Omid Mirzaei

DIAGNOSIS CHRONIC HEPATITIS B USING EXPERT SYSTEM

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ATHESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCE

OF

NEAR EAST UNIVERSITY

By

Omid Mirzaei

In Partial Fulfillment of the Requirements for

the Degree of Master of Science

in

Biomedical Engineering

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Approval of Director of Graduate School of

Applied Science

Prof. Dr. Nadire CAVUS

We certify this thesis is satisfactory for the award of the degree of Master of Science in Biomedical Engineering

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that I have fully cited and referenced all material and results that are not original to this work, as required by these rules and conduct.

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To My Parents…

ABSTRACT

Now a day, computer and programming helps the human to improve the health system. This can be done in two main ways, first the accuracy of programs helps to avoid the human's mistake and second by quick calculations we save times. The main proposes of this thesis is introducing the new program that can show the stage of the special type of hepatitis for the patients that is diagnosed for this disease. Actually, several programs were introduced before but this program is more accurate and friendly. This program is based on the Hepatitis B patients who has not any background about medical or programming.

In fact, this program take the simple medical reports as HBsAg, HBeAg, ALT,HBV DNA, fibrosis results and by analyzing these data shows the stage of chronic hepatitis type B. Actually, the specialist can do the same by analyzing these data, but this program make the access of patients to them easier and do this procedure quicker. The investigated that leads to this program is the special branch of Expert system, called VP expert system. The method of this system were used before to investigate another diseases. We examined 20 patients that were collected randomly at Turkey and this VP expert System is applied. The reports for these patients after 6 months of diagnosing were studied and we found the accuracy of VP expert system as 95%.

Keywords: Expert system; artificial intelligent; VP Expert; chronicHepatitis B; chronichepatitis B diagnosis system

ÖZET

Bugünlerde, bilgisayar ve programlama insanlara sağlık sistemi geliştirme konusunda yardım etmektedir. Bu iki farklı yoldan yapılabilir. Birincisi, programların güvenilirliği insan hatalarını önlemeye yardımcı olur., ve ikinci olarak hızlı hesaplamalarla zaman kazanıyoruz. Bu tezin genel amacı Hepatit tanısı konan hastalara hastalığın basamaklarını gösteren programı sunmaktır. Aslında, önceden bir çok program tanıtılmasına rağmen bu program daha arkadaş canlısı ve güvenilirdir.

Bu programın temeli programlarla ilgili bilgi sahibi olmayan Hepatit B hastalarına yardımcı olmaya yöneliktir. Gerçekte, bu program, HbsAg, HbeAg, ALT, HBV DNA, fibrosis sonuçlarını analiz ederek kronik Hepatit B sürecini gösterir. Uzman aynı analizi, aynı verilere bakarak yapabilir fakat, bu program hastaların erişimini kolaylaştırıp prosedürü hızlandırmaktadır. Araştırmaların sonucu olarak karşımıza çıkan bu program Uzman sistemin bir dalı olarak karşımıza çıkmaktadır ve VP uzman sistemi olarak adlandırılır. Bu sistemin metodu daha önce başka hastalıkları araştırmakta kullanılmıştır. Türkiyede rastgele seçilmiş 20 hastayı inceledik. Çıkarılan raporlara göre tanıdan altı ay sonra incelenen bu hastalar VP uzamn sisteminin 95% güvenilir olduğunu ortaya çıkarmıştır.

Anahtar Kelimeler:Uzman sistem; yapay zeka; VP uzman; Kronik Hepatit; Kronik Hepatit B tanı sistem

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LIST OF ABBREVIATION

AI:	Artificial Intelligence
AGI:	Artificial General Intelligence
ANI:	Artificial Narrow Intelligence
ASI:	Artificial Super Intelligence
KB:	Knowledge Base
KBES:	Knowledge Base Expert System
MAI:	Medical Artificial Intelligence
WHO:	World Health Organization
HBV:	Hepatitis B virus
DNA:	Deoxyribonucleic acid
RNA:	Ribonucleic acid
IS:	Intelligence system
FES:	Fuzzy Expert System
FIS:	Fuzzy Interference System
NN:	Neural Network
AIBESHBD:	Artificial Intelligence Based Expert System for Hepatitis B Diagnosis
NFI:	Neuro- Fuzzy Inference
NNFS:	Neural Network Fuzzy System
NFES:	Neural Fuzzy Expert System
FES:	Fuzzy Expert System
CHBDX:	Diagnosis Chronic Hepatitis B Using Expert System

CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter presents the essential data around Artificial intelligence, Expert system, chronic Hepatitis B and the investigate objective. Segment 1.1 Clarifies the concept of Artificial intelligence in connection to the medical field and Segment 1.2 Briefly clarifies Expert system, its applications and component. In Segment 1.3 Brief definition of chronic Hepatitis B have been examined and the concept of chronic Hepatitis B demography. Segment 1.4 clarifies the issue explanation and Area 1.5 states the investigate objective. Finally, the proposal organization was show in Area 1.6. 1

1.2 Artificial Intelligence (AI)

Artificial Intelligence could be a coordination of planning a computer, a computer program that considers consistently, fair the way shrewdly people think or a computer-controlled mechanization or robot. AI is shining by examining how human being brain reasons, and how people make a decision and work in spite of the fact attempting to reply a risky task, and after that applying the comes about of this examination as a root of creating cleverly computer program and systems. Expert systems are the category of Artificial Intelligence system. The expressed zone of Artificial Intelligence consider is to copy-cat the working of human intellect capacity by computer programs or computers with the capacity to copycat or imitate the assignments of human insights. The region of artificial insights is gigantic in scope and measure. Whereas proceeding, we reflect the to a great extent common and thriving investigate ranges within the zone of Artificial Intelligence which are; Master framework, Neural network, Neural Language preparing and Fuzzy logic (Mishkoff, 1985). AI is utilized in a regular cycle of life. AI is broadly utilized in medicine and the healthcare segment. The most advantages of AI within the world of medication would be talked about briefly. Changing the healthcare segment: with later Utilized of artificial intelligence in medications changes the way healthcare segment collaborates with instruction, businesses, and mechanical. It brings new conceivable outcomes for headway and collaboration. The progressed within the healthcare segment is certain and its benefits ought to be used, scholarly people.

Diminishing mortality rate: Decreasing the period patients spend holding up for consideration from masters, artificial intelligence in medicine reduces the mortality rate and has a hopeful impact on the prevalence of this care. Having such offer assistance, specialists have additional time for advancement. There wasn't have to treat artificial intelligence within the medical field as an exertion to supplant specialists. Supplementary, it's the exertion to help specialists.

Making diagnostics more exact: As medical AI systems have the capacity to memorize from past cases, they offer specialists get to the data around the most recent news in medicine, the healthcare division, and a few ranges of pondering in specific. A human can't combine taking after the most up to date leanings and treating patients at the same time. There wasn't adequate time for that forms but an artificial intelligence System can. That's why it gets to be an imperative collaborator.

Diminishing the reliance on social administrations: Another way to use artificial intelligence in healthcare and medication is to allow robots to require care of a few patients. For occurrence, restorative robots offer assistance Alzheimer's patients move forward the quality of life, decrease the dependence on social administrations, and increment the time an individual may remain at domestic without human restorative help.

Diminishing human errors: With more than 100 patients in a week, specialists discover it extreme to offer everybody with the comparative volume of care. Too, there's a so-called human figure. People likely make botches. Manufactured intelligence in medicine could be a strategy to eradicate blunders related to human tiredness and soothe specialists of a few tedious errands.

Supporting in developments: The impacts expressed over are viable and important. In any case, this advantage is the foremost genuine life. Wellbeing care specialists frequently encounter the have to be move overwhelming things or carry out a few monotonous errands like giving out pills. Robots may be the specified alter. Medication pros may utilize machines as a strategy to outsource these tedious assignments.

Improving obtrusive surgery: Surgical robotics may be a gadget that gives specialists with precision, consolation, and predominant visualization. With the assistance of sorting such robots, specialists get the bolster that abbreviates patients' healing center remain, reduces torment and medical costs.

AI is, for the most part, generally separated into 3 stages: Artificial super intelligence (ASI), Artificial narrow insights (ANI), Artificial general intelligence (AGI) Artificial Super Intelligence: ASI is the ultimate organize of Artificial Intelligence anticipated by the researcher in which the

machines with ASI can able to pass the normal human intelligence. On the off chance that we reach to that point, we are going be able to fix all the puzzles of the universe and can find everything which is unfamiliar right presently.

