

A Comparison of a Web based Intelligent Decision Support System for Early Diagnosis of Hepatitis and a Manual System

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ABSTRACT

The liver is a very important organ in the human body; it helps in processing nutrient, filtration of the blood and also helps in fighting infections. If the liver is damaged, it can lead to serious health challenge, such as hepatitis virus. Hepatitis infections are major causes of disease death globally; there is need for a system that can detect the infection early, due to the challenging nature of this disease. In this paper, we shall discuss the different classes of hepatitis, causes, and preventive measures. We also discussed a centralized (web-based) diagnostic decision support system for early detection of the disease and do a comparison of a manual system and the web based decision support system, with a view in bringing out the benefit of the web based over the manual method. The centralized system was developed using PHP as front-end with MYSQL as the back-end.

Keywords

Web base, decision support, infection, detection

1. INTRODUCTION

In the work of Iezzi *et al.*, (2017) [5], hepatitis is an inflammation of the liver. This may be caused by drugs, alcohol use, or certain medical conditions. However, in most cases it is caused by a virus. This is known as viral hepatitis. The condition of hepatitis can be self-limiting or it can cause fibrosis i.e., scarring, cirrhosis or liver cancer. Hepatitis is the most common type of disease that occurs in the world. Along with the virus, other infection and toxic substances such as alcohol, certain drugs, and auto-immune disease can also cause hepatitis. Autoimmune hepatitis is a disease that occurs when the body produces antibodies against the liver tissues.

According to the Centers for Disease Control and Prevention (CDC 2017) [2], approximately 4.4 million Americans are currently living with chronic hepatitis B and C.

Treatment options vary depending on which type of hepatitis, and prevention of some classes of hepatitis through immunizations and lifestyle precautions.

Hepatitis Virus, is a major public health problem world wide, it is more prevalent in developing countries. Over 2 billion people are infested with HBV world-wide, while about 280 million are chronic carriers, sheltering the virus in their liver.

2. LITERATURE REVIEW

The challenges involve in the detection of hepatitis virus is vital in the medical science research for the past thirty years. In this paper, we intend to exploit the detailed survey for the improvement of hepatitis detection in the medical sector. Application of computer based detection of hepatitis contains

several process such as, determination of most significant features, attributes filtering, training the neural network, detecting the accuracy level and finally classifying the hepatitis virus and so on. This section briefly gives the description of the survey made in the literature.

3. HISTORY OF HEPATITIS

Hepatitis is an inflammation of the liver which can result from a range of causes, both infectious and noninfectious. Infective agents that cause hepatitis include viruses and parasites. Noninfectious sources include certain drugs and poisonous agents. In certain occurrences, hepatitis can also result from an autoimmune reaction directed against the liver cells of the body.

4. DIFFERENT CLASSES OF HEPATITIS AND THEIR VIRAL CAUSES

The main causes of hepatitis are as a result of viral infection. These viruses give rise to liver infection which include cytomegalovirus, yellow-fever virus, Epstein-Barr virus, herpes simplex viruses, measles, mumps, and chickenpox viruses; and a number of hepatitis viruses. Viral hepatitis, applies only to those cases of liver disease, which are caused by the hepatitis viruses, (Jordan *et al.*, 2017) [6].

Hepatitis viruses are of seven types, they are categorized as A, B, C, D, E, F, and G. Hepatitis A, E, and F viruses can be spread through ingestion of polluted food or water (called the fecal-oral path); the spread of these causative agents are further worsened by congested environments and poor sanitation. The B, C, D, and G viruses are spread mainly by blood or bodily fluids; sexual contact or exposure to contaminated blood are also common means of spread, (Jordan *et al.*, 2017) [6].

3.1 Hepatitis A

Hepatitis A is the most common viral infections, globally. Some patients may recover within two months; the disease can produce significant morbidity; it can be greatly prevented with suitable immunization approaches. Hepatitis A virus (HAV) is an enveloped RNA agent classified as a picornavirus that can produce symptomatic or asymptomatic infection in humans. It is the major cause of nearly one-half of all the reported cases of viral hepatitis in the United States, although the prevalence of HAV infections has declined by 92 percent since the introduction of a vaccine, (Jordan *et al.*, 2017) [6].

