The hospitalization records study indicated a steadily decreasing risk of acute viral hepatitis in the U.S. military during the last 20 years. A similar trend has been observed in the civilian community where a greater than 80% reduction in acute hepatitis C infection has occurred. In the general population, hepatitis C infection has primarily been associated with illicit drug use.

Today's military personnel are at substantially less risk of hepatitis C infection than civilians because of very low levels of drug abuse. The 0.48% prevalence of infection found in active duty troops is more than three times lower than the 1.8% prevalence found in the CDC study of the general U.S. population. The low risk of viral hepatitis in the U.S. military can be attributed to existing DoD programs, including:

- High induction standards, which include testing for illicit drug use and human immunodeficiency virus (HIV) infection
- Routine, randomized drug screening throughout military service
- Routine medical screening and examinations of active duty and Reserve personnel
- Routine physical performance testing that identifies chronic health problems
- Hepatitis C testing of blood donors and the donor/recipient "lookback" program
- Universal precautions to prevent transmission of bloodborne infections
- Total force hepatitis A immunization and risk-based hepatitis B immunization

The Department's extensive investigations indicate no requirement at this time to deviate from national screening policy on HCV as established by the Centers for Disease Control and Prevention (CDC), *Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease*, Morbidity and Mortality Weekly Report, October 16, 1998 / Vol. 47 / No. RR-19 (enclosure 2). Also, expanded HCV screening would not enhance military force readiness because of the very low levels of HCV infection among active duty personnel and because HCV infection seldom leads to clinical disease during military service.

Because older service members have a higher prevalence of infection, individuals 35 years of age and older who separate or retire from service will be specifically screened for risk factors of HCV infection and tested when indicated based on CDC guidelines (enclosure 3). The results of this targeted screening, and subsequent evaluation, counseling, and treatment, will be annotated in the service members' medical record, which will provide continuity of care within the Department of Veterans Affairs (VA) health care system. By basing testing on CDC national consensus guidelines, the military population most at risk of HCV infection will be screened, ensuring appropriate use of health care dollars.

The Department also has initiated a concerted provider and patient education program (enclosure 4). This effort emphasizes increased awareness of the risk factors for hepatitis C infection so that potentially exposed individuals and their health care providers understand the need for testing and counseling. Additionally, every physician within DoD is being contacted and provided a brochure prepared by the CDC with important information about the risk, diagnosis, and treatment of hepatitis C.

Background

Hepatitis C virus (HCV) is a positive-stranded RNA virus in the family Flaviviridae.[1,2] This very heterogeneous virus can be divided into at least six distinct genotypes and over 90 subtypes. HCV was not identified until 1988, although for several decades an unidentified virus had been suspected to be a major cause of hepatitis following blood transfusions.[3] Since its discovery, HCV infection has been detected worldwide. In developed countries, HCV infection has been found in 0.5 to 2% of the general population and in less than 1% of volunteer blood donors.[1,2]

In the largest U.S. study conducted to date by the Centers for Disease Control (CDC), HCV infection was found in 1.8% of 21,241 persons greater than six years old.[4] The highest prevalence of infection was observed in males (2.5% prevalence) and persons aged 30 to 49 years (4.2% prevalence). Groups at increased risk included African-Americans (3.2% prevalence), Hispanics (2.1% prevalence), and individuals at lower socioeconomic status. A history of drug abuse was strongly associated with infection. Notably, military veterans had a lower prevalence of infection (1.2%) compared to other age-matched subjects (1.7%).[4]

In the United States, the annual incidence of new HCV infections has declined more than 80% during the last 10 years from an estimated 230,000 infections to 36,000 in 1996.[4-6] Despite a rapidly decreasing incidence of transmission, an estimated 3.9 million Americans have been infected with HCV.[4]

Transmission

Hepatitis C virus is transmitted predominantly by the blood-borne route through large or repeated direct percutaneous exposures.[6] In addition, perinatal infection occurs in about 5-6% of infants born to HCV infected mothers.[7,8] Whether HCV is commonly transmitted by heterosexual or homosexual contact is not well understood, but this mode of infection is less efficient than parenteral exposure.[9-12] For persons in long term sexual relations with one person, the risk of HCV infection is very low. Snorting drugs like cocaine may be another mode of transmission.[4,6,13] Prior studies in the USA have not demonstrated an association between HCV infection and medical and dental procedures, tattooing, acupuncture, ear piercing, or foreign travel.[6]

Since the development in 1990 of a commercial serological assay for HCV infection, blood donors have been screened for this infectious disease.[1] Consequently, blood transfusions rarely account for recently acquired HCV infections.[14] The current risk for transfusion-associated HCV infection is estimated to be 0.001% per unit transfused.[6,15]

The reasons why HCV transmission has decreased in the general population are not well known but may be related to changes in risk behaviors (drug use and sexual activity) due to the AIDS epidemic.[1,2] "Injecting drug use currently accounts for most HCV transmission in the United States, and has accounted for a substantial proportion of HCV infections during past decades."[6] Hemophiliacs and dialysis patients are also at higher risk of HCV infection.[1,2] Health care and emergency personnel are at increased risk of infection from accidental needle-sticks.[16,17] "HCV

is not spread by sneezing, hugging, coughing, food or water, sharing eating utensils or drinking glasses, or casual contact."[6]

Because blood-borne transmission predominates, the most effective method for reducing HCV transmission is to avoid illicit drugs and the use of contaminated needles.

Clinical Course

The majority of individuals infected with HCV do not develop acute jaundice but remain asymptomatic.[2,5] However, 75-85% of acute infections become chronic.[18] Chronic HCV infection is again asymptomatic in most cases and usually does not lead to clinically apparent liver disease or premature mortality.[1,2] Most individuals with chronic HCV infection therefore are not ill, and infection is only found because of blood tests conducted as part of a routine physical examination or because of standard testing of blood donations.

Although usually asymptomatic, nearly all patients with chronic HCV infection have indications of chronic hepatitis on liver biopsy.[2] After one or more decades, possibly 10-20% of chronic infections progress to cirrhosis, which is associated with the development of hepatocellular carcinoma in 1% to 5% of chronic HCV infections.[5,19] Factors linked to progressive liver fibrosis include:[20]

- age greater than 40 years at the time of HCV infection
- male sex
- alcohol consumption

Currently, HCV is the major infectious cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma.[1,2] HCV infection also is the leading cause of liver disease requiring organ transplantation among adults.[1] Possibly 8-10 thousand deaths each year in the USA result from hepatitis C virus infection.[4,5]

The lack of long-term clinical data is a major shortcoming when trying to predict the future health care burden of chronic liver disease due to prior HCV transmission. Most studies have been relatively small and involved unique populations. In one study of 568 cases of blood transfusion-associated non-A, non-B hepatitis (mostly hepatitis C), there was no difference in all-cause mortality between cases and transfused controls without hepatitis after more than 20 years of follow-up.[21,22]

In a study of 8,568 U.S. military recruits who had a blood sample collected and stored between 1948 and 1954, 0.4% had antibody to hepatitis C virus (anti-HCV).[23] As in recent military populations, HCV infection was more frequent in nonwhite race/ethnic groups. Among 26 recruits with HCV infection, there was no increase in mortality or liver cancer during over forty years of follow-up. Other studies have provided mixed results, indicating both favorable and poor long term prognosis from chronic hepatitis C virus infection.[24-27]

Treatment

At present, there is no specific means of preventing hepatitis C virus infection, and the only therapy of proven benefit is expensive, often poorly tolerated, and results in a favorable long-term response in a minority of patients. Parenteral alpha interferon has been the most effective treatment for chronic HCV infection but is associated with numerous side-effects, including anemia, flu-like symptoms, and psychiatric manifestations.[5,28] Also, treatment may be too demanding when patients have serious medical conditions. Consequently, treatment often is contraindicated, and patients frequently do not complete a full course of interferon therapy.[6]

Sustained biochemical response to interferon has been observed in 15-20% of patients treated for six months and in 25-30% of patients treated for 12 to 18 months.[29] Research studies have shown that the concurrent use of the oral drug ribavirin increases the rate of sustained response with alpha interferon to 28% for infection with genotype 1 and to over 50% with other genotypes.[30-32] In addition to biochemical response, treatment with alpha interferon may lower the risk of hepatocellular carcinoma among HCV infected patients with cirrhosis.[33,34]

In June 1998, the U.S. Food and Drug Administration (FDA) approved the used of combination therapy with oral ribavirin and parenteral interferon alfa-2b for the treatment of chronic hepatitis C. At present, treatment is recommended for patients with persistently elevated alanine aminotransferase (ALT) levels, positive HCV RNA, and a liver biopsy with either portal or bridging fibrosis, or at least moderate degrees of inflammation and necrosis.[5] Treatment is not recommended for HCV infected individuals who have persistently normal ALT levels, which occurs in about 30-40% of chronic HCV infections. Treatment of individuals with normal ALT levels has not been shown to be beneficial.[35] Because of substantial ongoing research, these treatment guidelines could change over the next few years.[36]

Although treatment often is not effective, the risk of serious liver disease can be reduced by abstinence from alcohol consumption and by the prevention of other viral infections of the liver with the hepatitis A and B vaccines. A vaccine to prevent HCV infection directly will be difficult to develop because of the rapid mutation rate of this virus and the lack of protective immunity following natural infection.[37]

Diagnosis and Screening

Commercial tests for hepatitis C infection first became available in May 1990. More sensitive and specific (multi-antigen) tests were developed in 1992. Infection with HCV is diagnosed by finding antibody to HCV (anti-HCV) in serum samples.[1,2] Testing for anti-HCV requires two different types of assays because screening tests are prone to false positive results. Sera are tested initially with a sensitive enzyme-immunoassay (EIA) based on recombinant viral proteins. Samples found to be reactive in two separate EIA assays then are evaluated by a more specific and costly, supplemental test -- generally an immunoblot assay that uses a nitrocellulose strip (RIBA).

This multi-step procedure detects anti-HCV in $\geq$ 97% of infected patients.[2,6] However, anti-

HCV may not be detected by this approach for several weeks or months after initial infection and among immunocompromised patients. Diagnosis in these cases can be made by the identification of HCV RNA using a gene amplification technique, reverse transcription polymerase chain reaction (RT-PCR), which is a more difficult and expensive test.[2] Also, there has been substantial variability between laboratories in the performance of PCR tests for HCV, and no PCR test kit has been approved by the FDA.[38]

In a report released in October 1998,[6] the CDC issued the following recommendations on HCV screening:

Screening was recommended for:

1. *Persons who should be tested routinely for HCV infection based on their risk for infection --*

   A. Persons who ever injected illegal drugs, even once

   B. Persons with selected medical conditions, including those:

      1) who received clotting factor concentrates produced before 1987
      2) who were ever on chronic (long-term) hemodialysis
      3) who have persistently abnormal alanine aminotransferase levels

   C. Prior recipients of transfusions or organ transplants, including those:

      1) who were notified that they received blood from a donor who later tested positive for HCV infection
      2) who received a transfusion of blood or blood components before July 1992
      3) who received an organ transplant before July 1992

2. *Persons who should be tested routinely for HCV-infection based on a recognized exposure --*

   A. Healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood

   B. Children born to HCV-positive women

HCV testing was of uncertain need for:

1. *Recipients of transplanted tissue*

2. *Intranasal cocaine and other non-injecting illegal drug users*

3. *Persons with a history of tattooing or body piercing*

4. *Persons with a history of multiple sex partners or sexually transmitted diseases (STDs)*

5. *Long-term steady sex partners of HCV-positive persons.*

Implementation of screening recommendations have uncovered asymptomatic HCV carriers. However, there are questions about the benefits of screening, especially in low risk populations, because the long-term consequences of infection are not well understood and because sexual and household transmission appear to be rare. Another consideration in developing screening policies is the possible adverse consequences of testing.[6] These problems include disclosure of test results to others, which could result in disrupted personal relationships. Discriminatory action is also possible from loss of employment, insurance, and educational opportunities.[6]

Hepatitis C in the U.S. Military

HCV infection has been found to be relatively uncommon among active duty military personnel[39-44] and an infrequent cause of chronic liver disease.[45] In published studies of general active duty personnel,[41,42] the prevalence of HCV infection was found to be less than one-half percent, as shown in table 1.

Table 1. Prevalence of anti-HCV among military populations in studies published in peer-reviewed journals

Population	*Date of Study*	*Number Tested*	*Prevalence*
Blood donors[39]	1990-91	5,719	0.2%
Military recruits[40]	1989	1,538	0.3%
Deployed personnel[41,42]	1988-90	3,082	0.4%
STD clinic patients[43]	1990-91	470	1.1%
HIV infected military members[44]	1986-90	235	3.4%

In addition to a low prevalence of HCV infection, the rate of viral hepatitis has declined substantially among U.S. military populations because of 1) frequent, random drug screening, which identifies individuals at increased risk of HCV infection;[46] and, 2) high induction standards, including drug screening and testing for human immunodeficiency virus (HIV) infection, which tend to exclude high risk groups from military service. Foreign deployments, tattooing, and the type of intramuscular immune serum globulin (gamma globulin) used in the past for hepatitis A prophylaxis prior to duty in developing countries have not been associated with HCV transmission.[6,41,47]

The major risk factor for HCV infection -- parenteral drug abuse -- is very uncommon in the U.S. military. Results from periodic surveys of military personnel (*1998 Department of Defense Survey of Health Related Behaviors Among Military Personnel*),[48] indicate that the use of heroin or other opiates during the past 30 days occurs in only 0.2% of the force, and the prevalence of any illicit drug use among military members is less than one-third the rate reported in age-matched civilian populations. Current low levels of drug abuse contrast with data from previous behavioral risk factor surveys first conducted in 1980, which found self-reported use of any illicit

drug during the past 30 days in 28% of surveyed military members compared to 2.7% today, which represents a decrease of over 90% during the last 18 years.

High standards of induction, including the requirement to be free of HIV infection and to have a negative drug test, tend to exclude applicants who have used illicit drugs. In addition, accession standards identify applicants with active liver disease. A history of hepatitis infection (including hepatitis C) within the preceding six months and persistent symptoms is a disqualifying condition for accession, as is objective evidence of impairment of liver function and chronic hepatitis. However, recruits found to be infected with HCV are not routinely separated from military service if they have no signs or symptoms of liver disease.

After induction, multiple screening points exist in a military member's career for the diagnosis of liver disease and the identification of occupational and personal risk factors for viral hepatitis infection and liver damage. Military members are randomly screened for drug use throughout military service. Additionally, military personnel have to undergo routine health examinations, which screen for liver diseases like hepatitis, and the periodic Health Enrollment Assessment Review (HEAR) assists clinicians in identifying persons at risk for liver disease. Throughout military service, members have to pass a physical fitness test every 6 to 12 months, which also identifies individuals with chronic health problems. At the end of active military duty, the retirement and separation physical for military members includes a clinical assessment of liver disease and follow-on blood tests as needed to diagnose viral hepatitis.

Targeted testing and treatment for HCV infection also occurs during military service when clinically indicated. Examples include follow-up for needle-stick injuries in the medical care setting. Similarly, military members found to be infected with HCV during testing of donated blood are evaluated and treated. A large proportion of the military force -- approximately 100,000 active duty personnel -- donate blood each year. Lastly, military personnel who have alcohol use problems and a higher risk of hepatitis C related morbidity are clinically evaluated for liver disease, including viral hepatitis.

In addition to these screening and intervention strategies, DoD has implemented a HCV blood donor and recipient lookback program (enclosure 5). On June 29, 1998, Dr. Sue Bailey, Assistant Secretary of Defense (Health Affairs), issued a memorandum to all military Services requiring blood donor lookback and recipient notification. The revised policy also included testing and care of former beneficiaries who may have been exposed to hepatitis C virus through transfusion in the military health care system. This policy letter also required the Services to be more inclusive than required by the FDA: the DoD lookback includes donors who test repeatedly reactive for anti-HCV with either the first or second generation tests, and not just the more accurate multi-antigen tests for anti-HCV. On July 2, 1998, Health Affair's Blood Program Office issued Blood Program Letter 98-03 that implemented and outlined DoD's HCV donor lookback, and recipient and consignee notification procedures. The Military Services had implemented their lookback policies by October 5, 1998.

The Department of Defense's multiple and overlapping surveillance programs identify military members who could be infected with the hepatitis C virus. Preventive health intervention,

clinical evaluation, and treatment are available for all active duty personnel at risk of liver disease from infectious and non-infectious causes. Hepatitis C infection by itself does not render military personnel unfit for continued military service. As is true for other chronic health problems, individuals are medically evaluated and separated from the military when HCV infection interferes with the performance of routine military duties and the ability to meet fitness and retention standards.

In order to provide needed information about this infectious disease problem, the Department of Defense has initiated an extensive outreach effort, which is directed at both health care providers and beneficiaries. Every physician within DoD is being contacted and provided a brochure prepared by the CDC with important information about hepatitis C. The TRICARE communications office has initiated several programs to reach DoD beneficiaries who may need to be evaluated and tested for HCV infection. These efforts include a news release for Service public affairs officers to distribute to base newspapers and other media sources (like TRICARE contractor and regional newsletters). The TRICARE web page has a health update message on hepatitis C, which includes links to the CDC and National Institutes of Health (NIH) Internet sites on hepatitis C information (enclosure 4).

Military Veterans

In contrast to a relatively low level of HCV infection among active duty military personnel, the number of patients detected as having HCV infection has steadily increased over a several year period in VA health care facilities.[49] An electronic survey of 125 VA Medical Centers conducted from February through December of 1997 identified nearly 15 thousand VA patients who tested positive for hepatitis C antibody.[50] VA transplant program data also indicate that 52% of liver transplant patients have hepatitis C virus infection.

Of greater concern are two recent studies of the prevalence of HCV infection in VA's patient population. A six-week inpatient survey at the VA Medical Center, Washington, DC, found anti-HCV in 20% of participants.[51] A similar investigation at the VA Medical Center in San Francisco found 10-19% of patients to be antibody positive.[50,52] The high levels of infection observed in these two studies may have been due to inner city drug abuse.[53] Whether VA patients living in areas with less illicit drug use are as frequently infected with HCV has yet to be determined.

High levels of liver disease and HCV infection among VA patients may be due to unique characteristics that distinguish this population from active duty and reserve military personnel and from the general community. The VA health care system primarily serves men, and about one-third of users are over age 65 and two-thirds have annual incomes below $20,000.[53] Substance abuse is a problem among some VA patient populations.