Artificial Narrow Intelligence: The primary organizes of AI as the title proposes is practically exceptionally contract. It is like child technology that can as it were work in one useful area. ANI is best after you ought to run any mechanized assignment and within the reparative design. It is additionally taken a toll sparing since it could be a onetime speculation and not like contracting any human asset and paying him on the month to month or week after week basis.

Artificial General Intelligence: AGI may as it was be one step encourage from Artificial Narrow Intelligence but this step is the greatest accomplishment of humankind. Mankind has at last built a machine which cannot as it were only as it thought but too can produce his thinking. With AGI, machines can speak to themselves as the human and can do whatever human is competent of doing. AGI is making a difference the organizations and government in problem-solving and unique considering. Be that as it may, it still needs a few more time to create appropriately to that degree where it can be work parallel to human.

1.3 Expert System (ES)

Within the universe of AI, a wise system may be a computer system with the scope to copycat or duplicate the errands of human's intelligence by preparing choices.

Human experts are able to understanding issues at a tall level since they abuse data around their range of capability. This data gave the essential for the plan of programs with expert-based problem-solving aptitudes

A skillful system, is habitually called, employments express information approximately a region in arrange to pick up competence proportionate to that of a human expert. The unequivocal data may be picked up by questioning one or more experts within the region in the address. The range of expert systems is conceivably the sub-area of artificial intelligence that has come to the greatest commercial victory. These days expert systems are utilized in a colossal number of topic zones, extending from medication, chemistry, and geography to law, legislative issues, and financial matters. Any zone in which choices are to be made may be a possible program of expert systems (Mishkoff, 1985).

The phenomena of expert systems are created to tackles troublesome issues by cognitive considering around information, communicated primarily as if-then rules very than through unsurprising procedural code. AI programs that accomplish competency at master level in understanding issues in a few assignment regions by passing on to persevere an outline of information almost particular tasks are named expert systems.

Regularly, the word Expert systems are reserved for a program whose information base has the information which is utilized by human specialists, in comparison to the information obtained by non-expert and course readings. The synonymous utilized the 2 terms, ES and knowledge-based systems (KBS), are utilized regularly. Considering the two terms, ES and KBS speak to the most prominent common sorts of Artificial intelligence application. In an expert system, the range which human mental endeavor to secure is distinguished as the assignment space. Assignment implies a few goal oriented, problem-solving movement and Space implies the precise range in which the errand is being finished.

1.3.1 Application of expert system

A few of the applications of the ES depends on Knowledge Domain which is utilized in Finding out issues in vehicles and computers. It moreover connected in Finance and Commerce for Revelation of conceivable extortion, dicey exchanges, stock advertise exchanging, Carrier planning and cargo plans. Another program could be a Design Domain where the Camera focal point is outlined and the vehicle plan. It too utilized in Monitoring Systems for Equating information persistently with the test system or with endorsed conduct such as outpouring observing in long petroleum pipeline. Another potential application is Medical Domain for Diagnosis Systems to diminish the cause of malady from test information and conduction medical operations on people.

1.3.2 Expert systems in medicine

Medicine continuously looked like a perfect AI application region. Medical Artificial Intelligence (MAI) was characterized as the utilize of AI strategies and computational bolster to reenact the mental forms a doctor applies when treating patients. This explanation allowed computer researchers to consider what was compulsory to secure and mimic the ability of the master.

After the persistent information have collected, the analyzed or analyzed is based on the put away therapeutic associate or information. The truths on signs or side effects, unmistakable actualities of investigate research facility tests are prepared by the strategy of characterized rules to realize the conceivable analyze. Additional information such as the presence or nonattendance of positive signs and indications help in choosing a last analyze.

The method of reasoning for making analyze or theories of analyze is recognized as well as the procedures for other investigations or examinations and for quiet treatment. Essentially, it is appeared once there are bizarre signs, indications or research facility truths. They include the realization of a set of a few questions, individualized to each address and the collection of information that's planning to be obtained replying the questions (Clancey, 1984).

1.4 Hepatitis B

Hepatitis B infection may be a prevalent reason of liver disease and liver cancer. Hepatitis B virus (HBV), a member of the Hepadnaviridae family, could be a small DNA infection with bizarre highlights comparable to retroviruses. HBV imitates through an RNA middle and can coordinate into the have genome. The special highlights of the HBV replication cycle bestow an unmistakable capacity of the infection to endure in infected cells. Virological and serological tests have been created for diagnosis of different shapes of HBV-associated malady and for treatment of unremitting hepatitis B contamination. HBV contamination leads to a wide range of liver infection extending from intense (counting fulminant hepatic disappointment) to unremitting hepatitis, cirrhosis, and hepatocellular carcinoma. Intense HBV disease can be either asymptomatic or show with symptomatic intense hepatitis. Most grown-ups infected with the virus recover, but 5%–10% are incapable to clear the infection and ended up chronically infected. Numerous chronically infected people have mellow liver infection.(Liang, 2009)

1. 4.1 Hepatitis B demography

Hepatitis B may be a possibly life-threatening liver contamination caused by the HBV. It could be a major worldwide health issue. It can cause chronic contamination and puts individuals at a high chance of passing from cirrhosis and liver cancer. A vaccine against hepatitis B has been accessible

since 1982. The vaccine is 95% successful in avoiding disease and the advancement of chronic disease and liver cancer due to hepatitis B.(WHO, 2016).

Around 33% of the population word have hepatitis B infection and between 300and 400 millions of people have Chronic Hepatitis B (Korkmaz et al., 2017)

In the geographical distribution section, it should consider that, Hepatitis B predominance is most elevated within the WHO Western Pacific Locale and the WHO African Locale, where 6.2% and 6.1% individually of the adult population is contaminated. Within the WHO Eastern Mediterranean Locale, the WHO South-East Asia Locale and the WHO European Locale, an evaluated 3.3%, 2.0% and 1.6%% of the common populace is tainted, separately. 0.7% of the populace of the WHO Locale of the Americas is infected (WHO, 2016).

1.5 Statement of problem

According to the global population, hepatitis is increasing. The reason for the HBV,the usual reasons for the transmission of hepatitis B to the body through sexual contact are the use of a common needle for transmission from mother to child, transfusion from blood transfusion, and blood transfusion of a patient with a healthy person, which is very easy and serious transmission routes. The motivation for this thesis is because of theways of transmission is very simple and also it is very dangerous. Similarly, hepatitis B imposes significant financial consequences on individuals, families, healthcare facilities and countries. If the public continues to ignore hepatitis B and its problems, people are suffering from a health problem and an economic problem. Hence, the primary diagnostic system and assessment tool are highly needed to serve the people in our society. The early development of this artificial intelligence system will further reduce the economic costs of the government, international donors and families. (Diktaşet al., 2012)

This Dissertation looks at different Medical Artificial Intelligence (MAI) related work and software's that can help make diagnosis easier for people with chronic Hepatitis B and their physicians in certain situations. We will present some development of an Expert systems for decision making in diagnosis and treatment in medicine.

The purpose of the dissertation writing is to help people who are in the deprived areas with HBV and do not have access to the physician, so artificial intelligence helps to diagnose the disease by using the test.

1.6 Aim of Dissertation Work

The purpose of the dissertation writing is to assist people who are in the deprived areas of the HBV and do not have access to the physician. In this way, the artificial intelligence makes it easier to diagnose the disease by using the test, and also, with this program, can help to poor families to recognize the disease at a very low cost and prevent otherwise poor people from getting a lot of money, which is not an appropriate for the community. It is believed that prevention and diagnosis are better than treatment

CHAPTER 2

RELATED WORK

2.1 Overview

Medical Expert Systems are exceptionally compelling and valuable within the range of diagnosis and medication. Different Expert systems were displayed and still in utilize in healing centers and wellbeing middle. The ensuing segment presents that medical Expert system and their interrelated researchers.

In this section there are four significant relative research fields which are main categories in the field of Expert System.