It was projected in 2009, that more than 21,000 cases of hepatitis A occurred in the United States, and 1.4 million cases occurred worldwide, (Jordan *et al.*, 2017) [6].

3.2 Hepatitis B

Hepatitis B is more severe and lasting longer, compared to hepatitis A. It can materialize as a serious disease, or, approximately 5 to 10 percent of cases, the infection may become chronic, which can lead to perpetual liver damage. The Signs generally appear from 40 days to 6 months after contact with the hepatitis B virus (HBV). People at greater risk at contracting hepatitis B, includes intravenous drug consumers, sexual partners of individuals with the disease, health care givers who are not adequately inoculated, and receivers of organ transplants or blood transfusions. HBV and HDV transmission are due to the presence of the virus in biological fluids (blood, semen, and vaginal secretions) of the infected individual, (Nelson *et al.*, 2016) [8].

3.3 Hepatitis C

Louie *et al.*, (2012) [7], Hepatitis C virus is a major causes of viral hepatitis, and different studies have shown that there is strong connection between hepatitis C infection and various other infections, co-morbidities, and increased death rates.

Ahmed *et al.*, (2013) [1], reported in a study on the genotypes of 630 hepatitis C infected patients revealed that genotype 4 was confirmed in the majority of these patients (60.8%). This finding confirms previous reports where genotype 4 is a landmark of the infected cases of HCV in Saudi Arabia. Roughly 60 to 80 percent of chronic contaminations advance to chronic liver disease, such as cirrhosis or liver cancer. Alcoholics who are diseased with hepatitis C are more likely to develop cirrhosis.

3.4 Hepatitis D

Hepatitis D Virus (HDV) infection, which is also referred to as delta agent, may occur merely in relation with HBV contamination, since HDV needs HBV to reproduce. Contamination with HDV may happen at the same time of infection with which HBV occurs, or HDV may contaminate a person previously infested with HBV. The latter condition seems to increase to a further severe situation, leading to cirrhosis or chronic liver disease. Alpha interferon is the only treatment for HDV infection. HBV and HDV transmission are due to the presence of the virus in biological fluids (blood, semen, and vaginal secretions) of the infected individual (Nelson *et al.*, 2016) [8].

Hepatitis viruses are responsible for 96% of the 1.34 million deaths related to cirrhosis and liver cancer (WHO, 2017) [12].

3.5 Causes of Hepatitis

The major cases of chronic hepatitis are caused by the hepatitis viruses B, C, and D, but some other factors such as alcoholism, reaction to certain medications, and autoimmune reactions may lead to the development of this ailment. Chronic hepatitis can likewise be connected with certain illnesses, such as Wilson disease and alpha-1-antitrypsin deficiency. Chronic hepatitis B mainly affects males, while chronic hepatitis C arises in equal numbers in both sexes. Autoimmune hepatitis, an ailment connected with the malfunction of the immune system, it usually happens in young women. Treatment for autoimmune hepatitis includes corticosteroids; this can help to reduce the symptoms (Jordan *et al.*, 2017 [6]; Hoofnagle *et al.* 2012, [4];

3.6 Causes of Hepatitis B

Hepatitis B is inflammation of the liver caused by a virus. Globally, there are over 400 million chronic carriers of hepatitis B. Of the 200,000 people who contract hepatitis B each year in the U.S., 10 to 15,000 go on to develop a chronic form of the disease. Men are six times more likely than women to become

chronic carriers of the hepatitis B virus (HBV), but the reasons for this are unclear.

3.7 Mode of Transmission

Hepatitis B is transmitted through contaminated bodily fluids like: Blood, Sweat, Tears, Saliva, Semen, Vaginal secretions, Menstrual blood, Breast milk, or other body fluids infected with the virus enters the body of a person who is not infected. Chronically-infected people can spread Hepatitis B virus to others, even if they do not feel or look sick themselves. The Hepatitis B virus is passed easily through breaks in the skin or in soft tissues such as the nose, mouth, and eyes. People can become infected during activities such as:

- a. Birth (spread from an infected mother to her baby during birth)
- b. Sex with an infected partner
- c. Sharing needles, syringes, or other drug-injection equipment
- d. Sharing items such as razors or toothbrushes with an infected person
- e. Direct contact with the blood or open sores of an infected person
- f. Exposure to blood from needle sticks or other sharp instruments

Hepatitis B virus can survive outside of the body on objects for at least 7 days. During that time, the virus can still cause infection if it enters the body of a person who is not infected.