On June 11, 1998, the VA announced that it would begin screening veterans for hepatitis C virus infection based on the presence of risk factors for infection.[50] And on January 27, 1999, the VA announced that it would offer FDA approved combination drug treatment for HCV infection, when clinically indicated.[54]

Coordinated Federal Response

Dr. Sue Bailey, Assistant Secretary of Defense (Health Affairs), initiated formation of an "Interagency Working Group on Hepatitis C Virus" on August 10, 1998. The intent of the working group is "to serve as a catalyst for bringing separate agencies closer together and for working toward development of appropriate strategies to both prevent new infections and minimize the impact of current hepatitis C virus infections on our civilian and military populations." The Working Group represents a forum to discuss issues related to HCV of common interest to the various Agencies and promote cooperation and collaboration regarding clinical and research initiatives. This working group is composed of public health officials from the CDC, NIH, VA, and DoD. Its first meeting was held on October 6, 1998.

Each Military Service has a representative on this interagency working group:

- Army: Dr. Shailesh Kadakia for the Army (210-916-4578)
  COL_Shailesh_Kadakia @bamc.smtplink.amedd.army.mil
- Navy: Dr. W. Z. .McBride for the Navy (202-762-3495)
  WZMcBride@us.med.navy.mil
- Air Force: Dr. Dana Bradshaw for the Air Force (202-767-4286)
  Dana.bradshaw@usafsg.bolling.af.mil

These representatives provide DoD health care professionals with the most recent guidance on screening and treatment of HCV infection. In addition, the NIH maintains an Internet site, which contains substantial amounts of information on hepatitis C: www.hepnet.com/nih/contents.html.

Assessment of Risks and Potential Intervention Strategies in DoD

The 1999 Senate Armed Services Committee Report No. 105-189 on S. 2060 directed the Department of Defense (DoD) to study the extent of service-connected hepatitis C infection, to include the advisability and feasibility of testing for hepatitis C virus during separation and retirement physicals. Such tests could increase the cost of separation and retirement physicals. However, early detection of hepatitis C may reduce costs to the Department of Defense and the Department of Veterans Affairs by reducing the rate of serious liver disease. Additionally, an individual identified as infected with hepatitis C would understand that he or she should not donate blood, thus assisting in maintaining a safe blood supply. The committee directed the Secretary of Defense to report the results of the study to the Committee on Armed Services of the Senate and the National Security Committee of the House of Representatives not later than March 31, 1999.

The Department had previously initiated a comprehensive hepatitis C research plan in 1998, which included: 1) the first large-scale, sero-epidemiological investigation of over 20,000 randomly selected military personnel; 2) analysis of DoD hospital records of inpatient admissions for acute and chronic viral hepatitis during the last 20 years; and, 3) cost analysis of testing for HCV infection. The goals of these investigations were to:

1. Determine the prevalence of hepatitis C virus infection among current U.S. military personnel and evaluate the risk of acquiring HCV infection during military service; and,

2. Provide information to assess various surveillance strategies for their effectiveness in identifying HCV infected military members, including the following possible approaches for anti-HCV testing --

    a. Assessment at the time of routine blood donations and when clinically indicated during standard health screening and medical care within the Military Health Services System;
    b. Assessment of potential military recruits at induction health screening, which would identify individuals who could not provide blood during military service, should refrain from alcohol consumption, and would need to be followed medically during a military career;
    c. Assessment of military personnel at the same time as routine, periodic testing for HIV infection every 1 to 5 years; and,
    d. Assessment of military personnel just prior to separation or retirement from the military, which would identify veterans who may need clinical follow-up in the VA health care system.

Investigation Methods

Serological Survey

In order to assess the prevalence and incidence of HCV infection, serum samples from varied populations were obtained from the DoD Serum Repository, which is used for surveillance of HIV infection and storage of serum samples collected before and after overseas deployments. Active duty personnel and selected Reservists routinely provide a venous blood sample for the serum repository every 1 to 5 years. For this investigation, all subjects were drawn at random from military personnel serving in 1997 who provided a serum sample. Subjects were chosen in proportion to the size of each major Service within the U.S. military: Army (34% of entire military force), Navy (26%), Air Force (27%), and Marine Corps (12%). No other selection criterion was used.

Because military personnel provide serial serum samples, the computerized database was scanned for prior samples of the selected subjects, and if any were available, the first serum sample obtained for the repository also was chosen. About 70% of military personnel in 1997 had more than two sequentially obtained serum samples in the repository. Analysis of sequential samples provided incidence data of infection during military service.

Serum samples and associated demographic data were given a unique investigation number. All personal identifiers were then removed from both single and matched samples and from computerized demographic data. Testing therefore was done anonymously, without the possibility of linking subsequent serological test results to individuals. Analyzable data included: serological test results, age, gender, race/ethnicity, marital status, home of record, service branch, rank, length of military service, and military job classification. The following population groups were evaluated initially:

1. A random selection of 10,000 active duty military personnel providing routine serum samples during the calendar year 1997. A random selection of service personnel was essential in order to determine the overall prevalence of HCV infection in the U.S. military.

2. A random selection of 2000 sera from selected Reservists providing a routine serum sample during the calendar year 1997.

3. A random selection of 2000 military recruits inducted during 1997.

4. Additional, random over-sampling of various groups that provided serum in 1997 is being conducted to obtain more precise estimates of the risk in these military populations --

    a. Vietnam era personnel: 1000 personnel currently on active duty who had been serving in the military since January 1, 1974.
    b. Active duty retirees with at least 20 years of military service: 2000 individuals.
    c. Women: testing of 2000 active duty personnel is in progress.
    d. Minority racial/ethnic groups: testing of 1000 active duty personnel is planned.

5. Over-sampling is being considered for the following groups --

   a. Health care personnel: 1000 individuals
   b. Officers: 1000 active duty members

Sample size calculations were based on the prevalence of HCV infection in prior studies of U.S. military personnel and estimates of HCV infection in the civilian community. To detect a two-fold increase in prevalence among military personnel as compared to the general population, a sample size of 5000 has power of 99% (i.e., beta error of less than 0.01) to detect this difference at the alpha = 0.05 level (one-sided). Moreover, a sample size of 5000 allows for a 95% confidence interval to estimate the difference in prevalence in the military and the general civilian population to within +/- 0.6%. The statistical methods employed were standard methods for comparing the differences in binomial proportions, which use the binomial and Chi-square distributions for hypothesis testing and confidence interval estimation. A Type I error of alpha = 0.05 was assumed.

The most recently collected serum samples initially were screened for anti-HCV using commercial, second generation EIA test kits (Abbott HCV EIA 2.0; Abbott Laboratories, Abbott Park, IL). Sera that were reactive were re-tested in duplicate by EIA. Repeatedly reactive samples by EIA were then tested by immunoblot assay (Chiron RIBA HCV 2.0; Chiron Corporation, Emeryville, CA). Only samples that were reactive by both EIA and immunoblot assay were considered positive. For samples found positive or indeterminate by RIBA, any previously collected, matching serum sample was tested by EIA and RIBA.

A selection of samples that were indeterminate by RIBA were further tested by RT-PCR at the CDC to evaluate positivity.[55]

Hospitalization Study

DoD hospitalization databases were evaluated to determine how frequently the Military Health System cares for active duty personnel who either develop acute viral hepatitis or require medical care for chronic hepatitis. This part of the DoD effort was a continuation of a prior investigation of medical records for hospital admissions due to viral hepatitis.[46]

In DoD hospitals, a summary of discharge information is maintained in a computerized database. Diagnoses at discharge are coded using the International Classification of Diseases (ICD). Data are available for hospitalizations within Navy medical centers since 1975 and for all hospitalizations within the military health care system since 1989. A military member's first hospital admission per year for viral hepatitis was used for this analysis.

Cost Analysis

The purpose of this analysis was to estimate the one time costs of detecting HCV infection using three potential HCV testing strategies: 1) screening of recruits at the Military Entrance Processing Station (MEPS); 2) all force testing of active duty and selected Reserve personnel;

and, 3) testing of retiring/separating active duty and selected Reserve service members.

Decision analyses using a cost and outcome analytic model were conducted from a military perspective using DATA 3.0, TreeAge Software, Inc., Williamstown, MA (enclosure 6). Estimated costs were approximated in 1998 dollars. No future costs were considered; consequently, discounting was not performed. The medical outcome was defined as an identified case of HCV infection. The case finding potential of each strategy was based on initial data obtained from the current sero-prevalence investigation using serum repository samples. Observed prevalence estimates were age adjusted and assumed to estimate the true population prevalence.

Assay sensitivities were derived from the available literature and expert opinion. Economic outcomes were defined as all screening-related program costs, as well as the costs of lost recruiting and processing associated with a recruit applicant disqualified because of HCV infection. Program costs included cost of serum collection (materials, personnel, and overhead), cost of initial and confirmatory assays, and cost of preliminary clinical work-up based on confirmed HCV infection. Testing for anti-HCV was modeled independently from the HIV screening program.

All screening costs assumed initial testing of sera by EIA according to manufacturer guidelines, confirmation of repeatedly reactive EIA results using RIBA, and testing of RIBA indeterminate samples by RT-PCR. Additionally, all HCV infected individuals received an initial work-up, including an internal medicine outpatient visit and PCR (if not done as part of diagnosis) and viral genotyping. Lost productivity for time of tests and work-up was not considered. For recruit applicants processing through the MEPS, HCV infection was presumed to be a disqualifying condition. Initial clinical work-ups and RT-PCR were not conducted for individuals not inducted into the military.

Results were extrapolated to a recruit entry applicant pool of 300,000 persons receiving entry physicals per year for active duty (Office of Assistant Secretary of Defense - Force Management Policy [OASD-FMP], Washington, DC, 1999) and 141,000 for Reserves/National Guard (OASD - Reserve Affairs [RA], 1998). For total military force screening, active duty and selected Reserve personnel were considered for testing. Results were extrapolated to 1,480,000 active duty and 934,000 Reserve population totals (Defense Manpower Data Center, Monterey, CA, 1999). Individuals retiring or separating from the active duty military or the selected Reserves were analyzed in aggregate (totals from DMDC, 1996, and OASD-RA, 1998, respectively; enclosure 6).

Results of DoD Investigations

Serological Survey

To date, testing has been completed on a random sample of greater than 17,000 military personnel, including: 1) 10,000 active duty troops; 2) 2000 recruits; 3) 2000 selected Reservists; 4) 1000 Vietnam era troops; and, 5) 2000 retirees. The demographic characteristics of the initial population of 10,000 active duty personnel were very similar to the overall military population. Also, the sample of Reservists had comparable demographic characteristics to the overall Reserve population, which is older than active duty troops. The mean age of the sample of active duty personnel was 28.2 years, and the mean age of surveyed Reservists was 34.7 years.

The overall prevalence of anti-HCV among active duty troops was 0.48% (95% CI, 0.3 to 0.6%) (table 2). The prevalence of infection among recruits was just 0.1% (95% CI, 0 to 0.36%).

Table 2. Prevalence of anti-HCV by RIBA among evaluated military personnel

Category	*% Positive (number positive/number tested)**		
	Recruits (n = 2000)	*Active Duty* (n = 10,000)	*Reservists* (n = 2000)
Sex			
Male	0.1 (2/1649)	0.5 (43/8428)	0.6 (9/1593)
Female	0 (0/351)	0.3 (5/1572)	1.2 (5/407)
Age groups (in years)			
≤ 19	0.2 (2/1305)	0 (0/1127)	0 (0/173)
20 - 24	0 (0/537)	0.1 (2/3189)	0 (0/240)
25 - 29	0 (0/87)	0.1 (2/2091)	0.8 (2/255)
30 - 34	0 (0/16)	0.3 (5/1551)	0.4 (1/256)
35 - 39	0 (0)	1.1 (14/1219)	1.7 (4/240)
≥ 40	0 (0/1)	3.0 (25/823)	1.2 (7/587)
Race/ethnicity			
White	0.08 (1/1294)	0.4 (26/6951)	0.5 (7/1415)
Nonwhite	0.14 (1/706)	0.7 (22/3043)	1.3 (7/527)
Rank			
Enlisted	0.1 (2/1956)	0.5 (42/8492)	0.9 (14/1557)
Officer	0 (0/44)	0.4 (6/1508)	0 (0/440)

*Denominator totals vary slightly because of missing demographic information.

For Reservists, who tend to be older than active duty personnel, the overall prevalence of infection (0.54% after adjusting for the younger age of the active duty sample) was comparable to other troops. Enlisted personnel and nonwhite racial/ethnic groups had a higher prevalence of HCV infection; female troops generally had a lower level of infection. A higher risk of HCV infection was found in older military personnel. Among 12,810 active duty personnel, the prevalence of infection was:

- 0.1% in 7958 troops < 35 years of age (1 per 1000 troops)
- 1.5% in 1305 troops 35-39 years of age
- 1.8% in 3547 troops > 39 years of age

Active duty troops who had been on duty during the Vietnam era had a lower prevalence of infection than general military personnel of similar age (tables 2 and 3). The level of infection in 1997 among retirees with a mean age of 45 years was 1.7% (95% CI, 1.2 to 2.4%).

Table 3. Prevalence of anti-HCV by RIBA among evaluated military personnel

	% Positive (no positive/no tested)	
Category	*Vietnam Era* (n = 1000)	*Retirees* (n = 2000)
Sex		
Male	1.0 (10/960)	1.7 (31/1869)
Female	0 (0/40)	2.3 (3/131)
Age groups (in years)		
≤ 19	0 (0)	0 (0)
20 - 24	0 (0)	0 (0)
25 - 29	0 (0)	0 (0)
30 - 34	0 (0)	0 (0)
35 - 39	0 (0)	5.8 (5/86)
≥ 40	1.0 (10/1000)	1.7 (29/1724)
Race/ethnicity		
White	0.4 (3/788)	1.0 (15/1434)
Nonwhite	3.3 (7/211)	3.4 (19/565)
Rank		
Enlisted	1.7 (7/412)	2.2 (27/1228)
Officer	0.5 (3/587)	0.9 (7/751)

Incidence data were available for the random selection of 10,000 active duty personnel. In this group, a previous serum repository sample had been obtained from 7,368 troops (74%). There was a mean interval of 4.6 years between sequential serum samples, which provided 34,020 person-years of exposure. In this cohort, 6 individuals seroconverted to anti-HCV for an annual incidence of 18 new infections per 100,000 troops (0.018% per year). This risk translates into 1 new HCV infection each year among every 5,670 troops, or approximately 252 new HCV infections per year in 1.4 million active duty troops.

As expected in mass screening of a low risk population, false positive serologic test results were common. In the initial testing of 5000 randomly-selected, active duty personnel, there were 44 samples that were repeatedly reactive by EIA and required immunoblot confirmation. Among these 44 EIA reactive samples, just one-half (22) were RIBA positive and 7 were indeterminate. For the 2000 tested recruits, a greater number of serum samples were indeterminate by RIBA (3 samples) than positive (2 samples). Importantly, none of these indeterminate samples was positive by RT-PCR when tested at the CDC.

Hospitalization Study

Analysis of hospitalizations within military hospitals for acute hepatitis shows a steady decline in admissions during the last 20 years (figure 1). All types of viral hepatitis have declined in the U.S. military (figure 2). Drug abuse was associated with hospitalizations for viral hepatitis in this military population,[46] and the decline in admissions for viral hepatitis have paralleled the decrease in illicit drug use within DoD.[48]

In 1997, there were 300 hospitalizations for acute hepatitis within DoD hospitals in a population of over 1.4 million active duty personnel (figure 3). Among these admissions for viral hepatitis, just 62 (21%) patients were diagnosed with acute hepatitis C. As in prior studies, the risk of viral hepatitis was higher among men and nonwhite racial/ethnic groups.[4,56]

Hospitalization of active duty personnel for chronic hepatitis and cirrhosis has been very infrequent in recent years. In the U.S. Navy, there were just 5 admissions for chronic hepatitis in 1996 and 13 in 1995. For all of DoD in 1997, there were 39 admissions for chronic hepatitis and 131 for cirrhosis among active duty personnel.