2.2 The Study of Diagnosing Hepatitis B utilizing Neural Network Expert system

Hepatitis B in fact is possible for threatening liver disease effect to the HBV. The virus meddling with the work of the liver during reproducing in hepatocytes. It may be a dominant worldwide well-being issue and the foremost genuine sort of hepatitis virus. It can cause unremitting liver infection and puts individuals at a high chance of passing from cirrhosis of the liver and finally causes the cancer. In medical science, determining is "the recognition of a disease". A broad sum of information is as of now accessible to medical doctors, extending from points of interest of clinical indications to different sorts of biochemical data and yields of imaging gadgets. Each sort of information gives data that must be assessed and relegated to anown pathology amid the diagnostic prepare.(Mahesh et al., 2014)

To streamline the diagnostic handle in every day schedule and prevent misdiagnosis, AI strategies particularly computer helped diagnosis and fake neural systems can be utilized. These confirmation learning calculations can handle differentiated sorts of medicinal information and coordinated them into classified product. The Artificial neural systems are finding numerous employments within the therapeutic determine application. In this research, we have proposed a GRNN based ES for the results of the Hepatitis B infection. The system categorizes every quiet into infected and the cases that are not in faced with infection. On the off chance that infected at that point how extreme it is in terms of concentrated rate. (Mahesh et al., 2014)

2.3 AIBESHBD

The Well-being of the populace, which is established basically on the outcomes of medical inquire about, includes a powerful effect for all human being's exercises. Between the foremost critical medical angles are assumed the great understanding of information and also setting the detection. But medical decision making gets to be a really difficult action since the human specialists, who ought to make choices, can barely prepare the colossal sums of information. So they require a device that ought to be capable to assist them to form a great choice. The existent a part of apparatuses that attempt to diminish the hazard of mistake emerge in medical world. Diagnosis includes an exceptionally vital part here. It is the primary step from a set of helpful activities; a mistake at this stage can have significant results. The nearness of innovation in the detection stage is an appreciated sense of its preferences: practicality, repeatability, productivity, insusceptibility forward annoyance components that are particular to human beings creatures (weakness, push, lessened consideration).(Panchal and Shah, 2011)

The innovation and technology doesn't supplant human beings specialists in this stage of medical help; it as it tried to assist them, executing frameworks that are capable to choose or create information that is significant. In medical determining is "the acknowledgment of an illness or stipulation by its clear signs and side effects" or "the analysis of fundamental physiological, Biochemical cause(s) ". Hepatitis B in addition to chronic liver illness is very usual within the real world that probably cause harm to hepatocytes. The seriousness shall extend from solid carrier to satisfied cirrhosis. In this study, there is depicted an AS for the detection of the hepatitis B infection illness, as Hepatitis is genuine illnesses that requests costly cure and extreme side impacts can show up exceptionally regularly. The IS comprises of the generalized relapse neural organize which provides the outcomes and results for even if the persistent is hepatitis B positive or not and the seriousness of the understanding. (Panchal and Shah, 2011)

An achievability study was carried out through interviews with medical specialists so as to extractability around hepatitis B. Doctors were met to pick up knowledge into their expectation as they would be a portion of the end users. After taking into thought the facts picked up from the interviews and the questioners the yield of this investigation was analyzed and the plan was made which was effectively executed. This project clarifies and appears how possible expert frameworks for the diagnosis of hepatitis B can be actualized. Underneath are some benefits: a. it makes

diagnosis speedier and less prone to errors b. The operation demonstrated to be more consistent and precise compared to the existing framework. (Panchal and Shah, 2011)

The project gives satisfactory arrangements to the issues said. It coordinating expert systems into healthcare administrations through the creation of a master framework for hepatitis B diagnosis and administration. In case this extent is fully actualized it'll incredibly help the distribution of essential health care services around Nigeria, Africa, and the globe. The result of this project has appeared that an expert system for diagnosis and management of hepatitis B would be of immense offer assistance to hepatitis, non-hepatitis, medical specialists and all who are interested in gaining data approximately hepatitis B and its symptoms. This system isn't implied to replace doctors but to help them within the quality service they render to humankind. The diagnostic capacity of a medical master using this System progresses as it were marginally compared with his/her capacity without the help of the system. (Panchal and Shah, 2011)

2.4 Diagnosing Hepatitis B by using FES and compare Adaptive NNFS

The study, an EX and a versatile neural fuzzy expert system (NFES) were planned to utilize the Adaptive NFI System and FIS apparatuses. Within the FES, precision of determining the hepatitis B intensity was 94.24%, be that as it may, within the adaptive NFES since of the utilize of back engendering and slightest implies square preparing strategies with the reason of evaluating participation function features within the FIS, ready to appraise the hepatitis B concentrated rate with the next precision. Work precision of this last mentioned system is 96.4± 0.2%. No reports with respect to deciding the hepatitis B concentrated have been already distributed. The lately investigation is totally unused in this major and the precision of the system work to has an extraordinary significant haven comparison with comparative researches. (Neshat and Yaghobi, 2009)

2.5 DEVELOPMENT OF MALARIA DIAGNOSIS SYSTEM USING VP-EXPERT SYSTEM

This research developed a malaria Diagnosis system, the knowledge acquisition procedure in the development of this system were done through direct interviewing with the medical experts and the knowledge was represented in the rule-based procedure. These rules determine whether a person is healthy or malaria patient with it types such as simple malaria, severe malaria or at risk. VP expert software is used for the design of this system and the system was tested on 35 patients with 93% accuracy (Adamu, 2018).

CHAPTER 3

EXPERT SYSTEM AND VP-EXPERT SHELL

3.1Overview

An expert could be a someone who through his preparing and knowledge is able to do things in a higher way, while the rest cannot. Expert System may be a Computer Program outlined to act as an expert to supply an arrangement to an issue in a particular space. The people included in an expert system improvement are the space expert, information Design and Client. The space expert presents the information approximately a particular space, through his information and preparing. The knowledge Build speaks to them in a suitable way, through a suitable instrument and makes an Expert System.

The final client employments the framework and tackles his/her issue. The most assignment totally depends on the information build, who must unique the information from the expert and display them to the client in a basic justifiable way. In this chapter, the different components of expert System and VP-Expert System Shell are briefly clarified.

3.2 Expert System

An expert system could be a computer program that employments artificial intelligence (AI) innovations to mimic the judgment and behavior of a human or an organization that has expert information and encounter in a specific field.An expert system may be a computer program that speaks to and reasons with knowledge of a few pro subjects with a view to understanding issues or giving advice. To unravel expert-level issues, expert systems will require effective get to a substantial space information base, and a thinking component to apply the knowledge to the issues they are given. Ordinarily they will too get to be able to explain, to the clients who depend on them, how they have come to their decisions. They will, for the most part, construct upon the thoughts of information representation, generation rules, search, and so on, that we have as of now covered. Often we utilizean expert system shell which is an existing information independent framework into which space information can be embedded to deliver a working expert system. Ready to hence avoid having to program each modern system from scratch.

An intelligent computer program that employments knowledge and deduction methods to illuminate issues that are difficult sufficient to require the critical human ability for their solutions. (Giarratano & Riley 1998).

3.3 Architecture of Expert system

The method of building expert systems is frequently called knowledge engineering. The knowledge engineer is included with all components of an expert system: constructing expert systems is for the most part an iterative prepare. The components and their interaction will be refined over the course of various gatherings of the knowledge engineer with the specialists and clients. We should see in turn at the different components.

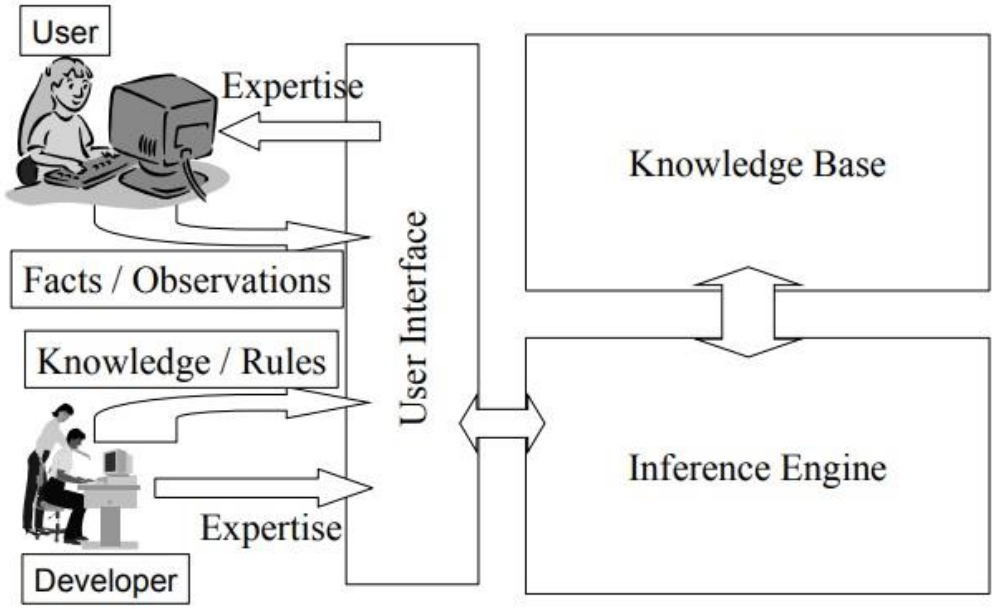

Figure 3.1: Expert System Architecture

3.3.1 Knowledge based

The heart of the expert system is the knowledge base. Engineering issue understanding employments heuristic knowledge as well as recognized logical belief systems and computational algorithms. Heuristic information could be a “rule-of-thumb” that helps one to restrain how to continue. The space knowledge of an expert system is composed within the knowledge base and this module is so basic that the fruitful practice of the system depends on the fabulousness and steadfastness of the knowledge restricted in it (Sayedah and Tawfik, 2013).