Hepatitis B virus is not spread through food or water, sharing eating utensils, breastfeeding, hugging, kissing, hand holding, coughing, or sneezing.

3.8 Signs and Symptoms

The signs and symptoms of acute viral hepatitis result from damage to the liver and are similar regardless of the hepatitis virus responsible. Patients may experience a flulike illness, and general symptoms include nausea, vomiting, abdominal pain, fever, fatigue, loss of appetite, and, less commonly, rash and joint pain. Sometimes jaundice, a yellowing of the skin and eyes, will develop. The acute symptomatic phase of viral hepatitis usually lasts from a few days to several weeks; the period of jaundice that may follow can persist from one to three weeks. Another complication is chronic hepatitis, which is characterized by liver cell death and inflammation over a period greater than six months, (CDCP, 2012) [2].

Majority of older children and adults (70%) develop symptoms from acute Hepatitis B infection, many young children below the age of 5 years do not. If symptoms occur, they can include: fever, feeling tired, and loss of appetite, nausea, vomiting, abdominal pain, dark urine, clay-colored bowel movements, and joint pain, jaundice (yellow color in the skin or the eyes).

On average, symptoms appear 3 months after exposure, but they can appear any time between 6 weeks and 6 months after exposure. Symptoms usually last a few weeks, but some people can be ill for as long as 6 months. While some people have ongoing symptoms similar to acute Hepatitis B, most individuals with chronic Hepatitis B remain symptom free for as long as 20 to 30 years, liver damage from the disease can take place during this time.

3.9 Acute Hepatitis B

In its severe form, hepatitis B symptoms can make the person feel extremely ill. Others may believe they have the flu while some may experience no symptoms at all.

Symptoms include jaundice, fever, abdominal pain, poor appetite, nausea, vomiting, fatigue, dark colored urine, light colored stools, muscle and joint pain, and rash. The liver may also be enlarged and tender.

Fulminant hepatitis is a severe but very rare form of acute hepatitis. It may begin with fatigue and nausea, but, within a few weeks, the signs and symptoms become pronounced. About two weeks after jaundice develops, encephalopathy develops.

3.10 Chronic Hepatitis B

Signs and symptoms can vary in persons; most people are unaware of the presence of the ailment, some signs of chronic hepatitis B include mild or restless fatigue, jaundice, and an enlarged liver. Unfortunately, if chronic hepatitis is not cleared by the body or is not successfully treated and cured, liver disease or liver failure may result, (Takkenberg et al. 2010) [11].

3.11 Testing for HBV Infection

To diagnose hepatitis, first your doctor will take the patients history to determine any risk factors you may have for infectious or noninfectious hepatitis. During a physical examination, the doctor may press down gently on the abdomen of the patient to see if there's pain or tenderness. The doctor may also feel to see if the liver is enlarged. If the skin or eyes are yellow, the doctor will note this during the examination, (Supram et al. 2015) [10].

3.12 Precautions to Avoid HBV

Other ways to reduce your risk of HBV include:

- i. Know the HBV status of any sexual partner. Don't engage in unprotected sex unless you're absolutely certain your partner isn't infected with HBV or any other sexually transmitted infection.
- ii. Use a new latex or polyurethane condom every time you have sex, if you don't know the health status of your partner. Remember that although condoms can reduce your risk of contracting HBV, they don't eliminate the risk.
- iii. Don't use illegal drugs. If you use illicit drugs, get help to stop. If you can't stop, use a sterile needle each time you inject illicit drugs. Never share needles.
- iv. Be cautious about body piercing and tattooing. If you get a piercing or tattoo, look for a reputable shop. Ask about how the equipment is cleaned. Make sure the employees use sterile needles. If you can't get answers, look for another shop.
- v. Ask about the hepatitis B vaccine before you travel. If you're traveling to a region where hepatitis B is common, ask your doctor about the hepatitis B vaccine in advance. It's usually given in a series of three injections over a six-month period.