Figure 1. Hospitalizations for all Acute Viral Hepatitis, U.S. Navy

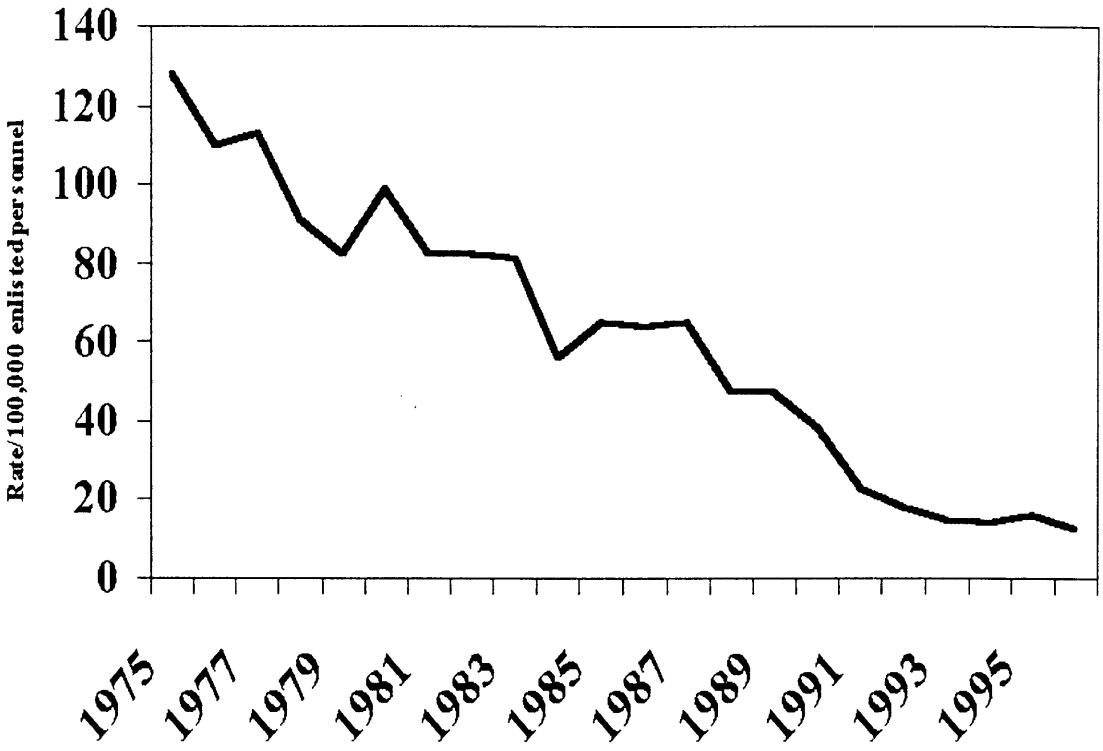


Figure 2. Hospitalizations for Different Types of Viral Hepatitis, US Navy

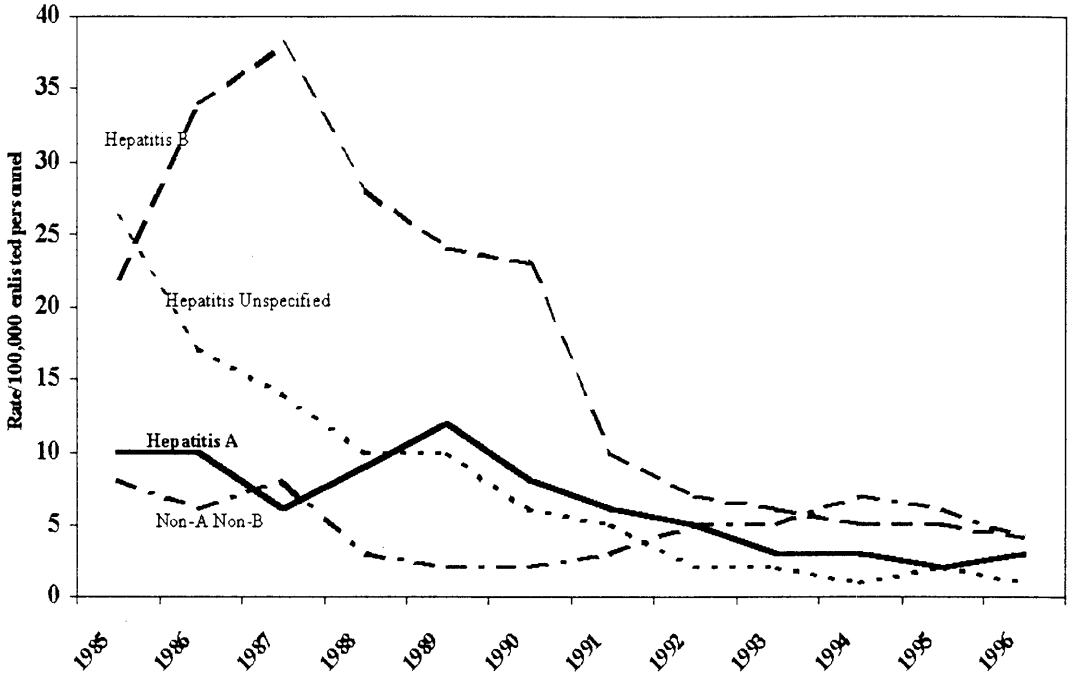
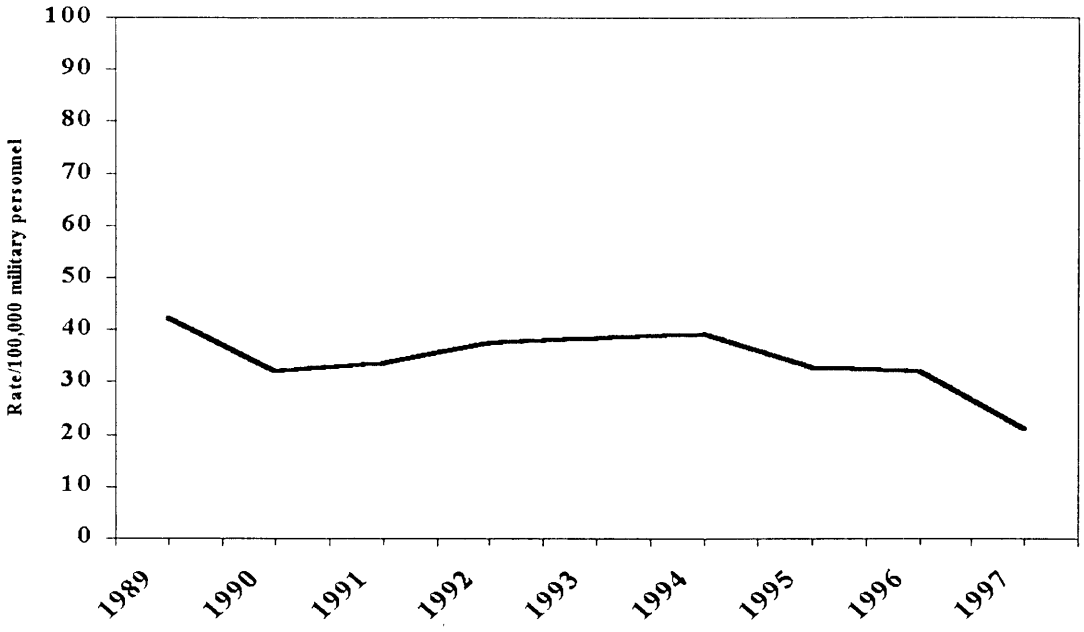


Figure 3. Hospitalizations for All Acute Viral Hepatitis within DoD



Cost Analysis

Testing all incoming recruits at MEPS for a year would cost approximately $4,300,000 in screening and lost recruiting efforts for active duty recruitment and approximately $2,000,000 for Reserve/National Guard recruitment (tables 4 and 5). An estimated 148 cases of HCV infection among active duty recruits and 70 cases among Reserve/National Guard recruits would be identified at a cost of $29,000 per case. Because so few military applicants have chronic viral hepatitis, any policy on HCV infection would have negligible impact on current retention standards.

One time total force screening for all active duty military would cost about $20,000,000 in screening program costs and initial work-up costs. An estimated 4,419 cases of HCV infection would be identified at a cost of $4,500 per case. Force testing of all selected Reserve military personnel would cost $13,000,000 in screening program and initial work-up costs. An estimated 4,394 cases of HCV infection would be identified at a cost of $2,900 per case.

Testing all active duty members at separation or retirement would cost $3,200,000 in screening program costs and initial clinical evaluation costs. An estimated 723 cases of HCV infection would be found at a cost of $4,400 per case. Testing active duty individuals at separation or retirement older than 34 years would cost $900,000, which would identify 632 cases of HCV infection at a cost of $1,400 per case. Screening individuals 35 years of age and older would thus target more than 87% of potentially infected individuals leaving active military duty.

Table 4. One time estimated costs of HCV screening of active duty members

Category	*Number Tested*	*Total Costs*	*Number cases identified*	*Costs per case identified*
Recruits	300,000	$4,300,000	148	$29,000
Total Force	1,480,000	$20,000,000	4419	$4,500
Retirement/Separation				
All	234,000	$3,200,000	723	$4,400
35 years of age and older	43,100	$900,000	632	$1,400

Testing all selected Reserve members at separation or retirement would cost about $2,000,000 in screening program costs and initial clinical evaluation costs. An estimated 818 cases of HCV infection would be identified at a cost of $2,400 per case of HCV infection. Testing Reserve personnel older than 34 years at separation would cost $600,000 and identify approximately 351 infections at a cost of $1,700 per case.

Table 5. One time estimated costs of HCV screening of Selected Reserves

Category	*Number Tested*	*Total Costs*	*Number cases identified*	*Costs per case identified*
Recruits	141,000	$2,000,000	70	$29,000
Total Force	875,000	$13,000,000	4394	$2,900
Retirement/Separation				
All	126,000	$2,000,000	818	$2,400
35 years of age and older	32,500	$600,000	351	$1,700

The results of this one-time cost analysis should be used as a tool in conjunction with other considerations to determine the best HCV screening policy for the military. It is important to note that after initiating screening of military personnel using any one of these three strategies, the cost per case identified could greatly increase for the other strategies because many cases already would have been identified. Therefore, implementation of all strategies would greatly increase the costs of identifying each HCV infection. Also, a screening program will require more than testing of individuals for hepatitis C infection. Provision also has to be made for clinical evaluation, counseling on prognosis, treatment, reducing transmission risks, and finally long-term medical follow-up. Any screening policy will have to consider potential adverse social and personal consequences of being identified as infected with HCV or potentially infected when testing is inconclusive.

The large number of false positive tests by EIA and indeterminate confirmatory test results highlights a problem found when screening is conducted in a population with a low prevalence of disease: test results have a low positive predictive value. Therefore, a screening program will have to provide for the confirmation of indeterminate results, which will add to the difficulties of counseling tested individuals and to the complexity and cost of the program.

Conclusion

The risk of hepatitis C infection among U.S. military personnel was found to be substantially less than in the civilian community. The 0.48% prevalence of infection in active duty troops was more than three times lower than the 1.8% prevalence found in the CDC study of the general U.S. population. Although military personnel are at lower risk, the demographic characteristics of infected individuals were similar in both populations. As true for many other infectious diseases, military personnel reflect the problem in the civilian community but at reduced overall levels of disease burden.

These data are consistent with the previous CDC study of the general civilian population, which identified a lower risk of hepatitis C infection among military veterans. These results are also consistent with previously published studies of hepatitis C infection among active duty troops. In this investigation of active duty troops serving in 1997, the prevalence of infection was 0.48%, which is almost the same prevalence found among 3000 active duty Navy and Marine Corps personnel serving in 1988-1990[41,42] and also among U.S. military recruits surveyed more than 40 years ago.[23] Although there may have been an increase in HCV infection during the 1960's, current military personnel have a very low risk of infection that may be similar to the levels seen among troops of the WWII and Korean War generation.

Importantly, the incidence of hospital admissions for acute viral hepatitis has been steadily declining during the last 20 years in the U.S. military, and there has been a steep decrease in the rate of new hepatitis C virus infections in the civilian population. At present, hepatitis C is primarily a problem among individuals who have ever injected illegal drugs. Because of low levels of drug use in the military, hepatitis C infection is much less a problem in this population. The decreased risk of viral hepatitis infection among active duty forces can be attributed to existing DoD programs, including:

- High induction standards, which include testing for illicit drug use and the human immunodeficiency virus (HIV) virus infection
- Routine, randomized drug screening throughout military service
- Routine medical screening and examinations of active duty and Reserve personnel
- Routine physical performance testing that identifies chronic health problems
- Hepatitis C testing of blood donors and the donor/recipient "lookback" program
- Universal precautions to prevent transmission of bloodborne infections
- Total force hepatitis A immunization and risk-based hepatitis B immunization

The low prevalence of hepatitis C infection among active duty troops and randomly surveyed veterans in the general population have to be contrasted with reports of a 10-20% prevalence of infection in two populations of VA patients.[52] The reason for this difference may be explained by the unique nature of VA patients and particular risk factors among the two study groups living in inner cities.[51,53]

The data from current DoD investigations clearly demonstrate that military personnel are at low risk for HCV infection and do not support a requirement to deviate from national screening

policy on HCV infection as established by the Centers for Disease Control and Prevention (enclosure 2). Based on the findings of a higher prevalence in older service members, the Department will implement a targeted risk-based testing program using CDC screening guidelines for individuals who are 35 years of age or older and are separating or retiring from military service (enclosure 3). This risk-based testing program has been reviewed by the members in the "Interagency Working Group on Hepatitis C Virus." The results of screening and subsequent evaluation, counseling, and treatment will be annotated in the service member's permanent medical record, which will provide continuity of care within the Department of Veterans Affairs health care system.

The DoD also has initiated an aggressive provider and patient education program (enclosure 4). This effort emphasizes increased awareness of the risk factors for hepatitis C infection so that potentially exposed individuals and their health care providers understand the need for testing and counseling. Additionally, every physician within DoD is being contacted and provided a brochure prepared by the CDC with important information about the risk, diagnosis, and treatment of hepatitis C.

The future health care burden of higher rates of HCV transmission during past decades is difficult to predict but could be substantial in the civilian community.[57] Also, current treatment for chronic hepatitis C is only partially effective and there is little prospect for developing a vaccine in the near-term. Further clinical research therefore is critical in order to develop improved treatment regimens.

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Enclosures

Enclosure 1: Defense Authorization Bill, Fiscal Year 1999; Report Language (1999 Senate Armed Services Committee Report No. 105-189 on S. 2060)

Enclosure 2: CDC MMWR, Recommendations and Reports: October 16, 1998 / 47(RR19);1-39

Enclosure 3: Proposed Hepatitis C Virus (HCV) Antibody Screening Policy

Enclosure 4: Hepatitis C Health Watch on Tricare web page

Enclosure 5: DoD blood donor lookback and recipient notification

Enclosure 6: Model Parameter Values -- probability and costs

Enclosure 1

Defense Authorization Bill, Fiscal Year 1999
Report Language (1999 Senate Armed Services Committee Report No. 105-189 on S. 2060)

HEPATITIS C TESTING: The committee understands that the incidence of service-connected hepatitis C infection may be increasing. The committee directs the Secretary of Defense to study the extent of service-connected hepatitis C infection, to include the advisability and feasibility of including an antibody or antigen test sufficient to detect hepatitis C virus during separation and retirement physicals. Such tests could increase the cost of separation and retirement physicals. However, early detection of hepatitis C may reduce costs to the Department of Defense and the Department of Veterans Affairs by reducing the rate of serious liver disease. Additionally, an individual identified as infected with hepatitis C would understand that he or she should not donate blood, thus assisting in maintaining a safe blood supply. The committee directs the Secretary of Defense to report the results of the study to the Committee on Armed Services of the Senate and the National Security Committee of the House of Representatives not later than March 31, 1999.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

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Recommendations and Reports

MORBIDITY AND MORTALITY WEEKLY REPORT

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Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention (CDC)
Atlanta, Georgia 30333

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Terms and Abbreviations Used in This Publication

Acute hepatitis C	Newly acquired symptomatic hepatitis C virus (HCV) infection.
ALT	Alanine aminotransferase.
Anti-HCV	Antibody to HCV that develops in response to HCV infection; detectable in persons with acute, chronic, and resolved infection.
AST	Aspartate aminotransferase.
Chronic (persistent) HCV infection	Persistent infection with HCV; characterized by detection of HCV RNA ≥6 months after newly acquired infection.
Chronic hepatitis C	Liver inflammation in patients with chronic HCV infection; characterized by abnormal levels of liver enzymes.
CSTE	Council of State and Territorial Epidemiologists.
DNA	Deoxyribonucleic acid.
EIA	Enzyme immunoassay.
FDA	U.S. Food and Drug Administration.
HBV	Hepatitis B virus.
HCC	Hepatocellular carcinoma.
HCV	Hepatitis C virus.
HCV-positive	Positive for anti-HCV as verified by supplemental testing or positive for HCV RNA.
HCV RNA	Hepatitis C virus ribonucleic acid.
HIV	Human immunodeficiency virus.
IG	Immune globulin.
IM	Intramuscular.
IV	Intravenous.
MSM	Men who have sex with men.
NHANES III	Third National Health and Nutrition Examination Survey.
NIH	National Institutes of Health.
Positive predictive value	Probability that a positive screening test is truly positive; dependent on prevalence of disease in a population.
Qualitative RT-PCR for HCV RNA	Test to detect HCV RNA by amplification of viral genetic sequences.
Quantitative assays for HCV RNA	Tests to detect HCV RNA concentration (viral load) by amplification of viral genetic sequences or by signal amplification.
Resolved HCV infection	Recovery following hepatitis C virus infection; characterized by sustained disappearance of serum HCV RNA and normalization of liver enzymes.
RIBA™	Recombinant immunoblot assay.
RNA	Ribonucleic acid.
RT-PCR	Reverse transcriptase polymerase chain reaction.
STD	Sexually transmitted disease.
Supplemental anti-HCV test	Additional test (i.e.,RIBA™) used to verify a positive anti-HCV result obtained by EIA.

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Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease

Summary

These recommendations are an expansion of previous recommendations for the prevention of hepatitis C virus (HCV) infection that focused on screening and follow-up of blood, plasma, organ, tissue, and semen donors (CDC. Public Health Service inter-agency guidelines for screening donors of blood, plasma, organs, tissues, and semen for evidence of hepatitis B and hepatitis C. MMWR *1991;40[No. RR-4];1-17). The recommendations in this report provide broader guidelines for a) preventing transmission of HCV; b) identifying, counseling, and testing persons at risk for HCV infection; and c) providing appropriate medical evaluation and management of HCV-infected persons. Based on currently available knowledge, these recommendations were developed by CDC staff members after consultation with experts who met in Atlanta during July 15–17, 1998. This report is intended to serve as a resource for health-care professionals, public health officials, and organizations involved in the development, delivery, and evaluation of prevention and clinical services.*

INTRODUCTION

Hepatitis C virus (HCV) infection is the most common chronic bloodborne infection in the United States. CDC staff estimate that during the 1980s, an average of 230,000 new infections occurred each year (*CDC, unpublished data*). Although since 1989 the annual number of new infections has declined by >80% to 36,000 by 1996 (*1,2*), data from the Third National Health and Nutrition Examination Survey (NHANES III), conducted during 1988–1994, have indicated that an estimated 3.9 million (1.8%) Americans have been infected with HCV (*3*). Most of these persons are chronically infected and might not be aware of their infection because they are not clinically ill. Infected persons serve as a source of transmission to others and are at risk for chronic liver disease or other HCV-related chronic diseases during the first two or more decades following initial infection.

Chronic liver disease is the tenth leading cause of death among adults in the United States, and accounts for approximately 25,000 deaths annually, or approximately 1% of all deaths (*4*). Population-based studies indicate that 40% of chronic liver disease is HCV-related, resulting in an estimated 8,000–10,000 deaths each year (*CDC, unpublished data*). Current estimates of medical and work-loss costs of HCV-related acute and chronic liver disease are >$600 million annually (*CDC, unpublished data*), and HCV-associated end-stage liver disease is the most frequent indication for liver transplantation among adults. Because most HCV-infected persons are aged 30–49 years (*3*), the number of deaths attributable to HCV-related chronic liver disease could increase substantially during the next 10–20 years as this group of infected persons reaches ages at which complications from chronic liver disease typically occur.