A knowledge base comprises both stationary and explanatory information (actualities around objects, occasions, and circumstance) and energetic or procedural knowledge that bargains with the information approximately the grouping of activity. There are different strategies of representation and organization of information and information base. The information is signified within the strategy of generation rules, (if-then rules), which are exceptionally compelling and habitually utilized strategy for speaking to knowledge.

A knowledge base contains truths and rules. Truths are short-term data that can change quickly, e.g. amid the course of a meeting. Rules are the longer-term data about how to produce modern realities or theories from what is by and by known. Production rules are a top pick implies of typifying rule-of-thumb knowledge. These include a familiar IF-THEN arrange.

3.3.2 Inference engine

Collecting of the Expert knowledge within the knowledge base isn't sufficient enough sufficient and there must be an additional component that guides the execution of the knowledge. This component of the expert system is recognized as the control structure, the run the show interpreter or the inference engine. The inference engine chooses the kind of look to be utilized to illuminate the issue. In truth, the induction motor runs the master framework, characterizing which run the show is to be valuable, executing the rules and characterizing when an appropriate arrangement is accomplished. The kind of induction instrument depends on similarly the nature of the issue space and the technique in which knowledge is spoken to within the knowledge base.

3.3.2.1 Forward chaining

In an expert system, somebody may begin with a preparatory state and tries to reach the objective state for the particular issue. The strategy of moving over distinctive arrangements to continue from the preparatory state to objective state is named look and the domain of all likely ways of look is the look space. There are 2 look strategies broadly utilized in run the show based frameworks are "forward chaining and in reverse chaining". In "forward chaining" the look continues within the forward direction. The forward chaining may be an information driven look. The forward chaining is beneficial when objective conditions areminor in number when related to the starting state. Forerunner portion is checked to begin with and after that goes to the ensuing portion.

3.3.2.2 Backward chaining

A system assumed to perform in reverse chaining in case it endeavors to back an objective state or proposal by analyzing known information within the framework. It looks within the state space working from objective state to the preparatory state by the application of reverse administrators. When there are uncommon objective states and numerous preparatory states, it may be way better, to begin with, the objective to work back towards the controller state. In reverse chaining may be an Objective driven or ambitious look.

3.3.2.3 Hybrid chaining

Hybrid chaining continuously begins with sending chaining and anyplace a reality is required from the administrator, go into opposition to the leaf hub of the knowledge and have it to continue with sending chaining component.

3.3.3 Context

The working memory or Context points at the gathering of images or dependable data that mirrors the display condition of the issue which comprises of the information accumulated amid issue execution.

3.3.4 Knowledge acquisition

Knowledge acquisition is exchanging information from human expert to computer. Knowledge acquisition incorporates the elicitation, collection, investigation, modeling, and approval of information.

3.3.5 User interface

The user interfaces prepare demands for benefit from system-user and from application layer components.

3.3.6 Explanation facility

The Expert System has the capacity to clarify to the client how a choice has been reached and this is often one of the most superiorities of the expert system.

3.4 Positive features of Knowledge - Based Expert System

Primary points of interest of KBES are

1. Knowledge is more express, open and expandable. The human intellect retains modern data without exasperating the information as of now put away within the brain or influencing the way in which it processes the data.Within the same manner, the information in KBES can be extended without influencing and disturbing the existing knowledge.
2. The knowledge base can be gradually and incrementally developed over an extended period of time. The modularity of the system allows for continuous expansion and refinement of the knowledge base.
3. A KBES can clarify the conduct through a clarification facility.
4. 4. A KBES isn't one-sided and does not make quick or unreasonable choices. It uses a orderly approach for finding the reply to the problem.

3.5 Restrictions of Expert System

The lacks of KBES:

- They do not acquire
- They have paucity of common sense and instinct
- They cannot take uncommon mastery
- They are more reasonable for issues including finding.

3.6 VP-Expert Shell

VP-Expert could be a Rule-Based Expert System Shell. VP-Expert gives the inference motor, the user interface, and each thing required to make a working expert system. A shell is an expert system containing zero knowledge base. On the off chance that one makes a knowledge base for a particular domain at that point it gets to be an expert system in that specific space. Employing a shell one can make an Expert System in various spaces. VP-Expert underpins as it were Rule Base Knowledge representation, which is straightforward English like run the show development.

3.7 Reason for Selecting VP-Expert

There is a number of expert system tools accessible within the showcase, but VP / Expert offers a combination of effective as clarified below:

1. The capacity to trade information with VP-info or DBASE information base records, VP-Planner, VP-Planner also, or 1-2-3 work sheet records and ASCII Content files. 2. An actuate command that consequently makes information from a table contained in a content, database or worksheet file. 3. An deduction motor which employments "Backward Chaining". 4. Optimal improvement windows that creates it conceivable to watch what is going on behind the screen as the inference motor navigates the knowledge base. 5. Certainty components that lets one account for dubious data in the knowledge base. 6. Straightforward English like run the show construction. 7. Commands that permit VP-Expert to clarify its actions during consultation. 8. Knowledge base "Chaining" which permits one to form knowledge bases and chain, something else it would be as well

expansive to fit in memory.9. Programmed address generation. 10. The capacity to execute External DOS programs.

3.8 Knowledge Base in VP-Expert

A knowledge base record in VP-Expert contains three essential components and they are Actions Block, Rules and Statements. The activity piece tells the deduction motor the arrange in which it must discover out the objective. Activities square the objectives are characterized and other numerical calculations are carried out. Rules expressed as IF/THEN recommendations contain the actual knowledge of the information base. Rules on VP-Expert have four basic aspects and they are:

- The rule name
- The rule premise
- The rule conclusion
- A semicolon at the end of rule

Explanation typically contains data relevant to the interview itself. Most VP-Expert explanations allot extraordinary characteristics to knowledge base variables. A test knowledge base record with Actions Block, Rules and Statements .Within the activities block the primary operation is to show the title and the deduction motor displays the same state. The another activity is the primary objective statement "Find Span", and the inference motor looks rules for the objective 'span'. If it is incapable to find the objective, it goes to the articulation portion. There it finds, for the ASK explanation, "Enter the span of truss in meters", shown and holds up for user’s input. At that point it calculates the rise as given by the equation within the activity block.

A while later the following objective "Find Truss" is studied and deduction motor looks the rules and finds the objective 'truss', and executes the expression (span/rise), and depending upon its value, the comparing sort of arrangement is taken as truss value.

3.9 VP-Expert’s Interview Screen

In VP-Expert discussion screen there are two windows and they are l) Rule Window and 2) the values window. The Rules Window permits one to detect the movement of the VP-Expert's deduction motor because of it interatomic with the knowledge base amid interview. The values

window notes the halfway and final determined values amid the course of the discussion. The values are communicated as variable = value CNFn.

3.10 Commands in VP-Expert

The VP-Expert's Menu command tree is appeared in Fig 3.2. The most menu are 1) Help 2) Initiate 3) Edit 4) Consult 5) Tree 6) File name 7) Path and 8) Quit. The most menu having moment level commands are too appeared in Fig. 3.2. The moment level command of 'GO' is shown amid discussion and they are* Help- Executes offer assistance framework * HOW? - Tells how a esteem is carried out * WHY? - Tells why the current Address is being inquired. * Slow- Moderates down the information base execution so that exercises within the Rules and values windows can be closely taken after.* Fast - resumes ordinary execution speed after the moderate command has been given. * Quit - Stops the meeting and returns to the most menu.