3.13 Benefits of the Web-based System

The system we proposed, is a centralized (web-based) pre-diagnostic decision support system that will help in prompt diagnosis of the classes of Hepatitis (A, B, C, D and E) some of the advantages are as follows:

- a. It ensures that Hepatitis is detected at an early stage and treatment can be effected early, this will help in reducing mortality.
- b. The system will also help individuals to do pre-diagnosis on their own before going for laboratory test, as it provides a scale of tolerable, and if exceeded, there is likelihood of hepatitis disease.
- c. The system can be used at anytime and anywhere for users both in rural and urban areas.
- d. The system is user friendly and easy to use
- e. The system is cost effective; it can be easily downloaded from the internet.

4. ARCHITECTURAL DIAGRAM OF THE WEB-BASED SYSTEM

It gives a high level view of the new system with the main components of the system and the services they provide and how they communicate. The system is implemented using a three architecture that comprises of user interface, process management and DBMS.

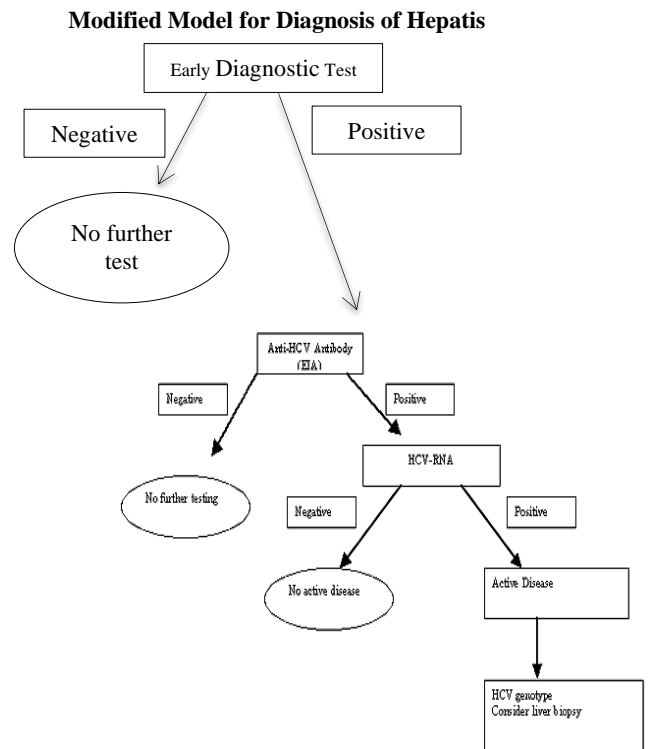


Fig. 1 Architecture of the Proposed System

4.1 System Design

System design contains Logical Design and Physical designing; logical designing describes the structure and characteristics, like output, input, files, database and procedures. The physical design, which follows the logical design, actual software and working system, constraints like Hardware, Software, Cost, Time, and Interfaces. The algorithm of our system design, we adopted Peng et al. algorithm, (2011).

The tools which are employed in the methodology stage were majorly tables, Data Flow Diagram (DFDs) and Entity Relationship Diagram (ERDs). The design allows only authorized users to access the system's information. System analysis is the process of analyzing a system with a view of

bringing out problems in the existing system and proffering an alternative solution, most usually a computerized system. In this research project, most existing decision support system lack centralized process of pretest (early-diagnostic) to addressing the different classes of hepatitis virus (A, B, C, D and E)

5. CONCLUSION AND DISCUSSION

This paper discusses the benefit of a web-based decision support system over the manual system, it is a pre-diagnostic diagnostic system for early detection of the different classes of Hepatitis (A, B, C, D and E), unlike the manual process, where the patient has to see a medical personnel, then carryout a blood test to know the patients state. But in the web based system, the patient can on his/her own do a pre-test, by inputting in the system the signs and if the level trench-hood level permissible is exceeded, then the patient is advice to see a health care giver. In this case, the disease can be drastically controlled without doing much damage to infected people; this will as a result, reduces the endemic nature of the disease

In this paper, we discuss the different classes of hepatitis, causes, preventive measures and ways to avoid this disease. The proposed system embodies a permissible threshold limit that serves as a warning signal, if this threshold limit is exceeded, and then adequate attention should be given to such patient. If the decision and policy makers approve the utilization of this system, the prevalent rate of the disease will be curtailed, thereby reducing the induced burden of death as a result of the disease.

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