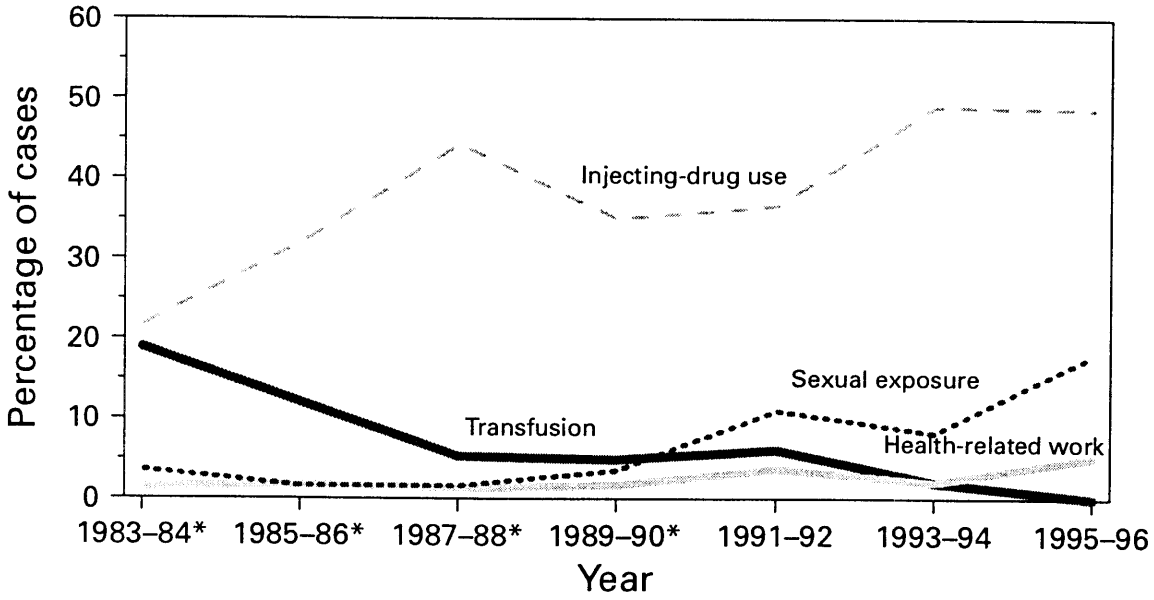
HCV is transmitted primarily through large or repeated direct percutaneous exposures to blood. In the United States, the relative importance of the two most common

exposures associated with transmission of HCV, blood transfusion and injecting-drug use, has changed over time (Figure 1) (*2,5*). Blood transfusion, which accounted for a substantial proportion of HCV infections acquired >10 years ago, rarely accounts for recently acquired infections. Since 1994, risk for transfusion-transmitted HCV infection has been so low that CDC's sentinel counties viral hepatitis surveillance system* has been unable to detect any transfusion-associated cases of acute hepatitis C, although the risk is not zero. In contrast, injecting-drug use consistently has accounted for a substantial proportion of HCV infections and currently accounts for 60% of HCV transmission in the United States. A high proportion of infections continues to be associated with injecting-drug use, but for reasons that are unclear, the dramatic decline in incidence of acute hepatitis C since 1989 correlates with a decrease in cases among injecting-drug users.

Reducing the burden of HCV infection and HCV-related disease in the United States requires implementation of primary prevention activities to reduce the risk for contracting HCV infection and secondary prevention activities to reduce the risk for liver and other chronic diseases in HCV-infected persons. The recommendations contained in this report were developed by reviewing currently available data and are based on the opinions of experts. These recommendations provide broad guidelines for a) the

*Sentinel counties viral hepatitis surveillance system identifies all persons with symptomatic acute viral hepatitis reported through stimulated passive surveillance to the participating county health departments (four during 1982–1995 and six during 1996–1998). These counties are demographically representative of the U.S. population. Serum samples from reported cases are tested for all viral hepatitis markers, and case-patients are interviewed extensively for risk factors for infection.

FIGURE 1. Reported cases of acute hepatitis C by selected risk factors — United States, 1983–1996



*Data presented for non-A, non-B hepatitis.
Source: Centers for Disease Control and Prevention.

prevention of transmission of HCV; b) the identification, counseling, and testing of persons at risk for HCV infection; and c) the appropriate medical evaluation and management of HCV-infected persons.

BACKGROUND

Prospective studies of transfusion recipients in the United States demonstrated that rates of posttransfusion hepatitis in the 1960s exceeded 20% (*6*). In the mid-1970s, available diagnostic tests indicated that 90% of posttransfusion hepatitis was not caused by hepatitis A or hepatitis B viruses and that the move to all-volunteer blood donors had reduced risks for posttransfusion hepatitis to 10% (*7–9*). Although non-A, non-B hepatitis (i.e., neither type A nor type B) was first recognized because of its association with blood transfusion, population-based sentinel surveillance demonstrated that this disease accounted for 15%–20% of community-acquired viral hepatitis in the United States (*5*). Discovery of HCV by molecular cloning in 1988 indicated that non-A, non-B hepatitis was primarily caused by HCV infection (*5,10–14*).

Epidemiology

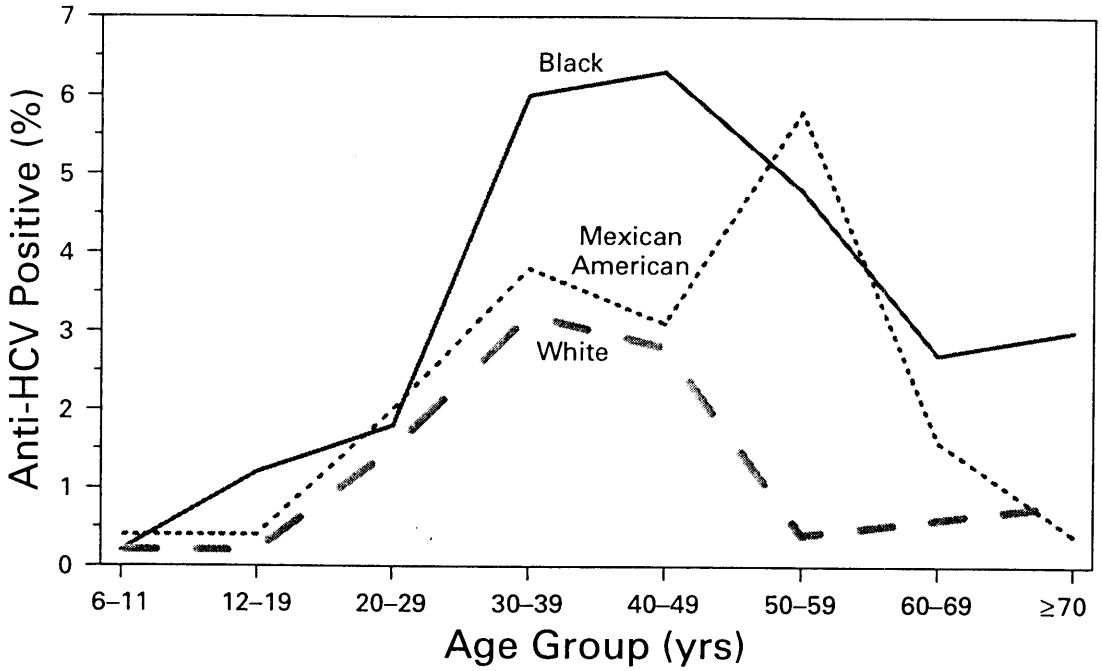
Demographic Characteristics

HCV infection occurs among persons of all ages, but the highest incidence of acute hepatitis C is found among persons aged 20–39 years, and males predominate slightly (*5*). African Americans and whites have similar incidence of acute disease; persons of Hispanic ethnicity have higher rates. In the general population, the highest prevalence rates of HCV infection are found among persons aged 30–49 years and among males (*3*). Unlike the racial/ethnic pattern of acute disease, African Americans have a substantially higher prevalence of HCV infection than do whites (Figure 2).

Prevalence of HCV Infection in Selected Populations in the United States

The greatest variation in prevalence of HCV infection occurs among persons with different risk factors for infection (*15*) (Table 1). Highest prevalence of infection is found among those with large or repeated direct percutaneous exposures to blood (e.g., injecting-drug users, persons with hemophilia who were treated with clotting factor concentrates produced before 1987, and recipients of transfusions from HCV-positive donors) (*12,13,16–22*). Moderate prevalence is found among those with frequent but smaller direct percutaneous exposures (e.g., long-term hemodialysis patients) (*23*). Lower prevalence is found among those with inapparent percutaneous or mucosal exposures (e.g., persons with evidence of high-risk sexual practices) (*24–28*) or among those with small, sporadic percutaneous exposures (e.g., health-care workers) (*29–33*). Lowest prevalence of HCV infection is found among those with no high-risk characteristics (e.g., volunteer blood donors) (*34; personal communication, RY Dodd, Ph.D., Head, Transmissible Diseases Department, Holland Laboratory, American Red Cross, Rockville, MD, July 1998*). The estimated prevalence of persons with different risk factors and characteristics also varies widely in the U.S. population (Table 1) (*3; 35–39; CDC, unpublished data*).

FIGURE 2. Prevalence of hepatitis C virus (HCV) infection by age and race/ethnicity — United States, 1988–1994



Source: Third National Health and Nutrition Examination Survey, CDC.

Transmission Modes

Most risk factors associated with transmission of HCV in the United States were identified in case-control studies conducted during 1978–1986 (*40,41*). These risk factors included blood transfusion, injecting-drug use, employment in patient care or clinical laboratory work, exposure to a sex partner or household member who has had a history of hepatitis, exposure to multiple sex partners, and low socioeconomic level. These studies reported no association with military service or exposures resulting from medical, surgical, or dental procedures, tattooing, acupuncture, ear piercing, or foreign travel. If transmission from such exposures does occur, the frequency might be too low to detect.

Transfusions and Transplants. Currently, HCV is rarely transmitted by blood transfusion. During 1985–1990, cases of transfusion-associated non-A, non-B hepatitis declined by >50% because of screening policies that excluded donors with human immunodeficiency virus (HIV) infection and donors with surrogate markers for non-A, non-B hepatitis (*5,42*). By 1990, risk for transfusion-associated HCV infection was approximately 1.5%/recipient or approximately 0.02%/unit transfused (*42*). During May 1990, routine testing of donors for evidence of HCV infection was initiated, and during July 1992, more sensitive — multiantigen — testing was implemented, reducing further the risk for infection to 0.001%/ unit transfused (*43*).

Receipt of clotting factor concentrates prepared from plasma pools posed a high risk for HCV infection (*44*) until effective procedures to inactivate viruses, including HCV, were introduced during 1985 (Factor VIII) and 1987 (Factor IX). Persons with

TABLE 1. Estimated average prevalence of hepatitis C virus (HCV) infection in the United States by various characteristics and estimated prevalence of persons with these characteristics in the population

Characteristic	HCV-infection prevalence		Prevalence of persons with characteristic, %
	%	(range,%)	
Persons with hemophilia treated with products made before 1987	87	(74–90)	<0.01
Injecting-drug users			
current	79	(72–86)	0.5
history of prior use	No Data		5
Persons with abnormal alanine aminotransferase levels	15	(10–18)	5
Chronic hemodialysis patients	10	(0–64)	0.1
Persons with multiple sex partners (lifetime)			
≥50	9	(6–16)	4
10–49	3	(3–4)	22
2–9	2	(1–2)	52
Persons reporting a history of sexually transmitted diseases	6	(1–10)	17
Persons receiving blood transfusions before 1990	6	(5–9)	6
Infants born to infected mothers	5	(0–25)	0.1
Men who have sex with men	4	(2–18)	5
General population	1.8	(1.5–2.3)	NA*
Health-care workers	1	(1–2)	9
Pregnant women	1	—	1.5
Military personnel	0.3	(0.2–0.4)	0.5
Volunteer blood donors	0.16	—	5

*Not applicable.

hemophilia who were treated with products before inactivation of those products have prevalence rates of HCV infection as high as 90% (*20–22*). Although plasma derivatives (e.g., albumin and immune globulin [IG] for intramuscular [IM] administration) have not been associated with transmission of HCV infection in the United States, intravenous (IV) IG that was not virally inactivated was the source of one outbreak of hepatitis C during 1993–1994 (*45,46*). Since December 1994, all IG products — IV and IM — commercially available in the United States must undergo an inactivation procedure or be negative for HCV RNA (ribonucleic acid) before release.

Transplantation of organs (e.g., heart, kidney, or liver) from infectious donors to the organ recipient also carried a high risk for transmitting HCV infection before donor screening (*47,48*). Limited studies of recipients of transplanted tissue have implicated transmission of HCV only from nonirradiated bone tissue of unscreened donors (*49,50*). As with blood-donor screening, use of anti-HCV–negative organ and tissue donors has virtually eliminated risks for HCV transmission from transplantation.

Injecting and Other Illegal Drug Use. Although the number of cases of acute hepatitis C among injecting-drug users has declined dramatically since 1989, both incidence and prevalence of HCV infection remain high in this group (*51,52*). Injecting-drug use currently accounts for most HCV transmission in the United States, and has accounted for a substantial proportion of HCV infections during past decades (*2,5,53*). Many persons with chronic HCV infection might have acquired their infection 20–30 years ago as a result of limited or occasional illegal drug injecting. Injecting-drug

use leads to HCV transmission in a manner similar to that for other bloodborne pathogens (i.e., through transfer of HCV-infected blood by sharing syringes and needles either directly or through contamination of drug preparation equipment) (*54,55*). However, HCV infection is acquired more rapidly after initiation of injecting than other viral infections (i.e., hepatitis B virus [HBV] and HIV), and rates of HCV infection among young injecting-drug users are four times higher than rates of HIV infection (*19*). After 5 years of injecting, as many as 90% of users are infected with HCV. More rapid acquisition of HCV infection compared with other viral infections among injecting-drug users is likely caused by high prevalence of chronic HCV infection among injecting-drug users, which results in a greater likelihood of exposure to an HCV-infected person.

A study conducted among volunteer blood donors in the United States documented that HCV infection has been independently associated with a history of intranasal cocaine use (*56*). (The mode of transmission could be through sharing contaminated straws.) Data from NHANES III indicated that 14% of the general population have used cocaine at least once (*CDC, unpublished data*). Although NHANES III data also indicated that cocaine use was associated with HCV infection, injecting-drug use histories were not ascertained. Among patients with acute hepatitis C identified in CDC's sentinel counties viral hepatitis surveillance system since 1991, intranasal cocaine use in the absence of injecting-drug use was uncommon (*2*). Thus, at least in the recent past, intranasal cocaine use rarely appears to have contributed to transmission. Until more data are available, whether persons with a history of noninjecting illegal drug use alone (e.g., intranasal cocaine use) are likely to be infected with HCV remains unknown.

Nosocomial and Occupational Exposures. Nosocomial transmission of HCV is possible if infection-control techniques or disinfection procedures are inadequate and contaminated equipment is shared among patients. Although reports from other countries do document nosocomial HCV transmission (*57–59*), such transmission rarely has been reported in the United States (*60*), other than in chronic hemodialysis settings (*61*). Prevalence of antibody to HCV (anti-HCV) positivity among chronic hemodialysis patients averages 10%, with some centers reporting rates >60% (*23*). Both incidence and prevalence studies have documented an association between anti-HCV positivity and increasing years on dialysis, independent of blood transfusion (*62,63*). These studies, as well as investigations of dialysis-associated outbreaks of hepatitis C (*64*), indicate that HCV transmission might occur among patients in a hemodialysis center because of incorrect implementation of infection-control practices, particularly sharing of medication vials and supplies (*65*).

Health-care, emergency medical (e.g., emergency medical technicians and paramedics), and public safety workers (e.g., fire-service, law-enforcement, and correctional facility personnel) who have exposure to blood in the workplace are at risk for being infected with bloodborne pathogens. However, prevalence of HCV infection among health-care workers, including orthopedic, general, and oral surgeons, is no greater than the general population, averaging 1%–2%, and is 10 times lower than that for HBV infection (*29–33*). In a single study that evaluated risk factors for infection, a history of unintentional needle-stick injury was the only occupational risk factor independently associated with HCV infection (*66*).

The average incidence of anti-HCV seroconversion after unintentional needle sticks or sharps exposures from an HCV-positive source is 1.8% (range: 0%–7%) (*67–70*), with one study reporting that transmission occurred only from hollow-bore needles compared with other sharps (*69*). A study from Japan reported an incidence of HCV infection of 10% based on detection of HCV RNA by reverse transcriptase polymerase chain reaction (RT-PCR) (*70*). Although no incidence studies have documented transmission associated with mucous membrane or nonintact skin exposures, transmission of HCV from blood splashes to the conjunctiva have been described (*71,72*).

The risk for HCV transmission from an infected health-care worker to patients appears to be very low. One published report exists of such transmission during performance of exposure-prone invasive procedures (*73*). That report, from Spain, described HCV transmission from a cardiothoracic surgeon to five patients, but did not identify factors that might have contributed to transmission. Although factors (e.g., virus titer) might be related to transmission of HCV, no methods exist currently that can reliably determine infectivity, nor do data exist to determine threshold concentration of virus required for transmission.

Percutaneous Exposures in Other Settings. In other countries, HCV infection has been associated with folk medicine practices, tattooing, body piercing, and commercial barbering (*74–81*). However, in the United States, case-control studies have reported no association between HCV infection and these types of exposures (*40,41*). In addition, of patients with acute hepatitis C who were identified in CDC's sentinel counties viral hepatitis surveillance system during the past 15 years and who denied a history of injecting-drug use, only 1% reported a history of tattooing or ear piercing, and none reported a history of acupuncture (*41; CDC, unpublished data*). Among injecting-drug users, frequency of tattooing and ear piercing also was uncommon (3%).

Although any percutaneous exposure has the potential for transferring infectious blood and potentially transmitting bloodborne pathogens (i.e., HBV, HCV, or HIV), no data exist in the United States indicating that persons with exposures to tattooing and body piercing alone are at increased risk for HCV infection. Further studies are needed to determine if these types of exposures and settings in which they occur (e.g., correctional institutions, unregulated commercial establishments), are risk factors for HCV infection in the United States.

Sexual Activity. Case-control studies have reported an association between exposure to a sex contact with a history of hepatitis or exposure to multiple sex partners and acquiring hepatitis C (*40,41*). In addition, 15%–20% of patients with acute hepatitis C who have been reported to CDC's sentinel counties surveillance system, have a history of sexual exposure in the absence of other risk factors. Two thirds of these have an anti-HCV–positive sex partner, and one third reported >2 partners in the 6 months before illness (*2*).