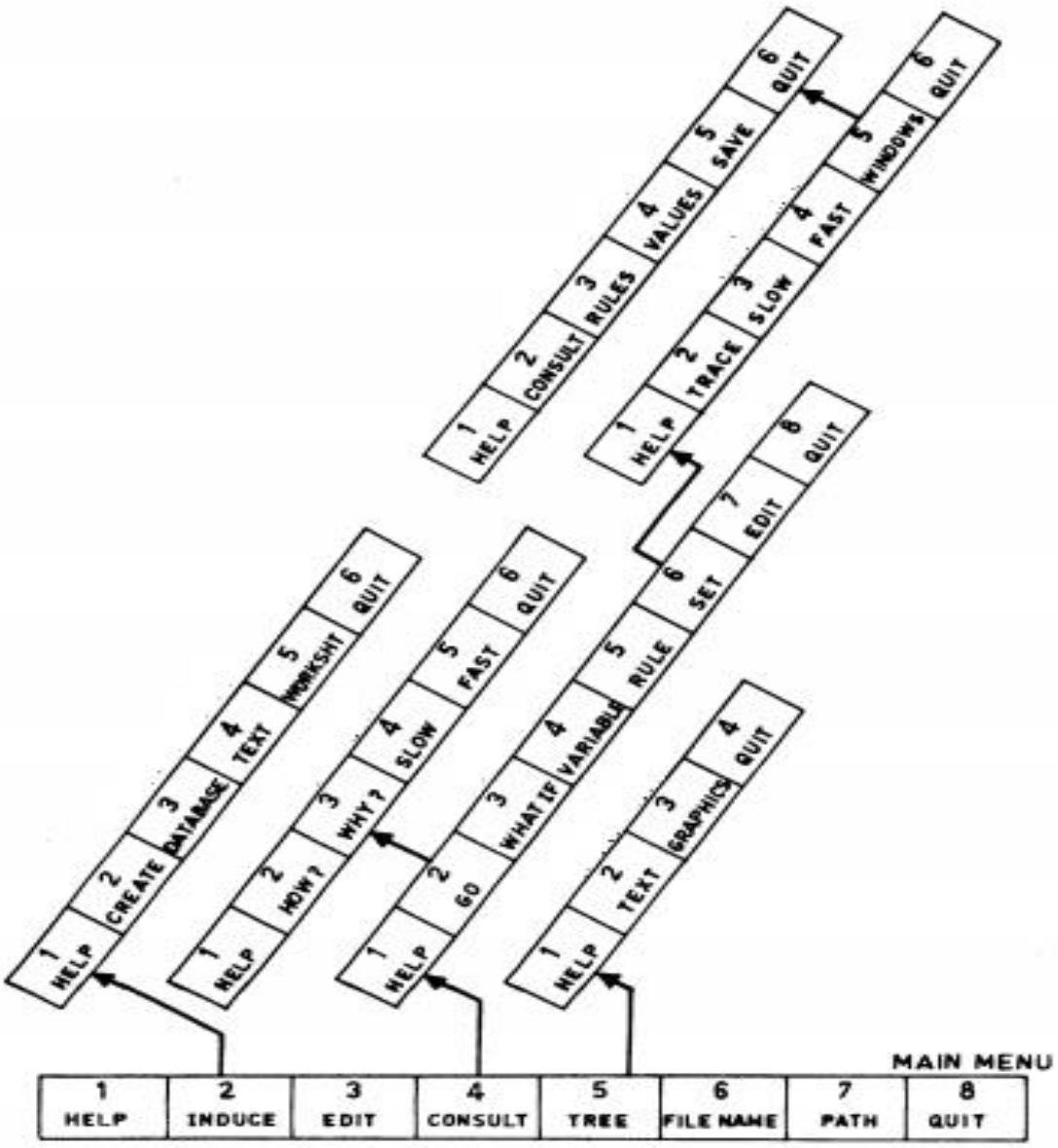

FIGURE 3.2: VP-EXPERT Menu Command Tree

3.11 Significant Keywords in VP-Expert

In VP-Expert "Keywords" are those words which have uncommon meaning in the knowledge base. A few of the critical key words are briefed here. ACTIONS: The key word Activities recognizes the starting of an ACTIONS square. The Activities square in a VP-Expert knowledge base sets the agenda for the VP-Expert discussion by posting one or more clauses

to be executed. ASK: At whatever point the VP-Expert deduction motor cannot discover a run the show to get esteem to a specific variable, it looks for an Inquire articulation naming the variable.

B CALL: This clause executes a DOS batch (BAT) direction record. After the execution of the group record is over, the VP-Expert's discussion resumes. BECAUSE: The since Catchphrase is utilized to supply illustrative content for the show in reaction to the Why? Or how? Command. CHAIN: The CHAIN direction utilized in combination with the SAVEFACTS and LOADFACTS clauses grants utilize of knowledge bases. The broad knowledge base can be broken into two or three knowledge bases and they can be chained. Example: CHAIN COMMON 1 The Common 1. KBS is executed after the current file's execution is over. CHOICES: The CHOICES articulation works alongside the Inquiry Command. The address generated by an Inquire command is shown amid a consultation and the values given within the comparing CHOICES articulation are displayed to the client as a menu of choice.

Display: The Show command is utilized to show messages to the user. When the clause is executed amid a meeting, the content inside the twofold quotes is shown within the counsel window. EXECUTE: Command causes a meeting to start automatically upon execution of the Most Menu counsel command. If this command is not shown in an information base, the client must provide an extra command "Go" to begin a consultation.

Find: The Discover clause is utilized in a VP-Expert knowledge base to distinguish variables whose values are required for fruitful completion of the consultation. LOADFACTS: it utilized at the side the CHAIN clause loads all the values of factors got in past record and within the new record these values are taken automatically. RECEIVE: The Get clause is utilized to get values from outside files into the VP-Expert.

Ship: Transport command stores the substance of the title variable as the final item within the text record named within the Ship command.

In this episode, the highlights of expert system improvement shell "VP-Expert" accustomed to form knowledge base to a plan of Mechanical rooftops are talked about briefly.

CHAPTER 4

DIAGNOSIS CHRONIC HEPATITIS B USING EXPERT SYSTEM

4.1 History hepatitis B

Viral hepatitis could be an illness with multiple causes that was, first portrayed within the fifth century BC. When Hippocrates portrayed scourge jaundice, he was without a doubt alluding to people tainted with intense hepatitis B infection as well as other operators able to tainting the liver. Scourges of jaundice have been described all through history and were especially common amid different wars within the 19th and 20th centuries. Whereas numerous of these flare-ups were due to hepatitis A, it is likely that plague transmission of hepatitis B too happened in settings where the utilize of blood-containing items was accepted.(Mahoney, 1999)

After the studies; MacCallum and Bauer reported in 1947 that there were two viruses, Hepatitis A and Hepatitis B. Then, in 1973, the World Health Organization approved these terms. (Mahoney, 1999; Akıncı, 2015)

In the early 1960's, Blumberg and his co-workers were studying human lipoprotein all types with micro Ouchterlony gel diffusion techniques. They've got the greenhouse of two hemophiliac patients. The factor in the aboriginal serum was not the usual lipoprotein. Pursuing this chance observation. (Simon, 1971)

In 1970, when Dane DS and colleagues examined the patient sera with the help of electron microscopy technique, they found particles resembling the same antigen on their surfaces. They claimed that these particles were related to the HBV and called these particles u Dane Particles Bu. These particles are 42 nm in size and are the infectious part of the HBV. Apart from these, 22 nm sphere and 22 x 100-200 nm filamentous particles have been described with the help of electron microscopy. In later studies, the genomic structure and proteins of the virus have been characterized (Dane DS. et al., 1970).

4.2Acute Hepatitis B

An acute hepatitis B infection may final up to 6 months (with or without indications) and tainted people are able to pass the infection to others amid this time and Symptoms of an intense infection may incorporate misfortune of craving,(AASLD,2018) joint and muscle pain, low-grade fever, and

conceivable stomach pain. In spite of the fact that most individuals don't involvement symptoms, they can show up 60-150 days after disease, with the normal being 90 days or 3 months. A few individuals may involvement more extreme symptoms such as nausea, heaving, jaundice, or a bloated stomach which will cause them to see a wellbeing care supplier.

4.3 Chronic Hepatitis B

People who test positive for the hepatitis B infection for more than 6 months are analyzed as having chronic infection. This implies their resistant system was not able to urge freed of the HBV and it still remains in their blood and liver. The hazard of creating a chronic hepatitis B infection is additionally straightforwardly related to the age at which one to begin with gets to be uncovered to the HBV: 90% of tainted newborns and babies will create a chronic hepatitis B infection, Up to 50% of tainted children (1-5 a long time) will create an incessant hepatitis B infection, 5-10% of infected adults will create a constant hepatitis B infection.

Acquiring merely have a chronic hepatitis B infection can be exceptionally disquieting. Since most individuals don't have symptoms and can be analyzed decades after their beginning presentation to the hepatitis B infection, it can be a stun and astonish to be analyzed with a persistent hepatitis B infection. The great news is that most individuals with chronic hepatitis B ought to anticipate to live a long and sound life. (Hepatitis B Foundation: Acute vs. Chronic Hepatitis B Infection, n.d.)

4.4 Diagnosing Hepatitis B

The specialist will look at you and hunt for signs of liver harm, such as yellowing skin or paunch torment. Tests that can offer assistance analyze hepatitis B or its complications are Blood tests. Blood tests can distinguish signs of the hepatitis B infection in your body and tell your specialist whether it's intense or chronic. A straightforward blood test can moreover decide in the event that you're resistant to the condition. Liver ultrasound. An uncommon ultrasound called transitory electrography can appear the sum of liver damage. Liver biopsy. Your specialist might evacuate a little test of your liver for testing (liver biopsy) to check for liver harm. Amid this test, your specialist embeds a lean needle through your skin and into your liver and evacuates a tissue test for a research facility analysis.(Hepatitis B - Diagnosis and treatment - Mayo Clinic, n.d.)

4.5Methodology

The created system utilizes the collection of information from a master accurately a specialist by means of coordinate meet and other significant sources to deliver the rules utilizing expert system technique for the actualization of VP-Expert system for diagnosing Inveterate Hepatitis B patients. The planned system advancement method is separated into two categories; Knowledge Acquisitions and Knowledge Representation. Knowledge Acquisitions it incorporates the securing of information from a master, papers, books, and other important sources. Knowledge Representation clarifies how the knowledge is being spoken to and it incorporates coding in terms of IF-THEN explanation. Running the system on VP expert computer program and at long last stacking the program for consultations.

4.5.1 Knowledge acquisitions

The knowledge procurement steps within the improvement of this system were done through coordinate meeting with the restorative pros within the field of hepatitis B, therapeutic course readings, master's proposal, papers and considering the related scientific materials. Too starting elementary enquiries, adopting fundamental alterations in each organization and after that the created expert system is outlined based on going before phases.

4.5.2 Knowledge representations

The created system was a based on rule system, for the information representing the IF…THEN rules have been utilized, where on the off chance that illustrate the situation and after that gives the arrangements. For changing over experts' knowledge to these certain rules, 2 common stages must be dealt with which are "Block Graph and Decision Tables". For determining Chronic Hepatitis B, the knowledge was displayed in a Block diagram as appeared in Figure 4.1.

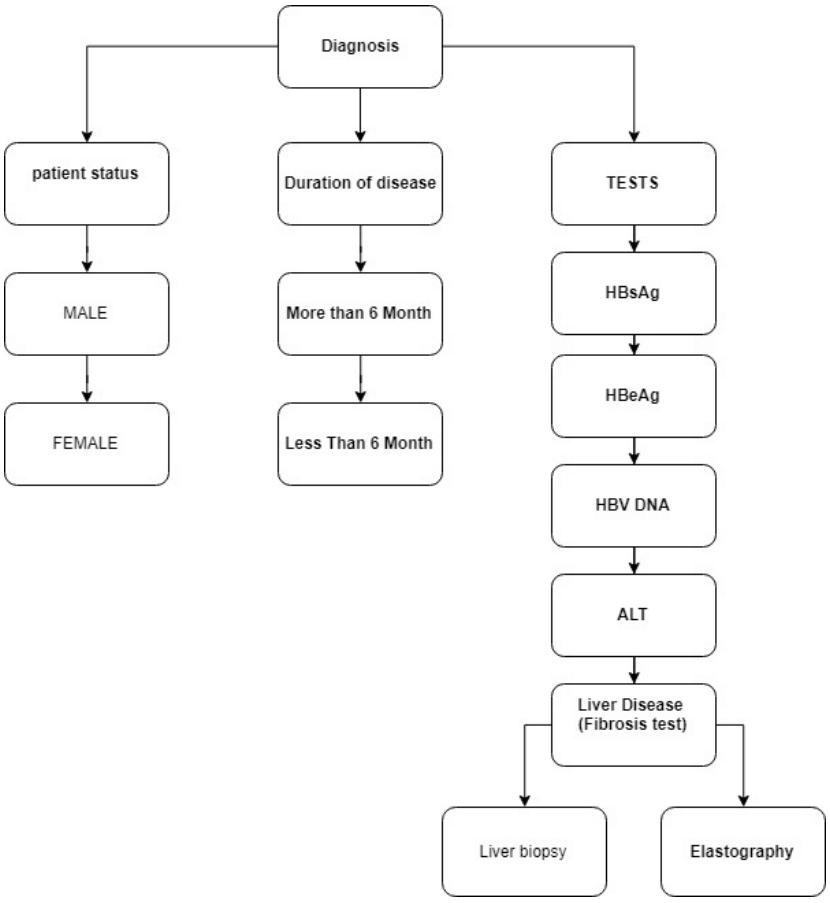

Figure 4.1: Block Diagram of Diagnosis

After Designing Block Diagram According each subcategories of Medical Tests help us to diagnose and decide the level of Chronic Hepatitis B disease now this Decision Tables will explain the subcategories test result separately.

Table 4.1: The Decision Table of Chronic Hepatitis B Level

	HBeAg POSITIVE		**HBeAg NEGATIVE**	
	Chronic infection	Chronic hepatitis	Chronic infection	Chronic hepatitis
HBsAg	High	High/intermediate	Low	Intermediate
HBeAg	Positive	Positive	Negative	Negative
HBV DNA	$>10^7$ IU/ml	10^4 -10^7 IU/ml	<2,000 IU/ml	>2,000 IU/ml
ALT	Normal	Elevated	Normal	Elevated
LIVER DISEASE	None/minimal	Moderate/severe	None	Moderate/severe

HBsAg :positive results between 0-2 % of the population, it means HBsAg prevalence accept as low and results between 2-7 % of the population, it means HBsAg prevalence accept as Intermediate and if results is 7% or more than 7 % of the population, it means HBsAg prevalence accept as High and the population who is 7% or more 7%,they are 45%of the word and the risk of hepatitis B infection is more than 60 %.(Güler,2018)

ALT: In this test normal range is 0-55 U/L its normal and if it's more than 55 is meant elevated

Liver disease : In chronic hepatitis b the damage of liver cells could be explain with the fibrosis test, fibrosis test can make two different way first one is the liver biopsy the second way is elastography test

Scoring of the liver cells fibrosis is between 0and 4,0is meaning normal liver cells, 1 is meaning low, 2 and 3 is intermediate and 4 is the highest one.

4.6 Coding

Chronic Hepatitis B Diagnosing Expert system was coded by means of the utilize of a VP-Expert shell, the shell is a precise apparatus for planning ES hence as it were expert's systems designers are acquainted with it. VP-Expert works based on the in reverse thinking for induction. The tool has an interference engine for checking the knowledge base to answer inquiries, an editor for

coding rules of the knowledge base, and a client interfacing for dealing with the inquiries, asking questions from the client, and advertising recommendations and clarifications, where alluring. It moreover has limited graphical proficiencies. The generation rules of this ES include seven quality address which serves as the input of this system.

1. WHAT IS YOUR HBsAg?
2. WHAT IS YOUR HBeAg?
3. WHAT IS YOUR HBV_DNA?
4. WHAT IS YOUR ALT?
5. WHAT IS YOUR Liver_disease (Fibrosis test)?"
6. When you infected to HBv is it more than 6 month?
7. WHAT IS YOUR PATIENT_STATUS?