In contrast, a low prevalence of HCV infection has been reported by studies of long-term spouses of patients with chronic HCV infection who had no other risk factors for infection. Five of these studies have been conducted in the United States, involving 30–85 partners each, in which average prevalence of HCV infection was 1.5% (range: 0% to 4.4%) (*56,82–85*). Among partners of persons with hemophilia coinfected with HCV and HIV, two studies have reported an average prevalence of HCV infection of

3% (*83,86*). One additional study evaluated potential transmission of HCV between sexually transmitted disease (STD) clinic patients, who denied percutaneous risk factors, and their steady partners (*28*). Prevalence of HCV infection among male patients with an anti-HCV–positive female partner (7%) was no different than that among males with a negative female partner (8%). However, female patients with an anti-HCV–positive partner were almost fourfold more likely to have HCV infection than females with a negative male partner (10% versus 3%, respectively). These data indicate that, similar to other bloodborne viruses, sexual transmission of HCV from males to females might be more efficient than from females to males.

Among persons with evidence of high-risk sexual practices (e.g., patients attending STD clinics and female prostitutes) who denied a history of injecting-drug use, prevalence of anti-HCV has been found to average 6% (range: 1%–10%) (*24–28,87*). Specific factors associated with anti-HCV positivity for both heterosexuals and men who have sex with men (MSM) included greater numbers of sex partners, a history of prior STDs, and failure to use a condom. However, the number of partners associated with infection risk varied among studies, ranging from >1 partner in the previous month to >50 in the previous year. In studies of other populations, the number of partners associated with HCV infection also varied, ranging from >2 partners in the 6 months before illness for persons with acute hepatitis C (*41*), to ≥5 partners/year for HCV-infected volunteer blood donors (*56*), to ≥10 lifetime partners for HCV- infected persons in the general population (*3*).

Only one study has documented an association between HCV infection and MSM activity (*28*), and at least in STD clinic settings, the prevalence rate of HCV infection among MSM generally has been similar to that of heterosexuals. Because sexual transmission of bloodborne viruses is recognized to be more efficient among MSM compared with heterosexual men and women, why HCV infection rates are not substantially higher among MSM compared with heterosexuals is unclear. This observation and the low prevalence of HCV infection observed among long-term spouses of persons with chronic HCV infection have raised doubts regarding the importance of sexual activity in transmission of HCV. Unacknowledged percutaneous risk factors (i.e., illegal injecting-drug use) might contribute to increased risk for HCV infection among persons with high-risk sexual practices.

Although considerable inconsistencies exist among studies, data indicate overall that sexual transmission of HCV appears to occur, but that the virus is inefficiently spread through this manner. More data are needed to determine the risk for, and factors related to, transmission of HCV between long-term steady partners as well as among persons with high-risk sexual practices, including whether other STDs promote transmission of HCV by influencing viral load or modifying mucosal barriers.

Household Contact. Case-control studies also have reported an association between nonsexual household contact and acquiring hepatitis C (*40,41*). The presumed mechanism of transmission is direct or inapparent percutaneous or permucosal exposure to infectious blood or body fluids containing blood. In a recent investigation in the United States, an HCV-infected mother transmitted HCV to her hemophilic child during performance of home infusion therapy, presumably when she had an unintentional needle stick and subsequently used the contaminated needle in the child (*88*).

Although prevalence of HCV infection among nonsexual household contacts of persons with chronic HCV infection in the United States is unknown, HCV transmission to such contacts is probably uncommon. In studies from other countries of nonsexual household contacts of patients with chronic hepatitis C, average anti-HCV prevalence was 4% (*15*). Although infected contacts in these studies reported no other commonly recognized risk factors for hepatitis C, most of these studies were done in countries where exposures commonly experienced in the past from contaminated equipment used in traditional and nontraditional medical procedures might have contributed to clustering of HCV infections in families (*75,76,79*).

Perinatal. The average rate of HCV infection among infants born to HCV-positive, HIV-negative women is 5%–6% (range: 0%–25%), based on detection of anti-HCV and HCV RNA, respectively (*89–101*). The average infection rate for infants born to women coinfected with HCV and HIV is higher — 14% (range: 5%–36%) and 17%, based on detection of anti-HCV and HCV RNA, respectively (*90,96,98–104*). The only factor consistently found to be associated with transmission has been the presence of HCV RNA in the mother at the time of birth. Although two studies of infants born to HCV-positive, HIV-negative women reported an association with titer of HCV RNA, each study reported a different level of HCV RNA related to transmission (*92,93*). Studies of HCV/HIV-coinfected women more consistently have indicated an association between virus titer and transmission of HCV (*102*).

Data regarding the relationship between delivery mode and HCV transmission are limited and presently indicate no difference in infection rates between infants delivered vaginally compared with cesarean-delivered infants. The transmission of HCV infection through breast milk has not been documented. In the studies that have evaluated breastfeeding in infants born to HCV-infected women, average rate of infection was 4% in both breastfed and bottle-fed infants (*95,96,99,100,105,106*).

Diagnostic criteria for perinatal HCV infection have not been established. Various anti-HCV patterns have been observed in both infected and uninfected infants of anti-HCV–positive mothers. Passively acquired maternal antibody might persist for months, but probably not for >12 months. HCV RNA can be detected as early as 1 to 2 months.

Persons with No Recognized Source for Their Infection. Recent studies have demonstrated that injecting-drug use currently accounts for 60% of HCV transmission in the United States (*2*). Although the role of sexual activity in transmission of HCV remains unclear, ≤20% of persons with HCV infection report sexual exposures (i.e., exposure to an infected sexual partner or to multiple partners) in the absence of percutaneous risk factors (*2*). Other known exposures (occupational, hemodialysis, household, perinatal) together account for approximately 10% of infections. Thus, a potential risk factor can be identified for approximately 90% of persons with HCV infection. In the remaining 10%, no recognized source of infection can be identified, although most persons in this category are associated with low socioeconomic level. Although low socioeconomic level has been associated with several infectious diseases and might be a surrogate for high-risk exposures, its nonspecific nature makes targeting prevention measures difficult.

Screening and Diagnostic Tests

Serologic Assays

The only tests currently approved by the U.S. Food and Drug Administration (FDA) for diagnosis of HCV infection are those that measure anti-HCV (Table 2) (*107*). These tests detect anti-HCV in ≥97% of infected patients, but do not distinguish between acute, chronic, or resolved infection. As with any screening test, positive predictive value of enzyme immunoassay (EIA) for anti-HCV varies depending on prevalence of infection in the population and is low in populations with an HCV-infection prevalence of <10% (*1,34*). Supplemental testing with a more specific assay (i.e., recombinant immunoblot assay [RIBA™]) of a specimen with a positive EIA result prevents reporting of false-positive results, particularly in settings where asymptomatic persons are being tested.

Supplemental test results might be reported as positive, negative, or indeterminate. An anti-HCV–positive person is defined as one whose serologic results are EIA-test–positive and supplemental-test–positive. Persons with a negative EIA test result or a positive EIA and a negative supplemental test result are considered uninfected, unless other evidence exists to indicate HCV infection (e.g., abnormal ALT levels in immunocompromised persons or persons with no other etiology for their liver disease). Indeterminate supplemental test results have been observed in recently infected persons who are in the process of seroconversion, as well as in persons chronically infected with HCV. Indeterminate anti-HCV results also might indicate a false-positive result, particularly in those persons at low risk for HCV infection.

Nucleic Acid Detection

The diagnosis of HCV infection also can be made by qualitatively detecting HCV RNA using gene amplification techniques (e.g., RT-PCR) (Table 2) (*108*). HCV RNA can be detected in serum or plasma within 1–2 weeks after exposure to the virus and weeks before the onset of alanine aminotransferase (ALT) elevations or the appearance of anti-HCV. Rarely, detection of HCV RNA might be the only evidence of HCV infection. Although RT-PCR assay kits for HCV RNA are available for research purposes from various manufacturers of diagnostic reagents, none have been approved by FDA. In addition, numerous laboratories perform RT-PCR using in-house laboratory methods and reagents.

Although not FDA-approved, RT-PCR assays for HCV infection are used commonly in clinical practice. Most RT-PCR assays have a lower limit of detection of 100–1,000 viral genome copies/mL. With adequate optimization of RT-PCR assays, 75%–85% of persons who are anti-HCV–positive and >95% of persons with acute or chronic hepatitis C will test positive for HCV RNA. Some HCV-infected persons might be only intermittently HCV RNA-positive, particularly those with acute hepatitis C or with end-stage liver disease caused by hepatitis C. To minimize false-negative results, serum must be separated from cellular components within 2–4 hours after collection, and preferably stored frozen at -20 C or -70 C (*109*). If shipping is required, frozen samples should be protected from thawing. Because of assay variability, rigorous quality assurance and control should be in place in clinical laboratories performing this assay, and proficiency testing is recommended.

TABLE 2. Tests for hepatitis C virus (HCV) infection

Test/Type	Application	Comments
Hepatitis C virus antibody (anti-HCV)		
• EIA (enzyme immunoassay) • Supplemental assay (i.e., recombinant immunoblot assay [RIBA™])	• Indicates past or present infection, but does not differentiate between acute, chronic, or resolved infection • All positive EIA results should be verified with a supplemental assay	• Sensitivity ≥97% • EIA alone has low-positive predictive value in low-prevalence populations
HCV RNA (hepatitis C virus ribonucleic acid)		
Qualitative tests*†		
• Reverse transcriptase polymerase chain reaction (RT-PCR) amplification of HCV RNA by in-house or commercial assays (e.g., Amplicor HCV™)	• Detect presence of circulating HCV RNA • Monitor patients on antiviral therapy	• Detect virus as early as 1–2 weeks after exposure • Detection of HCV RNA during course of infection might be intermittent; a single negative RT-PCR is not conclusive • False-positive and false-negative results might occur
Quantitative tests*†		
• RT-PCR amplification of HCV RNA by in-house or commercial assays (e.g., Amplicor HCV Monitor™) • Branched chain DNA§ (bDNA) assays (e.g., Quantiplex™ HCV RNA Assay)	• Determine concentration of HCV RNA • Might be useful for assessing the likelihood of response to antiviral therapy	• Less sensitive than qualitative RT-PCR • Should not be used to exclude the diagnosis of HCV infection or to determine treatment endpoint
Genotype*†		
• Several methodologies available (e.g., hybridization, sequencing)	• Group isolates of HCV based on genetic differences, into 6 genotypes and >90 subtypes • With new therapies, length of treatment might vary based on genotype	• Genotype 1 (subtypes 1a and 1b) most common in United States and associated with lower response to antiviral therapy
Serotype*		
• EIA based on immunoreactivity to synthetic peptides (e.g., Murex HCV Serotyping 1–6 Assay)	• No clinical utility	• Cannot distinguish between subtypes • Dual infections often observed

* Currently not U.S. Food and Drug Administration approved; lack standardization.
† Samples require special handling (e.g., serum must be separated within 2–4 hours of collection and stored frozen [-20 C or -70 C]; frozen samples should be shipped on dry ice).
§ Deoxyribonucleic acid.

Quantitative assays for measuring the concentration (titer) of HCV RNA have been developed and are available from commercial laboratories (*110*), including a quantitative RT-PCR (Amplicor HCV Monitor™, Roche Molecular Systems, Branchburg, New Jersey) and a branched DNA (deoxyribonucleic acid) signal amplification assay (Quantiplex™ HCV RNA Assay [bDNA], Chiron Corp., Emeryville, California) (Table 2). These assays also are not FDA-approved, and compared with qualitative RT-PCR assays, are less sensitive with lower limits of detection of 500 viral genome copies/mL for the Amplicor HCV Monitor™ to 200,000 genome equivalents/mL for the Quantiplex™ HCV RNA Assay (*111*). In addition, they each use a different standard, which precludes direct comparisons between the two assays. Quantitative assays should not be used as a primary test to confirm or exclude diagnosis of HCV infection or to monitor the endpoint of treatment. Patients with chronic hepatitis C generally circulate virus at levels of 10^5–10^7 genome copies/mL. Testing for level of HCV RNA might help predict likelihood of response to antiviral therapy, although sequential measurement of HCV RNA levels has not proven useful in managing patients with hepatitis C.

At least six different genotypes and >90 subtypes of HCV exist (*112*). Approximately 70% of HCV-infected persons in the United States are infected with genotype 1, with frequency of subtype 1a predominating over subtype 1b. Different nucleic acid detection methods are available commercially to group isolates of HCV, based on genotypes and subtypes (*113*). Evidence is limited regarding differences in clinical features, disease outcome, or progression to cirrhosis or hepatocellular carcinoma (HCC) among persons with different genotypes. However, differences do exist in responses to antiviral therapy according to HCV genotype. Rates of response in patients infected with genotype 1 are substantially lower than in patients with other genotypes, and treatment regimens might differ on the basis of genotype. Thus, genotyping might be warranted among persons with chronic hepatitis C who are being considered for antiviral therapy.

Clinical Features and Natural History

Acute HCV Infection

Persons with acute HCV infection typically are either asymptomatic or have a mild clinical illness; 60%–70% have no discernible symptoms; 20%–30% might have jaundice; and 10%–20% might have nonspecific symptoms (e.g., anorexia, malaise, or abdominal pain) (*13,114,115*). Clinical illness in patients with acute hepatitis C who seek medical care is similar to that of other types of viral hepatitis, and serologic testing is necessary to determine the etiology of hepatitis in an individual patient. In ≤20% of these patients, onset of symptoms might precede anti-HCV seroconversion. Average time period from exposure to symptom onset is 6–7 weeks (*116–118*), whereas average time period from exposure to seroconversion is 8–9 weeks (*114; personal communication, HJ Alter, M.D., Chief, Department of Transfusion Medicine, Clinical Center, National Institutes of Health, Bethesda, MD, September 1998*). Anti-HCV can be detected in 80% of patients within 15 weeks after exposure, in ≥90% within 5 months after exposure, and in ≥97% by 6 months after exposure (*14,114*). Rarely, seroconversion might be delayed until 9 months after exposure (*14,119*).

The course of acute hepatitis C is variable, although elevations in serum ALT levels, often in a fluctuating pattern, are its most characteristic feature. Normalization of ALT levels might occur and suggests full recovery, but this is frequently followed by ALT elevations that indicate progression to chronic disease (*14*). Fulminant hepatic failure following acute hepatitis C is rare (*120,121*).

Chronic HCV Infection

After acute infection, 15%–25% of persons appear to resolve their infection without sequelae as defined by sustained absence of HCV RNA in serum and normalization of ALT levels (*122; personal communication, LB Seeff, M.D., Senior Scientist [Hepatitis C], National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, MD, July 1998*). Chronic HCV infection develops in most persons (75%–85%)(*14,122–124*), with persistent or fluctuating ALT elevations indicating active liver disease developing in 60%–70% of chronically infected persons (*12–15,116,122–124*). In the remaining 30%–40% of chronically infected persons, ALT levels are normal. No clinical or epidemiologic features among patients with acute infection have been found to be predictive of either persistent infection or chronic liver disease. Moreover, various ALT patterns have been observed in these patients during follow-up, and patients might have prolonged periods (≥12 months) of normal ALT activity even though they have histologic-confirmed chronic hepatitis (*14*). Thus, a single ALT determination cannot be used to exclude ongoing hepatic injury, and long-term follow-up of patients with HCV infection is required to determine their clinical outcome or prognosis.

The course of chronic liver disease is usually insidious, progressing at a slow rate without symptoms or physical signs in the majority of patients during the first two or more decades after infection. Frequently, chronic hepatitis C is not recognized until asymptomatic persons are identified as HCV-positive during blood-donor screening, or elevated ALT levels are detected during routine physical examinations. Most studies have reported that cirrhosis develops in 10%–20% of persons with chronic hepatitis C over a period of 20–30 years, and HCC in 1%–5%, with striking geographic variations in rates of this disease (*124–128*). However, when cirrhosis is established, the rate of development of HCC might be as high as 1%–4%/year. In contrast, a study of >200 women 17 years after they received HCV-contaminated Rh factor IG reported that only 2.4% had evidence of cirrhosis and none had died (*129*). Thus, longer term follow-up studies are needed to assess lifetime consequences of chronic hepatitis C, particularly among those who acquired their infection at young ages.

Although factors predicting severity of liver disease have not been well-defined, recent data indicate that increased alcohol intake, being aged >40 years at infection, and being male are associated with more severe liver disease (*130*). In particular, among persons with alcoholic liver disease and HCV infection, liver disease progresses more rapidly; among those with cirrhosis, a higher risk for development of HCC exists (*131*). Furthermore, even intake of moderate amounts (>10 g/day) of alcohol in patients with chronic hepatitis C might enhance disease progression. More severe liver injury observed in persons with alcoholic liver disease and HCV infection possibly is attributable to alcohol-induced enhancement of viral replication or increased susceptibility of cells to viral injury. In addition, persons who have chronic liver disease are at increased risk for fulminant hepatitis A (*132*).

Extrahepatic manifestations of chronic HCV infection are considered to be of immunologic origin and include cryoglobulinemia, membranoproliferative glomerulonephritis, and porphyria cutanea tarda (*131*). Other extrahepatic conditions have been reported, but definitive associations of these conditions with HCV infection have not been established. These include seronegative arthritis, Sjögren syndrome, autoimmune thyroiditis, lichen planus, Mooren corneal ulcers, idiopathic pulmonary fibrosis (Hamman-Rich syndrome), polyarteritis nodosa, aplastic anemia, and B-cell lymphomas.

Clinical Management and Treatment

HCV-positive patients should be evaluated for presence and severity of chronic liver disease (*133*). Initial evaluation for presence of disease should include multiple measurements of ALT at regular intervals, because ALT activity fluctuates in persons with chronic hepatitis C. Patients with chronic hepatitis C should be evaluated for severity of their liver disease and for possible treatment (*133–135*).

Antiviral therapy is recommended for patients with chronic hepatitis C who are at greatest risk for progression to cirrhosis (*133*). These persons include anti-HCV–positive patients with persistently elevated ALT levels, detectable HCV RNA, and a liver biopsy that indicates either portal or bridging fibrosis or at least moderate degrees of inflammation and necrosis.

In patients with less severe histologic changes, indications for treatment are less clear, and careful clinical follow-up might be an acceptable alternative to treatment with antiviral therapy (e.g., interferon) because progression to cirrhosis is likely to be slow, if it occurs at all. Similarly, patients with compensated cirrhosis (without jaundice, ascites, variceal hemorrhage, or encephalopathy) might not benefit from interferon therapy. Careful assessment should be made, and the risks and benefits of therapy should be thoroughly discussed with the patient.