Following figure is sample of program rules

```
RULE 255
IF  HBsAg=Positive AND
    HBeAg=Negative AND
    HBV_DNA=More_Than_2000 AND
    ALT=More_Than_55 AND
    Liver_disease=Four AND
    Age=NO AND
    PATIENT_STATUS=FEMALE
THEN
TREATMENT=Chronic_Hepatits_need_for_Trat
ment;
```

Figure 4.2: A Sample of the chronic hepatitis B diagnosis expert system rule

CHAPTER 5

RESULTS, TESTING AND VALIDATION

5.1 Design Presentation

In this section, first we introduce the VP Expert system's design presentation. We apply necessary changes in the rules and paths to describe designing system. In fact, VP expert system is a special programming file that is used to design the system. We examine the program on 20 patients from Turkey and North Cyprus who had chronic hepatitis type B. The VP expert system programming runs under the disk operating system (DOS). The following figure shows the first page that is appeared after running the system. In this page some information are asked. These data are about how long the hepatitis B were diagnosed, patient's status and some information about the last report of test. In fact, patients give these information to the system and get the feedback about level of the chronic hepatitis B. The following diagram describe this process better:

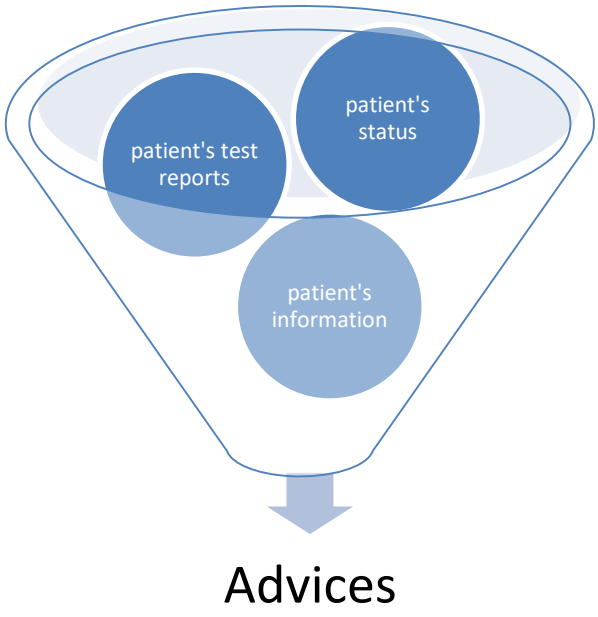

Figure 5.1: The correspondence between the system and human

This program is abbreviated by CHBDX as a chronic Hepatitis B diagnosing expert system.

5.2 Results

At the first step The System Consulting the KB as shown in bellow figure

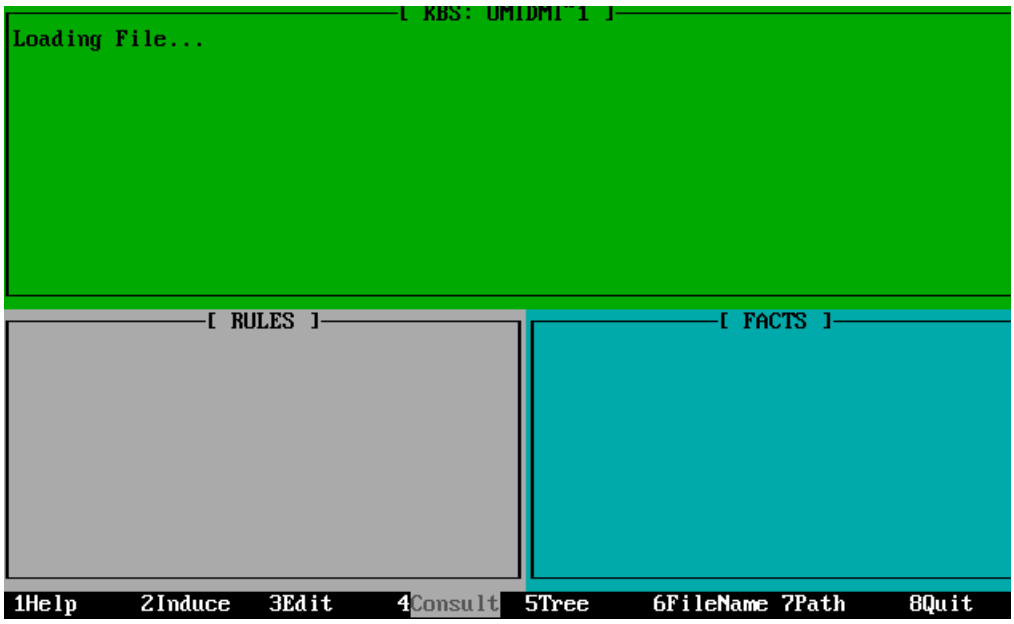

Figure 5.2: The System Consulting the KB

After that each patient answer the question the below figure show one example of the answers

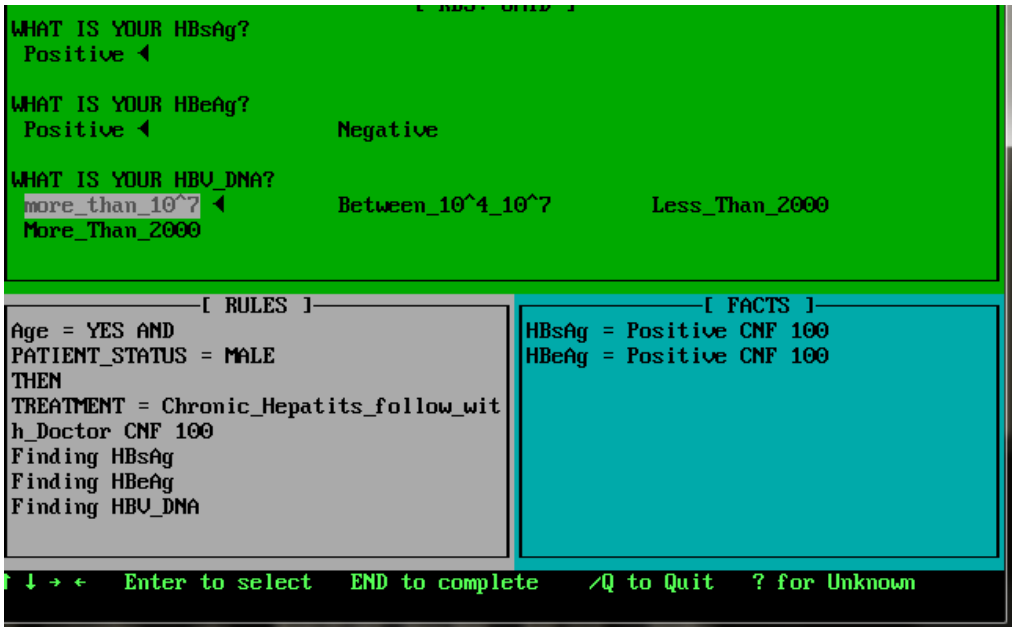

Figure 5.3: User begin answering questions

After that the system will provide the answers which will be interrupted the bellow figure demonstrated an example of the result

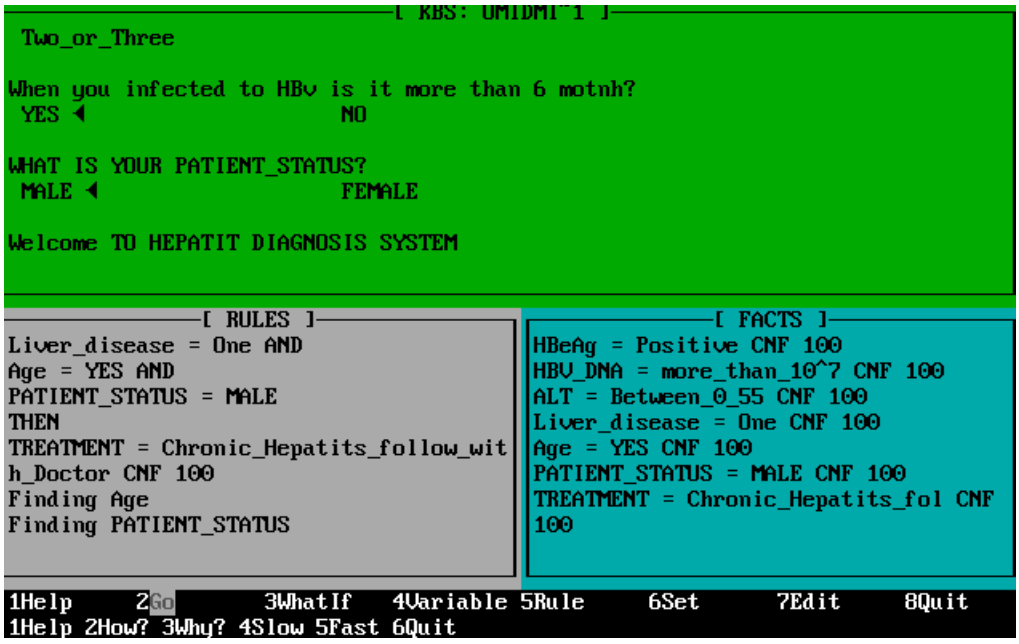

Figure 5.4: Result of a Diagnosis

The CHBDX system has proven a great performance. The results illustrated in Figure 5.4 have shown the possible value and helpfulness of the system. It was confirmed by the Medical doctors that this system can be used to determining chronic hepatitis B. And it will assist in minimizing the workloads of these experts who work under pressure due to the high number of chronic hepatitis B patients that are in increased for every minute.