Patients with persistently normal ALT values should not be treated with interferon outside of clinical trials because treatment might actually induce liver enzyme abnormalities (*136*). Patients with advanced cirrhosis who might be at risk for decompensation with therapy and pregnant women also should not be treated. Interferon treatment is not FDA-approved for patients aged <18 years, and more data are needed regarding treatment of persons aged <18 years or >60 years. Treatment of patients who are drinking excessive amounts of alcohol or who are injecting illegal drugs should be delayed until these behaviors have been discontinued for ≥6 months. Contraindications to treatment with interferon include major depressive illness, cytopenias, hyperthyroidism, renal transplantation, and evidence of autoimmune disease.

Most clinical trials of treatment for chronic hepatitis C have been conducted using alpha-interferon (*134,135,137,138*). When the recommended regimen of 3 million units administered subcutaneously 3 times/week for 12 months is used, approximately 50% of treated patients have normalization of serum ALT activity (biochemical response), and 33% have a loss of detectable HCV RNA in serum (virologic response) at the end of therapy. However, ≥50% of these patients relapse when therapy is stopped. Thus, 15%–25% have a sustained response as measured by testing for ALT and HCV RNA ≥1 years after therapy is stopped, many of whom also have histologic

improvement. For patients who do not respond by the end of therapy, retreatment with a standard dose of interferon is rarely effective. Patients who have persistently abnormal ALT levels and detectable HCV RNA in serum after 3 months of interferon are unlikely to respond to treatment, and interferon treatment should be discontinued. These persons might be considered for participation in clinical trials of alternative treatments. Decreased interferon response rates (<15%) have been found in patients with higher serum HCV RNA titers and HCV genotype 1 (the most common strain of HCV in the United States); however, treatment should not be withheld based solely on these findings.

Therapy for hepatitis C is a rapidly changing area of clinical practice. Combination therapy with interferon and ribavirin, a nucleoside analogue, is now FDA-approved for treatment of chronic hepatitis C in patients who have relapsed following interferon treatment and might be approved soon for patients who have not been treated previously. Studies of patients treated with a combination of ribavirin and interferon have demonstrated a substantial increase in sustained response rates, reaching 40%–50%, compared with response rates of 15%–25% with interferon alone (*139,140*). However, as with interferon alone, combination therapy in patients with genotype 1 is not as successful, and sustained response rates among these patients are still <30%.

Most patients receiving interferon experience flu-like symptoms early in treatment, but these symptoms diminish with continued treatment. Later side effects include fatigue, bone marrow suppression, and neuropsychiatric effects (e.g., apathy, cognitive changes, irritability, and depression). Interferon dosage must be reduced in 10%–40% of patients and discontinued in 5% –15% because of severe side effects. Ribavirin can induce hemolytic anemia and can be problematic for patients with preexisting anemia, bone marrow suppression, or renal failure. In these patients, combination therapy should be avoided or attempts should be made to correct the anemia. Hemolytic anemia caused by ribavirin also can be life-threatening for patients with ischemic heart disease or cerebral vascular disease. Ribavirin is teratogenic, and female patients should avoid becoming pregnant during therapy.

Other treatments, including corticosteroids, ursodiol, and thymosin, have not been effective. High iron levels in the liver might reduce the efficacy of interferon. Use of iron-reduction therapy (phlebotomy or chelation) in combination with interferon has been studied, but results have been inconclusive. Because patients are becoming more interested in alternative therapies (e.g., traditional Chinese medicine, antioxidants, naturopathy, and homeopathy), physicians should be prepared to address questions regarding these topics.

Postexposure Prophylaxis and Follow-Up

Available data regarding the prevention of HCV infection with IG indicate that IG is not effective for postexposure prophylaxis of hepatitis C (*67,141*). No assessments have been made of postexposure use of antiviral agents (e.g., interferon) to prevent HCV infection. Mechanisms of the effect of interferon in treating patients with hepatitis C are poorly understood, and an established infection might need to be present for interferon to be an effective treatment (*142*). As of the publication of this report, interferon is FDA-approved only for treatment of chronic hepatitis C.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

MMWR
MORBIDITY AND MORTALITY WEEKLY REPORT

October 16, 1998 / Vol. 47 / No. RR-19

Recommendations and Reports

Continuing Medical Education Activity Sponsored by the Centers for Disease Control and Prevention (CDC)

Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HVC-Related Chronic Disease

OBJECTIVE

This *MMWR* provides recommendations for preventing transmission of hepatitis C virus (HCV); identifying, counseling, and testing persons at risk for HCV infection; and providing appropriate medical evaluation and management of HCV-infected persons. These recommendations were developed by CDC staff members after consultation with expert consultants. This report is intended to serve as a resource for health-care professionals, public health officials, and organizations involved in the development, delivery, and evaluation of prevention and clinical services. Upon completing this continuing education activity, the reader should possess a clear working knowledge regarding this topic.

ACCREDITATION

Continuing Medical Education (CME) Credit: This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME) by the CDC. CDC is accredited by the ACCME to provide continuing medical education for U.S. physicians. CDC awards 2.0 hours of category 1 credit toward the AMA Physician's Recognition Award for this activity.

EXPIRATION — October 16, 1999

The response form must be completed and returned electronically, by fax, or by mail, **postmarked no later than one year from the publication date of this report**, for eligibility to receive continuing education credit.

INSTRUCTIONS

1. Read this MMWR *(Vol. 47, RR-19)*, which contains the correct answers to the questions beginning on the next page.
2. Complete all registration information on the response form, including your name, mailing address, phone number, and e-mail address, if available.
3. Select your answers to the questions, and mark the corresponding letters on the response form provided. To receive continuing education credit, you must answer *all* of the questions. Questions with more than one answer will instruct you to "indicate all that are true."
4. Return the answer form, or a photocopy of the form, no later than **October 16, 1999**, to CDC by one of the following methods:

   Fax: 404-639-4148
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   Office of Scientific and Health Communications
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   Centers for Disease Control and Prevention
   1600 Clifton Road, N.E.
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   If you answer all of the questions, you will receive an award letter for 2.0 hours of CME credit within 90 days. No fees are charged for participating in this continuing education activity.

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES

To receive continuing education credit, please answer all of the following questions:

1. **Which of the following statements about hepatitis C virus (HCV) infection and HCV-associated chronic liver disease in the United States are true?** ***(Indicate all that are true.)***

   A. HCV is responsible for 40% of chronic liver disease.

   B. HCV-associated chronic liver disease often results in death.

   C. An estimated 8,000–10,000 deaths occur each year as a result of HCV-associated chronic liver disease.

   D. Persistent HCV infection develops in most persons (85%), including those with no biochemical evidence of active liver disease.

   E. HCV-associated chronic liver disease is the cause of most liver transplantation in the United States.

2. **Which of the following is currently the major risk factor for HCV infection in the United States?** ***(Choose the one correct answer.)***

   A. Tattoos

   B. Injecting-drug use

   C. Blood transfusion

   D. Sexual activity

   E. Working in healthcare occupations

3. **Which of the following tests could be used to "confirm" the diagnosis of HCV infection in a patient who is anti-HCV positive by enzyme immunoassay (EIA)?** ***(Indicate all that are true.)***

   A. Recombinant Immunoblot Assay (RIBA™)

   B. Qualitative reverse transcriptase polymerase chain reaction (RT-PCR)

   C. Quantitative RT-PCR

   D. Genotyping

   E. All of the above

4. **For which of the following persons is routine testing for HCV infection recommended?** ***(Indicate all that are true.)***

   A. Persons who have been tattooed

   B. Persons who have had a history of sexually transmitted disease

   C. Persons who have ever injected illicit drugs

   D. Persons who have had a transfusion of blood or blood components before July 1992

   E. Persons who have received clotting factor concentrates made before 1987

5. **For which of the following persons is need for routine testing for HCV infection unclear? (Indicate all that are true.)**

   A. Injecting-drug users

   B. Persons who have been tattooed or who have body piercing

   C. Persons with a history of sexually transmitted disease

   D. Pregnant women

   E. All of the above

6. **For which of the following persons is routine testing for HCV infection not recommended?** ***(Indicate all that are true.)***

   A. Persons with a history of blood transfusion

   B. Pregnant women

   C. Persons with a history of sexually transmitted disease

   D. Household contacts of persons with HCV infection

   E. Health-care and public safety workers

7. **What is the percentage of persons with HCV infection who develop chronic hepatitis C?** ***(Choose the one correct answer.)***

   A. 10%

   B. 40%

   C. 60%–70%

   D. 100%

   E. 0%

8. **What are the licensed therapies for the treatment of chronic hepatitis C?** ***(Indicate all that are true.)***

   A. Milk thistle

   B. No licensed therapies are available

   C. Monotherapy with interferon

   D. Monotherapy with ribavirin

   E. Combination therapy with interferon and ribavirin

9. **Indicate the setting where you work.**

   A. State/local health department

   B. Other public health setting

   C. Hospital clinic/private practice

   D. Managed care organization

   E. Academic institution

   F. Other, please specify _____

10. Indicate the approximate number of patients with hepatitis C that you treat or counsel on a monthly basis.

A. None

B. 1–5

C. 6–15

D. 16–25

E. 25

11. What is your training background?

A. Internal medicine

B. Family practice

C. Gastroenterology

D. Infectious disease

E. Other

The following questions will assess your perceptions of the readability of the material.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
12. I understood the rationale for the recommendations.	**A**	**B**	**C**	**D**	**E**
13. Overall, the presentation of the article enhanced my ability to read and understand the material	**A**	**B**	**C**	**D**	**E**

Answer Guide for questions 1–8

1.a, c, d, e; 2.b; 3.a, b; 4.c, d, e; 5.b, c; 6.b, d, e; 7.c; 8. c, e

MMWR ANSWER FORM for CME Credit
MMWR Vol. 47/No. RR-19. October 16, 1998

Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease

Fill in the appropriate block(s) to indicate your answer(s).

1.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
2.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
3.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
4.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
5.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
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The immediate postexposure setting provides opportunity to identify persons early in the course of their HCV infection. Studies indicate that interferon treatment begun early in the course of HCV infection is associated with a higher rate of resolved infection (*143*). However, no data exist indicating that treatment begun during the acute phase of infection is more effective than treatment begun early during the course of chronic HCV infection. In addition, as stated previously, interferon is not FDA-approved for this indication. Determination of whether treatment of HCV infection is more beneficial in the acute phase than in the early chronic phase will require evaluation with well-designed research protocols.

PREVENTION AND CONTROL RECOMMENDATIONS

Rationale

Reducing the burden of HCV infection and HCV-related disease in the United States requires implementation of *primary* prevention activities that reduce risks for contracting HCV infection and *secondary* prevention activities that reduce risks for liver and other chronic diseases in HCV-infected persons. In addition, surveillance and evaluation activities are required to determine the effectiveness of prevention programs in reducing incidence of disease, identifying persons infected with HCV, providing appropriate medical follow-up, and promoting healthy lifestyles and behaviors.

Primary prevention activities can reduce or eliminate potential risk for HCV transmission from a) blood, blood components, and plasma derivatives; b) such high-risk activities as injecting-drug use and sex with multiple partners; and c) percutaneous exposures to blood in health care and other (i.e., tattooing and body piercing) settings. Immunization against HCV is not available; therefore, identifying persons at risk but not infected with HCV provides opportunity for counseling on how to reduce their risk for becoming infected.

Elements of a comprehensive strategy to prevent and control hepatitis C virus (HCV) infection and HCV-related disease

- Primary prevention activities include
  - — screening and testing of blood, plasma, organ, tissue, and semen donors
  - — virus inactivation of plasma-derived products;
  - — risk-reduction counseling and services; and
  - — implementation and maintenance of infection-control practices.
- Secondary prevention activities include
  - — identification, counseling, and testing of persons at risk, and
  - — medical management of infected persons.
- Professional and public education.
- Surveillance and research to monitor disease trends and the effectiveness of prevention activities and to develop improved prevention methods.

Secondary prevention activities can reduce risks for chronic disease by identifying HCV-infected persons through diagnostic testing and by providing appropriate medical management and antiviral therapy. Because of the number of persons with chronic HCV infection, identification of these persons must be a major focus of current prevention programs. Identification of persons at risk for HCV infection provides opportunity for testing to determine their infection status, medical evaluation to determine their disease status if infected, and antiviral therapy, if appropriate. Identification also provides infected persons opportunity to obtain information concerning how they can prevent further harm to their liver and prevent transmitting HCV to others.

Factors for consideration when making decisions regarding development and implementation of preventive services for a particular disease include the public health importance of the disease, the availability of appropriate diagnostic tests, and the effectiveness of available preventive and therapeutic interventions. However, identification of persons at risk for HCV infection must take into account not only the benefits but also the limitations and drawbacks associated with such efforts. Hepatitis C is a disease of major public health importance, and suitable and accurate diagnostic tests as well as behavioral and therapeutic interventions are available. Counseling and testing can prevent disease transmission and progression through reducing high-risk practices (e.g., injecting-drug use and alcohol intake). However, the degree to which persons will change their high-risk practices based on knowing their test results is not known, and possible adverse consequences of testing exist, including disclosure of test results to others that might result in disrupted personal relationships and possible discriminatory action (e.g., loss of employment, insurance, and educational opportunities). Antiviral treatment is also available, and treatment guidelines have been developed. Such treatment is beneficial for many patients, although sustained response rates and mode of delivery are currently less than ideal.

Persons at risk for HCV infection who receive health-care services in the public and private sectors should have access to counseling and testing. Facilities that provide counseling and testing should include services or referrals for medical evaluation and management of persons identified as infected with HCV. Priorities for implementing new counseling and testing programs should be based on providing access to persons who are most likely to be infected or who practice high-risk behaviors.

PRIMARY PREVENTION RECOMMENDATIONS

Blood, Plasma Derivatives, Organs, Tissues, and Semen

Current practices that exclude blood, plasma, organ, tissue, or semen donors determined to be at increased risk for HCV by history or who have serologic markers for HCV infection must be maintained to prevent HCV transmission from transfusions and transplants (*1*). Viral inactivation of clotting factor concentrates and other products derived from human plasma, including IG products, also must be continued, and all plasma-derived products that do not undergo viral inactivation should be HCV RNA negative by RT-PCR before release.

High-Risk Drug and Sexual Practices

Health-care professionals in all patient care settings routinely should obtain a history that inquires about use of illegal drugs (injecting and noninjecting) and evidence of high-risk sexual practices (e.g., multiple sex partners or a history of STDs). Primary prevention of illegal drug injecting will eliminate the greatest risk factor for HCV infection in the United States (*144*). Although consistent data are lacking regarding the extent to which sexual activity contributes to HCV transmission, persons having multiple sex partners are at risk for STDs (e.g., HIV, HBV, syphilis, gonorrhea, and chlamydia). Counseling and education to prevent initiation of drug-injecting or high-risk sexual practices is important, especially for adolescents. Persons who inject drugs or who are at risk for STDs should be counseled regarding what they can do to minimize their risk for becoming infected or of transmitting infectious agents to others, including need for vaccination against hepatitis B (*144–148*). Injecting and noninjecting illegal drug users and sexually active MSM also should be vaccinated against hepatitis A (*149*).

Prevention messages for persons with high-risk drug or sexual practices

- Persons who use or inject illegal drugs should be advised
  - to stop using and injecting drugs.
  - to enter and complete substance-abuse treatment, including relapse-prevention programs.
  - if continuing to inject drugs,
    - to never reuse or "share" syringes, needles, water, or drug preparation equipment; if injection equipment has been used by other persons, to first clean the equipment with bleach and water;
    - to use only sterile syringes obtained from a reliable source (e.g., pharmacies);
    - to use a new sterile syringe to prepare and inject drugs;
    - if possible, to use sterile water to prepare drugs; otherwise to use clean water from a reliable source (such as fresh tap water).
    - to use a new or disinfected container ("cooker") and a new filter ("cotton") to prepare drugs;
    - to clean the injection site before injection with a new alcohol swab; and
    - to safely dispose of syringes after one use.
  - to get vaccinated against hepatitis B and hepatitis A.
- Persons who are at risk for sexually transmitted diseases should be advised
  - that the surest way to prevent the spread of human immunodeficiency virus infection and other sexually transmitted diseases is to have sex with only one uninfected partner or not to have sex at all.
  - to use latex condoms correctly and every time to protect themselves and their partners from diseases spread through sexual activity.
  - to get vaccinated against hepatitis B, and if appropriate, hepatitis A.

Counseling of persons with potential or existing illegal drug use or high-risk sexual practices should be conducted in the setting in which the patient is identified. If counseling services cannot be provided on-site, patients should be referred to a convenient community resource, or at a minimum, provided easy-to-understand health-education material. STD and drug-treatment clinics, correctional institutions, and HIV counseling and testing sites should routinely provide information concerning prevention of HCV and HBV infection in their counseling messages. Based on the findings of multiple studies, syringe and needle-exchange programs can be an effective part of a comprehensive strategy to reduce the incidence of bloodborne virus transmission and do not encourage the use of illegal drugs (*150–153*). Therefore, to reduce the risk for HCV infection among injecting-drug users, local communities can consider implementing syringe and needle-exchange programs.

Percutaneous Exposures to Blood in Health Care and Other Settings

Health-Care Settings

Health-care, emergency medical, and public safety workers should be educated regarding risk for and prevention of bloodborne infections, including the need to be vaccinated against hepatitis B (*154–156*). Standard barrier precautions and engineering controls should be implemented to prevent exposure to blood. Protocols should be in place for reporting and follow-up of percutaneous or permucosal exposures to blood or body fluids that contain blood.

Health-care professionals responsible for overseeing patients receiving home infusion therapy should ensure that patients and their families (or caregivers) are informed of potential risk for infection with bloodborne pathogens, and should assess their ability to use adequate infection-control practices consistently (*88*). Patients and families should receive training with a standardized curriculum that includes appropriate infection-control procedures, and these procedures should be evaluated regularly through home visits.

Currently, no recommendations exist to restrict professional activities of health-care workers with HCV infection. As recommended for all health-care workers, those who are HCV-positive should follow strict aseptic technique and standard precautions, including appropriate use of hand washing, protective barriers, and care in the use and disposal of needles and other sharp instruments (*154,155*).