Around 33% of the population word have hepatitis B infection and between 300and 400 millions of people have Chronic Hepatitis B

Early and accurate determining of chronic hepatitis B systems are essential for effective and life-saving

Determining, hence CHBDX is developed with the aim to be the nearest answer to this call. If

a master has the capacity of diagnosing 100 Chronic hepatitis B patients per day manually, then CHBDX have the ability to diagnose 300 Chronic hepatitis B patients per day, hence it makes the diagnosis of this disease much easier, faster, and more accurate. This offers the expected accuracy of the system since the aims of an expert system is to make fast and precise decision just the way an intelligent human or human experts do.

5.3 Comparison

pervious literatures focused in Hepatitis b in general or another disease but in over research we focused on diagnosing Chronic hepatitis b using vp-expert system fair comparison between our method and pervious one is limited sins we are using different data set and method. But our method over comes with its accuracy most researches in this field and we were able to achieve 95 % comparing to 94.24 % for using NNFS and 93% using the same method to diagnose malaria.

CHAPTER 6

CONCLUSION

6.1 Conclusion

In this thesis VP expert system is used to create the friendly program that determine the stage of chronic hepatitis B. This program is a special kind of expert system which is widely used in several part of investigation. In fact, now a day several parts of science use this program to analyze their data. This program is friendly and working with this program is easy. Most of the published paper in several topics like tourism, medical and economy applied this program to analyze their data and find the best final design. In this thesis, VP expert system has been used to determine the stage of the disease. This kind of program let the patient to be independent for knowing their stage in this diseases.

This program that we denote it by CHBDX is created based on 256 rules which are found by investigating the sign and level of diseases in medical paper series EASL. In this series of papers in a journal of hepatology, signs of chronic hepatitis B and relation between the stage of patients and reports of test were studied by experts of medical. The main rules derivate from these papers and seven input were collected to have most essential results. Two outputs which is presented by CHBDX give the information about stage of disease.

In fact, this program reduces requirements of patients to expert doctors but the patient must be follow by the general practitioner. They can find their stage of disease easily by knowing that 7 inputs. In a less than a second computer processes their data and give the results by comparing 256 rules there.

6.2 Future work

Actually CHBDX is the beginning of the way that can be developed to another type of hepatitis. Time by time, whenever the medical information about this diseases going to develop, new rules can be added to this program. Many disease can be studied and similar program can be applied to diagnose the stage of disease. These programs are the part of artificial intelligent which helps the

human to access the expert easily. They can recognize their disease and the stage or level of their disease in a less than a second without visiting any experts or spending time or money to much. In addition, these programs are accurate and save time and money.

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Güler, E., Süer, K., Arıkan, A., Güvenir, M., & Şanlıdağ, T. Kuzey Kıbrıs' ta Hepatit B Virüsü, Hepatit C Virüsü ve İnsan İmmün Yetmezlik Virüsü Seroprevalansı.

Appendices

APPENDIX

CHRONIC HEPATITIS B DIAGNOSIS SYSTEM KB

Note: we have 256 rules in our program this part just summary of our rules.

ACTIONS

FIND TREATMENT

DISPLAY "Welcome TO HEPATIT DIAGNOSIS SYSTEM";

RULE 0

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=more_than_10^7 AND

ALT=Between_0_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Chronic_Hepatits_follow_with_Doctor;

RULE 1

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=more_than_10^7 AND

ALT=Between_0_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 2

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=Between_10^4_10^7 AND
ALT=Between_0_55 AND
Liver_disease=Zero AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 3
IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=Between_10^4_10^7 AND
ALT=Between_0_55 AND
Liver_disease=Zero AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 4
IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=Less_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Zero AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 5
IF HBsAg=Positive AND

HBeAg=Negative AND
HBV_DNA=Less_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Zero AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Chronic_Hepatits_follow_with_Doctor;

RULE 6
IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=More_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Zero AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 7
IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=More_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Zero AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 8
IF HBsAg=Positive AND
HBeAg=Positive AND

HBV_DNA=more_than_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 9

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=more_than_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 10

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Between_10^4_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 11

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Between_10^4_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 12

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Less_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 13

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Less_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 14

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=More_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 15

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=More_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Zero AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 16

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=more_than_10^7 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Chronic_Hepatits_follow_with_Doctor;

RULE 17

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=more_than_10^7 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 18

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Between_10^4_10^7 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 19

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Between_10^4_10^7 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 20

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Less_Than_2000 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 21

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Less_Than_2000 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 22

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=More_Than_2000 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 23

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=More_Than_2000 AND

ALT=Between_0_55 AND

Liver_disease=One AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 24

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=more_than_10^7 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 25

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=more_than_10^7 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 26

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=Between_10^4_10^7 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 27

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=Between_10^4_10^7 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 28

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=Less_Than_2000 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 29

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=Less_Than_2000 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 30

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=More_Than_2000 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 31

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=More_Than_2000 AND
ALT=More_Than_55 AND
Liver_disease=One AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 32

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=more_than_10^7 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 33

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=more_than_10^7 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 34
IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=Between_10^4_10^7 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 35
IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=Between_10^4_10^7 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 36
IF HBsAg=Positive AND

HBeAg=Positive AND
HBV_DNA=Less_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 37
IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=Less_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 38
IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=More_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Two_or_Three AND
Age=YES AND
PATIENT_STATUS=MALE
THEN TREATMENT=Please_check_your_Test_result;

RULE 39
IF HBsAg=Positive AND
HBeAg=Negative AND

HBV_DNA=More_Than_2000 AND

ALT=Between_0_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 40

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=more_than_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Chronic_Hepatits_need_for_Tratment;

RULE 41

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=more_than_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 42

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Between_10^4_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Chronic_Hepatits_need_for_Tratment;

RULE 43

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Between_10^4_10^7 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 44

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Less_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 45

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Less_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 46

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=More_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 47

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=More_Than_2000 AND

ALT=More_Than_55 AND

Liver_disease=Two_or_Three AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Chronic_Hepatits_need_for_Tratment;

RULE 48

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=more_than_10^7 AND

ALT=Between_0_55 AND

Liver_disease=Four AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 49

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=more_than_10^7 AND

ALT=Between_0_55 AND

Liver_disease=Four AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 50

IF HBsAg=Positive AND

HBeAg=Positive AND

HBV_DNA=Between_10^4_10^7 AND

ALT=Between_0_55 AND

Liver_disease=Four AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 51

IF HBsAg=Positive AND

HBeAg=Negative AND

HBV_DNA=Between_10^4_10^7 AND

ALT=Between_0_55 AND

Liver_disease=Four AND

Age=YES AND

PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 52

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=Less_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Four AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 53

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=Less_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Four AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 54

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=More_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Four AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 55

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=More_Than_2000 AND
ALT=Between_0_55 AND
Liver_disease=Four AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

RULE 56

IF HBsAg=Positive AND
HBeAg=Positive AND
HBV_DNA=more_than_10^7 AND
ALT=More_Than_55 AND
Liver_disease=Four AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Chronic_Hepatits_need_for_Tratment;

RULE 57

IF HBsAg=Positive AND
HBeAg=Negative AND
HBV_DNA=more_than_10^7 AND
ALT=More_Than_55 AND
Liver_disease=Four AND
Age=YES AND
PATIENT_STATUS=MALE

THEN TREATMENT=Please_check_your_Test_result;

ASK HBsAg: "WHAT IS YOUR HBsAg?";

CHOICES HBsAg:Positive;

ASK HBeAg:"WHAT IS YOUR HBeAg?";

CHOICES HBeAg:Positive,Negative;

ASK HBV_DNA: "WHAT IS YOUR HBV_DNA?";

CHOICES

HBV_DNA:more_than_10^7,Between_10^4_10^7,Less_Than_2000,More_Than_2000;

ASK ALT: "WHAT IS YOUR ALT?";

CHOICES ALT:Between_0_55,More_Than_55;

ASK Liver_disease: "WHAT IS YOUR Liver_disease (Fibrosis test)?";

CHOICES Liver_disease:One,Zero,Four,Two_or_Three;

ASK Age: "When you infected to HBv is it more than 6 motnh?";

CHOICES Age:YES,NO;

ASK PATIENT_STATUS: "WHAT IS YOUR PATIENT_STATUS?";

CHOICES PATIENT_STATUS:MALE,FEMALE;