In chronic hemodialysis settings, intensive efforts must be made to educate new staff and reeducate existing staff regarding hemodialysis-specific infection-control practices that prevent transmission of HCV and other bloodborne pathogens (*65,157*). Hemodialysis-center precautions are more stringent than standard precautions. Standard precautions require use of gloves only when touching blood, body fluids, secretions, excretions, or contaminated items. In contrast, hemodialysis-center precautions require glove use whenever patients or hemodialysis equipment is touched. Standard precautions do not restrict use of supplies, instruments, and medications to a single patient; hemodialysis-center precautions specify that none of these items be shared among any patients. Thus, appropriate use of hemodialysis-center precautions

Routine precautions for the care of all hemodialysis patients

- Patients should have specific dialysis stations assigned to them, and chairs and beds should be cleaned after each use.
- Sharing among patients of ancillary supplies such as trays, blood pressure cuffs, clamps, scissors, and other nondisposable items should be avoided.
- Nondisposable items should be cleaned or disinfected appropriately between uses.
- Medications and supplies should not be shared among patients, and medication carts should not be used.
- Medications should be prepared and distributed from a centralized area.
- Clean and contaminated areas should be separated (e.g., handling and storage of medications and hand washing should not be done in the same or an adjacent area to that where used equipment or blood samples are handled).

should prevent transmission of HCV among chronic hemodialysis patients, and isolation of HCV-positive patients is not necessary or recommended.

Other Settings

Persons who are considering tattooing or body piercing should be informed of potential risks of acquiring infection with bloodborne and other pathogens through these procedures. These procedures might be a source of infection if equipment is not sterile or if the artist or piercer does not follow other proper infection-control procedures (e.g., washing hands, using latex gloves, and cleaning and disinfecting surfaces).

SECONDARY PREVENTION RECOMMENDATIONS

Persons for Whom Routine HCV Testing Is Recommended

Testing should be offered routinely to persons most likely to be infected with HCV who might require medical management, and testing should be accompanied by appropriate counseling and medical follow-up. In addition, anyone who wishes to know or is concerned regarding their HCV-infection status should be provided the opportunity for counseling, testing, and appropriate follow-up. The determination of which persons at risk to recommend for routine testing is based on various considerations, including a known epidemiologic relationship between a risk factor and acquiring HCV infection, prevalence of risk behavior or characteristic in the population, prevalence of infection among those with a risk behavior or characteristic, and the need for persons with a recognized exposure to be evaluated for infection.

Persons who should be tested routinely for hepatitis C virus (HCV) infection based on their risk for infection

- Persons who ever injected illegal drugs, including those who injected once or a few times many years ago and do not consider themselves as drug users.
- Persons with selected medical conditions, including
  - — persons who received clotting factor concentrates produced before 1987;
  - — persons who were ever on chronic (long-term) hemodialysis; and
  - — persons with persistently abnormal alanine aminotransferase levels.
- Prior recipients of transfusions or organ transplants, including
  - — persons who were notified that they received blood from a donor who later tested positive for HCV infection;
  - — persons who received a transfusion of blood or blood components before July 1992; and
  - — persons who received an organ transplant before July 1992.

Persons who should be tested routinely for HCV-infection based on a recognized exposure

- Healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood.
- Children born to HCV-positive women.

Persons Who Have Ever Injected Illegal Drugs

Health-care professionals in primary-care and other appropriate settings routinely should question patients regarding their history of injecting-drug use, and should counsel, test, and evaluate for HCV infection, persons with such histories. Current injecting-drug users frequently are not seen in the primary health-care setting and might not be reached by traditional media; therefore, community-based organizations serving these populations should determine the most effective means of integrating appropriate HCV information and services into their programs.

Testing persons in settings with potentially high proportions of injecting-drug users (e.g., correctional institutions, HIV counseling and testing sites, or drug and STD treatment programs) might be particularly efficient for identifying HCV-positive persons. HCV testing programs in these settings should include counseling and referral or arrangements for medical management. However, limited experience exists in combining HCV programs with existing HIV, STD, or other established services for populations at high risk for infection with bloodborne pathogens. Persons at risk for HCV infection through limited or occasional drug use, particularly in the remote past, might not be receptive to receiving services in such settings as HIV counseling and testing sites and drug and STD treatment programs. In addition, whether a substantial proportion of this group at risk can be identified in these settings is unknown. Studies are needed to determine the best approaches for reaching persons who might not identify themselves as being at risk for HCV infection.

Persons with Selected Medical Conditions

Persons with hemophilia who received clotting factor concentrates produced before 1987 and long-term hemodialysis patients should be tested for HCV infection. Educational efforts directed to health-care professionals, patient organizations, and agencies who care for these patients should emphasize the need for these patients to know whether they are infected with HCV and encourage testing for those who have not been tested previously. Periodic testing of long-term hemodialysis patients for purposes of infection control is currently not recommended (*61*). However, issues surrounding prevention of HCV and other bloodborne pathogen transmission in long-term hemodialysis settings are currently undergoing discussion, and updating recommendations for this setting is under development.

Persons with persistently abnormal ALT levels are often identified in medical settings. As part of their medical work-up, health-care professionals should test routinely for HCV infection persons with ALT levels above the upper limit of normal on at least two occasions. Persons with other evidence of liver disease identified by abnormal serum aspartate aminotransferase (AST) levels, which is common among persons with alcohol-related liver disease, should be tested also.

Prior Recipients of Blood Transfusions or Organ Transplants

Persons who might have become infected with HCV through transfusion of blood and blood components should be notified. Two types of approaches should be used — a) a targeted, or directed, approach to identify prior transfusion recipients from donors who tested anti-HCV positive after multiantigen screening tests were widely implemented (July 1992 and later); and b) a general approach to identify all persons who received transfusions before July 1992. A targeted notification approach focuses on a specific group known to be at risk, and will reach persons who might be unaware they were transfused. However, because blood and blood-component donor testing for anti-HCV before July 1992 did not include confirmatory testing, most of these notifications would be based on donors who were not infected with HCV because their test results were falsely positive. A general education campaign to identify persons transfused before July 1992 has the advantage of not being dependent on donor testing status or availability of records, and potentially reaches persons who received HCV-infected blood from donors who tested falsely negative on the less sensitive serologic test, as well as from donors before testing was available.

- **Persons who received blood from a donor who tested positive for HCV infection after multiantigen screening tests were widely implemented.** Persons who received blood or blood components from donors who subsequently tested positive for anti-HCV using a licensed multiantigen assay should be notified as provided for in guidance issued by FDA. For specific details regarding this notification, readers should refer to the FDA document, *Guidance for Industry. Current Good Manufacturing Practice for Blood and Blood Components: (1) Quarantine and Disposition of Units from Prior Collections from Donors with Repeatedly Reactive Screening Tests for Antibody to Hepatitis C Virus (Anti-HCV); (2) Supplemental Testing, and the Notification of Consignees and Blood Recipients of Donor Test Results for Anti-HCV.* (This document is available on the Internet at <http://www.fda.gov/cber/gdlns/gmphcv.txt>.)

Blood-collection establishments and transfusion services should work with local and state health agencies to coordinate this notification effort. Health-care professionals should have information regarding the notification process and HCV infection so that they are prepared to discuss with their patients why they were notified and to provide appropriate counseling, testing, and medical evaluation. Health-education material sent to recipients should be easy to understand and include information concerning where they can be tested, what hepatitis C means in terms of their day-to-day living, and where they can obtain more information.

- **Persons who received a transfusion of blood or blood components (including platelets, red cells, washed cells, and fresh frozen plasma) or a solid-organ transplant (e.g., heart, lung, kidney, or liver) before July 1992.** Patients with a history of blood transfusion or solid-organ transplantation before July 1992 should be counseled, tested, and evaluated for HCV infection. Health-care professionals in primary-care and other appropriate settings routinely should ascertain their patients' transfusion and transplant histories either through questioning their patients, including such risk factors for transfusion as hematologic disorders, major surgery, trauma, or premature birth, or through review of their medical records. In addition, transfusion services, public health agencies, and professional organizations should provide to the public, information concerning the need for HCV testing in this population. Health-care professionals should be prepared to discuss these issues with their patients and provide appropriate counseling, testing, and medical evaluation.

Health-Care, Emergency Medical, and Public Safety Workers After Needle Sticks, Sharps, or Mucosal Exposures to HCV-Positive Blood

Individual institutions should establish policies and procedures for HCV testing of persons after percutaneous or permucosal exposures to blood and ensure that all personnel are familiar with these policies and procedures (see text box on next page) (*141*). Health-care professionals who provide care to persons exposed to HCV in the occupational setting should be knowledgeable regarding the risk for HCV infection and appropriate counseling, testing, and medical follow-up.

IG and antiviral agents are not recommended for postexposure prophylaxis of hepatitis C. Limited data indicate that antiviral therapy might be beneficial when started early in the course of HCV infection, but no guidelines exist for administration of therapy during the acute phase of infection. When HCV infection is identified early, the individual should be referred for medical management to a specialist knowledgeable in this area.

Children Born to HCV-Positive Women

Because of their recognized exposure, children born to HCV-positive women should be tested for HCV infection (*158*). IG and antiviral agents are not recommended for postexposure prophylaxis of infants born to HCV-positive women. Testing of infants for anti-HCV should be performed no sooner than age 12 months, when passively transferred maternal anti-HCV declines below detectable levels. If earlier diagnosis of HCV infection is desired, RT-PCR for HCV RNA may be performed at or after the infant's first well-child visit at age 1–2 months. Umbilical cord blood should not be

Postexposure follow-up of health-care, emergency medical, and public safety workers for hepatitis C virus (HCV) infection

- For the source, baseline testing for anti-HCV.*
- For the person exposed to an HCV-positive source, baseline and follow-up testing including
  - baseline testing for anti-HCV and ALT† activity; and
  - follow-up testing for anti-HCV (e.g., at 4–6 months) and ALT activity. (If earlier diagnosis of HCV infection is desired, testing for HCV RNA§ may be performed at 4–6 weeks.)
- Confirmation by supplemental anti-HCV testing of all anti-HCV results reported as positive by enzyme immunoassay.

* Antibody to HCV.
† Alanine aminotransferase.
§ Ribonucleic acid.

used for diagnosis of perinatal HCV infection because cord blood can be contaminated by maternal blood. If positive for either anti-HCV or HCV RNA, children should be evaluated for the presence or development of liver disease, and those children with persistently elevated ALT levels should be referred to a specialist for medical management.

Persons for Whom Routine HCV Testing Is Not Recommended

For the following persons, routine testing for HCV infection is not recommended unless they have risk factors for infection.

Persons for whom routine hepatitis C virus (HCV) testing is not recommended

- Health-care, emergency medical, and public safety workers.
- Pregnant women.
- Household (nonsexual) contacts of HCV-positive persons.
- The general population.

Health-Care, Emergency Medical, and Public Safety Workers

Routine testing is recommended only for follow-up for a specific exposure.

Pregnant Women

Health-care professionals in settings where pregnant women are evaluated or receive routine care should take risk histories from their patients designed to determine the need for testing and other prevention measures, and those health-care professionals should be knowledgeable regarding HCV counseling, testing, and medical follow-up.

Household (Nonsexual) Contacts of HCV-Positive Persons

Routine testing for nonsexual household contacts of HCV-positive persons is not recommended unless a history exists of a direct (percutaneous or mucosal) exposure to blood.

Persons for Whom Routine HCV Testing Is of Uncertain Need

For persons at potential (or unknown) risk for HCV infection, the need for, or effectiveness of, routine testing has not been determined.

Persons for whom routine hepatitis C virus (HCV) testing is of uncertain need

- Recipients of transplanted tissue (e.g., corneal, musculoskeletal, skin, ova, sperm).
- Intranasal cocaine and other noninjecting illegal drug users.
- Persons with a history of tattooing or body piercing.
- Persons with a history of multiple sex partners or sexually transmitted diseases.
- Long-term steady sex partners of HCV-positive persons.

Recipients of Transplanted Tissue

On the basis of currently available data, risk for HCV transmission from transplanted tissue (e.g., corneal, musculoskeletal, skin, ova, or sperm) appears to be rare.

Intranasal Cocaine and Other Noninjecting Illegal Drug Users

Currently, the strength of the association between intranasal cocaine use and HCV infection does not support routine testing based solely on this risk factor.

Persons with a History of Tattooing or Body Piercing

Because no data exist in the United States documenting that persons with a history of such exposures as tattooing and body piercing are at increased risk for HCV infection, routine testing is not recommended based on these exposures alone. In settings having a high proportion of HCV-infected persons and where tattooing and body piercing might be performed in an unregulated manner (e.g., correctional institutions), these types of exposures might be a risk factor for HCV infection. Data are needed to determine the risk for HCV infection among persons who have been exposed under these conditions.

Persons with a History of Multiple Sex Partners or STDs

Although persons with a history of multiple sex partners or treatment for STDs and who deny injecting-drug use appear to have an increased risk for HCV infection, insufficient data exist to recommend routine testing based on these histories alone. Health-care professionals who provide services to persons with STDs should use that

opportunity to take complete risk histories from their patients to ascertain the need for HCV testing, provide risk-reduction counseling, offer hepatitis B vaccination, and, if appropriate, hepatitis A vaccination.

Long-Term Steady Sex Partners of HCV-Positive Persons

HCV-positive persons with long-term steady partners do not need to change their sexual practices. Persons with HCV infection should discuss with their partner the need for counseling and testing. If the partner chooses to be tested and tests negative, the couple should be informed of available data regarding risk for HCV transmission by sexual activity to assist them in making decisions about precautions (see section regarding counseling messages for HCV-positive persons). If the partner tests positive, appropriate counseling and evaluation for the presence or development of liver disease should be provided.

Testing for HCV Infection

Consent for testing should be obtained in a manner consistent with that for other medical care and services provided in the same setting, and should include measures to prevent unwanted disclosure of test results to others. Persons should be provided with information regarding

- exposures associated with the transmission of HCV, including behaviors or exposures that might have occurred infrequently or many years ago;
- the test procedures and the meaning of test results;
- the nature of hepatitis C and chronic liver disease;
- the benefits of detecting infection early;
- available medical treatment; and
- potential adverse consequences of testing positive, including disrupted personal relationships and possible discriminatory action (e.g., loss of employment, insurance, and educational opportunities).

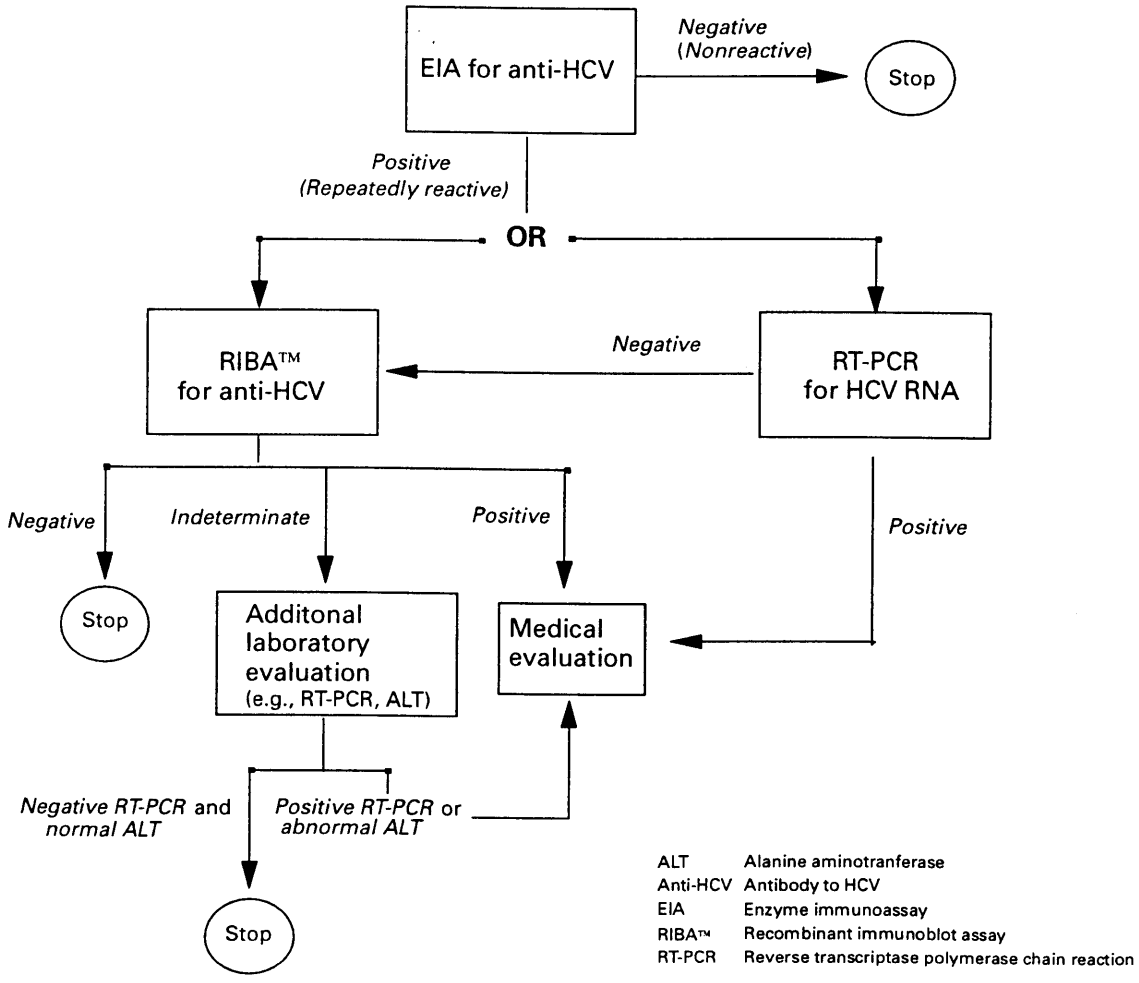
Comprehensive information regarding hepatitis C should be provided before testing; however, this might not be practical when HCV testing is performed as part of a clinical work-up or when testing for anti-HCV is required. In these cases, persons should be informed that a) testing for HCV infection will be performed, b) individual results will be kept confidential, and c) appropriate counseling and referral will be offered if results are positive.

Testing for HCV infection can be performed in various settings, including physicians' offices, other health-care facilities, health department clinics, and HIV or other freestanding counseling and testing sites. Such settings should be prepared to provide appropriate information regarding hepatitis C and provide or offer referral for additional medical care or other needed services (e.g., drug treatment), as warranted. Facilities providing HCV testing should have access to information regarding referral resources, including availability, accessibility, and eligibility criteria of local medical care and mental health professionals, support groups, and drug-treatment centers.

The diagnosis of HCV infection can be made by detecting either anti-HCV or HCV RNA. Anti-HCV is recommended for routine testing of asymptomatic persons, and should include use of both EIA to test for anti-HCV and supplemental or confirmatory testing with an additional, more specific assay (Figure 3). Use of supplemental antibody testing (i.e., RIBA™) for all positive anti-HCV results by EIA is preferred, particularly in settings where clinical services are not provided directly.

Supplemental anti-HCV testing confirms the presence of anti-HCV (i.e., eliminates false-positive antibody results), which indicates past or current infection, and can be performed on the same serum sample collected for the EIA (i.e., routine serology). Confirmation or exclusion of HCV infection in a person with indeterminate anti-HCV supplemental test results should be made on the basis of further laboratory testing, which might include repeating the anti-HCV in two or more months or testing for HCV RNA and ALT level.

FIGURE 3. Hepatitis C virus (HCV)-infection–testing algorithm for asymptomatic persons



In clinical settings, use of RT-PCR to detect HCV RNA might be appropriate to confirm the diagnosis of HCV infection (e.g., in patients with abnormal ALT levels or with indeterminate supplemental anti-HCV test results) although RT-PCR assays are not currently FDA-approved. Detection of HCV RNA by RT-PCR in a person with an anti-HCV–positive result indicates current infection. However, absence of HCV RNA in a person with an anti-HCV–positive result based on EIA testing alone (i.e., without supplemental anti-HCV testing) cannot differentiate between resolved infection and a false-positive anti-HCV test result. In addition, because some persons with HCV infection might experience intermittent viremia, the meaning of a single negative HCV RNA result is difficult to interpret, particularly in the absence of additional clinical information. If HCV RNA is used to confirm anti-HCV results, a separate serum sample will need to be collected and handled in a manner suitable for RT-PCR. If the HCV RNA result is negative, supplemental anti-HCV testing should be performed so that the anti-HCV EIA result can be interpreted before the result is reported to the patient.

Laboratories that perform HCV testing should follow the recommended anti-HCV testing algorithm, which includes use of supplemental testing. Having assurances that the HCV testing is performed in accredited laboratories whose services adhere to recognized standards of good laboratory practice is also necessary. Laboratories that perform HCV RNA testing should review routinely their data regarding internal and external proficiency testing because of great variability in accuracy of HCV RNA testing.

Prevention Messages and Medical Evaluation

HCV-specific information and prevention messages should be provided to infected persons and individuals at risk by trained personnel in public and private health-care settings. Health-education materials should include a) general information about HCV infection; b) risk factors for infection, transmission, disease progression, and treatment; and c) detailed prevention messages appropriate for the population being tested. Written materials might also include information about community resources available for HCV-positive patients for medical evaluation and social support, as appropriate.

Persons with High-Risk Drug and Sexual Practices

Regardless of test results, persons who use illegal drugs or have high-risk sexual practices or occupations should be provided with information regarding how to reduce their risk for acquiring bloodborne and sexually transmitted infections or of potentially transmitting infectious agents to others (see section regarding primary prevention).

Negative Test Results

If their exposure was in the past, persons who test negative for HCV should be reassured.

Indeterminate Test Results

Persons whose HCV test results are indeterminate should be advised that the result is inconclusive, and they should receive appropriate follow-up testing or referral for further testing (see section regarding testing for HCV infection).

Positive Test Results

Persons who test positive should be provided with information regarding the need for a) preventing further harm to their liver; b) reducing risks for transmitting HCV to others; and c) medical evaluation for chronic liver disease and possible treatment.

- To protect their liver from further harm, HCV-positive persons should be advised to
  - not drink alcohol;
  - not start any new medicines, including over-the-counter and herbal medicines, without checking with their doctor; and
  - get vaccinated against hepatitis A if liver disease is found to be present.
- To reduce the risk for transmission to others, HCV-positive persons should be advised to
  - not donate blood, body organs, other tissue, or semen;
  - not share toothbrushes, dental appliances, razors, or other personal-care articles that might have blood on them; and
  - cover cuts and sores on the skin to keep from spreading infectious blood or secretions.
- HCV-positive persons with one long-term steady sex partner do not need to change their sexual practices. They should
  - discuss the risk, which is low but not absent, with their partner (If they want to lower the limited chance of spreading HCV to their partner, they might decide to use barrier precautions [e.g., latex condoms]); and
  - discuss with their partner the need for counseling and testing.
- HCV-positive women do not need to avoid pregnancy or breastfeeding. Potential, expectant, and new parents should be advised that
  - approximately 5 out of every 100 infants born to HCV-infected women become infected (This occurs at the time of birth, and no treatment exists that can prevent this from happening);
  - infants infected with HCV at the time of birth seem to do very well in the first years of life (More studies are needed to determine if these infants will be affected by the infection as they grow older);
  - no evidence exists that mode of delivery is related to transmission; therefore, determining the need for cesarean delivery versus vaginal delivery should not be made on the basis of HCV infection status;
  - limited data regarding breastfeeding indicate that it does not transmit HCV, although HCV-positive mothers should consider abstaining from breastfeeding if their nipples are cracked or bleeding;

- infants born to HCV-positive women should be tested for HCV infection and if positive, evaluated for the presence or development of chronic liver disease (see section regarding routine testing of children born to HCV-positive women); and
- if an HCV-positive woman has given birth to any children after the woman became infected with HCV, she should consider having the children tested.

- Other counseling messages
  - HCV is not spread by sneezing, hugging, coughing, food or water, sharing eating utensils or drinking glasses, or casual contact.
  - Persons should not be excluded from work, school, play, child-care or other settings on the basis of their HCV infection status.
  - Involvement with a support group might help patients cope with hepatitis C.
- HCV-positive persons should be evaluated (by referral or consultation, if appropriate) for presence or development of chronic liver disease including
  - assessment for biochemical evidence of chronic liver disease;
  - assessment for severity of disease and possible treatment according to current practice guidelines in consultation with, or by referral to, a specialist knowledgeable in this area (see excerpts from NIH Consensus Statement in the following section); and
  - determination of need for hepatitis A vaccination.

NIH Consensus Statement Regarding Management of Hepatitis C (Excerpted)

The NIH "Consensus Statement on Management of Hepatitis C" was based on data available in March 1997 (*133*). Because of advances in the field of antiviral therapy for chronic hepatitis C, standards of practice might change, and readers should consult with specialists knowledgeable in this area.

Persons Recommended for Treatment

Treatment is recommended for patients with chronic hepatitis C who are at greatest risk for progression to cirrhosis, as characterized by

- persistently elevated ALT levels;
- detectable HCV RNA; and
- a liver biopsy indicating either portal or bridging fibrosis or at least moderate degrees of inflammation and necrosis.

Persons for Whom Treatment Is Unclear

Included are

- patients with compensated cirrhosis (without jaundice, ascites, variceal hemorrhage, or encephalopathy);

- patients with persistent ALT elevations, but with less severe histologic changes (i.e., no fibrosis and minimal necroinflammatory changes) (In these patients, progression to cirrhosis is likely to be slow, if at all; therefore, observation and serial measurements of ALT and liver biopsy every 3–5 years is an acceptable alternative to treatment with interferon); and
- patients aged <18 years or >60 years (note that interferon is not approved for patients aged <18 years).

Persons for Whom Treatment Is Not Recommended

Included are

- patients with persistently normal ALT values;
- patients with advanced cirrhosis who might be at risk for decompensation with therapy;
- patients who are currently drinking excessive amounts of alcohol or who are injecting illegal drugs (treatment should be delayed until these behaviors have been discontinued for ≥6 months); and
- persons with major depressive illness, cytopenias, hyperthyroidism, renal transplantation, evidence of autoimmune disease, or who are pregnant.

PUBLIC HEALTH SURVEILLANCE

The objectives of conducting surveillance for hepatitis C are to

- identify new cases and determine disease incidence and trends;
- determine risk factors for infection and disease transmission patterns;
- estimate disease burden; and
- identify infected persons who can be counseled and referred for medical follow-up.

Various surveillance approaches are required to achieve these objectives because of limitations of diagnostic tests for HCV infection, the number of asymptomatic patients with acute and chronic disease, and the long latent period between infection and chronic disease outcome.

Surveillance for Acute Hepatitis C

Surveillance for acute hepatitis C — new, symptomatic infections — provides the information necessary for determining incidence trends, changing patterns of transmission and persons at highest risk for infection. In addition, surveillance for new cases provides the best means to evaluate effectiveness of prevention efforts and to identify missed opportunities for prevention. Acute hepatitis C is one of the diseases mandated by the Council of State and Territorial Epidemiologists (CSTE) for reporting to CDC's National Notifiable Diseases Surveillance System. However, hepatitis C

reporting has been unreliable to date because most health departments do not have the resources required for case investigations to determine if a laboratory report represents acute infection, chronic infection, repeated testing of a person previously reported, or a false-positive result. Historically, the most reliable national data regarding acute disease incidence and transmission patterns have come from sentinel surveillance (i.e., sentinel counties study of acute viral hepatitis). As hepatitis C prevention and control programs are implemented, federal, state, and local agencies will need to determine the best methods to effectively monitor new disease acquisition.

Laboratory Reports of Anti-HCV–Positive Tests

Although limitations exist for the use of anti-HCV–positive laboratory reports to identify new cases and to monitor trends in disease incidence, they potentially are an important source from which state and local health departments can identify infected persons who need counseling and medical follow-up. Development of registries of persons with anti-HCV–positive laboratory results might facilitate efforts to provide counseling and medical follow-up and these registries could be used to provide local, state, and national estimates of the proportion of persons with HCV infection who have been identified. If such registries are developed, the confidentiality of individual identifying information should be ensured according to applicable laws and regulations.

Serologic Surveys

Serologic surveys at state and local levels can characterize regional and local variations in prevalence of HCV infection, identify populations at high risk, monitor trends, and evaluate prevention programs. Existing laboratory-based reporting of HCV-positive test results cannot provide this information because persons who are tested will not be representative of the population as a whole, and certain populations at high risk might be underrepresented. Thus, data from newly designed or existing serologic surveys will be needed to monitor trends in HCV infection and evaluate prevention programs at state and local levels.

Surveillance for Chronic Liver Disease

Surveillance for HCV-related chronic liver disease can provide information to measure the burden of disease, determine natural history and risk factors, and evaluate the effect of therapeutic and prevention measures on incidence and severity of disease. Until recently, no such surveillance existed, but a newly established sentinel surveillance pilot program for physician-diagnosed chronic liver disease will provide baseline data and a template for a comprehensive sentinel surveillance system for chronic liver disease. As the primary source of data regarding the incidence and natural history of chronic liver disease, this network will be pivotal for monitoring the effects of education, counseling, other prevention programs, and newly developed therapies on the burden of the disease.

FUTURE DIRECTIONS

To prevent chronic HCV infection and its sequelae, prevention of new HCV infections should be the primary objective of public health activities. Achieving this objective will require the integration of HCV prevention and surveillance activities into current public health infrastructure. In addition, several questions concerning the epidemiology of HCV infection remain, and the answers to those questions could change or modify primary prevention activities. These questions primarily concern the magnitude of the risk attributable to sexual transmission of HCV and to illegal noninjecting-drug use.

Identification of the large numbers of persons in the United States with chronic HCV infection is resource-intensive. The most efficient means to achieve this identification is unknown, because the prevention effectiveness of various implementation strategies has not been evaluated. However, widespread programs to identify, counsel, and treat HCV-infected persons, combined with improvements in the efficacy of treatment, are expected to lower the morbidity and mortality from HCV-related chronic liver disease substantially. Monitoring the progress of these activities to determine their effectiveness in achieving a reduction in HCV-related chronic disease is important.

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Enclosure 3

Proposed Hepatitis C Virus (HCV) Antibody Screening Policy

According to the Centers for Disease Control and Prevention (CDC), testing should be offered routinely to persons most likely to be infected with HCV who might require medical management, and testing should be accompanied by appropriate counseling and medical follow-up (*Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease*, Morbidity and Mortality Weekly Reports, October 16, 1998 / Vol. 47 / No. RR-19). In addition, anyone who wishes to know or is concerned regarding their HCV-infection status should be provided the opportunity for counseling, testing, and appropriate follow-up. The determination of which persons are at risk and who to recommend for routine testing is based on various considerations, including a known epidemiologic relationship between a risk factor and acquiring HCV infection, prevalence of risk behavior or characteristic in the population, prevalence of infection among those with a risk behavior or characteristic, and the need for persons with a recognized exposure to be evaluated for infection.

ACTION:

To determine the need for hepatitis C screening, the following statement will be administered and placed in the medical record for all Service personnel 35 years of age or older who separate or retire from military service.

Individuals who answer "yes" and want to be screened for HCV will receive testing for HCV antibody, including appropriate confirmatory testing. An individual does not have to specify a particular risk factor to justify screening.

If positive for HCV infection, the individual will receive appropriate clinical evaluation and treatment and receive counseling on lifestyle modifications and measures to protect others from infection.

Hepatitis C is transmitted primarily by injections of contaminated blood. The following are the possible sources of hepatitis C infection. If you can answer "yes" to any of these risk factors and have not previously been tested for hepatitis C, you should receive a simple blood test to determine if you could have hepatitis C.

- **Receiving a transfusion of blood or blood products before 1992**
- **Ever injecting illegal drugs, including use once or a few times many years ago**
- **Receiving clotting factor concentrates produced before 1987**
- **Having been on chronic (long-term) hemodialysis**
- **Being told that you have persistently abnormal liver enzyme tests (alanine aminotransferase) or an unexplained liver disease**
- **Receiving an organ transplant before July 1992**
- **Having a needlestick, sharps or mucosal exposure to potentially HCV-infected blood as part of your occupational duties**

If you consider yourself at risk based on an exposure to a possible source of hepatitis C virus you should have a simple blood test for hepatitis C virus infection (HCV antibody test). You may request HCV testing even if you don't have a specific risk factor for infection. You will not be asked to identify any specific risk factors to justify HCV testing.

If the test is positive, you will receive a medical evaluation to confirm HCV infection, determine your need for specific treatments, and be provided counseling on lifestyle modifications and steps to protect others from infection.

Circle your response below.

No -- I do not consider myself at risk for hepatitis C
Yes – I wish to be screened in the absence of indicating risk factors
Yes -- I am at risk and want to be tested for hepatitis C

_____ _____

SIGNATURE **DATE**

Additional Information

- Centers for Disease Control and Prevention: Spotlight on Hepatitis
- National Institute of Health: HepNet
- Armed Serivces Blood Program Office's (ASBPO) Hepatitis C Page

News Releases

- Hepatitis C: What You Need to Know About the Silent Epidemic
- Hepatitis C Virus May Lurk Within Certain Blood Recipients

Hepatitis C

Health Watch

Hepatitis C infects one or two out of every 100 persons in the general U.S. civilian population. The rate is lower among military members on active duty, but it is important to consider whether you or your family may have a risk factor for hepatitis C. You may have become infected with the virus if you received a transfusion of blood or other blood products before 1992, ever injected drugs, ever used nasal cocaine, or had a needlestick injury while working in health care. It may be possible to get hepatitis C through sexual contact. The risk is very low for persons in mutually monogamous relationships, but if you have had multiple sexual partners, you may be at higher risk. If you think you or a family member may be at risk, contact your physician or public health representative and discuss having a simple blood test for hepatitis C. Hepatitis C may damage the liver; persons with hepatitis C need a medical evaluation and may need treatment.

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Last update: 2/26/1999

THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D. C. 20301-1200

HEALTH AFFAIRS

JUN 29 1998

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (M&RA)
ASSISTANT SECRETARY OF THE NAVY (M&RA)
ASSISTANT SECRETARY OF THE AIR FORCE (MRAI&E)

SUBJECT: Department of Health and Human Services (DHHS) Advisory Committee on Blood Safety and Availability Recommendations for Hepatitis C Virus (HCV) Blood Donor Lookback and Recipient Notification

In a public meeting August 11-12, 1997, the DHHS Advisory Committee on Blood Safety and Availability recommended that individuals transfused prior to 1992 be tested for HCV due to the significant but often asymptotic nature of the infection. The DHHS Advisory Committee also recommended targeted lookback of blood donors, either HCV repeatedly reactive without confirmation or confirmed HCV positive, to include recipient notification. On March 23, 1998, the Food and Drug Administration (FDA) issued GUIDANCE FOR INDUSTRY: SUPPLEMENTAL TESTING AND THE NOTIFICATION OF CONSIGNEES OF DONOR TEST RESULTS FOR ANTIBODY TO HEPATITIS C VIRUS (ANTI-HCV) which outlines requirements for HCV lookback. In addition to the FDA's guidance, the Department of Defense will be more inclusive and perform donor HCV lookbacks on all HCV V1.0 repeatedly reactive donors which do not have a subsequent negative supplemental test.

The Services shall implement the Armed Services Blood Program Office (ASBPO) Blood Program Letter (BPL) 98-03 dealing with HCV donor and recipient lookback; recipient notification, testing; and, if necessary, HCV counseling. Identification of transfusion recipients may be through several mechanisms including review of medical records by current providers, self-identification by the patients, and recipient notification through implication of donor lookback results.

Medical services are available for any individual identified as HCV positive if the mode of Hepatitis C transmission appears to be the result of a transfusion in a DoD medical treatment facility (MTF). HCV positive individuals who are no longer DoD healthcare beneficiaries but were beneficiaries at the time the transfusion occurred must be offered testing and initial counseling in an MTF. Additional care for complications relevant to the HCV infection will be provided through the Department of Veteran Affairs (DVA) or, for those for whom DVA care is unavailable, from DoD under Secretarial Designee authority. Donors implicated in a recipient HCV lookback who are not beneficiaries but who donated to the Armed Services Blood Program must be offered testing to ensure closure of the lookback case. If the non-beneficiary donor tests HCV positive, the donor must be advised to seek his/her own counseling and treatment.

The ASBPO is a Tri-Service organization which will oversee implementation of this memorandum so that uniform guidance among the Services, VA, and Reserve Affairs can be provided. Major L. Groshel, USAF, BSC, Deputy Director, Armed Services Blood Program Office, is the ASBPO point of contact at 703-681-8011/8024.

Dr. Sue Bailey

cc:
Surgeon General of the Army
Surgeon General of the Navy
Surgeon General of the Air Force